Датчики уровня Liquiphant FDL30/FDL31 и Liquiphant FDL35/FDL36

Технические характеристики

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Level Limit Switch
liquiphant FDL 30/31 and FDL 35/36

Safety sensor for all liquids.
The vibration limit switch Liquiphant II.
For Ex area (EEx ia) and with separate terminal chamber for extremely rugged conditions.

Liquiphant II
with aluminium
housing T3 having
separate terminal
chamber for extremely
rugged conditions
(FDL 35, FDL 36).

Liquiphant II
with aluminium,
plastic or
stainless steel
housing for standard
applications
(FDL 30, FDL 31):

Level sensors
- As compact version or with extension tube
- With various process connections

Safety Level Limit Switches
The safety Liquiphant FDL sensors are always used when increased safety is required, e.g. for limit detection in explosion hazardous areas. The sensors are connected to the switching units FTL 320 / 370 / 372.

Features and Benefits
- Operational safety: Monitoring signal cabling for short-circuits and breakage, function monitoring of the electronic insert, the piezocrystal unit and the sensor fork.
  The tines are continuously monitored for corrosion.
- Universal application: Operates safely with no maintenance in all types of liquid and is independent of turbulence, electrical properties, solids and gas contents, foam or build-up.
- Accurate switching: A constant switchpoint with millimetre accuracy without the need for calibration.
- Vibration resistant: Thanks to its improved and patented drive electronics, the Liquiphant is unequalled in its tolerance to external vibrations.
- Proven in practice: One million vibration limit switches installed.

Application
Liquiphant FDL sensors are used for level detection in all types of liquid. The intrinsically safe sensor circuit (EEx ia) means that they are approved for use in explosion hazardous areas. When used with the Nivotester FTL switching unit, the sensors can monitor the upper and lower level limits in tanks and vessels and are suitable for all liquids
- with temperatures between –40 °C and +150 °C (–40 °F and +300 °F)
- with viscosities up to 10,000 mm^2/s (cSt)
- with densities greater than 0.5 g/cm^3.

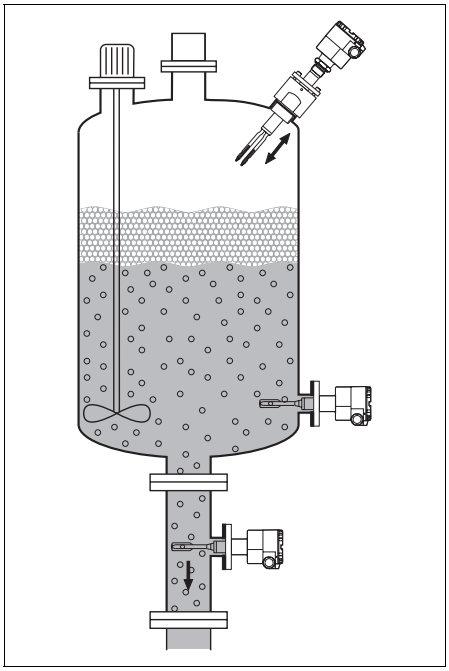
The plastic-coated or Hastelloy versions are available for particularly corrosive liquids.

Measurement Principle

Operating Principle of the Liquiphant
The sensor in the form of a tuning fork is made to vibrate at its resonant frequency by a piezocrystal drive unit. Its resonant frequency changes when the sensor is immersed in the liquid. This frequency change is detected and then converted into a switching signal by the Nivotester FTL switching unit. The switch-over mode for minimum or maximum detection enables the level limit switch to be used for each application in the required fail-safe mode.

Installation
A wide range of application-specific designs, process connections and high corrosion-resistant materials allows limit detection of all types of liquids in tanks and pipes.
A few examples are given here:

- ☐ Top mounting to monitor the maximum level.
  With an optional sliding sleeve to set the switchpoint during commissioning.
- ☐ Side mounting to monitor the minimum level.
- ☐ Mounting in a pipe as dry-run protection for the pump.



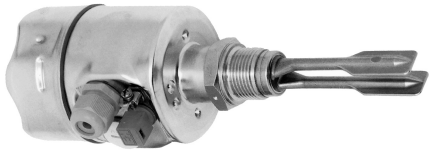
The limit switch with greater operational safety, even for liquids which are adhesive, causing build-up, corrosive, agitated, sparkling or foaming.

Complete Measuring System

Housing F6/F10

Housing T3

Housing F8



The complete level limit switch consists of the sensor and the switching unit.

Sensor versions

- Liquiphant FDL 30
  Sensor as a compact version
- Liquiphant FDL 31
  Sensor with extension tube

Polyester housing (F10)
Aluminium housing
with epoxy resin coating (F6)
or stainless steel housing (F8).
Protection: IP 66

- Liquiphant FDL 35
  Sensor as a compact version
- Liquiphant FDL 36
  Sensor with extension tube

Aluminium housing with
separate terminal chamber (T3)

– Electronics chamber and terminal chamber are completely separated from one another to ensure operation under extremely rugged conditions.
– Interference-immune to electromagnetic fields up to 30 V/m.

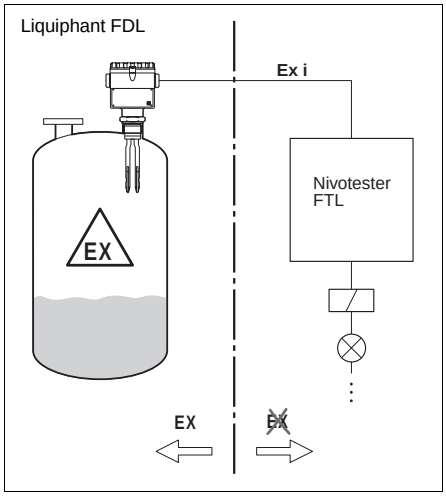
An overspill protection to VbF or WHG (Germany) consists of:
Sensor Liquiphant FDL 30 / 31 / 35 / 36
and
Switching unit Nivotester
FTL 320 / 370 / 372

Switching units with intrinsically safe EEx ia sensor circuits
in Racksyst format:
- Nivotester FTL 370, single channel unit
- Nivotester FTL 372, two-channel unit

In Minipac format:
- Nivotester FTL 320

Liquiphant sensors FDL 30/31 or FDL 35/36

Nivotester switching units FTL 320/370/372



Versions

Process Connections
Application-specific process connections and designs ensure an ideal adaptability to the mounting requirements

- ☐ Threaded boss G 1 A or 1" NPT
- ☐ Flanges according to various standards: DIN, ANSI, JIS. Nominal diameters from DN 32 or $1^1/_4$"

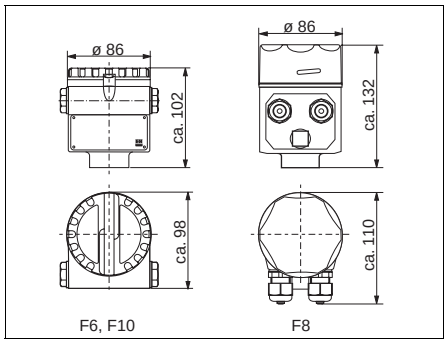
For particularly hygienic requirements, e.g. food processing:

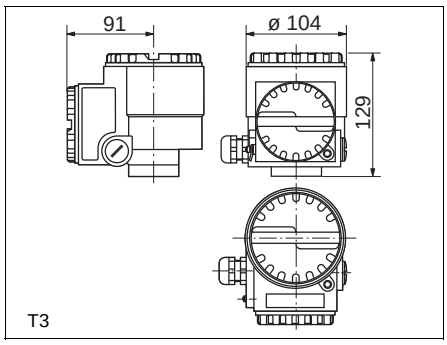
- ☐ Milk pipe coupling
- ☐ Triclamp® coupling
- ☐ Weld-in socket for flush mounting

Polished fork and extension tube.

Process connection materials
Stainless steel 316 Ti (1.4571) or Hastelloy C (2.4610), the flange version is also available with an ECTFE– (Halar®) coating, extension tube up to 6 m (with PFA up to 1 m).

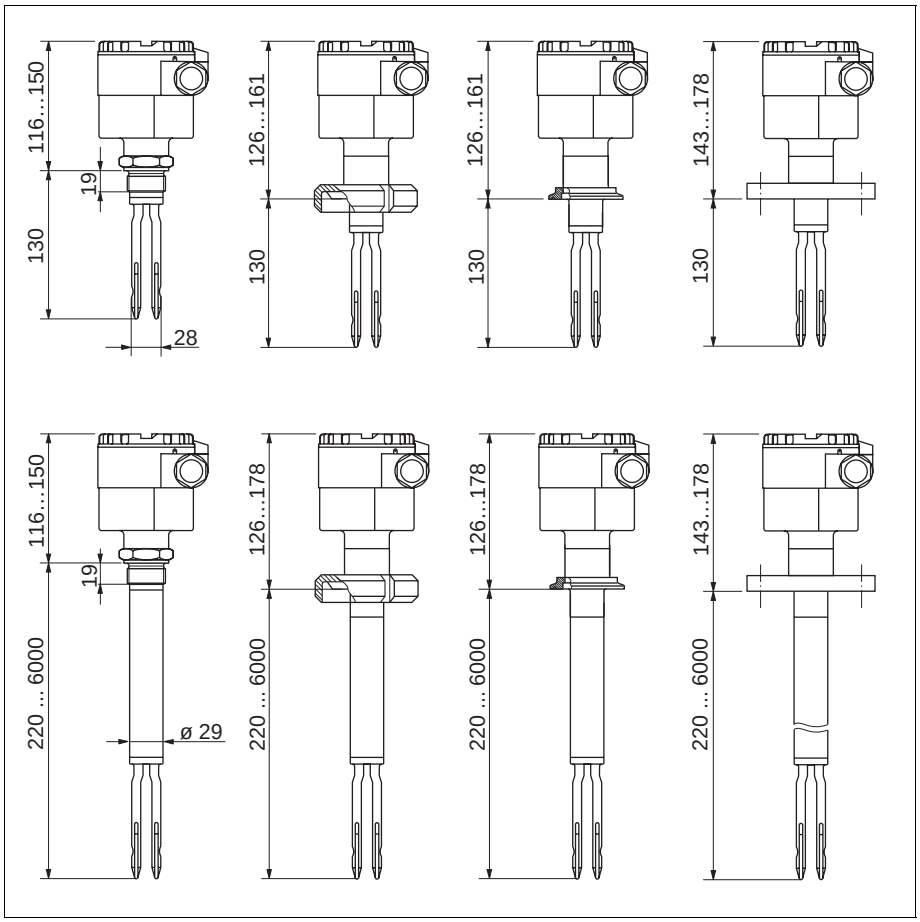
Note: The threaded boss and Triclamp process connections (and weld-in socket) are also approved for explosion hazardous areas (except for Zone 0 in Germany).





Above:
Housing dimensions for FDL 30, 31

Below:
Dimensions of housing with separate connection compartment for FDL 35, 36.



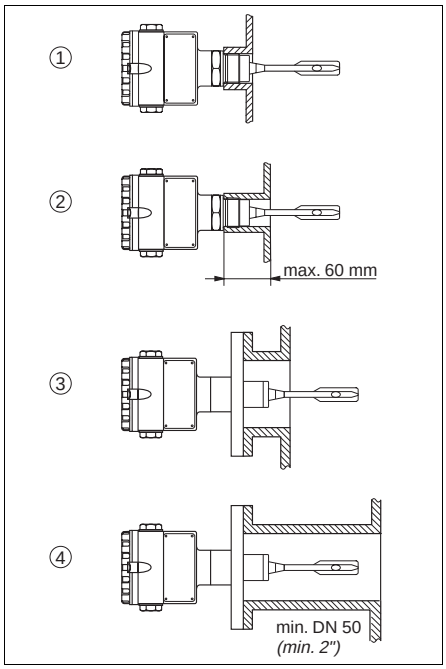
Installation

When mounting the Liquiphant note that:
- Vibration of the tines must not be blocked, e.g. due to adhering material.
- If build-up occurs, then ensure a sufficient distance to the tank or pipe wall.

Nozzle Mounting

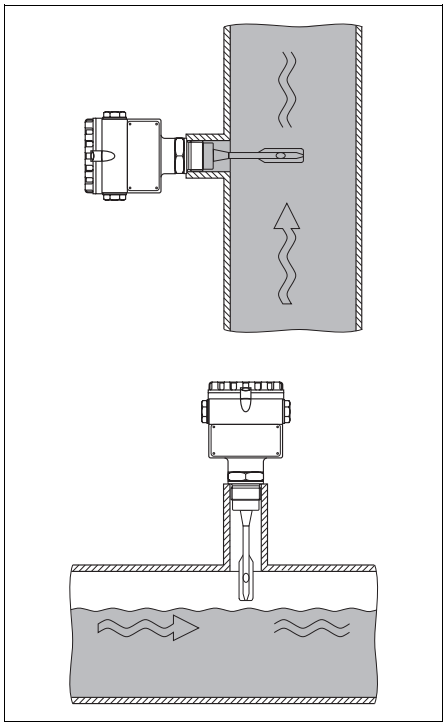
When mounting the sensor in a nozzle, the viscosity of the liquid should be taken into account:

1. Generally:
   The process connection should be flush with the tank wall.
2. With low viscosity liquids:
   mount the sensor so that the liquid can flow out of the nozzle and uncover the tines.
3. With high viscosity liquids
   nozzle max. 60 mm long (with a 1"-nozzle).
   Recommended: A nozzle with a larger diameter should be used.
4. Tuning fork in pipe:
   min. DN 50 with low viscosity liquids.



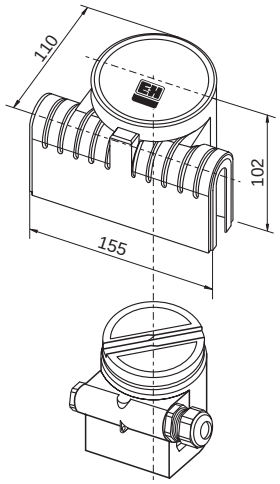
Pipe Mounting

- When used for dry-run protection of pumps, the Liquiphant should be mounted in a vertical pipe.
- When determining the length of the nozzle, take the pipe diameter into account.
- When mounted in a horizontal pipe, partial pipe filling can be detected if the correct nozzle length is chosen.



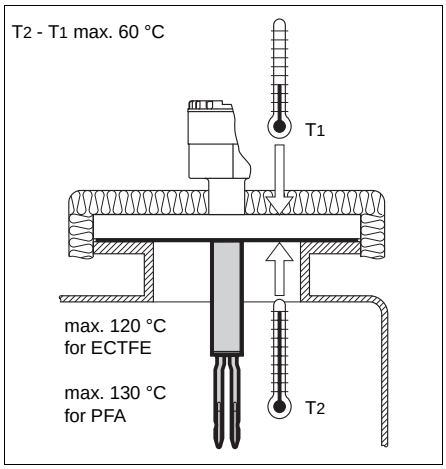
Liquiphant with plastic coating

- Maximum operating temperature for ECTFE 120 °C (250°F) and for PFA 130 °C (270 °F).
- The temperature difference T2 - T1 between the inner and outer surfaces of the flange must not exceed 60 °C (140 °F). If necessary, insulate the outer surface of the flange.

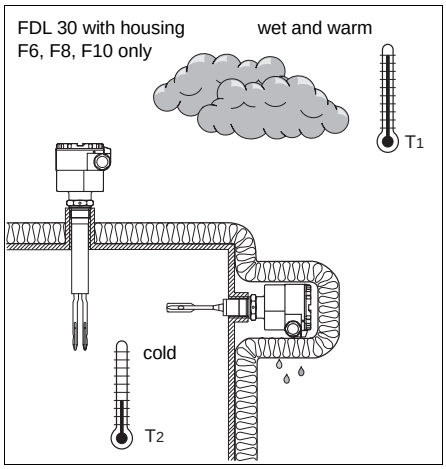


All-Weather Hood for housing F6, F10;
Made of polyamide. The all-weather hood protects the sensor from excessive temperature and from condensation forming in the housing which can occur with wide temperature variations.

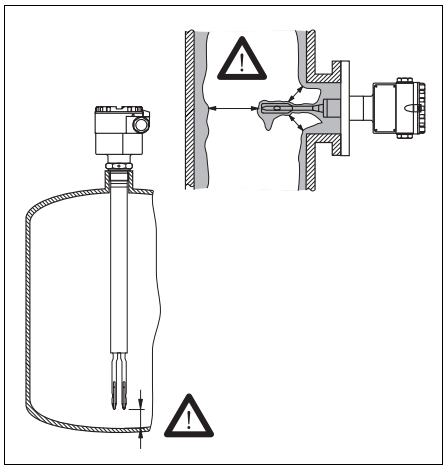
Liquiphant with plastic coating (ECTFE or PFA).



For humid environments or cold media, to avoid condensate forming within the housing:
install a FDL 31, min. length 220 mm, or insulate the housing.



The fork tines may not touch the tank or pipe wall or any build-up



Connection

CE Mark

The device fulfils the legal requirements of the following EC Guidelines:
Guideline 89/336/EC (Electromagnetic compatibility), Guidelines 73/23/EC and 93/68/EC (Low Voltage Appliances).

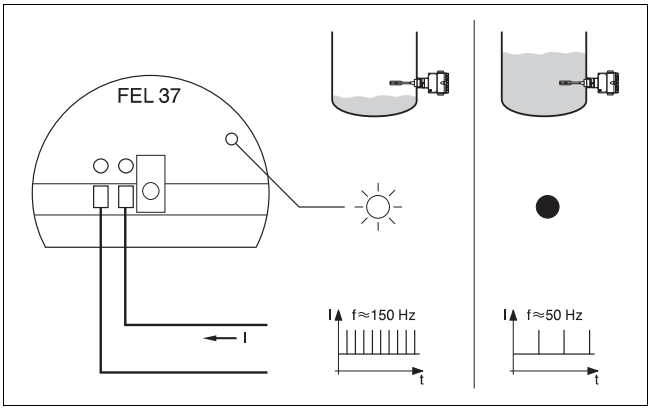
Electromagnetic compatibility (EMC): Immunity to EN 50082-2 and industrial standard NAMUR, at field strength 10 V/m (FDL 30, 31), at field strength 30 V/m (FDL 35, 36). Emission to EN 50081-1.

For general information on electromagnetic compatibility (test methods, installation hints) see TI 241F/00/en.

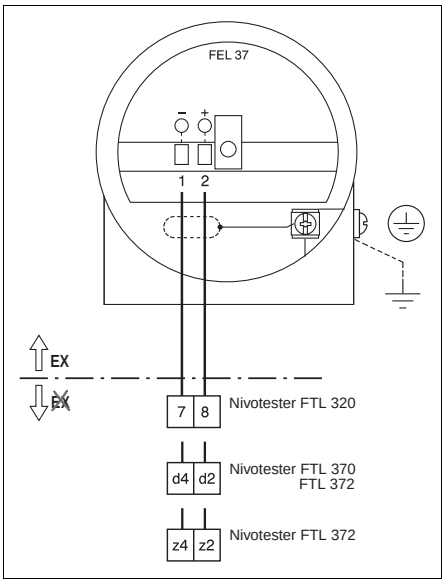
The Nivotester FTL switching unit and the FEL 37 electronic insert in the Liquiphant FDL sensor are electrically connected via commercially available two-core installation cable or via two cores of a multicore cable.
Pulse Frequency Modulation (PFM) confers high interference immunity on signal transmission.

All appropriate regulations must be observed when laying intrinsically safe cabling in explosion hazardous areas!

Transmission frequency with covered and exposed tines.



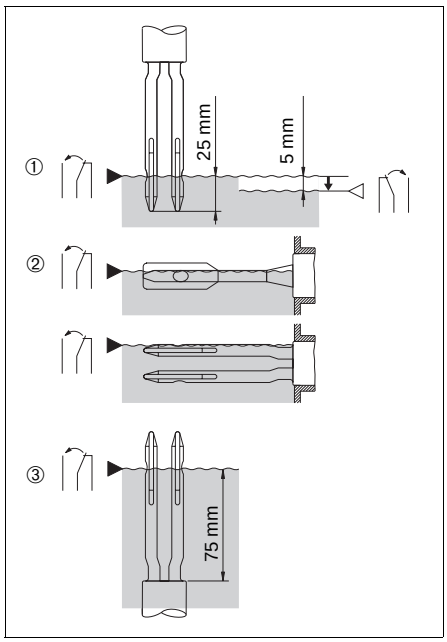
Electrical connection of the Nivotester FTL switching unit to the FDL sensor.



Electrical Data
Connection terminals: for max. 2.5 mm^2
Cable entry:
see product structure
Cable resistance: max. 25 Ω per core
Power supply: approx. 11.4 V
Operating current: approx. 4 ... 10 mA
Signal transmission:
Pulse Frequency Modulation (PFM)
Pulsed current: approx. 10 mA, superimposed on the operating current
Explosion protection: EEx ia II C T3…T6

Setting the Switchpoint
If the switchpoint is to be set with millimetre accuracy, then please refer to the diagram opposite:
1. Top mounting
2. Side mounting with the tines next to each other or above one another
3. Mounting from below

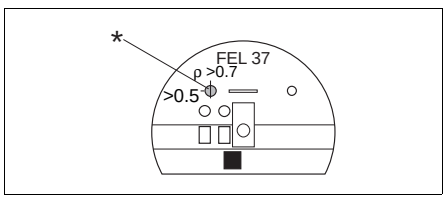
Switchpoint data are related to water (density 1 g/cm^3). For use in extremely light liquids (liquefied gas - LPG), the switch on the Liquiphant should be set to "Density 0.5".



*Switch for liquid density:

ρ > 0.5 e.g. for liquefied gas

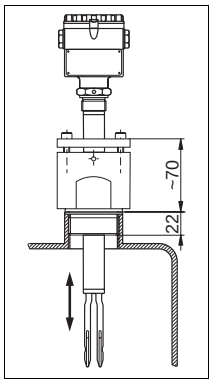
ρ > 0.7 standard setting



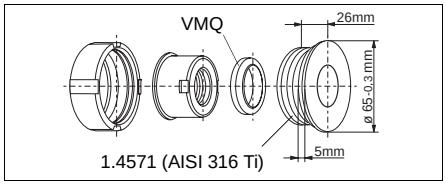
Accessories

Sliding Sleeve
High pressure sleeve for Liquiphant with extension tube FDL 31 / 36.
Internal pressure in vessels up to 40 bar.
For infinitely variable setting of the switchpoints during commissioning.
Up to 6000 mm extension tube (without coating).

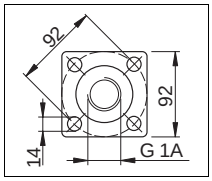
Length tolerances
max. 1 m tube length: + 0 mm / – 5 mm
max. 3 m tube length: + 0 mm / – 10 mm
max. 6 m tube length: + 0 mm / – 20 mm



High pressure sleeve
for FDL 31, FDL 36.
with G1 1/2A or
1 1/2 - 11 1/2 NPT
threaded boss
and bright pipe.



Weld-in socket
for FDL 30/35 with
G 1A thread for flush
mounting.
Order No. 215159-0000



Loose flanges
for FDL 30/31 or
FDL 35/36

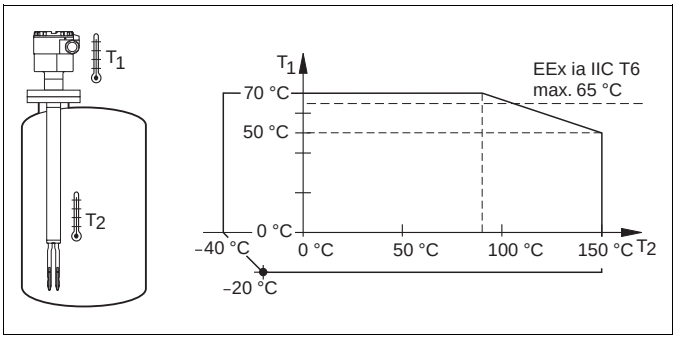
Technical Data

Operating Data
Operating data in tank:
max. 40 bar (600 psi), see fig. below
Test pressure: max. 60 bar (900 psi)
Operating temperature in tank:
–40 °C…+150 °C (–30 °F ... +300 °F)
Ambient housing temperature:
–20 °C…+70 °C (–4 °F ... +158 °F)
Liquid viscosity: max. 10000 mm^2/s
Minimum density of liquid: 0.5 g/cm^3
Switching hysteresis: approx. 5 mm
Switching delay:
when covered approx. 0.4 s,
when exposed approx. 1 s
Fail-safe mode : min./max. selectable
Switching display:
LED on the electronic insert

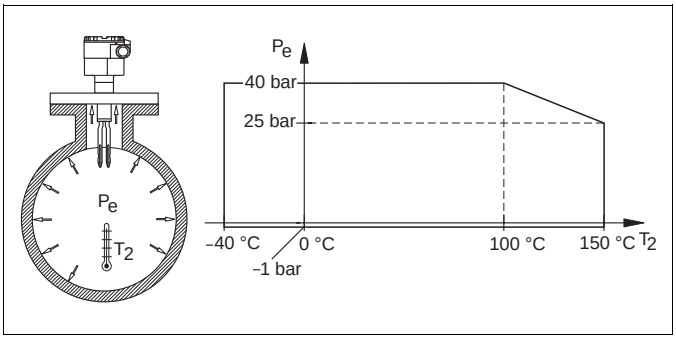
Sensor Materials
- Stainless steel 1.4581 (~AISI 316 Ti), polished as required
- Stainless steel 1.4581 (~AISI 316 Ti), with ECTFE or PFA coating, together with coated flanges
- Hastelloy C (2.4610)

Certificates
- Certificate of conformity (CENELEC) KEMA No. Ex - 92.C.8494
- German national test certificate: (Zone 0, overspill protection to VbF) PTB No. III B/S 2243 F
- General type approval (DIBt) Z-65.11-16

The maximum permissible temperature T_1 at the housing depends on the operating temperature T_2 in the tank.
x °C = (1.8x + 32) °F



The maximum permissible pressure p_e in the vessel depends on the temperature T_2 in the vessel.
1 bar = 14.5 psi



Product Structure

Other
process connections,
materials,
electronic inserts,
housings
on request

FDL 30, FDL 35

Certificate
- R Version for non-hazardous areas
- G EEx ia IIC T6 (CENELEC)
- F PTB, EEx ia IIC T6 (Zone 0) Overspill protection to VbF, WHG
- 0 FM, IS, Class I,II,II, Div. 1, Groups A,B,C,D,E,F,G
- S CSA, IS, Class I,II,III, Div.1, Groups A,B,C,D,E,F,G
- Y Other certificate

Process connection, material
- GR2 Threaded boss G1 A, AISI 316 Ti (1.4571)
- GN2 Threaded boss 1" NPT, AISI 316 Ti
- ME2 Pipe coupling DIN 11851 DN 50, AISI 316 Ti } not with certificate F;
- TE2 Triclamp (ISO 2852) 2", AISI 316 Ti } fork surface finish B = polished
- …… For flanges see separate table on next page
- YY9 Other process conection

Fork surface finish
- A Standard (material same as process connection)
- B Polished (with process connection in AISI 316 Ti only)
- Y Special finish

Electronics
- 7 FEL 37, two-wire PFM transmission

Housing, cable entry

FDL 30 / FDL 31
- K Polyester housing F10, IP 66, Pg 16 (IP 66)
- O Polyester housing F10, IP 66, M 20x1.5
- R Aluminium housing F6, IP 66, Pg 16 (IP 66)
- T Aluminium housing F6, IP 66, $^1/_2$ NPT
- U Aluminium housing F6, IP 66, G $^1/_2$
- V Aluminium housing F6, IP 66, M 20x1.5
- 1 Stainless steel housing F8, IP 66, Pg 13,5 (IP 66)
- 2 Stainless steel housing F8, IP 66, G $^1/_2$
- 3 Stainless steel housing F8, IP 66, M 20x1.5
- 4 Stainless steel housing F8, IP 66, $^1/_2$ NPT

FDL 35 / FDL 36
- E Aluminium housing, IP 66, Pg 16 (IP 66)
- G Aluminium housing, IP 66, $^3/_4$ NPT
- H Aluminium housing, IP 66, G $^1/_2$
- J Aluminium housing, IP 66, M 20x1.5

- Y Special housing

FDL – [ ][ ][ ][ ][ ][ ] Product designation

- Liquiphant FDL 30
  Compact version
- Liquiphant FDL 35
  Compact version

FDL 31, FDL 36

Certificate
- R Version for non-hazardous areas
- G EEx ia IIC T6 (CENELEC)
- F PTB, EEx ia IIC T6 (Zone 0) Overspill protection to VbF, WHG
- 0 FM, IS, Class I,II,II, Div. 1, Groups A,B,C,D,E,F,G
- S CSA, IS, Class I,II,III, Div.1, Groups A,B,C,D,E,F,G
- Y Other certificat

Process connection, material
- GR2 Threaded boss G1A, AISI 316 Ti (1.4571)
- GN2 Threaded boss 1" NPT, AISI 316 Ti
- SR2 Sliding sleeve G1$^1/_2$A, AISI 316 Ti
- ME2 Pipe coupling DIN 11851 DN 50, AISI 316 Ti } not with certificate F;
- TE2 Triclamp (ISO 2852) 2", AISI 316 Ti } fork surface finish B = polished
- …… For flanges see separate table on next page
- YY9 Other process connection

Fork surface finish
- A Standard (material same as process connection)
- B Polished
  process connection GR2, GN2, ME2, TE2
  and with extension tube »G« or »4«

Sensor length, extension tube material

Plastic coating with flanges only
Min. length 220 mm, max. length 6000 mm
mm / in
- A / 1 AISI 316 Ti (1.4571)
- B / 2 AISI 316 Ti/ECTFE coated (with flange only)
- C / 3 Hastelloy C
- G / 4 AISI 316 Ti, polished
- Y Special length, special material (e.g. PFA)

Electronics
- 7 FEL 37, two-wire PFM transmission

Housing, cable entry
as FDL 30 / FDL 35 – see above

FDL – [ ][ ][ ][ ][ ][ ] Product designation

state length in mm or inch

- Liquiphant FDL 31
  With extension tube
- Liquiphant FDL 36
  With extension tube

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