Mass Flow Meters

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RESOURCES

Weights & Measures Website
https://datcp.wi.gov/Pages/Programs_Services/WeightsAndMeasures.aspx

Wis. Admin. Code ATCP 92
http://docs.legis.wisconsin.gov/code/admin_code/atcp/090/92

Wis. Statute ch. 98
http://docs.legis.wisconsin.gov/statutes/statutes/98

NIST Handbook 44
https://www.nist.gov/pml/weights-and-measures/publications/nist-handbooks

Mass flow meters

A Mass Flow Meter is a device that is designed to dynamically measure the mass or mass and density of liquids or hydrocarbon gas in the vapor state. Some examples of products that may be measured with these devices are: Milk, liquid fertilizer, liquid feed, asphalt, propane, and natural gas. All commercial (Legal for Trade) devices must be installed, calibrated, and serviced by a Wisconsin licensed Weights and Measures Service Company using device-specific certified technicians, per Wisconsin Administrative Code § ATCP 92.20(1).

To find a licensed service company, search the DATCP listing from our website: https://mydatcp.wi.gov/documents/dtcp/WMSvcCoListing(InstallSvcTestCalib).pdf

Basic requirements

- The device, transmitter, and/or register must be an NTEP (National Type Evaluation Program) approved type. The National Conference on Weights and Measures issues an NTEP Certificate of Conformance following successful completion of an evaluation of a device. It indicates that the device described in the Certificate is capable of meeting applicable requirements of NIST Handbook 44. NTEP approved devices are legal for trade in Wisconsin.
- The device must be appropriate for the product being measured in terms of specific gravity and general fluid characteristics.
- The device must be installed in accordance with the manufacturer's instructions. Some meters may only be installed horizontally and others only vertically.
- The mass flow meter system must have an effective air elimination system to prevent the metering of air.
- The device may not be used to measure quantities less than the manufacturer stated MMQ (Minimum Measured Quantity).
- All digital values of like value in a system must match exactly. For example, if the indicator displays "30,465" pounds, all other indicators and recorded representations (receipts or tickets) must also display "30,465 pounds."
- Devices are not required to be state-tested annually, but they must be continuously maintained in proper operating condition.

Please refer to NIST Handbook 44 for a complete listing of requirements, including additional requirements for the use of mass flow meters in retail motor fuel dispenser or truck-mounted applications:
https://www.nist.gov/pml/weights-and-measures/publications/nist-handbooks

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Delivery ticket requirements

When a commodity in bulk is delivered by vehicle to an individual purchaser and the commodity is sold in terms of weight units, the delivery shall be accompanied by a duplicate delivery ticket with the following information clearly stated in ink or by means of other indelible marking equipment:

- The name and address of the vendor.
- The name and address of the purchaser.
- The net weight of the delivery expressed in pounds.
- The gross and tare weights of the delivery if the net weight of the delivery is derived from determination of gross and tare weights.
  (Wis. Stat. § 98.225(1))

Gasoline, kerosene, fuel oil, diesel fuel or alternative fuels sold via a vehicle tank meter must include a delivery ticket printed from the meter's ticket printer that includes the following:

- Name and address of seller
- Name and address of purchaser
- Description of liquid fuel delivered
- Meter reading showing volume of liquid fuel delivered
  (Wis. Stat. § 98.225(2))

For bulk milk picked up at farms, only the identity of the vendor and the net weight need to be stated on the delivery ticket. Wis. Stat. § 98.22(2)

Liquefied petroleum gas sales

No person may sell liquefied petroleum gas and deliver it by a vehicle equipped with a pump and meter unless the meter is equipped with a delivery ticket printer. The seller shall, at the time of delivery, either provide a copy of the delivery ticket printed by the delivery ticket printer to the purchaser or leave a copy at the place of delivery. The delivery ticket shall contain all of the following information:

- The name and address of the seller.
- The name and address of the purchaser.
- The meter reading showing the volume of liquefied petroleum gas delivered.
- If there is a malfunction with the delivery ticket printer, the seller shall, at the time of delivery, either provide the purchaser or leave at the place of delivery the information required in written form.
  https://docs.legis.wisconsin.gov/document/statutes/98.245

Testing of the system

The metering system must be installed and tested prior to commercial use in accordance with the manufacturer's instructions and NIST Handbook 44 Specifications, Tolerances, and other Technical Requirements for Weighing and Measuring Devices. The following four tests must be conducted:

1. A test draft should be run at the maximum flow rate of the installation, with an acceptance tolerance of +/- 0.2%.
2. A test of the air elimination system (NIST Handbook 44 - 3.37.N.6.2).
3. A repeatability test consisting of at least three drafts (NIST Handbook 44 - 3.37.N.6.1.1).
4. At least one test with the flow restricted to less than the maximum flow rate, but greater than the minimum flow rate (NIST Handbook 44 - 3.37.N.6.1).

Reference scales

Reference scales must be tested immediately prior to use as a reference standard using certified test weights and NIST Handbook 44 procedures.

Reference scales must also have an appropriate capacity and division size. The capacity must be large enough to accommodate the necessary test draft size plus the weight of the receiving vessel, and must have a division size no greater than one tenth of the minimum tolerance applied. Error weights may be used in order to "read between" the displayed scale divisions on a digital device.

Example:
If the receiving vessel is 400 lbs and the test draft weight is 2,900 lbs, the scale would need a capacity of at least 3,300 lbs and the tolerance for the test draft would be +/- 5.8 lb so the maximum reference scale division size would be 0.5 lb.

There are several NIST OWM (Office of Weights and Measures) articles online which provide guidance on choosing an appropriate reference scale for gravimetric testing, such as the article "Using Reference Scales:" https://www.nist.gov/sites/default/files/documents/2017/05/09/A-013.pdf

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