Energy and Flow Measurement for Hydronic Systems

Presented By:

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AEB Technologies

Flow Meter Technology

Quote of the day:

“A flow meter, can only be as good as its installation”.

HPAC Engineering

"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 INCORPORATED

Manufacturer

aeb technologies

Representative

Meter Selection


ONICON
INCORPORATED

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 <u>outstanding service</u>**

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**


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AEB Technologies

- Focused Line Card
- Instrumentation and Controls
- Personal Service
- Intimate and experienced with our technologies
- Application assistance

AEB Technologies

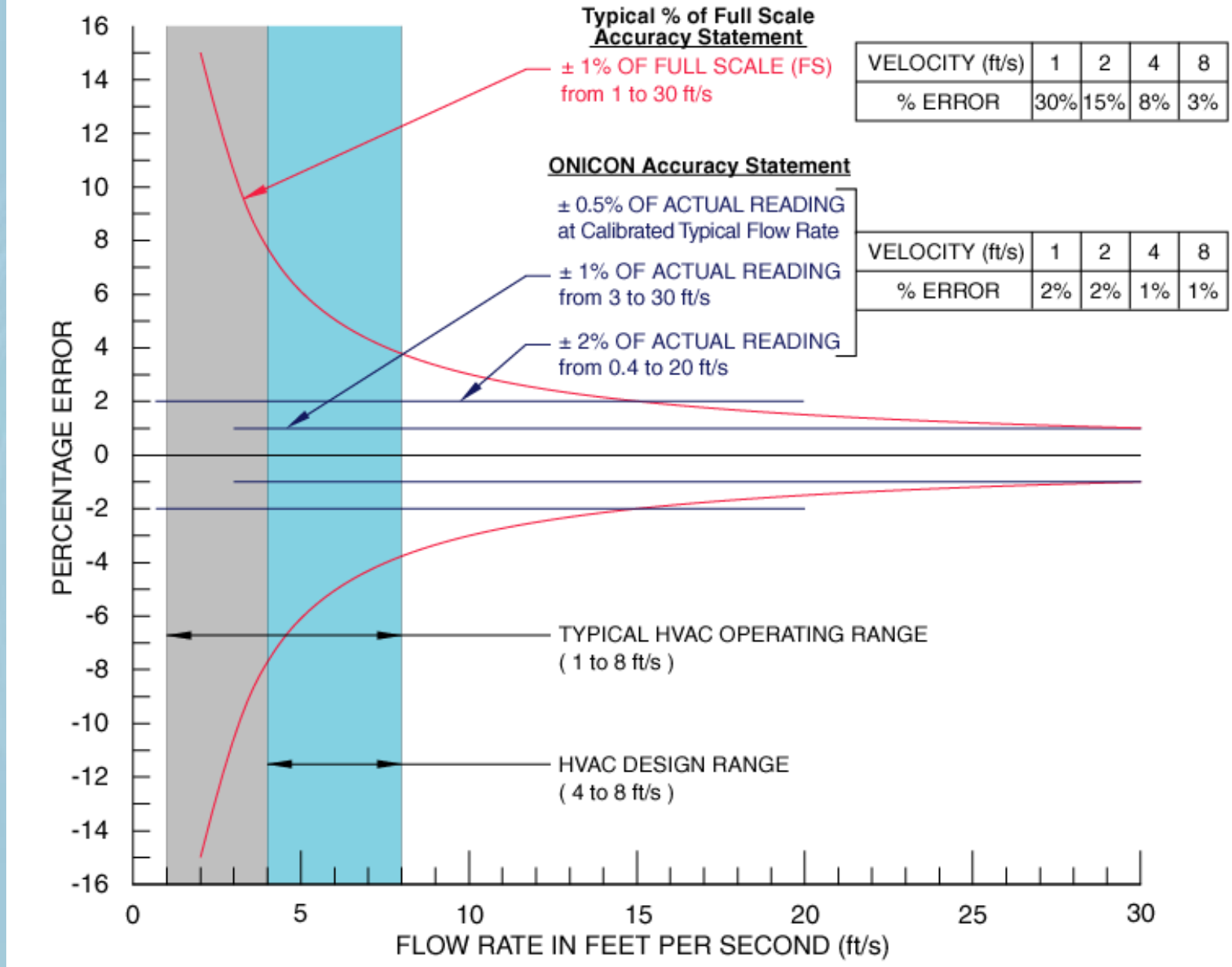
- For a given an application, I can help you select the highest value meter according to the needs of your project.
- Can help you get that meter applied correctly which will bring you the best value that the meter has to offer.

Meter Selection

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
VELOCITY (ft/s) 1 2 4 8
% ERROR 30% 15% 8% 3%
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 2% 2% 1% 1%
TYPICAL HVAC OPERATING RANGE
(1 to 8 ft/s)
HVAC DESIGN RANGE
(4 to 8 ft/s)
PERCENTAGE ERROR
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
0
5
10
15
20
25
30
FLOW RATE IN FEET PER SECOND (ft/s)

Rangeability/Turndown

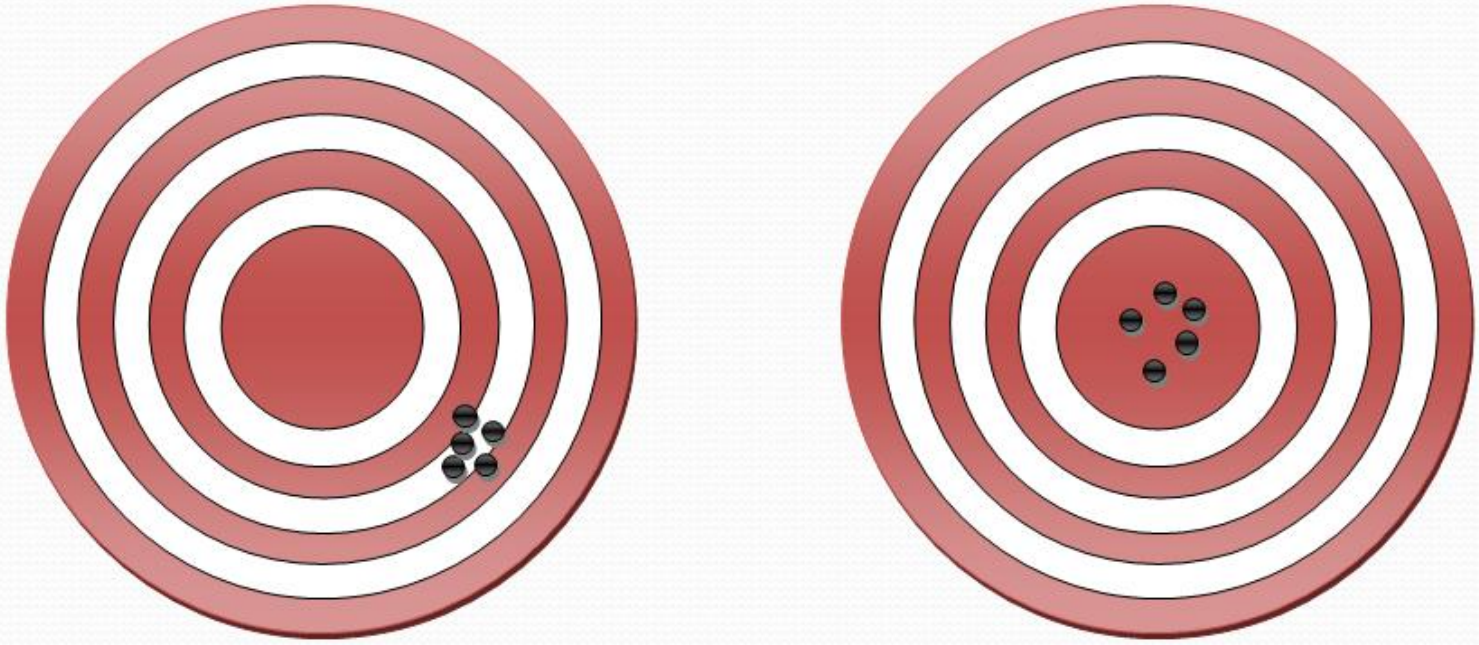
- **Rangeability: The range over which an instrument can measure**

1-30 fps, 10-1000 gpm

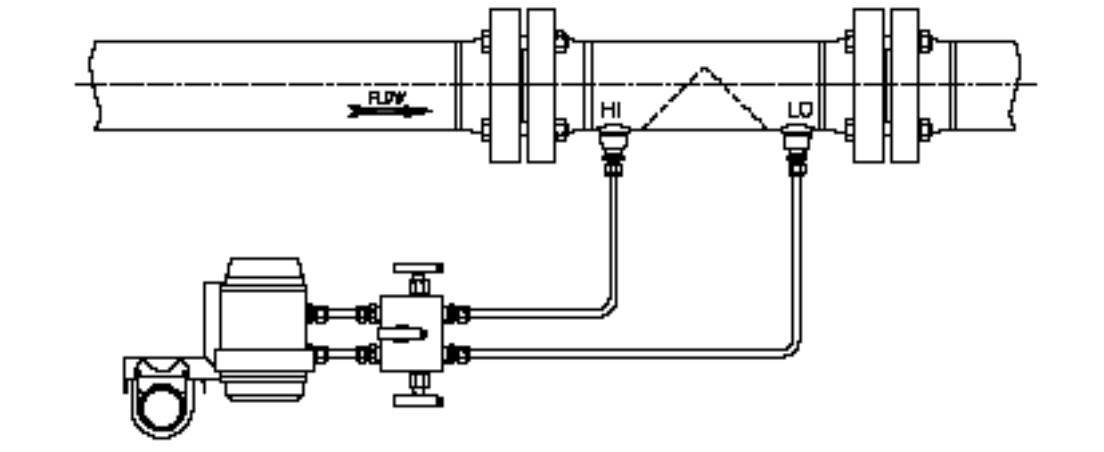
- **Turndown: The range specified as a ratio of the highest measured value over the lowest**

30:1, 100:1

Repeatability vs. Accuracy



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

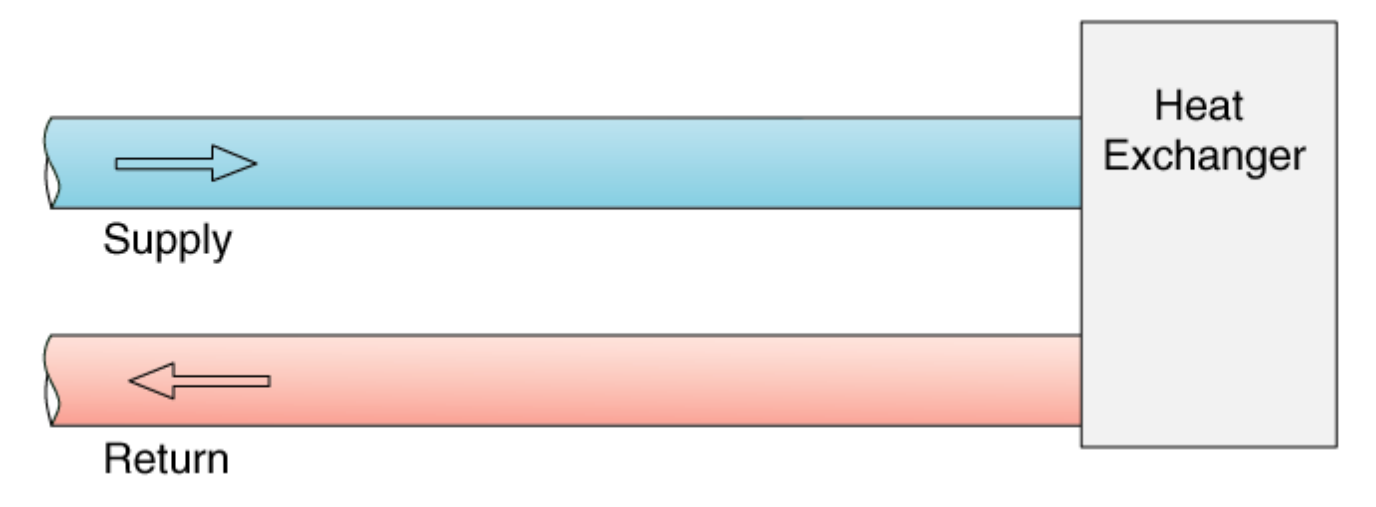
ONICON's Technologies

- 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.

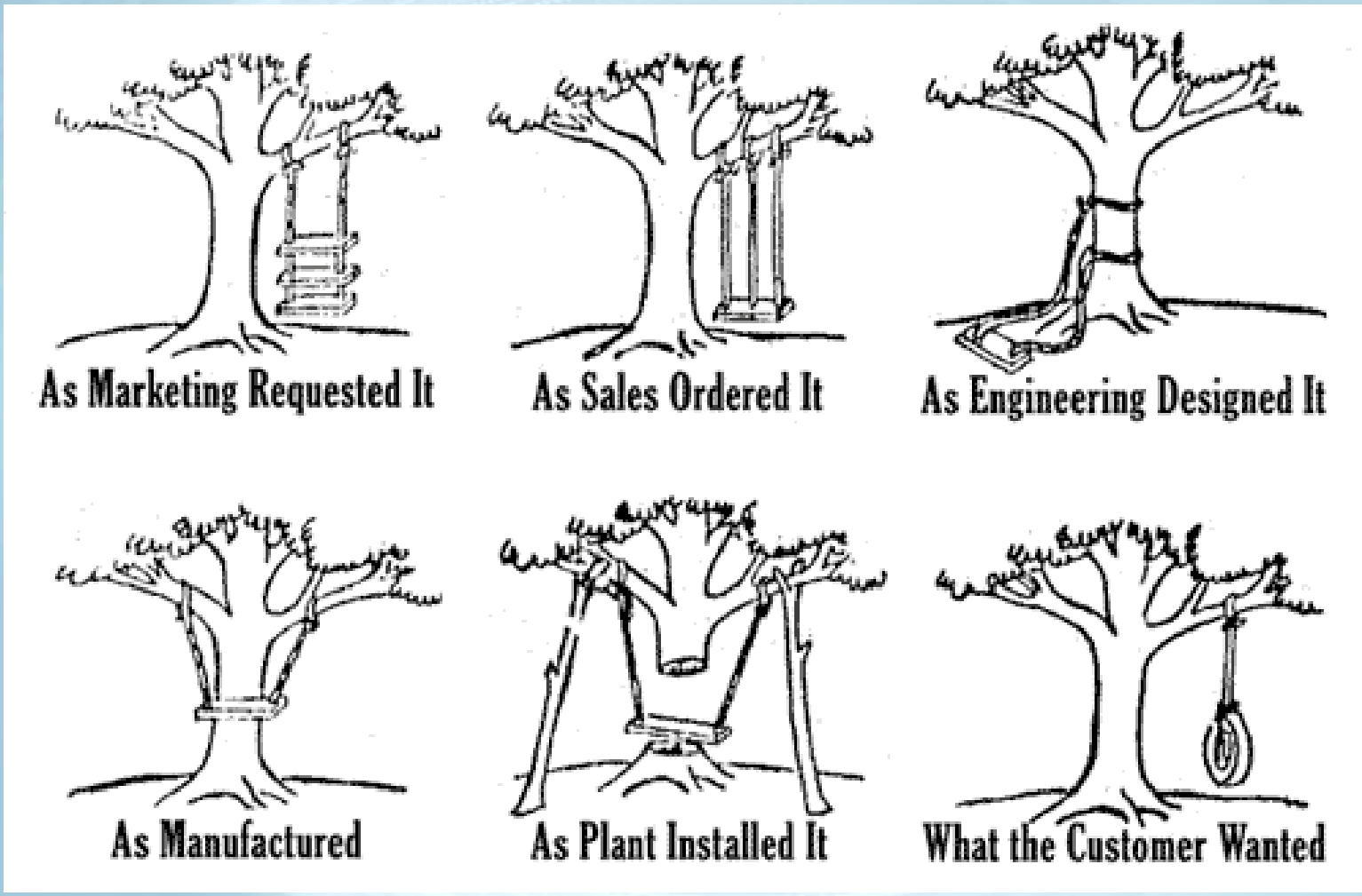
Full Bore Vortex Shedding Meter

- 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



Installation

Reynolds Number

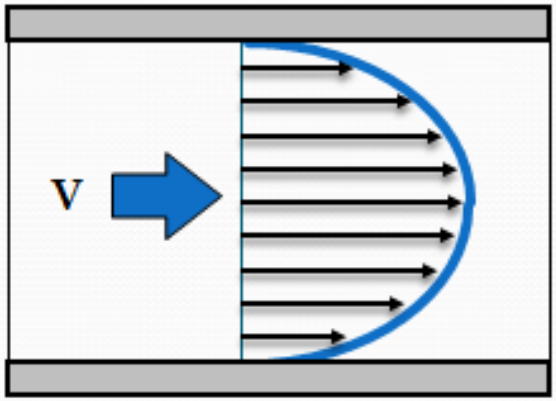
Inertial Forces/Viscous Forces

$$\mathrm{Re} = \frac{\text{inertial forces}}{\text{viscous forces}} = \frac{\rho \mathbf{v} L}{\mu} = \frac{\mathbf{v} L}{\nu}$$ [6]

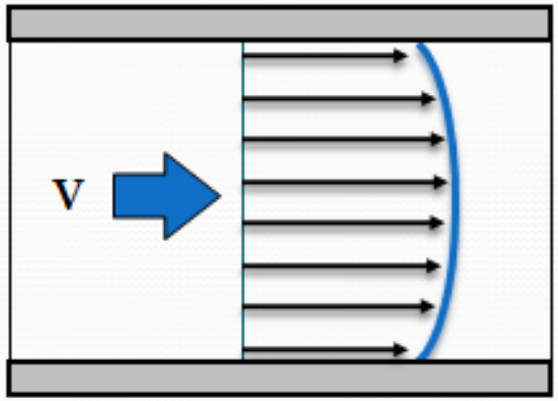
Laminar	Transitional	Turbulent
Re < 2300	2300 to 4000	Re > 4000

Flow Regimes

LAMINAR
flow profile.



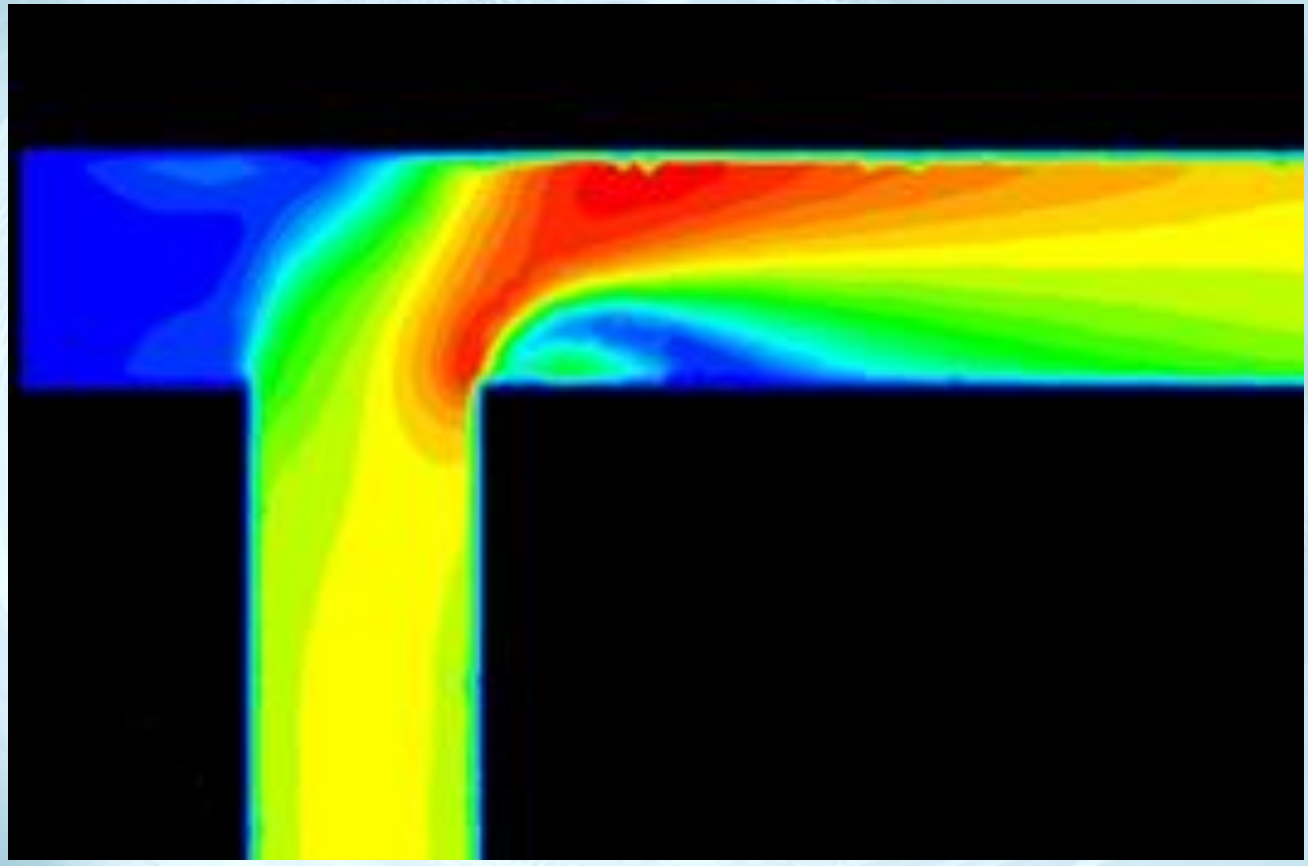
TUBULENT
flow profile



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