Oilfield Processing Measurement & Control - Oil & Gas Separation

Only the measurement experts at Endress+Hauser can combine products, services, and expertise to provide a wide range of highly accurate, well designed devices and systems required for efficient and state-of-the-art oilfield techniques required in today's fast paced and competitive industry.





Overview

Proper separation design and function is a crucial component to a well-managed oilfield and is totally dependent on the types of well(s) within the reservoir field.

Crude Oil Wells Crude oil wells often produce raw natural gas referred to as associated gas. The gas can exist separately from the crude oil in the underground formation or can be dissolved in the crude oil.

Dry Gas Wells These wells typically produce only raw natural gas that does not contain any hydrocarbon liquids. Such gas is called nonassociated gas.

Condensate Wells These wells produce raw natural gas along with natural gas liquids (ethane, propane, butane, etc.). Such gas is also non-associated gas and often referred to as "wet gas".

The ideal separator is designed to divide the well-stream into liquid-free gas, gas-free liquid, and produced water. Separator operating conditions will vary depending on well-stream fluid characteristics and flowing parameters. To achieve good, stable separation, the liquid level and gas-liquid interfaces should be controlled along with temperature and pressure control. Once separation is completed, accurate measurement of the flowing streams (oil, gas, and water) will account for the products produced by the well(s).

Selection of proper metering and control instrumentation is critical to the management of the separator and the accurate reporting of produced products.

Within the oilfield, the three most common applications for separators are well testing, production, and allocation.

The most common types of separators used are horizontal and vertical two phase, three phase, and two phase cyclone type separators for well testing. We know it's tough out there - not enough man-power, tough conditions, even tougher time lines - how can we help? Simplify your work with a complete offering from Endress+Hauser. Together we offer everything you need to automate and get your wells up and running quickly and on budget. And, we provide products along with the right services and support to keep your wells running long term.



Well Testing

Accurate measurement and control of each component of a multi-phase production stream, prior to comingling for further processing, is necessary for the effective management of oil and gas production and asset allocation. A typical installation is normally designed to handle testing for multiple producing wells with varying stream parameters and flowing conditions. This emphasizes the need for very accurate measurements with precise temperature and pressure control and interface in order to ensure proper separation within the test vessel.

Conventional two phase, three phase, compact two phase, or GLCC (Gas/Liquid Cyclonic Cylinder) separators can be used in well testing applications.





Production

Bulk production separation is extremely critical. In oil and gas processing, each process required for a given field has been designed to handle the expected reservoir conditions. The subsequent individual product streams coming from the bulk production separator need to be within a product range that the process can handle and pass on to the next process in the sequence. If the separator does not perform to expectations, there will be issues with every process in the sequence. Therefore it is essential that the separator be controlled to allow for precise liquid/gas separation and accurate product stream measurement. The importance of the bulk production separator system demands precise temperature, pressure and level interface devices. The metering devices must be capable of handling a wide range of product parameters and flow conditions while maintaining accuracy.





Allocation

In allocation, the function of the separator is much the same as a test separator in that allocation measurement is used to determine what portion of the total production from a field can be attributed to each individual well or lease.

Most fields have a wide variety of operating parameters such as temperature, pressure, flow rate, water cut, and product densities.

These conditions once again demand precise temperature, pressure, and level interface devices. As in all oilfield

production processes, the metering devices used in allocation measurement must be capable of handling a wide range of product parameters and flow conditions while maintaining accuracy.

A heater treater is used as part of the oil production process and separates oil from water, along with any solids from the production stream, by using heat and retention time. The oil from the heater treater can be measured for allocation and transferred to oil storage for custody measurement.





Instruments



Cerabar S PMP71



Process Pressure

- Used for process pressure monitoring up to SIL3, certified according to IEC 61508
- Overload resistant and . function-monitored.
- Continuous modularity for differential pressure hydrostatic and pressure
- Extensive diagnostic functions



- Temperature Transmitter Dual input temperature field
- transmitter High reliability in harsh
- environments due to dual compartment housing and compact electronics.





- Easy integration
- Continuously self-monitoring No calibration: quick, low-cost
- start-up
- No mechanically moving parts: no maintenance, no wear, long operating life

Liquicap FMI51



- conductive processes
- . Built-in DAT chip stores calibration data
 - Short measured value reaction time
- Universal application
- . Fully insulated rod probe for standard and extreme process conditions

Water Cut Probe & Monitor



Water cut probe and monitor

- Provides the highest possible sensitivity, resolution, and accuracy for water content determination in crude oil and natural gas condensate
- For water content up to 25% Enhanced digital signal processing and full product temperature . compensation

Deltabar S PMD75



- **Differential Pres** Reduce backwash and
- contamination by measuring pressure across debris filters Robust ceramic sensors can handle
- the toughest of applications Overload resistant and . function-monitored

Deltabar S FMD72



Electronic DP

- Differential pressure measurement is often used to measure the level in pressurized and vacuum tanks Traditional differential pressure
- measurement using impulse lines and capillaries have issues such as icing up, clogging, leaky taps, and dry/wet leg inconsistencies
- All of these issues can lead to less accuracy, process safety risks and greater total cost of ownership
- With the Endress+Hauser FMD72 Electronic DP system all of these issues are eliminated

Liquiline CM442



Analytics

- Simple, easy to maintain measurement for detecting excess oil in water, and thus validates the operation of the Separator.
- Memosens technology gives the user actual run time hours. This along with Sensor Check System can alert for extreme coating and planned maintenance vs. reactionary.





RTD TH13

- - enclosure
 - US manufacturing of temperature components and complete assemblies, protection heat and insulating shields, ceramic fiber

- - sheath protection

Temperature Sensors

Flow Metering Technology

Promass 83F & F 100



Coriolis Meter

- . Density calibration under process
- conditions < 0.0005 g/cc High accuracy even under varying,
- demanding process conditions Superior zero stability
- Self-draining and compact low . profile design
- Application specific "Quick Setup" (83F)
- Heartbeat Technology™ (HBT™) on-board diagnostics and
- verification tool (F 100)
- HistoROM™ for event, configuration, and data storage (F 100)

INVALCO WH Series



Turbine Meter

- INVALCO WH Oilfield Series Meter utilizes a rugged durable three-piece rotor/stator required for the extreme oil patch demands
- Wide flow, temperature, and . pressure range
- Superior accuracy
- Small in size and weight
- Heavy duty stainless steel construction for durability and long service life

INVALCO 400 Series



Control Valve

- Ideal for temperature and pressure applications such as separators, heater treaters, and free water knockouts
- Soft plug for tight shutoff Double port construction for maximum discharge rates

Promass 83E & E 100



Coriolis Meter

- Density calibration under process conditions < 0.0005 g/cc High accuracy even under varying, demanding process conditions
- Low cost of ownership
- Self-draining and compact low profile design
- Application specific "Quick Setup" (83E)
- Heartbeat Technology™ (HBT™) on-board diagnostics and verification tool (E 100)
- HistoROM™ for event, configuration, and data storage (E 100)

Prowirl 72F



Vortex Meter

- No zero-point drift ("lifetime" calibration)
- High resistance to vibrations, temperature shocks and contaminated fluids
- Optional meter body with integrated line size reduction

Smith Meter® Model E3 & F4



- Positive Displacement (PD) Meter Streamlined flow path provides low pressure drop
- Superior accuracy and measurement
- stability Immune to paraffin build-up .
- .
- No electricity required Low friction ball bearings, fixed cam-type timing, and rugged construction for sustained accuracy and long service life

Smith Meter® SC13 Series



- Positive Displacement (PD) Meter Streamlined flow path provides low
- pressure drop Superior accuracy and
- measurement stability
- . Immune to paraffin build-up
- No electricity required Low friction ball bearings, fixed cam-type timing, and rugged construction for sustained accuracy and long service life



- **Electromagnetic Meter** High resistance to abrasion thanks .
- to industry-optimized linings and measuring electrodes
- No pressure loss Insensitive to vibration
- Software options for: electrode cleaning, advanced diagnostics, calculation of mass flow and solids
- content High degree of efficiency due to the modular device and operating concept

INVALCO 500 Series



Back Pressure Valve

- Maintains back pressure on vent . lines from separators, treaters, dehydrators, compressor stations, and gas gathering systems
- Internal sensing line reduces the chance of blockage

Flow Computer



microFlow.net Liquid or Gas Flow Computer

- Sediment and water monitor input and NSV calculation
- Automatically corrects volumes per API MPMS Chapter 11.1-2004 and many other tables
- . Temperature, pressure, and density compensation and averaging
- Network compatible . Interfaces with Proline Coriolis
- meters Customizable report formats
- . Multi-level security access





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