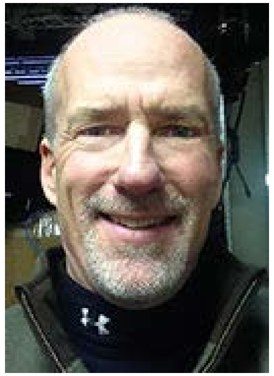
Thank You for Attending Today's Webinar

Your Host

Tom Douglas
Sales
RAECO-LIC LLC
tom@raeco.com



Our Featured Speaker

Dan Kilpatrick
Account Manager
GE Measurement & Control
daniel.kilpatrick@ge.com

Using Ultrasonic Meters for Successful Energy Metering

imagination at work

Types of Energy Use:

Chilled Water
Steam – HTHW
Electric
Compressed Air
Natural Gas

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Where?

Central Utility Plants

Campus Energy

- Universities - Hospitals
- Industrial
- Pharmaceutical
- Food

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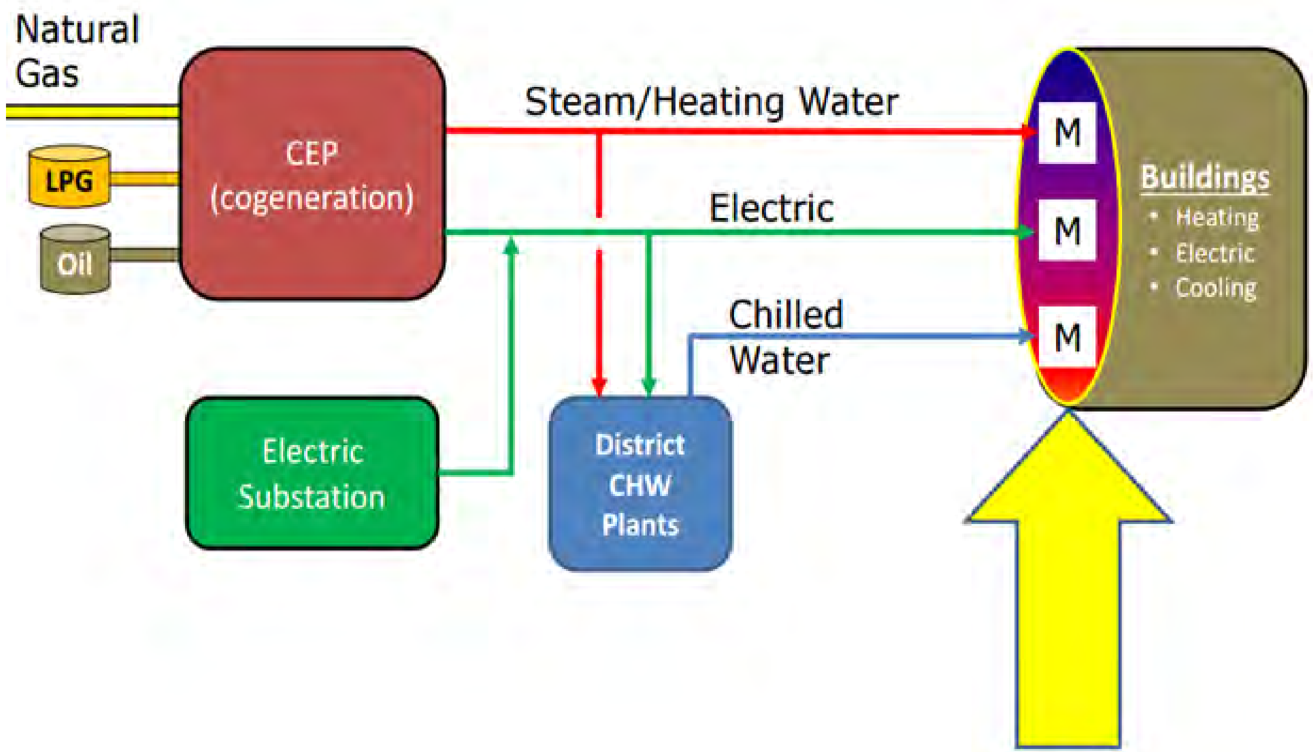
Submetering



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http://www.districtenergy.org/assets/pdfs/2016-Campus-Austin/2-10-16-Weds/3A/3A.2GERSHBERGKEEL.pdf
RMF Engineering

Why Meter?

Energy Reduction
Control – Optimization of Utility Plants and Buildings
Accurate Billing
Data
Required by regulatory agencies

- MACT
- NSPS Ja

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Resources:

RaecoRents (www.raecorents.com)
- Rent portable ultrasonic liquid or gas meters

SustainableSteam (www.sustainablesteam.com)
- Steam & Water consulting services

JIM McAULEY, LLC (www.jimmcauley.com)
- Energy engineering specific to compressed air systems

RMF Engineering (www.rmf.com)
- Full service engineering company
- Energy Management & Control Systems experience

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GE
Measurement & Control

Ultrasonic & Vortex Flow Meters for Energy Management Systems

GE imagination at work

"If you cannot measure it, you cannot improve it"

- Lord Kelvin

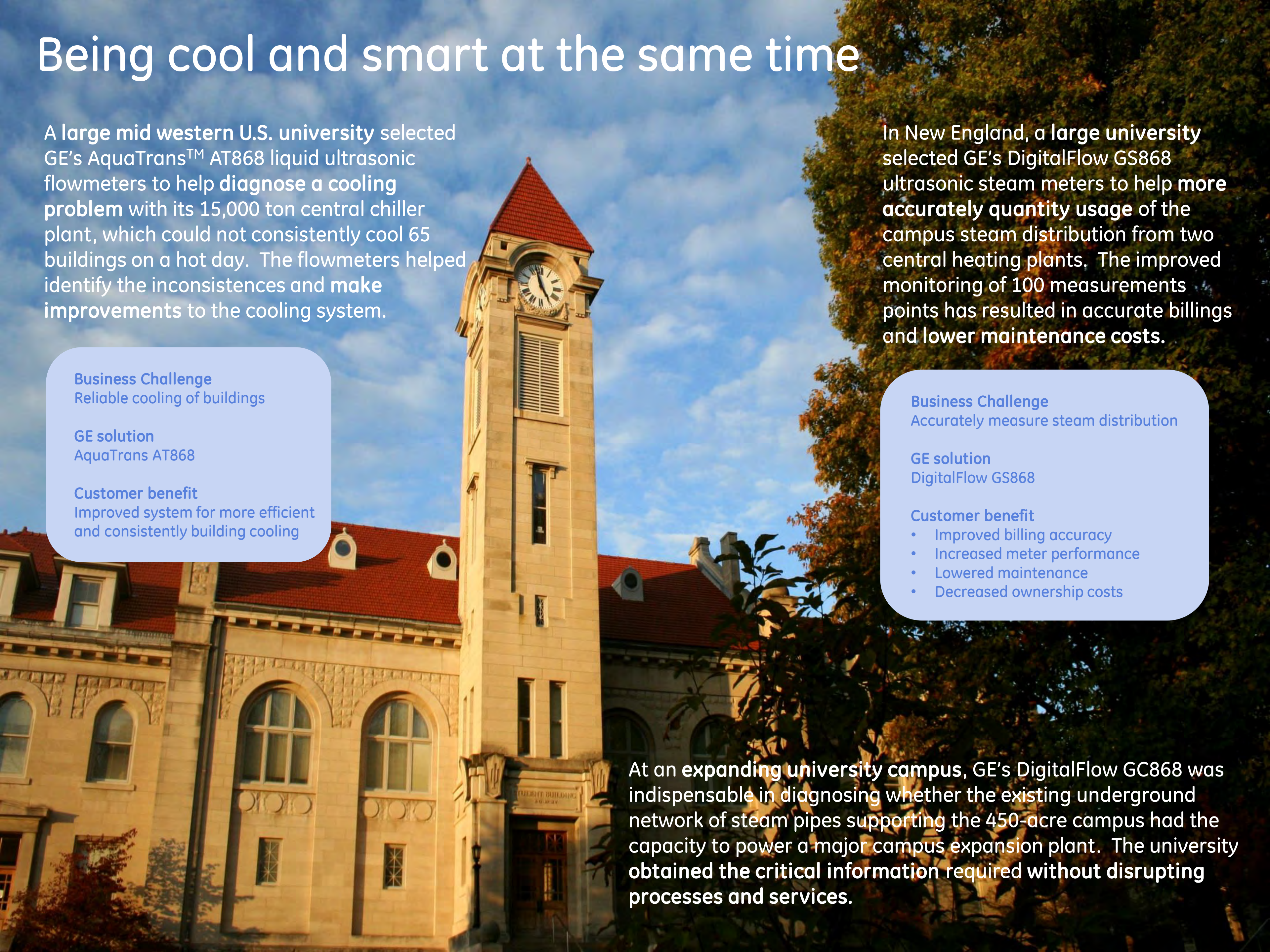
Big government… small energy consumption

A U.S. **federal agency** chose 50 of GE's DigitalFlow™ DF868 and GS868 flowmeters to measure 100 points on its steam boilers and mechanical chillers, enabling the agency to monitor energy usage, **converse resources**, and **reduce maintenance costs** at many of its facilities in Washington DC

Business Challenge
Mandate to reduce energy consumption in the U.S. government buildings

GE solution
- DigitalFlow GS868
- DigitalFlow DF868

Customer benefit
- Increased measurement range
- Reduced overall maintenance costs
- Eliminated pressure drop



Being cool and smart at the same time

A **large mid western U.S. university** selected GE's AquaTrans™ AT868 liquid ultrasonic flowmeters to help **diagnose a cooling problem** with its 15,000 ton central chiller plant, which could not consistently cool 65 buildings on a hot day. The flowmeters helped identify the inconsistences and **make improvements** to the cooling system.

Business Challenge
Reliable cooling of buildings

GE solution
AquaTrans AT868

Customer benefit
Improved system for more efficient and consistently building cooling

In New England, a **large university** selected GE's DigitalFlow GS868 ultrasonic steam meters to help **more accurately quantity usage** of the campus steam distribution from two central heating plants. The improved monitoring of 100 measurements points has resulted in accurate billings and **lower maintenance costs.**

Business Challenge
Accurately measure steam distribution

GE solution
DigitalFlow GS868

Customer benefit
- Improved billing accuracy
- Increased meter performance
- Lowered maintenance
- Decreased ownership costs

At an **expanding university campus**, GE's DigitalFlow GC868 was indispensable in diagnosing whether the existing underground network of steam pipes supporting the 450-acre campus had the capacity to power a major campus expansion plant. The university **obtained the critical information** required **without disrupting processes and services.**

Prescription for cost savings

After a **major Canadian medical company** acquired a large campus, it selected GE's DigitalFlow GS868, DigitalFlow DF868, and AquaTrans AT868 to **track energy costs**. Since installing the ultrasonic flowmeters to measure steam, chilled water, and condensate, the company has **realized cost savings** and expected to achieve more savings from years to come.

Business Challenge
Track and obtain data on energy costs

GE solution

- DigitalFlow GS868
- DigitalFlow DF868
- AquaTrans AT868

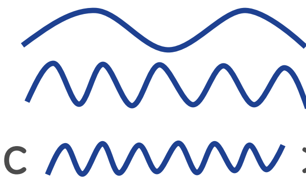
Customer benefit

- Accurately recorded data
- DigitalFlow DF868

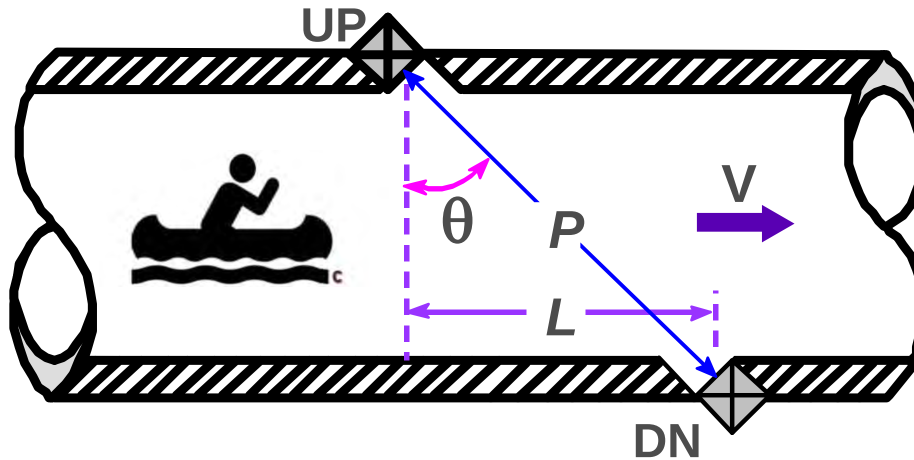
Two Flow Technologies – Ultrasonic

Sound

Subsonic 0 to 20 Hz
Audio 20 to 20 kHz
Ultrasonic >20 kHz

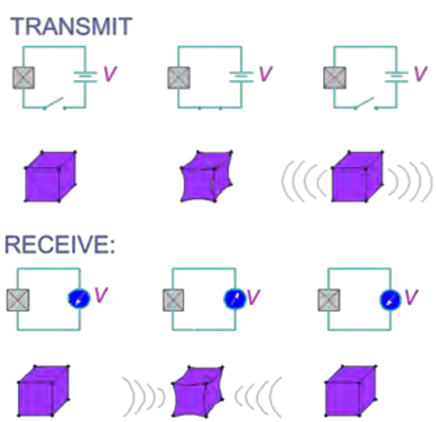


Transit Time

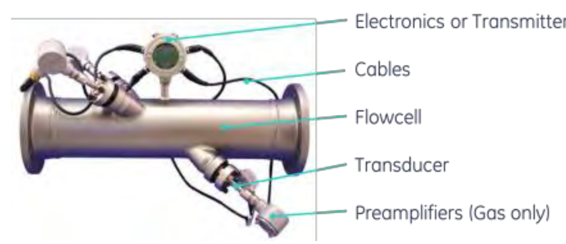


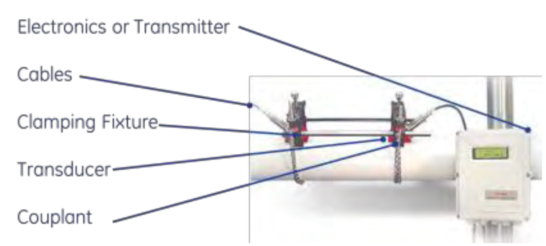
Transducers

Electrical to Mechanical Energy



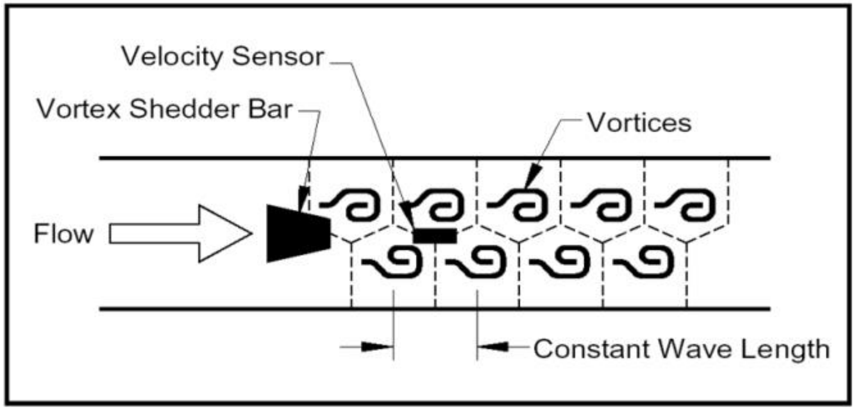
Wetted or Clamp-On





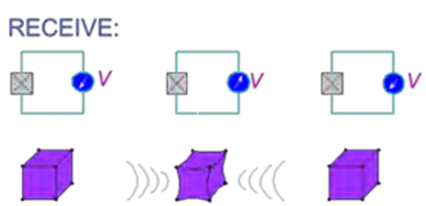
Two Flow Technologies – Vortex

Frequency to Velocity



Transducers

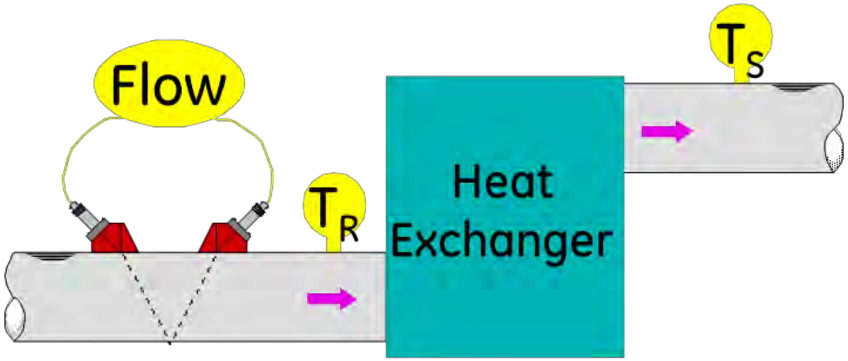
Mechanical to Electrical Energy



Inline or Insertion

Liquid Flow Measurements

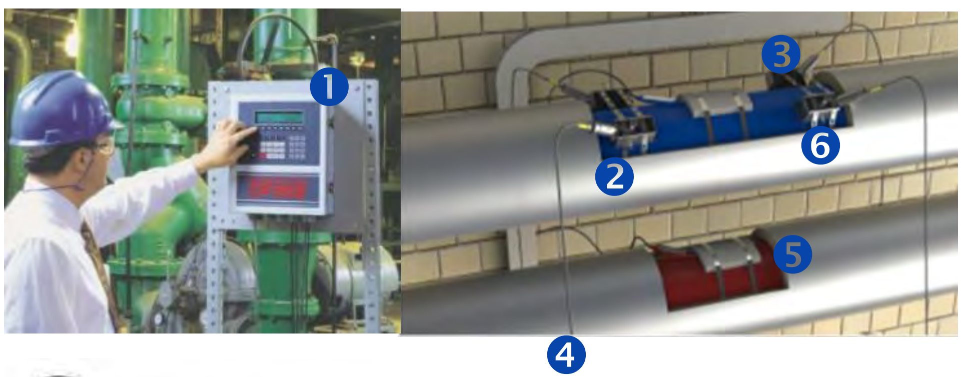
- Permanent clamp-on ultrasonic flow meter for nominal temperature liquids for energy measurements
- The flowmeter computes flow, measures temperature, and calculates the energy rate (example: BTU/HR)
- Stores enthalpy and density information for water, water/glycol mixtures, and custom Fluids



Δ Q = ENERGY RATE

$$\Delta Q = VA\rho(h_S - h_R)$$
$$\Delta Q = VA\rho(\Delta h)$$

where V = velocity
A = cross-sectional area
ρ = density of fluid
h_S = enthalpy of supply
h_R = enthalpy of return



1. DF868 Electronics
2. Transducers: C-RS, UTXDR
3. Clamping Fixture
4. Cable
5. Clamp-on or wetted temperature
6. Couplant

DigitalFlow Energy Measurement

- Full Featured Permanent Flowmeter
- Single Channel or Two-Channel/Two-Path
- NEMA 4X package standard, FM&CSA Cl. 1, Div. 2, all groups
- Other enclosures available
- Wetted or Clamp-On
- PC programmable
- Multiple output options
- MODBUS (RS485 or TCP, BACNET, & HART
- Energy measurement capable

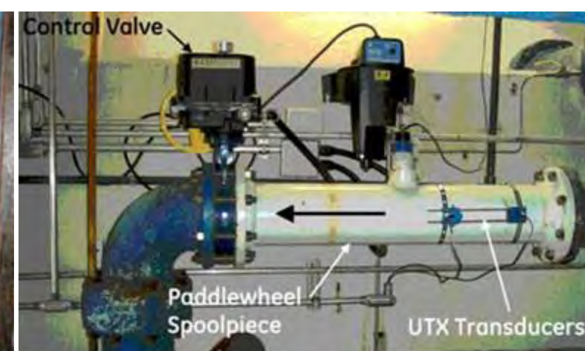
- -40 to 300°F Typical
- IP67 (option for IP68)
- Multiple frequencies
- Multiple pipe sizes
- 100 ft cable (longer upon request)

AquaTrans AT868

AquaTrans AT600

AquaTrans Water Measurement – AT868

- Water & Wastewater Flowmeter
- General Purpose, NEMA 4X enclosure
- 1 or 2 channel
- Clamp-on or wetted transducers
- Cable gland entry only
- Back plate for mounting
- Internal keypad for data entry



AquaTrans Water Measurement – AT868

- Water / Wastewater Flowmeter
- General Purpose, NEMA 4X enclosure
- 1 channel
- Clamp-on
- Cable gland entry only
- Back plate for mounting
- Low power consumption

Improves on AT868 legacy

- Green/red light health indication
- Multiple languages
- External keypad with software protection
- Modbus/RS485 communication
- Vitality software capable
- Improved fixture/transducer design
- Calibration standard (1%)

Transport Energy Measurement

- Portable clamp-on ultrasonic flow meter for nominal temperature liquids
- The flowmeter computes flow, measures temperature, and calculates the energy rate (example: BTU/HR)
- Stores enthalpy and density information for water, water/glycol mixtures, and custom Fluids

❶ PT878 Electronics
❷ Transducers: C-RS, C-PT, CF-LP
❸ Clamping Fixture
❹ Cable
❺ Accessories
❻ Couplant

Advantages of Ultrasonic Measurement

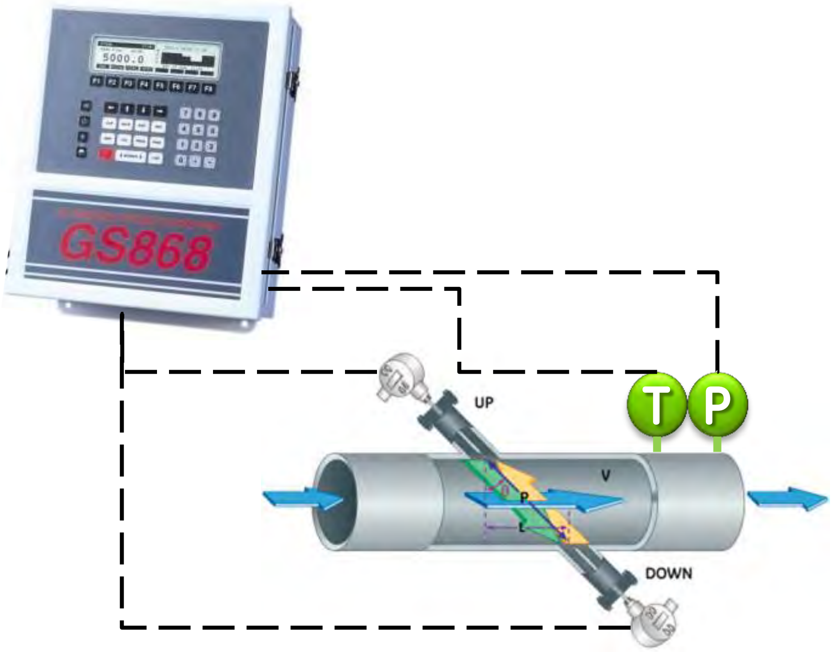
No drifting, no periodic calibration required	No loss of process control, optimization of assets and efficiency, no downtime or expense from calibration
No pressure drop	No wasted energy from running a pump or purchase of a larger size pump
No restriction in the pipe	Contamination will not affect meter's measurement (drifting) or any damage to meter
No filters or strainers	No maintenance cost
Bi-directional measurement	No additional meters required
No moving parts	No loss of process control, optimization of assets and efficiency, no downtime or expense from calibration
Flow measurement independent of temperature, pressure, viscosity and conductivity	No impact to accuracy, which affects process control

Advantages of Clamp-On Measurement

Install on new or existing pipes	Save time and money not cutting into pipe, install in difficult locations, install anytime
Install on outside of pipe	Save time and money not cutting into pipe, no process shutdown, no process contamination
No welding, no extra parts	Save time and money
No leakage	No contamination
No required maintenance	Low cost of ownership

Steam Flow Measurements

- Permanent wetted ultrasonic flow meter for nominal or high temperature steam
- The flowmeter computes flow, measures temperature and pressure to calculates mass (example: LB/HR)



1. GS868 / XGS868i Electronics
2. Transducers: T5, T9, BWT
3. Holder: FH, FTPA, FIPA
4. Cable
5. Flowcell

DigitalFlow Steam Measurement

- Full Featured Permanent Flowmeter
- Single Channel or Two-Channel/Two-Path
- GS868: NEMA 4X package standard, FM&CSA Cl. 1, Div. 2, all groups
- XGS868o: NEMA 7 package
- Wetted Only
- PC programmable
- Multiple output options
- MODBUS (RS485 or TCP, & HART)
- Inputs for temperature and pressure

T9/T5 Transducers

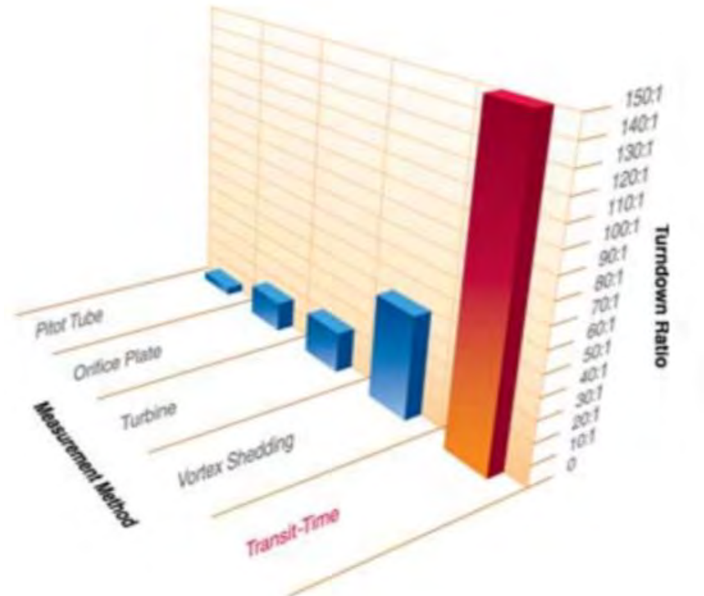
- T_{max}: 450oF
- P_{max}: 250 psig

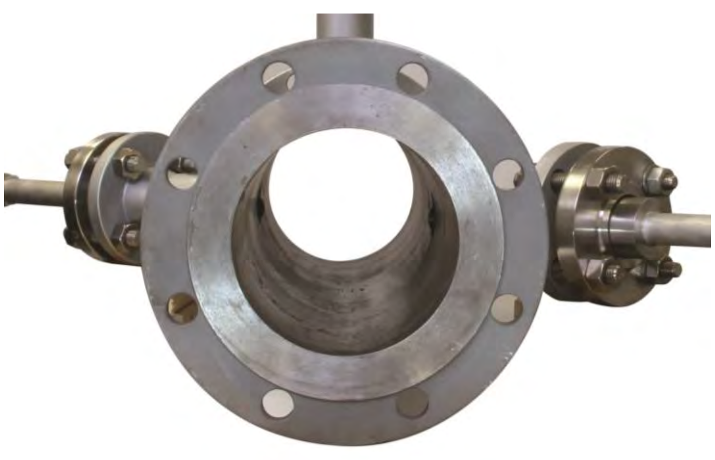
BWT System

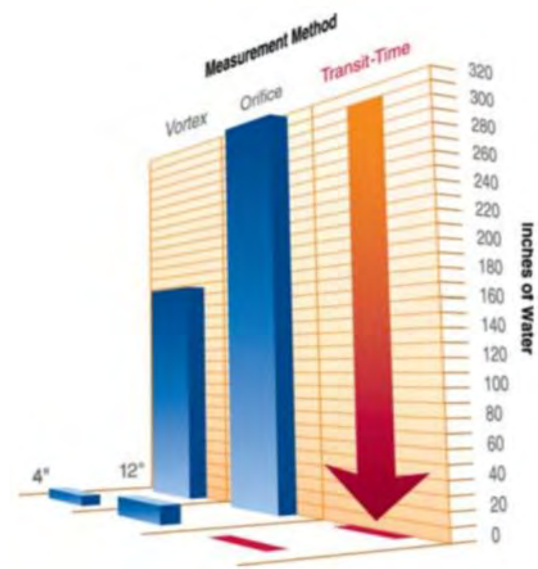
- T_{max}: 1110oF
- P_{max}: Flange

Ultrasonic Steam Measurement Advantages

- High reliability
- Bidirectional
- No moving parts
- Low-end resolution at or better than 1 ft/sec
- Wide rangeability—150 to 1
- Non-obstructive flow
- Tolerance to dirty streams
- No pressure drop
- No maintenance
- Suitable for high temperatures
- No periodic calibration

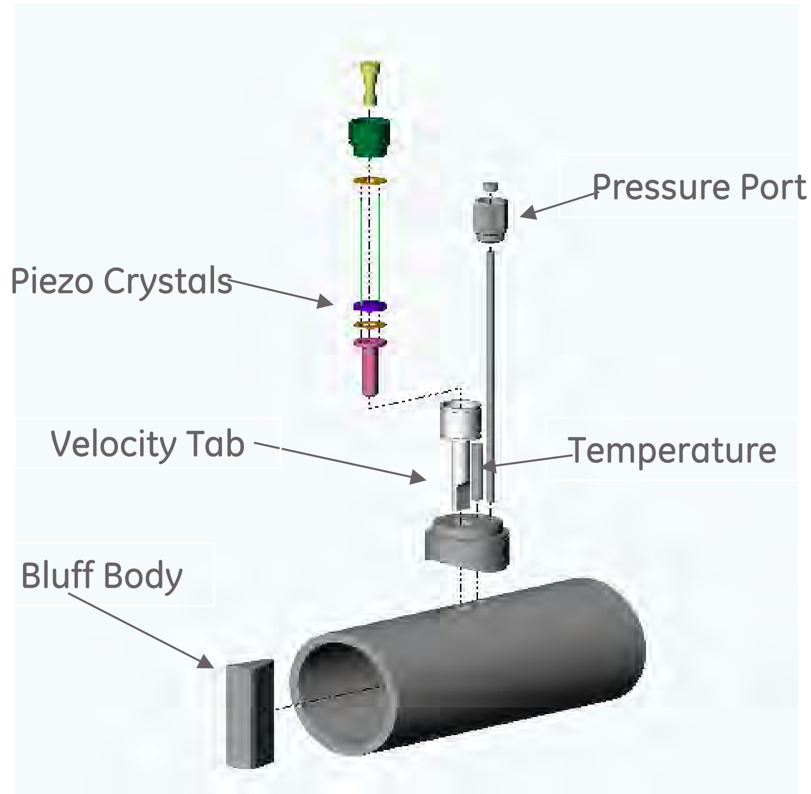






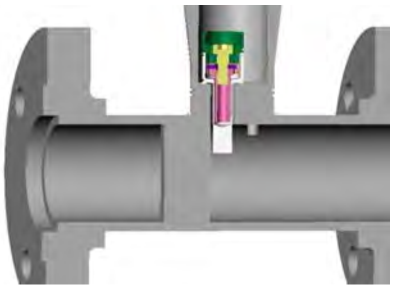
Multivariable Vortex

- Permanent wetted vortex meter for nominal or high temperature steam
- The flowmeter computes flow, measures temperature and pressure to calculates mass (example: LB/HR)



MV80

MV82



Multivariable Vortex

- Temperature, pressure, and energy capability
- ½” to 8” sizes
- Carbon or stainless steel
- 150# to 600# standard
- Multiple outputs including HART, Modbus, and Bacnet
- -40oF to 500°F/750°F temperature
- 0 to 2500 psig pressure

- Same options as MV80 inline
- 2” to 72” sizes
- Compact, standard, or extended lengths
- Permanent or retractable options

Multivariable Vortex Advantages

- Good accuracy
- High reliability
- Multi-variable meter
- Ability to dynamically calculate density and mass flow rate
- Wide operating range for liquid, steam and gases
- Insertion – one size fits many....
- Reduced installation and maintenance costs
- Low pressure drop
- Mass flow from loop powered 4-20mA device

Multivariable Vortex Advantages

Temperature and Pressure Compensation (Steam Example)

- Application: Steam at 350oF/**100** psig (superheated) in 4" , std sch. Line
  - Flow Rate: *1000* lb/hr (12.4745 ft/s at density of *0.2519* lb/ft3)

- Application changes conditions to 350oF/**95** psig (superheated)
  - Flow Rate: *954* lb/hr (12.4745 ft/s at density of *0.2402* lb/ft3)
  - If meter is not pressure compensated, it would measure 1000 lb/hr!!

$$\frac{(1000-954)}{954} \times 100 = \textbf{4.82\% error!!!}$$

Pressure Measurement is Important!

GE imagination at work

Flow Services

- Rentals
- Energy Flow Surveys
- Onsite Startup Assistance
- Training

Case Studies

Chilled Water at University #1

- University had a 15,000 ton central chiller plant feeding 65 buildings.
- On hot days they would run out of cooling.
- They needed to find out how much each building was using so they could make improvements to their system

- Why did they chose ultrasonic meters?

"We chose to go with ultrasonic because it was less invasive. We didn't have to have an outage of the system in order to install," he said. "It installs on the outside of the pipe and provides the accuracy we need"

- They purchased 65 GE Sensing AT868 liquid ultrasonic flowmeters.
- They had them all up and running within three months of delivery.

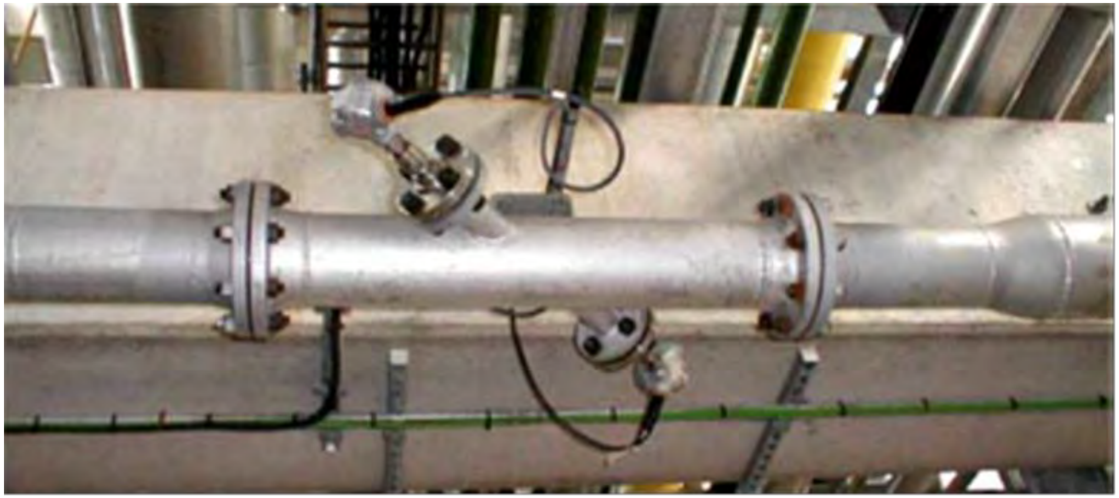
- Over 100 points of steam measurement from 2 central heating plants
- Traditional technologies had been used including
    1. Orifice Plate
    2. Turbine Meter
    3. Condensate Return

Why these techniques failed?

- Orifice Plates
  - Significant Energy Loss
  - Low Turn Down of 10:1
  - Erosion of Orifice Plate – accuracy drift
- Condensate
  - Leaking Traps
  - Reverse flow, faulty backflow preventers
  - Pipes that drain
- Turbine Meter
  - Replacing rotors every 6 months
  - Calibration issues

Why did they choose Ultrasonic?

- Save money by eliminating pressure drop
- Increase measurement range with high turn down ratio
- Increase accuracy
- Low maintenance



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