

N. Bonavita, G.Ciarlo – ABB Measurement Products, 27 Novembre 2014 mcT Petrolchimico

ABB VIS Multiphase Flow Meter Un nuovo misuratore multifase "γ-free" per il monitoraggio e l'ottimizzazione della produzione nell'Oil and Gas



ABB VIS Multiphase Flow Meter Agenda









- Why Multi-Phase Metering?
- VIS Multiphase Flow Meter and Underlying Technology
- Technology Background and Evolution
- VIS Advantages





- Upstream production facilities usually collect streams from a
 number of wells drilled to properly exploit hydrocarbon reservoirs
- Each well stream is actually a mixture of oil, hydrocarbon gas and water in highly variable proportions depending on locations and on reservoir age. This is why they are called **Multiphase Streams**









- Knowledge of the individual fluid flow rates of a producing oil well is required to facilitate reservoir management, field development, operational control, flow assurance, and production allocation.
- Conventional solutions concerning two- and three-phase metering systems require expensive and cumbersome test separators, high maintenance, and field personnel intervention. These conventional solutions do not lend themselves to continuous monitoring or metering
- A multiphase flow meter (<u>MPFM</u>) is a device used to measure the individual flow rates of constituent phases in a given stream
- The typical application is in the in oil and gas industry to meter mixtures produced during oil production processes.













MPFM Main Applications:

- Process Metering
 - Identification of operation outside the design envelope (e.g. condensate carried over separators)

Production Monitoring & Optimization

- Tracking in real-time any changes in fluid composition, flow rates, pressure and temperature profiles to optimize production.
- Diagnosis of the well system and prediction of future trends through combined analysis of current and historical data

Allocation Metering

- Proper allocation of produced hydrocarbons from different wells/areas to a single processing facilities
- Minimization of dedicated test pipelines
- Well testing
 - Identification of well's production potential



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ABB VIS Multiphase Flow Meter A new, high-performing yet compact meter







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- VIS, which stands for <u>Vega Isokinetic Sampling</u>, is the evolution of the TEA Sistemi's Vega meter, which has been successfully installed and operated in more than 40 applications
- The powerful and advanced technology of TEA Sistemi has been coupled with a redesign of the meter in order to minimize footprint of the new ABB's VIS, maintaining its performance and accuracy









VIS Structure and Working Principle

- VIS is a compact meter which can be directly inserted on pipelines for topside onshore and offshore applications
- It is based on a unique and patented technology: the isokinetic sampling method
- A small portion of the multiphase stream is sampled and separated into liquid and gaseous phase by means of a patented high efficiency axial separator installed inside the probe
- The liquid and gas are then measured separately in single phase with high accuracy
 - Gaseous phase is measured by a traditional single phase meter
 - Liquid phase is estimated through the filling time of known volumes of the main vessel
- Overall flowrates are calculated through the sampling ratio (i.e. the ration between probe and pipe areas)





Isokinetic Sampling

- Sampling is performed in a section of the pipe where the two phases (gas and liquid) are well mixed (velocity profiles are uniform)
- The liquid volume fraction in the sample is the same as in the main stream
- Isokinetic sampling requires that the ratio between the sampling flowrate and the overall flowrate be the same as the ratio between the sampling probe cross section and the pipe cross section (at the sampling location)
- No use of empirical correlations or field calibration





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VIS Multiphase Flow Meter

High gas content applications solved with no radioactive source - Measurement made easy







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ABB VIS Multiphase Flow Meter Technology Background ...



- VIS is the result of a partnership between ABB and TEA Sistemi, a University of Pisa spin-off, committed to R&D in the Oil & Gas sector
- VIS has its root in TEA Sistemi's VEGA meter developed since 1998
- The field tests of this meter were carried out at Trecate field in 2000-2001.
- The first commercial installation of VEGA regarded the Allegheny platform, Gulf of Mexico in 2002 (World's First Installation of a Multiphase Wet Gas Meter)
- In 2011 the world's largest MPFM ever built have been installed in Seth platform (Egypt): it is a 16" nominal size VEGA meter

ABB VIS Multiphase Flow Meter Technology Background ...

Allegheny Installation



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ABB VIS Multiphase Flow Meter Technology Background ...

Allegheny Installation: Results



ABB VIS Multiphase Flow Meter ... and Evolution

 The conventional instrumentation installed in the VEGA meter was designed and produced by ABB.



- The partnership allows to properly blend two excellences in order to provide the best solutions and services to our customers
 - TEA Sistemi brings its knowledge and world-class
 experience in multiphase systems and flow assurance
 - ABB makes available its global presence, its sales and service network, the engineering competence and a full portfolio of measurement products and systems for the Upstream industry.
- The resulting technical cooperation between TEA Sistemi and ABB has brought new life into the project with a continuous pursuit for improvements and advancements

ABB VIS Multiphase Flow Meter ... and Evolution



- The Meter has been re-designed and its size optimized.
- The mechanical construction has been deeply changed, with a substantial weight reduction.
- The valves required for VIS operation have been positioned inside the system.
- The final result is a smaller, lower weight MPFM



H: 3000mm; W: 1000mm; L: 2000mm Weight: 2700kg

10" ANSI 900LB



H: 1800mm; W: 1000mm; L: 1000mm Weight: 1300kg



ABB VIS Multiphase Flow Meter ... and Evolution





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ABB VIS Multiphase Flow Meter VIS Advantages



- VIS exploits a unique and patented operating principle
- VIS is tailored for wet-gas (GVF>80%) applications
- VIS exploits a technology able to provide very high accuracy even in the most challenging conditions (GVF>95%)
- The technology performances have been confirmed and validated in tests performed by NEL (UK)
- VIS is based on conventional instrumentation only, facilitating installation and maintenance
- No radioactive source is involved
- No calibration is needed
- No limitation due to size: it can be tailored for any specific application.
- It can be used as a mobile unit. For well testing applications
- Due to its unique design, VIS is perfectly suited also for Gas Storage applications, in order to detect water content during gas extraction



ABB VIS Multiphase Flow Meter VIS Advantages

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- VIS employs a proven and exclusive γ-free technology:
 - Radioactive sources represent an issue for importation, transport and maintenance activities
 - Customers often experience long delays (up to 12 months!) just for Custom Clearance
- VIS utilizes conventional instrumentation → much easier to maintain than other MPFMs
 - VIS uses traditional ABB field devices (dP, P, and T)
- On the most demanding applications, VIS provides extremely high accuracy:
 - For MPFM, the biggest challenge is to deal with high Gas Volume Fraction (GVF)
 - Even when GVF > 95% or even 98%, VIS does not compromise on accuracy
 - Meter accuracy has been validated by NEL (UK)



ABB VIS Multiphase Flow Meter VIS Advantages: an additional, unique feature



Turndown expanded up to 100:1 with the same accuracy

 With the "Dual Inlet" option a meter designed to operate at a given flowrate (say X m³/h) can be easily used also at 1/10 of the design flowrate (X/10 m³/h) with the same accuracy and no component replacement.



ABB VIS Multiphase Flow Meter High technology and global coverage at your disposal



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Baolo Andreussi <u>Paolo Andreussi</u> <u>Conserving of Super-</u> <u>164</u> States with Pa- <u>164</u> St	Multiphase	TETIC SAMPLING
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