

Level Limit Switch *liquiphant FTL 365 / FTL 366*

**Level limit switch Liquiphant II
with vibrating probe. For all types of liquid.
With explosionproof housing for use
in hazardous areas.**



Level limit switch
Liquiphant II.
Limit switch with
T3 housing
with separate
terminal chamber:

- Liquiphant FTL 365
Compact version
- Liquiphant FTL 366
Extended version

Application

The Liquiphant is a level limit switch for all liquids.

It can monitor the upper and lower level limits in tanks and vessels and is suitable for all liquids

- with temperatures lying between -40°C and $+150^{\circ}\text{C}$ (-40°F and $+300^{\circ}\text{F}$)
- with a viscosity up to $10.000\text{ mm}^2/\text{s}$ (cSt)
- and a density greater than 0.5 g/cm^3 .

For particularly corrosive liquids the ECTFE-coated version or the Hastelloy-version are suitable.

Because of its flameproof housing (Ex d / EExde) the Liquiphant can be used in hazardous location.

The Liquiphant is used wherever float switches were previously installed.

It is also used in those applications where float switches are not suitable. (due to build-up, turbulence, flow, air bubbles).

Features and Benefits

- Maintenance free: Operates completely reliably even with heavy build-up.
- Cost-effective: An economical standard Liquiphant can be used in all applications. It operates safely in all types of liquids and under all process conditions, independent of turbulence, electrical properties, solids or gas content, foam, or tank vibrations.
- Accurate switching: A constant switchpoint with millimetre accuracy without need for calibration.
- Operational safety: Thanks to its improved and patented system with intelligent drive electronics, the Liquiphant is unequalled in its tolerance to external vibrations. The tines are monitored electronically for corrosion.
- Proven in practice: The reliability you need is the experience we offer with more than 1 000 000 measuring points already installed.

Endress+Hauser

Nothing beats know-how



Measurement Principle

Operating Principle of the Liquiphant

The sensor in the form of tuning fork is made to vibrate at its resonant frequency.

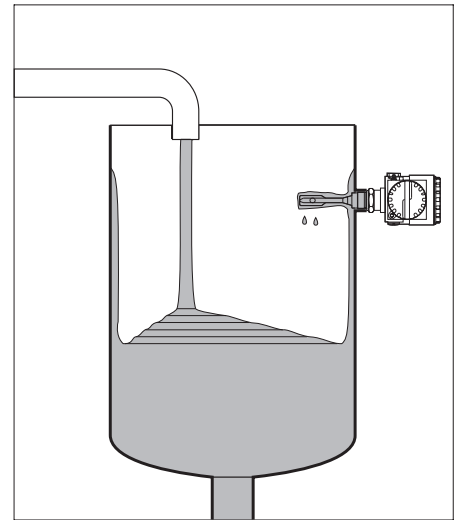
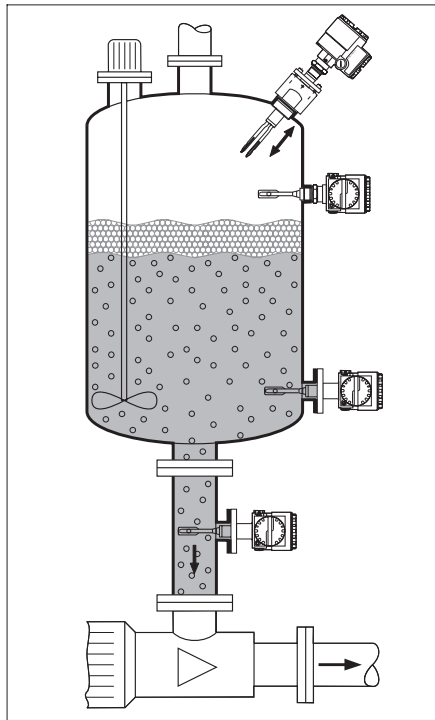
When the sensor is immersed in the liquid, the resonant frequency changes. The frequency change is detected and then converted into a switching signal. The built-in switch for minimum or maximum detection enables the Liquiphant to be used for each application in the required fail-safe mode.

Installation Possibilities

A wide range of application-specific designs, process connections and high corrosion-resistant materials allows limit detection of all kinds of liquids in tanks and pipes.

A few examples:

- ❑ Top mounting to monitor the maximum level. Optionally with a sliding sleeve to vary the switchpoint.
- ❑ Side mounting to monitor the minimum level.
- ❑ Mounted 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, sparking or foaming

Measuring System

The complete measuring system consists of:

- Liquiphant as compact version or with extension tube
- Process connection: Threaded boss, flange or hygienic coupling
- Electronic insert for alternating or direct current, with electronic switching or a relay contact
- Housing

A clear description of Liquiphant and its options can be found on page 7 in the product structure.

T3 Housing

Aluminium housing with epoxy coating

- Electronics chamber and terminal chamber are completely separated from one another to ensure operation under extremely rugged conditions.

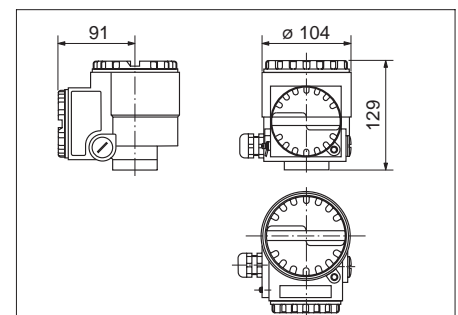
Protection: IP 66

Housing can be rotated 300°



Electronics chamber

Terminal chamber



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

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

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

Fork and extension tube are polished.

Process connection materials: Stainless steel 316 Ti (1.4571) or Hastelloy C (2.4610), the flange version additionally available with ECTFE– (Halar®–) coating.

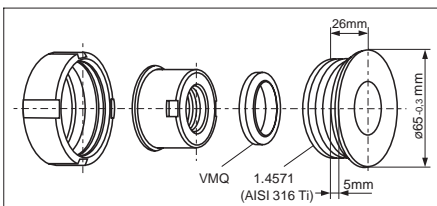
Accessories

- ❑ High pressure sliding sleeve for variable switch point setting (when commissioning)
- ❑ Separate flanges
- ❑ Weld-in socket

Dimensions in mm
100 mm = 3.94 in

FTL 365
Compact version

FTL 366
Extension tube version

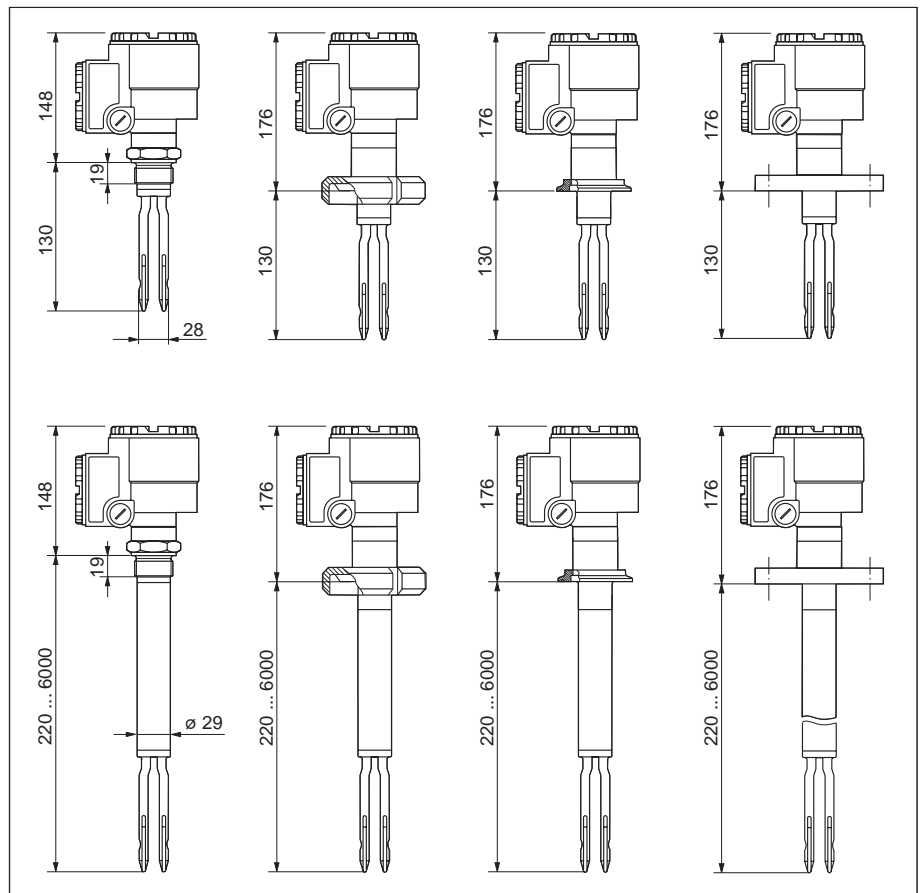


Threaded boss
G1A or
1 - 11½ NPT

Pipe coupling
DIN 11851, DN 50

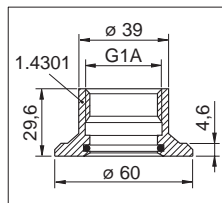
Triclamp coupling
ISO 2852, 2"

Flange version
DIN, ANSI, JIS

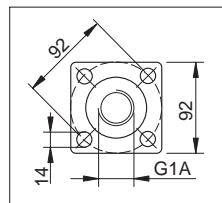


Above:
Weld-in socket*
with fork orientation
for FTL 365 with
G1A thread for flush
mounting
Order No. 215159-0000

Below:
Weld-in socket*
without fork orientation
for FTL 365 with
G1A thread for flush
mounting
(with FPM-O-Ring)
Order No. 917969-1000

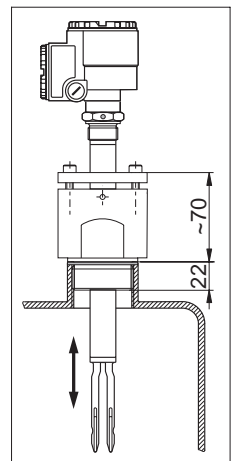


Separate flange*
for FTL 365 / 366 with
G1A threaded boss



* These accessories
have no FM or CSA
approval
** No CSA approval

Sliding sleeve**
High pressure sliding
sleeve for Liquiphant
FTL 366 for variable
switchpoint setting.
Operating pressure
up to 40 bar.
(FM: up to 300 psi)
Thread G1½A
or 1½ - 11½ NPT



Installation

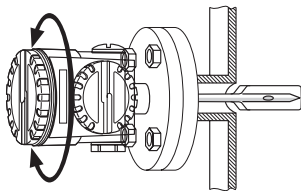
Please note when mounting the Liquiphant:

- The vibration of the tines must not be blocked, e.g. due to adhering material.
- If build-up occurs then sufficient distance to the tank or pipe wall must be maintained.

Nozzle Mounting

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

- ① Generally:
The process connection preferably 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 length max. 60 mm (with a 1"-nozzle).
Better: Use a nozzle with a larger diameter.
- ④ Nozzle diameter min. DN 50 (min. 2")



The housing can be turned through 300°

Pipe Mounting

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

Liquiphant with Halar Coating

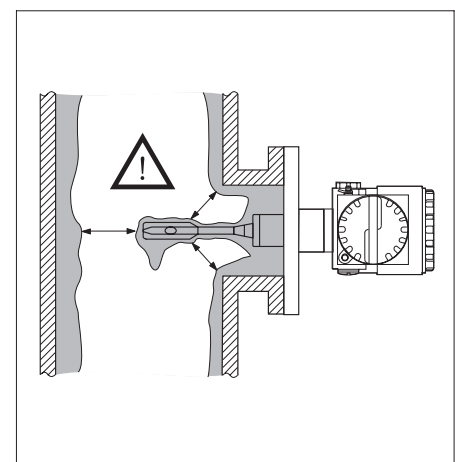
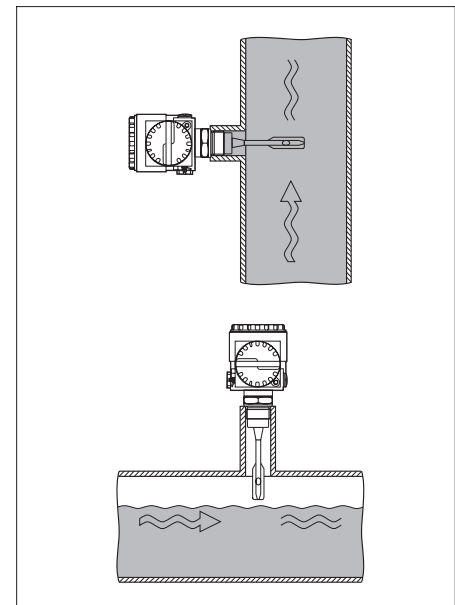
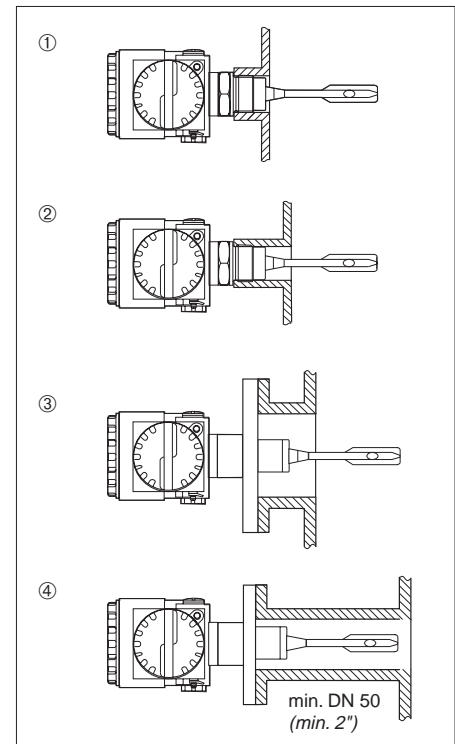
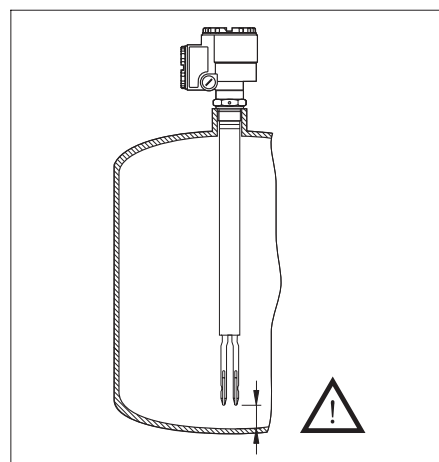
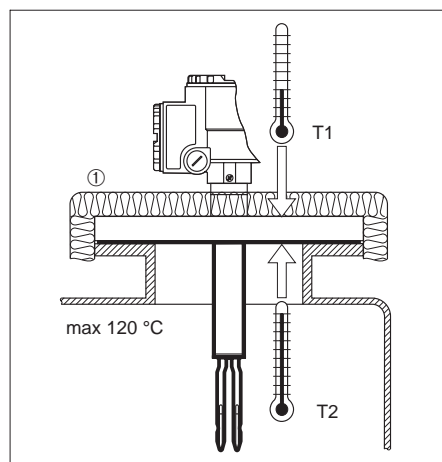
With ECTFE (Halar®) coated versions please note:

- Maximum operating temperature 120 °C (250 °F)
- The temperature difference T1 - T2 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.

Liquiphant with Halar coating

The tines must not touch the tank or pipe wall nor the sediment

① Insulation



Electrical Connection

CE Mark

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

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

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

Electronic Inserts

Electronic switch with:

- Two-wire AC connection
- Three-wire DC connection PNP
- Three-wire DC connection NPN
- Universal connection with potential free relay contact

The electronic inserts are exchangeable without requiring a recalibration!

FEL 31

Two-wire AC connection
21 V ... 253 V, 50 / 60 Hz

- Load for short periods
max. 1.5 A / 40 ms
max. 375 VA / 250 V
max. 36 VA / 24 V
Continuous load max. 350 mA
max. 87 VA / 250 V
max. 8.4 VA / 24 V
- Minimum load
min. 2.5 VA / 250 V (10 mA)
min. 0.5 VA / 24 V (20 mA)
- Residual current when open 4 mA
- Voltage drop across the electronic switch when closed, 10 V
- Do not use the FEL 31 without an external load!

FEL 32

Three-wire DC connection PNP

- Continuous load max. 350 mA for short periods 1 A, max. 1 s
- Operating voltage 10 V ... 55 V
- Overload and reverse polarity protected
- Residual current when open <100 µA
- Current consumption max. 15 mA

FEL 33

Three-wire DC connection NPN

- Continuous load max. 350 mA for short periods 1 A, max. 1 s
- Operating voltage 10 V ... 55 V
- Overload and reverse polarity protected
- Residual current when open <100 µA
- Current consumption max. 15 mA

FEL 34

Universal connection for
AC 21 V ... 253 V, 50 / 60 Hz
or DC 20 V ... 200 V.

Current consumption max. 7 mA.
Potential free relay contact.

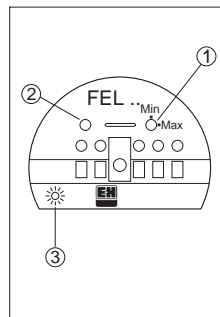
Load capacity:

- Ex d applications
 $U \leq \text{max. } 250 \text{ V}$, $I \leq \text{max. } 6 \text{ A}$
 $P \sim \text{max. } 1500 \text{ VA}$, $\cos \phi = 1$
- EEx de applications
 $U \leq \text{max. } 250 \text{ V}$, $I \leq \text{max. } 4 \text{ A}$
 $P \sim \text{max. } 1000 \text{ VA}$, $\cos \phi = 1$

$P \sim \text{max. } 750 \text{ VA}$, $\cos \phi \geq 0,7$

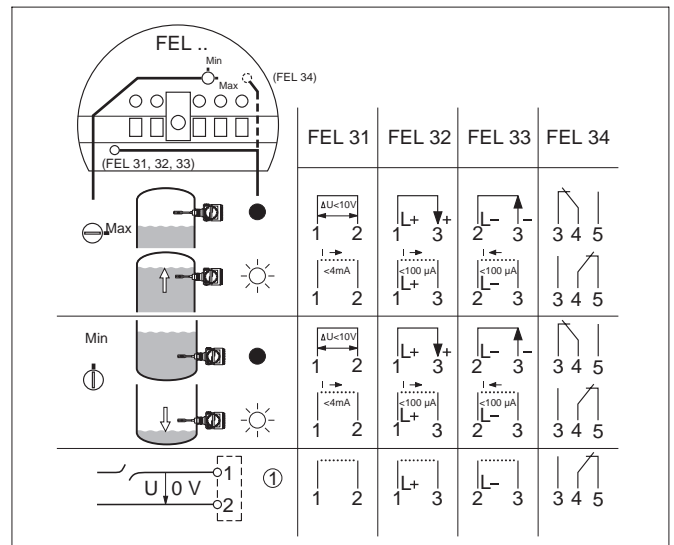
$P - \text{max. } 200 \text{ W}$

- ① Maximum-/Minimum-fail-safe can be switched on the electronic insert
- ② Switch for liquid density: $\rho > 0,5$: e.g. for liquefied gas; $\rho > 0,7$: standard setting
- ③ The LED indicates the switching status

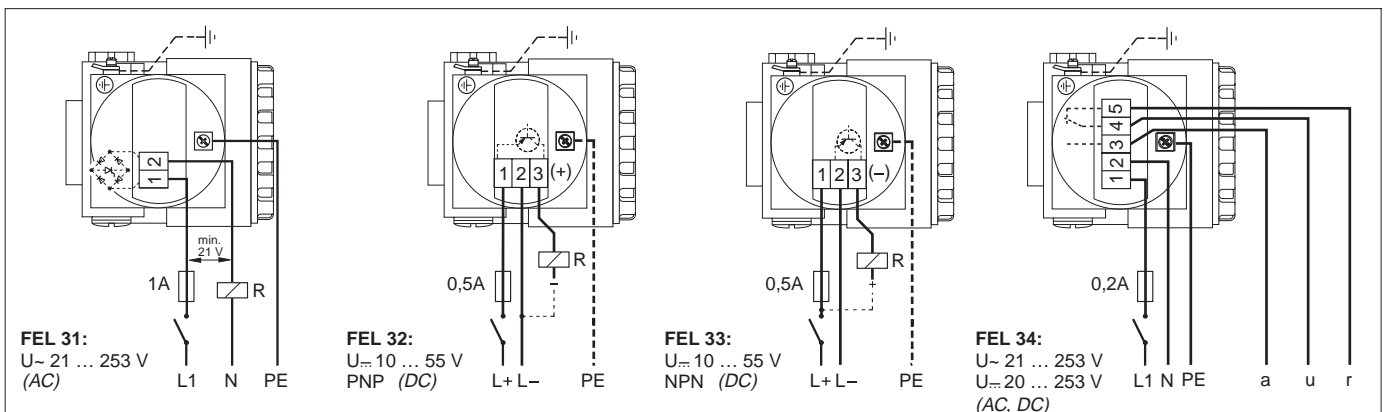


Function and switching of the electronic inserts

- ① by cable breakage or fork corrosion



Electrical connection

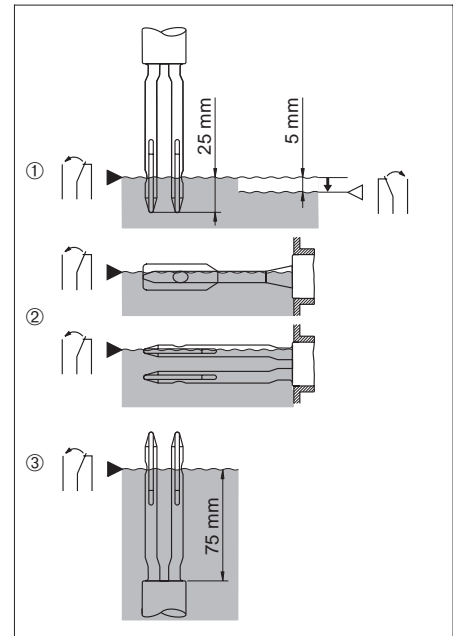


Setting the Switchpoint

If a switchpoint with millimetre accuracy is required please note the diagram opposite.

- ① Top mounting
- ② Side mounting with the tines next to each other or above one another
- ③ Bottom mounting

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



Technical Data

Operating Data

Operating pressure in tank: max. 40 bar (600 psi), see the illustration below for permissible temperature
 Test pressure: max. 60 bar (900 psi)
 Operating temperature in tank:
 $-40^\circ\text{C} \dots +150^\circ\text{C}$ ($-40^\circ\text{F} \dots +300^\circ\text{F}$)
 Ambient housing temperature:
 $-20^\circ\text{C} \dots +70^\circ\text{C}$ ($0^\circ\text{F} \dots +160^\circ\text{F}$)
 Liquid viscosity: max. $10000 \text{ mm}^2/\text{s}$ (cSt)
 Minimum density of the 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

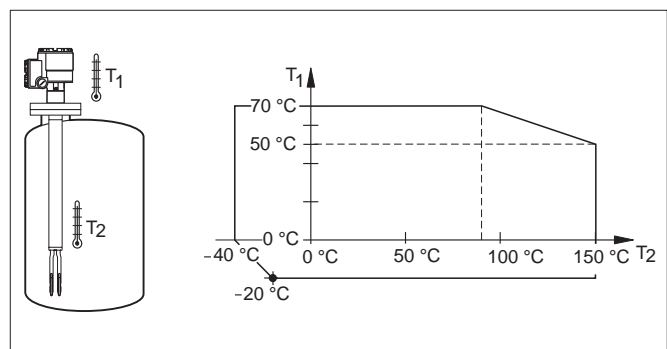
- Stainless steel 1.4581 (~AISI 316 Ti), optionally polished
- Stainless steel 1.4581 (~AISI 316 Ti) with ECTFE coating, together with ECTFE coated flanges
- Hastelloy C (2.4610)

Certificates

See product structure

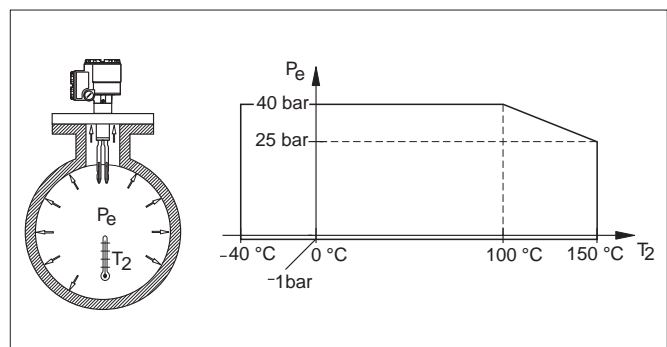
The maximum permissible temperature T_1 at the housing depends on the operating temperature T_2 in the tank

$$x^\circ\text{C} = (1.8x + 32)^\circ\text{F}$$



The maximum permissible pressure p_e in the vessels depends on the temperature T_2 in the vessel.

$$1 \text{ bar} = 14.5 \text{ psi}$$



Product Structure

Summary of vibration
limit switches with
T 3 housing with
separate terminal
chamber:

- Liquiphant FTL 365
as compact version
- Liquiphant FTL 366
with extension tube

FTL 365					
Certificate					
R	No particular approval				
I	CENELEC, EEx de IIC T6				
Q	FM, Class I,II,III, Div. 1, Group A, B, C, D, E, F, G				
U	CSA, Class I,II,III, Div. 1, Groups A, B, C, D, E, F, G				
Process connection / Material					
GR2	Threaded boss G1 A, AISI 316 Ti				
GR5	Threaded boss G1 A, Hastelloy C				
GN2	Threaded boss 1" NPT, AISI 316 Ti				
GN5	Threaded boss 1" NPT, Hastelloy C				
ME2	Pipe coupling DIN 11851 DN 50, SS 316 Ti				Fork surface finish "B", polished
TE2	Triclamp (ISO 2852) 2", AISI 316 Ti				Fork surface finish "B", polished
.....	For flanges see separate table				
YY9	Special process connection				
Fork surface finish					
A	Standard fork (Material same as process connection)				
B	Polished fork (only with process connection in SS 316 Ti)				
Electronic					
1	FEL 31, AC-2-wire, 21...253 V				
2	FEL 32, DC-PNP, 10...55 V				
3	FEL 33, DC-NPN, 10...55 V				
4	FEL 34, AC/DC with relay contact				
	21V...253 V AC, 20V...200 V DC				
9	Special electronic				
Housing, cable entry					
E	Aluminium, coated, IP 66, PG 16 (IP 66)				
G	Aluminium, coated, IP 66, NPT 3/4 "				
H	Aluminium, coated, IP 66, G 1/2				
J	Aluminium, coated, IP 66, M 20x1.5				
Y	Special housing				
FTL 365-					

FTL 366						
Certificate						
R	No particular approval					
I	CENELEC, EEx de IIC T6					
Q	FM, Class I,II,III, Div. 1, Group B, C, D, E, F, G					
U	CSA, Class I,II,III, Div. 1, Groups A, B, C, D, E, F, G					
Process connection / Material						
GR2	Threaded boss G1A, AISI 316 Ti					
GR5	Threaded boss G1A, Hastelloy C					
GN2	Threaded boss 1" NPT, AISI 316 Ti					
GN5	Threaded boss 1" NPT, Hastelloy C					
ME2	Pipe coupling DIN 11851 DN 50, AISI 316 Ti				Fork surface finish "B", polished	
TE2	Triclamp (ISO 2852) 2", AISI 316 Ti				Fork surface finish "B", polished	
.....	For flanges see separate table					
YY9	Special process connection					
Fork surface finish						
A	Standard fork (Material same as process connection)					
B	Polished fork					
	(only with process connection in AISI 316 Ti and with extensions tube »G«)					
Sensor length, extension tube material						
	Min. length 220 m, max. length 6000 mm					
	ECTFE- coating only with flanges					
A	mm Length, AISI 316 Ti					
B	mm Length, AISI 316 Ti/ECTFE-coated					
C	mm Length, Hastelloy C					
G	mm Length, AISI 316 Ti polished					
Y	Special length / Material					
Electronic						
1	FEL 31, AC-2-Wire, 21...253 V					
2	FEL 32, DC-PNP, 10...55 V					
3	FEL 33, DC-NPN, 10...55 V					
4	FEL 34, AC/DC with relay contact					
	21 V...253 V AC, 20 V...200 V DC					
9	Special electronic					
Housing, cable entry						
E	Aluminium, coated, IP 66, PG 16 (IP 66)					
G	Aluminium, coated, IP 66, NPT 3/4 "					
H	Aluminium, coated, IP 66, G 1/2					
J	Aluminium, coated, IP 66, M 20x1.5					
Y	Special housing					
FTL 366--						
Probe length 220...6000mm						

Product Structure for Flanges

Flanges for Liquiphant
FTL 365 and FTL 366

DIN-Flanges to DIN 2527 Form B (Hastelloy-clad in Form C)		ANSI-Flanges to B 16.5 (RF)	
BE2	DN 50, PN 6, AISI 316 Ti	AE2	2", 150 psi, AISI 316 Ti
BE7	DN 50, PN 6, AISI 316 Ti/ECTFE	AE7	2", 150 psi, AISI 316 Ti/ECTFE
CE5	DN 50, PN 6, Hastelloy-clad	AE5	2", 150 psi, Hastelloy-clad
BG2	DN 50, PN 40, AISI 316 Ti	AG2	2", 300 psi, AISI 316 Ti
BG7	DN 50, PN 40, AISI 316 Ti/ECTFE	AG7	2", 300 psi, AISI 316 Ti/ECTFE
CG5	DN 50, PN 40, Hastelloy-clad	AG5	2", 300 psi, Hastelloy-clad
CG2	DN 50, PN 40, AISI 316 Ti with raised face		
NG2	DN 50, PN 40, AISI 316 Ti with groove	AK2	2 1/2", 300 psi, AISI 316 Ti
FG2	DN 50, PN 40, AISI 316 Ti with tongue		
		AL2	3", 150 psi, AISI 316 Ti
BK2	DN 65, PN 40, AISI 316 Ti	AL7	3", 150 psi, AISI 316 Ti/ECTFE
BM2	DN 80, PN 16, AISI 316 Ti	AN2	3", 300 psi, AISI 316 Ti
BN2	DN 80, PN 40, AISI 316 Ti	AP2	4", 150 psi, AISI 316 Ti
BN7	DN 80, PN 40, AISI 316 Ti/ECTFE	AR2	4", 300 psi, AISI 316 Ti
CN5	DN 80, PN 40, Hastelloy-clad		
CN2	DN 80, PN 40, AISI 316 Ti with raised face	AV2	6", 150 psi, AISI 316 Ti
		A12	6", 300 psi, AISI 316 Ti
BQ2	DN 100, PN 16, AISI 316 Ti	JIS-Flanges to JIS B 2210	
BQ7	DN 100, PN 16, AISI 316 Ti/ECTFE	KE2	10 K, 50, AISI 316 Ti
CQ5	DN 100, PN 16, Hastelloy-clad	KE7	10 K, 50, AISI 316 Ti/ECTFE
CQ2	DN 100, PN 16, AISI 316 Ti with raised face	KE5	10 K, 50, Hastelloy-clad
BR2	DN 100, PN 40, AISI 316 Ti	YY9	other Flanges, other material on request

Supplementary Documentation

Technical information (TI)
for the other level limit switches
of the Liquiphant II family:

- ❑ Liquiphant II Limit Switches
Special Documentation
SD 047F/00/en
- ❑ Certificate of Conformity
KEMA No. Ex-93.C.7751
Certificate ZE 092F/00/d,e,f
- ❑ Liquiphant FTL 360 / FTL 361
Level limit switch Liquiphant II with
vibrating probe. For all types of liquid.
Technical Information TI 184F/00/en
- ❑ Liquiphant FDL 30 / 31, FDL 35 / 36
Intrinsically safe vibration sensor for
use in hazardous locations.
To connect to the switches Nivotester
FTL 320, FTL 370 / 372
Technical Information TI 185F/00/en

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