

Notice of Opportunity to Qualify Flow Meters For Participation in IDWR's Water Measurement Program

Purpose:

The purpose of this notice is to provide manufacturers an opportunity to have specific models of flow meters accepted by the Idaho Department of Water Resources (IDWR) for use in IDWR's water measurement program. To qualify, meters must meet minimum specifications, and successfully complete testing under the criteria established by IDWR. Third-party testing of flow meters under these requirements must be completed at the Utah Water Research Laboratory (UWRL) in Logan, Utah.

Background:

The need for highly accurate and reliable closed conduit measurement was precipitated by priority water calls in the Eastern Snake Plain Aquifer (ESPA). Water measurement in the State of Idaho is required for ground and surface water diversions within regulated areas. Measurement data are reviewed and used by state Water Districts and IDWR for water management and administration of water rights. IDWR measurement orders require pre-approved flow meters to be installed for measurement of ground water wells or other closed conduit water diversions. Pre-approval of flow meters is required to ensure that all meters installed pursuant to such orders perform at a level that meets or exceeds the manufacturer's specifications. Approved meter models are identified on IDWR's "List of Approved Closed Conduit Flow Meters". This list is subject to change and is periodically updated as additional meters are tested and added, or removed. A current copy of the list may be found at:

<http://idwr.idaho.gov/files/water-measurement/approved-flow-meter-list.pdf>

Eligible Flow Meter Classes:

Three classes of flow meters may be tested at UWRL and subsequently considered for inclusion on IDWR's List of Approved Closed Conduit Flow Meters:

- Full profile Electromagnetic or Spooled Ultrasonic, included for all nominal meter sizes manufactured as of date of testing (10" diameter model required for testing)
- Clamp-on or Wetted Transducer Ultrasonic, included for pipe sizes 14 inches or greater
- Small diameter models (electromagnetic or spooled ultrasonic) which are manufactured *only* for pipe sizes 2 inches or less

These classes are intended to accommodate the diverse measurement needs of diversion systems in Idaho. Many irrigation systems do not provide sufficient straight pipe length for proper operation of mechanical or insertion meters. Magnetic and spooled ultrasonic models approved by IDWR were tested and performed favorably in "short-coupled" conditions (three pipe diameters below a flow disturber). Approved ultrasonic models with transducers and small diameter models provide levels of accuracy comparable to magnetic meters and may be more affordable options for very large or very small diameter systems.

Separate test criteria have been developed for each testing class. Test criteria are detailed below in this document.

Test Submittal Procedure:

1. To notify IDWR of your intent to participate in testing, first fill out the Flow Meter Certification Submittal Form found at:

<http://www.idwr.idaho.gov/water-data/water-measurement/forms.html>

(one form for each model tested)

This form must be submitted to IDWR along with a factory calibration curve and certificate for each model meter. There is no fee charged by IDWR to include a flow meter on the approved list. Vendors will be required to pay UWRL the costs associated with their testing.

2. Contact Maria Gates at the UWRL Business Office, (435) 797-3120 or maria.gates@usu.edu, for a price quote and to establish a purchase order with UWRL. Testing costs set by UWRL range from \$1600-\$8400 depending on the class of meter tested. Some discounts are available for multiple meters tested at the same time. Testing costs may change at the discretion of UWRL.

3. Request a test date. Contact Steve Barfuss at the UWRL test facility, (435) 797-3214 or steve.barfuss@usu.edu. Meters submitted for testing at UWRL must be shipped to **1600 Canyon Rd, Logan UT 84321**.

Vendors and technicians are encouraged to attend the lab on their test date to help with meter installation and setup and to observe lab testing procedures for their meter(s). The time required to complete testing of an individual meter has been estimated by UWRL at 8 hours. Vendors who choose to observe lab testing must notify UWRL a minimum of five business days prior to the scheduled meter test date.

Meters submitted for testing must be a representative sample of the specific model as intended to be marketed and sold. The tested meter must not be calibrated beyond factory default calibration. Each vendor is required to sign a statement which guarantees that submitted meters have not been modified. Vendors will not be allowed to alter or manipulate meters beyond normal calibration while in the lab. Vendors may submit new or additional meters for testing as products are added to the market. Testing of new meter products will be required before meters are approved by IDWR.

Minimum Meter Specifications:

All meter models to be tested for approval by IDWR must meet the following minimum manufacturer specifications:

- 1) Operational flow range of 0.1 to 33 feet per second (fps).
- 2) Listed manufacturer accuracy of $\pm 2\%$ of flow rate from 0.1 to 33 fps, with a repeatability of $\pm 0.5\%$ of reading.
- 3) The register or display unit shall:
 - a) Have a waterproof and tamperproof seal.
 - b) Have an LCD backlit display showing instantaneous flow rate and totalized volume.
 - c) Have a minimum of six (6) digits for flow rate display.
 - d) Have a minimum of eight (8) digits for totalized volume display and a sufficient selection of multipliers so that reset of the display will not occur within two years operation, based on the maximum rate of flow and annual volume elements of the authorizing water rights. See Table 1 for examples of appropriate meter multipliers based on expected annual volume use.

- e) Have password or similar protection of all settings and data to prevent unauthorized programming change or re-set of totalizers.
 - f) Have a non-volatile memory and contain a back-up battery to prevent loss of data in the case of primary power failure.
 - g) Contain programmable features that allow the selection of flow rate units. Available flow units must include gallons per minute (gpm) or cubic feet per second (cfs). The flow rate field must also allow decimal display formatting of up to three (3) places when using cubic feet per second units.
 - h) Contain programmable features that allow the selection of volumetric units. Available units of volume must include gallons or acre feet. The volume field must also allow decimal formatting of up to four places, and the application of unit multipliers ranging from 0.0001 to 10,000. See Table 1 for examples of appropriate meter multipliers based on expected annual volume use.
- 4) Signal output when data logger is required.

Data loggers may be required by specific water right conditions of approval in some locations or circumstances.

Scaled pulse frequency output (or pulse counting) is required for continuous recording of totalized volume data on data loggers. Output signals must be compatible with data logger inputs. Analog output signal for flow rate (usually 4-20mA) is optional (most magnetic flow meters provide both analog and pulse frequency as standard output signals).

Table 1: Meter multiplier selection based on water right volume.

Volume Acre Feet (AF)	Multiplier X gallons (gal)	Multiplier X Acre Feet (AF)
0-150	1, 10, 100	.0001, .001
>150-1000	10, 100, 1000	.001, .01
>1000	100, 1000	.001, .01

Third Party Testing Criteria

Independent third party testing for the IDWR meter certification program is conducted by the UWRL at Utah State University using NIST¹ traceable instrumentation. All meters will be tested using a NIST traceable weight tank and/or an approved/calibrated secondary flow metering device to measure actual flows. The gravimetric (weight tank) measurement method has an accuracy rating of 0.15% and the secondary meters provide 0.25% accurate flow measurements.

Results of the testing must meet the following minimum criteria established by IDWR.

1. Accuracy of +/- 2% of flow rate over the entire range of tested flows
2. Repeatability of +/- 0.5% defined as the percent deviation of flow rate from average accuracy at each data point

The UWRL will publish a written report within 5-7 business days which contains test results for each laboratory data point specified in IDWR's criteria. Vendors must authorize UWRL to release the test report to IDWR upon completion of meter testing.

¹ NIST - National Institute of Standards and Technology.

Please note that testing protocol outlined below will be required of all makes and/or models of meters offered by the same manufacturer, including both AC and DC powered meter options of the same model number.

Magnetic Flow Meters

1. The tests will be performed in standard wall carbon steel 10-inch pipe, which has an inside diameter of 10.02 inches. A 10-inch diameter meter is required for testing.
2. Two tests will be conducted for each meter that is sent to the laboratory. These include a straight pipe test and a short-coupled test with the meter installed downstream of a flow disturber.
 - a. Straight pipe test: This test will be performed to establish the baseline accuracy of the meter under ideal conditions. A minimum of 40 diameters of straight 10-inch pipe will be installed upstream of the meter for these tests.
 - i. 5 data points tested at 1 fps, 4 fps, 8 fps, 12 fps, and 16 fps.
 - b. Elbow test: The meter will be installed with the upstream flange located 3 diameters downstream of a 90 degree elbow.
 - i. 14 data points tested from 0.5 fps to 16 fps with an additional point at 20 fps. (15 points total)
 - ii. The meter will be shut down, re-zeroed if necessary, and then 5 data points repeated at 1 fps, 4 fps, 8 fps, 12 fps, and 16 fps.
 - iii. Step ii. repeated with data points replicated as close as possible.
3. Both the 4-20mA signal and the meter's local display will be recorded for each run.

Ultrasonic Flow Meters

1. The tests will be performed on 18 and 48-inch standard wall carbon steel pipe using standard or ideal transducer methodology for testing. A single set of transducers may be submitted for each full test. Transducers may be clamp-on or wetted (flush mounted).
**See requirements below for wetted installations.*
2. Two tests will be conducted for each meter that is sent to the laboratory. These will include both an 18-inch and a 48-inch pipe test. In each case, a minimum of 10 diameters of straight pipe will be installed upstream and a minimum of 5 diameters of straight pipe will be installed downstream of the transducer locations. Each test will include:
 - a. Five data points tested at velocities of 2 fps, 4 fps, 6 fps, 8 fps and 10 fps with repeat measurements at these velocities.
 - b. Four additional data points tested at 3 fps, 5 fps, 7 fps and 9 fps.
3. Either the 4-20mA signal, pulse output or manufacturer's recommendation of output, and the meter's local display will be averaged and recorded for each run.

****Wetted Transducer Installation-*** *Ultrasonic models with wetted transducer installations must have "hot tap" capabilities and vendors must notify UWRL in advance of their test date to accommodate this setup. Installation of wetted transducers will likely increase costs to the lab and vendors with wetted transducers that require "tapping" the pipe will be responsible for the additional costs. Please contact Steve Barfuss at UWRL for estimates of additional costs if you are planning to submit a wetted transducer ultrasonic meter.*

Small Diameter Flow Meters:

1. The tests will be performed on two different size meters of the same model. Nominal sizes may be of the vendors choosing, ranging from 5/8 inch to 2 inches in diameter. A minimum of five flow meters of each size shall be submitted to the lab for testing.
2. Each set of flow meters of the same diameter will be installed in series and tested at the same time across all test points. Eleven data points will be collected for each meter submitted.
 - a. Four data points tested at American Water Works Association (AWWA) test flow rates as shown in the table below. These flows represent approximate velocities of 0.25 fps, 1 fps, 1.75 fps and high velocities ranging from 9 to 18 fps. Two intermediate flow rates are included to ensure that all meters of any type are tested at the same conditions.
 - b. Four data points tested at 2 fps, 4 fps, 6 fps, and 10 fps as calculated by the nominal pipe diameter.
 - c. Three additional data points tested at 5 fps, 7 fps, and 9 fps as calculated by the nominal pipe diameter.
3. The register or the output signal will be recorded for each run (depending upon the meter type).

Table 2. Selected AWWA Standard Test Flow Rates for Small Diameter Meters

Nominal Pipe Size	Minimum	Intermediate 1	Intermediate 2	Maximum
	all flows shown in gallons per minute			
5/8" X 3/4"	0.25	1.0	2.0	15.0
3/4"	0.5	2.0	3.0	25.0
1"	0.75	3.0	4.0	40.0
1 1/2"	1.5	5.0	8.0	50.0
2"	2.0	8.0	15.0	100.0

Contacts

Questions and or inquires related to the UWRL testing for flow meters should be routed to:

Idaho Department of Water Resources

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Contract information for UWRL

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Laboratory information for UWRL

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