Level, Pressure, and Density
Instrumentation for Modern Refining

Application Examples and Products

Looking Forward VEGA

Instrumentation for Modern Refining

This brochure presents examples of applied level and pressure measurement technology. Here, you'll learn which sensors fit which measuring tasks.

1	**Tank Farms in the Refinery**	Level Measurement
2	**Desalters**	Interface Measurement
3	**Distillation Columns**	Level and Pressure Measurement
4	**Tray Levels**	Level Measurement
5	**Flare Knockout Drum**	Level and Interface Measurement
6	**Catalyst Bed Reactors**	Level and Density Measurement
7	**Alky Settler**	Interface and Density Measurement
8	**Sulfur Decanter**	Level and Interface Measurement
9	**Compressor Knockout Drum**	Level Measurement
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11	**LPG Spheres**	Level and Pressure Measurement
12	**Steam Drums**	Level Measurement

Modern Refining

Accurate and Reliable Instrumentation

VEGA's comprehensive offering of products and services for the measurement of level, pressure, and density is setting the standard in the refining industry. With advanced electronics and technology, VEGA products are equipped to handle the increased demands of modern refining methods used to process both light and heavy crude. VEGA's diverse product offering delivers overfill protection and redundant systems for the most challenging applications, even with extreme temperature and pressure. These advanced products enable greater efficiency and accuracy within the refinery.

Instrument Overview

Continuous Level Measurement

Instrument Type		Measuring Range	Process Fitting	Process Temperature	Process Pressure
VEGAPULS 62 Pulse radar sensor for level measurement of liquids under difficult conditions		up to 115 ft (35 m)	Threads from G1½, 1½ NPT Flanges from DN 50, 2"	-320 … +842°F (-196 … +450°C)	-14.5 … +2,320 psi (-1 … +160 bar)
VEGAFLEX 81 Guided wave radar sensor for continuous level measurement of liquids		up to 246 ft (75 m)	Threads from G¾, ¾ NPT Flanges from DN 25, 1"	-40 … +392°F (-40 … +200°C)	-14.5 … +580 psi (-1 … +40 bar)
VEGAFLEX 86 Guided wave radar sensor for liquid and interface measurement in high temperatures/pressures		up to 246 ft (75 m)	Threads from G¾, ¾ NPT Flanges from DN 25, 1"	-320 … +842°F (-196 … +450°C)	-14.5 … +5,800 psi (-1 … +400 bar)
FiberTrac 31 Radiation-based sensor for continuous level measurement		up to 23 ft (7 m)	Mounts external to the vessel	-4 … +122°F (-20 … +50°C)	Mounts external to the vessel
VEGAMAG 82 Combination measuring system — magnetic level indicator paired with bridle and guided wave radar		up to 50 ft (15 m)	Threads from G½, ½ NPT Flanges from DN 25, 1"	-320 … +842°F (-196 … +450°C)	-14.5 … +5,800 psi (-1 … +400 bar)
VEGAPASS 81 Bridle chamber		up to 13 ft (4 m)	Threads from G½, ½ NPT Flanges from DN 25, 1"	-320 … +842°F (-196 … +450°C)	-14.5 … +3,626 psi (-1 … +250 bar)

Point Level Detection

Instrument Type		Measuring Range	Process Fitting	Process Temperature	Process Pressure
VEGASWING 63 Vibrating level switch with tube extension for liquids		up to 20 ft (6 m)	Threads from G¾, ¾ NPT Flanges from DN 25, 1"	-58 … +482°F (-50 … +250°C)	-14.5 … +928 psi (-1 … +64 bar)
VEGASWING 66 Vibrating level switch for liquids in high temperatures/pressures		up to 10 ft (3 m)	Threads from G1, 1 NPT Flanges from DN 40, 1½"	-321 … +842°F (-196 … +450°C)	-14.5 … +2,320 psi (-1 … +160 bar)

Pressure Measurement

Instrument Type		Deviation	Process Fitting	Process Temperature	Measuring Range
VEGABAR 81 Pressure transmitter with chemical seal system		0.2%	Threads from G½, ½ NPT Flanges from DN 25, 1" Hygienic fittings	-130 … +752°F (-90 … +400°C)	-14.5 … +14,500 psi (-1 … +1,000 bar)
VEGABAR 82 Pressure transmitter with CERTEC® measuring cell		0.05 … 0.2%	Threads from G½, ½ NPT Flanges from DN 15, 1" Hygienic fittings	-40 … +302°F (-40 … +150°C)	-14.5 … +1,450 psi (-1 … +100 bar)
VEGABAR 83 Pressure transmitter with METEC® measuring cell		0.075 … 0.2%	Threads from G½, ½ NPT Flanges from DN 25, 1" Hygienic fittings	-40 … +392°F (-40 … +200°C)	-14.5 … +14,500 psi (-1 … +1,000 bar)

Density Measurement

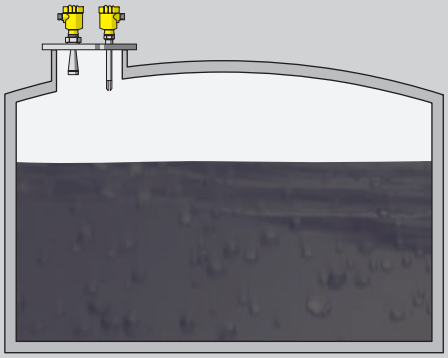
Instrument Type		Measuring Range	Process Fitting	Process Temperature	Process Pressure
MiniTrac 31 Radiation-based density and point level measurement		up to 40" (1 m) of process material	Mounts external to the vessel	-40 … +140°F (-40 … +60°C)	Mounts external to the vessel

Application: Tank Farms in the Refinery

Reliable
Redundant measurement ensures a high degree of safety

Cost-effective
Self-monitoring reduces maintenance costs

Convenient
Easy installation and setup



Level Monitoring of Fixed-Roof Storage Tanks

Level measurement of bulk liquids storage tanks in a refinery is necessary for inventory management and overflow protection. An instrument that can adapt to meet existing process connections to continuously monitor the liquid level in the storage tank is necessary. Multiple measurement devices can fit into a single process connection, reducing the cost of implementation for the system.

Level Monitoring of Floating-Roof Storage Tanks

The floating-roof style of storage tanks proves to be a difficult measurement. It is imperative to have an instrument that is accessible from the platform at the top of the storage vessel and is able to track the level of the roof as it rises with the stored material.

VEGAPULS 62

Pulse radar sensor for level measurement in fixed- and floating-roof storage tanks

- Small, lightweight design makes installation easy
- Simple retrofit capability utilizes existing process connections
- Exact measuring results independent of pressure, temperature, gas, or steam
- Use of optional PLV system fulfills API 2350 requirements

VEGASWING 63

Vibrating level switch for overfill protection in fixed-roof storage tanks

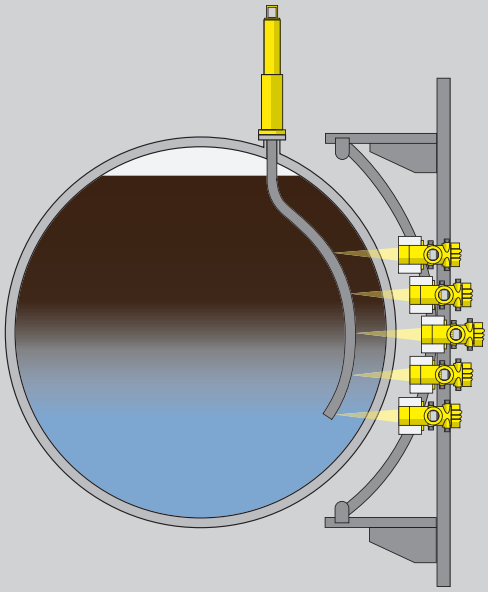
- High level switch provides redundancy
- Varying insertion lengths meet specific application requirements
- By simply pushing a button, you can meet the legal requirements of the periodic test in seconds
- Unaffected by media properties ensures reliable measurement

Application: Desalters

Reliable
High measuring precision, independent of process conditions

Cost-effective
Simple air and water calibration for fast commissioning time

Convenient
Mounts external to the vessel



Interface Tracking in the First Stage Desalter

To prevent corrosion to downstream equipment following the desalter, it is important that the desalter unit runs efficiently. When the crude oil mixes with the emulsifying chemicals and water, the resulting emulsion layer makes it difficult for standard level measurement technologies to reliably track the interface. Reliable tracking of the emulsion layer and changing interfaces within the process provides a clear picture for the operator to efficiently run the desalter and maximize throughput.

Multi-Point Density Array

Fixed density profile system for emulsion interface control

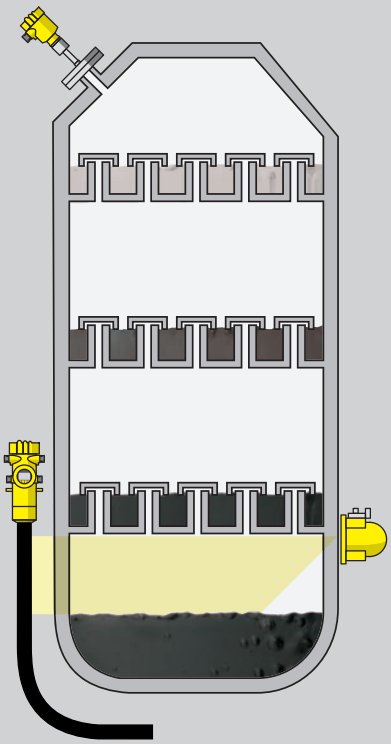
- Reliably tracks emulsion layer to keep the process stream efficient
- Adjustable measurement span accommodates changing process properties
- Remains online even when replacing a detector to eliminate downtime
- Allows operator to maintain high throughput even when switching between light to heavy feedstock
- Enables better management of chemical usage

Application: Distillation Columns

Reliable
Precise measurement results even in extreme environments

Cost-effective
Single source/detector combination

Convenient
Operates independent of the process



Measurement of Distillation Column Bottoms

The heavy, highly viscous process material and extreme temperature in the bottom range of the distillation unit can cause operational difficulties for most traditional instrumentation. Thick insulation and the contours of the column bottom create measurement and mounting challenges. For reliable level control of residual feeds in such conditions, a non-contact technology is necessary.

Column Pressure

Monitoring head space pressure at the upper end of refinery columns is important to ensure that the process is operating under ideal pressure conditions. A pressure transmitter that can operate effectively during temperature fluctuations ensures efficiency and stability of the column's process.

FiberTrac 31

Flexible radiation-based detector that measures through thick insulation and easily adapts to vessel contours

- Flexible detector adapts to vessel shape, minimizing detector quantities and cost
- Detector replacement is online, eliminating process downtime for maintenance
- Lightweight design reduces mounting hardware and structural requirements
- Easy proof test verifies operation without costly process downtime
- Can be provided with integrated air fitting

VEGABAR 81

Pressure sensor for monitoring head pressure in the distillation unit

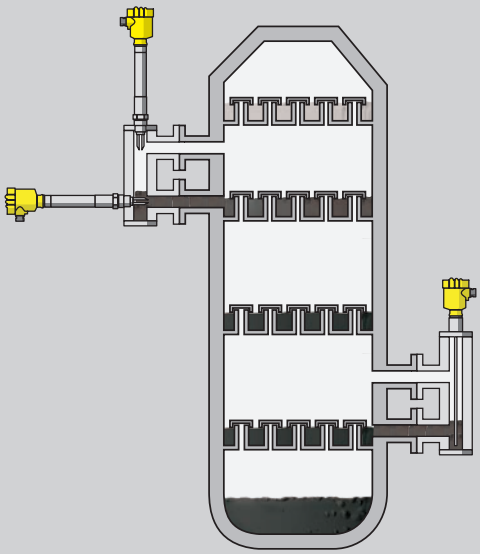
- Isolated diaphragm increases temperature resistance
- Unobtrusive sensor is unaffected by foam generation
- Tough diaphragm materials provide excellent chemical resistance

Application: Tray Levels

Reliable
Unaffected by process conditions

Cost-effective
Low maintenance costs, because no moving parts

Convenient
Overfill protection increases plant safety



Level Control of Column Trays

Accurate level control of the distillation unit ensures product quality of the different cuts of hydrocarbon, but is made difficult due to flashing and other extreme process characteristics. Technology that is immune to product density changes and buildup is necessary to produce an accurate measurement through changes in the process.

VEGAFLEX 81 and VEGAPASS 81

Guided wave radar sensor with bridle chamber for reliable tray measurement

- Non-moving parts are immune to mechanical failure
- Low maintenance requirements reduce downtime and costs
- Single rod probe prevents plugging and results in a reliable measurement

VEGASWING 66

Vibrating level switch for monitoring high- and low-alarm in the distillation unit

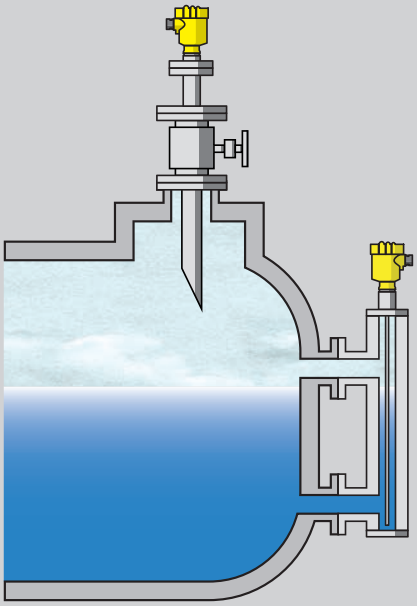
- Reliable measurement unaffected by high temperature and pressure
- Test function during operation provides higher plant availability
- Redundancy increases plant safety and availability

Application: Flare Knockout Drums

Reliable
Tracks total process level and interface level

Cost-effective
Reduced maintenance cost due to no mechanical moving parts

Convenient
Easily fit within mounting constraints



Continuous Level Measurement with Ball Valve Isolation

The flare knockout drum requires continuous, accurate level monitoring to keep liquids from reaching the flare and creating a potential fire hazard. In order to ensure safety by performing this critical measurement, the total process level over the span of the drum needs to be tracked and continuously reported to the operator for proper control. Using the VEGAPULS 62 with a ball valve and wave-guide sleeve allows the unit to be removed from service without the need for shutting down the process. The integrated wave-guide sleeve ensure a high quality measurement without having to worry about nozzle imperfections causing increased noise in the radar signal.

VEGAFLEX 81 and Bridle Measurement

For interface measurement in the boot of the flare knockout drum, a VEGAFLEX 80 series mounted in a bridle provides remote reporting of interface. The accuracy of the measurement provided by the VEGAFLEX 80 series helps the operator determine the liquid level in the boot, and any accumulated water can be sent to the water treatment plant for processing.

VEGAPULS 62

Pulse radar sensor for continuous level measurement over the span of the knockout drum

- Continuous, online tracking maximizes operator control
- Isolation valve provides the ability to remove the device without emptying
- Reliable measurement ensures product quality
- Non-moving parts eliminate maintenance needs

VEGAFLEX 81 and VEGAPASS 81

Guided wave radar sensor with bridle chamber for reliable interface measurement

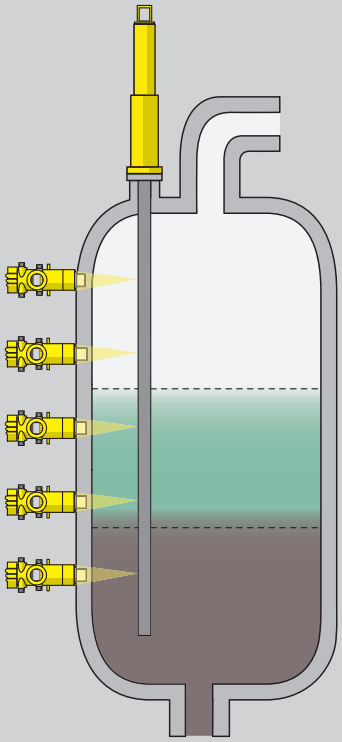
- Immune to mechanical failure due to no moving parts
- Low maintenance requirements reduce downtime and operating cost
- Flexible cable prevents plugging and results in a reliable measurement
- Bridle can be easily isolated to allow service of the VEGAFLEX without interrupting the process

Application: Catalyst Bed Reactors

Reliable
Unaffected by fluid viscosity, deflection, or refractive properties

Cost-effective
Mounts external to the vessel

Convenient
Measures though vessel walls and obstructions



Continuous Density Measurement

As with many other refining applications, the catalyst bed reactor has an optimum level that is critical to maintain efficiency. Product variation and high temperatures present the need for low-maintenance instrumentation. Maintaining the proper level in the vessel ensures that the expensive catalyst is used at the highest level of efficiency without waste.

MiniTrac 31

Radiation-based sensor used in series for catalyst bed reactor measurement

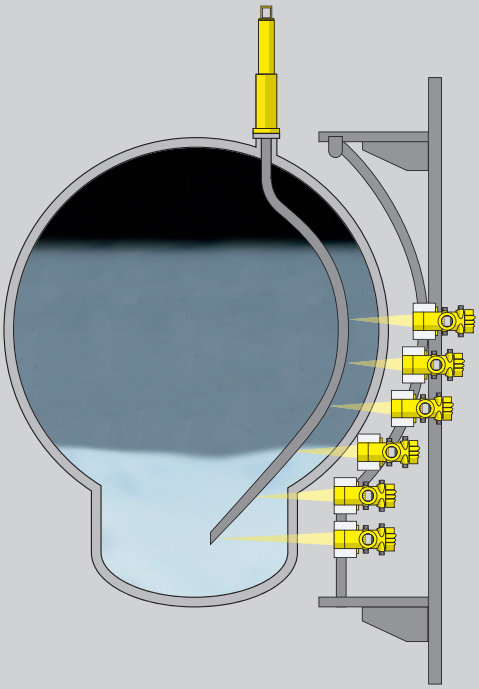
- Compact and lightweight detector mounts easily
- External mounting does not interrupt the process
- Non-contact technology measures through vessel walls and obstructions
- Ideal for all process conditions

Application: Alky Settler

Reliable
Measurement across the span of the vessel with multiple sensors

Cost-effective
Air and water calibration reduces commissioning time

Convenient
Non-invasive measurement ensures easy maintenance



Multi-Point Interface Tracking

The layers created in a separation process form interfaces that must be tracked to manage the output of the material from the unit. Reporting density on a horizontal plane enables accurate control of the process.

Multi-Point Density Array

Fixed density profile system for emulsion interface control

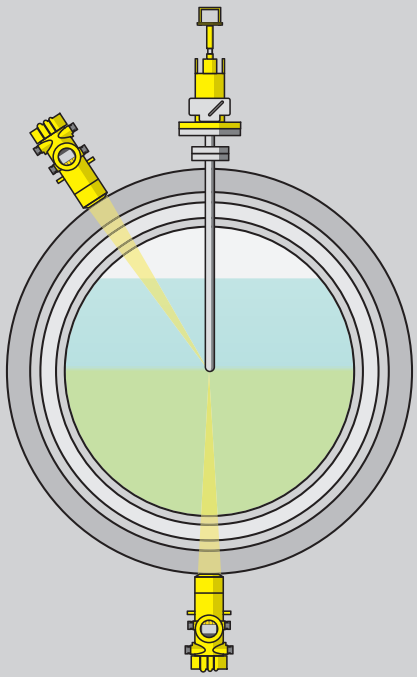
- Customizable detector system tracks multiple interfaces
- Non-contact measurement is unaffected by high process temperatures
- Online tracking increases production efficiency

Application: Sulfur Decanter

Reliable
Unaffected by process characteristics

Cost-effective
Minimal impact to the downstream process

Convenient
No manual involvement to determine the level



Total Level and Interface Measurement of Sulfur Decanters

In a sulfur decanter, the operator must manually verify the interface level of the elemental sulfur that slowly builds up under the water. Coating on the insertion probes in the sulfur decanter can sometimes cause incorrect readings, therefore manual verification is very difficult in this application. An instrument that can automate the measuring process and provide continuous operation of the process ensures availability of the vessel and minimal impact to the downstream process.

MiniTrac 31

Radiation-based density detector paired with insertion source for sulfur decanting automation

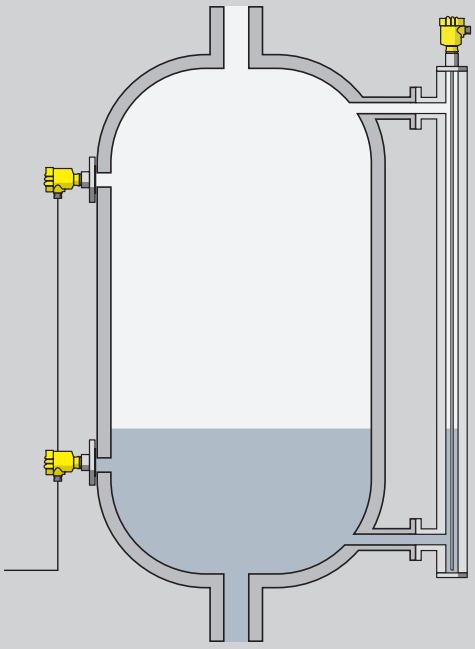
- Detector placement maximizes process insight with minimum source size
- Optimized measurement across vessel span eliminates the need for manual involvement

Application: Compressor Knockout Drum

Reliable
Differential output can provide redundant level measurement

Cost-effective
Diaphragm with high chemical resistance

Convenient
Continuous level reporting



Water Level Control

The vapor-liquid separation that occurs in the knockout drum protects the waste or cooling stream from process vapors and the compressor from water, which required constant level monitoring. A reliable instrument is necessary to monitor the crucial level without being influenced by the high volume of vapor created in the vessel. The reliability of an instrument ensures that there is no water carry-over to the compressor, avoiding the extremely expensive downtime that results from an upset. An alternate level measurement technology is recommended for the knockout drum in order to establish redundancy.

VEGAFLEX 81

Guided wave radar sensor for water level control in the knockout drum

- Reliable measurement, unaffected by vapor presence
- Easy installation directly in the drum or in a bridle chamber
- Quick setup reduces installation costs
- Will not experience zero point drift or fluctuations due to specific gravity, temperature, dust, or pressure

VEGABAR 82

Electronic differential pressure system for measurement redundancy in the drum

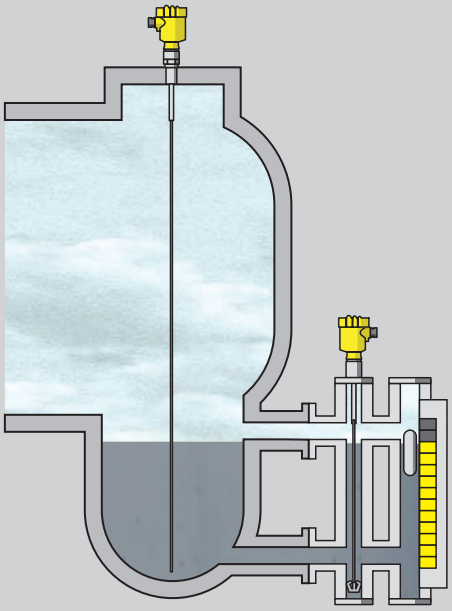
- No additional temperature influences because no liquid capillary connection required
- Very good reproducibility and long-term stability
- High resistance diaphragm materials
- Easy installation because no insulation for capillary needed

Application: Sour Water Stripper

Reliable
Redundant level monitoring

Cost-effective
Low maintenance costs

Convenient
Mounts to most standard tank process connections



Continuous Level Measurement

The sour water stripper or water knockout drum requires continuous, accurate level monitoring to keep sour water from entering the process vessels. Sour water is highly corrosive and over time can cause severe damage to process vessel and piping if not addressed. Any water collected in the sour water stripper is sent to sulfur removal unit to be processed.

VEGAFLEX 81

Guided wave radar sensor for continuous level measurement over the span of the knockout drum

- Continuous, online tracking maximizes operator control
- Reliable measurement ensures product quality
- Non-moving parts eliminate maintenance needs
- Dual measurement capability provides both total level and interface level

VEGAFLEX 81 and VEGAMAG 82

Guided wave radar and magnetic level indicator dual measurement for reliable interface control when air is present

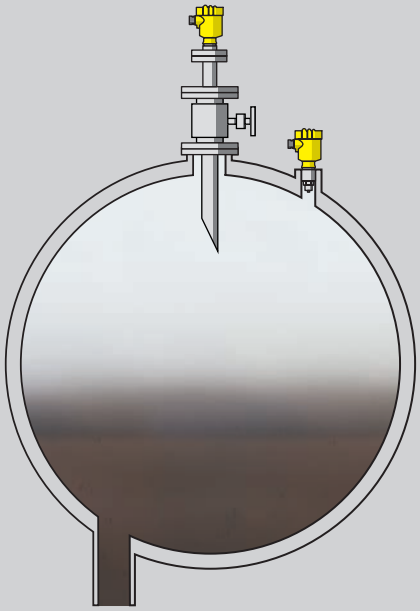
- Guided wave radar and MLI provide redundancy
- Guide wave radar is immune to the crude supply density changes offering reliable continuous level control

Application: LPG Sphere

Reliable
High measuring precision, independent of vapor or pressure

Cost-effective
Maintenance-free operation

Convenient
Remove the device without emptying the sphere



Level Monitoring of LPG Spheres

LPG spheres are very large and are rarely taken out of service. As a result, this measurement requires a very reliable level transmitter. The need for system isolation and low product dielectric constants are important process attributes.

Pressure Monitoring

Monitoring the process pressure in the separator is a safety precaution for the unit and refinery itself. The process pressures inherent to separation and the potential for condensation and vibration, requires a reliable pressure reading back to the controller.

VEGAPULS 62

Radar sensor installed in a sleeve for long-distance measurement

- Maintenance-free operation through non-contact measuring principle
- High plant availability, because it is wear- and maintenance-free
- Reliable measurement independent of vapor
- Able to measure a low DK liquid over a long distance
- Isolation valve provides the ability to remove the device without emptying the sphere

VEGABAR 83

Pressure transmitter with extremely rugged Hastelloy measuring cell for high pressure environments

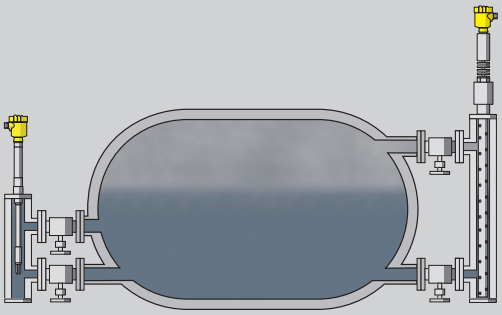
- Strain gauge sensor cell contains no fill fluid to avoid potential leaks
- Numerous connection options fit to existing connections

Application: Steam Drums

Reliable
High measuring precision, independent of temperature and pressure

Cost-effective
Low maintenance costs

Convenient
Easy installation



Level Measurement and Point Level in the Steam Drum

High pressure steam is critical to the operation of the refinery. An accurate level measurement must be made to ensure the most efficient operation of the drum to provide reliable steam and also make certain the drum level does not fall below a minimal level which can create a very dangerous situation which could lead to major damage and possible injury to plant personnel.

VEGAFLEX 86

Guided wave radar with steam compensation for a reliable drum level control

- Accurate measurement due to the automatic run-time correction, even under changing steam conditions
- Flexible mounting options easily retrofit displacer bridles or installs directly in the vessel
- Meets high safety standard up to SIL 2/3 according to IEC 61508

VEGASWING 66

Vibrating level switch for high and low water limit

- Simple setup without product presence reduces time and cost
- Precise and reliable function through product-independent switching point
- Reliable measurement unaffected by high temperature and pressure

plics® — Easier is Better

Instrument Platform plics®

The plics® idea is simple: Each instrument is assembled from prefabricated components once the order is received. This modular design allows full flexibility when selecting the required sensor features. You receive your customized, user-friendly instrument within an amazingly short time. And the best part: these instrumens are more cost-effective and advantageous in every way – and that throughout their entire life cycle.

Display and Adjustment

The display and adjustment module PLICSCOM is used for measured value indication, adjustment, and diagnosis of the sensor. Its menu structure is simple and allows for quick setup and commissioning. Status messages are displayed in plain text.

Connection

The mobile VEGACONNECT is used to connect your instrument to a PC via the USB interface. Parameterization of the instruments is carried out with the tried-and-true adjustment software PACTware and the appropriate DTM. For EDD-based adjustment we also offer graphics-driven EDDs.

Recognition of Maintenance Requirements

The integrated self-monitoring function of plics® instruments continuously reports on the status of the instruments. Status messages allow proactive and cost-effective maintenance. All diagnostic data can be called up easily and quickly in plain text via the built-in memory functions.

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Looking Forward