The Verabar® handles a wide range of applications in the power industry, including steam, condensate, boiler feedwater, cooling water and combustion air. However, these types of applications are not found solely in power plants. One such example is at Nova Chemicals in Corruna, Ontario.

**Application**
Measurement was required for feedwater flow through three of Nova’s feedwater pumps. The pumps operate at a suction pressure of 60 PSIG and a discharge pressure of 1500 PSIG. The water temperature is 300°F. Nova initially specified vortex meters for this application.

**Problem**
The vortex meters were to be installed at the discharge side of the pump. With a discharge pressure of 1500 PSI in the 10” line, a 900# ANSI rating would be required for the meter. Given the high cost of such a meter, the decision was made to locate the meter on the suction side of the pump instead.

Installing flowmeters on the inlet of a pump is usually not recommended because the pressure drop through the meter reduces the pressure available to the pump.

In a feedwater application, there is another factor to consider. With an inlet pressure of 60 PSI at 300°F, the 1.8 PSI pressure drop through the vortex meter would push the pump perilously close to the point where the water could flash into steam, causing the pump to cavitate dangerously.

**Solution**
The vortex meter was judged to be unsuitable for the application. After getting positive feedback from a Nova plant in Western Canada with a Verabar in service on a gas line, Nova agreed to consider the Verabar as an alternative for their feedwater applications.

The differential pressure produced by the Verabar in the 10” line was calculated at 18” H₂O. The permanent pressure loss through the Verabar is 3% of the DP or .54” (.02 PSI) in this case. It was this number that really got Nova’s attention. When they discovered the Verabar could be installed and removed under full line pressure, Nova decided to purchase three V400 flanged hot tap models. The photo below shows one of the units installed.

**Results**
Even with a hot tap assembly, access valve and mounting hardware, the cost of the Verabar was significantly less than the vortex meter.

The three units purchased have been in service for over three years, and have performed flawlessly to Nova’s satisfaction.
Compressed air installations account for a significant portion of Verabar® gas applications. Ease of installation, documented accuracy, minimal pipe blockage and a low-maintenance design make the Verabar the best choice for compressed air flow measurement.

As an example of the diverse potential for compressed air applications, customers with Verabars in service on compressed air lines include Tampa Electric, Kansas City Power & Light, Detroit Edison (Power), Eli Lilly (Pharmaceutical), Air Liquide, Clinton Mills (Textile), Weyerhaueser (Pulp & Paper), Coors (Brewery), Kaeser Compressors, U.S. Steel and Ford Motor.

**Application**

Monitoring compressor efficiency, compressed air auditing, leak detection, plant distribution, usage, etc. with pressures ranging from 50 PSI to 300 PSI and pipe sizes 2” to 30”.

**Problem**

1. Pressure loss created by flow meters with a large pipe blockage equates to high operating costs and reduced efficiency. In many cases, orifice plates are being used to monitor compressor efficiency. There is a problem with monitoring compressor efficiency when the monitoring device itself creates a 3 PSI pressure loss.

2. Rust in pipes, residual oil particulate from compressor lubricant, moisture and bits of pipe thread sealant from threaded connections can contaminate the air and create maintenance problems for other types of meters (turbine, vortex, paddle wheel, thermal dispersion, etc.).

3. Often, it is not practical to shut down and depressurize a compressed air system to install a flow meter.

**Solution**

1. Since the Verabar creates virtually no pressure loss (typically 3% of the measured DP), compressor efficiency is not compromised and operating costs are minimal.

2. A Verabar with a DP transmitter is a simple installation with technology that is easily understood by plant personnel. Hot tap models can be installed on lines that cannot be shut down and depressurized.

3. The Verabar’s non-clog design with no moving parts means no down time or maintenance concerns.

4. The Verabar has been thoroughly tested and field proven in compressed air applications throughout the world. In addition, the Verabar Flow Test Report (VED-100) documents accuracy of the Verabar, which tests were verified by C.E.E.S.I., the largest independent air flow test and calibration facility in the world.

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**Fluid:** Compressed Air  
**Industry:** Textile — Utility Measurement  
**Application:** Energy Savings  
**Specifications:** Low Permanent Pressure Loss

**Verabar installed on 10” compressed air main header (27,500 SCFM, 95 PSI, 85°F); one of 18 sensors in service at Clinton Mills, a large textile plant in Clinton, South Carolina**
The mineral processing industry has its share of challenging flow measurement applications. The processes often have a high particulate content that can render certain types of flow measurement devices inoperable in a short period of time. So, when System C Industrie recommended the Verabar® for a particularly demanding application at Lafarge Aluminate near Marseille, France, it was no surprise when plant personnel were skeptical.

**Application**
Accurate measurement of combustion air is required to control combustion efficiency of six ovens. Powered bauxite & calcium carbonate are fed into an oven along with combustion air. Bauxite/Calcium Carbonate blocks (kinkers) are formed in the ovens, then shipped to Aluminum producers. The temperature ranges from 20°C (68°F) at start-up to 300°C (572°F) during operation.

**Problem**
1. Because the combustion air is recycled from the oven in a 400mm (16”) pipe, it contains a high concentration of dry bauxite and calcium carbonate particulate.
2. Shutdown of the oven was required every two weeks to remove and clean a plugged Annubar sensor.

**Solution**
Because the Verabar is far less likely to plug than any other sensor, it can often be applied where other sensors fail. However, due to the high maintenance required for previous sensors, Lafarge would only install a Verabar on a trial (delayed billing) basis. If the sensor outperformed the previous Annubar in a two-month trial, the original Verabar would be purchased along with others for the remaining ovens.

**Results**
After the original Verabar performed trouble-free for two months, Verabars were purchased for the remaining ovens. The Verabar was removed after seven months for inspection. No cleaning was required. Only 1 cm³ of particulate was found inside the sensor. The last report stated that the Verabars had been operating for over a year in continuous service with no purging or cleaning.

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<table>
<thead>
<tr>
<th>Fluid:</th>
<th>Combustion Air with Particulate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry:</td>
<td>Mineral Processing</td>
</tr>
<tr>
<td>Application:</td>
<td>Bauxite/Calcium Carbonate Blocks</td>
</tr>
<tr>
<td>Specifications:</td>
<td>No Excessive Downtime Due to Clogging</td>
</tr>
</tbody>
</table>

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**Combustion Air with Particulate (VB-6028)**

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![Verabar Model V100 installed in a combustion air line](image-url)
Verabar® flow sensors are the measurement of choice in many fluidized bed coal combustion power plant applications. Fluidized beds suspend solid fuels on upward jets of air during the combustion process. The result is a turbulent mixing of gas and solids. The turbulent action, much like a bubbling fluid, provides more effective chemical reactions, heat transfer and lowers emissions.

Verabar applications include Air (primary, secondary, combustion, undergrate, seal, FGD’s and OFA), Water (condenser, boiler feedwater and cooling) and Steam (LP, IP, HP, SBF).

Application
Alabama Power operates a coal fired, fluidized bed power plant in Burks, Alabama. They requested assistance in solving a problem in the measurement of Soot Blower Flow (SBF) where superheated steam is used to remove the combustion residue for disposal. The Flowing Conditions are: 4” pipe — 50,000 (max.), 5,000 (min.) lbs/hr, 609 psig @ 700°F.

Problem
Initially, two vortex meters were installed, proving to be unreliable:
1. First the vortex meters became inoperable during start-up due to water hammer from residual condensate.
2. After repair, they were inaccurate below 50% of flow and could not measure the minimum flow rate.
3. Additionally, the vortex meter could not output a temperature and pressure compensated flow rate.

Solution
Veris designed two special 600# flanged spool sections with integral V510 flanged Verabar flow sensors and separate flanged RTD’s in a Thermowell (Photo 1). The spool piece had to fit the existing dimensions of the Vortex meters. The DP at max flow was 175.288” H2O (50,000 lbs/hr). At minimum flow (5,000 lbs/hr), the DP was 1.75” H2O. This represents a 100:1 turndown in DP and a 10:1 turndown in flow.

Results
Alabama Power reported complete satisfaction with the performance of the Verabar spool sections (Photo 2).
1. Problems associated with water hammer from residual condensate during start-up were eliminated.
2. The Verabar produced accurate readings over the entire 10:1 flow range.
3. Multivariable transmitters were incorporated to output a dynamically compensated flow rate.

<table>
<thead>
<tr>
<th>Fluid:</th>
<th>Steam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry:</td>
<td>Power Utility—Soot Blower Flow</td>
</tr>
<tr>
<td>Application:</td>
<td>Removal of Combustion Residue</td>
</tr>
<tr>
<td>Specifications:</td>
<td>10:1 Turndown, Handles Water Hammer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Photo 1 (left) Verabar with RTDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo 2 (below) Verabar with RTDs installed</td>
</tr>
</tbody>
</table>
**Application**  
Blast furnace gas to utility and flare  

- **Pressure/Temp:** 5 PSI/100°F  
- **Flow Rate:** 25,000 to 250,000 SCFM  
- **Pipe Sizes:** 50”, 77”  
- **Focus:** 50” Flare  

**Problem**  
Internal structural supports of the existing flare stack created a non-standard flow profile. The “L” shaped circular brackets protruded into the flow stream five (5) inches causing an eddy region at the Verabar’s installation.  

**Solution**  
- **Easy and Adaptable Installation:** Sensors custom made per customer requirements; hand insertable for easy removal/inspection  
- **High Accuracy:** Mathematically verified flow coefficients and multiple sensing ports spanning the large diameter ducts  
- **Field Service/Engineering:** Veris Engineers performed in-line calibration and data reduction to verify Verabar flow coefficients and accuracy required for custody transfer (utility) and flare (EPA) measurement  

Veris performed an on-site pitot traverse at the Verabar locations in two planes 80 feet high on the customer’s flare stack. The data produced from the traverse was normalized and reduced to create a customized flow coefficient representing the actual flowing conditions.  

**Results**  
A true representation of the flow profile provided the necessary documentation, accuracy and error analysis for the customer’s billing requirements.

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**Table: Application Data**  

<table>
<thead>
<tr>
<th>Fluid:</th>
<th>Blast Furnace Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry:</td>
<td>Steel</td>
</tr>
<tr>
<td>Application:</td>
<td>Pitot Traverse 50” and 77”</td>
</tr>
<tr>
<td>Specifications:</td>
<td>Calibration of Verabar to Verify Accuracy</td>
</tr>
</tbody>
</table>

**Image:** Verabar Model V550 installed  

**Image:** Verabar Model V550
**Application**

A major U.S. University is monitoring the flow of their chilled water lines with Verabar Hot Tap models with integral RTD’s. Increased energy costs have made the measurement of flow to individual buildings around the campus an important priority. In addition to determining individual building usage, they are also trending peak hours of consumption. The lines vary in size from 6” to 12”.

**Problem**

In various locations around the campus, no measurement existed. Other applications had old meters installed that were providing inaccurate readings. The University requested units that could be inserted and removed without shutting the system down or draining the pipe. Another request was a way to monitor the temperature change in the water from supply to return.

**Solution**

Veris supplied a Retractable V200 with integral RTD (see photo) to monitor the flow rate and temperature of the water being supplied to the buildings. On the return side, a retractable RTD designed by Veris was used to monitor the temperature of the water. The signals are imported to an energy monitoring system that tracks and trends the data for future planning. With the V200 retractable flow and temperature sensors, supply of chilled water to the campus buildings was not interrupted for installation. Future inspection and maintenance of the meters can be conducted without having to shut down, depressurize or drain the pipe.

**Results**

The Verabar systems are accurately monitoring flow and temperature. Veris continues to supply retractable systems for additional monitoring.

**Note**

The Verabar V200 Hot Tap model averages the velocity profile by using several sensing ports for more accurate flow measurement.

Other insertion type meters (magnetic, vortex, turbine, etc.) assume a “textbook” velocity profile and only sense a single point in the flow stream. They are extremely sensitive to inaccuracies caused by flow profile distortions caused by elbows, tees, valves, etc. and require a significant amount of pipe straight-run (see illustration).
**1. Enter Pipe Dimensions or Duct Dimensions**

<table>
<thead>
<tr>
<th>Fluid Name:</th>
<th>Maximum</th>
<th>Normal</th>
<th>Minimum</th>
<th>Units</th>
<th>Special Instructions</th>
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</thead>
<tbody>
<tr>
<td>Flow Rate:</td>
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<td>All Fluids:</td>
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<tr>
<td>Pressure @ Flow</td>
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<tr>
<td>Temperature @ Flow</td>
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<td>Gas:</td>
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<tr>
<td>Specific Gravity, or</td>
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<td>Molecular Weight</td>
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<tr>
<td>Veracalc Program can calculate Density from Temperature and Pressure</td>
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</tr>
</tbody>
</table>

**2. Pipe or Duct Orientation**

- (H) Horizontal
- (V) Vertical
- Short Straight Run
- Consult Factory

**3. Enter Flow Conditions**

**4. Select Model**

(Click one box)

- V100 V110 Regular
- V150 Spring Lock
- V200 Hot Tap
- V250 Hot Tap
- V300 Hot Tap
- V400 Hot Tap
- V450 Hot Tap
- V500 V510 Regular
- V550 Spring Lock

**5. Select Instrument Head**

- Remote Mount Transmitter (1/2" NPT)
- Direct Mount Transmitter (Flanged 450°F/232°C Max.)

**6. Select Instrument Valves or Manifold (Optional)**

<table>
<thead>
<tr>
<th>Instrument Valves (Opt.)</th>
<th>Manifolds (Optional)</th>
</tr>
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<tbody>
<tr>
<td>Needles</td>
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</tr>
<tr>
<td>C2NC (CS)</td>
<td>F5SC (CS)</td>
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<tr>
<td>C2GS (SS)</td>
<td>F5SS (SS)</td>
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<tr>
<td>C2NS (SS)</td>
<td>F5HC (CS)</td>
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<tr>
<td>Gate</td>
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<tr>
<td>C2GC (CS)</td>
<td>F3SC (CS)</td>
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<td>C2GS (SS)</td>
<td>F3SS (SS)</td>
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<td>3-Valve</td>
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<tr>
<td>F3HC (CS)</td>
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<tr>
<td>F3SS (SS)</td>
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<tr>
<td>5-Valve</td>
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<td>F5SC (CS)</td>
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<td>F5SS (SS)</td>
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<tr>
<td>5-Valve</td>
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<tr>
<td>F5HC (CS)</td>
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<tr>
<td>F5SS (SS)</td>
<td></td>
</tr>
</tbody>
</table>

**7. Transmitter**

- Supplied By
- Veris
- Others