Flowmeter Installer Training

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Flowmeter Installer Training

**Purpose:** to provide training to persons other than well drillers or pump installers licensed by MDEQ as part of the Delta Voluntary Metering Program

**Topics:**

1) Ordering the meter
2) Installing the meter
   - Upstream and downstream distances
   - flow straighteners
   - bolt on saddle meters
   - flow tubes
3) Reading the meter

**Note:** in no case does a flowmeter installation automatically require a 1D rise downstream of the flowmeter.
http://www.deq.state.ms.us/
or type MDEQ into a search engine (GOOGLE, BING, etc.)
Delta Metering Program

As part of ongoing efforts to effectively manage the use of the Mississippi River Valley Alluvial Aquifer (MRVA), the MDEQ Office of Land and Water Resources has adopted specifications for flow meter installation and a list of approved flow meters for agricultural uses.

MDEQ Specifications for Well Meter Installation
MDEQ List of Approved Meters for Agricultural Wells
Procedure for Adding a Meter to the MDEQ List of Approved Meters

MDEQ encourages producers to install flow meters and participate in the Voluntary Metering Program for MRVA agricultural wells.

Steps for participation in the Voluntary Metering Program
Voluntary Metering Participation Form
Meter Installation Training Presentation
Worksheet to assist in ordering correct meter

Please direct any questions you may have about the use of flow meters for managing the MRVA or about the Voluntary Metering Program to:

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This page contains all the latest, up-to-date information for the Delta Metering Program.
Voluntary Metering Requirements

Specifications for Metering Groundwater Withdrawals

- Any fixed meter installed before July 31, 2013, will qualify for inclusion in the voluntary meter program.
- To qualify for inclusion in the voluntary meter program, any meter installed after July 31, 2013, a) must measure 100% of the well output; b) must be installed to meet manufacturer’s requirements; c) and must be on the MDEQ Approved Meter List.

This training is for installing to the Voluntary Metering Program only.

Note: there are differences in NRCS Flowmeter Designs associated with NRCS financial assistance programs.
Flow Measurement:

Flowrate may be measured by measuring the velocity of fluid over a known area.

\[ Q = V \cdot A \]

where,

- \( Q \) = flowrate in cubic feet per second (cfs)
- \( V \) = velocity of the liquid, feet per second (fps)
- \( A \) = cross-sectional area of flow, square ft (ft\(^2\))

Flowmeters typically used in agriculture (propeller, ultrasonic, etc.) measure the velocity of water in the conduit, and use the fixed cross-section of the pipe to calculate flow rate.

All methods require an accurate measurement of the inside diameter for the flow rate to be correct.

Registers convert the cfs to other units for display, e.g. gallons per minute, acre-inches per hour.

\[ 1 \text{ cfs} = 1 \text{ ac-in/hr} = 448 \text{ gallons per minute (gpm)} \]
\[ 1800 \text{ gpm} = 4 \text{ ac-in/hr} \]

Example: 3 inch furrow application to 40 acres = 120 ac-in/4 ac-in/hr = 30 hours at 1800 gpm pumping rate
Typical Meter Manufacturer Installation Recommendations

- Propeller meters should be installed a minimum of 10 diameters downstream of any obstructions. Flowmeters are velocity sensing devices and are vulnerable to certain upstream disturbances. Because of this, meters need certain lengths of straight pipe runs before and after the meter. U.S. distances can be reduced with use of a flow straightener.

- These distances usually relate to the diameter of the pipe used. Obstructions can include elbows, valves, pumps, and changes in pipe diameter. The uneven flow created by these obstructions can vary with each system. If your application provides for more than five diameters of upstream run, use the available distance.

- Downstream (D.S.) run should be two diameter of straight pipe length after the meter.

U.S. = upstream
D.S. = downstream
I.D. = inside dia.
O.D. = outside dia.
OTHER INSTALLATION CONSIDERATIONS

- All propeller flowmeters are calibrated for a **full pipeline**. If the pipe is not completely full, the flowmeter will over register the flow. Although a minimum line pressure is not necessary for an accurate measurement, a full pipe is necessary. A 1D rise D.S. of the flowmeter insures full pipe flow, **but is not required**.

- Flowmeters can be mounted either horizontally or vertically. Although most applications are horizontally oriented, mounting the meter vertically actually offers some slight advantages. One reason is that gravity has a more pronounced flow conditioning effect with lines in the vertical (as opposed to horizontal) orientation. **The intended configuration of the meter must be specified when ordering.** If installing in a center pivot, identify system pressure.

- With the meter installed, check the rate-of-flow indicator. It should be stable to the point that it can be easily read. Some movement is normal, but if the indicator is moving erratically back and forth, disturbances exist and meter accuracy decreases. If you suspect a problem, please refer to the INSTALLATION INSTRUCTIONS section or the MAINTENANCE AND TROUBLESHOOTING section.
If an air vent mounted on the top of the pipe is closed, pipe is full. If it is not closed, likely not flowing full.
Flow Tubes
Flow tubes are manufacturer supplied sections of pipe that contain the saddle flow meter, flow straightener, and necessary upstream and downstream distances for accurate flow readings. Flow tubes are selected by the pipe size they are to be installed in line with.

Flow tube length requirements per diameter are:
- 6” pipe size – 30” tube length
- 8” pipe size – 34” tube length
- 10” pipe size – 40” tube length
- 12” pipe size – 46” tube length

Flow tubes with flow straightener are only to be installed with groundwater sources.

Supplier manufactured flow tubes must consist of flow straightener and meter in appropriate length tube with meter certified for specific I.D. of tube material.

Key Points:
- Flow Tubes insure best chance of a good installation and operation and require least distances. A flow tube consists of a know pipe size, flow straightener, flowmeter and all required U.S. and D.S. lengths within the tube length.

- Flow tube length requirements per diameter are typically:
  - 6” pipe size – 30” tube length
  - 8” pipe size – 34” tube length
  - 10” pipe size – 40” tube length
  - 12” pipe size – 46” tube length
A manufactured flow tube has all required distances, components, with a standard pipe I.D. to insure the best accuracy possible. This one is a flange mount.

1) Flow Straightener (not the same as straightening vanes, a 3 part unit, which requires more U.S. distance)
2) Proper U.S. and D.S. distances
3) Propeller properly sized for pipe I.D. and meter is properly located in pipe length
4) Saddle properly sized for O.D.
Key Points:

“In the absence of manufacturer’s recommendations.”

- U.S. and D.S. distances required

1D rise is not an absolute requirement for any meter installation under the Delta Voluntary Metering program. But full pipe flow must be obtained.

A 1 pipe dia. Min rise downstream insures full pipe flow.
1. Check available straight line distance available for flowmeter installation.

2. Determine material flowmeter will be installed in.


4. Complete form and submit to supplier for ordering.

If a flow straightener must be installed through flow meter opening (rather than end of pipe), you must specify to get the correct saddle to cover the larger opening.

Please Specify When Ordering Flowmeters for the Delta Voluntary Flowmeter Program. Meter must be on approved list.

Application – agriculture irrigation well flow measurement

Fluid type: Groundwater

Nominal line size*
  O.D.: __________________________
  I.D.: __________________________
  Material: ______________________

Units for indicator
  for totalizer: ac-ft
  for rate: gpm

Flow rate – maximum: __________
  Minimum: __________

Pressure – maximum: 22psi
  Minimum: 1 psi

Temperature – maximum operating
  (groundwater averages 65 deg F. Air temperature 100 deg F)

Style and model chosen:
  __ Bolt on saddle
  __ Flow Tube
    __ Flange
    __ Weld-in
  __ Other describe: ______________________

Flow straightener/conditioner (if bolt on) – note these are not straightening vanes:
  __ Yes
  __ No

Position:
  __ Horizontal
  __ Vertical (e.g. center pivot)

Special Constructions and Options:
  - overrun bearings required

* – On saddle mounted meters, please furnish the inside diameter of the pipe in which the meter will be used. The outside diameter is also necessary on saddle meters and flow tubes.
Follow the specific recommendations from the manufacturer whose meter you are installing.

Flow tubes with Flow Straightener requires the least amount of distance, and all required distances are contained in the flow tube length.

Whenever straight length of pipe is minimal for meter installation, a “flow tube” has the best chance of fitting and working.
Note: if a flow straightener will be installed through the flowmeter opening (rather than through the end of the pipe), a special flowmeter is required to insure the saddle will adequately cover the hole. For this manufacturer a MO300F
For 10" and larger pipe sizes, a section of pipe may need to be cut out to allow insertion of the flow straightener from the end of the pipe, allowing the use of the normal meter.

Currently, some manufacturers can only provide the larger saddle in 6" and 8" pipe sizes.
Easiest site: open discharge, many options
- no issue meeting installation requirements
Easier site: existing closed system with sufficient straight pipe length
- bolt on saddle meter and flow straightener, or
- flow tube

- Key point: I.D. of pipe for ordering bolt-on meter

- 1D rise not required in existing “closed” system

- Operator will have to insure full pipe flow
Hard site:
- marginal room for even a flow tube
- since flow is split at stand no underground line that carries 100% of well flow to install in.
New closed system assuring proper flowmeter installation. Sufficient straight pipe length for U.S. and D.S. distances.
Locate placement for correct U.S. and D.S. distances
For bolt in vanes follow the specific recommended manufacturer procedure and distances.

Straightening Vanes are not the same as a Flow Straightener.

A Flow Straightener minimizes the required U.S. distance.
For bolt in Flow straightener, follow the specific recommended manufacturer procedure and distances.

Use of a flow straightener minimizes the U.S. distance requirement.

It is preferable to insert the Flow Straightener through the open end of pipe section.
Installation in existing “closed” system when insufficient distance exists between pump discharge and stand/dogleg.
Place in existing buried line that still carries 100% of well flow

- Pits should be sloped back on 3:1 on sides for safety and access.
- Register should be on extension to within 6” of meter box top.
  The register is not to be submerged.
- Alternative meter box installations can be accepted. (e.g. CPP
- Do not fill meter box with gravel or other material.

Meter Box of 4” thick concrete, 16 gauge corrugated steel, or 4” nominal treated lumber (for underground installations)

Length of meter plus 6” (3’ min.)
Line must be carrying 100% of well flow 100% of time!

Step 1: Access Underground Line

Step 2: Cut Appropriate Size Hole -continued

Step 2: Cut Appropriate Size Hole (See installation specs)

Step 2: Cut Appropriate Size Hole -continued
Order meter with a register extension to bring above surface!

Step 3: Clean and check hole size

Step 4: Install Meter - continued

Step 4: Install Meter

Step 4: Install Meter - continued
Do not backfill meter box, so meter can be accessed in future easily.

Meter on register extension and meter box should rise above soil surface so that the register is not submerged.
Dial Face with Gallon Totalizer x 100
Add 2 zeros to the 6-digit dial face reading.
Total Gallons = 89,057,200

Dial Face with Gallon Totalizer x 100
Add 2 zeros to the 6-digit dial face reading.
Total Gallons = 41,012,800

Dial Face with 3 fixed zeros.
Include these zeros in your reading.
Total Gallons = 113,509,000

Dial Face with Acre Feet Totalizer x .001
and GPM Flow Rate Indicator. Place a
Decimal Point 3 places to the left.
Acre Feet = 974.602

Dial Face with Acre Inches Totalizer x .01
and GPM Flow Rate Indicator. Place a
Decimal Point 2 places to the left.
Acre Inches = 160.53

Dial Face with Cubic Feet Per Second
flow rate and Acre Feet Totalizer. Place
a Decimal Point 3 places to the left.
Acre Feet = 278.760
Summary: Flowmeter installation for Delta Voluntary metering Program

Installation:
1) Pipe upstream and downstream lengths must be sufficient, measure, check.
2) Pipe I.D. and O.D. must be measured correctly
3) Meter must be ordered for correct pipe sizes (note: this is step 3)
4) Order a flow straightener if U.S. distances is insufficient
5) Surest installation is to order a “flow tube” to fit into your pipeline
6) Order meter from supplier with all information above.
7) Install to the manufacturer’s recommendations.
6) Regulate flow to create enough back pressure to cause full pipe flow at the meter (e.g. air vent closed)
QUESTIONS
1) Question: would a discharge going into a manifold (e.g. dogleg/stand) cause enough backpressure to make pipe flow full?

Answer: it may or may not, always check the air vent to see that it is closed.

2) If the “sweat” line on a stand (e.g. manifold) was above the flowmeter, would that mean the pipe is full?

Answer: the sweat line does represent the approximate water level, so if the line is 2-3 inches above the flowmeter, the pipe should be full.

3) If a check valve causes a “jetting” condition, should the check valve be moved downstream of the meter when installing the meter?

Answer: MDEQ oversees check valves on wells so they would have to clear moving it, but from the physical standpoint, being downstream of the flowmeter would eliminate the jetting concern.

4) If I have a system without a check valve, and install a flowmeter, do I also have to install a check valve.

Answer: MDEQ would have to answer that question.