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Non radioactive MPFM for accurate measurement up to high and ultra-high GVF

ASSOCIAZIONE ITALIANA STRUMENTISTI

ISA Italy Section

Power and productivity for a better world™ ABB

ABB VIS Multiphase Flow Meter
Agenda

- **VIS Multiphase Flow Meter and Underlying Technology**
- **Technology Background and Evolution**
- **VIS Advantages**

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

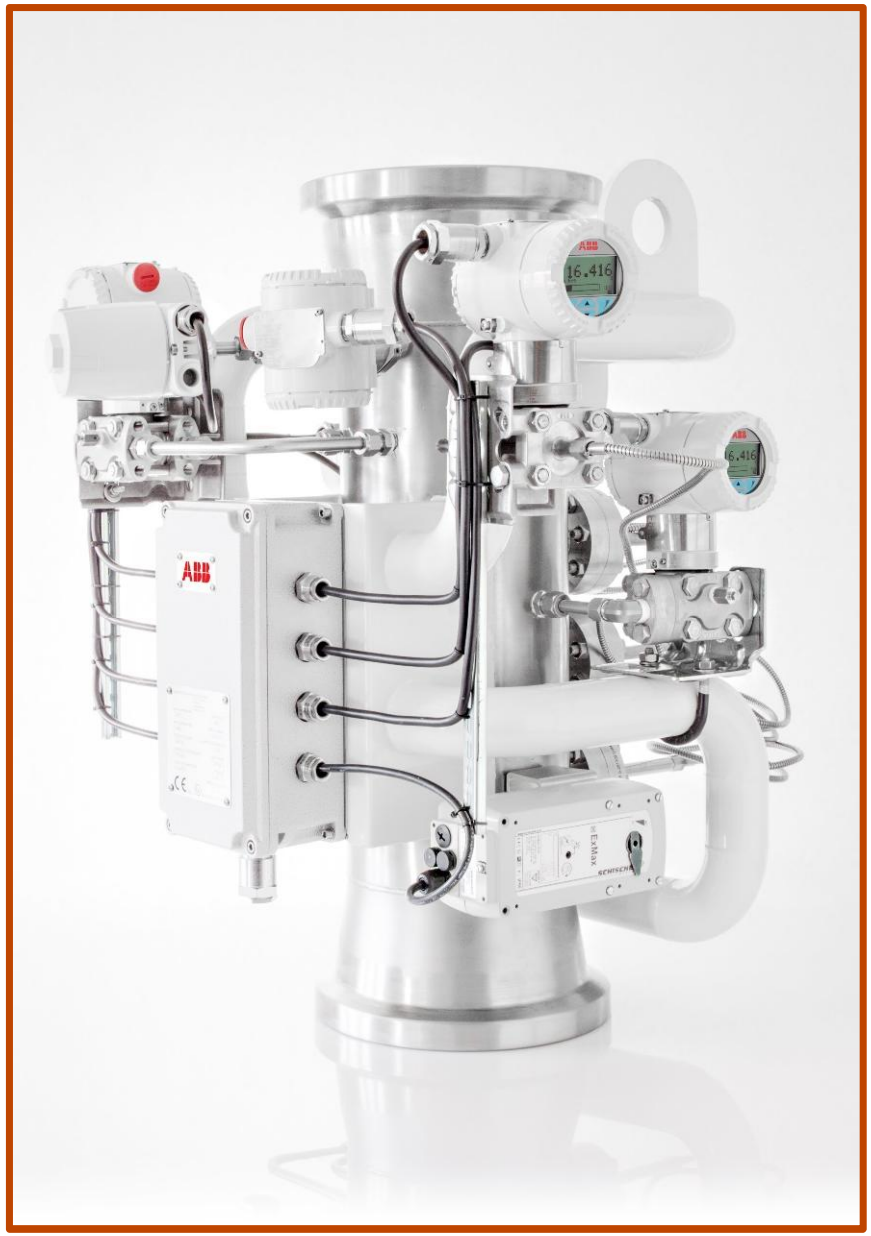
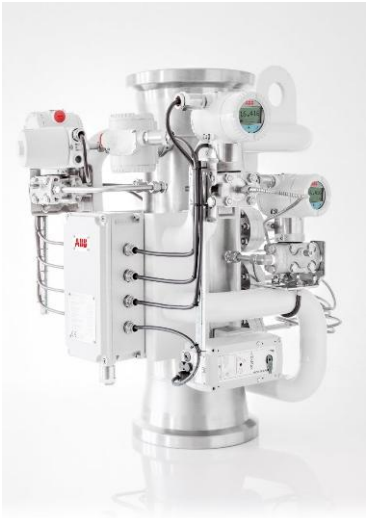


ABB VIS Multiphase Flow Meter
A new, high-performing yet compact meter

- VIS, which stands for Vega Isokinetic Sampling, is the evolution of the TEA Sistemi's Vega meter, which has been successfully installed and operated in the last 15 years
- The powerful and advanced technology of TEA Sistemi was coupled with a redesign of the meter in order to minimize footprint of the new ABB's VIS, maintaining its performance and accuracy

ABB VIS Multiphase Flow Meter
VIS Underlying Technology

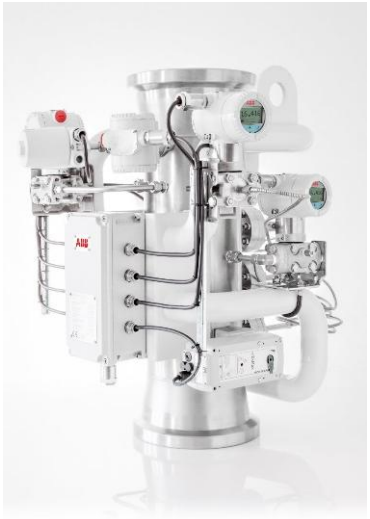
VIS Structure and Working Principle



- VIS is a compact meter to be directly inserted in pipelines for 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 gas phases by means of patented high efficiency axial separators installed inside the meter
- The liquid and gas are then measured separately as single phases with high accuracy
  - Gas phase is measured by a traditional single phase meter
  - Liquid phase is measured through the filling time of the known volume of the main vessel
- Overall flowrates are calculated through the sampling ratio (i.e. the ration between probe and pipe areas)

ABB VIS Multiphase Flow Meter
VIS Underlying Technology

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 sampled 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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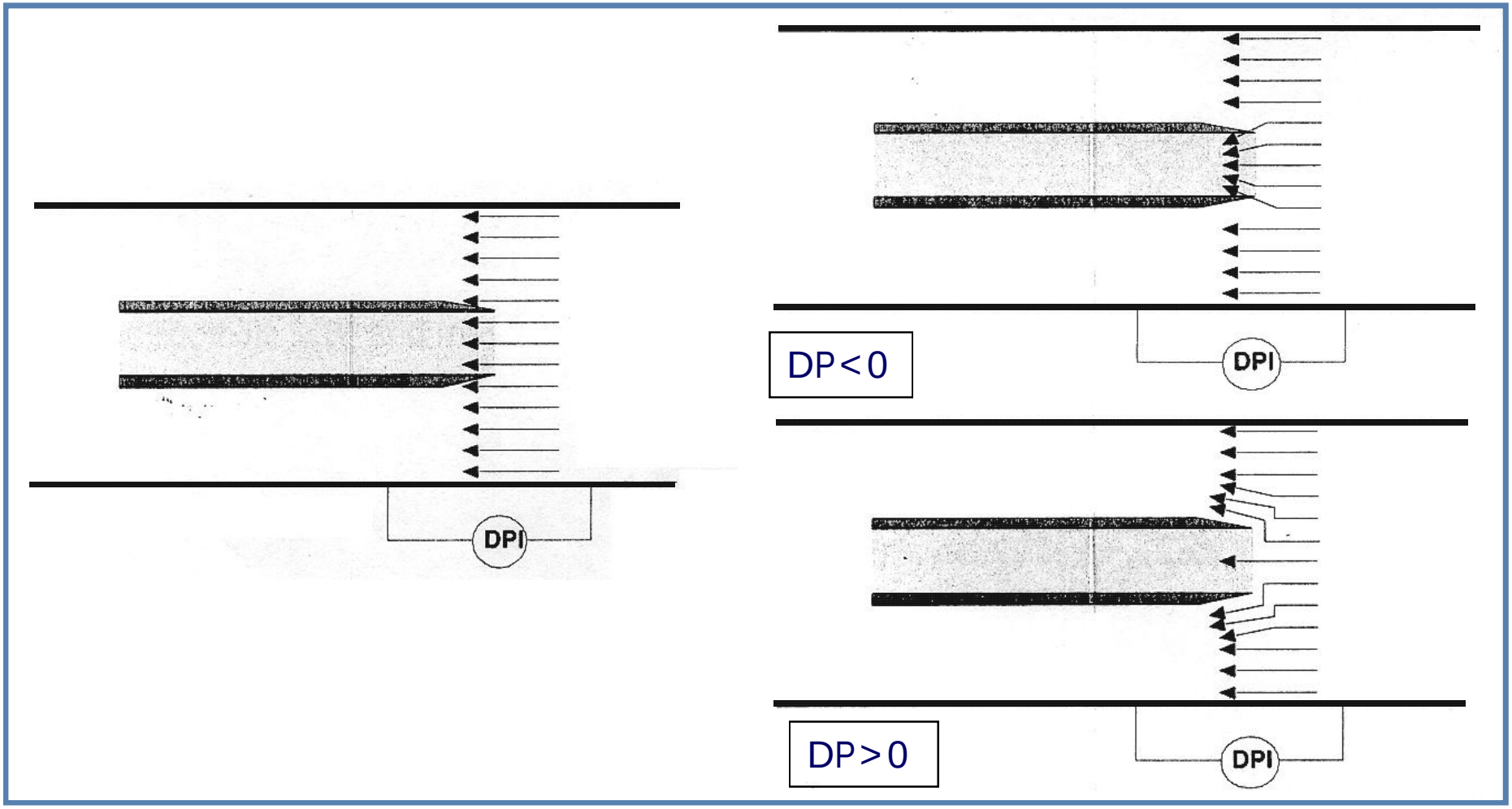

DP=0 ISOKINETIC SAMPLING

DP≠0 NON ISOKINETIC SAMPLING

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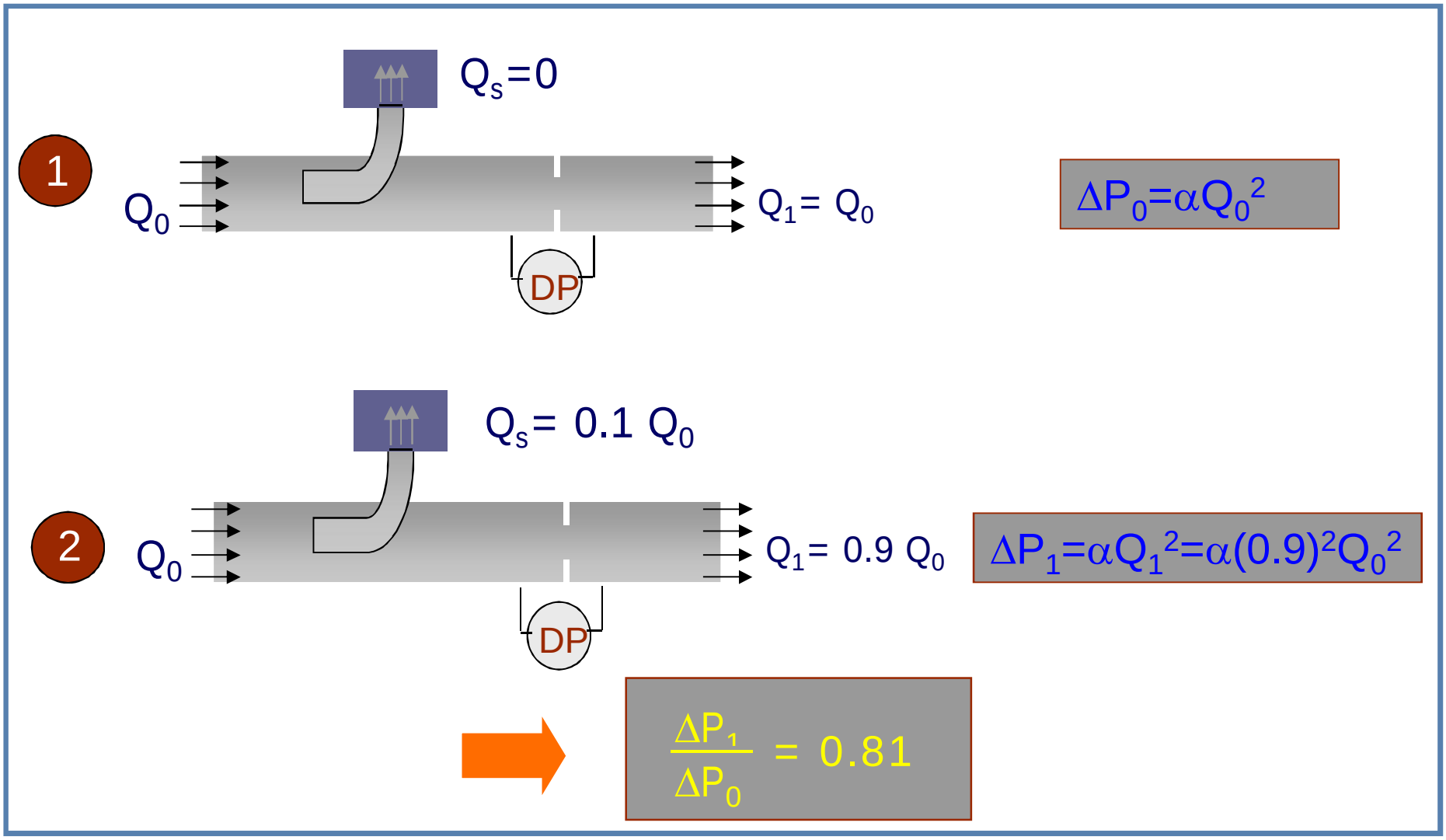

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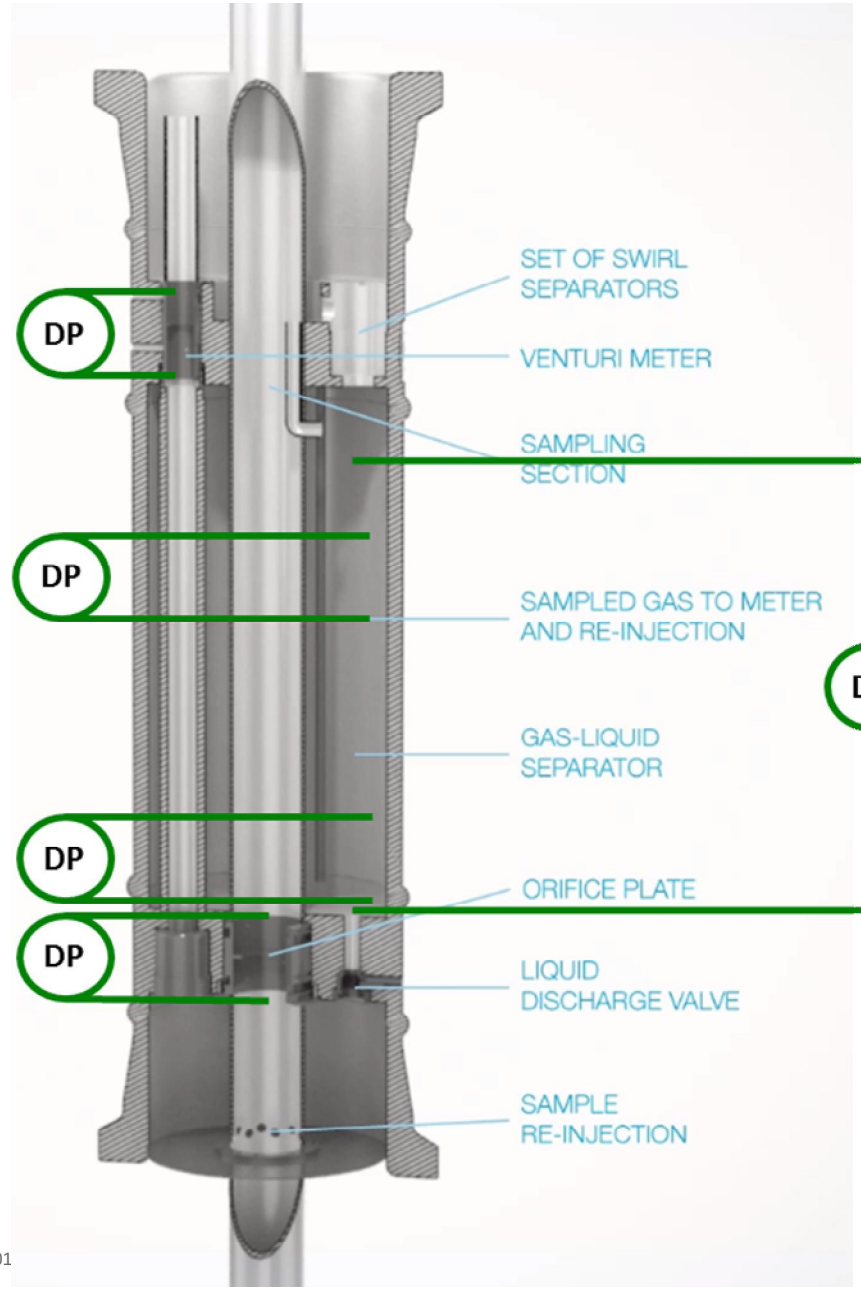
VIS Underlying Technology

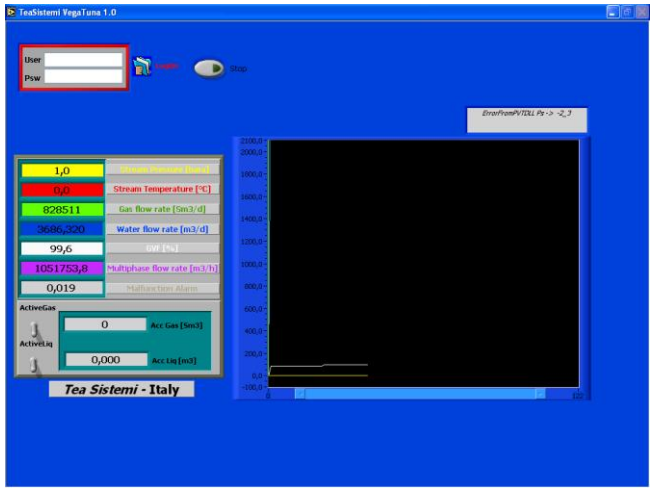
VIS Multiphase Flow Meter

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

ABB VIS Multiphase Flow Meter
VIS Underlying Technology



PC Station



Digital outs (modbus. profibus canbus …)

Analog outs

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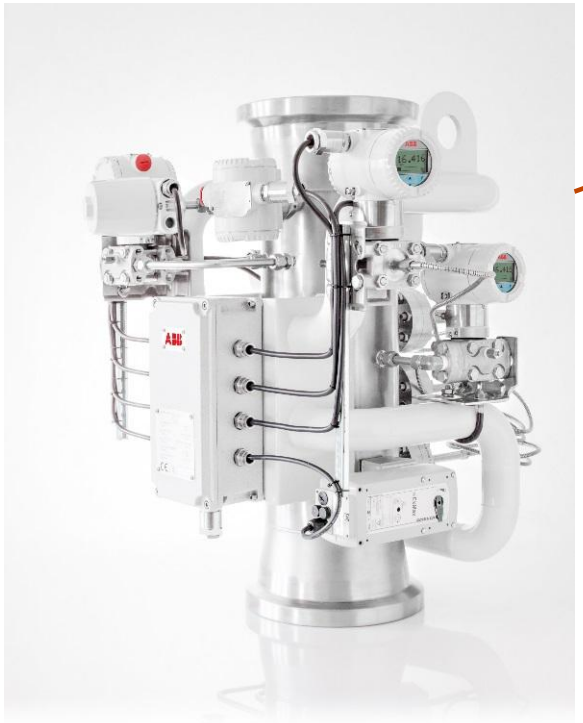
VIS Underlying Technology



VIS Proprietary SW Package

Overview

Fluid Composition

P&I

RT and Historical Trends

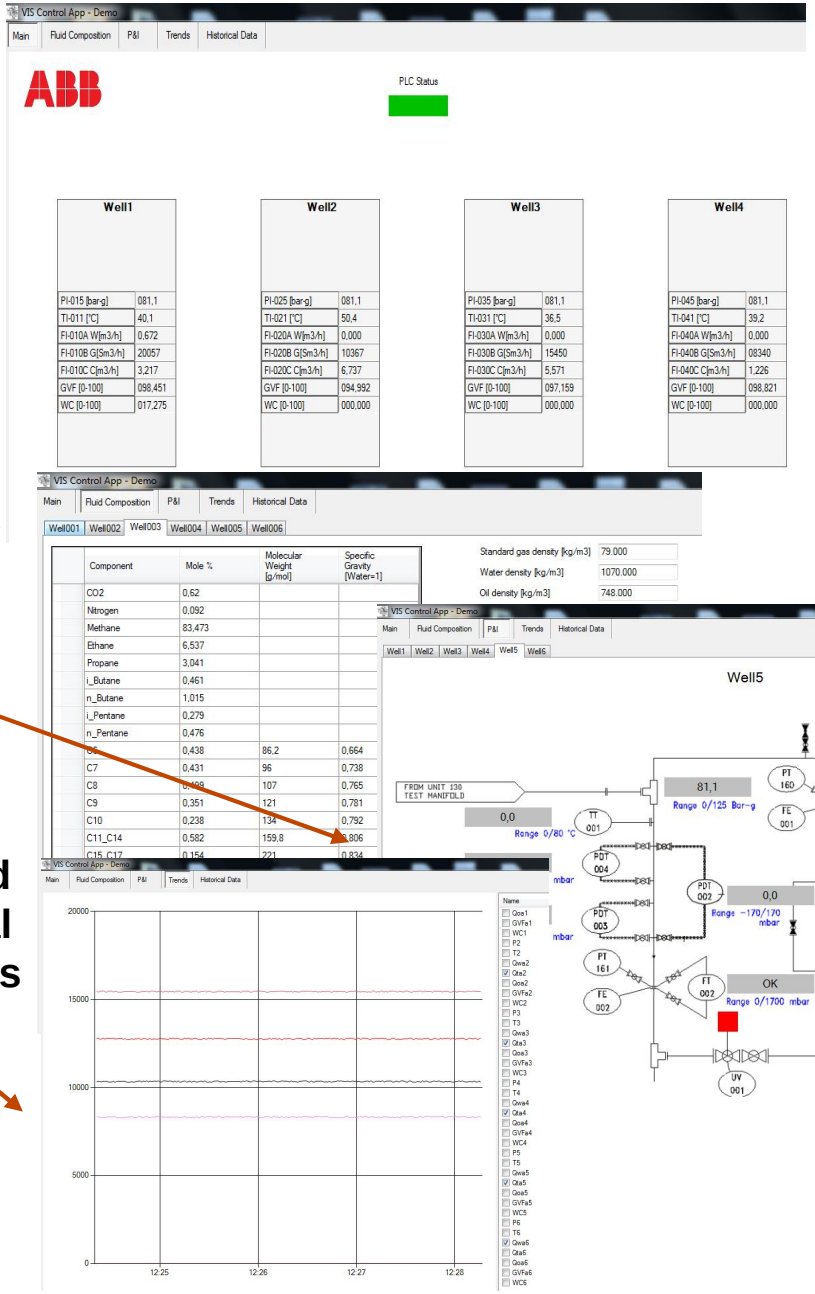


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ABB VIS Multiphase Flow Meter
VIS Underlying Technology

- VIS is the result of a partnership between ABB and TEA Sistemi, a spin-off of the University of Pisa, committed to R&D in the Oil & Gas sector
- VIS has its root in TEA Sistemi's VEGA meter developed since 1998
- Initial field tests of the VEGA meter were carried out at Trecate field in 2000-2001.
- The world's largest MPFM ever built, a 16" nominal size VEGA meter was installed on an offshore platform in the EMEA region

ABB VIS Multiphase Flow Meter Technology Background …

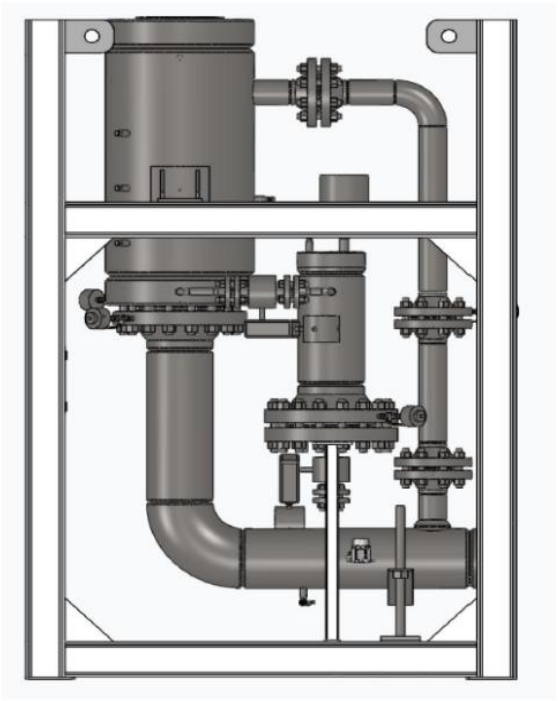
Sample Installation

ABB VIS Multiphase Flow Meter … and Evolution

- The conventional instrumentation installed in the VEGA meter is designed and produced by ABB
- The partnership allows to properly blend two excellences in order to provide the best solutions and services to customers
  - TEA Sistemi brings its knowledge and world-class experience in multiphase systems and flow assurance
  - ABB makes available its global presence, 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

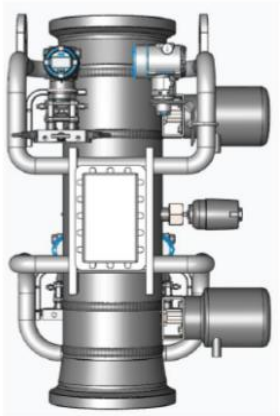
ABB VIS Multiphase Flow Meter
… and Evolution

- The Meter was re-designed and its size optimized.
- The mechanical construction was deeply changed, with a substantial weight reduction.
- The final result is a smaller and lighter system



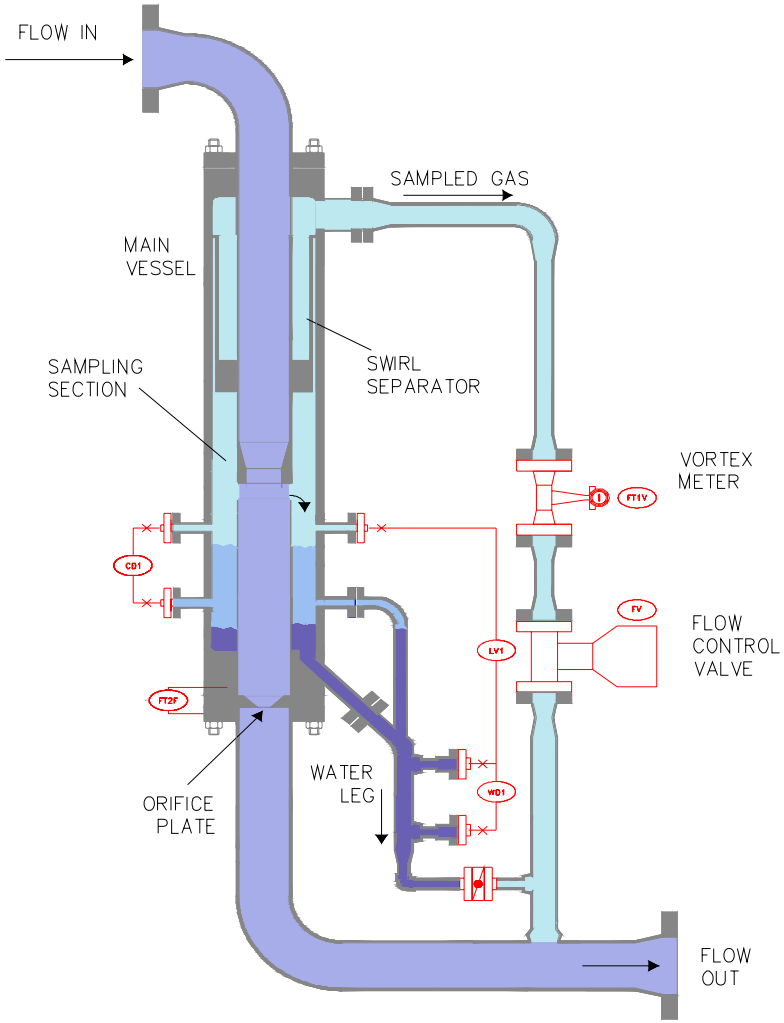
H: 3000mm; W: 1000mm; L: 2000mm
Weight: 2700kg

10” ANSI 900



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

ABB VIS Multiphase Flow Meter
… and Evolution



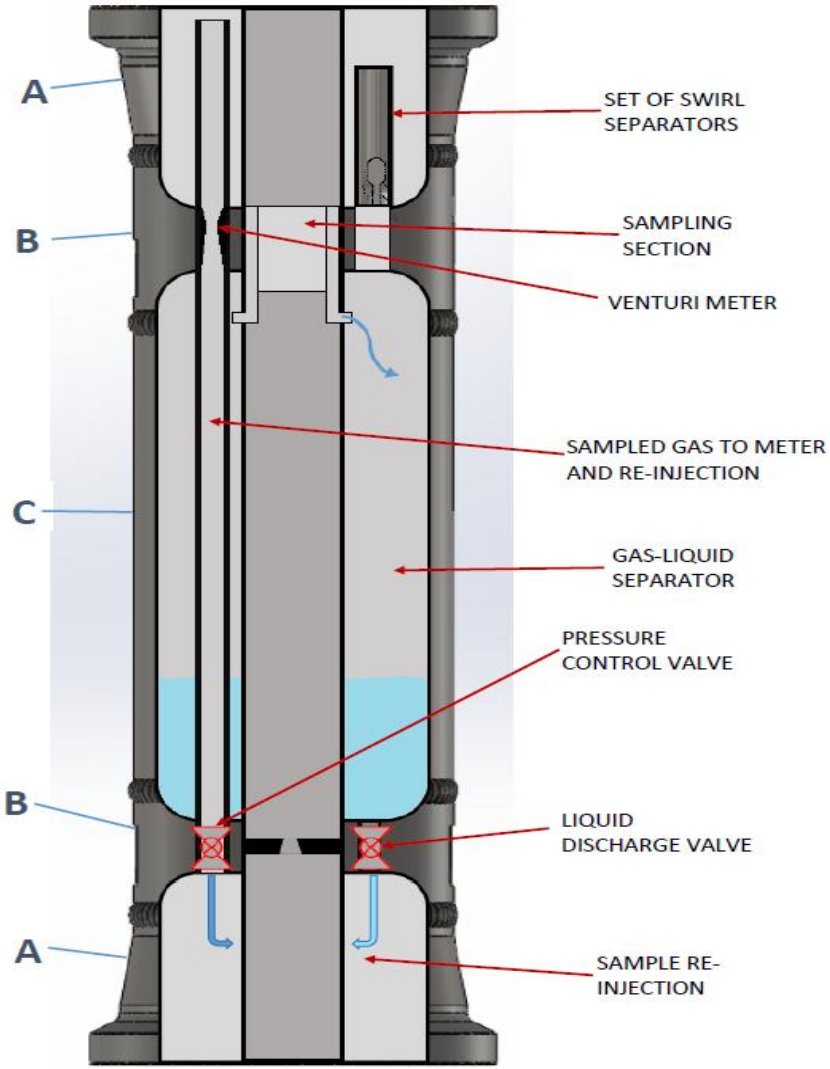


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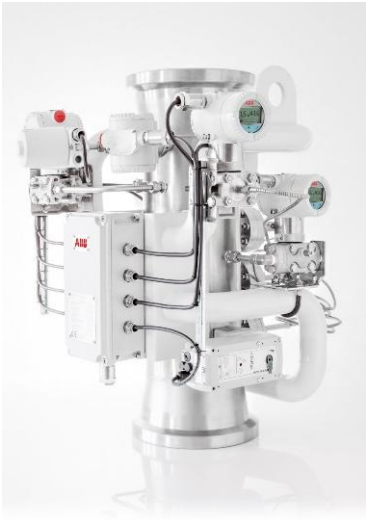
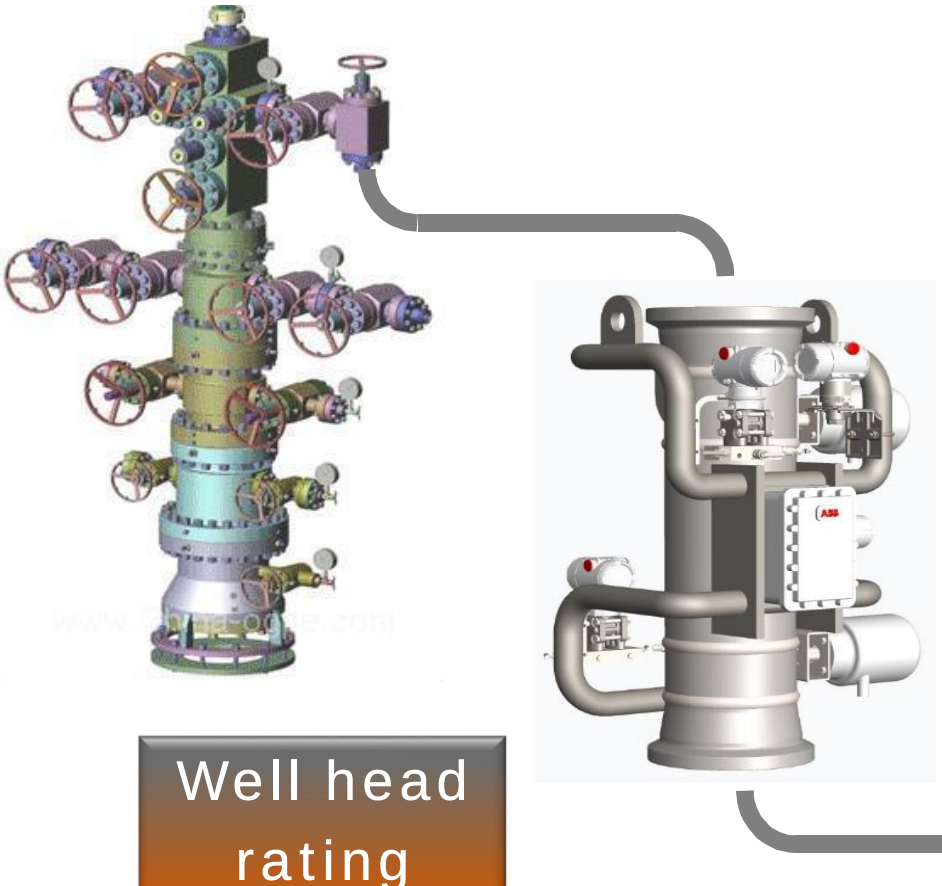
ABB VIS Multiphase Flow Meter
VIS Advantages



- VIS exploits a unique and patented operating principle
- VIS is specifically tailored for wet-gas applications
- VIS can provide very high accuracy even in the most challenging conditions (GVF>95%), and was successfully used in the field at 10^{-4}% LVF
- The technology performances are confirmed and validated in tests performed at TUV NEL (UK)
- VIS is based on conventional instrumentation only, facilitating installation and maintenance
- No radioactive source is used
- 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

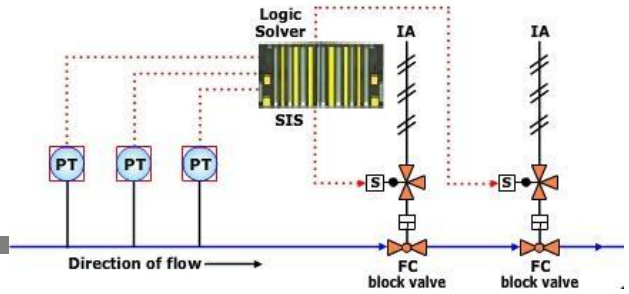
ABB VIS Multiphase Flow Meter
VIS Advantages – Downstream Positioning

Means MPFM with the same well head rating



Well head rating

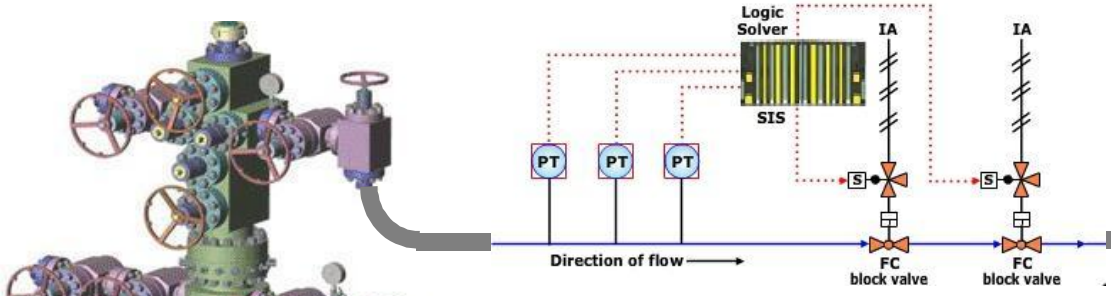
- Typical MPFMs preferred operation is at lower GVF: higher operating pressure means lower GVF
- Higher design pressure brings two disadvantages:
  - equipment become more expensive (tougher requirement on materials and components)
  - larger consequence extension due to loss of integrity and higher risks contribution of the meter to the overall process risk level



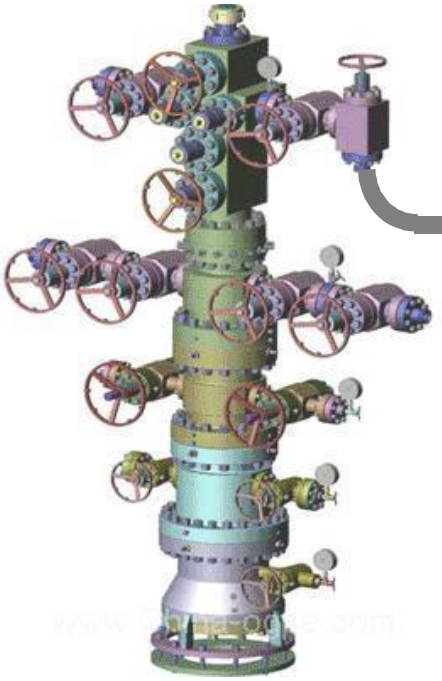
Plant rating

ABB VIS Multiphase Flow Meter
VIS Advantages – Downstream Positioning

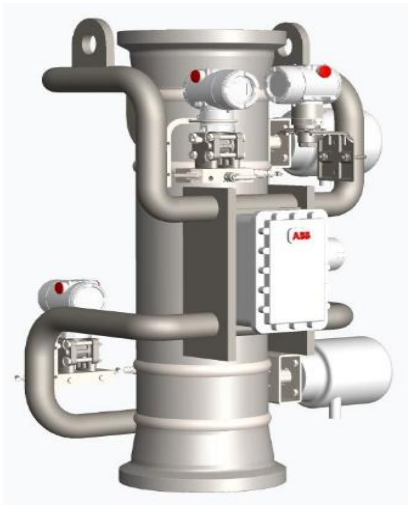
Means MPFM with the same plant rating



Plant rating



Well head rating



- ABB VIS is at ease (no accuracy degradation) at extremely high GVF: no needs to operate at higher pressure
- Two benefits:
  - Remarkable savings with NO IMPACT on performances
  - Operation at lower pressure means reduced consequence extension, minimizing meter risk contribution

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

Turndown extended up to 100:1

- With the “Dual Inlet” option a meter designed to operate at a given flowrate (say X m^3/h) can be easily used also at 1/10 of the design flowrate (X/10 m^3/h) with the same accuracy and no component replacement.

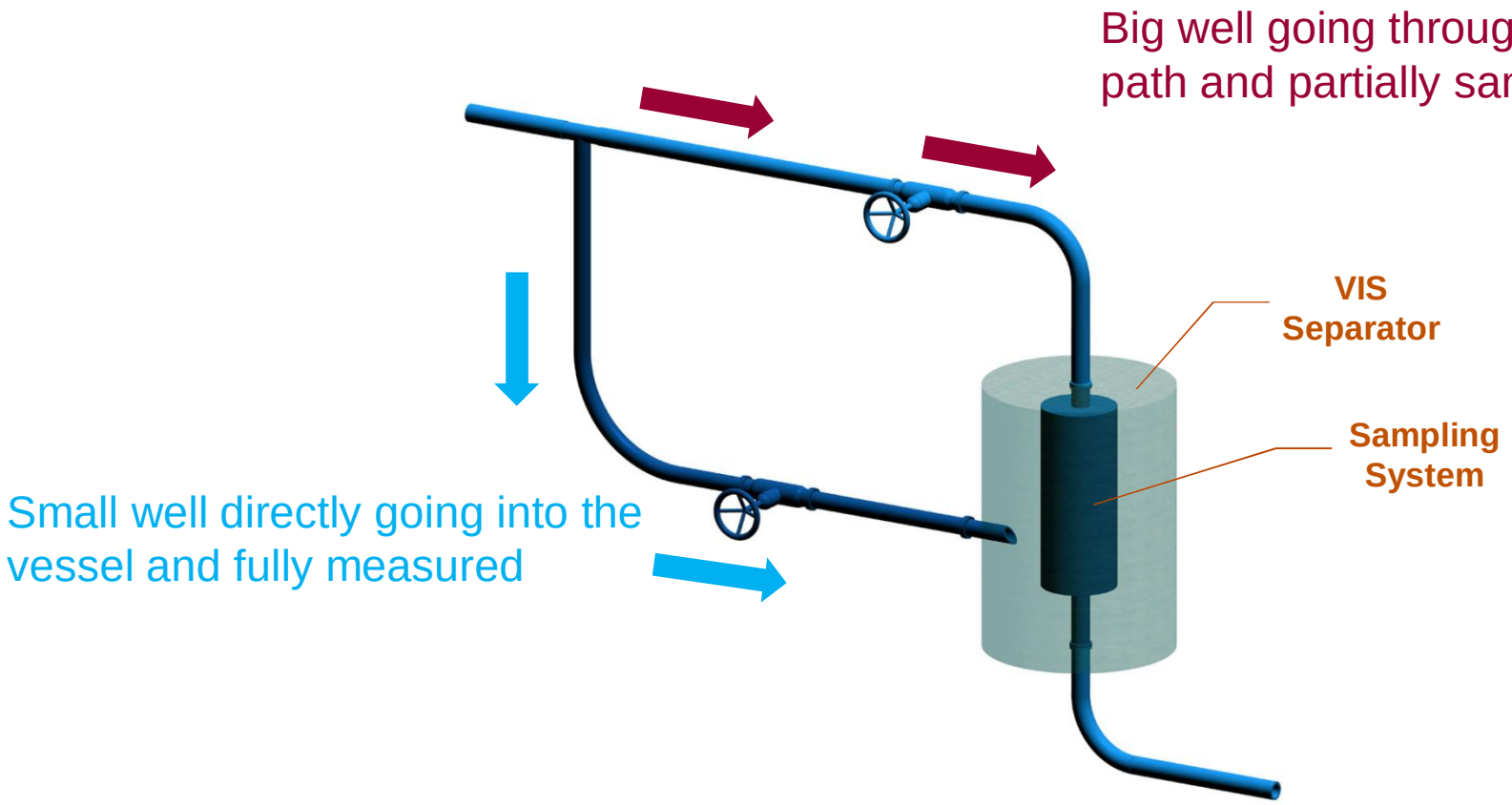


ABB VIS Multiphase Flow Meter
VIS Advantages: Summary

- VIS employs a proven and exclusive **gamma-free** technology:
  - Easier handling, HSE procedures, import, transport and maintenance activities
  - Avoid potential delays in Custom Clearance
  - Reduction in operational costs
- VIS only uses **conventional instrumentation**:
  - VIS only uses rugged ABB field devices (DPT, PT and TT)
  - Maintenance and troubleshooting can be directly done by end user without involving manufacturer
  - Downtime greatly reduced
  - No replacement of expensive parts is needed
- VIS was specifically developed for the most demanding **high GVF** applications:
  - It maintains high accuracy in the most challenging conditions for MPFMs (GVF>95%) where most MPFMs are severely affected in terms of performance
  - Field references of meter successfully measuring liquid flow rates as low as 10^{-4}% of the total flow rate

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