ADVANCED STEAM METER SPECIFICATION
12 MAR 2008

General specifications for all meters

Quantities Measured:	Pounds of Steam
Measurement Configuration:	Steam Supply to a building. For buildings that already have a steam meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a steam meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output into a data gathering device. If the existing meter will not accept a pulse kit or if no meter exists, a new steam meter will be installed, also requiring a pulse output to a data gathering device.
Operating Pressures & Temperatures:	-40 degrees F to +140 F ambient. When exterior mounting is required, consider the local ambient temperature extremes and moisture proof enclosures. Meter shall be rated for steam working pressure and temperature.
Humidity Operating Range:	5% to 90% RH (non-condensing)
Accuracy:	2.0% of scale.
Frequency:	Not less than one pulse per revolution. Meter pulser shall be coupled to the meter dial to provide a pulse rate of not less than one pulse per pound of steam.

For non-LonWorks meter applications

Digital Output Only:	Pulse Output

For LonWorks meter applications

Digital Output Only:	Pulse Output

Steam flow is measured with several types of flow meters:
Differential pressure-based (orifice plates, flow nozzles, venturi tubes, and averaging pitot tubes), vortex, Coriolis, and ultrasonic.

Based on the advantages and disadvantages shown in the Steam Flow Meter Comparison Chart below, the vortex type meter is highly recommended and the orifice plate type meter is also recommended. The other meter types are considered acceptable as required by the specific application. Ensure that the flow meter selected meets the requirements for the specific application based on steam type (wet, saturated or superheated), flow rate, and operating conditions.

Steam Flow Meters - General
Design pressure and temperature ratings of system components shall be for working pressure of 150 psig steam at 366 degrees F. Meter shall be for minimum working pressure of ASME Class 150 with steel pressure chambers or ASME Class 250 with cast-iron pressure chambers. Provide meter in horizontal pipe between two ASME B16.5 welding neck flanges. Provide a six-dial counter with an electrical contactor to transmit signal to a data gathering device (data terminal cabinet (DTC)) for indicating steam flow in pounds. Provide pressure compensated six-dial counter to automatically and continuously correct steam flow meter readings for steam pressure variations. For steam pipe main sizes 4 inches and smaller, provide meter directly in the steam piping. For steam pipe main sizes larger than 4 inches, provide meter in shunt bypass. Shunt bypass piping size shall be coordinated with the meter manufacturer. In the shunt bypass piping, provide two flanged gate valves calibrated by the meter manufacturer.

Vortex Meters
Provide a Vortex Meter with sensors to measure the vortices created by a bluff body placed in a flow stream. The frequency of these vortices shall be directly proportional to the fluid velocity and exact volumetric flow rate computed with the internal cross sectional area. Each vortex meter shall be tested to determine the relationship between velocity/flow rate and vortex frequency, which results in a meter K-factor. This volumetric relationship shall be converted to relative engineering units in pounds of steam, which the flow meter converter will then retransmit via a conditioned pulse.

Orifice Plate Meters
Provide a differential producing type orifice plate with a circular hole for insertion into the steam piping between two ASME B16.5 Class 300 welding neck orifice flanges. Orifice plate shall be Type 304 stainless steel. Furnish a dimensional report and flow versus differential curve with accuracy of plus or minus one percent over a 5 to 1 flow range. Orifice flanges shall have at least two radially-drilled and tapped holes for metering and two jack screws.

Output
Pulse output is required with an isolated (500 volts minimum) ac or dc switch closure rated at 50 volts dc or 40 volts RMS ac, one ampere minimum capacity. Duration of closure shall be not less than 0.04 second or more than 0.06 second.

Steam Flow Meter Comparison Chart

Type	Advantages	Disadvantages
Vortex	Easy to install. Low maintenance. Moderate installed cost. Good accuracy. Good turndown accuracy.	Sensitivity to vibration and inlet flow.
Orifice plate	Lowest cost. Easily installed and/or replaced. Inexpensive installation. Well established coefficient of discharge. Will not wiredraw or wear in service. Sharp edge will not foul up with scale. No moving parts.	High pressure loss. Suspended matter may build up at the inlet. Requires pipe line flanges. Low capacity. Flow conditioning (decreased accuracy at low flow).
Flow nozzle	Moderate price (costs less than venturi tubes). Can be used where no pipe line flanges exist.	Higher Cost than orifice plate. Same head loss as orifice for same capacity. Difficult installation. Difficult cleaning.
Venturi tube	Low pressure drop Simple upstream requirements. Has integral pressure connections. Will not obstruct flow of suspended matter. Can be used where no pipe line flanges exist. Well established coefficient of discharge.	Highest cost. Limited capacity. Awkward size (greatest weight and largest size for a given size line).
Averaging pitot tube	Accuracy does not degrade with use. Low pressure drop.	Not suited for low flow rates. High cost.
Coriolis	High accuracy. No flow conditioning.	High initial cost.
Ultrasonic	Non-intrusive. No pressure drop. Works in large pipe diameters.	High initial cost.

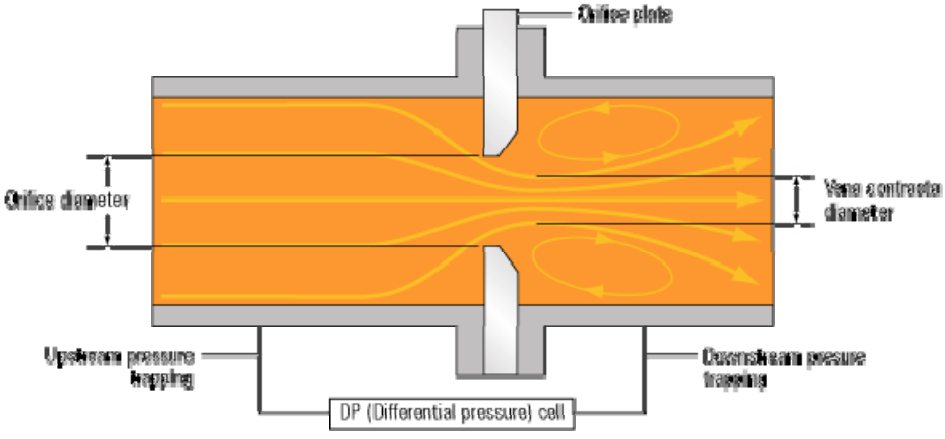
Vortex Meter

Vortex flow meters are flow sensors that detect the frequency of vortices shed by a bluff body placed in a flow stream. The frequency of the vortices is proportional to the flow velocity.

VORTEX FLOW METER

Orifice Plate

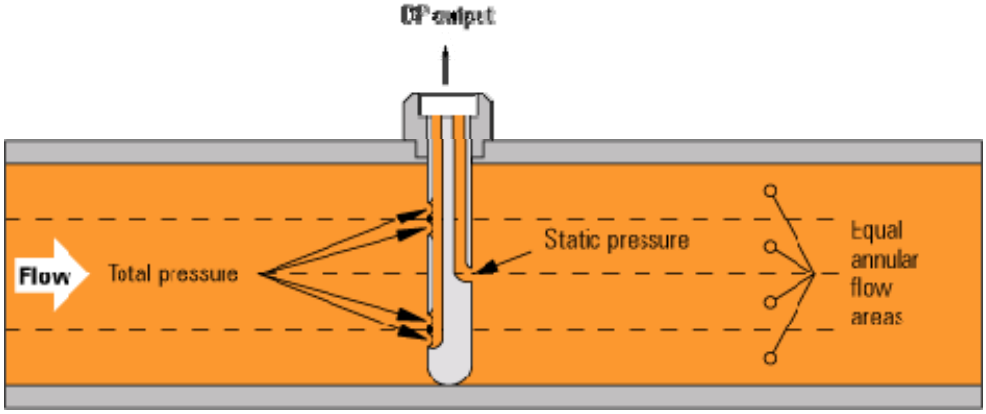
Orifice Plate flow meters are differential producing type orifice plate with a circular hole for insertion into the steam piping between two orifice flanges. Orifice flanges shall have at least two radially-drilled and tapped holes for metering and two jack screws.



ORIFICE PLATE METER

Pitot Tube Flowmeter

The Pitot Static tube measures the total pressure (or impact pressure) at the nose of the Pitot tube and the static pressure of the gas stream at side ports. The difference of these pressures, i.e. the dynamic or velocity pressure varies with the square of the gas velocity.



PITOT TUBE FLOWMETER

End of Specification

EXECUTION:

Connections to Publicly or Privately Operated Steam Utility Lines
Contractor shall provide materials for the connections to the existing steam lines. Final connections and the turning on of steam supply shall be made by the utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of steam supply lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new steam lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

Connection to Government Owned/Operated Steam Lines
Provide the name and location of the utility or operating agency of the existing steam lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing steam lines in accordance with approved procedures. The Contractor's Connection Plan shall be submitted and approved prior to making any connections to existing steam lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made. Reactivation of any existing steam supply lines will only be done by the Government.

Demolition
Remove materials so as not to damage materials which are to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction.

Cleaning of Piping
Keep the interior and ends of new piping and existing piping affected by the Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

Adjustments
Upon completion of the work, furnish the services of a competent technician regularly employed by the manufacturer of the flow meter to make the necessary adjustments to place the steam flow meter in operation and to conduct performance tests which demonstrate that the flow measuring equipment is functioning. Install the steam flow meter in accordance with manufacturer's recommendations.

Piping Tests
Provide piping modifications that facilitates acceptance testing such as piping which includes flanges at appropriate locations for flanged blanks to be installed for testing. Include requirements for how the modified piping shall be pressure tested and also specify which pipe sections or equipment that will be pressure tested in the shop if absolutely necessary.
Before final acceptance of the work, test each system as in service to demonstrate compliance with contract requirements. Before insulation is applied, hydrostatically test each piping system at not less than 225 psig in accordance with ASME B31.1, with no leakage or reduction in gage

pressure for 2 hours. The Contractor shall flush and clean piping before placing into operation. Flush piping at a minimum velocity of 8 fps. Correct defects in work provided by Contractor and repeat tests until work is in compliance with contract requirements. Furnish potable water, electricity, instruments, connecting devices, and personnel required for the tests.

End of Specification

ADVANCED ELECTRICAL METER SPECIFICATIONS, Including ADVANCED METER DATA MANAGEMENT SYSTEM Requirements 31 March 2009

1.0 Electrical meters and instrument transformers shall meet or exceed the following minimum requirements:

1.1 Measure quantities. Electrical meter quantities measured are Power (kilowatt), average demand over 15 minute intervals and Energy (kilowatt-hours).

1.2 System Accuracy. System accuracy for the meter product devices including instrument transformers shall not exceed 1% as calculated using the Root Sum Square (RSS) method and assuming normal distribution.

1.3 Meter Accuracy:

1.3.1 For facilities with connected loads equal to or greater than one (1) mega volt-ampere (MVA), meter certification shall be NEMA/ANSI C12.20, Accuracy class 0.2%.

1.3.2 For facilities with loads less than 1MVA, meter certification shall be IEEE/ANSI C12.16, Accuracy class 0.5%.

1.4 Communication Protocol. Meters shall communicate via either Modbus RTU or ANSI/CEA-709.1b (LonTalk) protocols or as otherwise specified.

1.5 Auxiliary data ports. Unless otherwise specified, electrical meters shall have a minimum of two pulse inputs for incorporation and transmission of other external meter data.

1.6 Surge Protection. IEEE/ANSI C37.90.1, Standard surge withstand capability (SWC) tests for relays and relay systems associated with electric power apparatus.

1.7 Current transformers (CTs) sized properly so that the meter secondary of the transformer shall output current to ensure at least a plus or minus 0.6% accuracy of current when measured between 10% and 90% of full amperage range.

1.7.1 CTs shall not exceed 5 amps on the secondary side.

1.7.2 Burden on CTs shall not exceed rated burden for the accuracy class.

1.7.3 CTs shall be provided in split core configuration.

1.7.4 CTs shall be provided in the appropriate ranges to meet the service entrance amperage requirements.

1.7.5 For facilities with a connected load equal to or greater than 1MVA, CT certification shall be IEC 185 or ANSI/IEEE C57.13 for 0.3% accuracy class or better.

1.7.6 For facilities with a connected load less than 1MVA, CTs shall revenue grade and certified per IEEE/ANSI C57.13 or IEC 185.

1.8 Current sensors shall be sized properly for the application and provide a voltage (normally 0-2 volts) to the meter that results in at least a plus or minus 0.6% accuracy of current when measured between 10% and 90% of full amperage range.

1.9 Voltage or Potential Transformers (PTs) sized properly so that the meter secondary of the transformer shall output voltage to ensure at least a plus or minus 0.6% accuracy of voltage when measured from zero to the IEEE/ANSI C57.13 or IEC 185 specified standard burden, at the specified standard burden power factor, and at any value from 90% to 110% of rated voltage.

1.9.1 For facilities with a connected load equal to or greater than 1MVA, PT certification shall be IEC 185 or IEEE/ANSI C57.13 for 0.3% accuracy class or better.

1.9.2 For facilities with a connected load less than 1MVA, PTs shall be revenue grade and certified per IEEE/ANSI C57.13 or IEC 185.

1.9.3 Burden on PTs shall not exceed rated burden for accuracy class.

1.10 Data Storage. Unless otherwise specified, the meter must be capable of providing and storing required interval data for a minimum of 30 days.

1.11 Environmental Tolerances of Metering Devices.

1.11.1 Meters shall be installed in indoors/interior locations and rated for operation and storage from 0º - 50º C or better and 5 to 90% relative humidity (non-condensing). Interior meters shall be provided with or installed within a NEMA 12 enclosure.

2.0 Advanced Metering Data Management System front end computer requirements are not necessary for USAR and NG sites unless requested by particular site via standard deviation request form:

2.1 Data encapsulation format shall be Extensible Markup Language (XML) and Simple Object Access Protocol (SOAP) for future output to a remote centralized meter data management system.

2.2 Storage of metered data for at least 2 years.

2.3 Display:

2.3.1 Display of data upon request and selectable from 1 minute to 15 minutes for kW.

2.3.2 Final install of front end equipment shall, at minimum, display accurate data readings for each meter in a text format. Customization of the user interface is not required. Two hardcopies and two electric copies (DVD or CD) of detailed instructions shall be provided for customization and integration of additional display features that are not prepared at the time of final install.

2.3.3 Display capability shall include multiple graphical formats such as data vs. time (minutes, hours, days, weeks, months, and year) comparison between metered data from two or more meters and other standard meter data.

2.4 System expansion capability of 50 times for incremental future growth of metered data to include water, gas and steam.

2.5 Data Transmission Media is VLAN, LAN, Radio Frequency, Calling Card, or Power Lines for interface of metered data to the Advanced Metering Data Management System (MDMS), whichever is most economical for the site.

2.6 Meter Collector Units shall be installed at exterior locations along the fence lines of the sites and rated for operation and storage from 0º - 50º C or better and 5 to 90% relative humidity (non-condensing). Collector shall be provided with or installed within a fire-rated, weather proof NEMA 12 enclosure. Data Transmission Media is VLAN, LAN, Radio Frequency, Calling Card, or Power Lines for interface of metered data to the collector, whichever is most economical for the site. Collectors shall display accurate daily data readings upon request for each meter in a text format. Customization of the user interface is not required.

ADVANCED NATURAL GAS METER SPECIFICATION
4 MAR 2009

General specifications for all meters

Quantity Measured:	Cubic Feet of Natural Gas
Measurement Configuration:	Natural Gas service to a building. For buildings that already have a gas meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a natural gas meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output to a data gathering device. If the existing gas meter will not accept a pulse kit or if no meter exists a new natural gas meter will be installed, also requiring a pulse output to a data gathering device. Ensure the pulse frequency and electronic characteristics are compatible with the existing data gathering device, if any.
Operating Temperatures:	-40 degrees F to +150 degrees F.
Humidity Operating Range:	5% to 90% RH (non-condensing)
Accuracy:	$\pm$ 1% of scale.
Pulse Frequency:	Not less than two pulses per revolution. Meter pulser shall be coupled to the meter dial to provide a pulse rate of not less than one pulse for every 100 cubic feet of gas.

For non-LonWorks meter applications

Digital Output Only:	Pulse Output

For LonWorks meter applications

Digital Output Only:	Pulse Output

NOTE: Gases are more difficult to measure than liquids, as measured volumes are highly affected by temperature and pressure. Gas meters measure a defined volume, regardless of the pressurized quantity or quality of the gas flowing through the meter. Temperature, pressure and heating value compensation must be made to measure actual amount and value of gas moving through a meter.

Natural Gas Meters shall be the Diaphragm, Rotary, or for high volume applications Turbine type with pulse output chosen to meet the specific application.

DIAPHRAGM

ROTARY

TURBINE

METERS

Provide gas meters for the natural gas service line to the building.

Diaphragm Gas Meters with flow rates less than 500 cubic feet per hour shall conform to AGA B109.1. Diaphragm Gas Meters with flow rates of 500 cubic feet per hour and higher shall conform to AGA B109.2. Rotary Type Gas Meters shall conform to AGA B109.3. Turbine Type Gas Meters shall conform to ASME MFC-4M. Meters shall be pipe or pedestal mounted and be provided with a strainer immediately upstream. Meters shall be provided with over-pressure protection as specified in ASME B31.8. Include tamper-proof protection, frost protection and fungus-proof protection as applicable. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates present. Meters shall have a pulse switch initiator capable of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments or calibration. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. The minimum pulse rate shall not be less than one pulse per 100 cubic feet of gas.

Valves and pressure regulators are necessary at all points where pressure reduction or regulation is required by the user. Install a shut-off valve upstream of the regulator and both upstream and downstream of the meter. Provide a gas meter bypass line with a lockable valve for buildings with critical service.

VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following: Steel valves 1-1/2 inches and smaller installed aboveground shall conform to ASME B16.34, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel valves 2 inches and larger installed aboveground shall conform to API Spec 6D, carbon steel, buttweld or flanged ends, with handwheel or wrench operator.

SERVICE LINE REGULATORS

Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self contained service regulator. Regulator pipe connections shall not exceed 2 inch size.

EARTHQUAKE ACTUATED AUTOMATIC GAS SHUTOFF SYSTEM

Include earthquake actuated automatic gas shutoff system if the facility is either essential or hazardous. The designer will determine the classification of the facility and provide a detail on the drawings showing this system. ASCE 25-97 EARTHQUAKE ACTUATED AUTOMATIC GAS SHUTOFF DEVICES includes a test procedure to verify that the valve will activate during strong ground shaking but will not activate for minor ground shaking or accidental bumping by a pedestrian or vehicle. The State of California, Division of the State Architect/Real Estate Services Division maintains a list of devices that have been tested and conform to the ASCE Standard; inquiries can be directed to telephone no. 916-445-2600. Show the earthquake actuated automatic gas shutoff on the drawings when required in the project. Earthquake Actuated Automatic Gas Shutoff devices shall conform to requirements furnished by the Contracting Officer, and shall be listed by the State of California, Division of the State Architect as being tested and in conformance with specified requirements. The system shall safely interrupt the flow of gas to the building due to strong ground shaking of an earthquake.

EXECUTION

A shutoff valve, meter set assembly, and service regulator shall be installed on the service line outside the building, 18 inches above the ground on the riser. An insulating joint (dielectric connection) shall be installed on the inlet side of the meter set assembly and service regulator and shall be constructed to prevent flow of electrical current. A 3/8 inch tapped fitting equipped with a plug shall be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. All service regulator vents and relief vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

Meters shall be installed in accordance with ASME B31.8. Permanent gas meters shall be installed with provisions for isolation and removal for calibration and maintenance, and shall be suitable for operation in conjunction with an energy monitoring and control system.

Connections to Publicly or Privately Operated Gas Utility Lines

Contractor shall provide materials for the connections to the existing gas lines. Final connections and the turning on of gas shall be made by the utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of gas lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new gas lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

Connection to Government Owned/Operated Gas Lines

Provide the name and location of the utility or operating agency of the existing gas lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing gas lines in accordance with approved procedures. Reactivation of any existing gas lines will only be done by the Government. The Contractor's Connection Plan shall be submitted and approved prior to making any connections to existing gas lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

Pressure and Leak Tests

Prior to returning the gas line back to service it shall be tested in accordance with ASME B31.8. Test pressures should recognize the weakest component of each system tested for the actual pressure, the maximum allowable operating pressure, and the gas supplier's maximum operating pressure. The test pressure will be 150 percent of the maximum operating pressure or 50 psig, whichever is greater. However, the maximum test pressure must not be more than three times the design pressure of the pipe.

The service lines shall be tested after modifications and before being placed in service using air as the test medium. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials.

Testing of gas service lines shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship T(1)P(2)=T(2)P(1), in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Contracting Officer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

Gas distribution equipment shall be installed in accordance with all applicable federal, state and local codes and regulations. Gas distribution equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of ASME B31.8, AGA XR0104 and 49 CFR 192. Gas distribution equipment installed in areas where they will be subject to damage will be protected by appropriate physical barriers (i.e. bollards). The Contractor shall provide installation details including catalog cuts and installation drawings for each gas service to be modified for approval by the Contracting Officer or the Contracting Officer’s Representative.

ADVANCED WATER METER SPECIFICATION
31 MAR 2009

General specifications for all meters

Quantities Measured:	Gallons of Water
Measurement Configuration:	Water Supply to a building. For buildings that already have a water meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a water meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output into a data gathering device. If the existing meter will not accept a pulse kit or if no meter exists, a new water meter will be installed, also requiring a pulse output to a data gathering device.
Operating Temperatures:	32 degrees F to 120 degrees F. When exterior mounting is required, consider the local ambient temperature extremes and protect from freezing with insulated, moisture proof enclosures and heat tracing as required.
Humidity Operating Range:	5% to 90% RH (non-condensing)
Accuracy:	1.5% of scale.
Frequency:	Not less than one pulse per revolution. Meter pulser shall be coupled to the meter dial to provide a pulse rate of not less than one pulse per gallon of water.

For non-LonWorks meter applications

Digital Output Only:	Pulse Output

For LonWorks meter applications

Digital Output Only:	Pulse Output

Water Meters shall be the turbine, propeller, or displacement type with pulse output chosen to meet the specific application (pipe size, flow, pressure, etc.).




Turbine Type Meters

Turbine type meters shall conform to AWWA C701 Class I or Class II depending on the application. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

Propeller Type Meters
Propeller type meters shall conform to AWWA C704. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 or an encoder-type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C703.

Displacement Type Meters
Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in U.S. gallons. Meters in sizes 1/2 through 1 shall be frost-protection design as required by the local environmental conditions. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C700.

Compound Type Meters
Compound type meters shall conform to AWWA C702 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. The main casing shall be tapped for field testing purposes. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and

Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C702.

Fire Service Type Meters

Provide Fire Service Type Meters as required by the Installation. Fire service type meters shall be proportional type or turbine type conforming to AWWA C703 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Any isolation valves installed as part of the meter assembly shall either have tamper switches or be position indicating valves in accordance with NFPA. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local Utility Monitoring and Control System. Meters shall comply with the accuracy and capacity requirements of AWWA C703. When turbine type main line meters are used, the meter shall be supplied with a separate check valve, as a unit.

Meter Boxes
Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid suitable for vehicle wheel loads. Boxes set in sidewalks, not subject to vehicular traffic, shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids can be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

Dielectric Fittings
Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

Gate Valves Smaller than 3 Inch in Size
Gate valves smaller than 3 inch size shall meet MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators. Valves shall open by counterclockwise rotation of the valve stem.

Gate Valves 3 Inch Size and Larger
Gate valves 3 inch size and larger shall meet AWWA C500 or UL 262 and be of one manufacturer. Valves shall be AWWA C500, nonrising stem type with double-disc gates or UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Valves shall open by counterclockwise rotation of the valve stem.

End of Specification

EXECUTION:

Connections to Publicly or Privately Operated Water Utility Lines
Contractor shall provide materials for the connections to the existing water lines. Final connections and the turning on of water shall be made by the utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of water lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new water lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

Connection to Government Owned/Operated Water Lines
Provide the name and location of the utility or operating agency of the existing water lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing water lines in accordance with approved procedures. The Contractor's Connection Plan shall be submitted and approved prior to making any connections to existing water lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made. Reactivation of any existing water lines will only be done by the Government.

Location of Meters
The location of meters and meter boxes shall be shown on the drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

Disinfection
Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.
Chlorinating materials shall conform to the following:
Chlorine, Liquid: AWWA B301.
Hypochlorite, Calcium and Sodium: AWWA B300.

Field Tests and Inspections
Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer will conduct field inspections and witness field tests. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for

field tests will be furnished. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the approved Statement of Work.

Testing Procedure
Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at copper pipe joints, copper tubing joints (soldered, compression type, brazed), plastic pipe joints, flanged joints and screwed joints.

Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system. Hold this pressure for not less than 2 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

CLEANUP
Upon completion of the installation of water meters, all debris and surplus materials resulting from the work shall be removed.

End of Specification