Energy and Flow Measurement for Hydronic Systems

Presented By:
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Flow Meter Technology

Quote of the day:
“A flow meter, can only be as good as its installation”.
“Building generated data is the supply chain of a data-driven decision-making economy”.
Michael S. Weil, Editorial Director
Why Should We Measure Flow?

Energy Management
– Provides the baseline for Energy Management, Sustainability and Energy Conservation.
– Provides the basis for Billing and Cost Allocation

Efficiency
– Required for the implementation of Complex Control Strategies
– Monitor/Verify Equipment Performance
– Reduced Energy Consumption
ONICON Background

• Founded in Clearwater, FL in 1988
• Shifted focus to HVAC building controls market in early 1990’s
• Recognized throughout the HVAC controls industry for innovation and outstanding service
Why ONICON?

• Engineered, calibrated measurement solutions at a competitive price
• Products ready to use out of the box
• Outstanding support from highly capable representatives and in-house support staff
• Industry leading two-year no-fault warranty on most products
AEB Technologies

• Focused Line Card
• Instrumentation and Controls
• Personal Service
• Intimate and experienced with our technologies
• Application assistance
• For a given application, I can help you select the highest value meter according to the needs of your project.

• Can help you get that meter applied correctly which will bring you the best value that the meter has to offer.
Meter Selection

Innovative Flow and Energy Measurement Solutions

Terms – Technologies - Installation
Terms

• Specifications for Flow Meters
  – Accuracy Statement (% of Rate or % of Span)
  – Range (typical flow rates for the application)
  – Repeatability (calibration certificate, known standard)

• What is a Flow Meter
Typical % of Full Scale Accuracy Statement

± 1% OF FULL SCALE (FS) from 1 to 30 ft/s

ONICON Accuracy Statement

± 0.5% OF ACTUAL READING at Calibrated Typical Flow Rate

± 1% OF ACTUAL READING from 3 to 30 ft/s

± 2% OF ACTUAL READING from 0.4 to 20 ft/s

VELOCITY (ft/s) | 1  | 2  | 4  | 8  |
---|---|---|---|---|
% ERROR       | 30%| 15%| 8% | 3% |

TYPICAL HVAC OPERATING RANGE
(1 to 8 ft/s)

HVAC DESIGN RANGE
(4 to 8 ft/s)
Rangeability/Turndown

• Rangeability: The range over which an instrument can measure
  
  1-30 fps, 10-1000 gpm

• Turndown: The range specified as a ratio of the highest measured value over the lowest
  
  30:1, 100:1
What is a Flow Meter

Flowmeter: An Instrument for measuring the rate of motion of a fluid that includes a primary SENSING ELEMENT and a secondary OUTPUT DEVICE.
Technologies
Technologies

Available Technologies

– Differential Pressure
– Electromechanical – moving parts
– Electromagnetic
– Thermal Dispersion
– Vortex Shedding
– Ultrasonic
– Others
ONICON’s Technologies

- Energy: BTU Meter
- Water: Turbine, Electromagnetic, Ultrasonic
- Steam: Vortex Shedding
- Gas: Thermal Dispersion
Hydronic Energy Transfer Calculation (BTU Meter)

Heat Load Calculation:
BTU Rate = Flow Rate x Delta-T x Specific Heat x Density
Dedicated BTU Metering System

- Dedicated hydronic energy (BTU) measurement system.
- Easily interfaced with common building automation protocols.
- Best choice for accurate hydronic energy measurement, provided:
  - Temperature sensors are matched over range
  - Flow Meter is wet calibrated
  - Provides serial communication
Insertion Turbine Meters

- Easy to install, immersion style sensor, direct reading.
- High turndown, linear response over a wide range of flow.
- Hot Tap-able, no system shut down required.
- Wet calibrated versions have high accuracy to cost ratio, good value in clean, closed loop systems.
- Good accuracy over wide turndown, provided straight run requirements are met.
Insertion Electromagnetic Meters

- Easy to install, immersion style sensor.
- Hot Tap-able, no system shut down.
- Electromagnetic technology, no moving parts.
- High accuracy over wide turndown, provided straight run requirements are met.
- Requires conductive fluid to operate.
- Good value in open loop, conductive fluid systems.
Clamp On Ultrasonic Meter

- High accuracy & turndown.
- Can measure bi-directional flow.
- Fairly high cost for small pipes, better value on larger pipes.
- Non-invasive design can be installed with no shutdown & no tapping the line.
- Type of transducers and sensing method best suited for application can be dependent on type of pipe and fluid properties.
Full Bore Electromagnetic Meters

- Highest accuracy & reliability, best short straight pipe run performance.
- Requires conductive fluid to operate.
- Installation, service, or calibration requires shutdown and drain.
- Suitable for use in most open loop and closed loop HVAC systems.
- Best choice for high dollar custody transfer.
Full Bore Vortex Shedding Meter

- Robust sensing technology, no moving parts, capable of measuring liquids, gases or steam.
- Ideally suited for steam applications.
- Limited turndown due to sensing technology, proper sizing of meter is paramount.
- Installation, service, or calibration requires shutdown and drain.
- Multi-variable technology provides good value in saturated steam applications.
Thermal Dispersion Meter

- High accuracy & turndown.
- Immersion sensor, hot-tapable versions available.
- Suitable for Gas and Compressed Air Applications.
- Compensated mass flow measurement technology
- Electronic based sensing system, provides outputs compatible with the BAS directly.
Installation

As Marketing Requested It
As Sales Ordered It
As Engineering Designed It
As Manufactured
As Plant Installed It
What the Customer Wanted
Installation
Reynolds Number

Inertial Forces/Viscous Forces

\[ \text{Re} = \frac{\text{inertial forces}}{\text{viscous forces}} = \frac{\rho v L}{\mu} = \frac{v L}{\nu} \]

- **Laminar**: \( \text{Re} < 2300 \)
- **Transitional**: 2300 to 4000
- **Turbulent**: \( \text{Re} > 4000 \)
Flow Regimes

LAMINAR
flow profile.

TUBULENT
flow profile
Obstructions

- Single 90° Elbow 20 Dia
- Tee 20 Dia
- Reducer/Expansion 20 Dia
- Two 90’s same plane 30 Dia
- Ball/Gate Valve Fully Open 30 Dia
- Two 90° Elbows out of plane 40 Dia
- Control Valve 50 Dia
- P.R.V 50 Dia
Installation
Review

• Important Decision Making Data
• Partners
• Specs/Selection
• Technologies (No Silver Bullet)
• Installation ("A flow meter, can ...")
Thank You!
For More Information

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