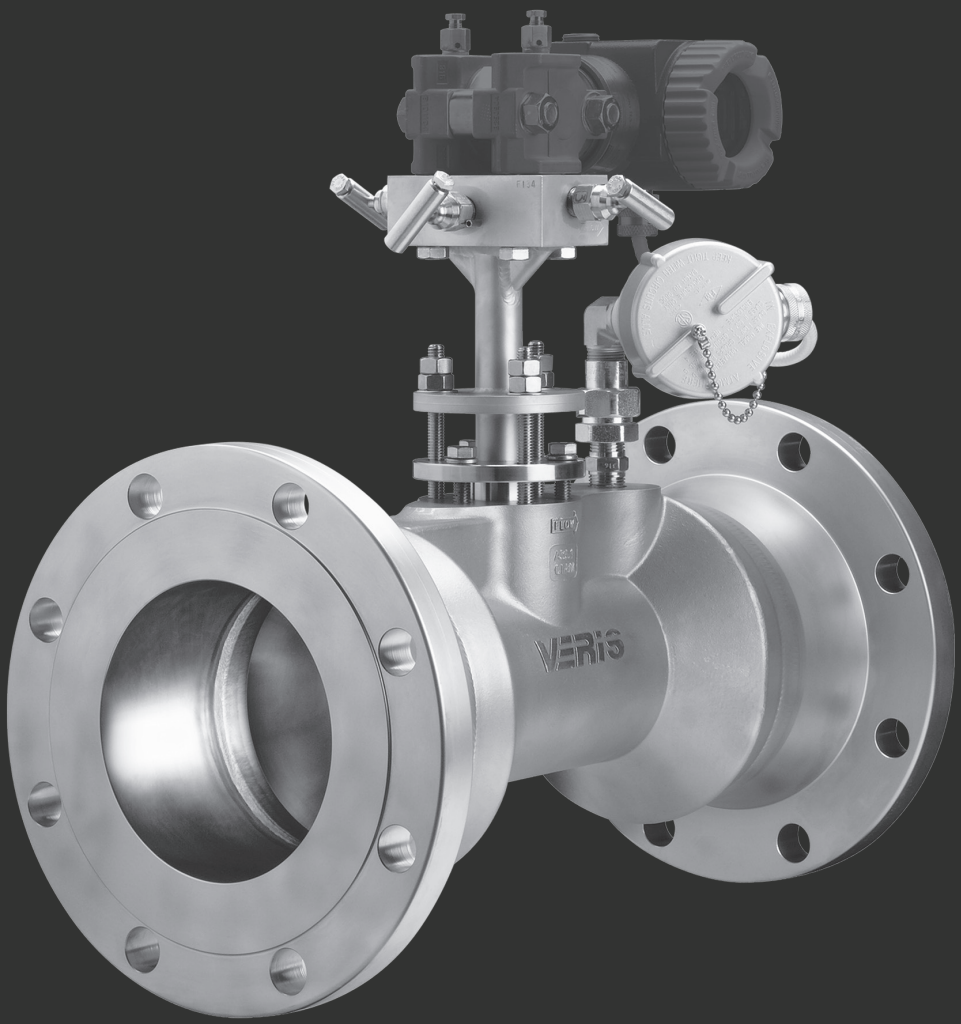
Armstrong®

VERIS ACCELABAR® APPLICATION DATA

TRUE PERFORMANCE IN FLOW MEASUREMENT



Vaporized Liquid Natural Gas (VB-6032)

Application

A liquid natural gas plant in the Midwest needed to measure gas flow to heaters that vaporize LNG to gaseous natural gas for use during peak periods in the winter season. The company stores LNG in two 12,000,000-gallon tanks and uses gas-fired heaters to vaporize it as required to meet customer demand. For most of the year demand is low (1,000 SCFH); however, during the coldest winter months gas consumption jumps to 60,000 standard cubic feet per hour (SCFH) in a 3" sch 40 line at 80 psig/70° F.

Problem

The plant must account for the gas usage over the entire range as it is part of the operating cost during LNG vaporization, as well as when it is used for plant heating. The customer could not find one meter to accommodate the entire range accurately. The plant had attempted to measure the flow rate with a Roots turbine meter sized for the maximum flow rate, but could not get accurate flow readings at the low end of the measurement range, making it impossible to determine actual usage during the off-peak periods. In addition to accuracy limitations, turbine meters have moving parts that wear and require expensive maintenance. The customer's operating cost was estimated and charged against the bottom line. In addition, as you can see from the photo, there was no straight run available which hindered a conventional meter's ability to perform accurately.

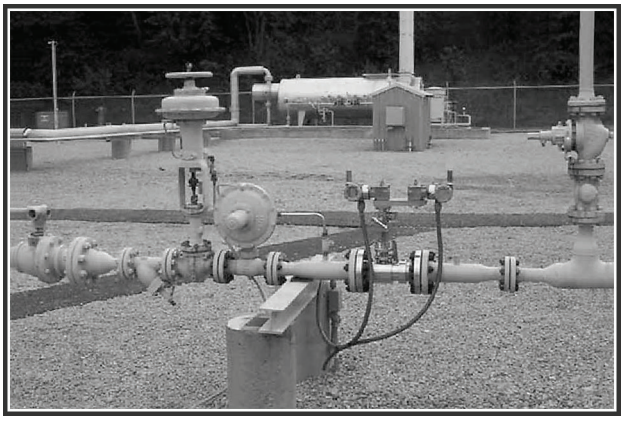
Solution

A Model AF 3" 150-H-M Accelabar was installed immediately downstream of a pipe reduction, control valve and pressure regulator. The Accelabar had two Foxboro IDP50 high accuracy DP transmitters directly mounted to the top of the Accelabar sensor. Stacked outputs were required to accommodate the wide turndown in DP of 308.2" w.c. at max and 0.08" w.c. at min.

Fluid:	Natural Gas
Industry:	Gas Distribution
Application:	Vaporized Liquid Natural Gas
Specifications:	No Straight Run Turndown 60:1

Results

The Accelabar performed as advertised with ±0.75% accuracy over the entire range of 1,000 to 60,000 SCFH—a flow turndown of 60:1. Because the Accelabar and transmitters have no moving parts to wear or seize, maintenance is minimal. The LNG supplier has found that the flow metering system is user friendly and easy to operate, especially since DP flow measurement is one of the most easily understood of any flow measurement technology available. To the LNG provider, this translates into improved material accountability and lower operating costs to increase profitability.



Application: 3" Sch 40 Natural Gas

Operating Pressure/Temperature: 80 psig/70° F

Max/Min Flow Rate: 60,000 SCFH/1,000 SCFH

Flow Turndown: 60:1

Steam Submetering (VB-6033)

Application
Steam flow at a large university over wide flow turndowns.

Problem
Steam flow rates vary based on changing demand (winter vs. summer, breaks, etc.).

Pressure/Temperature
125# Steam

Flow Rate
2,000 PPH to 30,000 PPH (turndown 15:1)

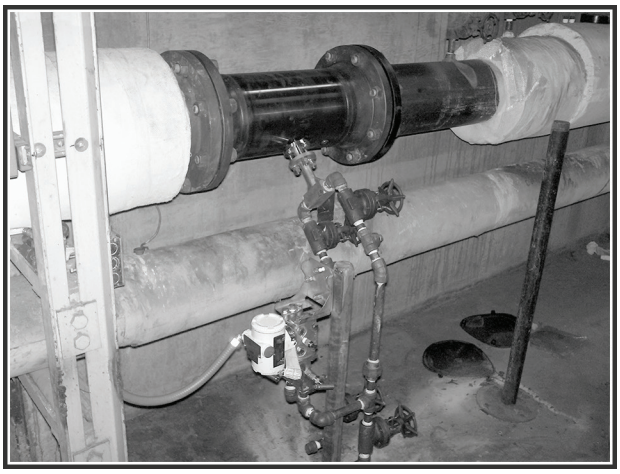
Pipe Sizes
8” Pipes

Solution
Accelabar Advantages:

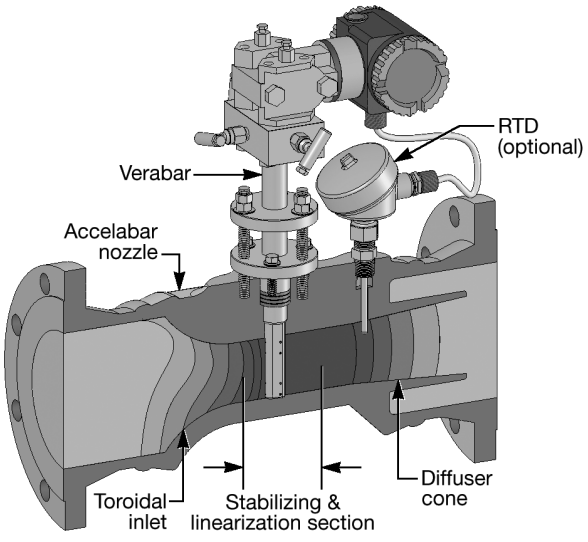
- Ability to accurately measure a wide range of steam flows. The Accelabar nozzle accelerates the steam velocity. The Verabar located within the nozzle accurately measures and significantly increases the differential pressure output to increase the operating range (turndown).
- No straight run requirements. Stabilization and linearization of the steam velocity profile within the throat of the nozzle eliminates the need for any upstream run.
- No piping modifications required. Other technologies require a reduction in pipe size (to increase the velocity to measurable ranges), including additional straight lengths of pipe. The Accelabar did not require a reduction in pipe size and was installed within only a 22” face-to-face dimension.

Results
Customer comment: “This time of year (summer) the steam flow on this steam line is low. We have been checking the readings and are pleased with the results. I feel this added accuracy on the lower end will be a real plus for our billing department. Thanks for your help.”

Fluid:	Steam Submetering
Industry:	District Energy
Application:	Energy Monitoring
Specifications:	No Straight Run Turndown 15:1



Accelabar in steam line



No straight run requirements are needed for Accelabar

Propylene – Chemical (VB-6036)

Application
Monitoring propylene usage by measuring the flow rates from the main line into a chemical plant.

Pressure/Temperature
700 PSIG / 80° F

Flow Rate
9,000 PPH to 130,000 PPH (future capacity)

Pipe Sizes
4” Pipe

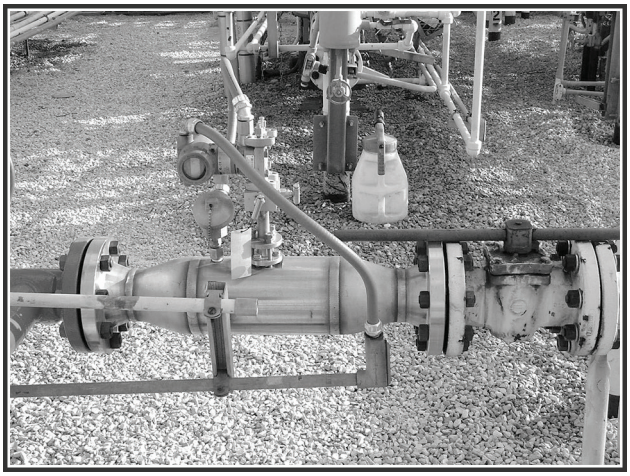
Problem
Piping constraints required the flow meter to be installed with no upstream or downstream straight run, bolted directly between a valve (upstream) and tee (downstream).

The meter would have to be sized with a future increase in demand considered.

Solution
- Ability to accurately measure current flow rates (low velocity) while having the ability to accommodate a future increase in capacity. The required 15:1 flow turndown is well within the operating limits of the Accelabar.
- No straight run requirements. The location between the upstream valve and downstream tee is adequate because the necessary straight run is integral to the Accelabar.
- No piping modifications or future meter replacement required. The Accelabar was designed to directly replace a turbine meter within the required face-to-face dimension.

Fluid:	Propylene
Industry:	Various
Application:	Chemical Plant
Specifications:	No Straight Run Turndown 15:1

Results
The Accelabar is accurately measuring the propylene flow despite the limited straight run. When checked against a custody transfer turbine meter, the Accelabar was in agreement within 0.2%. Because the meter was sized up (with an integral expansion from 4” to 6”), it is equipped to handle the increased future demand.



Chemical application installed Accelabar to accommodate future increases

Natural Gas – Boilers (VB-6039)

Application

Natural gas measurement for energy monitoring and system efficiency.

Comparison of Accelabar, Averaging Pitots and Orifice Plates

Requirements of the application were high accuracy and high turndown (typically greater than 20:1 due to varying demands – summer/winter, day/night or changing production requirements). The permanent pressure loss (PPL) could not exceed 1.5 psig (40" H_2O) and there was limited straight run (less than two diameters).

1. Typical natural gas flowing conditions to a boiler: 3" pipe flowing @ 21,000 SCFH, Temp 70°F, Pressure 12 psig.

2. The 3" orifice plate was sized at the recommended beta ratio of 0.5 = 70.6" H_2O DP, PPL = 55.13" H_2O (78%). Turndown 4:1, and a straight run requirement of eight pipe diameters up stream.

3. The Accelabar was sized for a 3" pipe, DP = 84.871" H_2O, Turndown 27:1, PPL = 30.7" H_2O (36%). Note: the Accelabar PPL is similar to a Venturi (30% to 35% of the DP).

4. If a reduced PPL is required, select a larger size Accelabar (lower DP and PPL). A 4" Accelabar produces a DP of 21.601" H_2O and a PPL of only 7.370" H_2O.

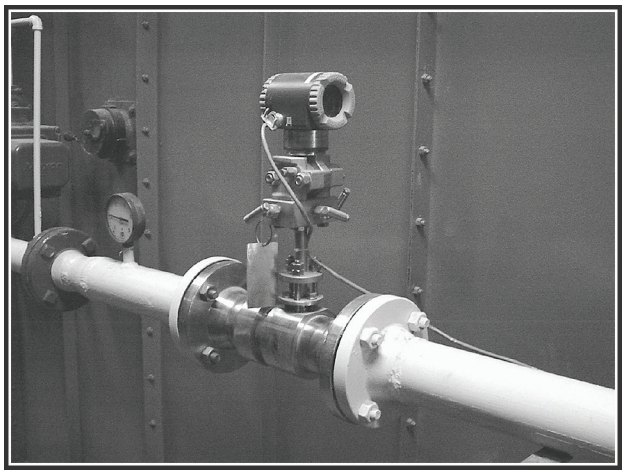
5. The averaging pitot produced a DP of 1.895" H_2O (too low for the application).

Fluid:	Natural Gas
Industry:	Various
Application:	Boilers, Burners & Heaters
Specifications:	No Straight Run Turndown 27:1

Results

1. The orifice sized at 70.6"H_2O DP, PPL of 78% or 55.3" H_2O (the DP usually is sized at 100" with a 60% PPL). The limited turndown of 4:1 and PPL in excess of 40" and straight run requirements eliminated the orifice from consideration.

2. The **Accelabar** at over **84" H_2O DP, PPL of 36%, 27:1 turndown** and **NO STRAIGHT RUN REQUIREMENT** is the only meter to meet the specifications.



Accelabar provides high accuracy with no straight run requirements

Boiler Feedwater (VB-6040)

Application

A large generating station in Puerto Rico needed to control the minimum boiler feedwater recirculation flow during low fire and under start-up conditions from the de-aerator tank to the main steam drum.

Problem

The customer previously installed flow meters that were too inaccurate to control at or near the minimum flow set point. On two occasions, the generating station was automatically shut down due to poor flow element performance. In addition to the low flow limitation of the existing meters, the piping arrangement (no straight run) also contributed to their inaccuracy. Without this control function, the generating station could not start up. Another complication was the delivery time required for replacement flow meters. The station was two weeks from a start-up deadline and the engineering contractor was potentially facing huge penalties.

Solution

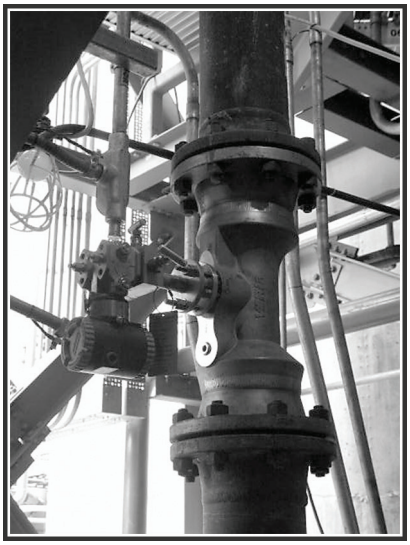
Eastern Controls, Inc., the VERIS representative in Philadelphia, presented the Accelabar to WGI, the A&E in Princeton, NJ. Not only did the Accelabar meet the application criteria of high accuracy and high turndown with NO STRAIGHT RUN, but VERIS fulfilled WGI's critical delivery requirement by manufacturing and shipping four 12" and four 6" Accelabar meters within a two week window.

Results

The units were immediately installed and the generating station made the start-up deadline. The job site reported that the Accelabars were working beyond expectations, providing critical measurement and control of the minimum boiler feed water recirculation flow during start-up and low fire.

Fluid:	Boiler Feedwater
Industry:	Power
Application:	Minimum Recirculation
Specifications:	No Straight Run Turndown 16.5:1 (12" meter) 7.5:1 (6" meter)

12" Accelabar
Range 600,000 – 36,365 PPH



6" Accelabar
Range 90,000 – 12,000 PPH

Pharmaceutical – Steam (VB-6041)

Application

A multi-billion dollar manufacturer of surgical equipment, pharmaceuticals and consumer vision care products required accurate steam flow measurement over a wide range of operating conditions. Steam is generated at a central utility plant and distributed for R&D, manufacturing and campus usage.

Problem

Existing flow meters were not providing accurate or repeatable measurement at low-fire conditions. Although the boilers are rated to 26,600 PPH, frequently they operate at a 14% fire rate (equivalent to 3,781 PPH). The low-end flow measurement was not reliable with existing flow meters. In addition, the only location for one of the replacement meters would be bolted directly to a valve.

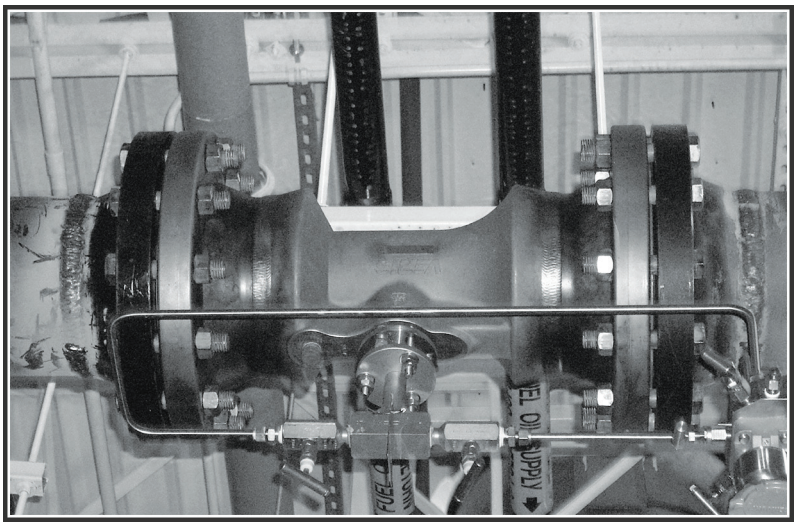
Solution

To handle the required flow rate changes (turndown), the new Accelabar meters were installed. VERIS sized each application to meet customer requirements. In some cases, 8” meters were installed in 6” pipes (see photo). Because straight run is integral to the meter, no piping modifications were required. Expanders and reducers were provided, integral to the Accelabar, to mate to the existing piping. The meter bolted directly to a valve was installed with no need for additional straight lengths of pipe.

Fluid:	Steam
Industry:	Pharmaceutical
Application:	Steam Distribution
Specifications:	High Turndown High Accuracy at Low Fire Limited Straight Run

Results

After the Accelabars were installed, calculations were run using fuel gas and pressure as references. It was determined that the Accelabars were providing accurate measurement over a wide range of flow rates, including the low fire flowing conditions that were previously too difficult for the old meters to handle. No other flow meter could match the Accelabar performance.



8” Accelabar
Range 26,600 – 3,781 PPH

Differential Pressure Flow Meters

INTELLIGENT SOLUTIONS IN STEAM, AIR, AND HOT WATER

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