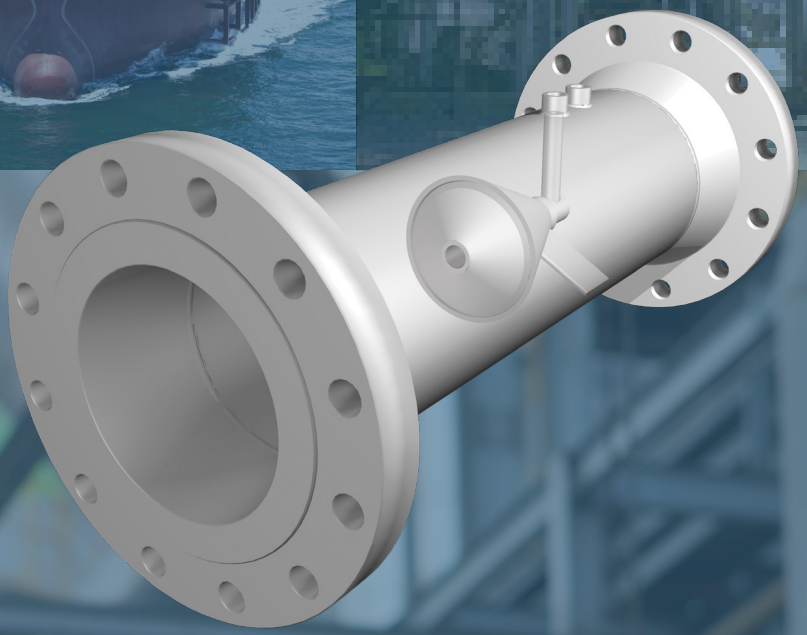
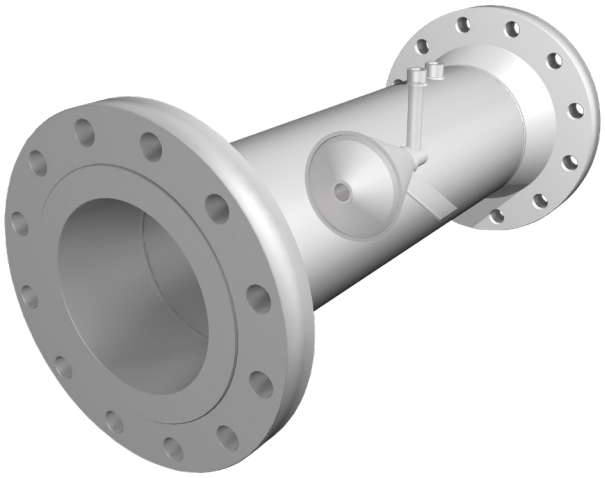
McCROMETER

V-Cone® Application Guide



V-Cone®



Engineers can rely on the V-Cone to make life easier. McCrometer's differential pressure meter is the versatile, highly compatible flow measurement solution for a variety of industries. When accuracy and repeatability are critical, the V-Cone's performance brings superior value.

The V-Cone is self-conditioning, creating minimal to no straight-run requirements and eliminating excess weight and space by up to 70%.

The V-Cone requires virtually no maintenance, featuring no moving parts and a 25+ year lifespan. The V-Cone is the robust, durable meter that prevents years of potential upkeep and expenditures.

Media Compatibility

	Potable Water	Waste Water	Cooling Water	Liquid Natural Gas	Steam	Natural Gas	Wet Gas	Liquid Hydro-carbons
V-Cone	X	X	X	X	X	X	X	X
VM V-Cone	X	X	X					
Wafer Cone	X	X	X	X	X	X		

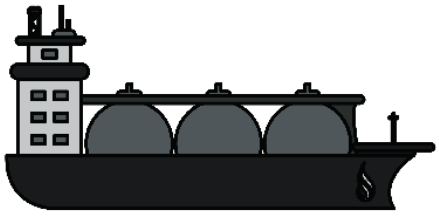
Industry Compatibility

	Agriculture	Municipal	Oil and Gas	Industrial
V-Cone	X	X	X	X
VM V-Cone		X		X
Wafer Cone		X	X	X

Application: FPSO

Flow Measurement Projects on FPSOs

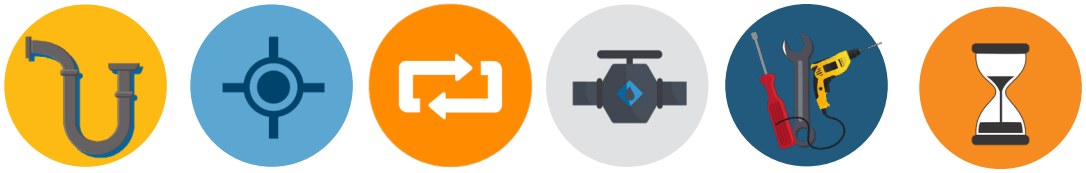
To meet the global demand for oil and gas production, Floating Production, Storage, & Offloading (FPSO) vessels have been utilized for a number of years to access deep water deposits. They process oil from subsea wells and store it until it can be offloaded onto waiting tankers or sent through a pipeline to other storage facilities onshore, refineries, etc. Liquid and gas flow meters play an important role in FPSO vessel operations by measuring hydrocarbons, water, and gas at multiple points in the process. Precise measurement allows for maximum recovery and efficient refining of crude oil on the vessels.



Segments and Applications for Flow Meters

- Separators: test and production, all fluids
- Gas or water reinjection
- Gas lift
- Fuel gas
- Chemical injection

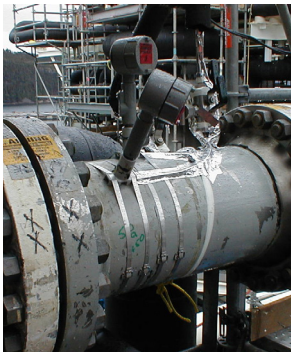
Metering Challenges



Space Constraints | Accuracy | Repeatability | Turndown | Maintenance | Life Expectancy

V-Cone as a Solution

V-Cone plays an important role in FPSO vessel operations by measuring hydrocarbons, water, and gas at multiple points in the process. Moreso, the V-Cone can be an **integral addition to an FPSO** by reducing costs usually associated with installing and maintaining a flow measurement device.



0 - 3 **diameters** upstream and downstream

+/- 0.5% **accuracy** and +/-0.1% **repeatability** over a 10:1 turndown

Standard **25+ year operating life** with generally no need for maintenance

Application: Steam

Flow Measurement Projects for Steam

Steam measurement is always a challenge, as the traditional pitot tubes and orifice plates offer low accuracy, low rangeability, and the ID of the process tube is usually unknown. Straight-run pipe requirements can be difficult to meet, making steam applications a challenge not many flow measurement devices can handle. There is a need to measure high turndowns because facilities such as campuses and hospitals have large flow ranges. Significantly more steam is used in winter compared to summer months and swapping a flow meter during every seasonal change carries a very high cost.

Segments and Applications for Flow Meters

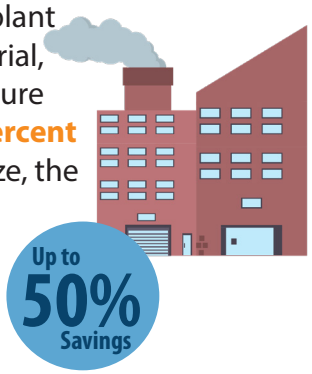
- Facilities
- Power plants
- University campuses
- Food and beverage

Metering Challenges

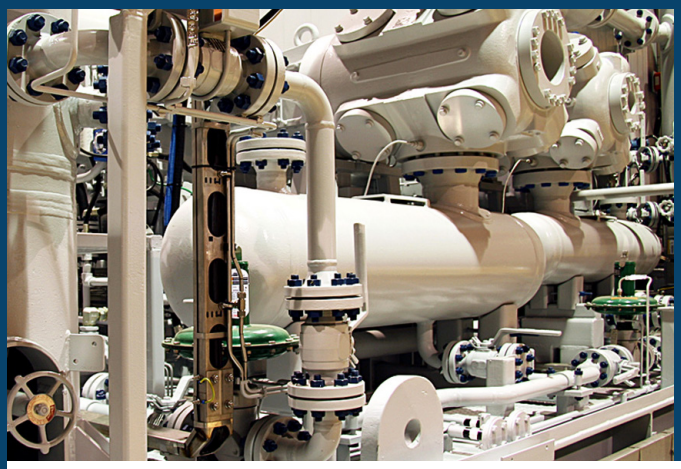
Accurate Measurements | Reliability | High Turndown | Straight-run Requirements | Disturbances

V-Cone as a Solution

The V-Cone typically reduces plant real estate needs, piping material, associated pipe support structure and installation labor by **50 percent** or more. The bigger the line size, the bigger the savings with the V-Cone. The V-Cone's ability to measure low flow is a major benefit.



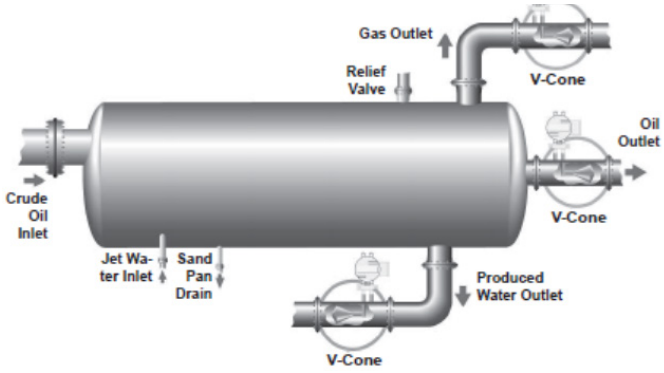
The **ExactSteam™** system is factory configured for energy metering or mass flow. Enabling the lowest permanent pressure loss, the ExactSteam unit maximizes plant efficiency. It boasts a 50:1 turndown, and can measure saturated steam, superheated, and low quality steam.



Application: Process Separators

Flow Measurement Projects for Process Separators

Process separators are typically used when more than one well and field deliver fluid to the platform at the same time. It is important to continuously monitor the oil, condensate, water, and gas being delivered to the platform from each well. Often, there are multiple meters in a very small amount of real estate, each measuring a different media of the separating fluid.



Segments and Applications for Flow Meters

- Wet and dry gases
- Output from separators (single-phase gas, oil, and water)
- Flow to gas injection systems
- Produced water

Metering Challenges

Space Constraints | Accuracy | Repeatability | Turndown | Maintenance | Wet Gas Scenarios

V-Cone as a Solution

The V-Cone is an ideal **retrofit solution** for separators, due to its ease of installation and straight-run requirements. Without the need for major construction, the V-Cone is a drop-in meter that lasts, on average boasting a **25+ year lifespan.**

- Low headloss
- ±0.5% accuracy
- ±0.1% repeatability

Application: Liquid Natural Gas (LNG)

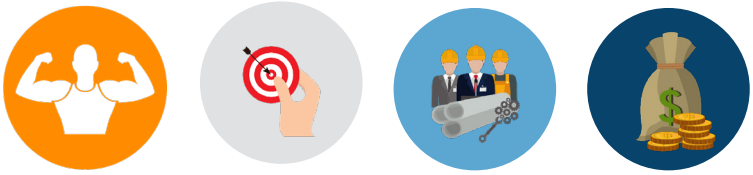
Flow Measurement Projects for Liquid Natural Gas

With the continuous increase in demand for energy worldwide, the popularity of clean-burning natural gas has grown rapidly over the past decades. LNG's relatively abundant supply, along with new high-efficiency production technologies and lower carbon dioxide (CO_2) emission footprint have led it to become a cost-effective, environmentally-friendly choice for a variety of applications. Plants dedicated to turning raw natural gas into liquid natural gas and later back into gas for distribution are either on-stream, under construction, or planned all over the globe.

Segments and Applications for Flow Meters

- Production and processing
- Storage and transportation
- Distribution
- Fuel gas
- Burners
- LNG plants
- Cold box

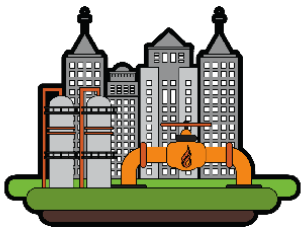
Metering Challenges



Durability | Accuracy | Ease of Installation | High Operating Costs

V-Cone as a Solution

The V-Cone's proprietary **self-conditioning** technology and lack of moving parts allows for a highly reliable measurement solution for liquid natural gas applications. Its innovative design is ideal for harsh operating conditions where precision is absolutely necessary.



- 0.5" to 120" line sizes
- Flanged, threaded, hub, or weld-end standard fittings
- Up to 20,000 psi

Application: Subsea

Flow Measurement Projects for Subsea

Flow measurement in subsea production systems, modules, and templates is a challenge for flow meters. Several pipe lines join below the surface and will eventually extend to a fixed platform, Floating Production Storage and Offloading Vessel (FPSO), or perhaps a pipeline running to a land-based operation.

Segments and Applications for Flow Meters

- Well head flows
- Gas lift
- Produced gas and water
- Gas and water injection
- MEG injection
- Compressor surge control

Metering Challenges

Accuracy | Turndown | Underwater Installation | Space Constraints | Lifespan and Maintenance

V-Cone as a Solution

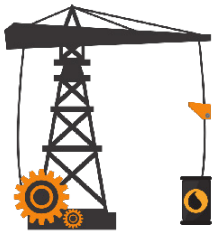
The V-Cone reduces installation real estate and allows for flexible layouts, due to its **self-conditioning design** and little to no straight-run requirements. The quality of craftsmanship and 25+ year operating lifespan make it an ideal solution for subsea applications.

- Can withstand 15,000 psi subsea
- 50:1 turndown
- 2" through 16" line size

Application: Enhanced Oil Recovery

Flow Measurement Projects for Enhanced Oil Recovery (EOR)

Maximizing oil recovery in offshore fields can require a myriad of enhanced oil recovery techniques which can add complexity at subsea depths. Whether it's water injection, gas injection, or CO2 injection, measurement of the media at the injection site and the oil at the production wellhead is required. In the case of water injection, production water often has corrosive materials, necessitating flow meters made of durable, oftentimes exotic materials, able to withstand high pressure in a harsh environment.



Segments and Applications for Flow Meters

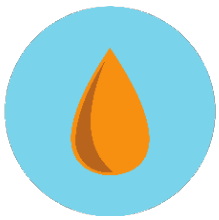
- Hydrocarbon gas injection
- CO2 injection, meeting carbon footprint (including supercritical CO2)
- Water injection
- Production wellhead

Metering Challenges

Accurate CO2 Measurement | Repeatability | Space Constraints | Durability & Custom Material Options

V-Cone as a Solution

Enhanced oil recovery often needs a flow meter that can **reduce the operation's carbon footprint**, and provide accurate measurement for a critical system like CO2 injection. The V-Cone performs in demanding environments with the added benefit of little to no straight run needed, reducing weight in offshore applications. The custom materials that V-Cones offer allow for durability in high-pressure applications.

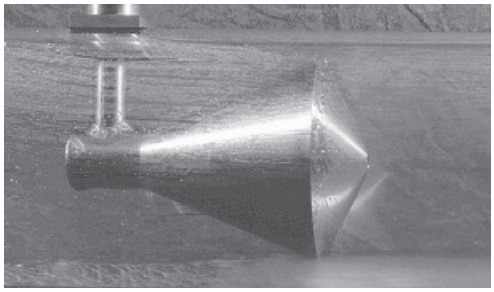


- ±0.5% accuracy
- ±0.1% repeatability
- Calibrated for customer application
- Durable for harsh environments

Application: Wet Gas

Flow Measurement Projects for Wet Gas

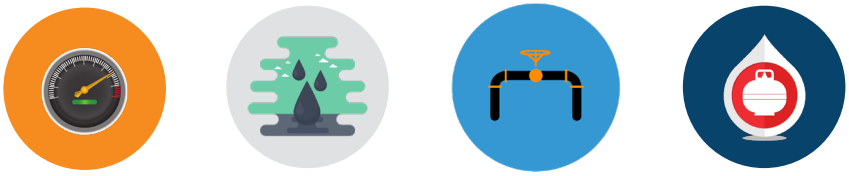
Wet gas is a commonly seen form of fluid that occurs in many large-scale industries like oil and gas. It can be classified as a natural gas with free liquid. The presence of liquid in the gas makes it very difficult to measure since it is no longer considered a single-phase fluid. Produced gas output from test and production separator units is often wet and needs to be metered; the liquid fraction in gas causes all flow meters to read in error, making it difficult for accurate allocation metering, mass balance, and correct chemical injection.



Segments and Applications for Flow Meters

- Offshore platforms
- Natural gas wells
- Digester gas
- Gas lift systems
- Production well heads

Metering Challenges



Meter Overreading | Oil:Liquid Determination | Blocked Ports | Possible Liquid Damming

V-Cone as a Solution

In side-by-side tests with other differential pressure meters, the V-Cone flow meter provided the **most accurate** measurement of challenging wet gas flow regimes. The V-Cone is available for wet gas applications in line sizes of 2" to 12". V-Cones are less prone to corrosion, making the 25 year lifespan of the meter highly desirable.

- Accuracy of ±2%, dependent on process conditions
- Turndowns of 10:1 and greater, without loss of accuracy
- Virtually no need for maintenance
- Low installation costs

Application: Municipal Water Treatment

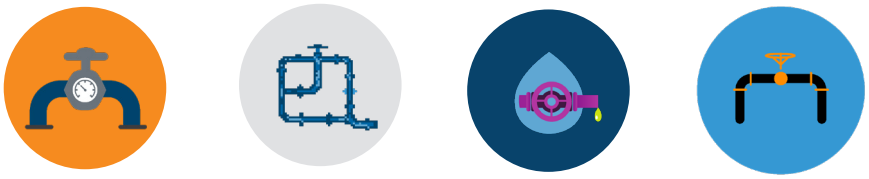
Flow Measurement Projects for Municipal Water Treatment

Water treatment facilities have a task of providing clean water to their surrounding communities. These facilities will measure the effluent flow from their plants, going through a standard treatment process where it is crucial to measure the fluid accurately prior to each stage. Oftentimes, due to tight piping locations with many flow disturbers near filter beds and pumps, viable metering technologies are limited. Flow meters are used to measure flow volume between wells, treatment filter beds, during backwashing processes, and more.

Segments and Applications for Flow Meters

- Water treatment facilities
- Water wells
- Chemical injection
- Reclaimed water
- Finished water effluent
- Back wash

Metering Challenges



Space Constraints | High Flow Turbulance | Requires Custom Meter Cleaning | Accuracy

V-Cone as a Solution

V-Cone is a great alternative to other differential pressure meters, due to the range of exotic materials the meter can be constructed from, with corrosion-resistent elements. The meter provides accurate readings despite installation near flow disturbers and its **long-term lifespan** prevents the need to dismantle piping or shut down water production to perform meter maintenance and repairs.

- ±0.5% accuracy
- ±0.1% repeatability
- Little to no straight-run requirements
- Provides oxygen cleaning services

Application: Digester Gas

Flow Measurement Projects for Digester Gas

With the ever-lasting demand for an alternative to fuel, digester gas has been a common application where biofuels are produced. A biofuel often used as an energy source, digester gas is found as an application in wastewater municipal plants, but can also be found on farms, and in breweries and distilleries. Due to varied compositions of digester gas, build-up can occur and cause issues in the pipeline. Flow measurement is used to monitor this energy source's performance and to comply with environmental regulations which may require greenhouse gas emissions reports.

Segments and Applications for Flow Meters

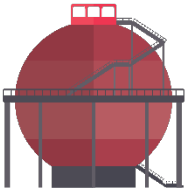
- Sanitation
- Power generations/cogen
- Biofuels

Metering Challenges

Corrosive and Wet Media | Accuracy Issues | Potentially Hazardous Application | Low Pressure & Low Flow Rates

V-Cone as a Solution

Built to endure harsh operating conditions, the V-Cone is well-suited to the varying temperature, turndown, and pressure that digester gas applications are known for. The varying materials that the V-Cone can be constructed from make the V-Cone highly customizable, and can contribute to **corrosion resistence** and build-up.



- ±0.5% accuracy
- ±0.1% repeatability
- Little to no straight-run requirements
- Wide variety of materials

Application: Food & Beverage

Flow Measurement Projects for Food & Beverage

The food and beverage industry is one that often utilizes a high amount of process water and produces a lot of effluent as well. Regulations and reporting for water usage and wastewater production necessitates accurate, reliable flow measurement to make informed decisions about daily operations. In a highly regulated industry like food and beverage, spot measurement is common, which often poses the challenge of flow metering in constrained spaces. This industry demands a flow meter that is retrofit-friendly, requires minimal straight-run, and can measure high-turndown to accomodate changing flow conditions.

Segments and Applications for Flow Meters

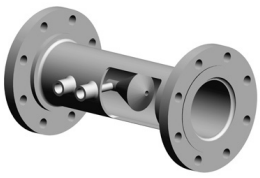
- Dairy
- Wine production
- Brewing
- Food production and processing
- Cooling and boiling

Metering Challenges

High Turndown Ratios| Space Constraints | Regulations and Governance | Overall Cost of Ownership

V-Cone as a Solution

The V-Cone allows users to maintain a small system footprint, cut costs, and optimize flow measurement. Ideal for retrofit and new applications, the V-Cone's 25+ year lifespan and minimal maintenance allows users to keep operating expenses low and maintain quality of process. The V-Cone can be manufactured from a variety of materials to accomodate industry regulations.



- Up to ±0.5% accuracy
- 10:1 or higher turndown
- Remote-mount transmitter available
- Overall low cost of ownership
- RTD & flow computer available

Industry: Metals & Mining

Flow Measurement Projects for Metals and Mining

Flow metering for the mining and minerals industry often involves highly corrosive, metallic media in a harsh environment. With many environmental protection regulations to abide by, mining companies seek to maintain a compact metering footprint, eliminate costly downtime for installation and maintenance, and measure flow as accurately and reliably as possible. Metals and mining projects often contain multiple metering points. Water transfer, fuel gasses, air, and slurry are just a few of the inputs and outputs that requiring monitoring that can help diagnose problems and increase productivity.

Segments and Applications for Flow Meters

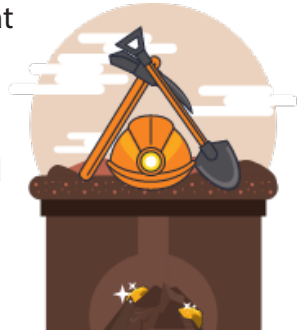
- Open pit mining
- Underground mining
- Crushing and conveyance
- Boiler fuel consumption / fuel gas
- Smelters
- Coke oven gas
- Combustion air

Metering Challenges

Corrosive & Harsh Media | Stringent Regulations | Hazardous Application | High Turndown

V-Cone as a Solution

The V-Cone is a customizable solution that withstands the harshest of flow media as well as environments. With minimal to no straight-run requirements and a 25+ year lifespan, the V-Cone is an economical and environmental solution providing a small footprint and no necessary maintenance. The V-Cone also offers bi-directional flow and up to 20:1 turndown for a large flow range.

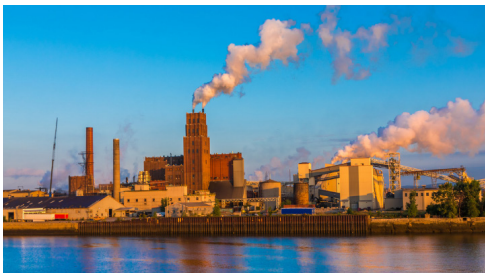


- Up to ±0.5% accuracy
- Corrosion-resistant materials
- Minimal straight-run requirements
- Material customization
- Up to 1,600 °F (870°C)

Industry: Pulp and Paper

Flow Measurement Projects for Pulp and Paper

The pulp and paper industry poses a challenge for many flow meters, as it often combines harsh, aggressive chemicals with high temperatures during the production process. The high temperatures and corrosive conditions can cause reliability issues with other metering technologies such as orifice plates and vortex meters. The range of corrosive media requires meters manufactured from a range of exotic materials, often highly customized to meet the needs of the application. Operating at maximum production rates and maintaining energy efficiency is critical for pulp and paper plants, and flow meters must handle high flow rates, pressures, and temperatures.



Segments and Applications for Flow Meters

- Recovery boiler
- Saturated and superheated steam
- Gas and fuel oil
- Chemical feed
- Digesters

Metering Challenges

Energy Efficiency | Harsh Chemicals | High Process Temperatures | Maintenance and Downtime

V-Cone as a Solution

The V-Cone is the ideal metering solution for steam and chemical measurement in pulp and paper. Boasting up to 20:1 turndown with stacked transmitters, and maintains up to ±0.5% accuracy over its expected lifespan of 25+ years with minimal maintenance. The meter is highly customizable, and can be constructed from a variety of popular and exotic materials for corrosion-resistance.

- 25+ lifespan and minimal maintenance
- Corrosion-resistant materials
- Minimal project footprint
- Up to 1,600 °F (870°C)
- Low permanent pressure loss

Propeller Flow Meters

Differential Pressure Flow Meters

Magnetic Flow Meters

Connected Solutions

McCROMETER

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