



Capacitive

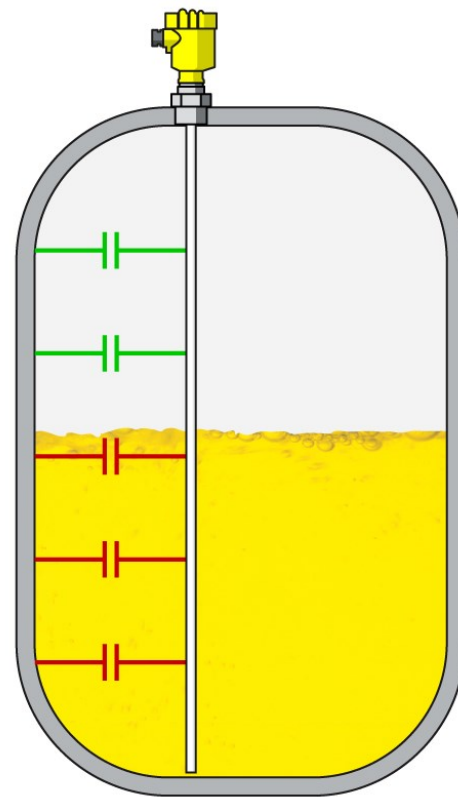
Level and Interface measurement

VEGACAL

Simple and robust

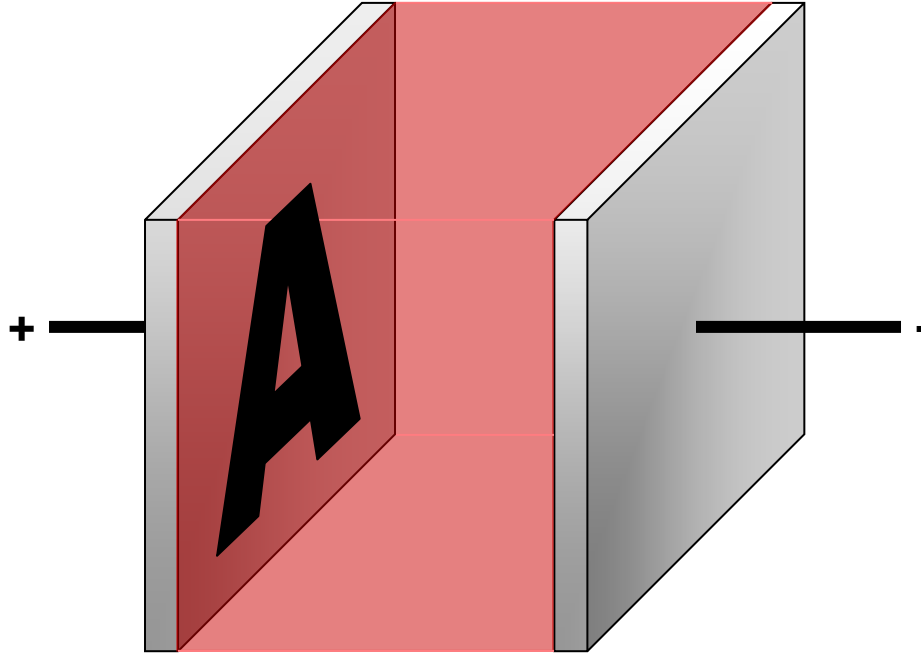
Measuring principle

- The capacitance is measured between the rod and the tank wall.
- The capacitance of a capacitor is determined by:
 - The dielectric constant of the product.
 - The mounting position of the probe (distance to the tank wall, length of the probe)
 - Level
- The electronics converts the capacitance variation into a proportional change of the level.



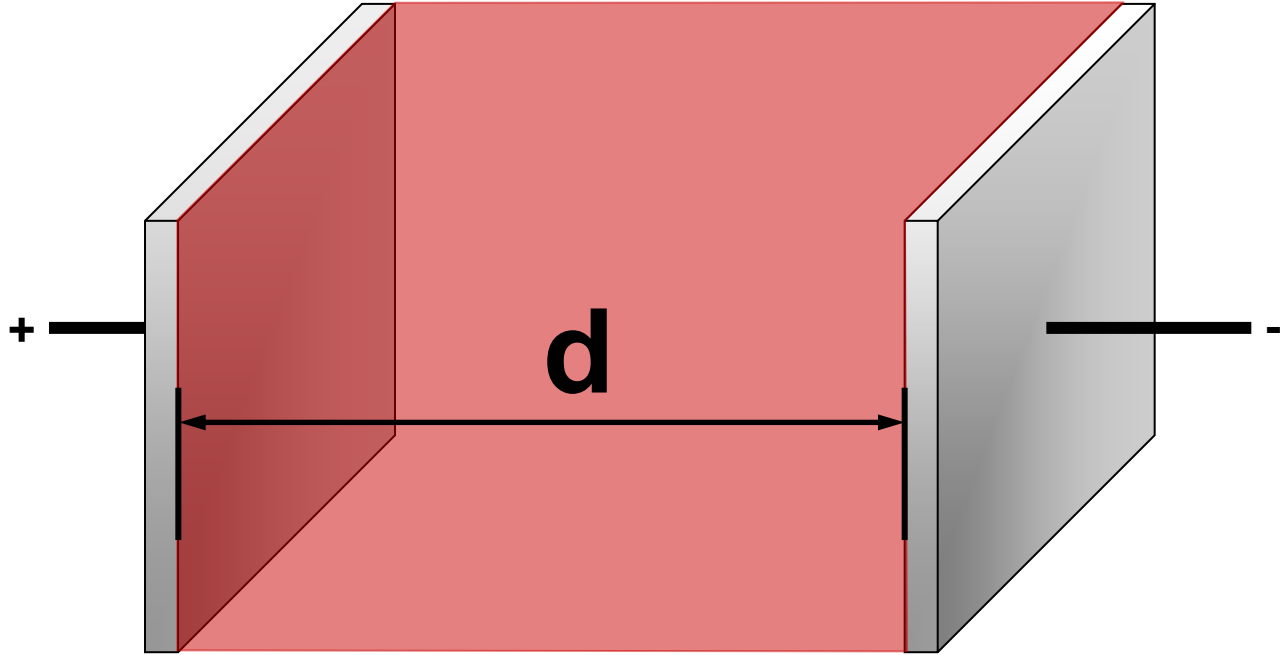
Three factors influence the capacitance

- Plate size: The larger the capacitor plates, the greater the capacitance



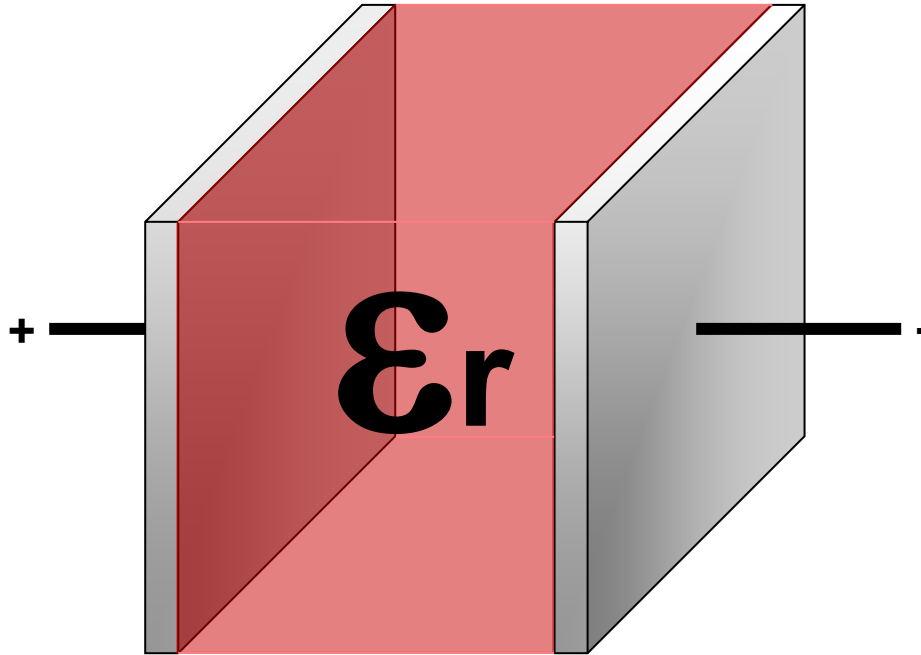
Three factors influence the capacitance

- Plate spacing: The greater the plate spacing, the lower the capacity



Three factors influence the capacitance

- Dielectric: The higher the relative dielectric constant, the greater the capacitance



List of dielectric constants

Substance	Substanz	Dielectric Constant
A		
Acetal	Acetal (25°C)	3,8
Acetaldehyde	Acetaldehyd	15,0
Acetamide	Acetamid (77°C)	59,2
Acetic acid	Essigsäure	6,2
Acetoacetic acid ethyl ester	Acetessigsäureethylester	15,0
Acetone	Aceton	21,5
Acetophenone	Acetophenon	18,0
Acetyl bromide	Acetyl bromid	16,2
Acetyl chloride	Acetylchlorid	15,9
Acetylacetone	Acetylaceton	23,0
Acetylacetic acid	Acetylaceton	2,2

VEGACAL

The capacity is obtained from the following equation:

$$C = \epsilon_r \frac{A}{d}$$

c = capacity

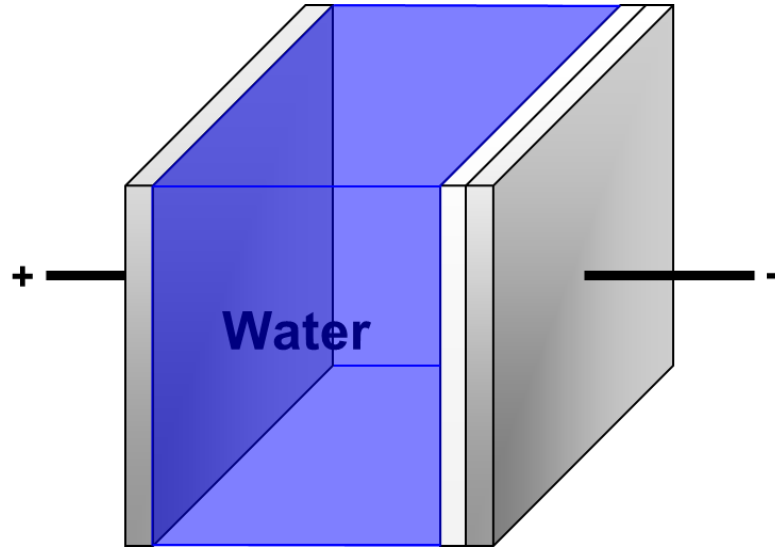
ϵ_r = dielectric constant

A = surface area

d = distance

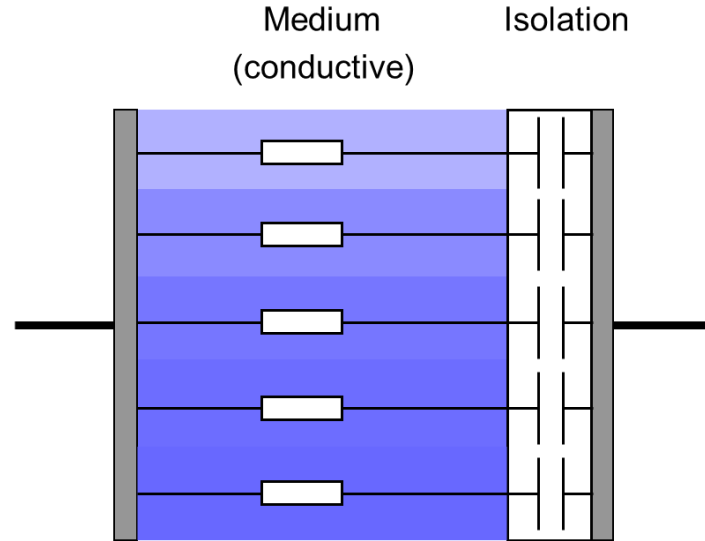
Conductive media

- If the medium is conductive, at least one plate must be insulated
- The insulation assumes the function of the dielectric



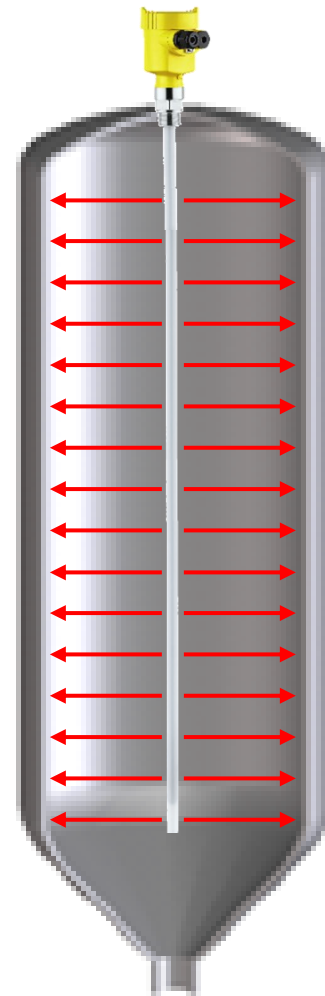
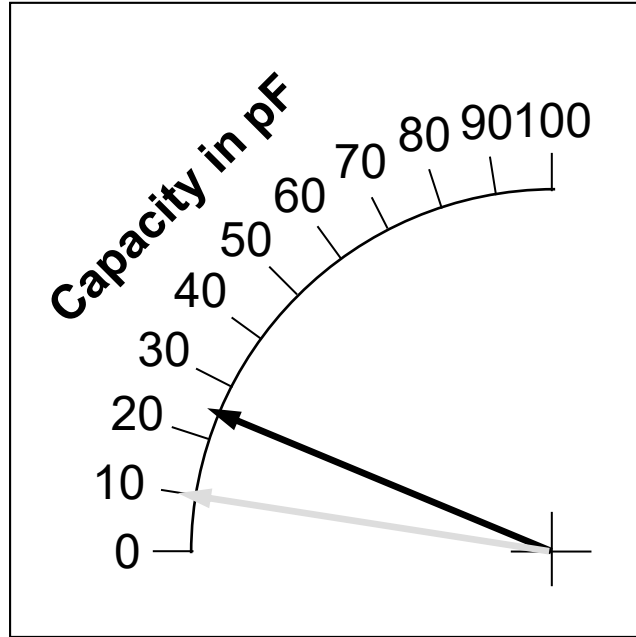
Conductive media

- If the medium is conductive, at least one plate must be insulated
- The insulation assumes the function of the dielectric



Initial or static capacity

Empty tank / container



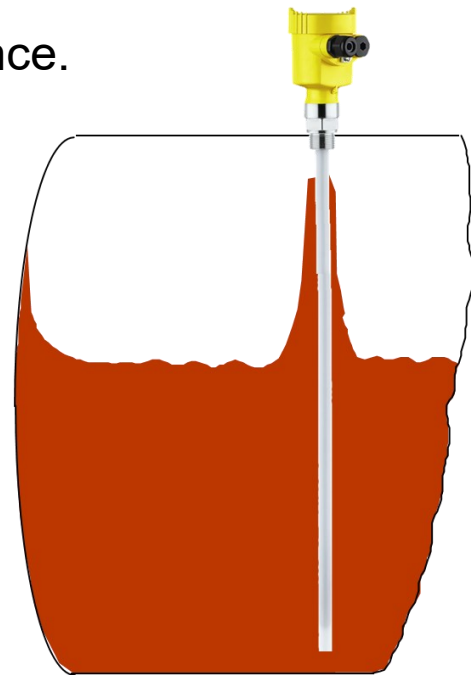
Measuring principle

VEGACAL works according to the admittance procedure.

- This is the evaluation of capacitance and electrical resistance.

This kind of measurement offers some advantages

- In case of product adhesion on the central electrode.



What kind of sensors do we have available?



VEGACAL/VEGACAP

Different versions



VEGACAL / VEGACAP 62

For bulk solids and non-conductive liquids



VEGACAL / VEGACAP 63

For conductive liquids

VEGACAL/VEGACAP

Different versions



VEGACAL / VEGACAP 64

For adhesive

Conductive liquids



VEGACAL / VEGACAP 65

For bulk solids and non-conductive liquids

VEGACAL/VEGACAP

Different versions



VEGACAL / VEGACAP 66
For conductive liquids

VEGACAL / VEGACAP 67
High temperature version
for bulk solids



VEGACAL/VEGACAP

Different versions



VEGACAL / VEGACAP 69
Measurement in non-
conductive or spherical
vessels



VEGACAP 98
For very light-weight
bulk solids

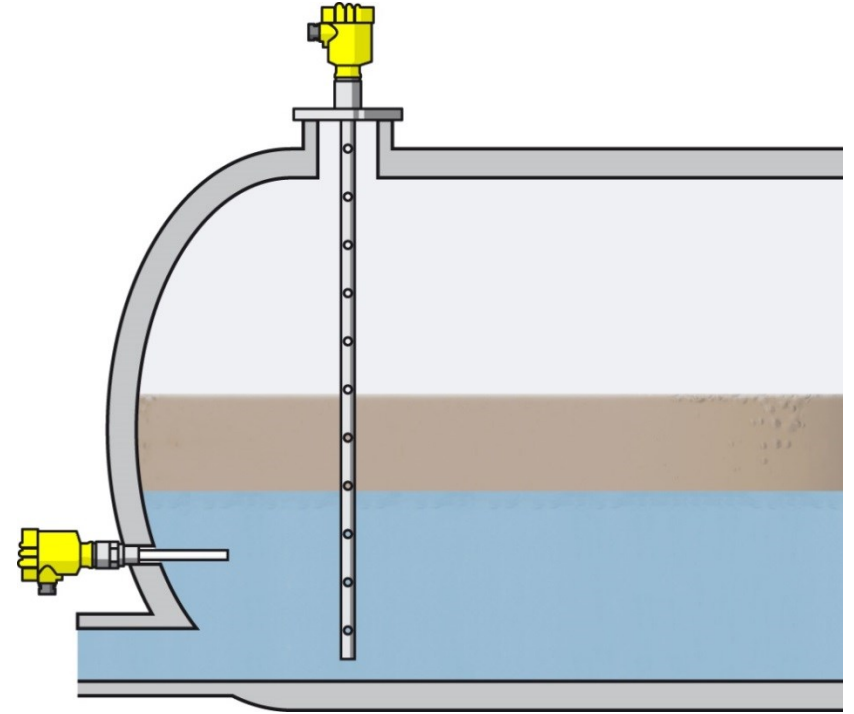
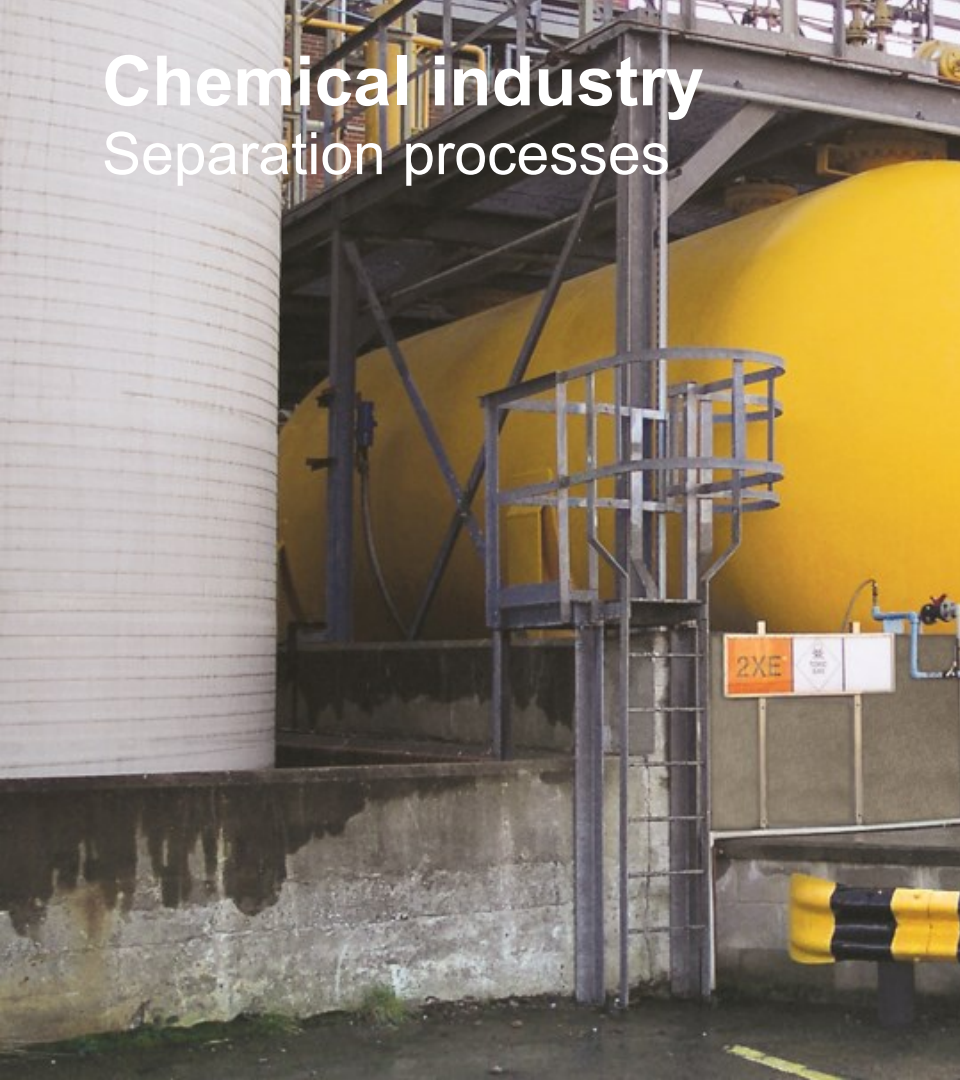






Chemical industry

Separation processes



VEGACAP 63

VEGACAL



Electronics for VEGACAL

- 4 ... 20 mA/HART
- Profibus
- Foundation Fieldbus
- Analog for connection to VEGAMET
- Optional SIL2

VEGACAP



Electronics for VEGACAP

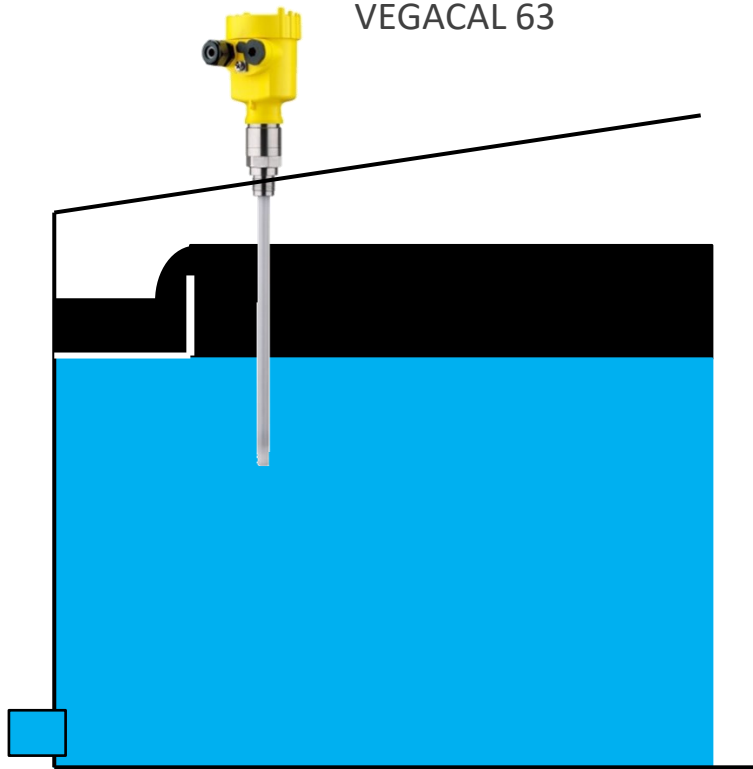
- Contactless electronic switch
- Relay (DPDT)
- Transistor (NPN/PNP)
- Two-wire for connection to VEGATOR 14x
- Optional SIL2

Applications

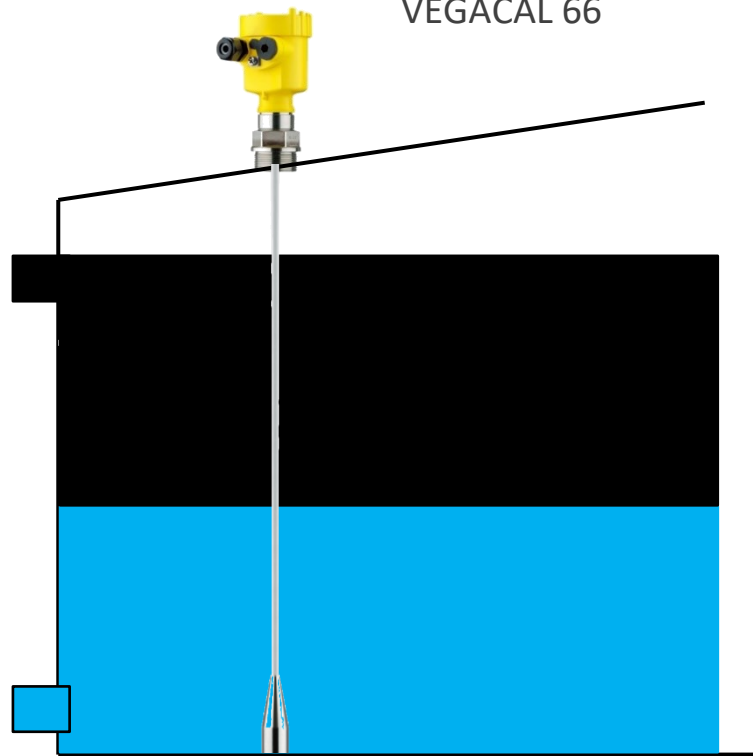
Skimmer

Cutter tank

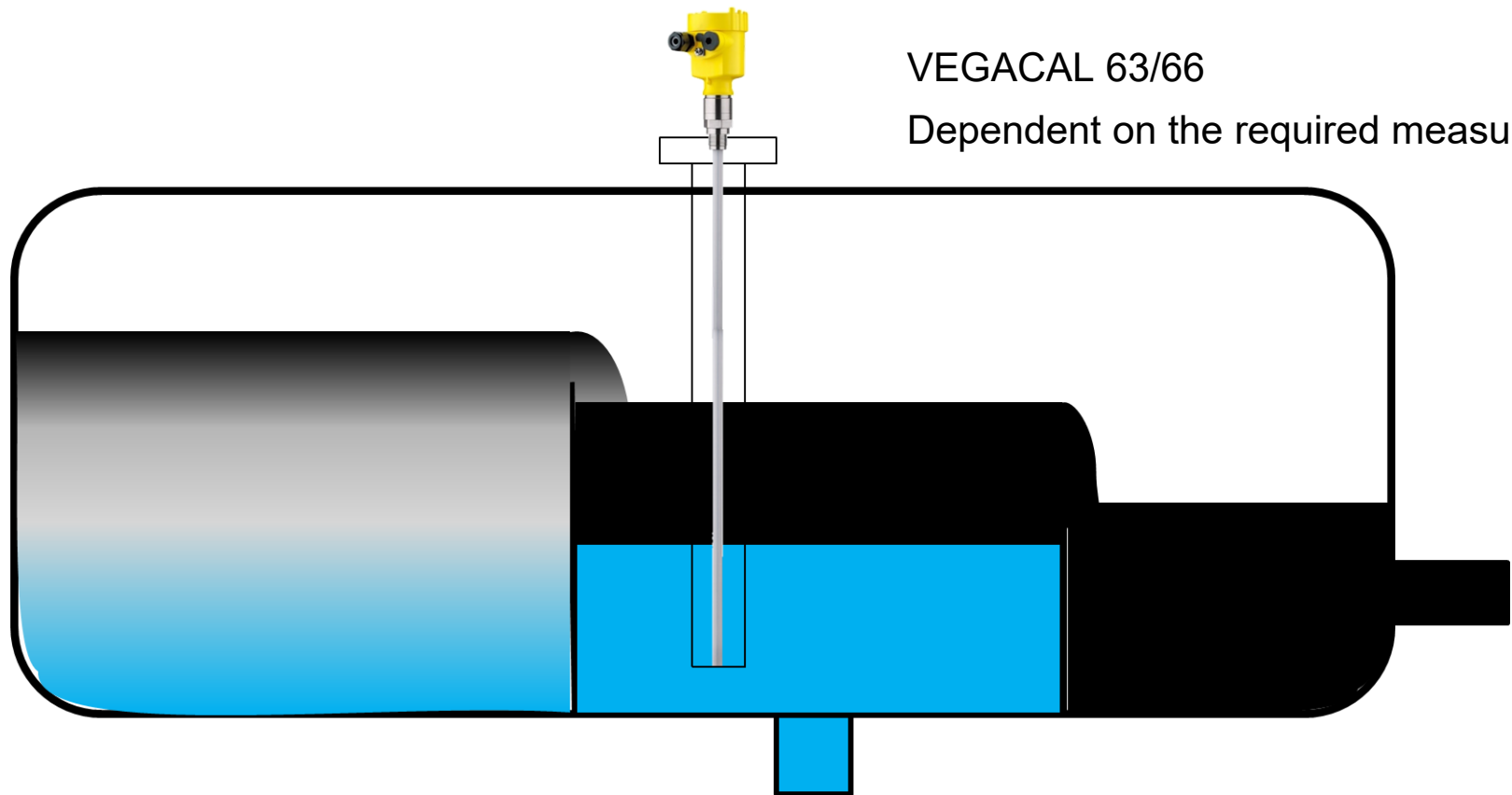
VEGACAL 63



VEGACAL 66



Free water



VEGACAL 63/66

Dependent on the required measuring length



Interface & emulsion

Capacitance vs GWR

Capacitance vs GWR

	Capacitance			GWR
Installation directly on vessel	Easy to install. No special requirement to fulfil.	✓	✓	Easy to install. No special requirement to fulfil.
Installation in bypass chamber	Easy to install. No special requirement to fulfil	✓		easy to install. However, it is important to know that upper part of the chamber shall be enough long to have gas phase. If gas phase is not there or disappear due to level moving above 100%, the signal of the total level will be disturbed for a certain time before to be aligned with interface signal. But signal of interface will stay stable during this time.
Output	Measurement for interface level. Total level is known due to the fact that it shall be fixed to ensure reliable measurement	✓	✓	Measurement of total level and interface level.
Commissioning	Required to fill in and emptying the vessel with water and then with oil for setting of 0% and 100% (or 25% and 75% to avoid to fill in the vessel up to 100%)		✓	settings for interface measurement can be done with medium in the vessel. Dielectric value of upper medium will be necessary
Reliability with clear interface	Perfect. The total level shall be fixed to ensure the reliability	✓	✓	Perfect

Capacitance vs GWR

	Capacitance		GWR
Reliability with emulsion	Sensor will be able to measure the emulsion but it will be not able to detect with accuracy where you will be in the emulsion but the signal will stay stable.	✓	sensor will be able to measuremen till a certain thickness of emulsion. Then the sensor will see the emulsion but depending of the type of emulsion, multiple echos will be generated. By consequence, the signal will jump from one to the other and you will not have stable signal output. Impossible to say with accuracy what is the max. thickness of the emulsion before to have this phenomena. It depends of combination of different factors like type of emulsion, proportion between oil/water, ...
Longevity	One time that on field calibration is done in the rules of art, there is no additional setting to do and the sensor will work for a long time. Even if oil composition change, no extra settings will be necessary due to the big difference of capacitance between oil and water	✓	If oil composition change, it can change the dielectric value. It will generate an offset of the measurement if settings are not updated

Capacitance vs GWR

	Capacitance			GWR
Maintenance	No maintenance required	✓		If build-up on rod/cable, it will generate a false echo. Depending on the size of the build-up, it can also generate an error of measurement. In this case, it will be necessary to dismount and clean the sensor.
Thickness of upper medium	From 4mm of thickness	✓		From 50mm of thickness
Cost	Cheaper up to insertion lengths of 2.000mm	✓	✓	Cheaper from insertion lengths of 2.000mm
Final evaluation	Capacitance	✓		GWR

Conclusion:

In our point of view, for a long-term reliable installation, we consider capacitance probe the best choice for interface measurement on separator applications.

Questions

