Wet Gas Metering systems - SmartVent™ MultiTrace™

The development cost of high Gas Volume Fraction (GVF) gas/condensate fields can be reduced significantly if test separators and related infrastructure are replaced by SmartVent™ wet gas venturi based meters in each of the flow lines. Besides the significant cost savings, the availability of continuous readings of each well's production rates allows for enhanced reservoir management and production optimization.

The methodology used does not rely on homogeneous flow conditions, nor does it require the flow to be conditioned in any other way. No obstructions are placed inside the flow line other than the venturi based meter.

Additional technologies are available offering the possibility of in-situ verification and calibration of installed meters using the tracer method, and the possibility to obtain accurate PVT fluid samples for well stream composition. Accurate well stream compositions are normally required during operations as gas-condensate behaviour is strongly dependent on pressure and temperature variations.

Expro Petrotech has specialised in wet gas metering since the early developments, and is actively participating in the continuing development and standardisation of this technique.

Offshore/Onshore Applications

SmartVent™ wet gas flow measurement is increasingly gaining acceptance in replacing test separators and related infrastructure from the design. Large size, weight and cost savings are realised by installing SmartVent™ wet gas meters on each of the flow lines.

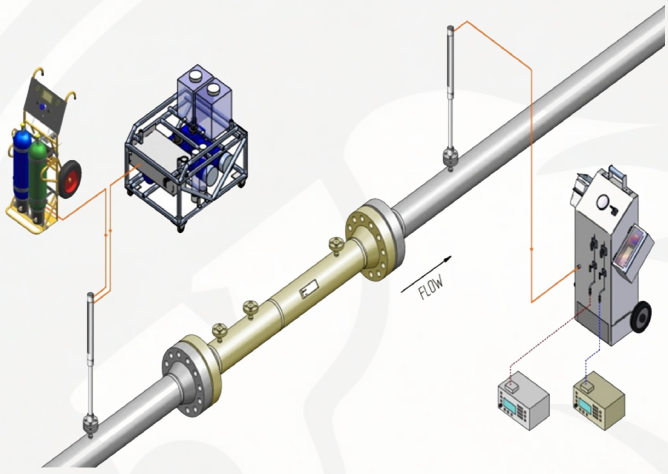
Measurement Principle using patented Dual DP measurements

The presence of liquid in the gas stream causes the differential pressure over the wet gas venturi meter to increase with respect to the case when only the gas phase is flowing. This leads to the so called over-reading of the gas flow rate.

This reading can however be corrected to give the actual gas flow rate using the latest "de Leeuw" gas correction correlation. Various independent institutes and government bodies have recommended this correlation for use in wet gas metering applications.

The total liquid flow rate in the gas stream is determined continuously from a second on-line differential pressure measurement over the meter. To distinguish the measured liquid flow rate into the respective water and condensate flow rates the tracer method can be used. This method measures the water and condensate flow rates independently. Alternatively the condensate flow rate may be determined using EOS or single stage flash calculations. To determine the required underlying well stream composition, special sampling techniques are required in combination with an independent condensate flow rate measurement using the tracer method.

The tracer method is also used to increase the overall installed accuracy and data confidence of the measurement results.



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Flow Calculation & Monitoring

Dedicated wet gas flow calculation and monitoring software options are available. The software seamlessly integrates the wet gas meter readings, fluid properties, and field calibration/verification data. Monitoring and trending of these data allow for immediate notification of well production changes.

- Multiple header configuration
- Real time data for each individual well
- Independent meter settings
- Daily totals
- Daily production reports
- All reports database archived
- Live trending

Field Calibration & Performance Verification using Tracers

SmartVent™ wet gas meters have been subject to extensive wet gas testing programmes over the last years. The extend of the operating conditions and testing fluids used are considered unique in the industry as high pressure natural hydrocarbon fluids have been used.

In addition the MultiTrace™ tracer technique can be used on-site to calibrate or verify the meter performance under actual conditions. Clearly the overall accuracy and data confidence is greatly improved by this technique. Expro Petrotech is one of the few companies who can offer this service.

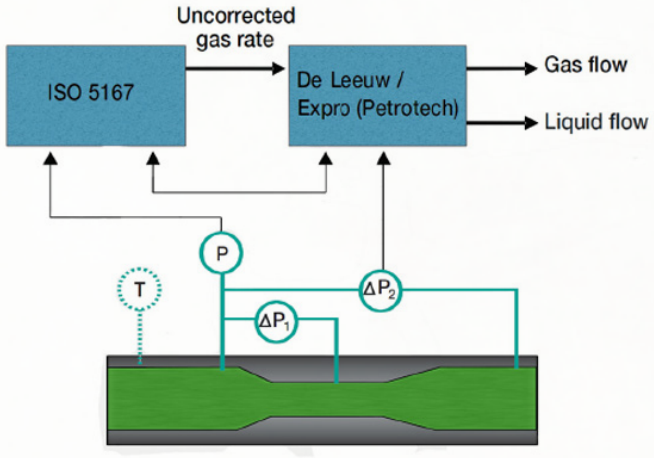
Fluid Sampling Technology

As gas-condensate behaviour is strongly dependent on pressure and temperature variations, an accurate well stream composition needs to be established. Expro Petrotech offers specialized wet gas sampling equipment to accurately determine the well composition.

Transmitters

Field instrumentation and valve options are available from all world leading suppliers. Basic instrumentation consists of:

- 2 x Differential pressure transmitters
- 1 x Gauge pressure transmitter
- 1 x Temperature transmitter



Operating Range and Meter Accuracy

Expro Petrotech SmartVent™ meter is designed to operate over the full wet gas metering flow regime. The operating range is typically from 90% to 100% GVF, depending on the actual line pressure and temperature.

Typical uncertainties are:

- Gas Flow Uncertainty: +/- 3-5%
- Liquid Flow Uncertainty: +/- 10%

Note: uncertainty can be improved by applying tracer calibration

Meter Output Values

Typical output values to the user are as follows.

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Many other parameters however can be specified.

- Gas Flow Rate
- Liquid Flow Rate
- Water Flow Rate
- Condensate Flow rate
- GVF
- LMF
- Pressure
- Temperature
- Water breakthrough

Service Support

Expro Petrotech has the expertise and personnel to provide technical support worldwide though our global network of offices.

Experience

Over the last years a large number of major and minor oil and gas companies have applied the technique successfully to various applications.

Locations include Norway, UK, The Netherlands, Middle East, South-East Asia and Australia.

Technical Specification

Line size:	2" – 12" (larger sizes on request)
Pressure Rating:	ANSI 150# - 2500#
Temperature Rating:	121 °C
Materials:	Carbon steel, stainless steel, Duplex SS / …

Installation Requirements

Upstream Straight Length:	5D
Downstream Straight Length:	3D
Orientation:	Horizontal

Accuracy and Range

Gas Rate - Uncertainty:	3% to 5% of reading
Liquid Rate - Uncertainty:	10% of reading
GVF Range:	90 – 100% (pressure dependent)
Lockhart-Martinelli Range:	0 – 0.35 (all pressure)
Static Pressure Loss:	Low

Instrumentation

DP Transmitters:	2 off Rosemount / Yokogawa / …
GP Transmitters:	1 off Rosemount / Yokogawa / …
T Transmitters:	1 off Yokogawa / …
Manifolds:	Models from all leading suppliers available

Data Acquisition

Type:	PC Based Flow Computer (Petrotech)
Inputs:	Digital transmitter signals from platform PCS
User Input:	Fluid Composition (%C1, %C2 …)
Outputs (digital):	Gas Flow Rate
	Liquid Flow Rate
	Condensate Flow Rate
	Water Flow Rate
	GVF
	LMF
	Pressure
	Temperature
	Diagnostics
	Alarms
Communication:	RS-232, RS-485, TCP/IP

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