

Manufacturer's Data Book Index

25472-101-POA-JL10-W0001

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	25472-101-V1A-JL10-W0003 01
Supplier Document Status	
Code4	
Code 1 = Work may proceed, submit certified print. Code 2 = Revise and resubmit. Work may proceed subject to resolution of indicated comments Code 3 = Revise and resubmit. Work may not proceed. Code 4 = Review not required. Work may proceed.	
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Responsible Engineer - Haroldson_John	
Date Signed - 08/25/2014	
VPTL - VPTL-33326	
Equipment No. - 121-HRDBP-BOLT0301	

Section 1.0

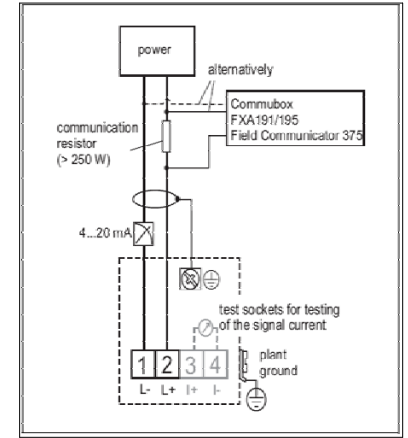
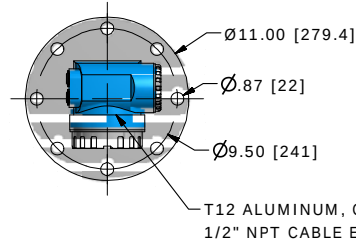
Design Documents and Data

Tags:

121-HRDBP-B0-LT-0301
122-LKSDE-B0-LT-0301
123-MTRSP-B0-LT-0301
124-OYENS-B0-LT-0301
125-BDLSS-B0-LT-0301
126-FXVLY-B0-LT-0301
127-PIAPT-B0-LT-0301
128-GRSSY-B0-LT-0301
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122-LKSDE-B0-LSHH-0302
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124-OYENS-B0-LSHH-0302
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125-BDLSS-B0-LT-0303
126-FXVLY-B0-LT-0303
127-PIAPT-B0-LT-0303
128-GRSSY-B0-LT-0303

TAG LIST

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124-OYENS-B0-LT-0301
125-BDLSS-B0-LT-0301
126-FXVLY-B0-LT-0301
127-PIAPT-B0-LT-0301
128-GRSSY-B0-LT-0301



2-WIRE, 4-20mA SIL HART

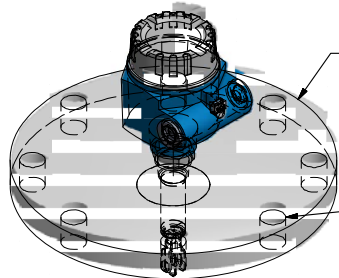
YY9 PROCESS CONNECTION: MVT6N0287
6" 150 lbs FF, 316/316L ANSI B16.5 FLANGE

Probe: TSP6N0812
Coax probe punched, SS316L,
center divisible via thread, for probe
length up to 7000 mm (276 in).
- Outside diameter max. 52 mm
- Sideways capacity max. 30 Nm
no tangential load , thread protection
supplied by customer, thread paste or
teflon tape

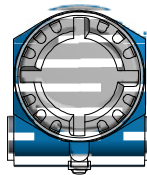
Unless otherwise specified "All dimensions are in IN [mm]"

		Endress+Hauser			
THIRD ANGLE PROJECTION		U.S. OPERATIONS GREENWOOD, INDIANA			
TITLE					
LEVELFLEX M FMP40 GUIDED RADAR LEVEL					
T12 ALUMINUM IP68 HOUSING					
6" CI. 150LBS. FF, 316/316L ANSI B16.5 FLANGE					
MODEL#				APPROVAL	
FMP40-VYY2YY9B21JB				FINAL	
SIZE		DWG NO			REV
B		L-1704_FMP40_10			0
SCALE				1 of 3	
0.125:1		12/22/2010			

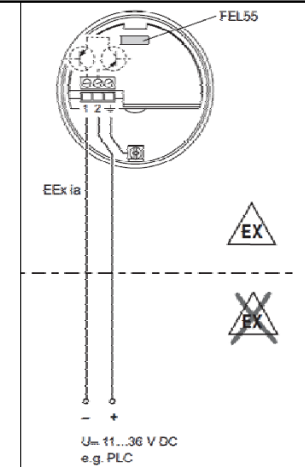




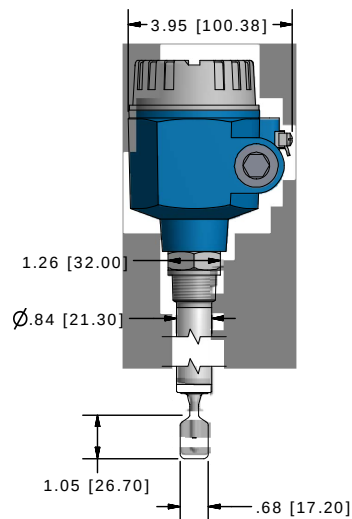
FTL51 LEVEL METER ASSEMBLY +
6" 150lbs FF, 3/4" FNPT, A105, WITH ZINC
COATING AND MATERIAL TRACABILITY REPORT
(71066521)



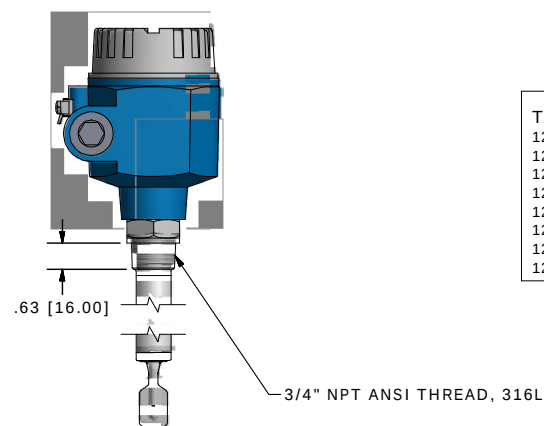
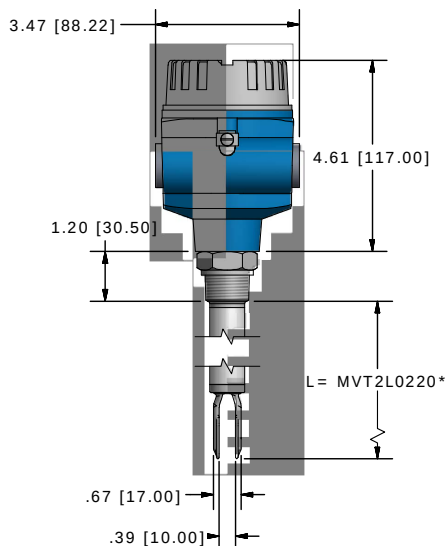
F13/17 ALU. NEMA 4X HOUSING,
3/4" NPT CABLE ENTRY



WIRING DIAGRAM



*MVT2L0220 :
Probe length 137.5" SS316L



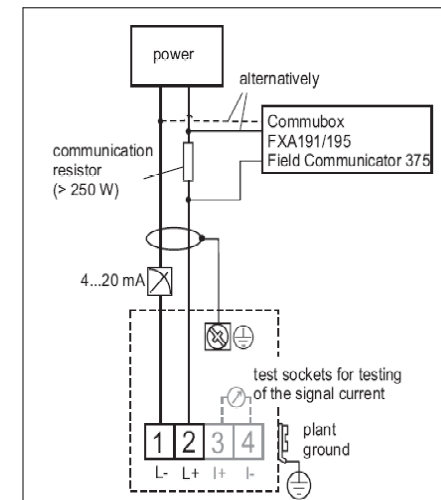
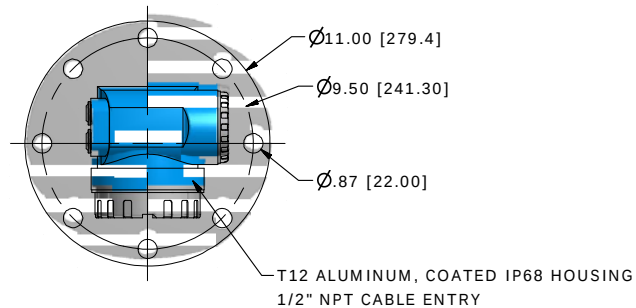
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124-OYENS-B0-LSHH-0302	
125-BDLSS-B0-LSHH-0302	
126-FXVLY-B0-LSHH-0302	
127-PIAPT-B0-LSHH-0302	
128-GRSSY-B0-LSHH-0302	

Unless otherwise specified "All dimensions are in IN [mm]"

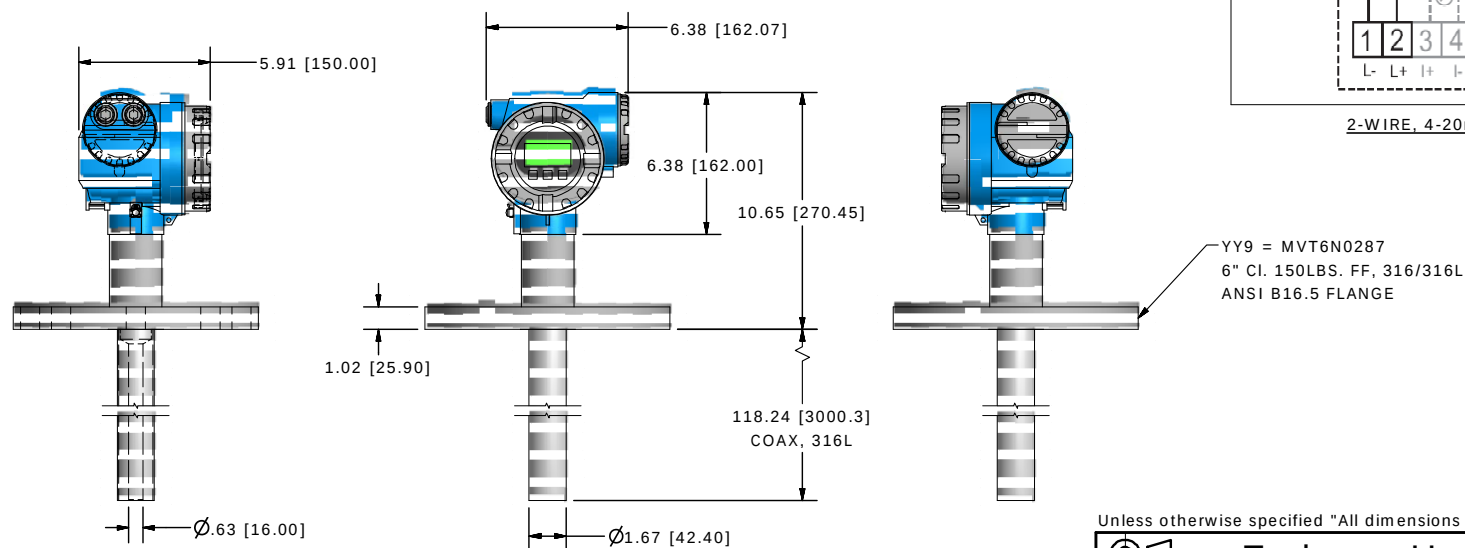
 THIRD ANGLE PROJECTION		Endress+Hauser U.S. OPERATIONS GREENWOOD, INDIANA			
TITLE LIQUIPHANT S FTL51 VIBRATION LEVEL LIMIT SWITCH 3/4" NPT ANSI THREAD, 316L F13/17 NEMA 4X ALU. HOUSING					
MODEL# FTL51-TGM2YY5E5A				APPROVAL ☐ FINAL ☐	
SIZE B		DWG NO L-1578_FTL51_20			REV 0
SCALE 0.35:1		12/22/2010		2 of 3	

TAG LIST

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 124-OYENS-B0-LT-0303
 125-BDLSS-B0-LT-0303
 126-FXVLY-B0-LT-0303
 127-PIAPT-B0-LT-0303
 128-GRSSY-B0-LT-0303



2-WIRE, 4-20mA WIRE



COAX PROBE

Unless otherwise specified "All dimensions are in IN [mm]"

		Endress+Hauser			
THIRD ANGLE PROJECTION		U.S. OPERATIONS GREENWOOD, INDIANA			
TITLE		LEVELFLEX M FMP40 GUIDED RADAR LEVEL T12 ALUMINUM, COATED IP68 HOUSING 6" CI. 150LBS. FF, 316/316L ANSI B16.5 FLANGE			
MODEL#		FMP40-VLN2YY9B21JB		APPROVAL	☐
				FINAL	☐
SIZE		DWG NO			REV
B		L-1705_FMP40_30			0
SCALE				3 of 3	
0.1875:1		12/22/2010			





Technical Information

Levelflex M FMP40

Run Time Measurement

Guided Level Radar; Smart Transmitter for

- Level Measurement in Bulk Solids and Liquids
- Interface Measurement in Liquids



Cable probe



Rod probe



Coax probe

- The HART® with 4 to 20 mA analog, PROFIBUS® PA and FOUNDATION™ Fieldbus protocols are available for system integration.
- Application in safety related systems (overspill protection) with requirements for functional safety up to SIL 2 in accordance with IEC 61508/IEC 61511-1.
- WHG approval

Interface measurement

Continuous measurement of interfaces between two liquids with very different dielectric constants, such as in the case of oil and water for example.

- Measurement independent of density, conductivity and temperature
- Electronics version for the simultaneous measurement of the level of interfaces and the total level in liquids. The HART with 4 to 20 mA analog protocol is available for system integration
- Special version for the measurement of the level of interfaces at a constant total level. The PROFIBUS PA and FOUNDATION Fieldbus protocols are available for system integration.

Your benefits

Probes are available with threaded process connections from 3/4" and flanges from DN40 / 1 1/2".

- Cable probes, for measurement in bulk solids, measuring range up to 115 ft (35 m).
- Rod probes, for liquids and solids
- Coax probes, for liquids
- Simple, menu-guided local operation with four-line plain text display.
- Local envelope curve on the display for easy diagnosis.
- Easy remote operation, diagnosis and measuring point documentation with the free operating program supplied.
- Optional remote display and operation.
- With coax probes the measurement is independent of structures in the tank or installation in a nozzle.
- Probe rod and probe cable can be replaced/shortened.
- Approvals: ATEX, FM, CSA, TIIS, NEPSI, IECEx.



Application

Level measurement

Continuous level measurement of powdery to granular bulk solids e.g. plastic granulate and liquids.

- Measurement independent of density or bulk weight, conductivity, dielectric constant, temperature and dust e.g. during pneumatic filling.
- Measurement is also possible in the event of foam or if the surface is very turbulent.

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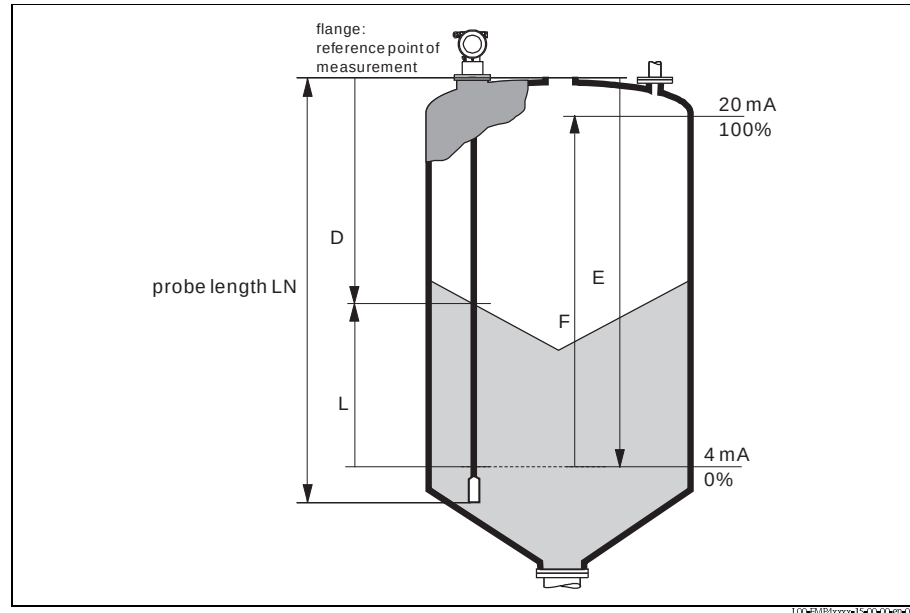
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Function and system design

Measuring principle

The Levelflex is a "downward-looking" measuring system that functions according to the ToF method (ToF = Time of Flight). The distance from the reference point to the product surface is measured. High-frequency pulses are injected to a probe and led along the probe. The pulses are reflected by the product surface, received by the electronic evaluation unit and converted into level information. This method is also known as TDR (Time Domain Reflectometry).



Reference point of the measurement

Dielectric constant

The dielectric constant (DK) of the medium has a direct impact on the degree of reflection of the high-frequency pulses. In the case of large DK values, such as for water or ammonia, there is strong pulse reflection while, with low DK values, such as for hydrocarbons, weak pulse reflection is experienced.

Input

The reflected pulses are transmitted from the probe to the electronics. There, a microprocessor analyzes the signals and identifies the level echo which was generated by the reflection of the high-frequency pulses at the product surface. This clear signal detection system benefits from over 30 years' experience with pulse time-of-flight procedures that have been integrated into the development of the PulseMaster® software.

The distance D to the product surface is proportional to the time of flight t of the impulse:

$$D = c \cdot t / 2,$$

where c is the speed of light.

Based on the known empty distance E, the level L is calculated:

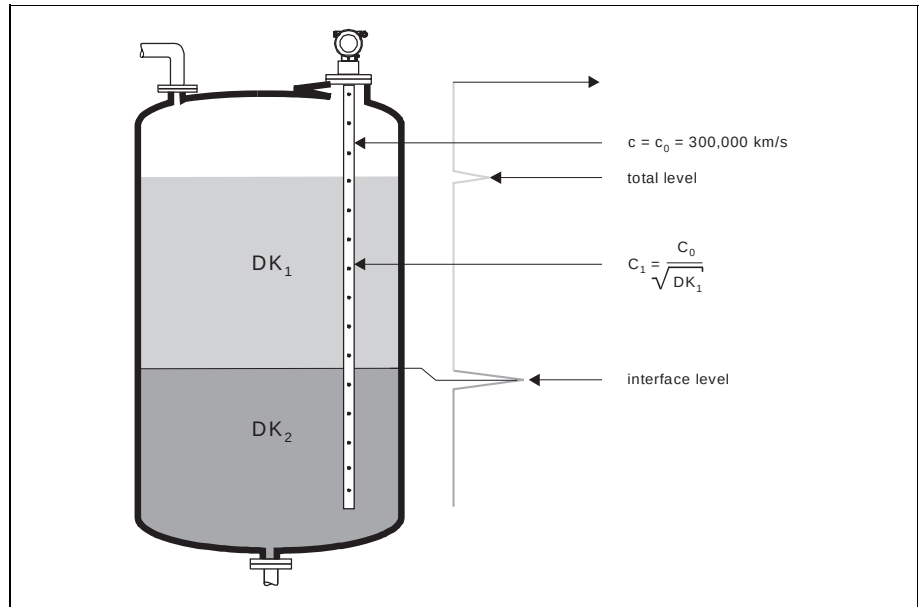
$$L = E - D$$

Reference point for "E" see diagram above.

The Levelflex possesses functions for interference echo suppression that can be activated by the user. They guarantee that interference echoes from e.g. internals and struts are not interpreted as level echoes.

Interface measurement

When the high-frequency pulses hit the surface of the medium, only a percentage of the transmission pulse is reflected. In the case of media with a low DK_1 , in particular, the other part penetrates the medium. The pulse is reflected once more at the interface point to a second medium with a higher DK_2 . The distance to the interface layer now can also be determined taking into account the delayed time-of-flight of the pulse through the upper medium.



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Output

The Levelflex is preset at the factory to the probe length ordered so that in most cases only the application parameters that automatically adapt the device to the measuring conditions need to be entered. For models with a current output, the factory adjustment for zero point E and span F is 4 mA and 20 mA, for digital outputs and the display module 0 % and 100 %. A linearization function with max. 32 points, which is based on a table entered manually or semi-automatically, can be activated on site or via remote operation. This function allows the level to be converted into units of volume or mass, for example.

Measuring system
Probe selection

The various types of probe in combination with the process connections are suitable for the following applications:

Probes with 1½" threaded connection or flange

Type of probe:	6 mm/0.24" cable probe	6 mm/0.24" cable probe PA-coated	4 mm/0.16" cable probe	16 mm/0.63" rod probe	16 mm/0.63" rod probe, separable probe	Coax probe
						
Max. probe length:	115 ft (35 m) ¹⁾	115 ft (35 m) ¹⁾	Liquids: 115 ft (35 m) Bulk solids: 49 ft (15 m)	13 ft (4 m)	33 ft (10 m)	13 ft (4 m)
For application:	■ Bulk solids	■ Bulk solids especially cereal, flour	■ Liquids measuring range > 13 ft (4 m)	■ Liquids ■ bulk solids on short measuring ranges and sideways mounting ■ Interface measurement	■ Liquids ■ cramped mounting position (limited head clearance) ■ Interface measurement	■ Liquids ■ Interface measurement
Sideways capacity:	not relevant	not relevant	not relevant	22 lbf ft (30 Nm)	15 lbf ft (20 Nm)	221 lbf ft (300 Nm)
Tensile loading capacity (min.): rupture load (max.): ²⁾	6744 lbf (30 kN) 7868 lbf (35 kN)	6744 lbf (30 kN) 7868 lbf (35 kN)	2698 lbf (12 kN) 3597 lbf (16 kN)	not relevant	not relevant	not relevant
Feature 30	Option "B"	Option "H"	Option "A"	Option "K"	Option "S, T, U, V"	Option "L"

1) Greater lengths available on request.

2) Max. load of silo ceiling. If overloaded, the cable tears; the bushing remains air-tight.

Probes with 3/4" threaded connection

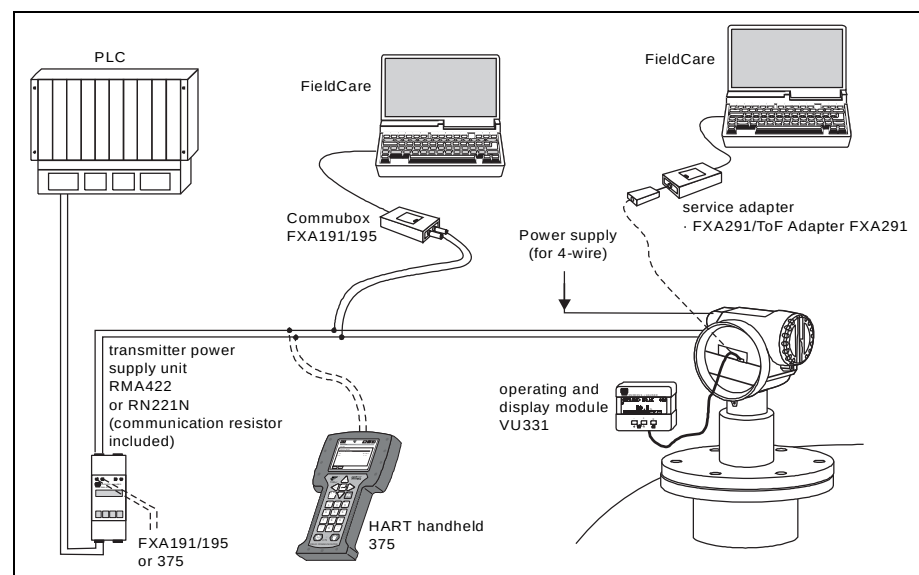
Version:	FMP40- #A#####	FMP40- #P#####	FMP40- #L#####
Type of probe:	4 mm/0.16" cable probe	6 mm/0.24" rod probe	Coax probe
			
Tensile loading capacity (min.): rupture load (max.): ¹⁾	1124 lbf (5 kN) 1798 lbf (12 kN)	not relevant	not relevant
Sideways capacity:	not relevant	3 lbf ft (4 Nm)	44 lbf ft (60 Nm)
For application:	■ Liquids measuring range > 4 m	■ Liquids ■ Interface measurement	■ Liquids
Max. probe length:	115 ft (35 m) ²⁾	6.6 ft (2 m)	13 ft (4 m)

1) Max. load of silo ceiling. If overloaded, the cable tears; the bushing remains air-tight.

2) Longer lengths available on request.

Stand-alone

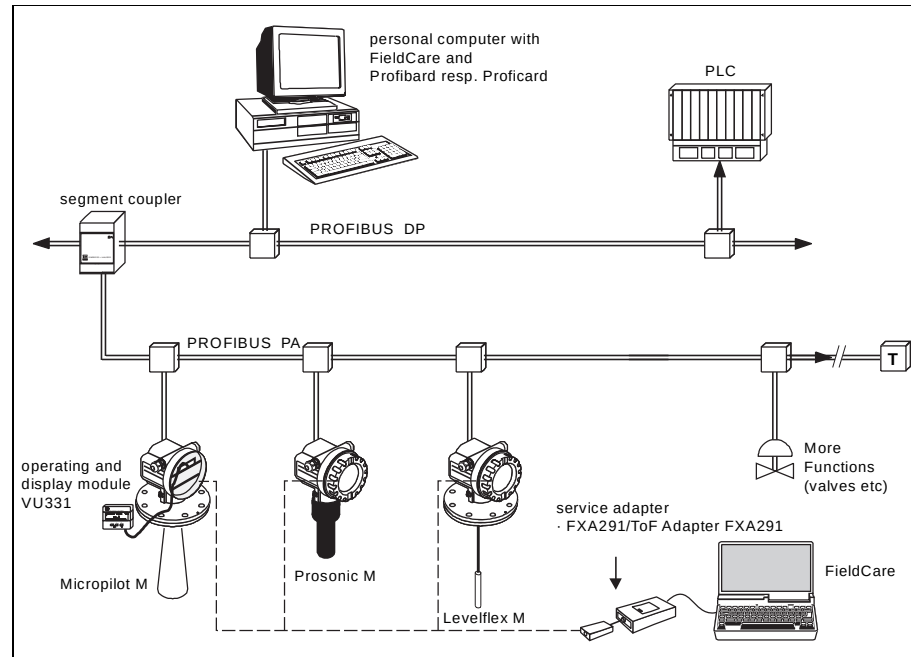
- Power supply directly from power line (4-wire) or from transmitter power supply unit (2-wire).
- Local operation with integrated display or remote operation with HART protocol.



If the HART communication resistor is not installed in the supply device and HART protocol communication is to be carried out, it is necessary to insert a communication resistor $\geq 250 \Omega$ into the 2-wire line.

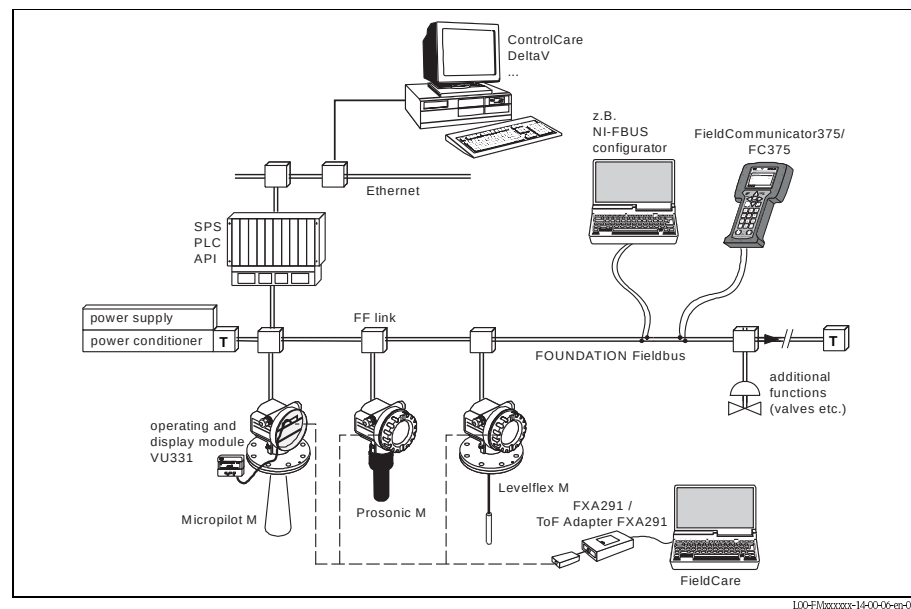
System integration via PROFIBUS PA

Maximum 32 transmitters (depending on the segment coupler, 10 in the Intrinsically safe / Ex ia IIC hazardous area according to the FISCO Model) can be connected to the bus. The Bus voltage is supplied by the segment coupler. Both local or remote operation are possible.



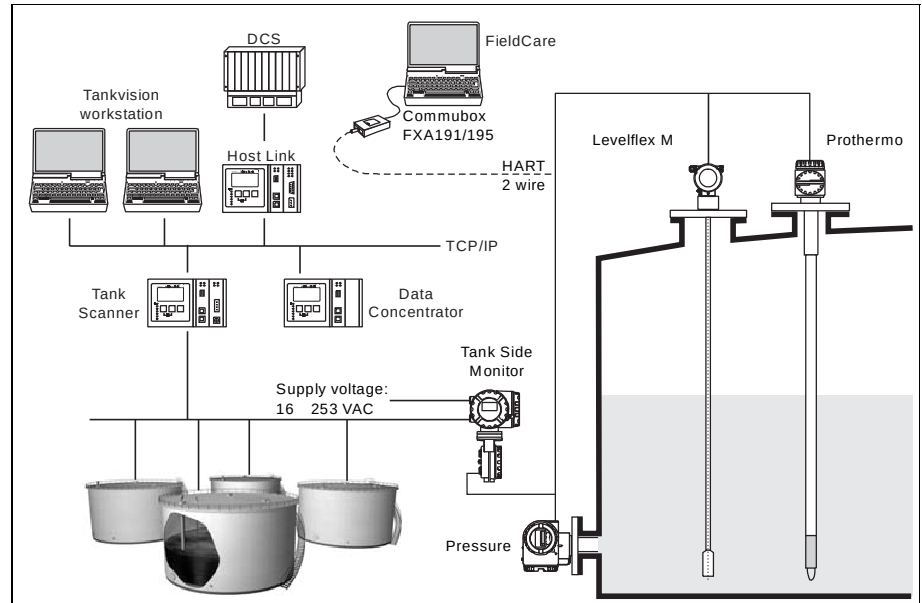
System integration via FOUNDATION Fieldbus

Max. 32 transmitters (standard, encapsulated / Ex em or explosion proof / Ex d) can be connected to the bus. In Intrinsically safe / Ex ia IIC explosion protection: the max. number of transmitters is based on the applicable regulations and standards for interconnecting intrinsically safe circuits (EN 60079-14), proof of intrinsic safety. Both local or remote operation are possible. The complete measuring system consists of:



Integration into the tank gauging system

The Endress+Hauser Tank Side Monitor NRF590 provides integrated communications for sites with multiple tanks, each with one or more sensors on the tank, such as radar, spot or average temperature, capacitive probe for water detection and/or pressure sensors. Multiple protocols out of the Tank Side Monitor guarantee connectivity to nearly any of the existing industry standard tank gauging protocols. Optional connectivity of analog 4 to 20 mA sensors, digital I/O and analog output simplify full tank sensor integration. Use of the proven concept of the intrinsically safe HART bus for all on-tank sensors yields extremely low wiring costs, while at the same time providing maximum safety, reliability and data availability.



100-FMPxxxx-14-00-00-en-04

Input

Measured variable

The measured variable is the distance between the reference point (see Fig. on → 43) and the product surface.
Subject to the empty distance entered (E, see Fig. on → 4), the level is calculated.
Alternatively, the level can be converted into other variables (volume, mass) by means of linearization (32 points).

Measuring range

Level measurement

The following table describes the media groups and the possible measuring range as a function of the media group.

Medium group	DC (εr)	Typical bulk solids	Typical liquids	Measuring range	
				bare metallic probes	PA-coated Cable probes
1	1,4 to 1,6	—	– Condensed gases, e.g. N ₂ , CO ₂	15 ft (4 m), only coax probe	—
2	1,6 to 1,9	– Plastic granulate – White lime, special cement – Sugar	– Liquefied gas, e.g. propane – Solvent – Freon – Palm oil	82 to 98 ft (25 to 30 m)	16 to 50 ft (12,5 to 15 m)
3	1,9 to 2,5	– Portland cement, plaster	– Mineral oils, fuels	98 to 115 ft (30 to 35 m)	—
		– Flour	—	—	50 to 82 ft (15 to 25 m)
4	2,5 to 4	– Grain, seeds	—	—	82 to 98 ft (25 to 30 m)
		– Ground stones – Sand	– Benzene, styrene, toluene – Furan – Naphthalene	115 ft (35 m)	82 to 98 ft (25 to 30 m)
5	4 to 7	– Naturally moist (ground) stones, ores – Salt	– Chlorobenzene, chloroform – Cellulose spray – Isocyanate, aniline	115 ft (35 m)	115 ft (35 m)
6	> 7	– Metallic powder – Carbon black – Coal	– Aqueous solutions – Alcohols – Ammonia	115 ft (35 m)	115 ft (35 m)

The respective lower group applies for very loose or loosened bulk solids.

Reduction of the max. possible measuring range through:

- Extremely loose surfaces of bulk solids, e.g. bulk solids with low bulk weight for pneumatic filling.
- Buildup, above all of moist products.



Note!

Due to the high diffusion rate of ammonia it is recommended to use the FMP45 with gas-tight bushing for measurements in this medium.

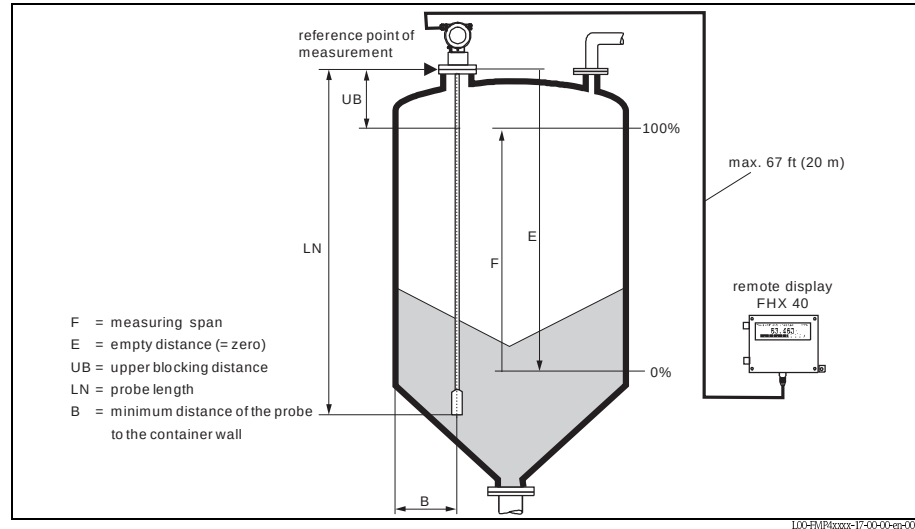
Interface measurement

The measuring range for interface measurement is limited to 33 ft (10 m). Larger measuring range available on request.

Blocking distance

The upper blocking distance (= UB) is the minimum distance from the reference point of the measurement (mounting flange) to the maximum level.

At the lowest part of the probe an exact measurement is not possible, see "Performance characteristics" on → 19.



Reference point of the measurement, details → 43

Blocking distance and measuring range:

FMP40	LN ft [m]		UB ft [m]
	min	max	min
Cable probe	3.3 (1)	115 (35) ¹⁾	0.6 (0.2) ²⁾
6 mm (0.24") rod probe	1 (0.3)	6.5 (2)	0.6 (0.2) ²⁾
16 mm (0.63") rod probe	1 (0.3)	13 (4)	0.6 (0.2) ²⁾
Coax probe	1 (0.3)	13 (4)	0

- 1) Larger measuring range available on request.
- 2) The indicated blocking distances are preset. At media with $DK > 7$, the upper blocking distance UB can be reduced for rod and rope probes on 0.1 m. The upper blocking distance UB can be entered manually.

FMP40 (interface)	LN ft [m]		UB ft [m]
	min	max	min
Coax probe	1 (0.3)	13 (4)	0
16 mm (0.63") rod probe in the bypass	1 (0.3)	13 (4)	0.3 (0.1) ¹⁾
6 mm (0.24") rod probe in the bypass	1 (0.3)	6.5 (2)	0.3 (0.1) ¹⁾
Cable probe in free field ²⁾	1 (0.3)	33 (10) ³⁾	0.3 (0.1) ¹⁾

- 1) The indicated blocking distances are preset. The upper blocking distance UB can be entered manually.
- 2) Measurements in free field available on request.
- 3) Larger measuring range available on request.



Note!
Within the blocking distance, a reliable measurement can not be guaranteed.

Used frequency spectrum

100 MHz to 1.5 GHz

Output

Output signal

- 4 to 20 mA with HART protocol
- PROFIBUS PA:
 - signal coding: Manchester Bus Powered (MBP); Manchester II
 - data transmission rate: 31.25 KBit/s, voltage mode
- FOUNDATION Fieldbus (H1):
 - signal coding: Manchester Bus Powered (MBP); Manchester II
 - data transmission rate: 31.25 KBit/s, voltage mode

Signal on alarm

Failure information can be accessed via the following interfaces:

- Local display:
 - Error symbol
 - Plain text display
- Current output, failsafe mode can be selected (e.g. according to NAMUR Recommendation NE 43).
- Digital interface

Linearization

The Levellflex M linearization function enables the measured value to be converted into any desired length or volume units and mass or %. Linearization tables for volume calculation in cylindrical tanks are preprogrammed. Any other tables with up to 32 value pairs can be input manually or semi-automatically. The creation of a linearization table with FieldCare is particularly convenient.

Data of the FOUNDATION Fieldbus interface

Basic Data

Device Type	1012 (hex)
Device Revision	04 (hex)
DD Revision	02 (hex)
CFF Revision	02 (hex)
ITK Version	4,61
ITK-Certification Driver-No.	www.endress.com / www.fieldbus.org
Link-Master (LAS) capable	yes
Link Master / Basic Device selectable	yes; Default: Basic Device
Number VCRs	24
Number of Link-Objects in VFD	24

Virtual communication references (VCRs)

Permanent Entries	1
Client VCRs	0
Server VCRs	24
Source VCRs	23
Sink VCRs	0
Subscriber VCRs	23
Publisher VCRs	23

Link Settings

Slot time	4
Min. Inter PDU delay	6
Max. response delay	10

Transducer Blocks

Block	Content	Output values
Sensor Block	contains all parameters related to the measurement	■ level or volume¹⁾ (channel 1) ■ distance (channel 2)
Diagnositic Block	contains diagnostiv information	no output values
Display Block	contains parameters to configure the local display	no output values

1) depending on the configuration of the sensor-block

Function Blocks

Block	Content	Execution time	Functionality
Resource Block	The Resource Block contains all the data that uniquely identifies the field device. It is an electronic version of a nameplate of the device.		enhanced
Analog Input Block 1 Analog Input Block 2	The AI block takes the manufacturer's input data, selected by channel number, and makes it available to other function blocks at its output.	30 ms	standard
PID Block	The PID block serves as proportional-integral-derivative controller and is used almost universally to do closed-loop-control in the field including cascade and feedforward.	80 ms	standard
Arithmetic Block	This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be done.	50 ms	standard
Input Selector Block	The input selector block provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and 'first good' signal selection.	30 ms	standard
Signal Characterizer Block	The signal characterizer block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is determined by a single look-up table with 21 arbitrary x-y pairs.	40 ms	standard
Integrator Block	The Integrator Function Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating discrete signals when these settings are reached.	60 ms	standard

Auxiliary energy

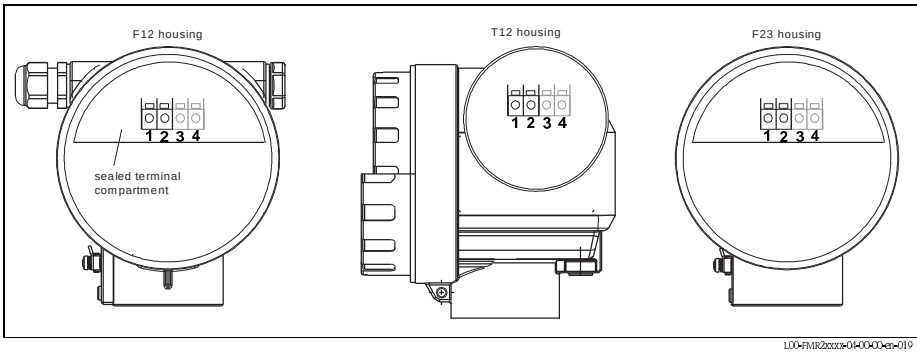
Electrical connection

Connection compartment

Three housings are available:

- Aluminum housing F12 with additionally sealed connection compartment for:
 - standard
 - Intrinsically safe / Ex ia
 - dust ignition-proof
- Aluminum housing T12 with separate connection compartment for:
 - standard
 - Encapsulated / Ex e
 - Explosion proof / Ex d
 - Intrinsically safe / Ex ia (with overvoltage protection)
 - dust ignition-proof
- Stainless steel 1.4435/316L housing F23 for:
 - standard
 - Intrinsically safe / Ex ia
 - dust ignition-proof

After mounting, the housing can be turned 350° in order to make it easier to access the display and the connection compartment.



Ground connection

It is necessary to make a good ground connection to the ground terminal on the outside of the housing, in order to achieve EMC security.

Cable gland

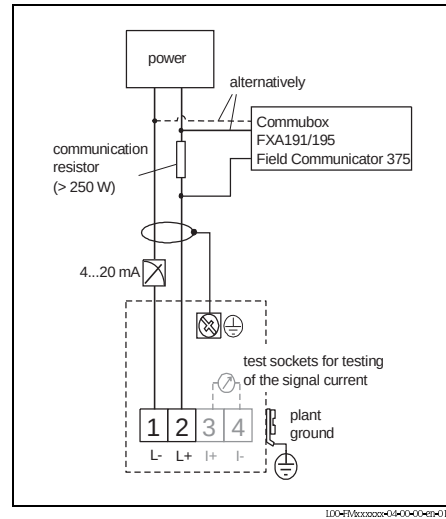
	Type	Clamping area
Standard, Ex ia, IS	Plastic M20x1.5	5 to 10 mm
Ex em, Ex nA	Metal M20x1.5	7 to 10.5 mm
All	1/2" NPT, metal	

Terminals

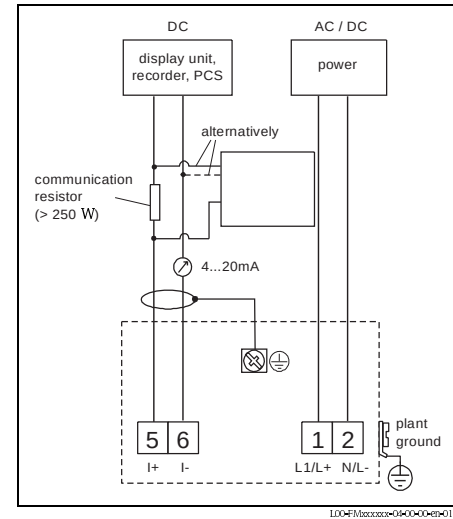
For wire cross-sections of 16 to 18 AWG (0.5 to 2.5 mm²)

Terminal assignment

2-wire, 4 to 20 mA with HART



4-wire, 4 to 20 mA active with HART



Note!

If 4-wire for dust-Ex-applications is used, the current output is intrinsically safe.

Connect the connecting line to the screw terminals in the terminal compartment.

Cable specification:

- A standard installation cable is sufficient if only the analog signal is used. Use a shielded cable when working with a superimposed communications signal (HART).



Note!

- See TI402F/00/en for connection to Tank Side Monitor NRF590.
- Protective circuitry against reverse polarity, RFI and over-voltage peaks is built into the device (see also Technical Information TI241F "EMC Test Procedures").

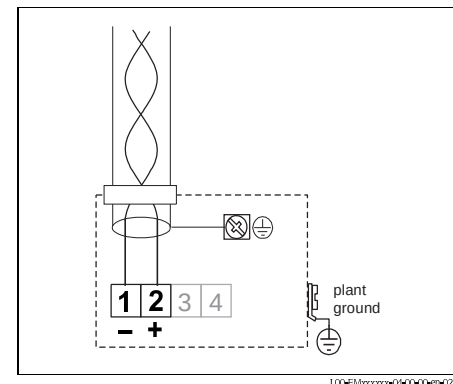
PROFIBUS PA

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy.

For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA034S "Guidelines for planning and commissioning PROFIBUS DP/PA" and the PNO Guideline.

Cable specification:

- Use a twisted, shielded two-wire cable, preferably cable type A



Note!

For further information on the cable specifications, see Operating Instructions BA034S "Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

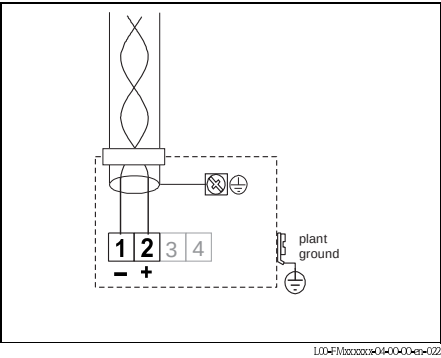
FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy.

For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA013S "FOUNDATION Fieldbus Overview" and the FONDATION Fieldbus Guideline.

Cable specification:

- Use a twisted, shielded two-wire cable, preferably cable type A



Note!
For further information on the cable specifications, see Operating Instructions BA013S "FOUNDATION Fieldbus Overview", FONDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Fieldbus plug connectors

For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

Pin assignment of the M12 plug connector (PROFIBUS PA plug)

	Pin	Meaning
	1	Ground
	2	Signal +
	3	Signal -
	4	not connected

Pin assignment of the 7/8" plug connector (FOUNDATION Fieldbus plug)

	Pin	Meaning
	1	Signal -
	2	Signal +
	3	not connected
	4	Ground

Load HART Minimum load for HART communication: 250 Ω

Supply voltage **HART, 2-wire**

All the following values are the terminal voltages directly at the device:

Communication		Current consumption	Terminal voltage	
			minimum	maximum
HART	Standard	4 mA	16 V	36 V
		20 mA	7.5 V	36 V
	Intrinsically safe (Ex ia)	4 mA	16 V	30 V
		20 mA	7.5 V	30 V
	Encapsulated (Ex em) Explosion proof (Ex d)	4 mA	16 V	30 V
		20 mA	11 V	30 V
Fixed current, adjustable e.g. for solar power operation (measured value transmitted via HART)	Standard	11 mA	10 V	36 V
	Intrinsically safe (Ex ia)	11 mA	10 V	30 V
Fixed current for HART Multidrop mode	Standard	4 mA ¹⁾	16 V	36 V
	Intrinsically safe (Ex ia)	4 mA ¹⁾	16 V	30 V

1) Start up current 11 mA.

HART residual ripple, 2-wire: $U_{ss} \leq 200$ mV

HART, 4-wire active

Version	Voltage	max. load
DC	10.5 to 32 V	600 Ω
AC, 50/60 Hz	90 to 253 V	600 Ω

Residual ripple HART, 4-wire, DC version: $U_{ss} \leq 2$ V, voltage incl. ripple within the permitted voltage (10.5 to 32 V)

PROFIBUS PA and FOUNDATION Fieldbus

Supply voltage	9 V to 32 V ¹⁾
Lift-off voltage	9 V

1) There may be additional restrictions for devices with an explosion protection certificate. Refer to the notes in the appropriate safety instructions (XA).

Cable entry Cable gland: M20x1.5 (only cable entry for Ex d)
Cable entry: G ½ or ½ NPT
PROFIBUS PA M12 plug
Fieldbus Foundation 7/8" plug

Power consumption Min. 60 mW, max. 900 mW

Current consumption
HART

3.6 to 22 mA for HART Multidrop: start up current is 11mA.

PROFIBUS PA

Max. 11 mA.

FOUNDATION Fieldbus

Nominal current	15 mA
Starting current	≤ 15 mA
Error current	0 mA
FISCO/FNICO conformance	compliant
Polarity sensitive	no

FISCO

U_i	17,5 V
I_i	500 mA; with overvoltage protection 273 mA
P_i	5.5 W; with overvoltage protection 1.2 W
C_i	5 nF
L_i	0.01 mH

Overvoltage protection

If the measuring device is used for level measurement in flammable liquids which requires the use of overvoltage protection according to DIN EN 60079-14, standard for test procedures 60060-1 (10 kA, pulse 8/20 μ s), it has to be ensured that:

- the measuring device with integrated overvoltage protection with 600 V gas discharge tubes within the T12-enclosure is used, refer to product overview Ordering information on page 53
- or
- This protection is achieved by the use of other appropriate measures (external protection devices e.g. HAW262Z).

Performance characteristics

Reference operating conditions

- Temperature = +20°C (68°F) $\pm$ 5 °C (9°F)
- Pressure = 1013 mbar abs. (14.7 psia) $\pm$ 20 mbar (0.3 psi)
- Humidity = 65 % $\pm$ 20%
- Reflection factor $\geq$ 0.8 (surface of the water for coax probe, metal plate for rod and rope probe with min. 1 m $\varnothing$)
- Flange for rod or cable probe $\geq$ 30 cm (12") $\varnothing$
- Distance to obstructions $\geq$ 1 m (3 ft)
- For interface measurement:
 - Coax probe
 - DK of the lower medium = 80 (water)
 - DK of the upper medium = 2 (oil)

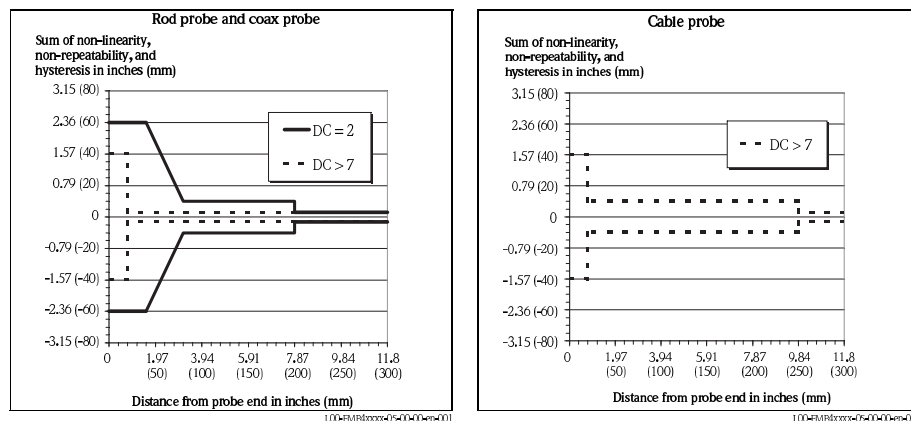
Maximum measured error

Typical data under reference operating conditions: DIN EN 61298-2, percentage values in relation to the span.

Output:	Digital	Analog
Sum of non-linearity, non-repeatability and hysteresis	Level (electronic version level and interface measurement): - Measuring range up to 10 m: ± 3 mm (33 ft: ± 0.13") - Measuring range > 10 m (33 ft): ± 0.03 % For PA-coated cable probes: - Measuring range up to 5 m: ± 5 mm (16 ft: ± 0.2") - Measuring range > 5 m (16 ft): ± 0.1 % Interface (only for electronic version "K" interface measurement): - Measuring range up to 10 m: ± 10 mm (33 ft: ± 0.4") If the thickness of the interface is < 60 mm (2.4"), the interface can no longer be differentiated from the overall level such that both output signals are identical.	± 0.06 %
Offset / Zero	± 4 mm (0.16")	± 0.03 %

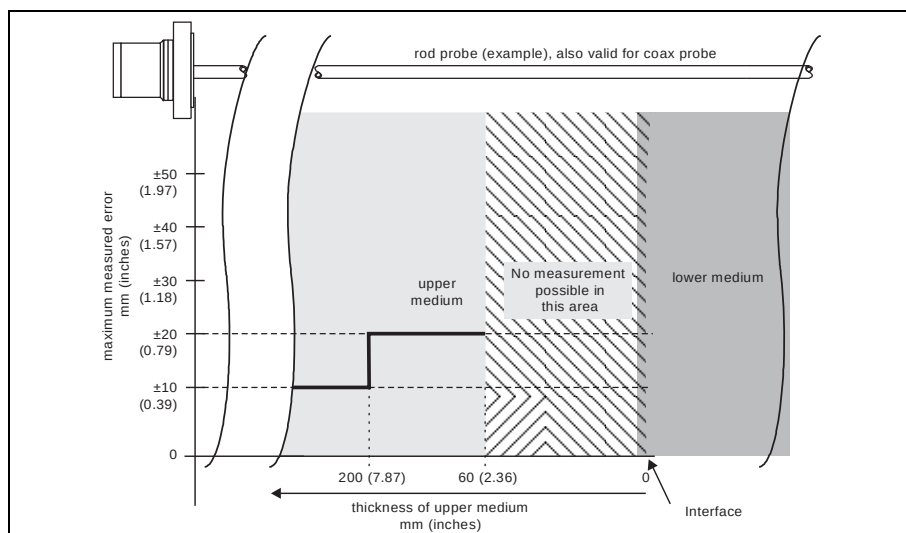
If the reference conditions are not met, the offset/zero point arising from the mounting situation may be up to ± 12 mm (0.47") for cable and rod probes. This additional offset/zero point can be compensated for by entering a correction (function "Offset" (057)) during commissioning.

Differing from this, the following measuring error is present in the vicinity of the level (electronic version level and interface measurement):



If for cable probes the DC value is less than 7, then measurement is not possible in the area of the straining weight (0 to 250 mm / 0 to 10" from end of probe; lower blocking distance).

Differing from this, the following measuring error is present for thin interfaces (only for electronic version "K" interface measurement):



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Resolution	■ Digital: 1 mm (0.04") ■ Analog: 0.03 % of the measuring range
Reaction time	The reaction time depends on the configuration. Shortest time: ■ 2-wire electronics: 1 s ■ 4-wire electronics: 0.7 s
Influence of ambient temperature	The measurements are carried out in accordance with EN 61298-3: ■ digital output (HART, PROFIBUS PA, FOUNDATION Fieldbus): – FMP40 Average T_K: 0.6 mm/10 K (0.023"/10K), max. ± 3.5 mm (0.14") over the entire temperature range -40°C to +80°C (-40 to +176°F) ■ 2-wire: ■ Current output (additional error, in reference to the span of 16 mA): – Zero point (4 mA) Average T_K: 0.032 %/10 K, max. 0.35 % over the entire temperature range -40°C to +80°C (-40 to +176°F) – Span (20 mA) Average T_K: 0.05 %/10 K, max. 0.5 % over the entire temperature range -40°C to +80°C (-40 to +176°F) ■ 4-wire: ■ Current output (additional error, in reference to the span of 16 mA): – Zero point (4 mA) Average T_K: 0.02 %/10 K, max. 0.29 % over the entire temperature range -40°C to +80°C (-40 to +176°F) – Span (20 mA) Average T_K: 0.06 %/10 K, max. 0.89 % over the entire temperature range -40°C to +80°C (-40 to +176°F)

Operating conditions: installation with level measurement

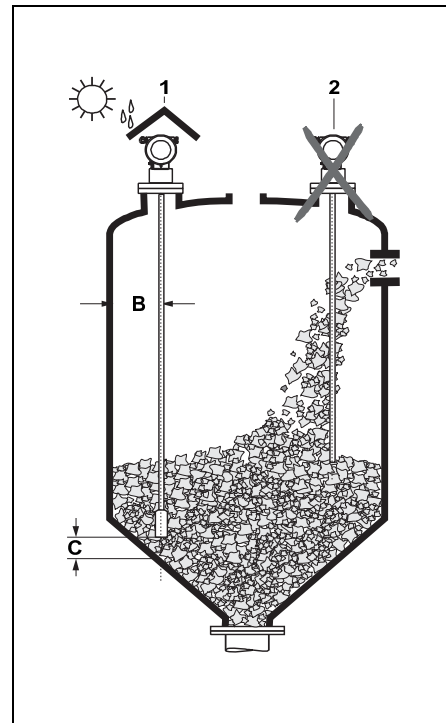
General information on level measurement

Probe selection (see overview on page 6-7)

- Normally, cable probes should be used for bulk solids, rod probes are only suitable for short measuring ranges up to approx. 2 m (6.5 ft) in bulk solids. This applies above all to applications in which the probe is installed laterally at an angle and for light and pourable bulk solids.
- Normally use rod or coax probes for liquids. Cable probes are used in liquids for measuring ranges > 4m (15 ft) and with restricted ceiling clearance which does not allow the installation of rigid probes.
- Coax probes are suited to liquids with viscosities of up to approx. 500 cst.
Coax probes can measure most liquefied gases, as of a dielectric constant of 1.4. Moreover, installation conditions, such as nozzles, tank internal fittings etc., have no effect on the measurement when a coax probe is used. A coax probe offers maximum EMC safety when used in plastic tanks.
- In the case of large silos, the lateral pressure on the cable can be so high that a cable with plastic jacketing must be used. We recommend PA-coated cables be used for cereal products wheat, flour etc..

Mounting location

- Do not mount rod or cable probes in the filling curtain (2)
- Mount rod and cable probes away from the wall (B) at such a distance that, in the event of buildup on the wall, there is still a minimum distance of 100 mm (4") between the probe and the buildup.
- Mount rod and cable probes as far away as possible from installed fittings. "Mapping" must be carried out during commissioning in the event of distances < 300 mm (12").
- When installing rod and cable probes in plastic containers, the minimum distance of 300 mm (12") also applies to metallic parts outside the container.
- Rod and cable probes may not, at times, contact metallic container walls or floors.
- Minimum distance of probe end to the container floor (C):
 - Cable probe: 150 mm (6")
 - Rod probe: 50 mm (2")
 - Coax probe: 10 mm
- When installing outdoors, it is recommended that you use a protective cover (1) see "Accessories" on page 57.
- Avoid buckling the cable probe during installation or operation (e.g. through product movement against silo wall) by selecting a suitable mounting location.



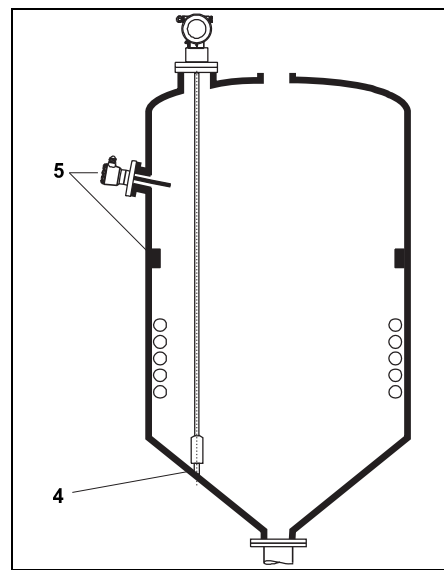
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Other installations

- Select the mounting location such that the distance to internals (5) (e.g. limit switch, struts) is > than 300 mm (12") over the entire length of the probe, also during operation.
- Probe must within the measuring span not touch any internals during operation. If necessary, when using cable probes the probe end (4) may be fixed to secure it (page 25)!

Optimization options

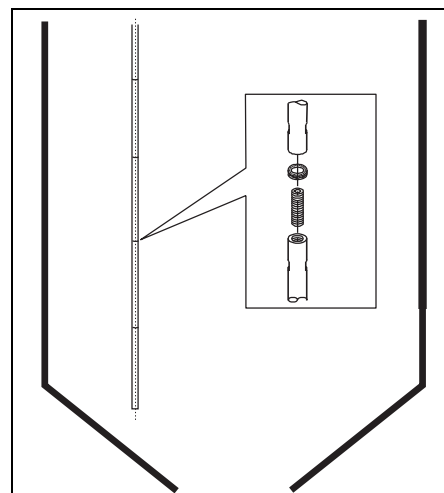
- Interference echo suppression: measurement can be optimized by electronically tuning out interference echoes.



Separable probes

If there is little mounting space (distance to the ceiling), it is advisable to use separable rod probes (Ø16 mm / 0.63").

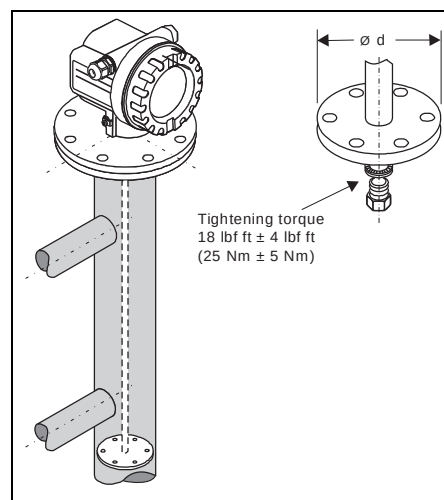
- max. probe length 10 m (394")
- max. sideways capacity 20 Nm (15 lbf ft)
- probes are separable several times with the lengths:
 - 500 mm (20")
 - 1000 mm (40")
- torque: 15 Nm (11 lbf ft)



Centering of probe end

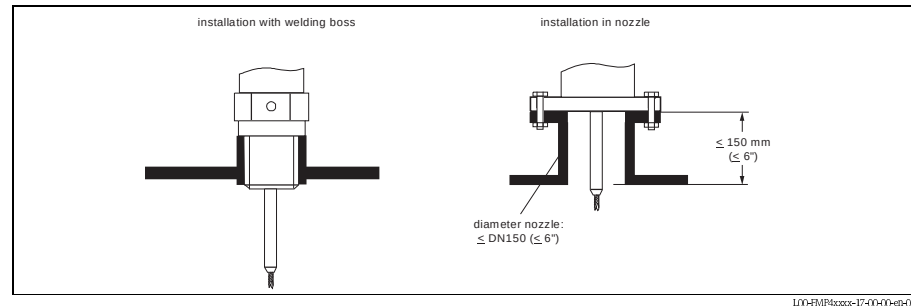
If the centering disk is mounted at the end of the probe, it enables a reliable measuring. See "Ordering information" page 53.

- Centering disk for rod probes:
 - d = 45 mm/1.77" (DN50/2" + DN65/2-1/2")
 - d = 75 mm/2.95" (DN80/3" + DN100/4")



Type of probe installation

- Probes are mounted to the process connection with threaded connections or flanges and are usually also secured with these. If during this installation there is the danger that the probe end moves so much that it touches the tank floor or cone at times, the probe must, if necessary, be shortened and fixed down. The easiest way to fix the cable probes is to screw them to the internal thread on the lower end of the weight. Thread size, page 25.
- The ideal installation is mounting in a screwed joint / screw-in sleeve which is internally flush with the container ceiling.
- If installation takes place in a nozzle, the nozzle should be 50 to 150 mm (2" to 6") in diameter and should not be more than 150 mm (6") high. Installation adapters are available for other dimensions, page 35.



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Welding the probe into the vessel

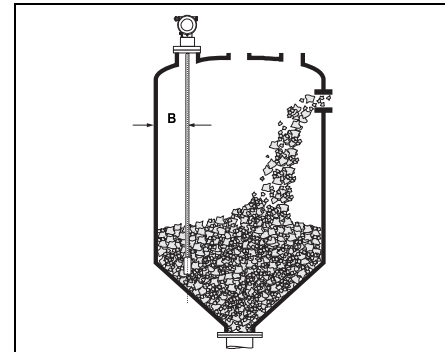


Caution!

Before welding the probe into the vessel, it must be grounded by a low-resistive connection. If this is not possible, the electronics as well as the HF module must be disconnected. Otherwise the electronics may be damaged.

Special notes for bulk solids

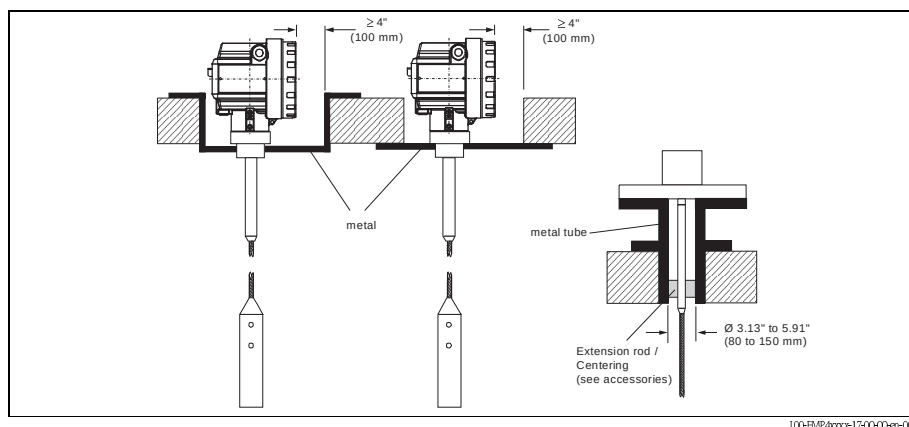
- In the case of bulk solids, as great a distance as possible from the filling curtain is especially important to avoid wear.
- In concrete silos, a **large distance** (B) should be observed between the probe and the concrete wall, if possible ≥ 1 m (3ft), but at least 0.5 m (1.5 ft).
- The installation of cable probes must be carried out carefully. The cable should not be buckled. If possible, installation should be carried out when the silo is empty.
- Check the probe regularly for defect.



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Installation in concrete silos

Installation, for example, into a thick concrete ceiling should be made flush with the lower edge. Alternatively, the probe can also be installed into a pipe that must not protrude over the lower edge of the silo ceiling. The pipe should be kept at a minimum length. Installation suggestions see diagram.

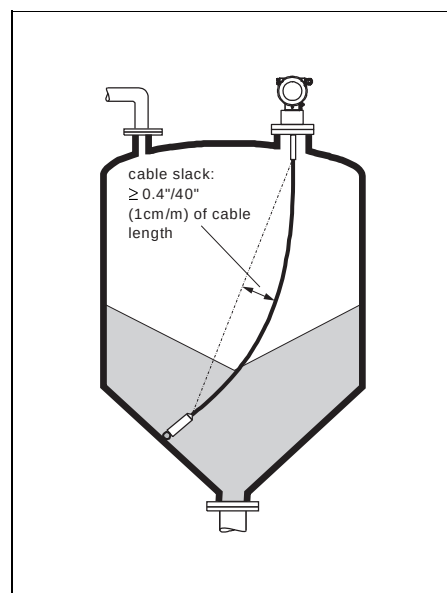


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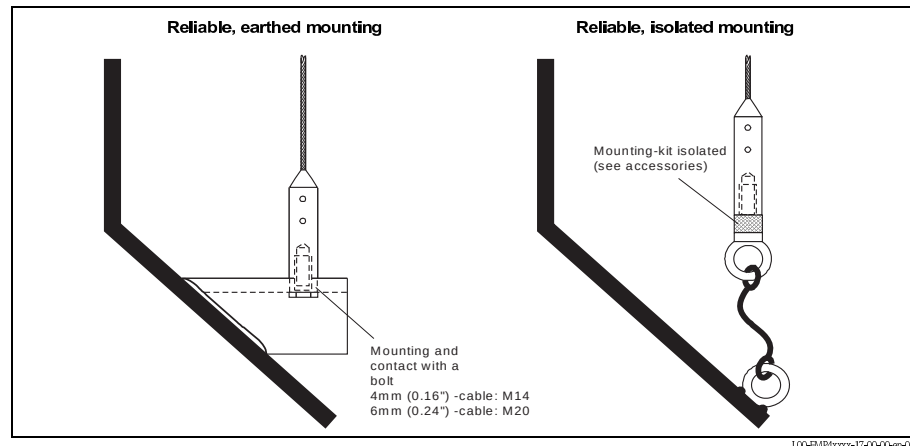
Note for installations with rod extension/center washer (accessories):
Strong dust generation can lead to build-up behind the center washer. This can cause an interference signal.
For other installation possibilities please contact Endress+Hauser.

Fixing cable probe

- The end of the probe needs to be secured if the probe would otherwise touch the silo wall, the cone or another part, or the probe comes closer than 0.5 m (1.5 ft) to a concrete wall. This is what the internal thread in the probe weight is intended for:
 - for 4 mm (0.16") cable: M14
 - for 6 mm (0.24") cable: M20
- Preferably use the 6 mm (0.24") cable probe due to the higher tensile strength when fixing a cable probe
- Page 57 The fixing must be either reliably grounded or reliably insulated (see accessories on Accessories). If it is not possible to mount the probe weight with a safe ground connection, it can be secured using an isolated eyelet, which is available as an accessory (page 62).
- In order to prevent an extremely high tensile load and the risk of cable crack, the cable has to be slack. Make the cable longer than the required measuring range such that there is a sag in the middle of the rope that is $\geq 1 \text{ cm/m}$ (0.4"/40") of the cable length.



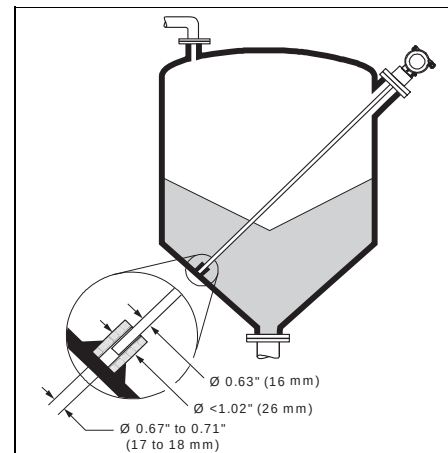
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Installation from the side

- If installation from above is not possible, the Levelflex can also be mounted from the side.
- In this case, always fix the cable probe (see Fixing cable probe).
- Support rod and coax probe if the lateral load-bearing capacity is exceeded (see table, page 6-7). Only fix rod probes at the probe end.

Caution!
Remove or ground the electronics when welding the sleeve as the device will otherwise be destroyed!



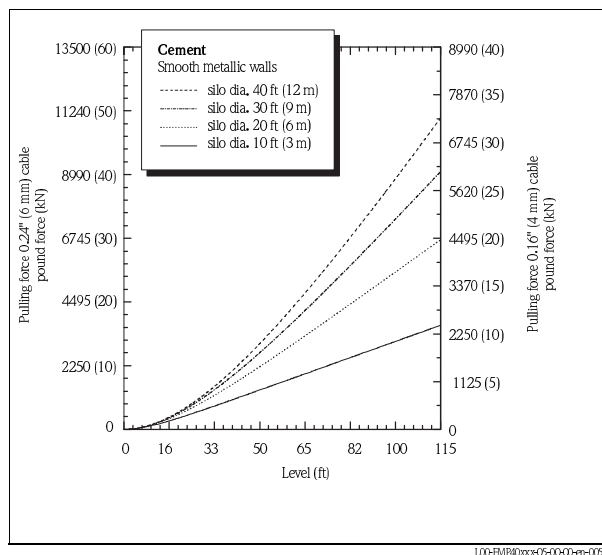
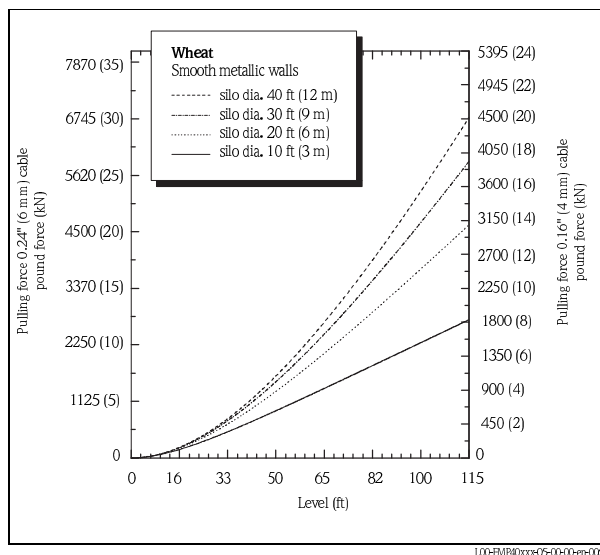
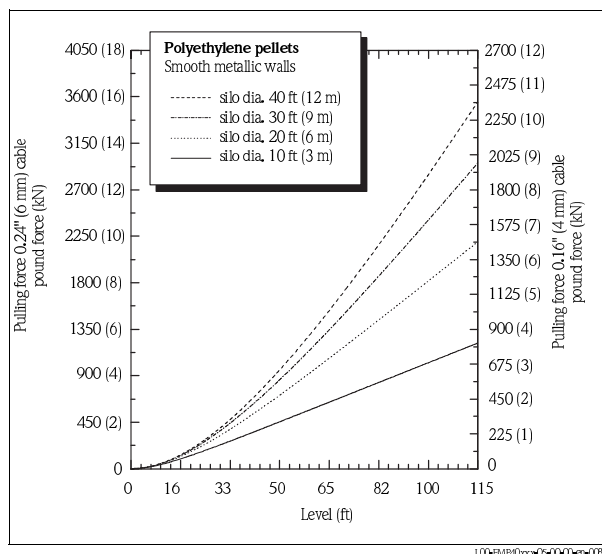
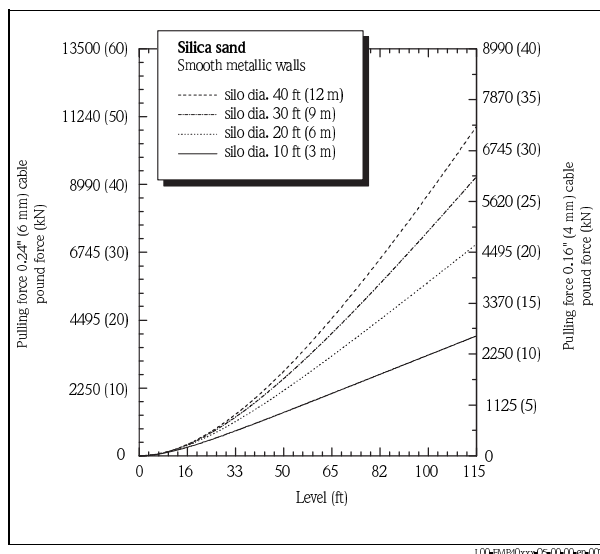
Tensile load

Bulk solids exert tensile forces (maximum admissible values page 6-7) on cable probes whose height increases with:

- the length of the probe, i.e. max. cover,
- the bulk density of the product,
- the silo diameter and
- the diameter of the probe cable

The following diagrams show typical loads for frequently occurring bulk solids as reference values. The calculation is performed for the following conditions:

- Suspended probe (probe end not fixed at the bottom)
- Free-flowing bulk solid, i.e. mass flow. A calculation for core flow is not possible. In the event of collapsing cornices, considerably higher loads can occur.
- The specification for tensile forces contains the safety factor 2, which compensates for the normal fluctuation range in pourable bulk solids.



Since the tensile forces are also heavily dependent on the viscosity of the product, a higher safety factor is necessary for highly viscous products and if there is a risk of cornice buildup. In critical cases it is better to use a 6 mm (0.24") cable instead of a 4 mm (0.16") one.

The same forces also act on the silo cover.

On a fixed cable, the tensile forces are definitely greater, but this can not be calculated.

Observe the tensile strength of the probes or ensure that the tensile strength of the probes is not exceeded (see table, page 6–7).

Options for reducing the tensile forces:

- Shorten the probe.
- If the maximum tensile load is exceeded, check whether it would be possible to use a non-contact Ultrasonic or Level-Radar device.

Special notes for liquids

- When installing in agitation units, check whether a no-contact process (Ultrasonic or Level-Radar) would be better suited, especially if the agitator generates large mechanical loads on the probe.
- If Levelflex is, nevertheless, installed in tanks with agitators, it is better to use coax probes which have a greater lateral loading capacity, page 6–7. Additionally the coax probe can be protected against warping, see page 31.

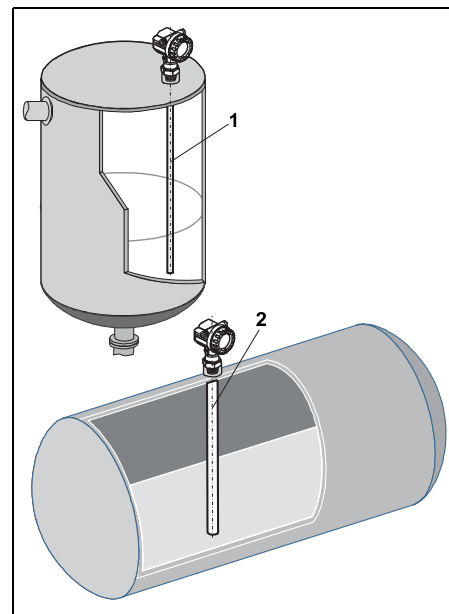
Standard installation

Using a coax probe offers great advantages when the viscosity of the product is < 500 cst and it is certain that the product does not accumulate buildup:

- Greater reliability:
 - As of dielectric constant=1.4, measurement functions independently of all electrical properties in all liquids.
- Internals in the tank and nozzle dimensions do not have any influence on measurement.
- Higher lateral load-bearing capacity than rod probes.
- For higher viscosity a rod probe is recommended, or using a non-contact measuring principle with the Level-Radar Micropilot M.

Installation in horizontal and upright cylindrical tanks

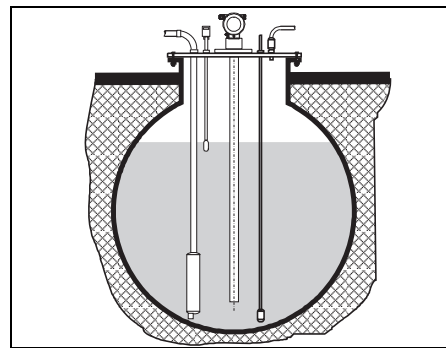
- Use the following types of probe for measuring ranges
 - up to 4 m (13 ft): rod probe (1) or coax probe (2)
 - up to 10 m (33 ft): separable probe
 - above 10 m (33 ft): 4mm (0.16") cable probe
- Installation and possible fixing as with bulk solids.
- Any distance from wall, as long as occasional contact is prevented.
- When installing in tanks with a lot of internals or internals situated close to the probe: use a coax probe.



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Installation in underground tanks

- Use coax probe for nozzles with large diameters in order to avoid reflections at the nozzle wall.



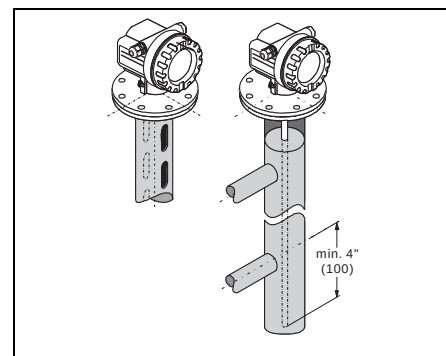
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Measurement in corrosive liquids

For measurement in corrosive liquids use Levelflex M FMP41C. When using plastic tanks it is also possible to mount the probe on the outside of the tank (see installation instructions on page 30). Levelflex measures the level of aqueous media through the plastic.

Installation in stilling well or bypass

- A rod probe can be used for pipe diameters bigger than 40 mm (1.5").
- When installing a rod probe into a metallic pipe with internal diameter of up to 150 mm (6"), you have all the advantages of a coax probe.
- Welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence measurement.
- If a rod probe is used, the probe length must be 100 mm (4") longer than the lower disposal.
- It must be ensured that the probe does not come into contact with the side wall. Where necessary, use a centering disk at the lower end of the probe (page 55 "Type of Probe:")

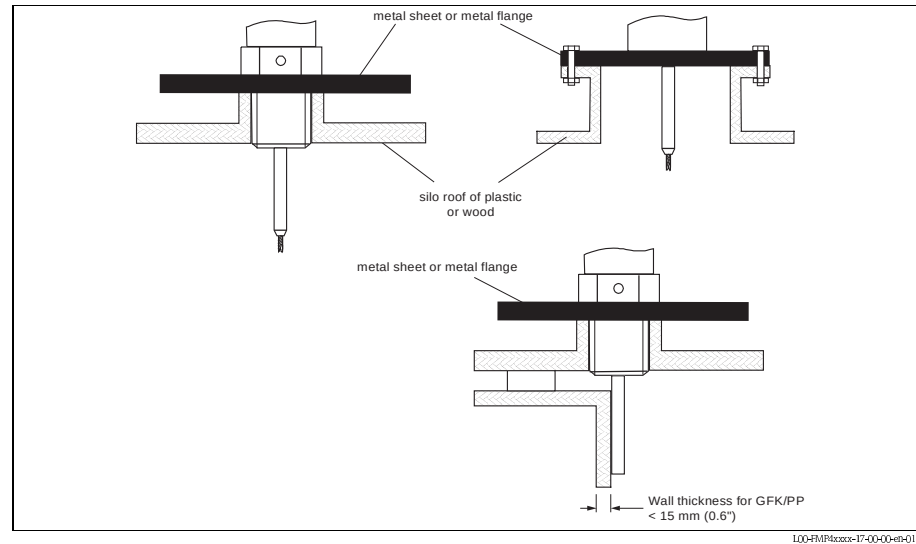


L00-FMP40coax-17-00-00-04-023

Installation in plastic containers

Please note that the "guided level radar" measuring principle requires a metallic surface at the process connection!

When installing the rod and rope probes in plastic silos, whose silo cover is also made of plastic or silos with wood cover, the probes must either be mounted in a $\geq \text{DN50} / 2"$ metallic flange, or a metal sheet with diameter of $\geq 200 \text{ mm}$ (8") must be mounted under the screw-in piece.



- It is also possible to mount the probe externally on the tank wall for measuring in Aqueous solutions. Measurement then takes place through the tank wall without contacting the medium. If people are in the vicinity of the probe mounting location, a plastic half pipe with a diameter of approx. 200 mm (8"), or some other protective unit, must be affixed externally to the probe to prevent any influences on the measurement.
- There must not be any metallic reinforcement rings secured to the tank.
- The wall thickness should be $< 15 \text{ mm}$ (0.6") for at GFR/PP.
- There must be no open space between the tank wall and the probe.

Supporting probes against warping

For WHG or Ex approval:

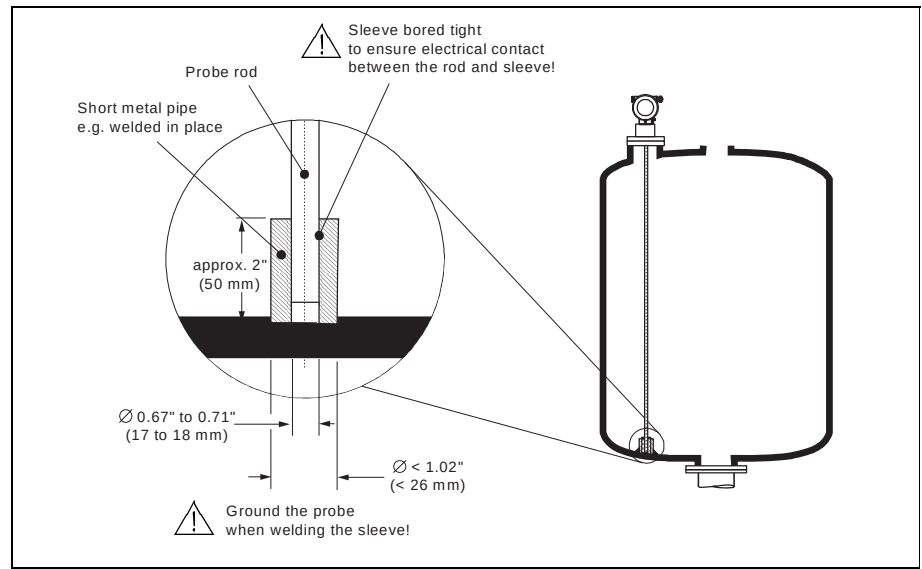
For probe lengths ≥ 3 m (10 ft) a support is required (see figure).

For GL/ABS approval:

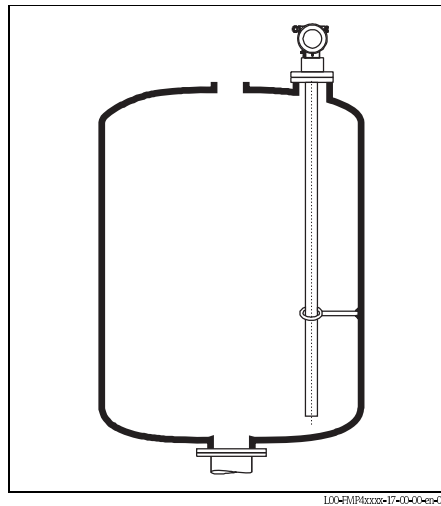
Rod probes $\varnothing 16$ mm (0.63") ≤ 1 m (3 ft) permissible, rod probes $\varnothing 6$ mm (0.24") not permissible.

For coax probes ≥ 1 m (3 ft) a support is required (see figure).

a. Rod probes



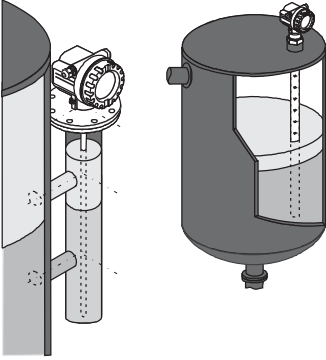
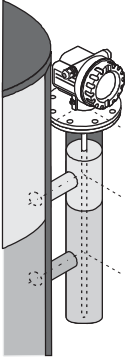
b. Coax probes



Operating conditions: installation with interface measurement

General information on interface measurement

The Levelflex M with the "Interface" electronics version ("power supply, output" feature) is the ideal choice for measuring interfaces. However, it is also possible to measure interfaces with a special version of the standard device but the total level has to remain constant here. This version is available on request.

	"Interface" electronics version	Special version
	 1.00-FMP40xxx-1.5-00-00-m-001	 1.00-FMP40xxx-1.5-00-00-m-002
Function	■ Measurement of variable interfaces and variable total levels. ■ Variable assignment of the output parameters. ■ Extended interface function	Measurement of variable interfaces with the prerequisite of a constant total level
Commissioning	Interface-specific menu guidance via onsite display or DTM	Special configuration, see modification information SV0107
Digital Communication	HART	PROFIBUS PA, FOUNDATION Fieldbus
Ordering information	FMP40 - ##### K #####	FMP40 - ##### D ##### (PROFIBUS PA) FMP40 - ##### F ##### (FOUNDATION Fieldbus) Y = Special version available on request

In addition, the following general conditions must be observed for interface measurement:

- The DK of the upper medium must be known and constant. The DK can be determined with the aid of the DK manual SD106F. In addition, whenever the interface thickness is existing and known, the DK can be calculated automatically via FieldCare.
- The DK of the upper medium may not be greater than 10.
- The DK difference between the upper medium and lower medium must be >10.
- The interface must have a minimum thickness of 60 mm/2.4" (interface electronics version) or 100 mm/4" (special version).
- Emulsion layers in the vicinity of the interface can severely dampen the signal. However, emulsion layers up to 50 mm /2" are permitted.

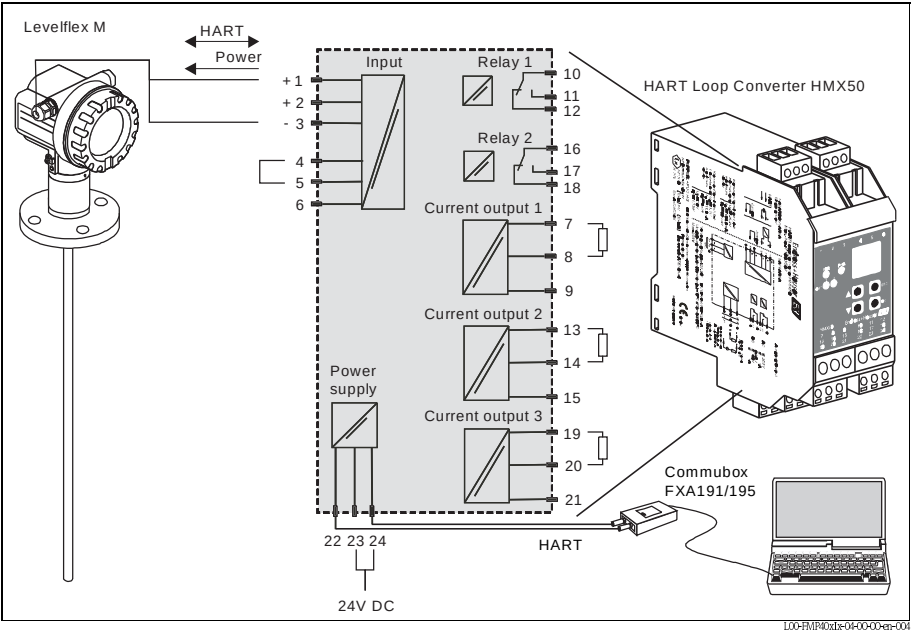
Interface electronics version:

The device with the "Interface" electronics version makes it possible to measure the total level and the interface level simultaneously. The resulting process variables are output using the dynamic variables of the HART protocol. The process variables can be flexibly assigned to the dynamic variables (primary, secondary, tertiary, quaternary value).

Dynamic variables of the HART protocol	Possible process variable assignment	Comment
Primary Value	Interface Total level Thickness of the upper layer	The "primary value" is permanently assigned to the 4 to 20mA current output
Secondary Value	Interface Total level Thickness of the upper layer	—
Tertiary Value	Interface Total level Thickness of the upper layer Amplitude of the total level signal	—
Quaternary (4 th) Value	Amplitude of the interface level signal	No variable assignment

Using the HART loop converter HMX50:

The dynamic variables of the HART protocol can be converted into individual 4 to 20 mA sections using the HART Loop Converter HMX50. The variables are assigned to the current output and the measuring ranges to the individual parameters in the HMX50.



Connection diagram for HART loop converter HMX50 (example: passive 2-wire device and current outputs connected as power source)

The HART loop converter HMX50 can be acquired using the order number 71063562.
Additional documentation: TI429F and BA371F.

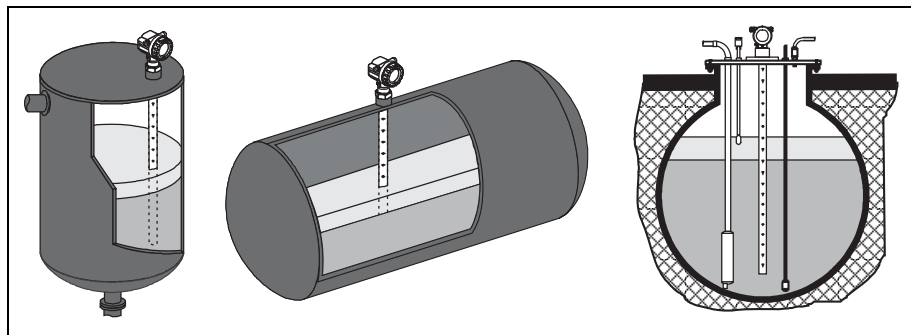
Probe selection (see overview on page 6-7)

- For interface measurement, ideally coax probes or rod probes are used in the bypass/stilling well.
- Coax probes are suited to liquids with viscosities of up to approx. 500 cst. Coax probes can measure most liquefied gases, as of a dielectric constant of 1.4. Moreover, installation conditions, such as nozzles, tank internal fittings etc., have no effect on the measurement when a coax probe is used. A coax probe offers maximum EMC safety when used in plastic tanks.
- Rod or cable probes for free installation in the tank available on request. Cable probes for free installation in the tank must always be used with a rod weight in accordance with special products MVTFN0203 or MVT6N0186. Cable probes may not be used in the bypass/stilling well since the end weight always causes interference reflection which can be misinterpreted during interface measurement.

Special information on interface measurement

Installation in horizontal cylindrical, upright and underground tanks

- Use coax probes or rod probes in the bypass/stilling well. A separable probe is available as a special version for longer measuring ranges.
- Any distance from the wall is possible for coax probes or rod probes in the stilling well. In the case of rod probes, it must be ensured that the probe does not come into contact with the wall.



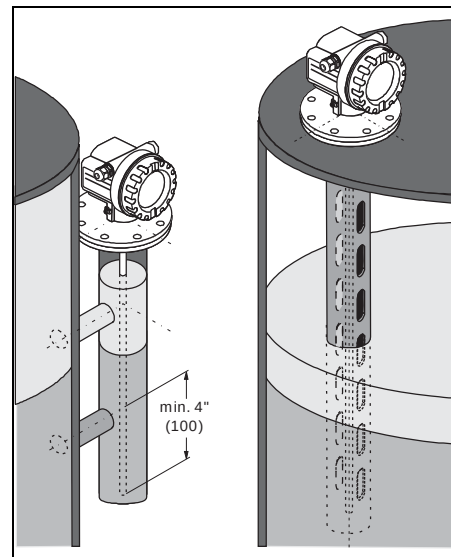
100-FMP40-17-00-00-00-002

Installation in stilling well or bypass

- A rod probe can be used for pipe diameters bigger than 40 mm (1-1/2").
- Rod probe installation can take place up to a diameter size of 100 mm (4"). In the event of larger diameters, a coax probe is recommended.
- Welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence measurement.
- The pipe may not exhibit any steps in diameter.
- If a rod probe is used, the probe length must be 100 mm (4") longer than the lower disposal.
- In the case of rod probes, it must be ensured that the probe does not come into contact with the wall. If necessary, use a centering disk at the end of the probe.

Note!

A plastic centering disk has to be used for interface measurement (see Accessories page 59).



100-FMP40-17-00-00-00-002

Operating conditions: general installation instructions for special installation situations

Probe length

The measuring range is directly dependent on the probe length.

It is better to order probes too long than too short since it is possible to shorten the probe if necessary.

In the case of the cable probe with a rod weight, shortening at the probe end weight is only possible with the special product in accordance with MVT6N0186. See also modification information MI0079.

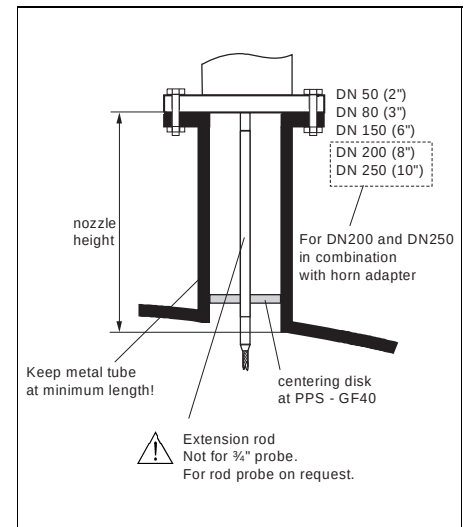
Installation in nozzles > 150 mm (6") high

If, when installing probes in nozzles DN40 to 250 / 1½" to 10" with nozzle height (HS) of > 150 mm/6", the probe could touch the lower edge of the nozzle due to moving materials in the container, we recommend using an extension rod with or without centering disk.

This accessory consists of the extension rod corresponding to the nozzle height, on which a centering disk is also mounted if the nozzles are narrow or when working in bulk solids. This component is delivered separately from the device. Please order the probe length correspondingly shorter. For the exact length of the rod see "extension rod/centering" on page 62.

Order codes for specific nozzle nominal diameters and heights can be found on page 62.

Only use centering disks with small diameters (DN40 and DN50 / 1-1/2" to 2") if there is no significant buildup in the nozzle above the disk. The nozzle must not become clogged with product.



1004FMP40xxx-1700400-er-026

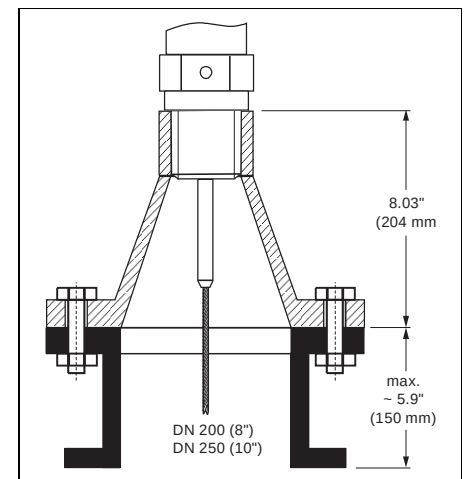
Installation in DN200/8" and DN250/10" nozzles

When installing the Levellflex in nozzles of > 200 mm/8", signals are generated by reflections on the nozzle wall, which can sometimes lead to faulty measurements in the case of products with small dielectric constants.

With nozzle diameters of 200 mm / 8" or 250 mm / 10", therefore, a special flange with a "horn adapter" must be fitted.

Nozzles with nominal diameters greater than DN250 / 10" should be avoided.

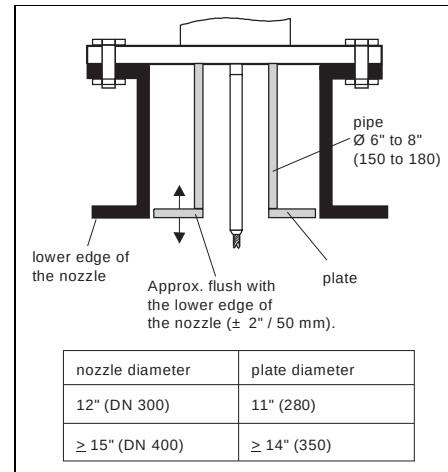
If the rope probe is strongly deflected: use an extension rod/centering HMP40, additionally.



1004FMP40xxx-1700400-er-026

Installation in nozzle $\geq$ DN300 (12")

If installation in $\geq 300\text{mm}/12\text{"}$ nozzles is unavoidable, installation must be carried out in accordance with the sketch on the right.



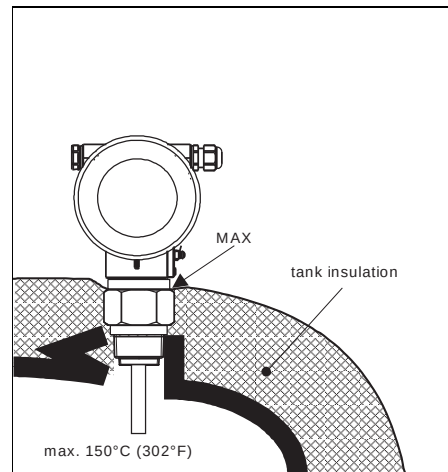
1.00-FMP40xxxx-1740040-ep034

Installation with heat insulation

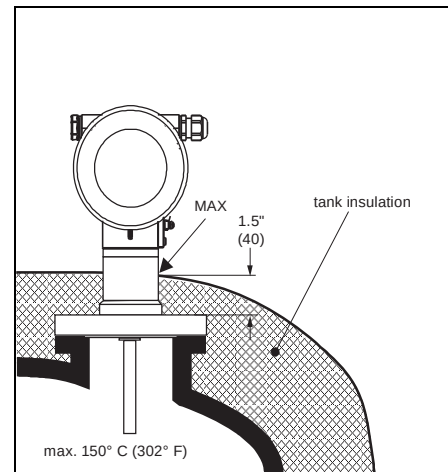
- If process temperatures are high, FMP40 must be included in normal tank insulation to prevent the electronics heating up as a result of heat radiation or convection.
- The insulation may not exceed beyond the points labeled "MAX" in the drawings.

Process connection with adapter G $\frac{3}{4}$, G $1\frac{1}{2}$, $\frac{3}{4}$ NPT or $1\frac{1}{2}$ NPT

Process connection with flange DN40 to DN200



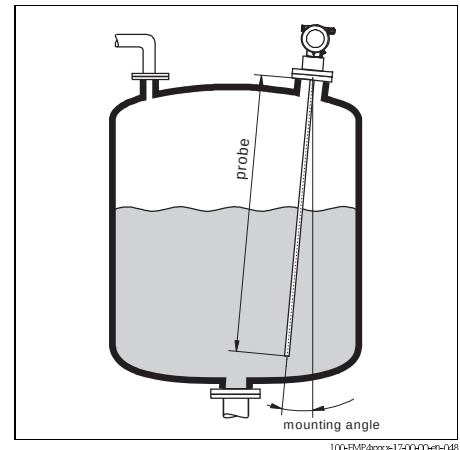
1.00-FMP40xxxx-1740040-ep003



1.00-FMP40xxxx-1740040-ep002

Installation at an angle

- For mechanical reasons, the probe should be installed as vertically as possible.
- With inclined installations the probe length has to be adjusted in dependence to the installation angle.
 - up to 1 m (3 ft) = 30°
 - up to 2 m (6.5 ft) = 10°
 - up to 4 m (13 ft) = 5°.



100-HMP40xxx-17-00-00-en-048

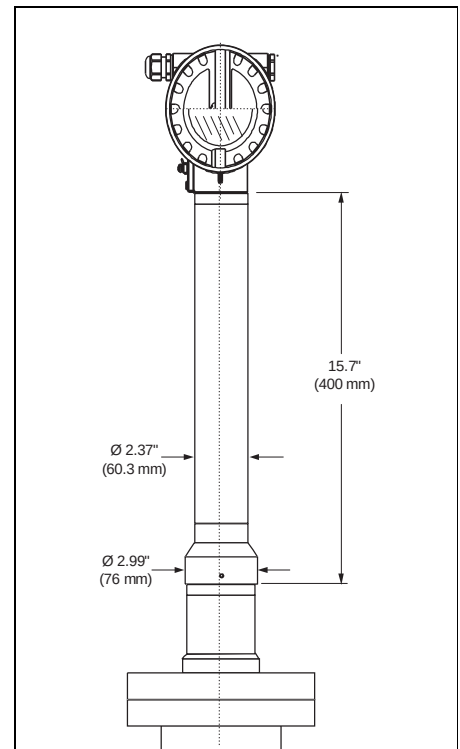
Installation for difficult-to-access process connections

For tight spaces or temperatures above that in the graphic (page 39), the electronics housing can be ordered with distance pipe or connecting cable (remote housing).

Installation with spacer tube

When mounting please observe engineering hints on page 22 the following points:

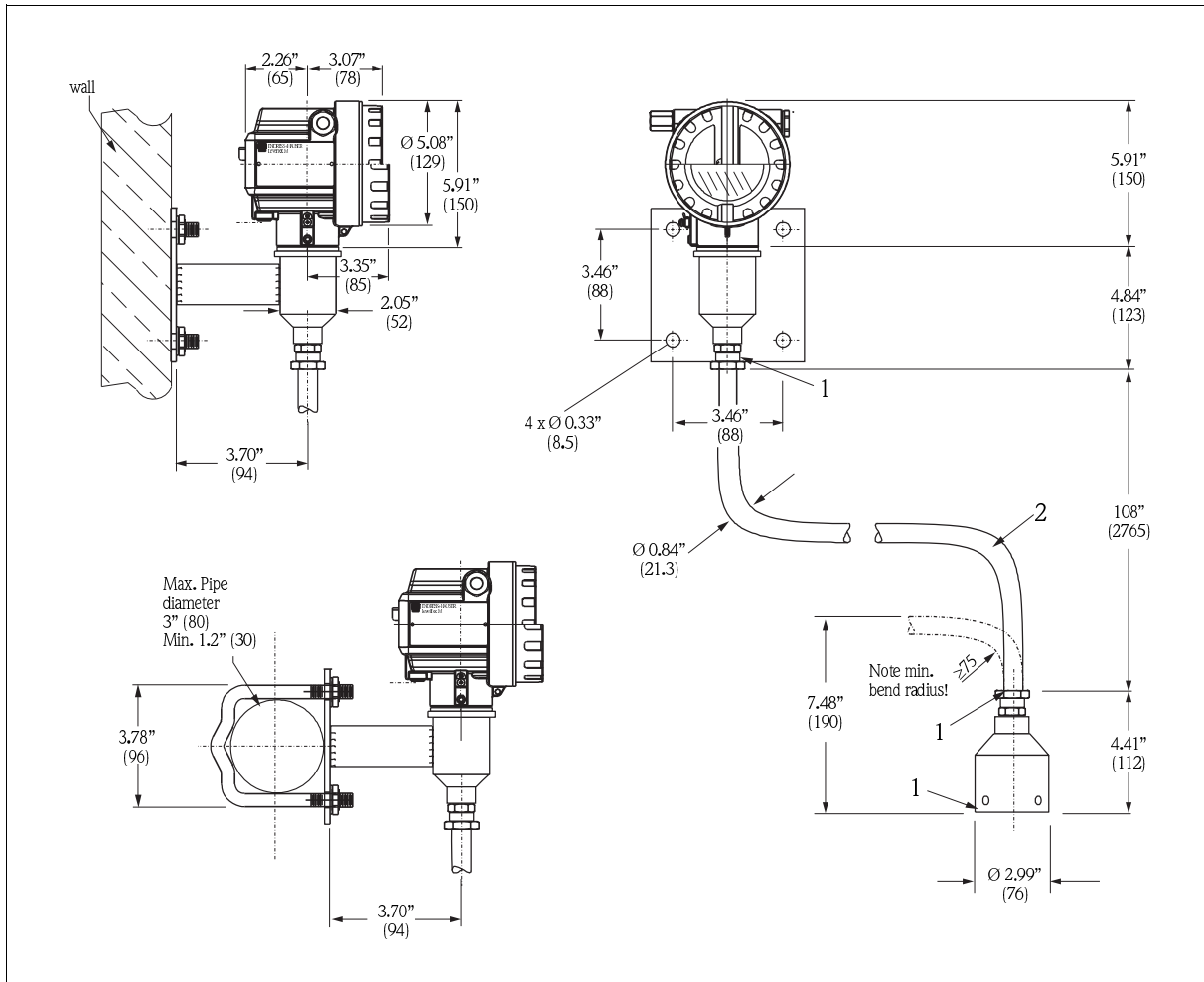
- After mounting, the housing can be turned 350° in order to make it easier to access the display and the connection compartment.
- The max. measuring range is reduced to 34 m (111 ft).



100-HMP40xxx-17-00-00-en-014

Installation with remote electronics

- When installing, follow the instructions on page 22.
- Mount housing on a wall or pipe (vertically or horizontally) as shown in the diagram.



Note!

The protective hose cannot be disassembled at these points (1).

The ambient temperature for the connecting pipe (2) between the probe and the electronics must not be greater than 105°C (221°F).

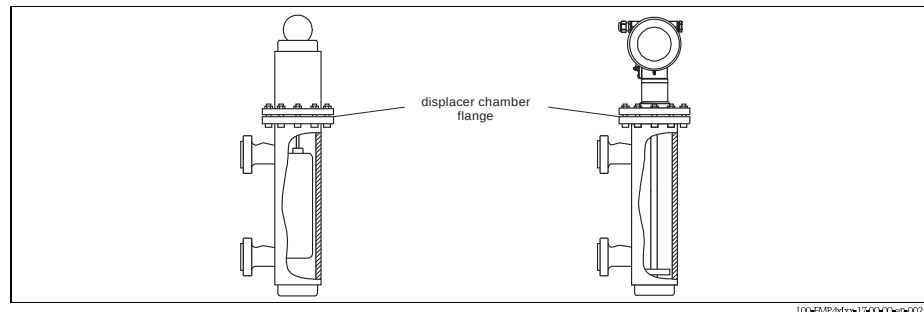
The version with remote electronics consists of the probe, a connecting cable and the housing. If they are ordered as a complete unit they are assembled when delivered.

Replacing a displacer system in an existing displacer chamber

The Levellflex M is a perfect replacement for a conventional displacer system in an existing displacer chamber. In addition to the DIN and ANSI flanges, which are available as standard, Endress+Hauser also offers flanges that suit Fischer and Masoneilan displacer chamber (special product) for this purpose. Thanks to menu-guided local operation, commissioning the Levellflex M only takes a few minutes. Replacement is also possible when partially filled, and wet calibration is not required.

Your benefits:

- No moving parts, thus zero-maintenance operation.
- Not sensitive to process influences such as temperature, density, turbulence and vibrations.
- The rod probes can be shortened or replaced easily. In this way, the probe can be easily adjusted on site.



100-FMP40-170000-002

Planning instructions:

- In normal cases, use a rod probe. When installing into a metallic displacer chamber up to 150 mm (6"), you have all the advantages of a coax probe (see probe selection page 6-7).
- It must be ensured that the probe does not come into contact with the side wall. Where necessary, use a centering disk at the lower end of the probe (page 55 "Type of Probe").
- A centering disk must be adapted as accurately as possible to the internal diameter of the displacer chamber to also ensure perfect operation in the area of the probe end.

Additional information on interface measurement

- The pipe may not exhibit any steps in diameter. Use the coax probe where necessary.
- In the case of rod probes, it must be ensured that the probe does not come into contact with the wall. If necessary, use a centering disk at the end of the probe.



Note!

A plastic centering disk has to be used for interface measurement (see Accessories page 59).

Operating conditions: Environment

Ambient temperature range

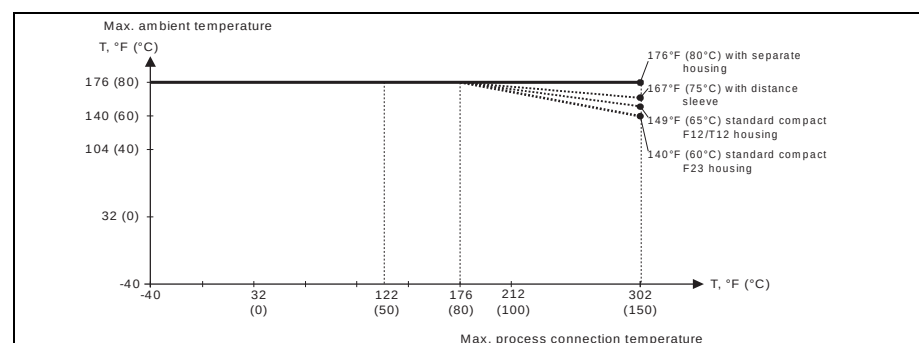
Ambient temperature at the electronics: -40°C to +80°C (-40° to +176°F)

The function of the LCD display is restricted at $T_A < -20^\circ\text{C}$ (-4°F) and $T_A > +60^\circ\text{C}$ (140°F).

A weather protection cover should be used for outdoor operation if the device is exposed to direct sunlight.

Ambient temperature limits

If temperatures above 80°C (176°F) are present at the process connection, the permitted ambient temperature is reduced according to the following diagram (temperature derating):



100-FMP40-170000-001

Please refer to the following standards for the pressure values permitted for higher temperatures:

- "EN 1092-1: 2001 Tab. 18
With regard to their temperature stability properties, the materials 1.4435 and 1.4404 are grouped under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5a - 1998 Tab. 2-2.2 F316
- ASME B 16.5a - 1998 Tab. 2.3.8 N10276
- JIS B 2220



Note!

All Levellflex probes have two levels of sealing. There is an O-ring seal and a molded seal behind that.

Materials in contact with process

Part	Material
Seal	See "Ordering information" from → 53
Process connection ¹⁾	See "Ordering information" from → 53
Feedthrough rod	1.4462, Duplex CR22
NordLock washers	1.4547
Cable probe	Cable probe, uninsulated: 1.4401; Weight: 1.4435 Cable probe coated: galv. steel PA 12 (Vestamid L 1940), suitable for use in food
Rod probe	See "Ordering information" from → 53
Coax probe	See "Ordering information" from → 53 Centering stars: PFA
All probes with 1½"- and flange connection	On the lower edge of the process connections: PTFE (Dyneon Hostaflon TFM 1600)
All probes with ¾" connection	Lower edge of the process connections: PPS-GF 40

- 1) Endress+Hauser supplies DIN/EN flanges made of stainless steel AISI 316L with the material number 1.4435 or 1.4404. With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

Dielectric constant

- With coax probe: $\epsilon_r \geq 1.4$
- Rod and cable probe: $\epsilon_r \geq 1.6$

Extension of the cable probes through tension and temperature

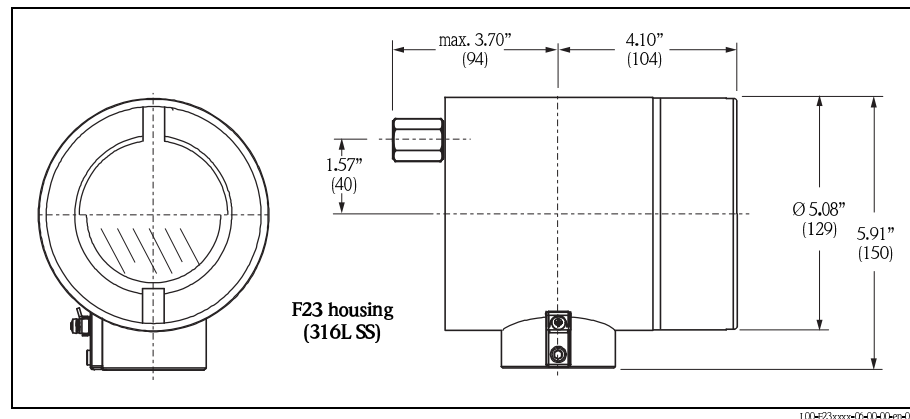
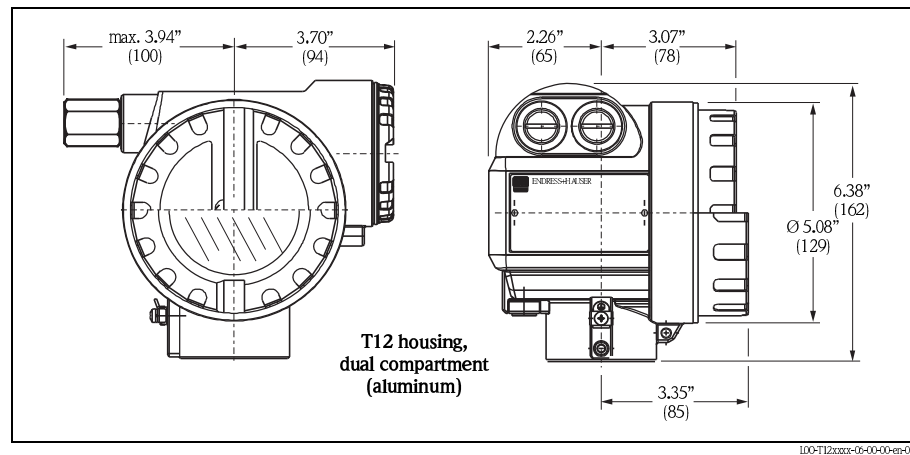
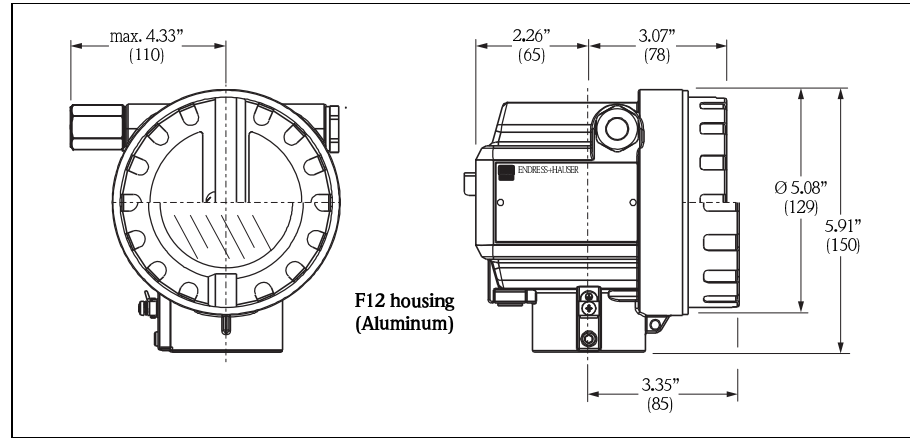
- 6 mm (0.24") cable:
- Elongation through tension: at max. permitted tensile load 6745 lbf (30 KN): 13 mm / m (0.51"/3 ft) cable length
 - Elongation through temperature increase from 30 to 150°C (86 to 350°F): 2 mm / m (0.08"/3 ft) cable length
- 4 mm (0.16") cable:
- Elongation through tension: at max. permitted tensile load 2700 lbf (12 KN): 11 mm / m (0.43"/3 ft) cable length
 - Elongation through temperature increase from 30 to 150°C (86 to 350°F): 2 mm / m (0.08"/3 ft) cable length

Mechanical construction

Design, dimensions

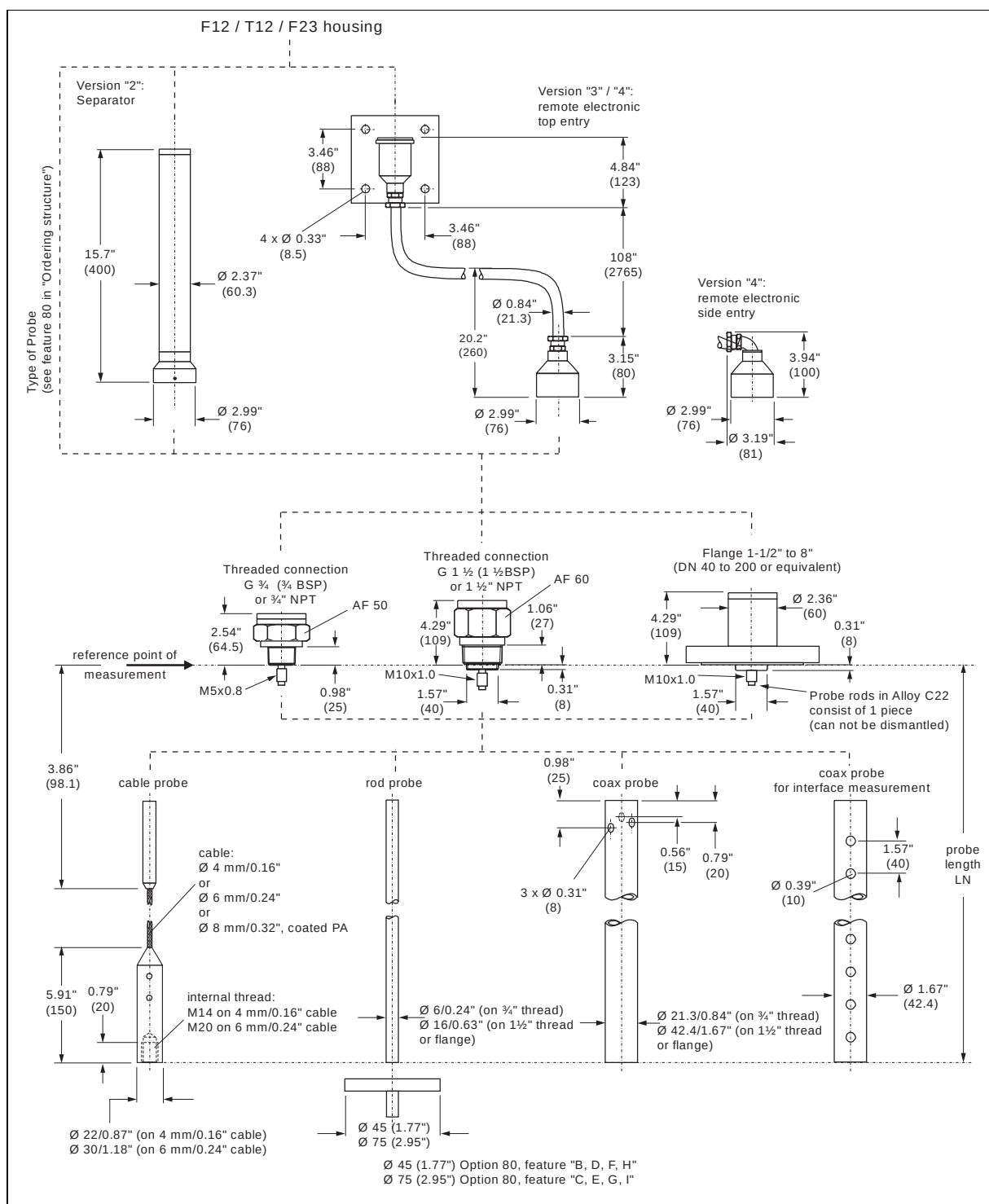
Housing dimensions

Dimensions for process connection and probe type page 43.



Levellflex M FMP40 - process connection, probe type

Housing dimensions page 42



General information on flanges

The surface roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards) made of Hastelloy C, Monel or Tantas, is Ra 3.2. Lower surface roughness levels are available on request.

Tolerance of probe length

Rod probes/coax probes				
Over		1 m (3 ft)	3 m (10 ft)	6 m (20 ft)
Up to	1 m (3 ft)	3 m (10 ft)	6 m (20 ft)	
Admissible tolerance (mm)	- 5 (-0.2")	- 10 (-0.4")	- 20 (-0.8")	- 30 (-1.2")

Cable probes				
Over		1 m (3 ft)	3 m (10 ft)	6 m (20 ft)
Up to	1 m (3 ft)	3 m (10 ft)	6 m (20 ft)	
Admissible tolerance (mm)	- 10 (-0.4")	- 20 (-0.8")	- 30 (-1.2")	- 40 (-1.6")

Weight

Levelflex M	FMP40 + cable probe 4 mm (0.16")	FMP40 + rod or cable probe 6 mm (0.24")	FMP40 + rod probe 16 mm (0.63")	FMP40 Coax probe
Weight for F12 or T12 housing	Approx. 4 kg (8.8 lb) + Approx. 0.1 kg/m (0.3 lb/3 ft) Probe length + weight of flange	Approx. 4 kg (8.8 lb) + Approx. 0.2 kg/m (0.4 lb/3 ft) Probe length + weight of flange	Approx. 4 kg (8.8 lb) + Approx. 1.6 kg/m Probe length (3.5/3 ft) + weight of flange	Approx. 4 kg (8.8 lb) + Approx. 3.5 kg/m Probe length (7.7 lb/3 ft) + weight of flange
Weight for F23 housing	Approx. 7.4 kg (16 lb) + Approx. 0.1 kg/m (0.3 lb/3 ft) Probe length + weight of flange	Approx. 7.4 kg (16 lb) + Approx. 0.2 kg/m (0.4 lb/3 ft) Probe length + weight of flange	Approx. 7.4 kg (16 lb) + Approx. 1.6 kg/m (3.5/3 ft) Probe length + weight of flange	Approx. 7.4 kg (16 lb) + Approx. 3.5 kg/m (7.7 lb/3 ft) Probe length + weight of flange

Material

- Housing:
 - Housing F12/T12: aluminum (AlSi10Mg), seawater-resistant, powder-coated
 - Housing F23: 316L, corrosion-resistant steel
- Sight window: glass

Process connection

See "Ordering information" on page 53.

Seal

See "Ordering information" on page 53.

Probe

See "Ordering information" on page 53.

Human interface

Operating concept

The display of the process value and the configuration of the Levellflex occur locally by means of a large 4-line alphanumeric display with plain text information. The guided menu system with integrated help texts ensures a quick and safe commissioning.

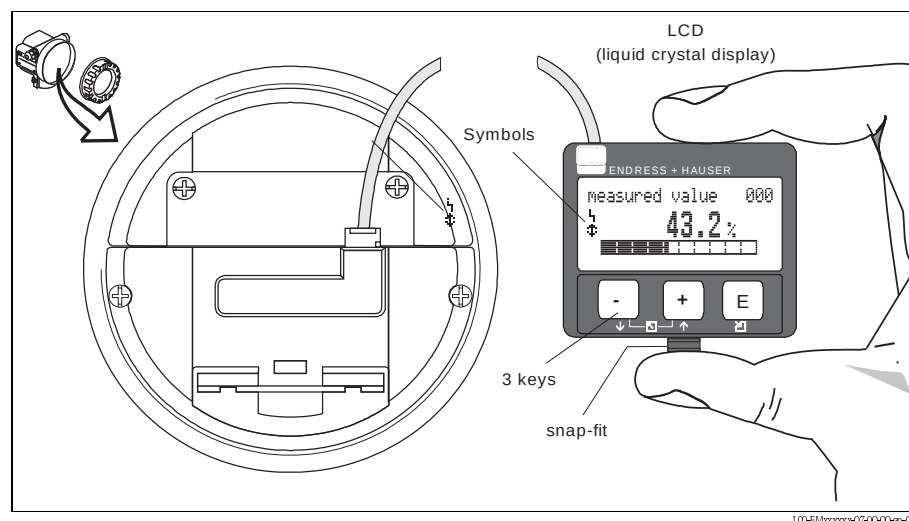
To access the display the cover of the electronic compartment may be removed even in hazardous area (IS and XP).

Remote commissioning, including documentation of the measuring point and in-depth analysis functions, is supported by FieldCare, the graphical operating software for Endress+Hauser time-of-flight systems.

Display elements

Liquid crystal display (LCD):

Four lines with 20 characters each. Display contrast adjustable through key combination.



100-FMxxxxxx07-00-00-en-001

The VU331 LCD display can be removed to ease operation by simply pressing the snap-fit (see graphic above). It is connected to the device by means of a 500 mm (20") cable.

The following table describes the symbols that appear on the liquid crystal display:

Symbol	Meaning
	ALARM_SYMBOL This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	LOCK_SYMBOL This lock symbol appears when the instrument is locked, i.e. if no input is possible.
	COM_SYMBOL This communication symbol appears when a data transmission via e.g. HART, PROFIBUS PA or FOUNDATION Fieldbus is in progress.
	SIMULATION_SWITCH_ENABLE This communication symbol appears when simulation in FOUNDATION Fieldbus is enabled via the DIP switch.

Operating elements

The operating elements are located inside the housing and are accessible for operation by opening the lid of the housing.

Function of the keys

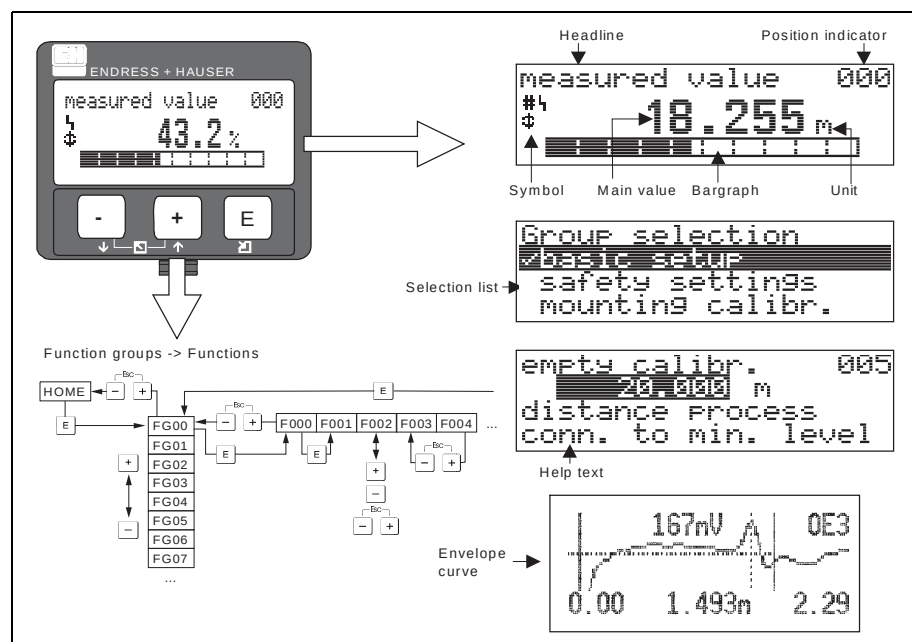
Key(s)	Meaning
 or 	Navigate upwards in the selection list Edit numeric value within a function
 or 	Navigate downwards in the selection list Edit numeric value within a function
 or 	Navigate to the left within a function group
	Navigate to the right within a function group, confirmation.
 and  or  and 	Contrast settings of the LCD
 and  and 	Hardware lock / unlock After a hardware lock, operation of the device via display or communication is not possible! The hardware can only be unlocked via the display. A release code must be entered to do so.

Local operation

Operation with VU331

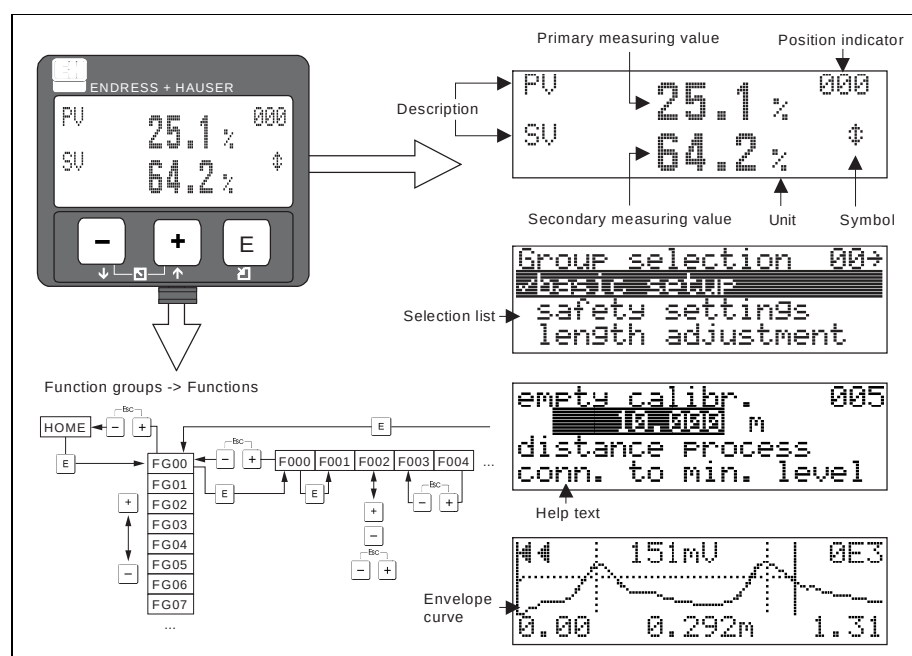
The LC-Display VU331 allows configuration via 3 keys directly at the instrument. All device functions can be set through a menu system. The menu consists of function groups and functions. Within a function, application parameters can be read or adjusted. The user is guided through a complete configuration procedure.

Display for level measurement



100-FMPxxxx-07-00-00-en-002

Display for interface measurement



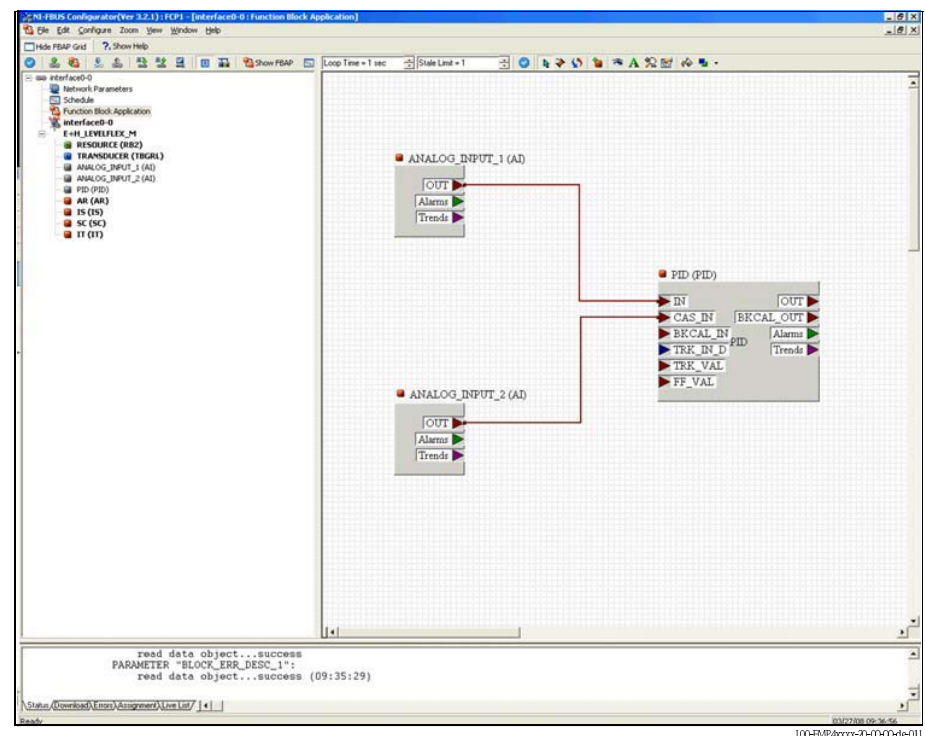
100-FMPxxxx-07-00-00-en-002

Operation with NI-FBUS Configurator (only FOUNDATION Fieldbus)

The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, loops, and a schedule based on the fieldbus concepts.

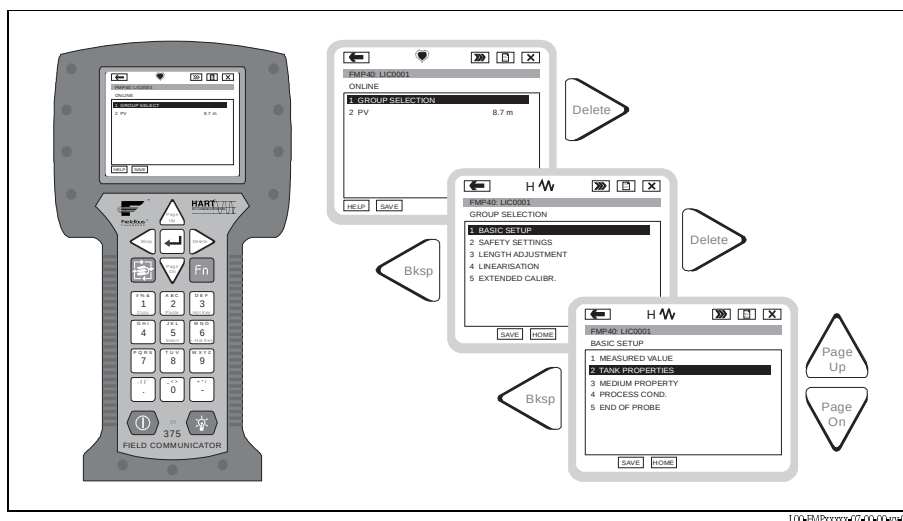
You can use the NI-FBUS Configurator to configure a fieldbus network as follows:

- Set block and device tags
- Set device addresses
- Create and edit function block control strategies (function block applications)
- Configure vendor-defined function and transducer blocks
- Create and edit schedules
- Read and write to function block control strategies (function block applications)
- Invoke Device Description (DD) methods
- Display DD menus
- Download a configuration
- Verify a configuration and compare it to a saved configuration
- Monitor a downloaded configuration
- Replace devices
- Save and print a configuration



Operation with handheld terminal Field Communicator 375

With the handheld terminal Field Communicator 375, you can configure all the device functions via menu operation.



Note!

- Further information on the HART handheld terminal is given in the appropriate Operating Instructions included in the carrying case of the Field Communicator 375.

Assignment of the certificates (XA, ZD, ZE) to the device:

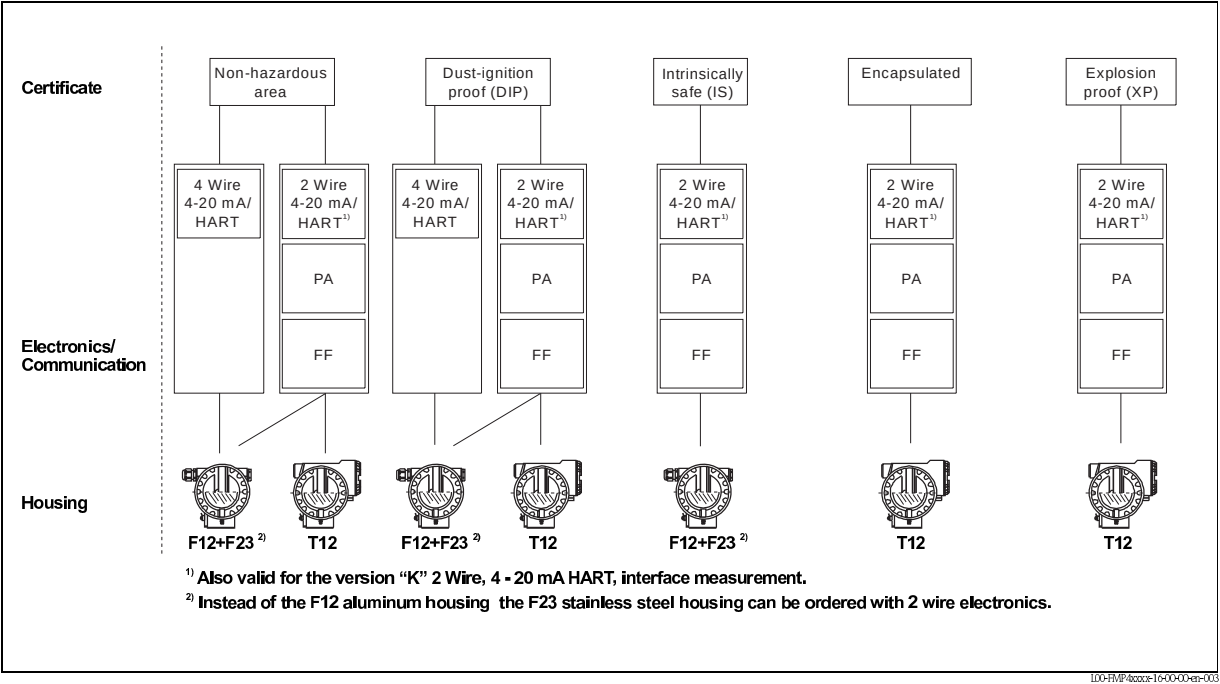
1) Housing F12/F23/T12-OVP: In combination with electronics B, D or F supply intrinsically safe.

Overspill protection	WHG. See "Ordering information" on page 53 (see ZE256F/00/en). SIL 2, for 4 to 20 mA output signal (see SD174F/00/en "Functional Safety Manual").
Telecommunications	Complies with part 15 of the FCC rules for an unintentional radiator. All probes meet the requirements for a Class A digital device. Coax probes and probes mounted in closed metallic vessels also meet the requirement for a class B digital device (residential environment).
Standards and guidelines applied	The European directives and standards applied can be taken from the associated EC Declarations of Conformity. In addition, the following also applied for Levelflex M: EN 60529 Protection class of housing (IP-code) NAMUR - international user association of automation technology in process industries ■ NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment. ■ NE 43 Standardization of the signal level for the failure information of digital transmitters.

Ordering information

Levelflex M FMP40

Instrument selection



100-FMP40xxx-16-0000-en-003

Temperature: (depending on O-ring)	V Viton, -30°C to +150°C (-22 to +302°F)	
	E EPDM, -40°C to +120°C (-40 to +248°F)	
	K Kalrez, -5°C to +150°C (+23 to +302°F)	
Pressure: (all types)	-1 to 40 bar (-14 to +580 psi)	
Wetted parts	Cable probes: Flanges: 1.4404 (SS316L) Process connection: 1.4435 (SS316L), 1.4462 Cable: 1.4401 (SS316) Cable weight: 1.4435 (SS316L)	Rod probes: Flanges: 1.4404 (SS316L) Process connection: 1.4435 (SS316L), 1.4462 Rod and coax pipe: 1.4435 (SS316L)

The metallic uninsulated probes are only insulated in the area of the bushing. Thus there is no danger of electrostatic charging. The PA-coated cable has been tested and there is no dangerous electrostatic charging. As a result, there are no restrictions on use in Ex-areas for any of the probes.



Note!
For orders with a display, the housing cover is delivered with an inspection glass. For orders without a display, a dummy cover is delivered.

Exception: For orders with the ATEX II 1/2 D dust ignition-proof certificate, a dummy cover is always delivered, even for orders with a built-in display.

This overview does not mark options which are mutually exclusive.

10	Approval:	A Non-hazardous area F Non-hazardous area, WHG 1 ATEX II 1/2G Ex ia IIC T6/IECEx Zone 0/1 2 ATEX II 1/2D, Alu blind cover 3 ATEX II 2G Ex em (ia) IIC T6/IECEx Zone I 4 ATEX II 1/3D 5 ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D 6 ATEX II 1/2G Ex ia IIC T6, WHG 7 ATEX II 1/2G Ex d (ia) IIC T6 8 ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D, WHG G ATEX II 3G Ex nA II T6 C NEPSI Ex em (ia) IIC T6 I NEPSI Ex ia IIC T6 J NEPSI Ex d (ia) IIC T6 Q NEPSI DIP R NEPSI Ex nA II T6 M FM DIP CL.II Div.1 Gr.E-G N.I. S FM IS CL.I,II,III Div.1 Gr.A-G N.I. T FM XP CL.I,II,III Div.1 Gr.A-G N CSA General Purpose P CSA DIP CL.II Div.1 Gr.G + coal dust, N.I. U CSA IS CL.I,II,III Div.1 Gr.A-D,G + coal dust, N.I. V CSA XP CL.I,II,III Div.1 Gr.A-D,G + coal dust, N.I. W IEC Ex td A20/21 X IEC Ex td A20/22 K *TIIS Ex ia IIC T4 L TIIS Ex d (ia) IIC T4 Y Special version, to be specified
20	Probe:	A Cable 4mm / 0.16", mainly liquid B Cable 6mm / 0.24", solid H Cable 6mm / 0.24", PA > steel, solid, T _{max} = 100°C / 212°F P Rod 6mm / 0.24", liquid I Rod 12mm / 0.47", liquid K Rod 16mm / 0.63", mainly liquid L Coax, liquid Y Special version, to be specified
30	Probe length:	A mm, cable 4mm, 316 B mm, cable 6mm, 316 C inch cable 0.16", 316 D inch, cable 0.24", 316 E mm, cable 6mm, PA > steel F inch, cable 0.24", PA > steel K mm, rod 16mm, 316L L mm, coax, 316L M inch, rod 16mm / 0.63", 316L N inch, coax, 316L P mm, rod 6mm, 316L R inch, rod 6mm / 0.24", 316L S *..... mm, rod 16mm, 316L, 500mm divisible T *..... mm, rod 16mm, 316L, 1000mm divisible U *..... inch, rod 16mm / 0.63", 316L, 500mm (20") divisible V *..... inch, rod 16mm, / 0.63" 316L, 1000mm (40") divisible 1 mm rod 12mm, AlloyC22 2 mm coax, AlloyC22 3 inch, rod 12mm / 0.47", AlloyC22 4 inch, coax, AlloyC22 Y Special version, to be specified
40	O-ring Material; Temperature:	2 Viton; -30...150°C/-22...302°F 3 EPDM; -40...120°C/-40...248°F 4 Kalrez; -5...150°C/23...302°F 9 Special version, to be specified

50						Process Connection:
						ACJ 1-1/2" 150lbs RF, 316/316L flange ANSI B16.5
						ACM 1-1/2" 150lbs, AlloyC22 >316/316L flange ANSI B16.5
						ADJ 1-1/2" 300lbs RF, 316/316L flange ANSI B16.5
						ADM 1-1/2" 300lbs, AlloyC22 >316/316L flange ANSI B16.5
						AEJ 2" 150lbs RF, 316/316L flange ANSI B16.5
						AEM 2" 150lbs, AlloyC22 >316/316L flange ANSI B16.5
						AFJ 2" 300lbs RF, 316/316L flange ANSI B16.5
						AFM 2" 300lbs, AlloyC22 >316/316L flange ANSI B16.5
						AIJ 3" 150lbs RF, 316/316L flange ANSI B16.5
						ALM 3" 150lbs, AlloyC22 >316/316L flange ANSI B16.5
						AMJ 3" 300lbs RF, 316/316L flange ANSI B16.5
						AMM 3" 300lbs, AlloyC22 >316/316L flange ANSI B16.5
						APJ 4" 150lbs RF, 316/316L flange ANSI B16.5
						APM 4" 150lbs, AlloyC22 >316/316L flange ANSI B16.5
						AQJ 4" 300lbs RF, 316/316L flange ANSI B16.5
						AQM 4" 300lbs, AlloyC22 >316/316L flange ANSI B16.5
						AWJ 6" 150lbs RF, 316/316L flange ANSI B16.5
						AWM 6" 150lbs, AlloyC22 >316/316L flange ANSI B16.5
						A3J 8" 150lbs RF, 316/316L flange ANSI B16.5
						CFJ DN40 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
						CFM DN40 PN25/40, AlloyC22 >316L flange EN1092-1 (DIN2527)
						CGJ DN50 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
						CGM DN50 PN25/40, AlloyC22 >316L flange EN1092-1 (DIN2527)
						CMJ DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
						CMM DN80 PN10/16, AlloyC22 >316L flange EN1092-1 (DIN2527)
						CSJ DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
						CSM DN80 PN25/40, AlloyC22 >316L flange EN1092-1 (DIN2527)
						CQJ DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
						CQM DN100 PN10/16, AlloyC22 >316L flange EN1092-1 (DIN2527)
						CTJ DN100 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
						CTM DN100 PN25/40, AlloyC22 >316L flange EN1092-1 (DIN2527)
						CWJ DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
						CWM DN150 PN10/16, AlloyC22 >316L flange EN1092-1 (DIN2527)
						CXJ DN200 PN16 B1, 316L flange EN1092-1 (DIN2527 C)
						CRJ Thread ISO228 G3/4, 316L
						GRJ Thread ISO228 G1-1/2, 316L
						GRM Thread ISO228 G1-1/2, AlloyC22
						CNJ Thread ANSI NPT3/4, 316L
						GNJ Thread ANSI NPT1-1/2, 316L
						GNM Thread ANSI NPT1-1/2, AlloyC22
						KDJ 10K 40 RF, 316L flange JIS B2220
						KDM 10K 40, AlloyC22 >316L flange JIS B2220
						KEJ 10K 50 RF, 316L flange JIS B2220
						KEM 10K 50, AlloyC22 >316L flange JIS B2220
						KLJ 10K 80 RF, 316L flange JIS B2220
						KLM 10K 80, AlloyC22 >316L flange JIS B2220
						KPJ 10K 100 RF, 316L flange JIS B2220
						KPM 10K 100, AlloyC22 >316L flange JIS B2220
						YY9 Special version, to be specified
60						Power Supply; Output:
						B 2-wire; 4-20mA SIL HART
						D 2-wire; PROFIBUS PA
						F 2-wire; FOUNDATION Fieldbus
						K 2-wire; 4-20mA HART, Interface measurement
						G 4-wire 90-250VAC; 4-20mA SIL HART
						H 4-wire 10.5-32VDC; 4-20mA SIL HART
						Y Special version, to be specified
70						Operation:
						1 W/o display, via communication
						2 4-line display VU331, Envelope curve display, local
						3 Prepared for FHX40, Remote display (Accessory)
						9 Special version, to be specified
80						Type of Probe:
						B *Compact, centering disk d=45mm, 316L, pipe diameter DN50/2" + DN65/2-1/2"
						C *Compact, centering disk d=75mm, 316L, pipe diameter DN80/3" + DN100/4"
						D *Spacer, center rod d=45mm, 316L, pipe diameter DN50/2" + DN65/2-1/2", spacer, 400mm

You can fill in the options of the respective feature into the following table. The filled in options result in the complete order code.

FMP40-											complete product designation
--------	--	--	--	--	--	--	--	--	--	--	------------------------------

Please enter probe length in mm or inch / 0.1 inch

mm

inch / 0.1 inch

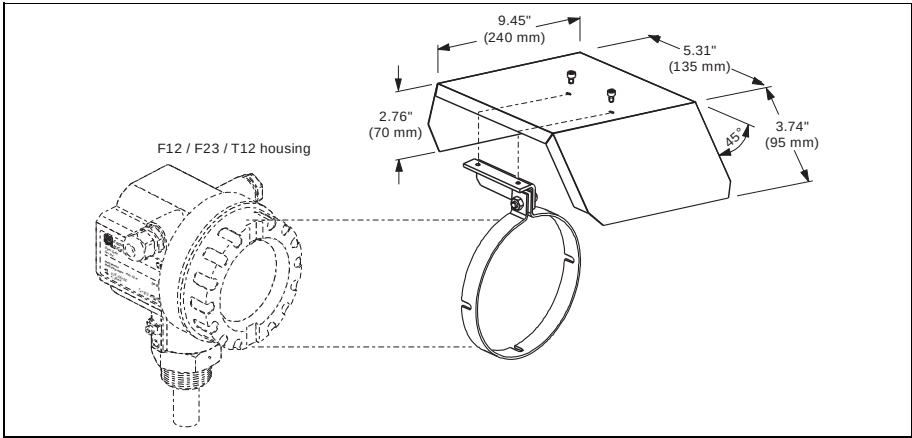
probe lenght LN → Page 43

1) OVP = overvoltage protection

Accessories

Weather protection cover

A weather protection cover made of stainless steel is available for outdoor installation (order code: 543199-0001). The shipment includes the protective cover and tension clamp.

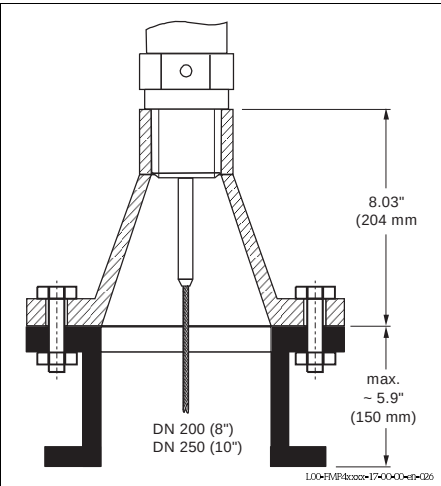


100-FMR2xxxx-00-00-06-en-001

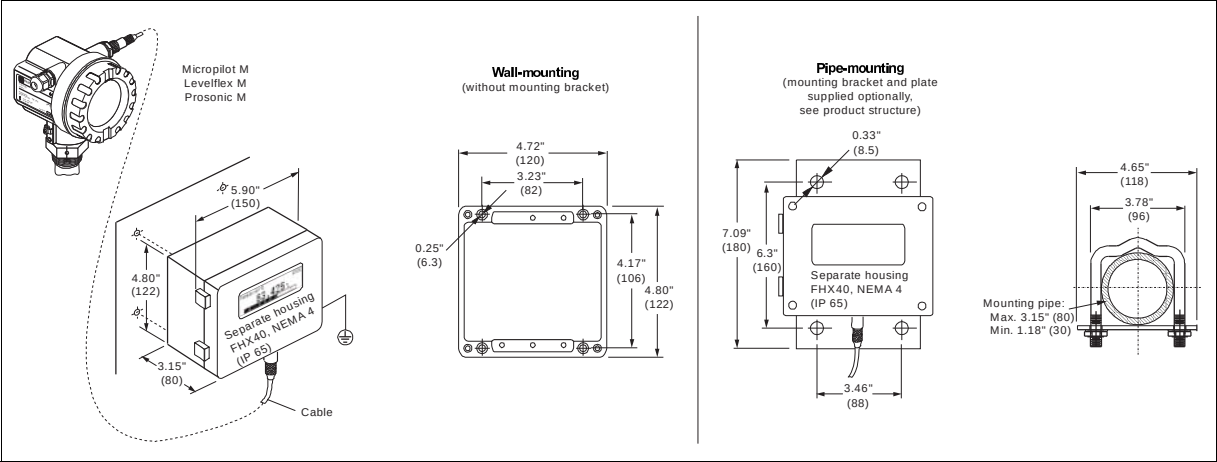
Flange with horn adapter to adapt on the following nozzles

Horn adapter	Order-No.
G 1 1/2" at DN 200 / PN 16	52014251
G 1 1/2" at DN 250 / PN 16	52014252
NPT 1 1/2" at 8" / 150 psi	52014253
NPT 1 1/2" at 10" / 150 psi	52014254

Material: 1.4435



Remote display and operation
FHX40



Technical data (cable and housing) and product structure:

Max. cable length	20 m (65 ft)
Temperature range	-30°C to +70°C (-22°F to 158°F)
Degree of protection	IP65/67 (NEMA 4), housing; IP68 (NEMA 6), cable acc. to IEC 60529
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm] / [inch]	122x150x80 (HxWxD) / 4.8 x 5.9 x 3.2

		Approval:
	A	Non-hazardous area
	C	NEPSI Ex ia IIC T6/T5
	G	IECEx Zone1 Ex ia IIC T6/T5
	K	TIIS Ex ia IIC T6
	N	CSA General Purpose
	S	FM IS Cl. I Div.1 Gr. A-D
	U	CSA IS Cl. I Div.1 Gr. A-D
	I	ATEX II 2G Ex ia IIC T6, ATEX II 3D
	Y	Special version, to be specified
		Cable:
	1	20m / 65ft (> for HART)
	5	20m / 65ft (> for PROFIBUS PA/FOUNDATION Fieldbus)
	9	Special version, to be specified
		Additional option:
	A	Basic version
	B	Mounting bracket, pipe 1" / 2"
	Y	Special version, to be specified
		Marking:
	1	Tagging (TAG)
FHX40 -		Complete product designation

For connection of the remote display FHX40 use the cable which fits the communication version of the respective instrument.

Centering disks

If the probes with rod version are used in a stilling well or bypass, it must be ensured that the probe does not come into contact with the wall. The centering disk fixes the rod probe in the middle of the pipe.

Centering disk PEEK Ø 1.89 - 3.74 inch

The centering disk is suitable for probes with a rod diameter of Ø 0.63in and can be used in pipes from DN40 (1½") up to DN100 (4"). Markings on the 4-leg centering disk ensure a simple tailoring. Hence the centering disk can be adapted to the pipe diameter. See also Operating Instruction BA377F.

- PEEK (statically dissipative)
- Measuring range: -60 to +250°C (-76 to +482°F)

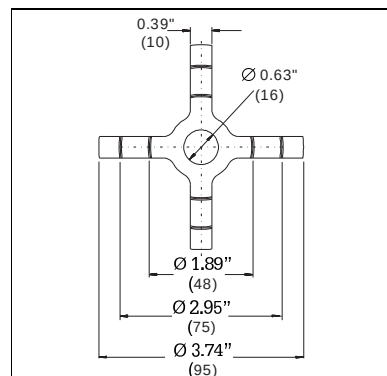
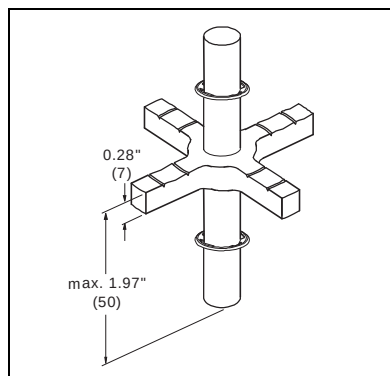
Order-no. 71069064



Note!

If the centering disk is inserted in an bypass, it must be positioned below the lower bypass outlet. This has to be accounted for when choosing the probe length.

Generally, the centering disk should not be mounted higher than 50 mm (2") from the probe end. It is recommended not to insert the PEEK centering disk in the measuring range of the rod probe.

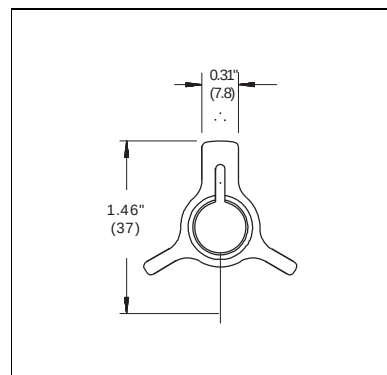
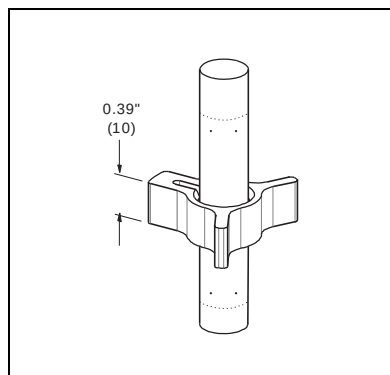


Centering disk PFA Ø 1.46 inch

The centering disk is suitable for probes with a rod diameter of 0.63 inch (also coated rod probes) and can be used in pipes from DN40 (1½") up to DN50 (2").

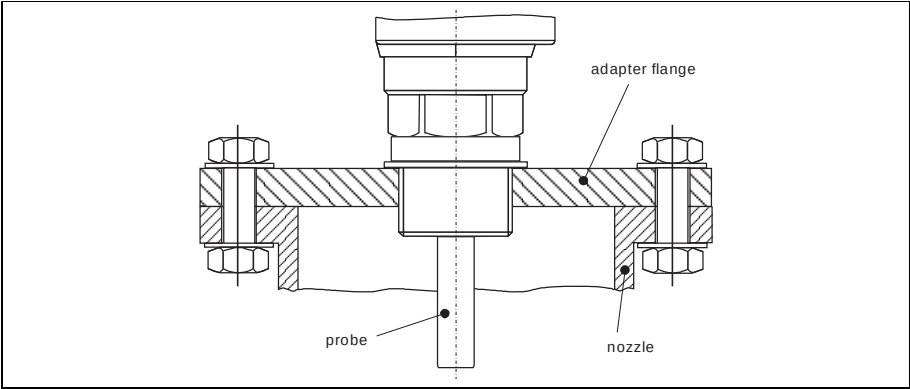
- Measuring range: -20 to +150°C (-4 to +302°F)

Order-no. 71069065



Commubox FXA191 HART	For intrinsically safe HART communication with FieldCare via the RS232C interface. For details refer to TI237F/00/en.
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details refer to TI404F/00/en.
Commubox FXA291 	The Commubox FXA291 connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) to the USB port of a personal computer or laptop. For details refer to TI405C/07/en. Note! For the following Endress+Hauser devices you need the "ToF adapter FXA291" as an additional accessory: ■ Cerabar S PMC71, PMP7x ■ Deltabar S PMD7x, FMD7x ■ Deltapilot S FMB70 ■ Gammapilot M FMG60 ■ Levelflex M FMP4x ■ Micropilot FMR130/FMR131 ■ Micropilot M FMR2xx ■ Micropilot S FMR53x, FMR540 ■ Prosonic FMU860/861/862 ■ Prosonic M FMU4x ■ Tank Side Monitor NRF590 (with additional adapter cable)
ToF adapter FXA291	The ToF adapter FXA291 connects the Commubox FXA291 via the USB port of a personal computer or laptop to the following Endress+Hauser devices: ■ Cerabar S PMC71, PMP7x ■ Deltabar S PMD7x, FMD7x ■ Deltapilot S FMB70 ■ Gammapilot M FMG60 ■ Levelflex M FMP4x ■ Micropilot FMR130/FMR131 ■ Micropilot M FMR2xx ■ Micropilot S FMR53x, FMR540 ■ Prosonic FMU860/861/862 ■ Prosonic M FMU4x ■ Tank Side Monitor NRF590 (with additional adapter cable) For details refer to KA271F/00/a2.

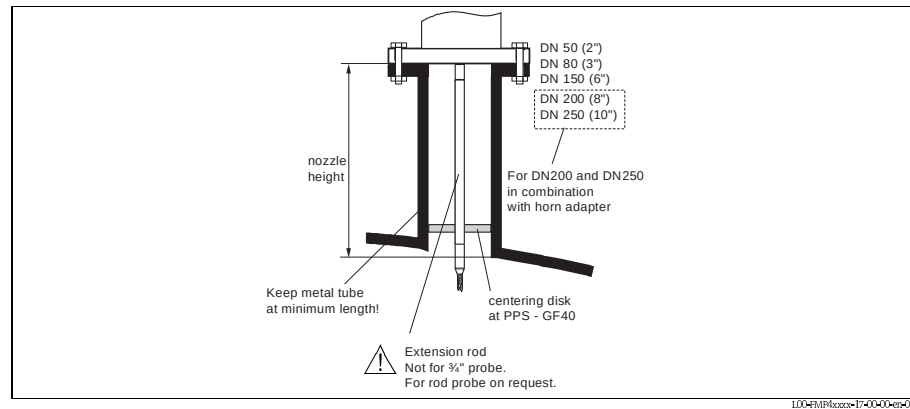
Adapter flange FAU70E / FAU70A



Process connection		
12	DN50 PN16 A, flange EN1092-1 (DIN2527 B)	
14	DN80 PN16 A, flange EN1092-1 (DIN2527 B)	
15	DN100 PN16 A, flange EN1092-1 (DIN2527 B)	
99	Special version, to be specified	
Sensor connection		
3	Thread ISO228 G1-1/2	
4	Thread ISO228 G2	
9	Special version, to be specified	
Flange material		
2	316L	
3	Steel	
7	Polypropylene	
9	Special version, to be specified	
FAU70E		Complete product designation

Process connection		
22	2" 150lbs FF, flange ANSI B16.5	
24	3" 150lbs FF, flange ANSI B16.5	
25	4" 150lbs FF, flange ANSI B16.5	
99	Special version, to be specified	
Sensor connection		
5	Thread NPT1-1/2	
6	Thread NPT2	
9	Special version, to be specified	
Flange material		
2	316L	
3	Steel	
7	Polypropylene	
9	Special version, to be specified	
FAU70A		Complete product designation

Extension rod / Centering



Approval

A	Non-hazardous area
M	FM DIP Cl.II Div.1 Gr. E-G N.I.
P	CSA DIP Cl.II Div.1 Gr. G + Coal dust, N.I.
S	FM Cl.I, II, III Div.1 Gr. A-G, N.I.
U	CSA Cl.I, II, III Div.1 Gr. A-G N.I.
1	ATEX II 1G
2	AREX II 1D

Extension rod

1	115mm; 150-250mm / 6-10"
2	215mm; 250-350mm / 10-14"
3	315mm; 350-450mm / 14-18"
4	415mm; 450-550mm / 14-22"
9	Special version, to be specified

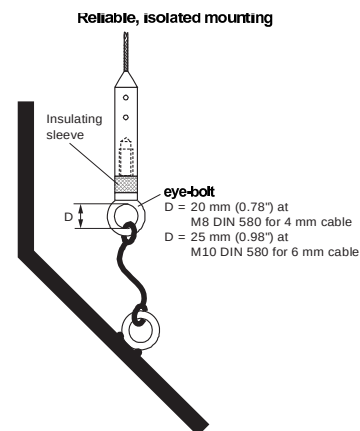
Center washer

A	not selected
B	DN40 / 1-1/2", inside-d.= 40-45mm, PPS
C	DN50 / 2", inside-d.= 50-57mm, PPS
D	DN80 / 3", inside-d.= 80-85mm, PPS
E	DN80 / 3", inside-d.= 76-78mm, PPS
G	DN100 / 4", inside-d.= 100-110mm, PPS
H	DN150 / 6", inside-d.= 152-164mm, PPS
J	DN200 / 8", inside-d.= 210-215mm, PPS
K	DN250 / 10", inside-d.= 253-269mm, PPS
Y	Special version, to be specified

HMP40- Complete product designation

Mounting-kit isolated

Mounting-kit	Order-No.
for 4mm (0.16") cable probe	52014249
for 6mm (0.24") cable probe	52014250
If a cable probe has to be fixed and a secure grounded mounting is not possible, we recommend using the insulating sleeve made of PEEK GF-30 with accompanying DIN 580 eye-bolt made of stainless steel. Max. process temp. 150°C (302°F). Due to the risk of electrostatic charge, the insulating sleeve is not suitable for use in hazardous areas. In these cases the fixing must be reliably grounded (page 26).	



HART loop converter HMX50 The HART loop converter HMX50 can be acquired using the order number 71063562.
Additional documentation: TI429F and BA371F.

Additional documentation

This Additional documentation can be found on our product pages on "www.endress.com".

Special Documentation

Time of Flight Liquid Level Measurement

Selection and engineering for the process industry, SD157F/00/en.

Radar Tank Gauging brochure

For inventory control and custody transfer applications in tank farms and terminals, SD001V/00/en.

Technical Information

Tank Side Monitor NRF590

Technical Information for Tank Side Monitor NRF590, TI402F/00/en.

Fieldgate FXA520

Technical Information for Fieldgate FXA520, TI369F/00/en.

Operating Instructions

Levellflex M FMP40

Correlation of operating instructions to the instrument:

Instrument	Output	Communication	Operating Instructions	Description of Device Functions	Brief Operating Instructions (in the device)
FMP40	B, G, H	HART	BA242F/00/en	BA245F/00/en	KA189F/00/a2
	K	HART (interface)	BA363F/00/en	BA366F/00/en	KA283/F/00/a2
	D	PROFIBUS PA	BA243F/00/en	BA245F/00/en	KA189F/00/a2
	F	FOUNDATION Fieldbus	BA244F/00/en	BA245F/00/en	KA189F/00/a2

Tank Side Monitor NRF590

Operating Instructions for Tank Side Monitor NRF590, BA256F/00/en.

Description of Instrument Functions for Tank Side Monitor NRF590, BA257F/00/en.

Engineering hints PROFIBUS PA

Guidelines for planning and commissioning, BA198F/00.

Certificates

See Section "Certificates and approvals" → Page 51 ff..

Patents

This product is protected by at least one of the following patents.
Further patents are pending.

- US 5,661,251 ≙ EP 0 780 664
- US 5,827,985 ≙ EP 0 780 664
- US 5,884,231 ≙ EP 0 780 665
- US 5,973,637 ≙ EP 0 928 974

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TI358F/24/ae/05.09
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Technical Information

Liquiphant M FTL50(H), FTL51(H)

Vibronic

Point level switch for all kinds of liquids

Suitable for use in hazardous areas, food and pharmaceuticals



The reliable function is not affected by flow, turbulence, bubbles, foam, vibration, solids content or buildup. The Liquiphant is thus the ideal substitute for float switches.

FTL50:

Compact design, ideal for mounting in pipes and for installation in areas difficult to access

FTL51:

With extension pipe up to 115" (3 m) Optional lengths up to 235" (6 m) available

FTL50H, FTL51H:

With polished tuning fork and easy-to-clean process connections and housings for food and pharmaceutical applications

High corrosion-resistant AlloyC4 (2.4610), AlloyC22 (2.4602) is available for the fork and process connections for applications in very aggressive liquids.

International approvals certify use in hazardous areas.

Your benefits

- Use in safety systems requiring functional safety to SIL2/SIL3 in accordance with IEC 61508/IEC 61511-1
- Large number of process connections to choose from: universal usage
- Suitable for use in sterile applications in the life science industry (device design according to ASME BPE-2007)
- PROFIBUS PA protocol: for commissioning and maintenance
- No adjustment: quick, low-cost startup
- No mechanically moving parts: no maintenance, no wear, long operating life
- Monitoring of fork for damage: guaranteed function
- FDA-approved material (PFA Edlon)
- Compact stainless steel housing (optional): the IP69K protection rating guarantees the unit remains permanently tight and can keep out water even in the event of intensive cleaning or flooding for several hours.

Application

The Liquiphant M is a point level switch which can be used in all liquids

- for process temperatures from -58 to +300°F (-50 to 150°C)
- for pressures up to 1450 psi (100 bar)
- for viscosity up to 10,000 cP (10,000 mm²/s)
- for densities ≥ 0.5 or ≥ 0.7 SGU (0.5 g/cm³ or ≥ 0.7 g/cm³), other settings available on request
- foam detection on request

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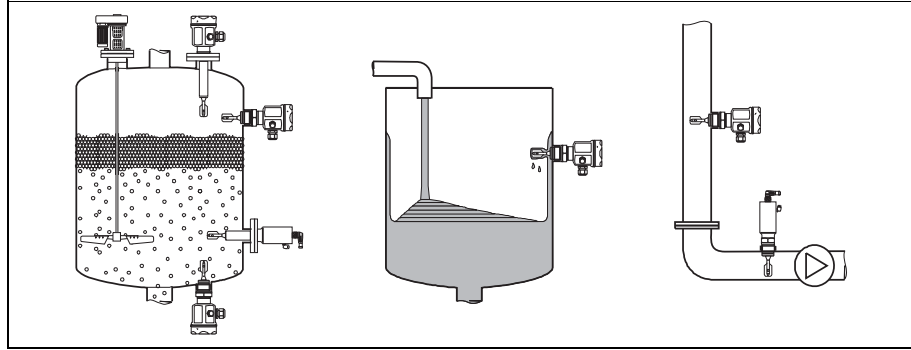
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Application

Point level detection

Maximum or minimum detection in tanks or pipes containing all kinds of liquids, including use in hazardous areas, food and pharmaceuticals.



100-FTL5xxxx-11-05-en-000

Function and system design

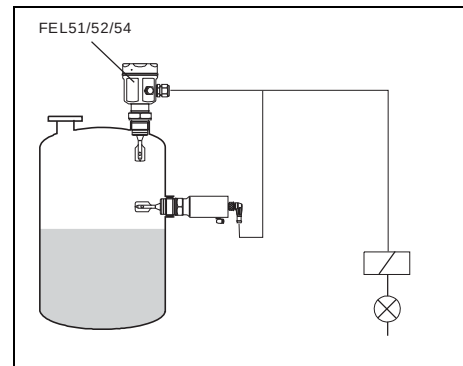
Measuring principle

The sensor's fork vibrates at its intrinsic frequency. This frequency is reduced when covered with liquid. This change in frequency causes the point level switch to switch.

Modularity

Point level switch

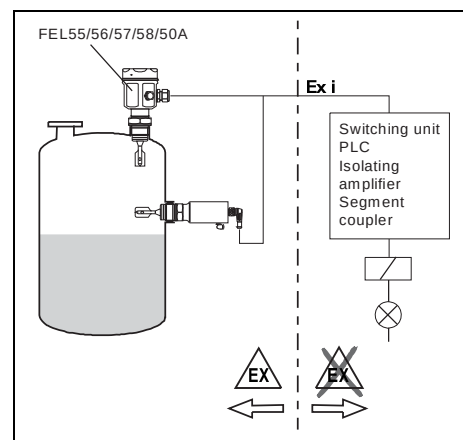
Liquiphant M FTL with electronic versions FEL51, FEL52, FEL54



100-FTL5xxxx-15-05-en-000

Point level switch

Liquiphant M FTL with electronic versions FEL55, FEL56, FEL57, FEL58 for connecting to a separate switching unit or an isolating amplifier FEL50A for connecting to a PROFIBUS PA segment



100-FTL5xxxx-15-05-en-000

Electronic versions	FEL51: Two-wire AC version; Switches the load directly into the power supply circuit via an electronic switch. FEL52: Three-wire DC version; Switches the load via the transistor (PNP) and separate connection. FEL54: Universal current version with relay output; Switches the loads via 2 floating change-over contacts. FEL55: For separate switching unit; signal transmission 16/8 mA on two-wire cabling. FEL56: For separate switching unit; signal transmission L-H edge 0.6 to 1.0 / 2.2 to 2.8 mA to EN 50227 (NAMUR) on two-wire cabling. FEL58: For separate switching unit; signal transmission H-L edge 2.2 to 3.5 / 0.6 to 1.0 mA to EN 50227 (NAMUR) on two-wire cabling. Checking of connecting cabling and other devices by pressing a key on the electronic insert. FEL57: For separate switching unit; PFM signal transmission; Current pulses superposed on the power supply along the two-wire cabling. Cyclical checking from the switching unit without changing levels. FEL50A: For connecting to PROFIBUS PA; Cyclic and acyclic data exchange acc. to PROFIBUS-PA Profile 3.0 Discrete Input
Electronics for continuous density measurement	FEL50D: For connecting to Density Computer FML621
Galvanic isolation	FEL51, FEL52, FEL50A: Between sensor and power supply FEL54: Between sensor and power supply and load FEL55, FEL56, FEL57, FEL58, FEL50D: See connected switching unit
Design	FTL50: Compact FTL51: With extension pipe FTL50H: Compact, with polished tuning fork and hygienic process connections FTL51H: With extension pipe, polished tuning fork and hygienic process connections

Input

Measured variable	Level (limit value)
Measuring range (detection range)	FTL50: Depends on mounting point FTL51: Depends on mounting point and the pipe extension. Standard 118" / 3000 mm (up to 236" / 6000 mm on request)
Density	Adjustment on the electronic insert > 0.5 SGU (0.5 g/cm ³) or > 0.7 SGU (0.7 g/cm ³), other on request

Electronic insert FEL51 (AC 2-wire)

Power supply

Supply voltage: 19 to 253 V AC
 Power consumption: < 0.83 W
 Residual current consumption: < 3.8 mA
 Short-circuit protection
 Overvoltage protection FEL51: overvoltage category III

Electrical connection

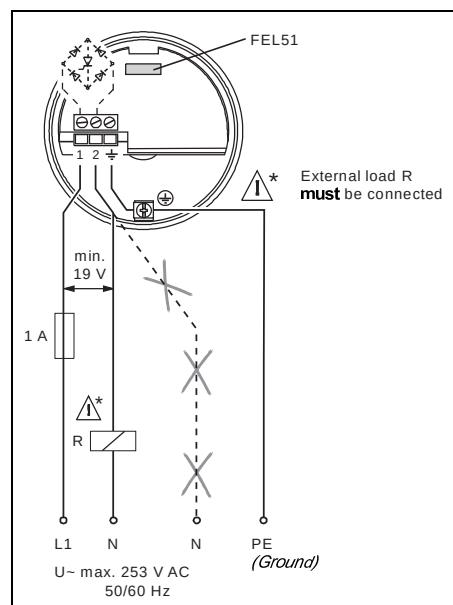
Two-wire AC connection

Switches the load directly into the power supply circuit via an electronic switch.

Always connect in series with a load!

Check the following:

- The residual current in blocked state (up to 3.8 mA)
- That for low voltage
 - the voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
 - the voltage drop across the electronics when switched through is observed (up to 12 V)
- That a relay cannot de-energize with holding power below 3.8 mA.
 If this is the case, a resistor should be connected parallel to the relay. An RC module is available under the modification number MVT2Y1278.
- When selecting the relay, pay attention to the holding power / rated power (see "Connectable load")



L00-FTL5xxxx-04+05-x8-en-007

Output signal

I_L = load current (switched through)

< 3.8 mA = residual current (blocked)



= lit



= unlit

L00-FTL2xxxx-07+05-x2-en-000

Safety mode	Level	Output signal	LEDs green	red
Max.		1 $\xrightarrow{I_L}$ 2		
		1 $\xrightarrow{< 3.8 \text{ mA}}$ 2		
Min.		1 $\xrightarrow{I_L}$ 2		
		1 $\xrightarrow{< 3.8 \text{ mA}}$ 2		

L00-FTL5xxxx-04+05-x8-en-001

Signal on alarm

Output signal on power failure or in the event of damaged sensor: < 3.8 mA

Connectable load

- For relays with a minimum holding power/rated power > 2.5 VA at 253 V AC (10 mA) or > 0.5 VA at 24 V AC (20 mA)
- Relays with a lower holding power/rated power can be operated by means of an RC module connected in parallel.
- For relays with a maximum holding power/rated power < 89 VA at 253 AC or < 8.4 VA at 24 V AC
- Voltage drop across FEL51 max. 12V
- Residual current with blocked electrical switch: max. 3.8 mA.
- Load switched directly into the power supply circuit via the thyristor.
 Transient (40 ms) max. 1.5 A, max. 375 VA at 253 V or max. 36 VA at 24 V (not short-circuit proof)

Electronics FEL51 (AC, in compact housing)

Power supply

Supply voltage: 19 to 253 V AC
 Power consumption: < 0.83 W
 Residual current consumption: < 3.8 mA
 Short-circuit protection
 Overvoltage protection FEL51: overvoltage category III

Electrical connection

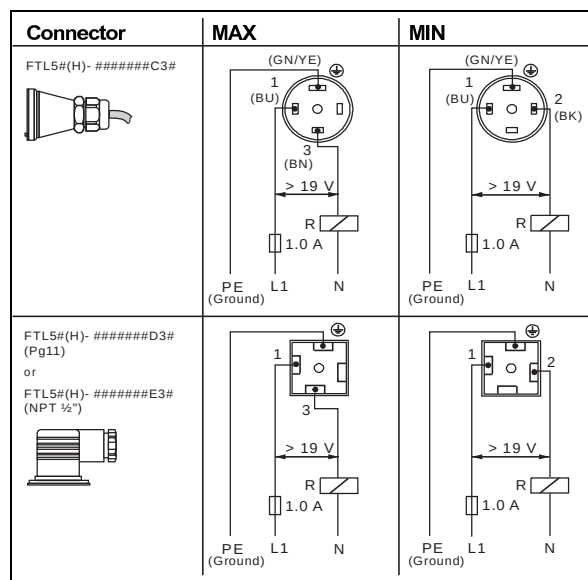
Two-wire AC connection

Switches the load directly into the power supply circuit via an electronic switch.

Always connect in series with a load!

Check the following:

- The residual current in blocked state (up to 3.8 mA)
- that for low voltage
 - the voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
 - the voltage drop across the electronics when switched through is observed (up to 12 V)



L00-FTL5xxxx-04-05-xx-en-008

- That a relay cannot de-energize with holding power below 3.8 mA.
 If this is the case, a resistor should be connected parallel to the relay (RC module available on request).

Output signal

I_L = load current (switched through)
 < 3.8 mA = residual current (blocked)

= lit
 = unlit

L00-FTL2xxxx-07-05-xx-en-000

Safety mode	Level	Output signal	LEDs green	red
Max.		1 $\xrightarrow{I_L}$ 3		
		1 $\xrightarrow{< 3.8 \text{ mA}}$ 3		
Min.		1 $\xrightarrow{I_L}$ 2		
		1 $\xrightarrow{< 3.8 \text{ mA}}$ 2		

L00-FTL5xxxx-04-05-xx-en-008

Signal on alarm

Output signal on power failure or in the event of damaged sensor: < 3.8 mA

Connectable load

- For relays with a minimum holding power/rated power > 2.5 VA at 253 V AC (10 mA) or > 0.5 VA at 24 V AC (20 mA)
- Relays with a lower holding power/rated power operated by means of an RC module connected in parallel.
- For relays with a maximum holding power/rated power < 89 VA at 253 AC or < 8.4 VA at 24 V AC
- Voltage drop across FEL51 max. 12V
- Residual current with blocked electrical switch: max. 3.8 mA.
- Load switched directly into the power supply circuit via the thyristor.
 Transient (40 ms) max. 1.5 A, max. 375 VA at 253 V or max. 36 VA at 24 V (not short-circuit proof)

Electronic insert FEL52 (DC PNP)

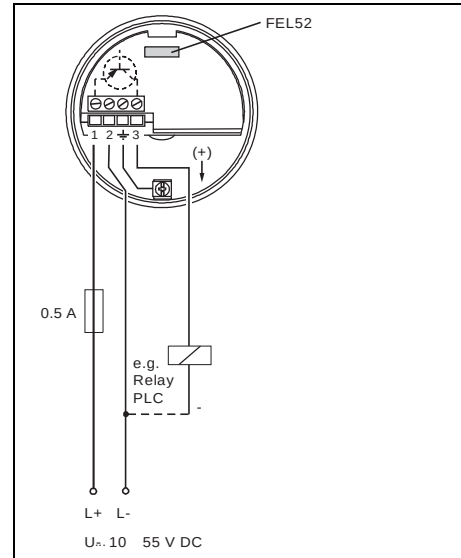
Power supply

Supply voltage: 10 to 55 V DC
 Ripple: max. 1.7 V, 0 to 400 Hz
 Current consumption: max. 15 mA
 Power consumption: max. 0.83 W
 Reverse polarity protection
 Overvoltage protection FEL52: overvoltage category III

Electrical connection

Three-wire DC connection

Preferably used with programmable logic controllers (PLC).
 DI module as per EN 61131-2.
 Positive signal at switching output of the electronics (PNP);
 Output blocked on reaching limit.



100-FTL5xxxx-04-05-xx-xx-001

Output signal

I_L = load current
(switched through)

$< 100 \mu A$ = residual current
(blocked)



= lit



= unlit

100-FTL5xxxx-04-05-xx-xx-000

Safety mode	Level	Output signal	LEDs green	red
Max.		$L+ \xrightarrow{I_L} +$ 1 → 3		
		$1 \xrightarrow{< 100 \mu A} 3$		
Min.		$L+ \xrightarrow{I_L} +$ 1 → 3		
		$1 \xrightarrow{< 100 \mu A} 3$		

100-FTL5xxxx-04-05-xx-xx-004

Signal on alarm

Output signal on power failure or in the event of damaged sensor: $< 100 A$

Connectable load

- Load switched via the transistor and separate PNP connection, max. 55 V DC
- Load current max. 350 mA (pulsed overload and short-circuit protection)
- Residual current $< 100 A$ (with transistor blocked).
- Capacitance load max. 0.5 F at 55 V, max. 1.0 F at 24 V
- Residual voltage $< 3 V$ (with transistor switched through);

Electronics FEL52 (DC PNP, in compact housing)

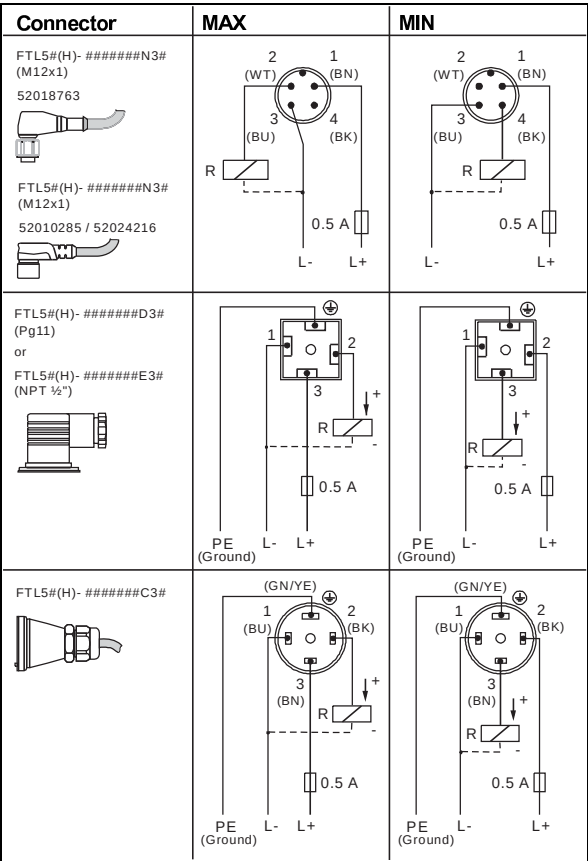
Power supply

Supply voltage: 10 to 55 V DC
Ripple: max. 1.7 V, 0 to 400 Hz
Current consumption: max. 15 mA
Power consumption: max. 0.83 W
Reverse polarity protection
Overvoltage protection FEL52: overvoltage category III

Electrical connection

Three-wire DC connection

Preferably used with programmable logic controllers (PLC).
DI module as per EN 61131-2.
Positive signal at switching output of the electronics (PNP);
Output blocked on reaching limit.



L00-FTL5xxxx-04-05-xx-xx-010

Output signal

With valve connector or cable tail

I_L = load current
(switched through)

$< 100 \mu A$ = residual current
(blocked)

 = lit

 = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs	
			green	red
Max.		$L+ \xrightarrow{I_L} 2$		
		$L+ \xrightarrow{< 100 \mu A} 2$		
Min.		$L+ \xrightarrow{I_L} 3$		
		$L+ \xrightarrow{< 100 \mu A} 3$		

L00-FTL5xxxx-04-05-xx-xx-010

With M12x1 connector 52010285 / 52024216 (without LEDs)

L00-FTL5xxxx-16-05-
xx-xx-002

I_L = load current
(switched through)

$< 100 \mu A$ = residual current
(blocked)



= lit

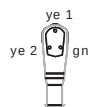


= unlit

L00-FTL2xxxx-07-05-
xx-xx-000

Safety mode	Level	Output signal	LEDs
Max.		$L+ \xrightarrow{I_L} -$ 1 2	
		$L+ < 100 \mu A \xrightarrow{-} -$ 1 2	
Min.		$L+ \xrightarrow{I_L} -$ 1 4	
		$L+ < 100 \mu A \xrightarrow{-} -$ 1 4	

L00-FTL5xxxx-04-05-xx-xx-010

With M12x1 connector 52018763 (with LEDs)

L00-FTL5xxxx-16-05-
xx-xx-001

I_L = load current
(switched through)

$< 100 \mu A$ = residual current
(blocked)



= lit



= unlit

L00-FTL2xxxx-07-05-
xx-xx-000

Safety mode	Level	Output signal	LEDs
Max.		$L+ \xrightarrow{I_L} -$ 1 2	
		$L+ < 100 \mu A \xrightarrow{-} -$ 1 2	
Min.		$L+ \xrightarrow{I_L} -$ 1 4	
		$L+ < 100 \mu A \xrightarrow{-} -$ 1 4	

L00-FTL5xxxx-04-05-xx-xx-011

Signal on alarm

Output signal on power failure or in the event of damaged sensor: $< 100 A$

Connectable load

- Load switched via the transistor and separate PNP connection, max. 55 V DC
- Load current max. 350 mA (pulsed overload and short-circuit protection)
- Residual current $< 100 A$ (with transistor blocked).
- Capacitance load max. 0.5 F at 55 V, max. 1.0 F at 24 V
- Residual voltage $< 3 V$ (with transistor switched through);

Electronic insert FEL54 (AC/DC with relay output)

Power supply

Supply voltage: 19 to 253 V AC, 50/60 Hz or 19 to 55 V DC
Power consumption: max. 1.3 W
Reverse polarity protection
Overvoltage protection FEL54: overvoltage category III

Electrical connection

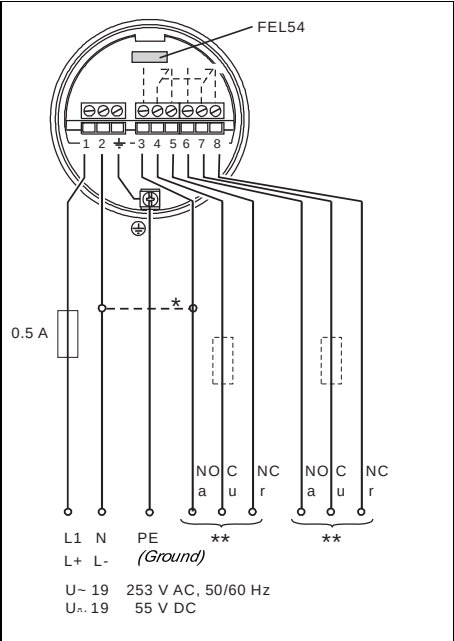
Universal current connection with relay output

Power supply:
Please note the different voltage ranges
for AC and DC.

Output:
When connecting an instrument with
high inductance, provide a spark arrester
to protect the relay contact.
A fine-wire fuse (depending on the
load connected) protects the relay contact
on short-circuiting.
Both relay contacts switch simultaneously.

* When jumpered, the relay
output works with NPN logic.

** See "Connectable load"



1.00-FTL50xxx-04-05-xix-xx-002

Output signal

= relay energized
 = relay de-energized
 = lit
 = unlit

1.00-FTL2xxxx-07-05-
xx-xx-001

Safety mode	Level	Output signal	LEDs green	red
Max.				
Min.				

1.00-FTL50xxx-04-05-xix-xx-002

Signal on alarm

Output signal on power failure or in the event of damaged sensor: relay de-energized

Connectable load

- Loads switched via 2 floating change-over contacts (DPDT).
- I~ max. 6 A (Ex de 4 A), U~ max. 253 V AC; P~ max. 1500 VA, cos φ = 1, P~ max. 750 VA, cos φ > 0.7
- I= max. 6 A (Ex de 4 A) bis 30 V DC, I= max. 0.2 A to 125 V
- When connecting a low-voltage circuit with double isolation according to IEC 1010, the following applies: total of voltages of relay output and power supply max. 300 V.

Electronic insert FEL55 (8/16 mA)

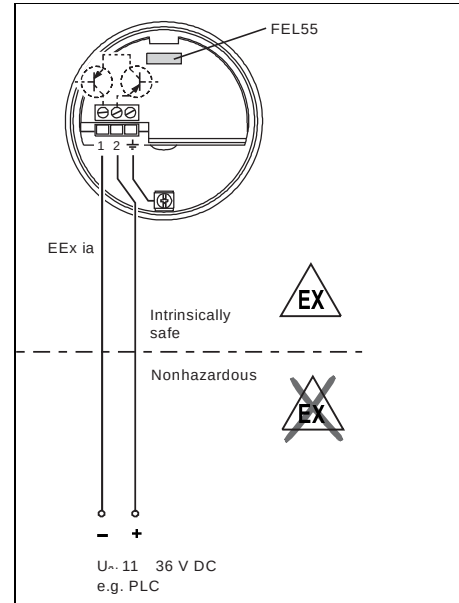
Power supply

Supply voltage: 11 to 36 V DC
 Power consumption: < 600 mW
 Reverse polarity protection
 Overvoltage protection FEL55: overvoltage category III

Electrical connection

Two-wire connection for separate switching unit

For connecting to programmable logic controllers (PLCs) for example, AI module 4 to 20 mA to EN 61131-2.
 Output signal jump from high to low current on limit.



1.00-FTL5xxxx-04-05-xx-xx-000

Output signal

$$\sim 16 \text{ mA} = 16 \text{ mA} \pm 5 \%$$

$$\sim 8 \text{ mA} = 8 \text{ mA} \pm 6 \%$$



= lit



= unlit

1.00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs green	red
Max.		+ ~16 mA 2 → 1		
		+ ~8 mA 2 → 1		
Min.		+ ~16 mA 2 → 1		
		+ ~8 mA 2 → 1		

1.00-FTL5xxxx-04-05-xx-xx-000

Signal on alarm

Output signal on power failure or in the event of damaged sensor: < 3.6 mA

Connectable load

- $R = (U - 11 \text{ V}) : 16.8 \text{ mA}$
- $U = \text{connection voltage: } 11 \text{ to } 36 \text{ V DC}$

Example:
 PLC with 250 Ω with 2-wire version

$$250 \Omega = (U - 11 \text{ V}) / 16.8 \text{ mA}$$

$$4.2 [\Omega/\text{A}] = U - 11 \text{ V}$$

$$U = 15.2 \text{ V}$$

Electronic insert FEL56 (NAMUR L-H edge)

Power supply

Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 2.8 mA
Connection data interface: IEC 60947-5-6

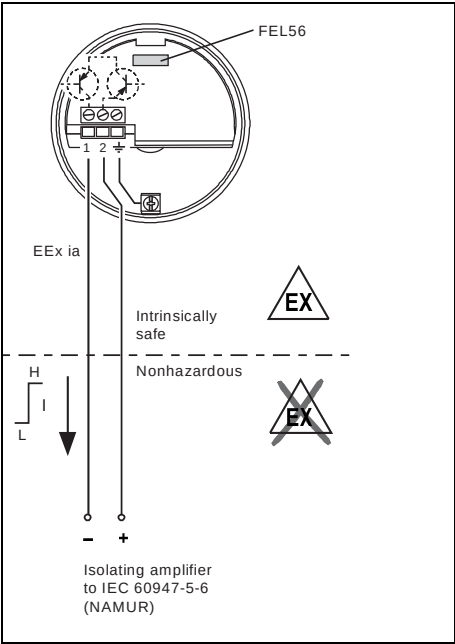
Electrical connection

Two-wire connection for separate switching unit

For connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser.
Output signal jump from low to high current on limit.

(L-H edge)

Connecting to multiplexer:
Set clock time to min. 2 s.

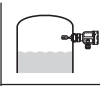
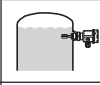
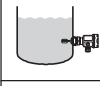
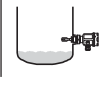


100-FTL5xxxx-04-05-zz-en-004

Output signal

 = lit
 = flashes
 = unlit

100-FTL5xxxx-07-05-zz-en-002

Safety mode	Level	Output signal	LEDs	
			green	red
Max.		+ 0.6 2 1.0 mA → 1		
		+ 2.2 2 2.8 mA → 1		
Min.		+ 0.6 2 1.0 mA → 1		
		+ 2.2 2 2.8 mA → 1		

100-FTL5xxxx-04-05-zz-en-003

Signal on alarm

Output signal in the event of damaged sensor: > 2.2 mA

Connectable load

See Technical Data of the isolating amplifier connected according to IEC 60947-5-6 (NAMUR)

Electronic insert FEL58 (NAMUR H-L edge)

Power supply

Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 3.5 mA
Connection data interface: IEC 60947-5-6

Electrical connection

Two-wire connection for separate switching unit

For connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser.
Output signal jump from high to low current on limit.

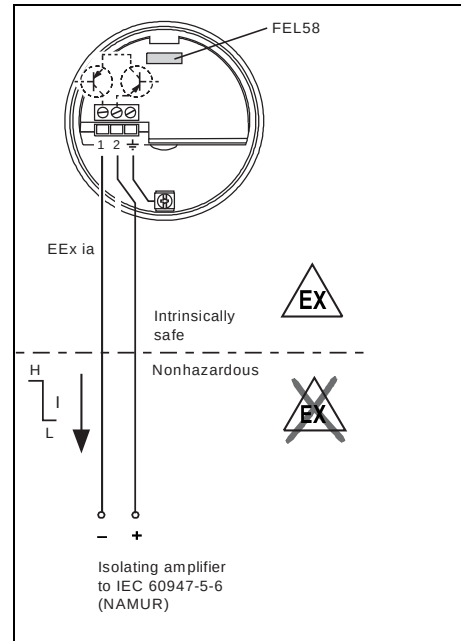
(H-L edge)

Additional function:
Test key on the electronic insert.
Pressing the key breaks the connection to the isolating amplifier.

Note!

In Ex-d applications, the additional function can only be used if the housing is not exposed to an explosive atmosphere.

Connecting to multiplexer:
Set clock time to min. 2 s.



L00-FTL50xxx-0405-xx-en-002

Output signal

☀ = lit
☀ = flashes
● = unlit

L00-FTL50xxx-0705-xx-xx-002

Safety mode	Level	Output signal	LEDs green yellow
Max.		2.2 3.5 mA + 2 → 1	☀ ☀
		0.6 1.0 mA + 2 → 1	☀ ●
Min.		2.2 3.5 mA + 2 → 1	☀ ☀
		0.6 1.0 mA + 2 → 1	☀ ●

L00-FTL50xxx-0405-xx-xx-007

Signal on alarm

Output signal in the event of damaged sensor: < 1.0 mA

Connectable load

- See Technical Data of the isolating amplifier connected according to IEC 60947-5-6 (NAMUR)
- Connection also to isolating amplifiers which have special safety circuits (I > 3.0 mA)

Electronics FEL58 (NAMUR H-L edge, in compact housing)

Power supply Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 3.5 mA
Connection data interface: IEC 60947-5-6

Electrical connection

Two-wire connection for separate switching unit

For connecting to isolating amplifiers acc. to NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser. Output signal jump from high to low current on limit

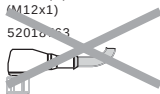
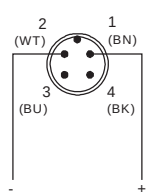
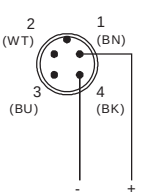
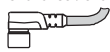
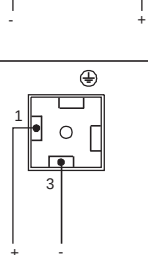
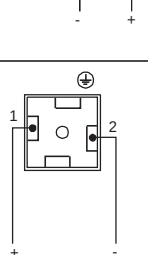
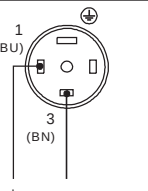
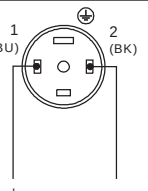
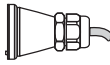
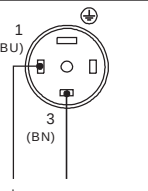
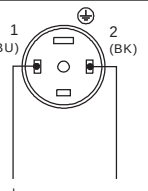
(H-L edge)

Additional function:
If the test magnet is held against the marking on the nameplate, the output signal is inverted.

Connecting to multiplexer:
Set clock time to min. 3 s.

The NAMUR interface has a defined power consumption rate.

Thus, it is not possible to use the M12 connector with an integrated LED (52018763)

Connector	MAX	MIN
FTL5#(H)- #####N3# (M12x1) 52018763 		
FTL5#(H)- #####N3# (M12x1) 52010285 / 52024216 		
FTL5#(H)- #####D3# (Pg11) or FTL5#(H)- #####E3# (NPT 1/2") 		
FTL5#(H)- #####C3# 		

L00-FTL5xxxx-04+05-xx-xx-009

Output signal

Safety mode	Level	Output signal	LEDs green yellow
Max.		+ 2.2 1 3.5 mA - → 3	 
		+ 0.6 1 1.0 mA - → 3	 
Min.		+ 2.2 1 3.5 mA - → 2	 
		+ 0.6 1 1.0 mA - → 2	 

 = lit
 = flashes
 = unlit

L00-FTL5xxxx-07+05-xx-xx-002
xx-xx-002

L00-FTL5xxxx-04+05-xx-xx-009

Signal on alarm Output signal in the event of damaged sensor: < 1.0 mA

Connectable load

- See Technical Data of the isolating amplifier connected according to IEC 60947-5-6 (NAMUR)
- Connection also to isolating amplifiers which have special safety circuits (I > 3.0 mA)

Electronic insert FEL57 (PFM)

Power supply

Supply voltage: 9.5 to 12.5 V DC
 Current consumption: 10 to 13 mA
 Power consumption: < 150 mW
 Reverse polarity protection

Electrical connection

Two-wire connection for separate switching unit

For connecting to Nivotester switching units FTL320, FTL325P, FTL370, FTL372, FTL375P (also with cyclical checking) from Endress+Hauser. Output signal jump of the PFM signal from high to low frequency when sensor is covered. Switching between minimum/maximum safety in the Nivotester.

Additional function “cyclical checking”:
 After interruption of the power supply, a test cycle is activated which checks the sensor and electronics without any change in level.
 Approved for overfill protection acc. to WHG (German Water Resources Act).
 The following can be switched at the electronic insert:

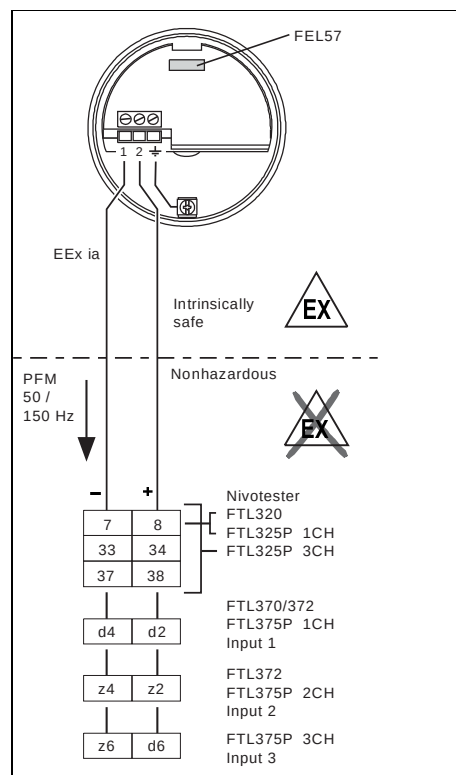
– Standard (STD):

Corrosion of the fork unlikely;
 simulation approx. 8 s
 tuning fork exposed – covered – exposed.
 This setting tests level reporting in the Nivotester during cyclical checking.

– Extended (EXT):

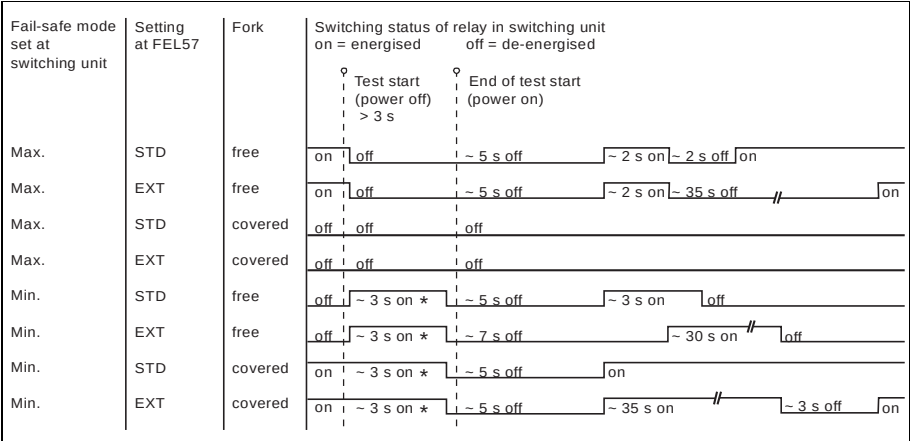
Corrosion of the fork possible;
 Simulation approx. 41 s; tuning fork exposed – covered – corroded – exposed.
 This setting tests level reporting and alarm notification in the Nivotester during cyclical checking.

The check is activated and monitored at the switching unit.



100-FTL5xxxx-0405-ver-003

Switching behavior of the connected device:

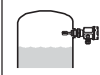
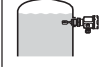


* De-energized on power supply failure

Please note this switching response and function of the plant especially when replacing a Liquiphant with an EL17Z or FEL37 electronic insert with a Liquiphant M with an FEL57 electronic insert.

Output signal

 = lit
 = unlit
L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal (PFM)	LEDs green yellow
		150 Hz 	 
		50 Hz 	 

Signal on alarm

Output signal on power failure or in the event of damaged sensor: 0 Hz

Connectable load

- Floating relay contacts in the connected switching device Nivotester FTL320, FTL325P, FTL370, FTL372, FTL375P
- For contact load, see the Technical Data of the switching unit

Electronic insert FEL50A (PROFIBUS PA)

Power supply

Bus voltage: 9 to 32 V DC

Bus current:

- 12.5 mA $\pm$ 1.0 mA (software version: 01.03.00, hardware version: 02.00)
- 10.5 mA $\pm$ 1.0 mA (software version: 01.03.00, hardware version: 01.00)

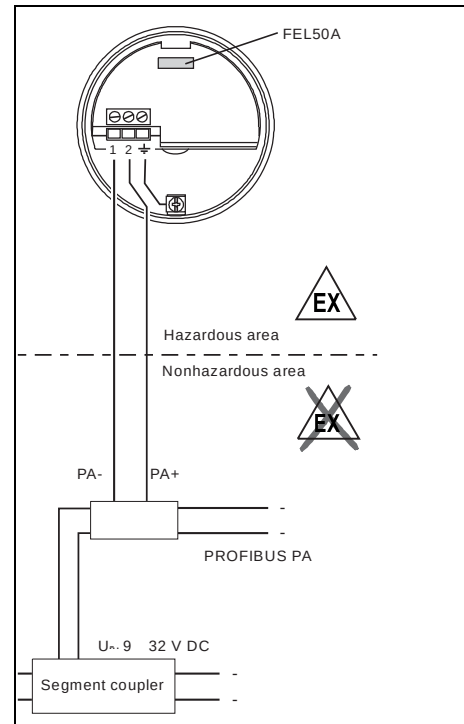
Electrical connection

Two-wire connection for power supply and data transfer

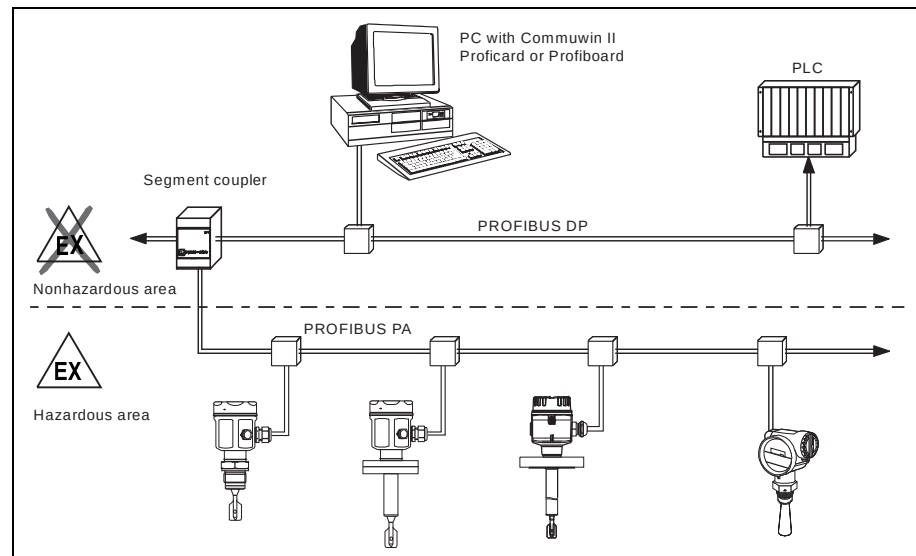
For connecting to PROFIBUS PA

Additional functions:

- Digital communication enables the representation, reading and editing of the following parameters:
Fork frequency, switch-on frequency, switch-off frequency, switch-on time and switch-off time, status, measured value, density switch.
- Matrix locking possible
- Switch to WHG mode possible (WHG approval).
- For a detailed description, see BA198F
- You can also visit www.profibus.com for more information



100-FTL50xxx-04-05-en-005



100-FTL50xxx-04-05-en-006

Output signal

 = lit
 = unlit
L00-FTL2xxxx-07-05-
xx-xx-000

Setting	Level	LEDs green	yellow	FEL50A
not inverted				OUT_D = 0 PA bus signal
				OUT_D = 1 PA bus signal
inverted				OUT_D = 1 PA bus signal
				OUT_D = 0 PA bus signal

L00-FTL5xxxx-04-05-xx-xx-000

Signal on alarm

- Failure information can be opened using the following interfaces:
Yellow LED flashing, status code, diagnostic code; see BA198F

Electronic insert FEL50D (density)

Power supply

Frequency range: 300 to 1500 Hz
 Signal level: 4 mA
 Pulse height: 16 mA
 Pulse width: 20 µS

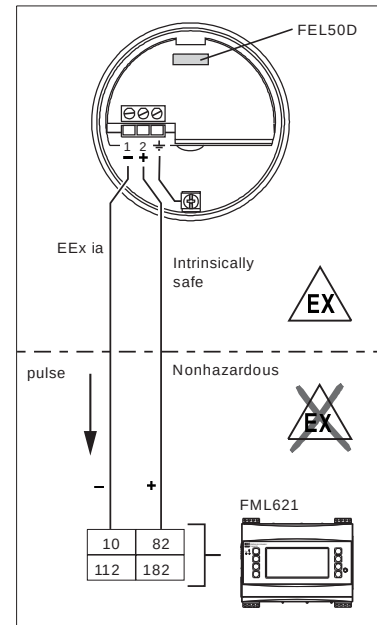
Electrical connection

Two-wire connection at Density Computer FML621
 For connecting to the density and concentration computer FML621.

The output signal is based on pulse technology.
 With the aid of this signal, the fork frequency is constantly forwarded to the switching unit.



Caution!
 Operation with other switching units, such as FTL325P, is not permitted.
 This electronic insert cannot be installed in devices that were originally used as a point level switch.



TI420F8004

Signal on alarm

Output signal on power failure or in the event of damaged sensor: 0 Hz

Adjustment

In the Liquiphant M modular system, the option of adjustment is also provided in addition to the electronics (see feature 60: "Accessories").

There are three types of adjustment:

Standard adjustment (see ordering information for additional options, basic version A)

- Here, two fork parameters are determined to describe the sensor characteristics, indicated in the adjustment report and provided with the product.
 These parameters must be transmitted to the Density Computer FML621.

Special adjustment (see ordering information for additional options, special adjustment, density H₂O (K) or special adjustment, density H₂O with 3.1 certificate (L))

- Here, three fork parameters are determined to describe the sensor characteristics, indicated in the adjustment report and provided with the product.
 These parameters must be transmitted to the Density Computer FML621.
 Greater accuracy is achieved with this type of adjustment (see also "Performance characteristics").

Field adjustment

- During field adjustment, a density value actually determined by the customer is entered and the system is automatically adjusted to this value (wet adjustment).

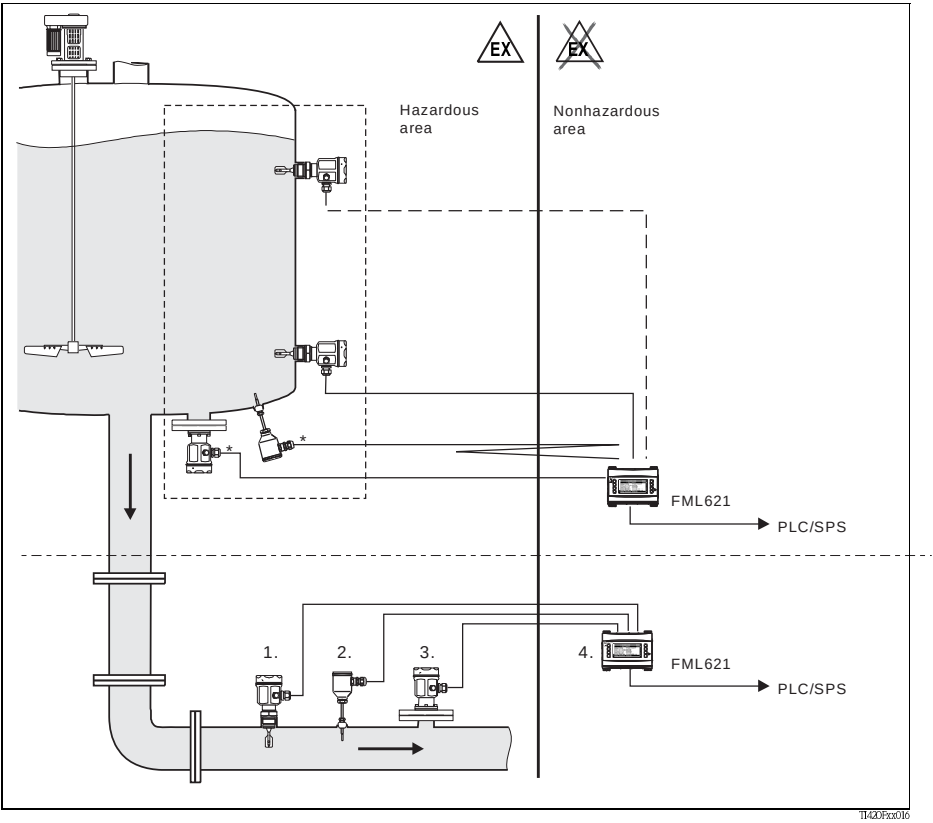


Note!

Further information on Liquiphant M Density is available in Technical Information TI420F. This document is available for download at www.endress.com => Download.

Operating principle

Measuring the density of a liquid medium in pipes and tanks. Also suitable for use in hazardous areas, and preferably for applications in the chemical and food industry.



- * Pressure and temperature information required depending on the application.
- 1. Liquiphant M sensor with electronic insert FEL50D (pulse output);
 - 2. Temperature sensor (e.g. 4 to 20 mA output);
 - 3. Pressure transmitter (4 to 20 mA output);
 - 4. Liquiphant density and concentration computer FML621 with display and operating unit

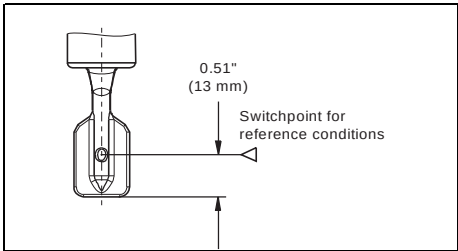
Light signals

LED	Symbol	Information
Yellow		Measurement valid
		Unstable process situation
		Maintenance required
Green		Power on
		Power off
Red		No fault
		Maintenance required
		Device failure

Connection and function

Connecting cables	■ Electronic inserts: cross-section max. 14 AWG (2.5 mm²); strand in ferrule to DIN 46228 ■ Protective ground in housing: cross-section max. 14 AWG (2.5 mm²) ■ External equipotential bonding connection on housing: cross-section max. 0.006 in² (4 mm²)
Safety mode	Minimum/maximum residual current safety selectable on electronic insert. (with FEL57 on Nivotester only) Max. = maximum safety: The output switches to the power fail response when the fork is covered For use with overflow protection for example Min. = minimum safety: The output switches to the power fail response when the fork is exposed For use with dry running protection for example
Switching time	When fork is covered: approx. 0.5 s When fork is exposed: approx. 1.0 s (Other switching times on request.) Additionally configurable for PROFIBUS PA: 0.5–60 s
Switch-on behavior	When switching on the power supply, the output assumes the alarm signal. After max. 3 s it assumes the correct switching mode (exception: FEL57)

Performance characteristics

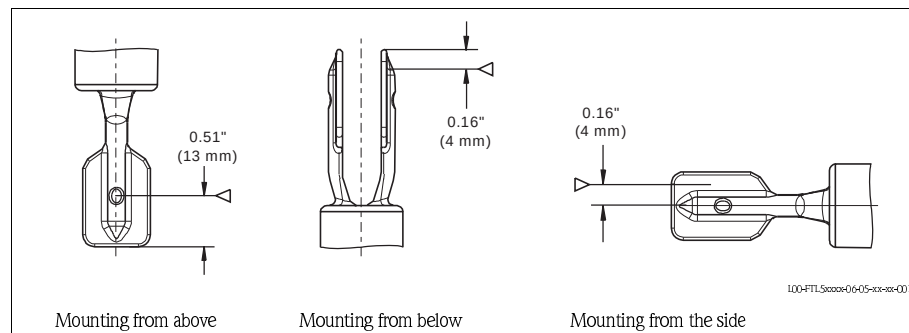
Reference operating conditions	Ambient temperature: 73°F (23°C) Medium temperature: 73°F (23°C) Medium density: 1 SGU (1 g/cm³), water Viscosity: 1 cP (1 mm²/s) Medium pressure p_g: 0 psi (0 bar) Sensor mounting: vertical from above Density switch: to > 0.7	 0.51" (13 mm) Switchpoint for reference conditions 1.00-FTL5xxxx-00-05xxx-01-000
Maximum measured error	Max. ± 0.04" (1 mm), at reference operating conditions	
Repeatability	0.004" (0.1 mm)	
Hysteresis	Approx. 0.08" (2 mm)	
Influence of medium temperature	Max. +0.07" to -0.11", -58 to +302°F (+1.8 to -2.8 mm, -50 to +150°C)	
Influence of medium density	Max. +0.19" to -0.14", 0.5 to 1.5 SGU (+4.8 to -3.5 mm, 0.5 to 1.5 g/cm ³)	
Influence of medium pressure	Max. 0 to -0.1", -14.5 to 930 psi (0 to -2.5 mm, -1 to 64 bar)	

Operating conditions

Installation

Installation instructions

Switch points ▷ on the sensor depend on the mounting position, with reference to water,
Density 1 SGU, 73°F, 0 psi (1 g/cm³, 23 °C, p_e 0 bar)



Note!

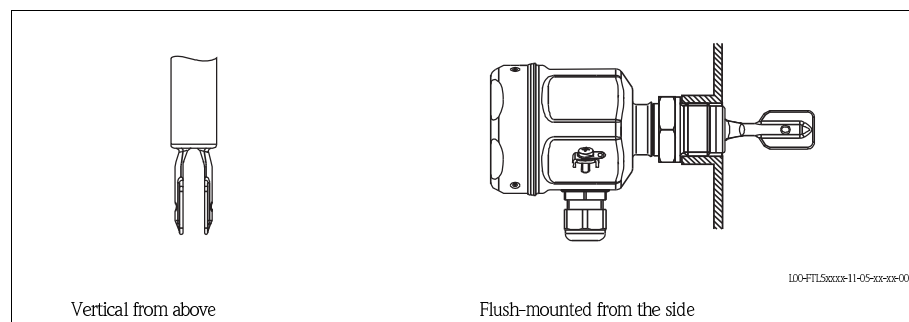
The switch points of the Liquiphant **M** are at other positions to those of the previous version Liquiphant **II**.

Examples of mounting

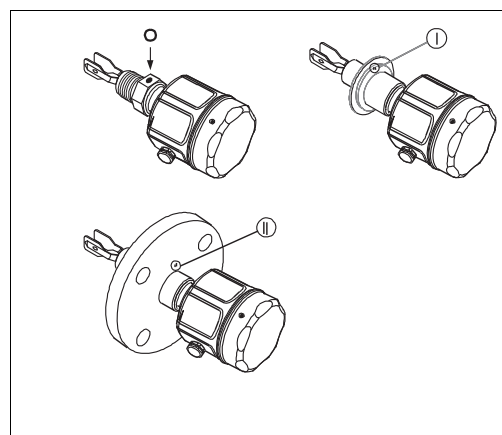
Examples of mounting with regard to the viscosity ν of the liquid and the tendency to form buildup

Optimum mounting, without problem even with high viscosity:

Position the fork so that the narrow edge of the tines is vertical to ensure that the liquid can run off easily.

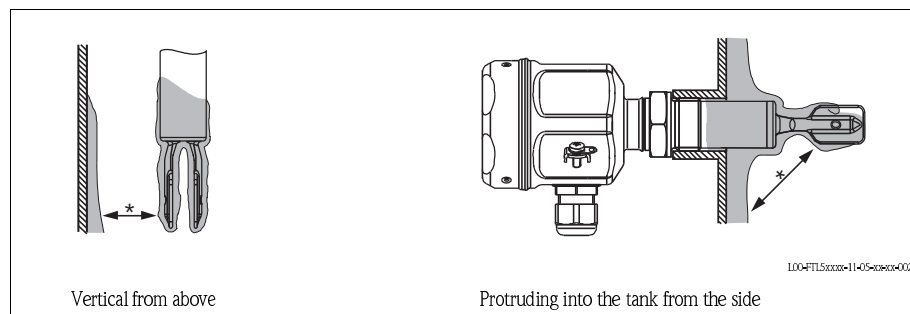


When installing the Liquiphant where the orientation of the tine is critical, such as in a pipeline, marks on the process connection indicate the tine orientation (see diagram)



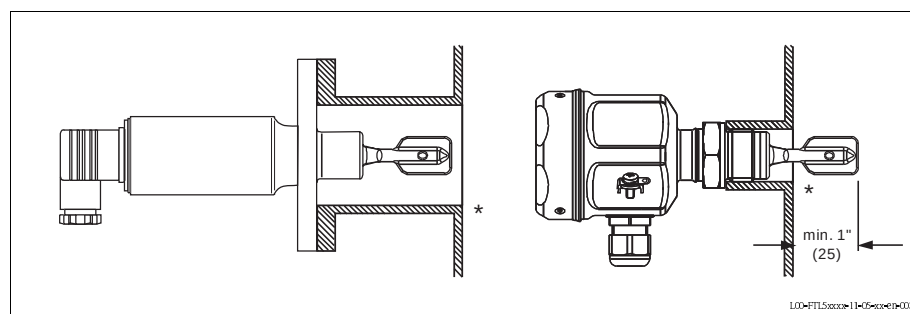
With buildup on the tank walls:

* Ensure that there is sufficient distance between the buildup expected on the tank wall and the fork.



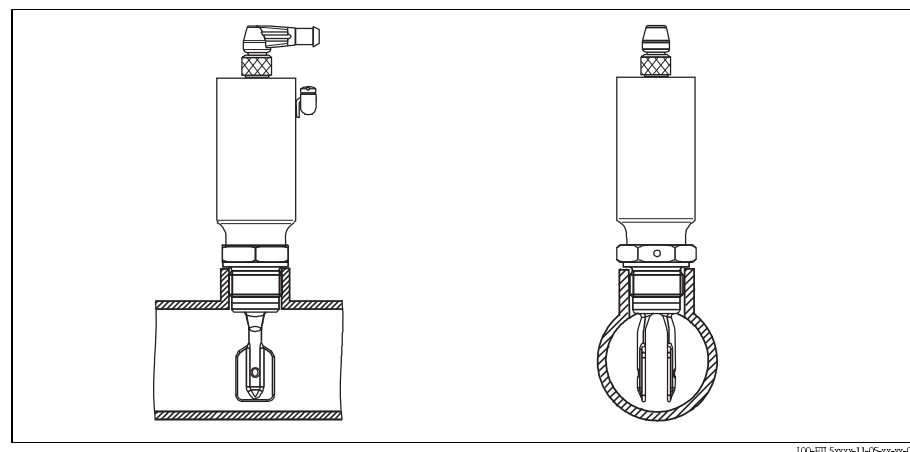
Mounting positions with low viscosity (up to 2000 mm²/s):

* Deburr the nozzle surfaces

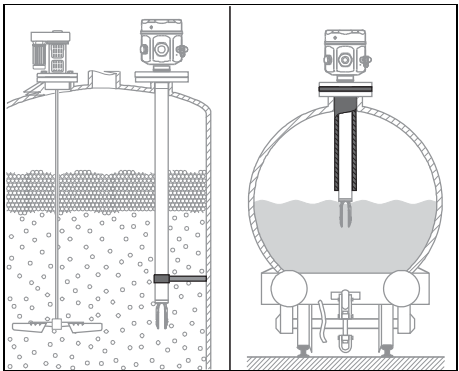


Mounting in piping from 2"

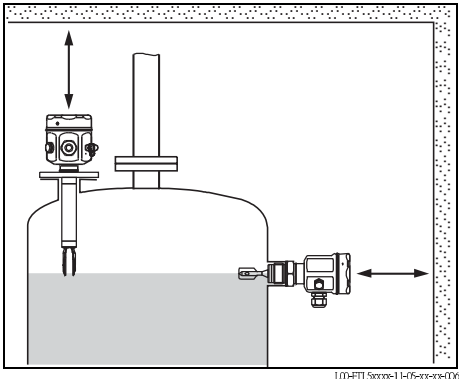
Flow velocities up to 16 ft/s (5 m/s) for viscosity 1 cP (1 mm²/s) and density 1 SGU (1 g/cm³).
(Check the function for other medium conditions.)



Support the Liquiphant M FTL51(H) in the event of severe dynamic load.



Ensure adequate space outside the tank for mounting, connection and configuration.



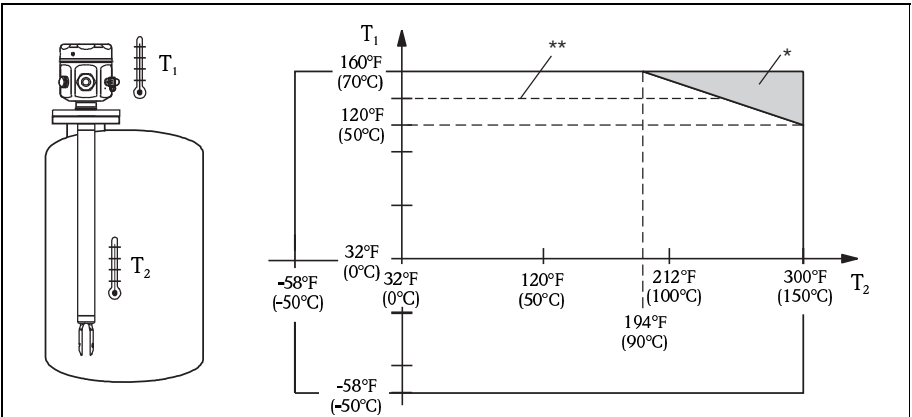
Orientation

FTL50(H) and FTL51(H) with short pipe (up to approx. 20" / 500 mm) – any position,
FTL51(H) with long pipe – vertical

Environment

Ambient temperature range

Permitted ambient temperature T_a at the housing depending on the medium temperature T_p in the tank:



* Additional temperature range for devices with a temperature spacer or Pressure tight feed through.

** Maximum ambient temperature with FEL50D/FEL50A in hazardous areas.

Ambient temperature limits

-58 to +160°F (-50 to +70°C), function with restricted data

Storage temperature -58 to +180°F (-50 to +80°C)

Climate class Climate protection to IEC 68, Part 2-38, Fig. 2a

Degree of protection

Types of housing	IP65	IP66*	IP67*	IP68*	IP69k	NEMA4X**
Compact housing with valve connector Pf11/NPT 1/2	X	—	—	—	—	—
Compact housing with 16 ft/5 m cable tail	—	X	—	X	—	—
Compact housing with M12x1 connector (52010285) 316L (metal)	—	X	—	X	—	—
Compact housing with elbowed connector (52024216) / L= 16 ft / 5 m, without integrated LEDs	—	X	—	X	X	—
Compact housing with elbowed connector (52018763) / L= 16 ft / 5 m, with integrated LEDs	—	X	—	X	X	—
Polyester housing F16	—	X	X	—	—	X
Stainless steel housing F15	—	X	X	—	—	X
Aluminum housing F17	X	X	X	—	—	X
Aluminum housing F13	X	X	—	X***	—	X
Stainless steel housing F27	—	X	—	X	—	4x/6P
Aluminum housing T13 with separate connection compartment (EEx d)	X	X	—	X***	—	4x/6P

* As per EN60529

** As per NEMA 250

*** Only with M20 cable entry or G1/2 thread

Vibration resistance To IEC 68, Part 2-6 (10 to 55 Hz, 0.15 mm, 100 cycles)
In the event of increased vibrations, we recommend the additional fitting feature "060" version "P" 1450 psi (100 bar) process pressure.

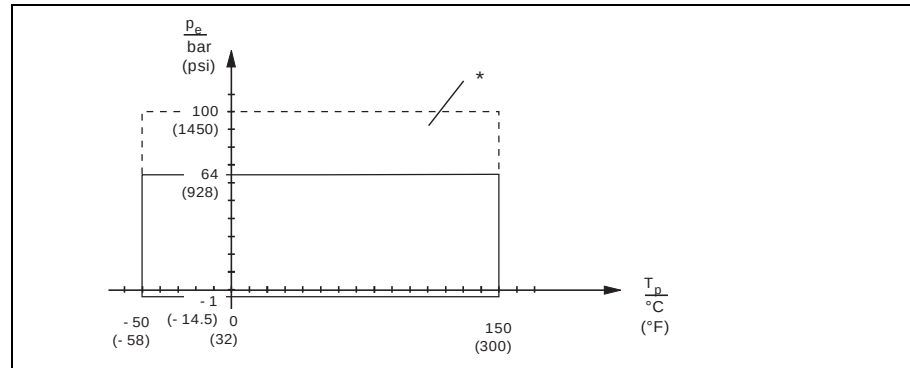
Electromagnetic compatibility Interference emission to EN 61326, Electrical Equipment Class B
Interference immunity to EN 61326; Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC)

Medium conditions

Medium temperature -58 to +300°F (-50 to +150°C); see "Process connections" for exceptions

Thermal shock Max. 250°F/s (120°C/s)

Medium pressure p_e



* Allowed pressure rating when the "1450 psi / 100 bar" option is selected (see "Product structure FTL51", feature 060, page 41). See "Process connections" for exceptions.

Please refer to the standards listed for the permitted pressure values of the flanges at higher temperatures:

■ pR EN 1092-1: 2005

With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are identical and are grouped together under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

■ ASME B 16.5a - 1998 Tab. 2-2.2 F316

■ ASME B 16.5a - 1998 Tab. 2.3.8 N10276

■ JIS B 2220

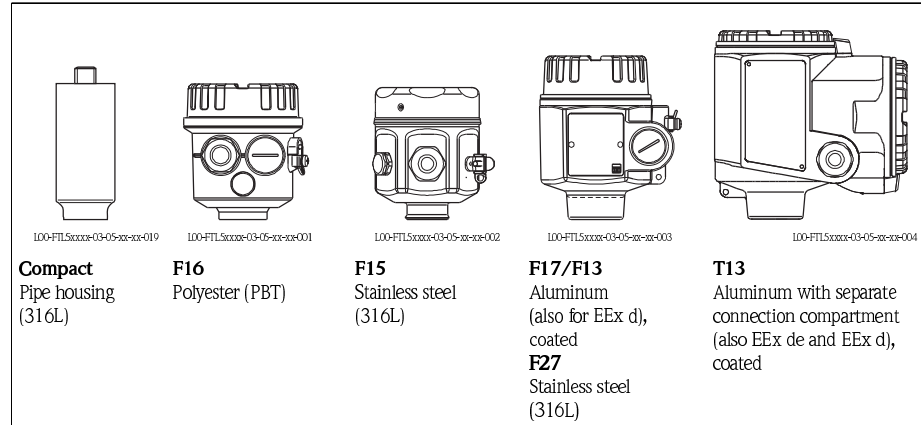
The lowest value from the derating curves of the device and selected flange applies in each case.

Test pressure	$p_e = 928 \text{ psi (64 bar)}$: Max. 1450 psi / 100 bar (1.5 times the medium pressure p_e); no function during test pressure Sensor burst pressure 2900 psi (200 bar) $p_e = 1450 \text{ psi (100 bar)}$: Max. 2175 psi / 150 bar (1.5 times the medium pressure p_e); no function during test pressure Sensor burst pressure 5800 psi (400 bar)
State of aggregation	Liquid
Density	0.7 SGU (0.7 g/cm³) = delivery status 0.5 SGU (0.5 g/cm³*) can be adjusted via switches * Density settings for the compact housing on request
Viscosity	Max. 10,000 cP (10000 mm ² /s)
Solids content	Max. Ø0.2" (5 mm)
Lateral loading capacity	≤ 55 lbf ft (75 Nm)

Mechanical construction

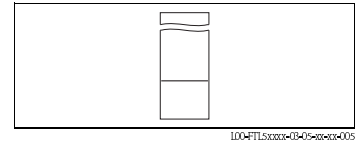
Design	Summary of all electrical and mechanical versions Plug-in electronic inserts to mount in the housing  L004FTL50ccc03405ccc04000 <table> <tr> <td>FEL51*:</td><td>Two-wire AC connection</td></tr> <tr> <td>FEL52*:</td><td>Three-wire DC connection PNP</td></tr> <tr> <td>FEL54:</td><td>Universal current connection, 2 relay outputs</td></tr> <tr> <td>FEL55:</td><td>Output 16/8 mA for separate switching unit</td></tr> <tr> <td>FEL56:</td><td>Output 0.6 to 1.0 / 2.2 to 2.8 mA for separate switching unit (NAMUR)</td></tr> <tr> <td>FEL58*:</td><td>Output 2.2 to 3.5 / 0.6 to 1.0 mA for separate switching unit (NAMUR)</td></tr> <tr> <td>FEL57:</td><td>Output 150/50 Hz, PFM, for separate switching unit (Nivotester)</td></tr> <tr> <td>FEL50A:</td><td>Digital communication PROFIBUS PA</td></tr> <tr> <td>FEL50D:</td><td>Pulse output for Density Computer FML621</td></tr> </table> * Electronics also available as compact housing. The electronics cannot be exchanged!	FEL51*:	Two-wire AC connection	FEL52*:	Three-wire DC connection PNP	FEL54:	Universal current connection, 2 relay outputs	FEL55:	Output 16/8 mA for separate switching unit	FEL56:	Output 0.6 to 1.0 / 2.2 to 2.8 mA for separate switching unit (NAMUR)	FEL58*:	Output 2.2 to 3.5 / 0.6 to 1.0 mA for separate switching unit (NAMUR)	FEL57:	Output 150/50 Hz, PFM, for separate switching unit (Nivotester)	FEL50A:	Digital communication PROFIBUS PA	FEL50D:	Pulse output for Density Computer FML621
FEL51*:	Two-wire AC connection																		
FEL52*:	Three-wire DC connection PNP																		
FEL54:	Universal current connection, 2 relay outputs																		
FEL55:	Output 16/8 mA for separate switching unit																		
FEL56:	Output 0.6 to 1.0 / 2.2 to 2.8 mA for separate switching unit (NAMUR)																		
FEL58*:	Output 2.2 to 3.5 / 0.6 to 1.0 mA for separate switching unit (NAMUR)																		
FEL57:	Output 150/50 Hz, PFM, for separate switching unit (Nivotester)																		
FEL50A:	Digital communication PROFIBUS PA																		
FEL50D:	Pulse output for Density Computer FML621																		

Housing

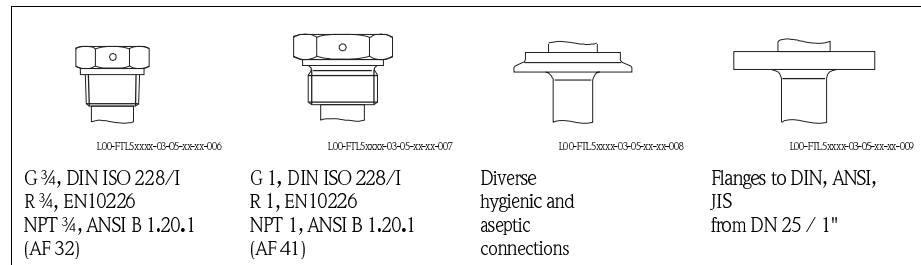


Bushings (optional)

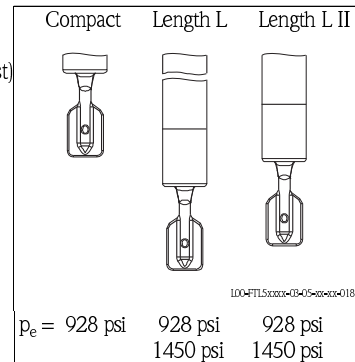
Temperature spacer and pressure tight feed through



Process connections



Sensors

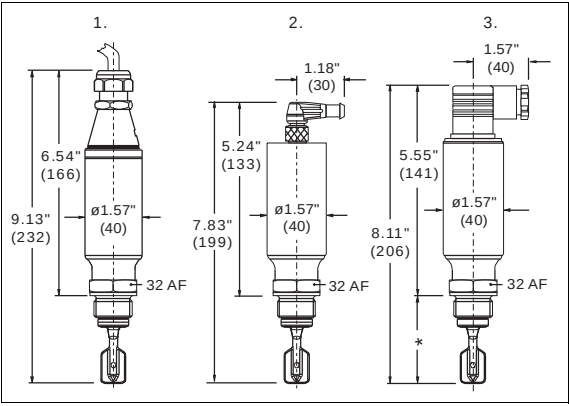
Compact,
with extension pipe up to 115" / 3 m (up to 236" / 6 m on request)
or special "length L II" (see Page 30)


Dimensions

Housing and sensor FTL50(H)

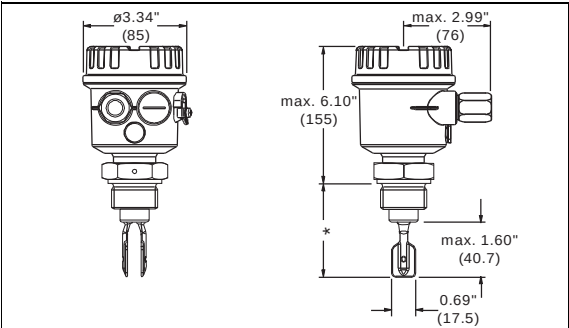
Compact housing, primarily for hygienic applications

- 1. 16 ft (5 m) cable
- 2. M12 connector
- 3. Pg11/NPT 1/2 connector



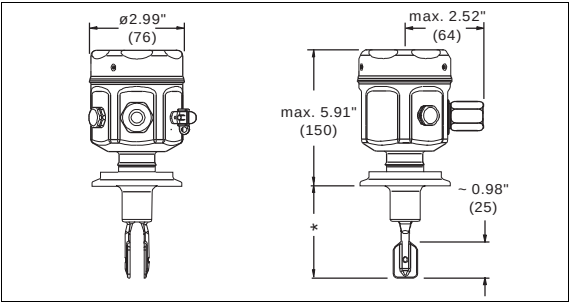
L00-FTL50xxx-06-05-xx-xx-008

Polyester housing F16



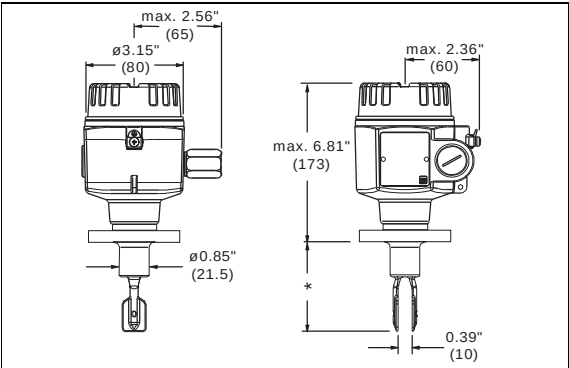
L00-FTL50xxx-06-05-xx-xx-009

Stainless steel housing F15, primarily for hygienic applications



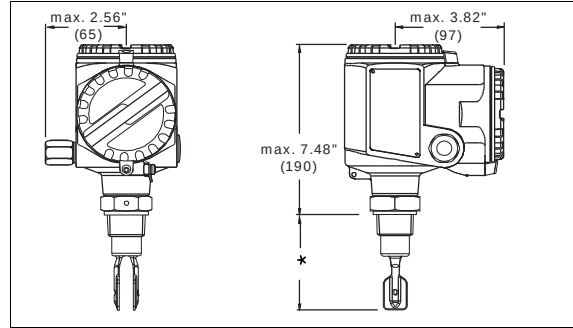
L00-FTL50xxx-06-05-xx-xx-010

Aluminum housing F17/F13
Stainless steel housing (316L) F27



L00-FTL50xxx-06-05-xx-xx-011

Aluminum housing T13
with separate connection
compartment



100-FTL5xxxx-06-05-en-en-007

* See "Process connections"



Note!

The switch points of the Liquiphant **M** are at other positions to those of the previous version Liquiphant **II**.

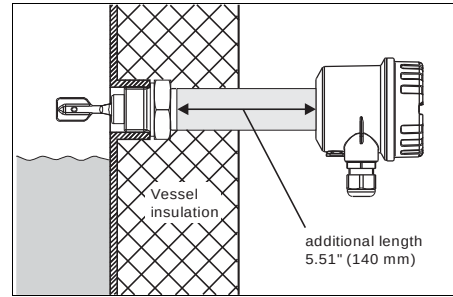
Bushings: temperature spacer, pressure tight feed through

Temperature spacer

Provides sealed insulation for the vessel
and normal ambient temperatures
for the housing.

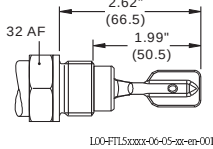
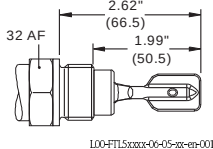
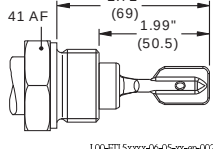
Pressure tight feed through

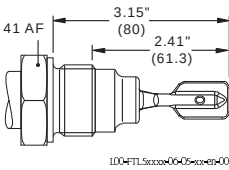
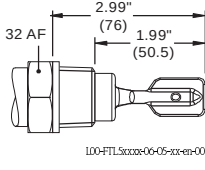
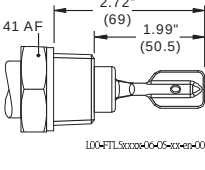
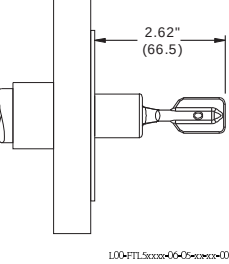
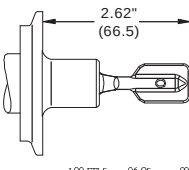
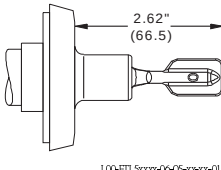
Protects the housing from pressures
up to 1450 psi (100 bar) if the sensor is damaged.
Provides sealed insulation for the
vessel and normal ambient temperatures
for the housing.

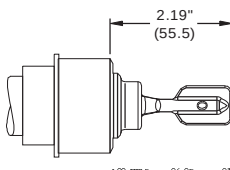
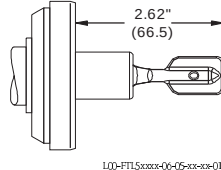
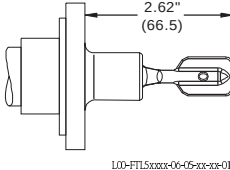
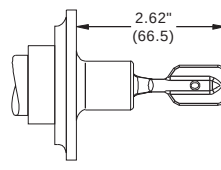
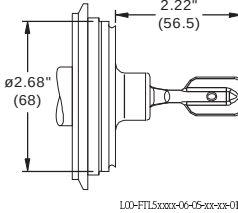
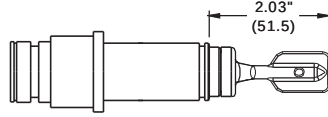


100-FTL5xxxx-14-05-en-en-000

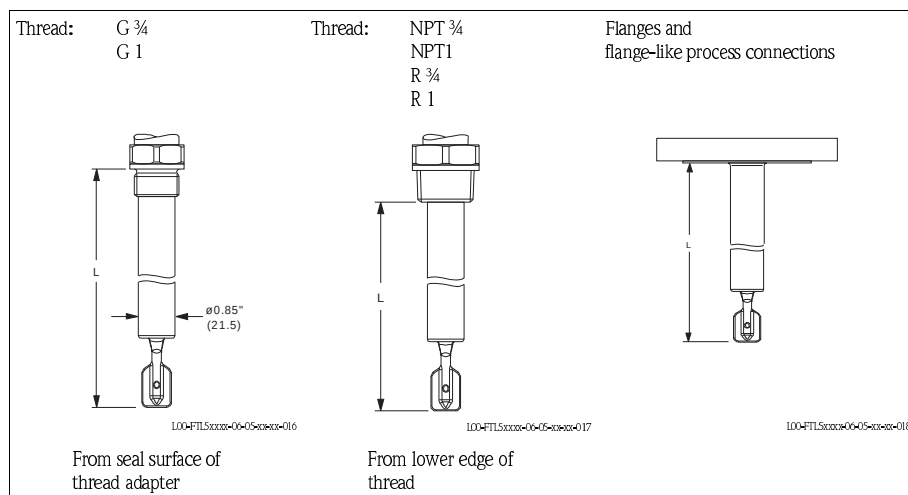
Process connections for FTL50(H) and FTL51(H)

Process connection		Dimensions	Accessories	Pressure Temperature
G 3/4 DIN ISO 228/1 with defined thread start With elastomer flat seal to DIN 7603: supplied	GO2 GO5 GO6			Max. 1450 psi (100 bar) (only FTL51) Max. 300°F (150°C)
G 3/4 DIN ISO 228/1 with defined thread start For flush-mounted installation in welding neck	GO2 GO5 GO6		Welding neck (with defined thread start) with silicone O-ring Endress+Hauser 52001052 In conformity with FDA* See "Accessories"	Max. 363 psi (25 bar) Max. 300°F (150°C) Max. 580 psi (40 bar) Max. 212°F (100°C)
G 1 DIN ISO 228/1 With elastomer flat seal to DIN 7603: supplied	GR2 GR5 GR6			Max. 1450 psi (100 bar) (only FTL51) Max. 300°F (150°C)

Process connection		Dimensions	Accessories	Pressure Temperature
* FDA approved materials according to 21 CFR Part 177.1550/2600				
G 1 DIN ISO 228/1 with defined thread start With seal surface for flush-mounted installation in welding neck	GW2	 100-FTL50xxx-06-05-xx-xx-003	Welding neck (with defined thread start) with silicone O-ring Endress+Hauser 52001051 In conformity with FDA* See "Accessories"	Max. 363 psi (25 bar) Max. 300°F (150°C) Max. 580 psi (40 bar) Max. 212°F (100°C)
NPT 3/4 ANSI B 1.20.1 or R 3/4 EN10226	GM2 GM5 GM6 GE2 GE5 GE6	 100-FTL50xxx-06-05-xx-xx-004	In conformity with FDA*	Max. 1450 psi (100 bar) (only FTL51) Max. 300°F (150°C)
NPT 1 ANSI B 1.20.1 or R 1 EN10226	GN2 GN5 GN6 GF2 GF5 GF6	 100-FTL50xxx-06-05-xx-xx-005	In conformity with FDA*	Max. 1450 psi (100 bar) (only FTL51) Max. 300°F (150°C)
Flanges ANSI B 16.5 EN 1092-1 (DIN 2527 B) JIS B2220	A## B## C## F## N## K##	 100-FTL50xxx-06-05-xx-xx-008	Seal depending on design installed on site In conformity with FDA*	See nominal pressure of flange, however Max. 1450 psi (100 bar) (only FTL51) Max. 300°F (150°C)
AlloyC4/C22 -plated flanges are available for higher chemical-resistance. The flange carrier material comprises 316L and is welded with a 0.08 to 0.12" (2 to 3 mm) thick AlloyC4/C22 disk.				
Tri-Clamp 1 1/2" = ø50.5 mm 2" = ø64.0 mm ISO 2852	TC2 TE2	 100-FTL50xxx-06-05-xx-xx-009	Clamping ring and front seal installed on site In conformity with FDA*	Max. 232 psi (16 bar) Max. 250°F (120°C) Max. 29 psi (2 bar) Max. 300°F (150°C)
Mounting with NA connector (as per ASME, TUBE Standard ASTM A276) only in conjunction with T13, F13 and compact housing. Other housings on request.				
Threaded pipe joint DN 32 DN 40 DN 50 DIN 11851 With thread adapter nut	MA2 MC2 ME2	 100-FTL50xxx-06-05-xx-xx-010	Sealing ring with collar, installed on site In conformity with FDA*	DN 32, DN 40: Max. 40 bar to 100°C Max. 25 bar to 140°C DN 50: Max. 25 bar Max. 140°C
* FDA approved materials according to 21 CFR Part 177.1550/2600				

Process connection		Dimensions	Accessories	Pressure Temperature
Flush-mounted for welding neck Factory standard Endress+Hauser with silicone seal and thread adapter nut: supplied	EE2	 1.00-FTL5xxxx-06-05-xx-xx-011	Welding neck (fork can be positioned) Endress+Hauser 52001047 In conformity with FDA* See "Accessories"	Max. 580 psi (40 bar) Max. 212°F (100°C) Max. 363 psi (25 bar) Max. 300°F (150°C)
Aseptic DN 50 DIN 11864-1 Form A for pipe DIN 11850 with thread adapter nut	HE2	 1.00-FTL5xxxx-06-05-xx-xx-012	Sealing ring, installed on site In conformity with FDA*	Max. 363 psi (25 bar) Max. 284°F (140°C)
DRD With clamped flange	PE2	 1.00-FTL5xxxx-06-05-xx-xx-013	Welding flange with PTFE flat seal (fork can be positioned) Endress+Hauser 52002041 In conformity with FDA* See "Accessories" (or installed on site)	Max. 580 psi (40 bar) Max. 212°F (100°C) Max. 363 psi (25 bar) Max. 300°F (150°C)
SMS 2" (DN 51) with thread adapter nut	UE2	 1.00-FTL5xxxx-06-05-xx-xx-014	Sealing ring, installed on site In conformity with FDA*	Max. 363 psi (25 bar) Max. 284°F (140°C)
Varivent for piping ≥ DN 65 ≥ O.D. 3" ≥ I.P.S. 3"	WE2	 1.00-FTL5xxxx-06-05-xx-xx-015	Clamping ring and O-ring seal, installed on site In conformity with FDA*	See specification as per Tuchenhausen VARIVENT-Inline housing, however: Max. 363 psi (25 bar) Max. 300°F (150°C)
Ingold fitting DN 25 Fitting length 1.81" (46 mm) Thread adapter nut G 1 1/4 With EPDM O-ring seal	TT2	 1.00-FTL5xxxx-06-05-xx-xx-104	In conformity with FDA* (USP Class VI)	Max. 145 psi (10 bar) Max. 300°F (150°C)
* FDA-compliant material in accordance with 21 CFR Part 177.1550/2600				

Sensor length L for FTL51 and FTL51H,
depending on process connection



Any length L:
6 to 118 in (148 mm to 3000 mm); special version (TSP) on request up to 236 in (6000 mm)



Note!

The switch points of the Liquiphant **M** are at other positions to those of the previous version Liquiphant **II**.

Special length "L II":

With vertical mounting from above the same switchpoint as for the Liquiphant II

FTL360, FTL365, FDL30, FDL35

"L II" depends on process connection:

L = 4.5" (115 mm) for flanges and flange-like process connections

L = 4.0" (99 mm) for threads NPT and R (BSPT)

L = 4.6" (118 mm) for threads G1 (BSP 1)

L = 4.5" (115 mm) for threads G ¾ (BSP ¾)

L = 4.1" (104 mm) for flush-mounted 1" (Endress+Hauser)

Weights

See "Product structure"

Material

Material specifications as per AISI and DIN-EN.

Parts in contact with process

- Process connection and extension pipe: 316L SS (1.4435) optionally 2.4610 (AlloyC4), 2.4602 (AlloyC22)
- Tuning fork: 316L SS (1.4435) optionally 2.4610 (AlloyC4), 2.4602 (AlloyC22)
- With a surface roughness quality Ra < 0.38 µm (electropolished), the wetted parts are made of 316L SS (1.4435) in accordance with BN2 (delta ferrite content < 1 %)
- Flanges: 316L SS (1.4435 or 1.4404)
- Flange plating: AlloyC4, AlloyC22
- Flat seal for process connection G ¾ or G 1: elastomer fiber, asbestos-free

Parts with no process contact

- Tuning fork/housing seal: EPDM
- Temperature spacer: 316 L SS (1.4435)
- Pressure tight feed through: 316L SS (1.4435)
- Grounding at housing (outside): 304 SS (1.4301)
- Nameplate at housing (outside): 304 SS (1.4301)
- Cable glands
 - Housing F13, F15, F16, F17: polyamide (PA)
 - With B or C approval (Page 41 ordering information): nickel-plated brass
 - Housing F27: 316L SS
 - Housing T13: nickel-plated brass

- Polyester housing F16: PBT-FR with PBT-FR cover or with PA12 transparent cover
 - Cover seal: EPDM
 - Nameplate glued: polyester film (PET)
 - Pressure compensation filter: PBT-GF20
- Stainless steel housing F15: 316L (1.4404)
 - Cover seal: silicone
 - Safety claw: 304 SS (1.4301)
 - Pressure equalizing filter: PBT-GF20, PA
- Aluminum housing F17/F13: EN-AC-ALSi10Mg, plastic-coated
 - Cover seal: EPDM
 - Safety claw: nickel-plated brass
 - Pressure compensation filter: silicone
- Stainless steel housing F27: 316L (1.4435)
 - Cover seal: FVMQ (optional: EPDM seal available as spare part)
 - Safety claw: 316L SS (1.4435)
- Aluminum housing T13: EN-AC-ALSi10Mg, plastic-coated
 - Cover seal: EPDM
 - Safety claw: nickel-plated brass
- Compact housing (valve connector or M12 connector): 316L SS (1.4435)

Process connections

- Parallel thread G ¾, G 1 to DIN ISO 228/1 with flat seal to DIN 7603
- Tapered thread R ¾, R 1 to EN10226
- Tapered thread ¾ -14 NPT, 1 - 1½ NPT to ANSI B 1.20.1
- Flush-mounted installation with welding neck to factory standard Endress+Hauser (G ¾, G 1)
- Flush-mounted installation with welding neck to factory standard Endress+Hauser (1"), sensor can be positioned
- Tri-Clamp 1½", 2" to ISO 2852
- Threaded pipe joint DN 32, 40, 50 to DIN 11851
- Aseptic connection DN 50 to DIN 11864-1 Form A for pipe DIN 11850
- SMS connection 2" (DN 51)
- DRD flange
- Varivent® DN 50 (50/40) to factory standard Tuchenhausen
- Flanges to EN/DIN from DN 25, for standards see "Product structure," to ANSI B 16.5 from 1", to JIS B2220 (RF)
- Ingold DN25 fitting length 1.81" (46 mm) with thread adapter nut G1 ¼

Human interface

Electronic inserts

With FEL51, FEL52, FEL54, FEL55:

- 2 switches for safety mode and density change,
- green LED to indicate operational status,
- red LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL56:

- 2 switches for safety mode and density change,
- green LED flashes to indicate operational status,
- red LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL57:

- 2 switches for density change and cyclical checking,
- green LED to indicate operational status,
- yellow LED to indicate the covered status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL58:

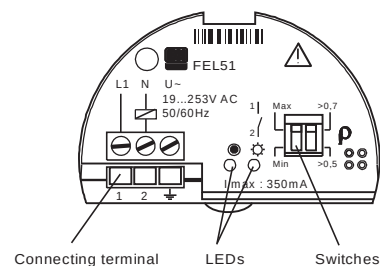
- 2 switches for safety mode and density change,
- green LED
 - flashes quickly to indicate operational status,
 - flashes slowly in the event of corrosion damage on sensor or if the electronics are defective,
- yellow LED to indicate the switching status, Test key – breaks the cable connection

With FEL50A:

- 8 switches for configuring the device address
- green LED to indicate operational status, pulsing to indicate communication;
- yellow LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL50D:

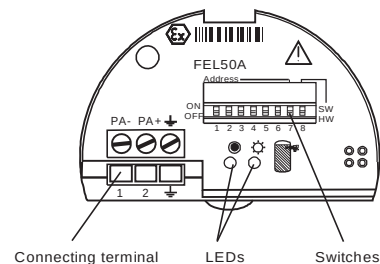
- yellow LED: to indicate the validation of the measurement
- green LED: to indicate the operational status
- red LED: to indicate faults



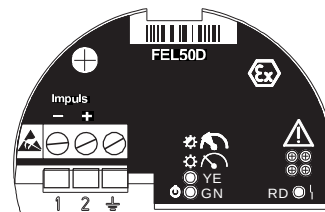
L00-FTL5xxxx-03-05-xx-xx-001



L00-FTL5xxxx-03-05-xx-xx-013



L00-FTL5xxxx-03-05-xx-xx-002



TT328Fxx004

Compact housing

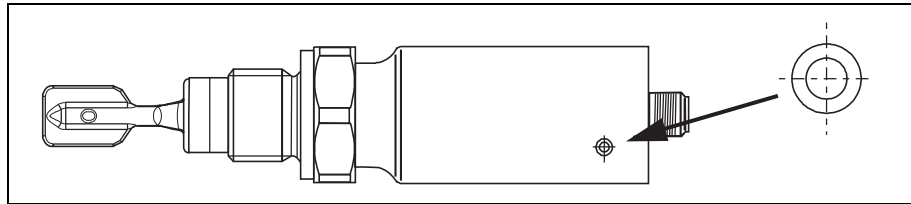
Function test with test magnet

Versions AC, DC-PNP and NAMUR:

During the test, the current state of the electronic switch is reversed.

Performing the test

Hold the test magnet against the marking on the nameplate:

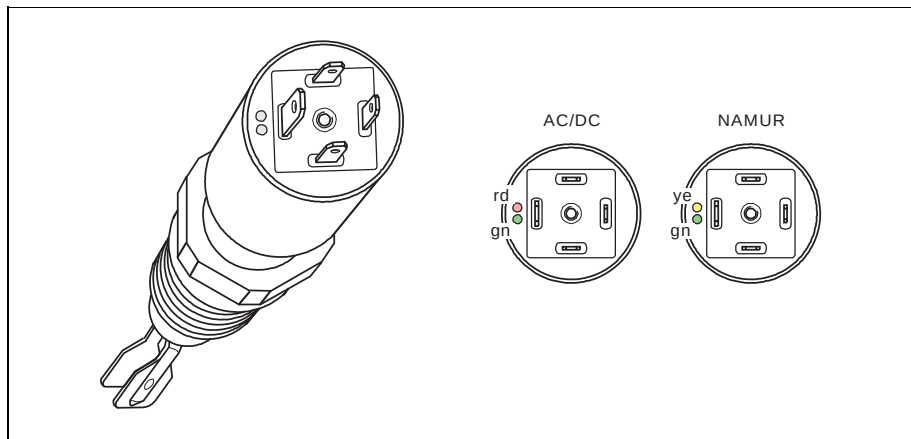


1100-FTL50xxxx-10-05-en-xx-001

The switching status is changed.

Light signals

Versions AC and DC-PNP with valve connector or cable tail



1100-FTL50xxxx-10-05-en-xx-005

Green light (gn) lights up (AC/DC):

Liquiphant M is connected to the power supply and is operational.

Green light (gn) flashing (NAMUR):

Liquiphant M is connected to the power supply and is operational.

Red light (rd) lights up (AC/DC):

MAX application mode (overflow protection): sensor is immersed in liquid.

MIN application mode (dry running protection): sensor is not immersed in liquid.

Yellow light (ye) lights up (NAMUR):

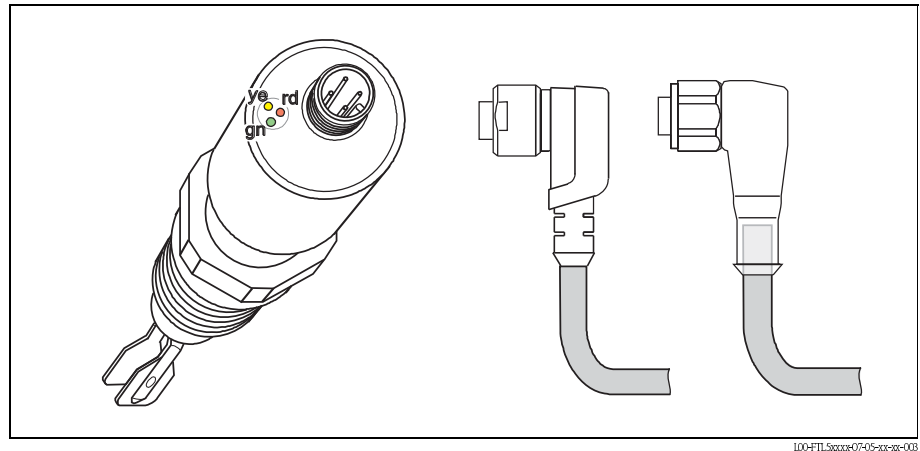
MAX application mode (overflow protection): sensor is not immersed in liquid.

MIN application mode (dry running protection): sensor is immersed in liquid.

Red light (rd) flashing (AC/DC):

Liquiphant M has detected a fault.

Version NAMUR and DC-PNP with M12x1 round connector 316L



LD0-FTL50xxx-07-05-xx-xx-003

Green light (gn) lights up (DC-PNP):

Liquiphant M is connected to the power supply and is operational.

Green light (gn) flashing with 1 Hz (NAMUR):

Liquiphant M is connected to the power supply and is operational.

Yellow light (ye) lights up (DC-PNP):

Sensor is immersed in liquid.

Yellow light (ye) lights up (NAMUR):

MAX application mode (overflow protection): sensor is not immersed in liquid.
MIN application mode (dry running protection): sensor is immersed in liquid.

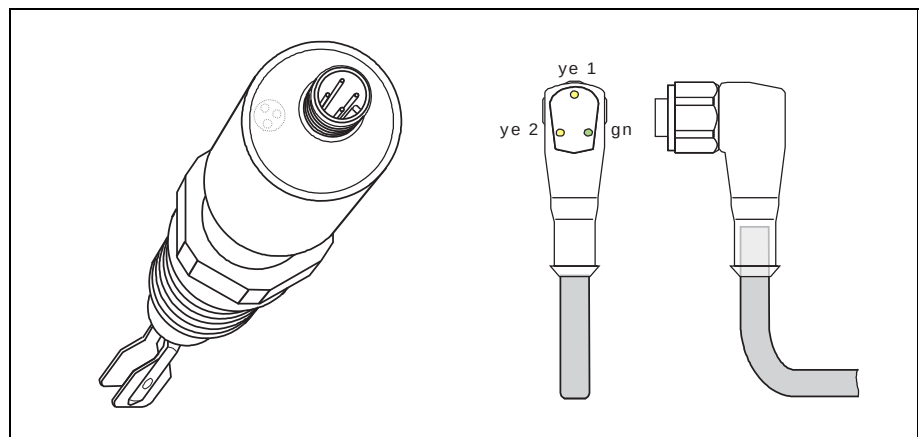
Red light (rd) flashing (DC-PNP):

Liquiphant M has detected a fault.

Green light (gn) flashing with 0.3 Hz (NAMUR):

Liquiphant M has detected a fault.

Version DC-PNP with M12x1 round connector 316L



LD0-FTL50xxx-07-05-xx-xx-004

Green light (gn) lights up:

Liquiphant M is connected to the power supply and is operational.

Yellow light (ye 1) lights up:

MAX application mode (overflow protection): sensor is not immersed in liquid.

MIN application mode (dry running protection): sensor is not immersed in liquid.

Yellow light (ye 2) lights up:

MAX application mode (overflow protection): sensor is immersed in liquid.

MIN application mode (dry running protection): sensor is immersed in liquid.

Green light (gn) lights up, both yellow lights (ye 1+2) do not light up:

Liquiphant M has detected a fault.

Operating concept

Onsite configuration

Certificates and approvals

General approvals

The following approvals are available for Liquiphant M FTL50(H), FTL51(H):

- EHEDG: certification (from TNO, The Netherlands), Report No. V99.394:
- 3A: 3A Certificate (USA), Authorization No. 459
- Certificate of Compliance as per ASME BPE-2007. For further information, please refer to SD310F. (Order code: additional option = B)

Process connections	Order code			ASME BPE + CoC	
				Ra (µm)	
				< 0.38	< 1.5
Flush-mounted G ¾, G1 (with welding neck)	GQ2, GW2	X	X	-	X
Tri-Clamp 2" (special seal from Hyjoin Limited, UK)	TE2	X	X	X	X
Threaded pipe joint	MA2, MC2, ME2	X	X	X	X
Flush-mounted (can be positioned)	EE2	X	X	X	X
Aseptic	HE2	X	X	X	X
DRD	PE2	X	-	-	X
SMS	UE2	X	X	X	X
Varivent®	WE2	X	X	X	X
Ingold	TT2	X	-	X	-



Note!

- For CIP (Clean in Place) and SIP (Sterilize in Place) processes the pressure and temperature specifications of the process connections must be observed.
- Suitable fittings and seals must be used to ensure hygiene-compliant design according to 3A, EHEDG, ASME BPE etc.
- Surface Ra < 0.38 µm (< 15 µin) electropolished; surface Ra < 1.5 µm (59 µin) mechanically polished.



Warning!

To avoid risk of contamination, install according to the "Hygienic Equipment Design Criteria (HDC)" as stated in the Subgroup Design Principles of the EHEDG, Doc. 8, July 1993.

The flow of liquid during cleaning is important and should be in compliance with the HDC.

CRN approval

Versions with a CRN approval (Canadian Registration Number) are marked with a "*" in ordering information feature 20 "process connection" (see Page 41 ff.). CRN-approved devices are fitted with a separate plate bearing the registration number 0F10525.5C.

Other certificates

- Leak-detection system in conjunction with WHG approval

Approval number: Z-65.40-446

(See also "Ordering information" Page 41)

- TSE Certificate of Suitability

The following applies to wetted device components:

- They do not contain any materials derived from animals.
- No additives or operating materials derived from animals are used in production or processing.



Note!

Wetted device components are listed in the "Mechanical construction" (see Page 27) and "Ordering information" (see Page 41) sections.

Combinations of housings and electronic inserts

Based on the various certificates, permissible combinations of housings *) and electronic inserts are given in the following table.

*) Abbreviations: Polyester = PBT, Stainless steel 316L = St., Aluminum = Alu
Aluminum housing with separate connection compartment = Alu/sep

Certificate, applications		Housing	Electronic inserts
A	Without any special certificate (for non-hazardous area)	PBT, St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
D	Overfill protection to WHG (Germany)	PBT, St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A
B	ATEX II 3G EEx nC IIC T6, WHG	PBT, St., Alu, Alu/sep.	FEL54
	ATEX II 3G EEx nC IIC T6, WHG ATEX II 3D T85°C, WHG	St., Alu, Alu/sep.	FEL54
C	ATEX II 3G EEx nA II T6, WHG	PBT, St., Alu, Alu/sep.	FEL51/52, FEL55/56/57/58/50A/ 50D***
	ATEX II 3G EEx nA II T6, WHG ATEX II 3D T85°C, WHG	St., Alu, Alu/sep.	FEL51/52, FEL55/56/57/58/50A/ 50D***
E	ATEX II 1/2 G, EEx de, WHG	Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
F	ATEX II 1/2 G, EEx ia IIC T6, WHG	PBT, St., Alu, Alu/sep.	FEL55/56/57/58/50A/50D
	ATEX II 1/2 G, EEx ia IIC T6, WHG ATEX II 1/2 D, T80°C	St., Alu, Alu/sep.	FEL55/56/57/58/50A/50D
G	ATEX II 1/2 G, EEx ia IIC T6	PBT, St., Alu, Alu/sep.	FEL55/56/57/58/50A/50D
	ATEX II 1/2 G, EEx ia IIC T6 ATEX II 1/2 D, T80°C	St., Alu, Alu/sep.	FEL55/56/57/58/50A/50D
H	ATEX II 1G, EEx ia IIC T6		FEL55/56/57/58/50A/50D
J	ATEX II 1G, EEx ia IIC T6, WHG		FEL55/56/57/58/50A
I	ATEX II 1/2 G, EEx de	Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
K	ATEX II 1/2 G, EEx d IIC T6	Alu	FEL51/52/54, FEL55/56/57/58/50A/50D
L	ATEX II 1/2 G, EEx d IIC T6, WHG	Alu	FEL51/52/54, FEL55/56/57/58/50A/50D
P	FM, IS, Cl. I, II, III, Div. 1, Gr. A–G	PBT, St., Alu, Alu/sep. with NPT cable entry	FEL55/56/57/58/50D FEL50A
Q	FM, XP, Cl. I, II, III, Div. 1, Gr. A–G	Alu with NPT cable entry	FEL51/52/54 FEL55/56/57/58/50D/50A
R	FM, NI, Cl. I, Div. 2, Gr. A–D	St., Alu, Alu/sep. with NPT cable entry	FEL51/52/54, FEL55/56/57/58/50D
		PBT with NPT cable entry	FEL55/56/57/58/50D/50A
U	CSA, General Purpose	St., Alu, Alu/sep. with NPT cable entry	FEL51/52/54, FEL55/56/57/58/50D/50A
		PBT with NPT cable entry	FEL51/52, FEL55/56/57/58/50D/50A
S	CSA, IS, Cl. I, II, III, Div. 1, Gr. A–G	PBT, St., Alu, Alu/sep. with NPT cable entry	FEL55/56/57/58/50D/50A
T	CSA, XP, Cl. I, II, III, Div. 1, Gr. A–G	Alu with NPT cable entry	FEL51/52/54, FEL55/56/57/58/50D/50A
V	TIIS Ex ia IIC T3	PBT, St., Alu	FEL57/50D***
W	TIIS Ex d IIB T3	Alu	FEL52/54/50D***
Y	Other certificate (for non-hazardous area)	PBT, St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
*** In preparation!			


Note!

With polyester housing (PBT), electric connecting cables run in pipes:
Do not screw cable entries firmly to the piping. Use flexible connections (e.g. with armored hose).
If piping is used for grounding, then ensure that there is a continuous electrical connection.


Note!

Despite the additional dust ignition-proof certificates, the FTL5x(H) is to be used as a liquid point level switch only.

Ordering information


Note!

Versions that are mutually exclusive are not indicated in this list.

Liquiphant M FTL50 FTL51 product structure

Design		Basic weight	
FTL50	Compact	1.3 lb	0.6 kg
FTL51	With extension pipe	1.3 lb	0.6 kg

10	Approval:		
A	Non-hazardous area		
B	ATEX/NEPSI II 3 G/ ATEX/NEPSI II 3 D	EEx nC II T6 T 85 °C*	Overfill protection to WHG (Germany)
C	ATEX/NEPSI II 3 G ATEX /NEPSI II 3 D	EEx nA II T6 T 85 °C*	Overfill protection to WHG (Germany)
D	Non-hazardous area		Overfill protection to WHG (Germany)
E	ATEX II 1/2 G	EEx de IIC T6	Overfill protection to WHG (Germany)
F	ATEX II 1/2 G ATEX II 1/2 D	EEx ia IIC T6 T 80 °C*	Overfill protection to WHG (Germany)
G	ATEX II 1/2 G ATEX II 1/2 D	EEx ia IIC T6 T 80 °C*	
H	ATEX II 1 G	EEx ia IIC T6	
I	ATEX II 1/2 G	EEx de IIC T6	
J	ATEX II 1 G	EEx ia IIC T6	Overfill protection to WHG (Germany)
K	ATEX II 1/2 G	EEx d IIC T6	
L	ATEX II 1/2 G	EEx d IIC T6	Overfill protection to WHG (Germany)
M	NEPSI	Ex ia IIC T6	
N	NEPSI	Ex d IIC T6	
P	FM	IS, Class I, II, III	Division 1, Group A–G
Q	FM	XP, Class I, II, III	Division 1, Group B–G, for E5 housing Group A–G
R	FM	NI, Class I	Division 2, Group A–D
S	CSA	IS, Class I, II, III	Division 1, Group A–G
T	CSA	XP, Class I, II, III	Division 1, Group A–G
U	CSA	General Purpose	
V	TIIS	Ex ia IIC T3	
W	TIIS	Ex d IIB T3	
X	TIIS	Ex ia IIC T6	
7	TIIS	Ex d IIC T3	
8	TIIS	Ex d IIC T6	
Y	Special version		
	*) Not for PBT		

20	Process connection:			Additional weight	
	Note! For a process pressure of 100 bar, please select the appropriate option under "Additional options"				
GQ2	G ¾	316L	Thread ISO 228		
	Installation > accessories: welding neck				
GQ5	G ¾	Alloy C4	Thread ISO 228		
GQ6**	G ¾	AlloyC22	Thread ISO 228		
GR2	G 1	316L	Thread ISO 228	0.4 lb	0.2 kg
GR5	G 1	Alloy C4	Thread ISO 228	0.4 lb	0.2 kg
GR6**	G 1	AlloyC22	Thread ISO 228	0.4 lb	0.2 kg
GW2*	G 1	316L	Thread ISO 228	0.4 lb	0.2 kg
	Installation > accessories: welding neck				

20	Process connection:				Additional weight	
	GM2*	NPT ¾	316L	Thread ANSI		
	GM5*	NPT ¾	Alloy C4	Thread ANSI		
	GM6**	NPT ¾	AlloyC22	Thread ANSI		
	GN2*	NPT1	316L	Thread ANSI	0.4 lb	0.2 kg
	GN5*	NPT1	Alloy C4	Thread ANSI	0.4 lb	0.2 kg
	GN6**	NPT1	AlloyC22	Thread ANSI	0.4 lb	0.2 kg
	GE2	R ¾	316L	Thread EN10226		
	GE5	R ¾	Alloy C4	Thread EN10226		
	GE6**	R ¾	AlloyC22	Thread EN10226		
	GF2	R 1	316L	Thread EN10226	0.4 lb	0.2 kg
	GF5	R 1	Alloy C4	Thread EN10226	0.4 lb	0.2 kg
	GF6**	R 1	AlloyC22	Thread EN10226	0.4 lb	0.2 kg
	BA2	DN32 PN6 A	316L	Flange EN 1092-1 (DIN 2527 B)	2.6 lb	1.2 kg
	BB2	DN32 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	4.4 lb	2.0 kg
	BC2	DN40 PN6 A	316L	Flange EN 1092-1 (DIN 2527 B)	3.0 lb	1.4 kg
	BD2	DN40 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	5.3 lb	2.4 kg
	BE2	DN50 PN6 A	316L	Flange EN 1092-1 (DIN 2527 B)	3.5 lb	1.6 kg
	BG2	DN50 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	7.1 lb	3.2 kg
	BH2	DN65 PN6 A	316L	Flange EN 1092-1 (DIN 2527 B)	5.3 lb	2.4 kg
	BJ2	DN50 PN100 A	316L (FTL51)	Flange EN 1092-1 (DIN 2527 B)		
	BK2	DN65 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	9.5 lb	4.3 kg
	BM2	DN80 PN10/16 A	316L	Flange EN 1092-1 (DIN 2527 B)	11 lb	4.8 kg
	BN2	DN80 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	13 lb	5.9 kg
	BQ2	DN100 PN10/16 A	316L	Flange EN 1092-1 (DIN 2527 B)	12 lb	5.6 kg
	BR2	DN100 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	17 lb	7.5 kg
	B12	DN80 PN100 A	316L (FTL51)	Flange EN 1092-1 (DIN 2527 B)		
	B82	DN25 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	3.0 lb	1.4 kg
	CA2	DN32 PN6 B1	316L	Flange EN 1092-1 (DIN 2527 C)	2.5 lb	1.1 kg
	CA5	DN32 PN6	Alloy C4 >316L	Flange EN 1092-1 (DIN 2527)	2.5 lb	1.1 kg
	CA6**	DN32 PN6 B1	AlloyC22 >316L	Flange EN 1092-1 (DIN 2527)	2.5 lb	1.1 kg
	CE2	DN50 PN6 B1	316L	Flange EN 1092-1 (DIN 2527 C)	3.3 lb	1.5 kg
	CE5	DN50 PN6	Alloy C4 >316L	Flange EN 1092-1 (DIN 2527)	3.3 lb	1.5 kg
	CE6**	DN50 PN6 B1	AlloyC22 >316L	Flange EN 1092-1 (DIN 2527)	3.3 lb	1.5 kg
	CG2	DN50 PN25/40 B1	316L	Flange EN 1092-1 (DIN 2527 C)	6.4 lb	2.9 kg
	CG5	DN50 PN25/40	Alloy C4 >316L	Flange EN 1092-1 (DIN 2527)	6.4 lb	2.9 kg
	CG6**	DN50 PN25/40 B1	AlloyC22 >316L	Flange EN 1092-1 (DIN 2527)	6.4 lb	2.9 kg
	CJ2	DN50 PN100 B2	316L (FTL51)	Flange EN 1092-1 (DIN 2527)		
	CN2	DN80 PN25/40 B1	316L	Flange EN 1092-1 (DIN 2527 C)	12 lb	5.2 kg
	CN5	DN80 PN25/40	Alloy C4 >316L	Flange EN 1092-1 (DIN 2527)	12 lb	5.2 kg
	CN6**	DN80 PN25/40 B1	AlloyC22 >316L	Flange EN 1092-1 (DIN 2527)	12 lb	5.2 kg
	CQ2	DN100 PN10/16 B1	316L	Flange EN 1092-1 (DIN 2527 C)	12 lb	5.3 kg
	CQ5	DN100 PN10/16	Alloy C4 >316L	Flange EN 1092-1 (DIN 2527)	12 lb	5.3 kg

20		Process connection:					Additional weight	
	CO6**	DN100	PN10/16 B1	AlloyC22 >316L	Flange EN 1092-1 (DIN 2527)	12 lb	5.3 kg	
	C12	DN80	PN25/40 B1	316L (FTL51)	Flange EN 1092-1 (DIN 2527)			
	C82	DN25	PN25/40 B1	316L	Flange EN 1092-1 (DIN 2527 C)	2.9 lb	1.3 kg	
	C85	DN25	PN25/40	Alloy C4 >316L	Flange EN 1092-1 (DIN 2527)	2.9 lb	1.3 kg	
	C86**	DN25	PN25/40 B1	AlloyC22 >316L	Flange EN 1092-1 (DIN 2527)	2.9 lb	1.3 kg	
	DC2	DN50	PN40 B1	316L	Flange EN 1092-1 (DIN 2526 D)			
	DN2	DN80	PN40 B1	316L	Flange EN 1092-1 (DIN 2526 D)			
	D82	DN25	PN40 B1	316L	Flange EN 1092-1 (DIN 2526 D)			
	FG2	DN50	PN40 C	316L	Flange EN 1092-1 (DIN 2512 F)	5.7 lb	2.6 kg	
	NG2	DN50	PN40 D	316L	Flange EN 1092-1 (DIN 2512 N)	6.4 lb	2.9 kg	
	AA2*	1¼"	150 lbs	RF 316/316L	Flange ANSI B16.5	2.6 lb	1.2 kg	
	AB2*	1¼"	300 lbs	RF 316/316L (FTL51)	Flange ANSI B16.5	4.4 lb	2.0 kg	
	AC2*	1½"	150 lbs	RF 316/316L	Flange ANSI B16.5	3.3 lb	1.5 kg	
	AD2*	1½"	300 lbs	RF 316/316L (FTL51)	Flange ANSI B16.5	6.0 lb	2.7 kg	
	AE2*	2"	150 lbs	RF 316/316L	Flange ANSI B16.5	5.3 lb	2.4 kg	
	AE5*	2"	150 lbs	RF Alloy C4 >316/316L	Flange ANSI B16.5	5.3 lb	2.4 kg	
	AE6**	2"	150 lbs	RF AlloyC22 >316/316L	Flange ANSI B16.5	5.3 lb	2.4 kg	
	AF2*	2"	300 lbs	RF 316/316L	Flange ANSI B16.5	7.1 lb	3.2 kg	
	AG2*	2"	600 lbs	RF 316/316L (FTL51)	Flange ANSI B16.5	9.3 lb	4.2 kg	
	AJ2*	2½"	300 lbs	RF 316/316L (FTL51)	Flange ANSI B16.5	11 lb	4.8 kg	
	AL2*	3"	150 lbs	RF 316/316L	Flange ANSI B16.5	11 lb	4.9 kg	
	AM2*	3"	300 lbs	RF 316/316L (FTL51)	Flange ANSI B16.5	15 lb	6.8 kg	
	AM6**	3"	300 lbs	RF AlloyC22 >316/316L	Flange ANSI B16.5	15 lb	6.8 kg	
	AN2*	3"	600 lbs	RF 316/316L (FTL51)	Flange ANSI B16.5			
	AP2*	4"	150 lbs	RF 316/316L	Flange ANSI B16.5	15 lb	7.0 kg	
	AQ2*	4"	300 lbs	RF 316/316L (FTL51)	Flange ANSI B16.5	25 lb	11.5 kg	
	AQ6**	4"	300 lbs	RF AlloyC22 >316/316L	Flange ANSI B16.5	25 lb	11.5 kg	
	AR2*	4"	600 lbs	RF 316/316L (FTL51)	Flange ANSI B16.5	38 lb	17.3 kg	
	A82*	1"	150 lbs	RF 316/316L	Flange ANSI B16.5	2.2 lb	1.0 kg	
	KA2	10 K 25		RF 316L	Flange JIS B2220			
	KC2	10 K 40		RF 316L	Flange JIS B2220			
	KE2	10 K 50		RF 316L	Flange JIS B2220	3.7 lb	1.7 kg	
	KE5	10 K 50		RF Alloy C4 >316L	Flange JIS B2220	3.7 lb	1.7 kg	
	KE6**	10 K 50		RF AlloyC22 >316L	Flange JIS B2220	3.7 lb	1.7 kg	
	KL2	10 K 80		RF 316L	Flange JIS B2220			
	KP2	10 K 100		RF 316L	Flange JIS B2220			
	TC2*	DN25-38 (1 to 1½")		316L	ISO 2852 Tri-Clamp			
	TE2*	DN40-51 (2")		316L	ISO 2852 Tri-Clamp	0.2 lb	0.1 kg	
	YY9	Special version						
		* With CRN approval. ** AlloyC22 in preparation						

30		Probe length; Type:					
		FTL50					
	AA	Compact;		Ra <3.2 µm/80 grit			
	IA	Compact;		Temperature spacer		1.3 lb	0.6 kg
	QA	Compact;		Pressure tight feed through		1.5 lb	0.7 kg
		FTL51					
	BB	 mm;	316L**	Ra <3.2 µm/80 grit			
	BE	 mm;	Alloy**	Ra <3.2 µm/80 grit			
	CB	 inch;	316L**	Ra <3.2 µm/80 grit			
	CE	 inch;	Alloy**	Ra <3.2 µm/80 grit		5.0 lb/100 in	
	DB	Length: type II*;	316L	Ra <3.2 µm/80 grit		0.2 lb	0.1 kg
	DE	Length: type II*;	Alloy	Ra <3.2 µm/80 grit		0.2 lb	0.1 kg
	JB	 mm;	316L**	+ Temperature spacer			0.9 kg/m +0.6 kg
	JE	 mm;	Alloy**	+ Temperature spacer			0.9 kg/m +0.6 kg

30		Probe length; Type:	
		KB	 inch; 316L** + Temperature spacer 5 lb/100 in +1.3 lb
		KE	 inch; Alloy** + Temperature spacer 5lb/100 in +1.3 lb
		LB	Length: type II*; 316L + Temperature spacer 0.2 lb 0.1 kg +1.3 lb +0.6 kg
		LE	Length: type II*; Alloy + Temperature spacer 0.2 lb 0.1 kg +1.3 lb +0.6 kg
		RB	 mm; 316L** + Pressure tight feed through 0.9 kg/m +0.7 kg
		RE	 mm; Alloy** + Pressure tight feed through 0.9 kg/m +0.7 kg
		SB	 inch; 316L** + Pressure tight feed through 5 lb/100 in +1.5 lb
		SE	 inch; Alloy** + Pressure tight feed through 5 lb/100 in +1.5 lb
		TB	Length: type II*; 316L + Pressure tight feed through 0.2 lb 0.1 kg 1.5 lb +0.7 kg
		TE	Length: type II*; Alloy + Pressure tight feed through 0.2 lb 0.1 kg 1.5 lb +0.7 kg
		YY	Special version
		*) Replacing devices: when vertically mounting a Liquiphant M FTL51 with length II, the switch point is at the same height as for a Liquiphant II FTL360, FTL365, FDL30, FDL35. See also Page 33, "L II" depends on process connection.	
		**) Order 116 to 235 in (3001 to 6000 mm) via yy	
40		Electronics; output:	
		A	FEL50A PROFIBUS PA
		D	FEL50D Density/concentration
		1	FEL51* 2-wire, 19 to 253 V AC
		2	FEL52* 3-wire PNP, 10 to 55 V DC
		4	FEL54 Relay DPDT, 19 to 253 V AC, 19 to 55 V DC
		5	FEL55 8/16 mA, 11 to 36 V DC
		6	FEL56 NAMUR (L-H signal)
		7	FEL57 2-wire PFM
		8	FEL58* NAMUR + test keys (H-L signal)
		9	Special version
		*) Also available in compact housing	
50		Housing; cable entry:	
		C3	Compact 316L IP66/68; Cable 5 m
		D3	Compact 316L IP65; Plug Pg11 ISO4400
		E1*	F27 316L NEMA6P; Thread NPT ¾
		E3	Compact 316L NEMA4X; Plug NPT ½ ISO4400
		N3	Compact 316L IP66/68; M12 connector
		E4	F16 Polyester NEMA4X; Thread NPT ½
		E5	F13/F17 Alu NEMA4X; Thread NPT ¾ 1.1 lb 0.5 kg
		E6	F15 316L NEMA4X; Thread NPT ½ 0.2 lb 0.1 kg
		E7	T13 Alu IP66; Thread NPT ¾ 2.0 lb 0.9 kg
		Separate connection compartment	
		F1*	F27 316L IP68 Thread G1/2
		F4	F16 Polyester IP66; Thread G ½
		F5	F13/F17 Alu IP66; Thread G ½ 1.1 lb 0.5 kg
		F6	F15 316L IP66; Thread G ½ 0.2 lb 0.1 kg
		F7	T13 Alu coated, IP66; Thread G ½ 2.0 lb 0.9 kg
		Separate connection compartment	
		G1*	F27 316L IP68; M20 threaded joint
		G4	F16 Polyester IP66; M20 threaded joint
		G5	F13/F17 Alu IP66; M20 threaded joint 1.1 lb 0.5 kg (EEx d > M20 thread)
		G6	F15 316L IP66; M20 threaded joint 0.2 lb 0.1 kg
		G7	T13 Alu coated, IP66; M20 threaded joint 2.0 lb 0.9 kg (EEx d > M20 thread)
		Separate connection compartment	
		N4	F16 Polyester IP66; M12 connector
		N5	F13/F17 Alu IP66; M12 connector
		N6	F15 316L IP66; M12 connector
		Y9	Special version
		* F27 housing in preparation.	



The basic weight includes the compact sensor, thread adapter G 3/4, electronic insert, polyester housing

Liquiphant M
FTL50H
FTL51H product structure

Design		Basic weight	
FTL50H	Compact	1.5 lb	0.7 kg
FTL51H	With extension pipe	1.5 lb	0.7 kg

10	Approval:			
A	Non-hazardous area			
B	ATEX/NEPSI II 3 G	EEx nC II T6	Overfill protection to WHG (Germany)	
	ATEX/NEPSI II 3 D	T 85 °C*		
C	ATEX/NEPSI II 3 G	EEx nA II T6	Overfill protection to WHG (Germany)	
	ATEX/NEPSI II 3 D	T 85 °C*		
D	Non-hazardous area		Overfill protection to WHG (Germany)	
E	ATEX II 1/2 G	EEx de IIC T6	Overfill protection to WHG (Germany)	
F	ATEX II 1/2 G	EEx ia IIC T6	Overfill protection to WHG (Germany)	
	ATEX II 1/2 D	T 80 °C*		
G	ATEX II 1/2 G	EEx ia IIC T6		
	ATEX II 1/2 D	T 80 °C*		
H	ATEX II 1 G	EEx ia IIC T6		
I	ATEX II 1/2 G	EEx de IIC T6		
J	ATEX II 1 G	EEx ia IIC T6	Overfill protection to WHG (Germany)	
K	ATEX II 1/2 G	EEx d IIC T6		
L	ATEX II 1/2 G	EEx d IIC T6	Overfill protection to WHG (Germany)	
M	NEPSI	Ex ia IIC T6		
N	NEPSI	Ex d IIC T6		
P	FM	IS, Class I, II, III	Division 1, Group A–G	
Q	FM	XP, Class I, II, III	Division 1, Group B–G, for E5 housing Group A–G	
R	FM	NI, Class I	Division 2, Group A–D	
S	CSA	IS, Class I, II, III	Division 1, Group A–G	
T	CSA	XP, Class I, II, III	Division 1, Group A–G	
U	CSA	General Purpose		
V	TIIS	Ex ia IIC T3		
W	TIIS	Ex d IIB T3		
X	TIIS	Ex ia IIC T6		
7	TIIS	Ex d IIC T3		
8	TIIS	Ex d IIC T6		
Y	Special version *) Not for PBT			

20	Process connection:				Additional weight	
	GO2	G ¾	316L (FTL50H)	Thread ISO 228		
	Installation > accessories: welding neck					
	GW2*	G 1	316L	Thread ISO 228	0.4 lb	0.2 kg
	Installation > accessories: welding neck					
	BA2	DN32 PN6 A	316L	Flange EN 1092-1 (DIN 2527 B)	2.6 lb	1.2 kg
	BB2	DN32 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	4.4 lb	2.0 kg
	BC2	DN40 PN6 A	316L	Flange EN 1092-1 (DIN 2527 B)	3.1 lb	1.4 kg
	BD2	DN40 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	5.3 lb	2.4 kg
	BE2	DN50 PN6 A	316L	Flange EN 1092-1 (DIN 2527 B)	3.5 lb	1.6 kg
	BG2	DN50 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	7.1 lb	3.2 kg
	BH2	DN65 PN6 A	316L	Flange EN 1092-1 (DIN 2527 B)	5.3 lb	2.4 kg
	BK2	DN65 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	9.5 lb	4.3 kg
	BM2	DN80 PN10/16 A	316L	Flange EN 1092-1 (DIN 2527 B)	11 lb	4.8 kg
	BN2	DN80 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	13 lb	5.9 kg
	BQ2	DN100 PN10/16 A	316L	Flange EN 1092-1 (DIN 2527 B)	12 lb	5.6 kg
	BR2	DN100 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	17 lb	7.5 kg
	B82	DN25 PN25/40 A	316L	Flange EN 1092-1 (DIN 2527 B)	3.1 lb	1.4 kg
	CG2	DN50 PN25/40 B1	316L	Flange EN 1092-1 (DIN 2527 C)	7.1 lb	3.2 kg

20	Process connection:					Additional weight	
	CN2	DN80	PN25/40 B1	316L	Flange EN 1092-1 (DIN 2527 C)	13 lb	5.9 kg
	CO2	DN100	PN10/16 B1	316L	Flange EN 1092-1 (DIN 2527 C)	12 lb	5.6 kg
	EE2	1" flush-mounted (52001047)		316L		0.7 lb	0.3 kg
	HE2	Installation > accessories: welding neck					
	AA2*	DN50	Pipe DIN 11850	316L	DIN 11864-1 A	0.7 lb	0.3 kg
	AC2*	1 1/4"	150 lbs	RF 316/316L	Flange ANSI B16.5	2.6 lb	1.2 kg
	AE2*	1 1/2"	150 lbs	RF 316/316L	Flange ANSI B16.5	2.6 lb	1.5 kg
	AE2*	2"	150 lbs	RF 316/316L	Flange ANSI B16.5	5.3 lb	2.4 kg
	AF2*	2"	300 lbs	RF 316/316L	Flange ANSI B16.5	7.1 lb	3.2 kg
	AJ2*	2 1/2"	300 lbs	RF 316/316L (FTL51H)	Flange ANSI B16.5	11 lb	4.8 kg
	AL2*	3"	150 lbs	RF 316/316L	Flange ANSI B16.5	11 lb	4.9 kg
	AM2	3"	300 lbs	RF 316/316L (FTL51H)	Flange ANSI B16.5	15 lb	6.8 kg
	AP2*	4"	150 lbs	RF 316/316L	Flange ANSI B16.5	15 lb	7.0 kg
	AQ2*	4"	300 lbs	RF 316/316L (FTL51H)	Flange ANSI B16.5	25 lb	11.5 kg
	AR2*	1"	150 lbs	RF 316/316L	Flange ANSI B16.5	2.2 lb	1.0 kg
	KA2	10 K 25		RF 316L	Flange JIS B2220		
	KC2	10 K 40		RF 316L	Flange JIS B2220		
	KE2	10 K 50		RF 316L	Flange JIS B2220	3.7 lb	1.7 kg
	KL2	10 K 80		RF 316L	Flange JIS B2220		
	KP2	10 K 100		RF 316L	Flange JIS B2220		
	MA2	DN32	PN25	316L	DIN 11851	0.2 lb	0.1 kg
	MC2	DN40	PN25	316L	DIN 11851	0.4 lb	0.2 kg
	ME2	DN50	PN25	316L	DIN 11851	0.7 lb	0.3 kg
	PE2	DRD	65 mm	316L		0.7 lb	0.3 kg
	TC2*	DN25-38 (1 to 1 1/2")		316L	ISO 2852 Tri-Clamp		
	TE2*	DN40-51 (2")		316L	ISO 2852 Tri-Clamp	0.2 lb	0.1 kg
	TT2**	Ingold fitting 25x46mm		316L			
	UE2	SMS 2"	PN25	316L		0.4 lb	0.2 kg
	WE2*	DN65-162	PN10	316L	Varivent N pipe	1.1 lb	0.5 kg
	YY9	Special version * CRN approval ** In preparation					

30	Probe length; Type:						
	FTL50H						
	AC	Compact;	Ra <1.5 µm/120 grit				
	AD	Compact;	Ra <0.3 µm/320 grit / A3				
	IC	Compact;	Ra <1.5 µm/120 grit + temperature spacer		1.3 lb	0.6 kg	
	ID	Compact;	Ra <0.3 µm/320 grit / A3 + temperature spacer		1.3 lb	0.6 kg	
	QC	Compact;	Ra <1.5 µm/120 grit + Pressure tight feed through		1.5 lb	0.7 kg	
	Q	Compact;	Ra <0.3 µm/320 grit / A3 + Pressure tight feed through		1.5 lb	0.7 kg	
	D						
	FTL51H						
	BC	 mm;	Ra <1.5 µm/120 grit			0.9 kg/m	
	BD	 mm;	Ra <0.3 µm/320 grit / A3			0.9 kg/m	
	CC	 inch;	Ra <1.5 µm/120 grit			5 lb/100 in	
	CD	 inch;	Ra <0.3 µm/320 grit / A3			5 lb/100 in	
	DC	Length: type II*;	Ra <1.5 µm/120 grit		0.2 lb	0.1 kg	
	DD	Length: type II*;	Ra <0.3 µm/320 grit / A3		0.2 lb	0.1 kg	
	JC	 mm;	Ra <1.5 µm/120 grit + Temperature spacer			0.9 kg/m	
	JD	 mm;	Ra <0.3 µm/320 grit + Temperature spacer			0.9 kg/m	
	KC	 inch;	Ra <1.5 µm/120 grit + Temperature spacer			5 lb/100 in	
	KD	 inch;	Ra <0.3 µm/320 grit + Temperature spacer			5 lb/100 in	
	LC	Length: type II*;	Ra <1.5 µm/120 grit + Temperature spacer		0.1 lb	0.1 kg	
	LD	Length: type II*;	Ra <0.3 µm/320 grit + Temperature spacer		0.1 lb	0.1 kg	
	RC	 mm;	Ra <1.5 µm/120 grit + Pressure tight feed through		0.9 kg/m	0.7 kg	
	RD	 mm;	Ra <0.3 µm/320 grit + Pressure tight feed through		0.9 kg/m	0.7 kg	
	SC	 inch;	Ra <1.5 µm/120 grit + Pressure tight feed through			5 lb/100 in	
	SD	 inch;	Ra <0.3 µm/320 grit + Pressure tight feed through			5 lb/100 in	

30					Probe length; Type:		
				TC	Length: type II*; Ra <1.5 µm/120 grit + Pressure tight feed through	0.2 lb +1.5 lb	0.1 kg +0.7 kg
				TD	Length: type II*; Ra <0.3 µm/320 grit + Pressure tight feed through	0.2 lb +1.5 lb	0.1 kg +0.7 kg
				YY	Special version		
				*) Replacing devices: when vertically mounting a Liquiphant M FTL51H with length II, the switch point is at the same height as for a Liquiphant II FTL360, FTL365, FDL30, FDL35. See also Page 33, "L II" depends on process connection.			
40					Electronics; output:		
				A	FEL50A	PROFIBUS PA	
				D	FEL50D	Density/concentration	
				1	FEL51*	2-wire, 19 to 253 V AC	
				2	FEL52*	3-wire PNP, 10 to 55 V DC	
				4	FEL54	Relay DPDT, 19 to 253 V AC, 19 to 55 V DC	
				5	FEL55	8/16 mA, 11 to 36 VDC	
				6	FEL56	NAMUR (L-H signal)	
				7	FEL57	2-wire PFM	
				8	FEL58*	NAMUR + test keys (H-L signal)	
				9	Special version		
				*) Also available in compact housing			
50					Housing; cable entry:		
				C3	Compact 316L	IP66/68; Cable 5 m	
				D3	Compact 316L	IP65; Plug Pg11	ISO 4400
				E1*	F27 316L	NEMA6P; Thread NPT ¾	
				E3	Compact 316L	NEMA4X; Plug NPT ½	ISO 4400
				N3	Compact 316L	IP66/68; M12 connector	
				E4	F16 Polyester	NEMA4X; Thread NPT ½	-0.2 lb -0.1 kg
				E5	F13/F17 Alu	NEMA4X; Thread NPT ¾	0.9 lb 0.4 kg
				E6	F15 316L	NEMA4X; Thread NPT ½	
				E7	T13 Alu coated, IP66;	Thread NPT ¾	1.8 lb 0.8 kg
				Separate connection compartment			
				F1*	F27 316L	IP68 Thread G1/2	
				F4	F16 Polyester	IP66; Thread G ½	-0.2 lb -0.1 kg
				F5	F13/F17 Alu	IP66; Thread G ½	0.9 lb 0.4 kg
				F6	F15 316L	IP66; Thread G ½	
				F7	T13 Alu coated, IP66;	Thread G ½	1.8 lb 0.8 kg
				Separate connection compartment			
				G1*	F27 316L	IP68; M20 threaded joint	
				G4	F16 Polyester	IP66; M20 threaded joint	-0.2 lb -0.1 kg
				G5	F13/F17 Alu	IP66; M20 threaded joint (EEx d > M20 thread)	0.9 lb 0.4 kg
				G6	F15 316L	IP66; M20 threaded joint	
				G7	T13 Alu coated, IP66;	M20 threaded joint (EEx d > M20 thread)	1.8 lb 0.8 kg
				Separate connection compartment			
				N4	F16 Polyester	IP66; M12 connector	
				N5	F13/F17 Alu	IP66; M12 connector	
				N6	F15 316L	IP66; M12 connector	
				Y9	Special version		
				* F27 housing in preparation.			
60					Additional options		
				A	Basic version		
				B*	CoC, EN 10204 - 3.1 material (316L wetted) inspection certificate		
				C	EN 10204 - 3.1 material (316L wetted), inspection certificate		
				K	Special adjustment, density H20		
				L	Special adjustment, density H20, EN10204-3.1 (316L wetted) inspection certificate		
				S	GL/ABS marine approval (FTL51H: max. 1600 mm)		
				Y	Special version		
* In preparation.							
FTL5#H -					Complete product designation		

**Note!**

Basic weight = compact sensor, thread adapter G ¾, electronic insert, stainless steel housing

Accessories

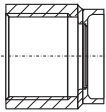
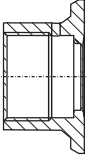
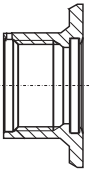
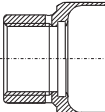
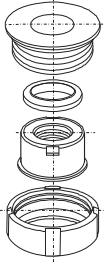


Note!

- All dimensions in mm
- For more detailed information on welding necks, please refer to TI426F/00.
- The tolerance of the defined thread start between the welding neck and sensor is $\pm 15^\circ$.

Welding neck

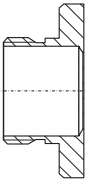
Overview

							
		a0008246	a0008251	a0008256	a0011924	a0008248	a0008253
		G$\frac{3}{4}$, d=29 without flange	G$\frac{3}{4}$, d=50 with flange	G$\frac{3}{4}$, d=55 with flange	G1, d=53 with flange	G1, d=60 with flange	G1 can be positioned
Material roughness μm (μin)		316L 1.5 (59.1)	316L 0.8 (31.5)	316L 0.8 (31.5)	316L 0.8 (31.5)	316L 0.8 (31.5)	316L 0.8 (31.5)
Without inspection certificate EN10204-3.1 material		—	—	52001052	—	52001051 ¹⁾	52001221 ²⁾
With inspection certificate EN10204-3.1 material		52028295	52018765	52011897	71093129 ¹⁾	52011896 ¹⁾	52011898 ²⁾
Seal (set of 5)		Silicone O-ring 52021717 ³⁾	Silicone O-ring 52021717 ³⁾	Silicone O-ring 52014473 ³⁾	Silicone O-ring 52014472 ³⁾	Silicone O-ring 52014472 ³⁾	Silicone profile gasket 52014424 ³⁾
Weld-in dummy		—	—	MVT2L0692	MVT2L0691	MVT2L0691	M40167
Liquiphant M	Feature	Version					
FTL50	020			GQ2			
FTL5x					GW2	GW2	GW2
FTL50H				GQ2			
FTL5xH					GW2	GW2	GW2

1) This welding neck replaces the welding neck with the order number 917969-1000.

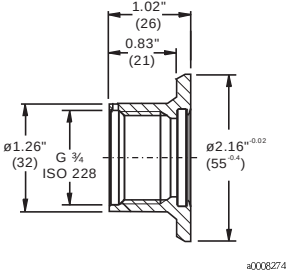
2) This welding neck replaces the welding neck with the order number 215159-0000.

3) A seal is included in the delivery.

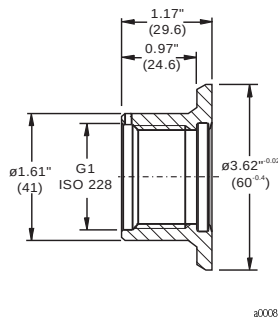
						
		a0008252	a0008245	a0008245	a0008552	a0008254
		RD52	Uni D85	Uni D65	M24 D65	DRD DN50 (65 mm) (welding flange)
Material roughness μm (μin), process side		316L 0.8 (31.5)	316L 3.2 (126)	316L 0.8 (31.5)	316L 0.8 (31.5)	316L/304 0.8 (31.5)
Without inspection certificate EN10204-3,1 material		52001047 ¹⁾	52006262	214880-0002	71041381	52002041/ 916743-0000
With inspection certificate EN10204-3,1 material		52006909 ¹⁾	52010173	52010174	71041383	52011899/ –
Seal (set of 5)		Silicone profile gasket 52014424	Silicone profile gasket 52023572	Silicone profile gasket 52023572	–	PTFE flat seal 52024228
Weld-in dummy		M40167	71093102	71093102	–	–
Device	Feature	Version				
Liquiphant M						
FTL5xH	O20	EE2				PE2

1) This welding neck replaces the welding neck with the order number 942329-0001.

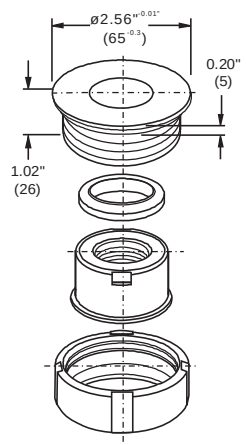
G $\frac{3}{4}$, d=55
with flange for
flush-mounted installation

Dimensions	Version	Order number
 ■ Max. 362 psi (25 bar) max. 300°F (150°C) ■ Max. 580 psi (40 bar) 212°F (max. 100°C)	■ AISI 316L (1.4435) ■ Roughness: Ra <0.8 µm	52001052
	■ AISI 316L (1.4435) with inspection certificate EN10204-3.1 material ■ Roughness: Ra <0.8 µm	52011897
	Silicone O-ring, Ø 21.89 x 2.62 Material: VMQ70, FDA	52014473 (set of 5)
	Sensor dummy for welding in the welding neck	MVT2L0692
	FDA-compliant material in accordance with 21 CFR Part 177.1550/2600 Approval: 3A, EHEDG	
	Alternative seals Ø 21.89 x 2.62	Order number
	Material: EPDM, FDA	MVT2L1148
	Material: Kalrez Comp. 2035	MVT2L0666
	Material: Viton	MVT2L0655
	Material: Viton/FEP-FEK 75 Shore	MVT2L1748
	Material: Silicone, VMQ23-70, FDA, USP Class VI	71086100 (set of 3)

G1, d=60
with flange for flush-mounted
installation with sealing
surface

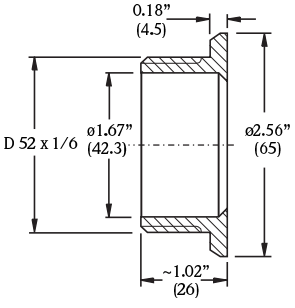
Dimensions	Version	Order number
 ■ Max. 362 psi (25 bar) max. 300°F (150°C) ■ Max. 580 psi (40 bar) max. 212°F (100°C)	■ AISI 316L (1.4435) ■ Roughness: Ra <0.8 µm	52001051
	■ AISI 316L (1.4435) with inspection certificate EN10204-3.1 material ■ Roughness: Ra <0.8 µm	52011896
	Silicone O-ring, Ø 28.17 x 3.53 Material: VMO70, FDA	52014472 (set of 5)
	Sensor dummy for welding in the welding neck	MVT2L0691
	FDA-compliant material in accordance with 21 CFR Part 177.1550/2600 Approval: EHEDG, 3A	
	Alternative seals Ø 28.17 x 3.53	Order number
	Material: EPDM70, FDA	MVT2L0920
	Material: Viton665, FDA	MVT2L0705 (set of 5)
	Material: Viton971, V, FDA	MVT2L1682
	Material: Kalrez comp. 4079	MVT2L0567
	Material: Silicone, VMO23-70, FDA, USP Class VI	71086102 (set of 3)

G1
Sensor can be positioned

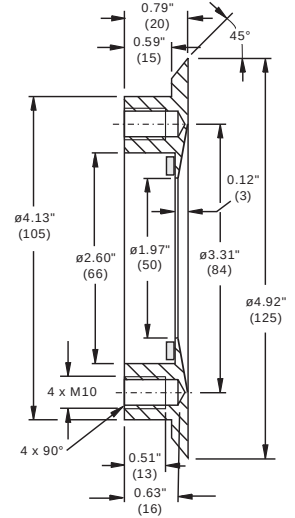
Dimensions	Version	Order number
 ■ Max. 362 psi (25 bar) max. 300°F (150°C) ■ Max. 580 psi (40 bar) max. 212°F (100°C)	■ AISI 316L (1.4435) ■ Roughness: Ra <0.8 µm	52001221
	■ AISI 316L (1.4435) with inspection certificate EN10204-3.1 material ■ Roughness: Ra <0.8 µm	52011898
	Silicone profile gasket 29 x 36 x 3.7 Material: SI-60, FDA	52014424 (set of 5)
	Sensor dummy for welding in the welding neck	M40167
	FDA-compliant material in accordance with 21 CFR Part 177.1550/2600 Approval: 3A, EHEDG	
	Alternative seals 29 x 36 x 3.7	Order number
	Material: EPDM-60, FDA	52012805
	Material: Silicone, VMO60, FDA, USP Class VI	71075662 (set of 5)

RD52

Sensor can be positioned

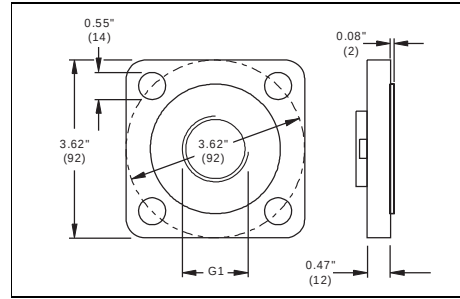
Dimensions	Version	Order number
 ■ Max. 362 psi (25 bar) max. 300°F (150°C) ■ Max. 580 psi (40 bar) max. 212°F (100°C)	■ AISI 316L (1.4435) ■ Roughness: Ra <0.8 µm	52001047
	■ AISI 316L (1.4435) with inspection certificate EN10204-3.1 material ■ Roughness: Ra <0.8 µm	52006909
	Silicone profile gasket 29 x 36 x 3.7 Material: SI-60, FDA ■ The seal can be easily replaced with this version.	52014424 (set of 5)
	Sensor dummy for welding in the welding neck	M40167
	FDA-compliant material in accordance with 21 CFR Part 177.1550/2600 Approval: 3A, EHEDG	
	Alternative seals 29 x 39 x 3.7	Order number
	Material: EPDM-60, FDA	52012805
	Material: Silicone, VMO60, FDA, USP Class VI	71075662 (set of 5)

DRD DN50 (65 mm)
for flush-mounted installation
of devices with DRD flange

Dimensions	Version	Order number
 ■ Max. 362 psi (25 bar) max. 300°F (150°C) ■ Max. 580 psi (40 bar) max. 212°F (100°C)	■ AISI 316L (1.4435) ■ Roughness: Ra <0.8 µm	52002041
	■ AISI 316L (1.4435) with inspection certificate EN10204-3.1 material ■ Roughness: Ra <0.8 µm	52011899
	AISI 304 (1.4301)	916743-0000
	Flat seal, 50 x 65 x 1 Material: PTFE, FDA	52024228 (set of 5)
	FDA-compliant material in accordance with 21 CFR Part 177.1550/2600	

Flange

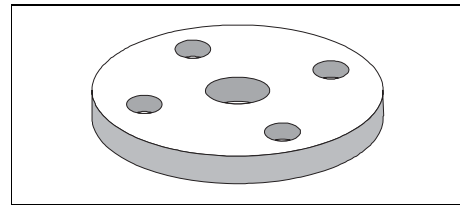
Order number: 918158-0000
 With G 1 thread for mounting
 a Liquiphant FTL50, FTL51
 with process connection GR2
 Pressure up to 580 psi (40 bar)
 Material: corrosion-resistant steel
 1.4301 (AISI 304 SS)
 Weight: 1.2 lb (0.54 kg)



100-FTL50xxx-00-05-en-es-024

Flange

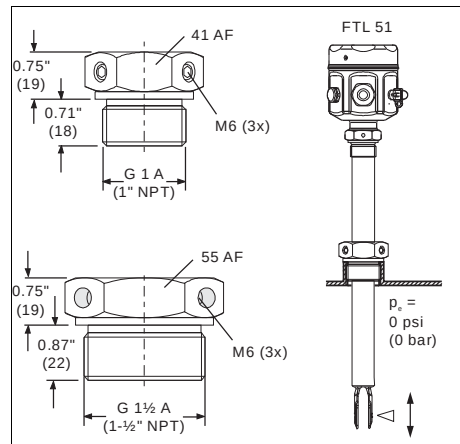
With G 1 thread for mounting
 a Liquiphant FTL50, FTL51
 with process connection GR2
 Material: corrosion-resistant steel
 1.4571 (AISI 316Ti SS)
 – Order number: 918143-0000
 Flange DN50 PN40, EN 1092-1
 Weight: 6.9 lb (3.11 kg)
 – Order number: 918144-0000
 Flange ANSI 2", 150 psi, RF
 Weight: 5.2 lb (2.38 kg)



100-FTL50xxx-00-05-en-es-015

Sliding sleeves for unpressurized operation

For continuous adjustment of the switch
 point of a Liquiphant M FTL51
 Material: corrosion-resistant steel
 1.4435 (AISI 316 L SS)
 Weight for G 1, NPT 1: 0.5 lb (0.21 kg)
 Weight for G 1½, NPT 1½: 1.2 lb (0.54 kg)



100-FTL50xxx-00-05-en-es-006

Thread	Standard	Material	Order number	Approval
G 1	DIN ISO 228/1	1.4435 (AISI 316 L)	52003978	
G 1	DIN ISO 228/1	1.4435 (AISI 316 L)	52011888	3.1 inspection certificate EN 10204 - 3.1 material
NPT1	ANSI B 1.20.1	1.4435 (AISI 316 L)	52003979	
NPT1	ANSI B 1.20.1	1.4435 (AISI 316 L)	52011889	3.1 inspection certificate EN 10204 - 3.1 material
G 1½	DIN ISO 228/1	1.4435 (AISI 316 L)	52003980	
G 1½	DIN ISO 228/1	1.4435 (AISI 316 L)	52011890	3.1 inspection certificate EN 10204 - 3.1 material
NPT1½	ANSI B 1.20.1	1.4435 (AISI 316 L)	52003981	
NPT1½	ANSI B 1.20.1	1.4435 (AISI 316 L)	52011891	3.1 inspection certificate EN 10204 - 3.1 material

High pressure sliding sleeves

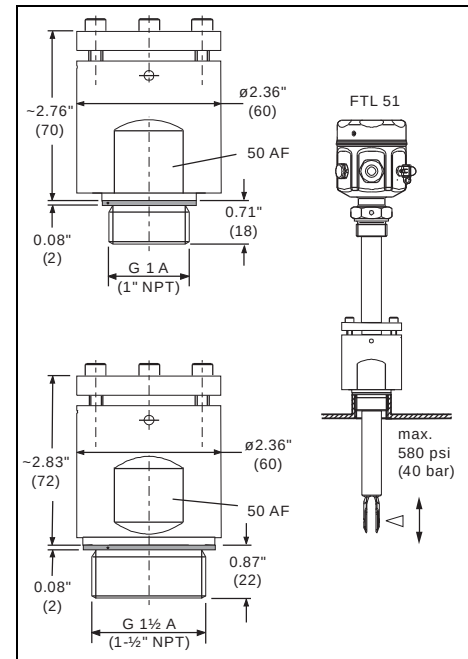
For continuous adjustment of the switch point of a Liquiphant M FTL51.
Also for use in hazardous areas.
For further information Page 59.
(ATEX, NEPSI).

Material: corrosion-resistant steel
1.4435 (AISI 316L SS) or AlloyC4

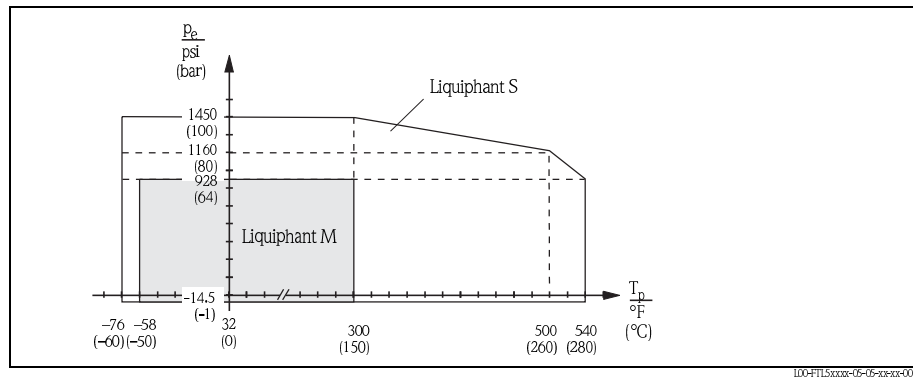
Weight for G 1, NPT 1: 2.5 lb (1.13 kg)

Weight for G 1½, NPT 1½: 2.9 lb (1.32 kg)

Seal package made of graphite



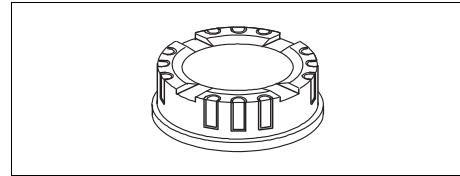
Thread	Standard	Material	Order number	Approval
G 1	DIN ISO 228/1	1.4435 (AISI 316 L)	52003663	
G 1	DIN ISO 228/1	1.4435 (AISI 316 L)	52011880	3.1 inspection certificate EN 10204 - 3.1 material
G 1	DIN ISO 228/1	Alloy C4	52003664	
G 1	DIN ISO 228/1	AlloyC22	*	
NPT1	ANSI B 1.20.1	1.4435 (AISI 316 L)	52003667	
NPT1	ANSI B 1.20.1	1.4435 (AISI 316 L)	52011881	3.1 inspection certificate EN 10204 - 3.1 material
NPT1	ANSI B 1.20.1	Alloy C4	52003668	
NPT1	ANSI B 1.20.1	AlloyC22	*	
G 1½	DIN ISO 228/1	1.4435 (AISI 316 L)	52003665	
G 1½	DIN ISO 228/1	1.4435 (AISI 316 L)	52011882	3.1 inspection certificate EN 10204 - 3.1 material
G 1½	DIN ISO 228/1	Alloy C4	52003666	
G 1½	DIN ISO 228/1	AlloyC22	*	
NPT1½	ANSI B 1.20.1	1.4435 (AISI 316 L)	52003669	
NPT1½	ANSI B 1.20.1	1.4435 (AISI 316 L)	52011883	3.1 inspection certificate EN 10204 - 3.1 material
NPT1½	ANSI B 1.20.1	Alloy C4	52003670	
NPT1½	ANSI B 1.20.1	AlloyC22	*	
* AlloyC22 in preparation.				



* FTL51 with high-pressure sliding sleeve (1450 psi / 100 bar). See "Additional fitting" Page 41 option "P" or "R".

Transparent cover

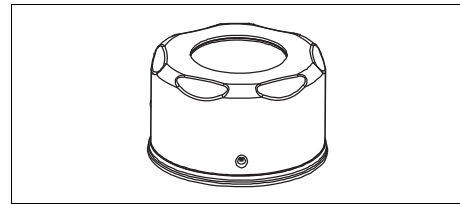
Order number: 943461-0001
for polyester housing F16
Material: PA 12
Weight: 0.1 lb (0.04 kg)



100-FTL5xxxx-03-05-xx-xx-002

Cover with sight glass

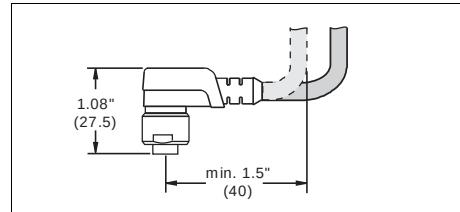
For stainless steel housing F15
Material: AISI 316L SS
Weight: 0.4 lb (0.16 kg)
– Order number: 943301-1000
With glass sight glass
– Order number: 52001403
With PC sight glass
(Not for CSA, General Purpose)



100-FTL5xxxx-03-05-xx-xx-017

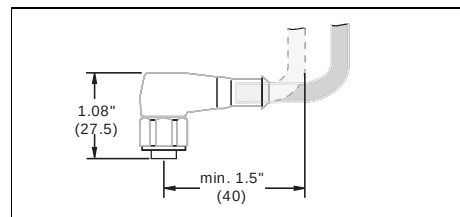
Circular connector

Order number: 52010285
4x0.34 M12 socket
Cable: PVC (gray) 16 ft / 5 m
Body: PUR (blue)
Thread adapter nut: Cu Sn/Ni
Degree of protection: IP67
Temperature range: -13 to +158°F (-25 to +70°C)



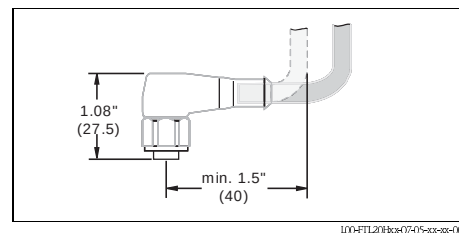
100-FTL20Hxx-07-05-xx-xx-004

Order number: 52024216
4x0.34 M12 socket
Cable: PVC (orange) 16 ft / 5 m
Body: PVC (orange)
Thread adapter nut: 316L SS
Degree of protection: IP69K (fully locked)
Temperature range: -13 to +158°F (-25 to +70°C)



100-FTL20Hxx-07-05-xx-xx-005

Order number: 52018763
 4x0.34 M12 socket with integrated LEDs
 Cable: PVC (orange) 16 ft / 5 m
 Body: PVC (transparent)
 Thread adapter nut: 316L SS
 Degree of protection: IP69K (fully locked)
 Temperature range: -13 to +158°F (-25 to +70°C)



Documentation



Note!
 You can find supplementary documentation on the product pages at www.endress.com

Operating Instructions

Electronic insert FEL50A for Liquiphant M/S
 PROFIBUS PA
 BA141F/00/en

Liquiphant M Density,
 Density Computer FML621
 BA335F/00/en

Liquiphant M FTL50, FTL51
 KA143F/00/a6

Liquiphant M FTL50(H), FTL51(H)
 KA144F/00/a6

Liquiphant M FTL51C
 KA162F/00/a6

Liquiphant M FTL50-##### # 7 #, FTL51-##### # 7 #
 KA163F/00/a6

Liquiphant M FTL50H-##### # 7 #, FTL51H-##### # 7 #
 KA164F/00/a6

Liquiphant M FTL51C-##### # 7 ##
 KA165F/00/a6

Liquiphant M FTL5#-# ### # # #3 #, FTL5#H-# ### # # #3 #
 KA220F/00/a6

Liquiphant M Density FTL50, FTL51
 Electronic insert: FEL50D
 KA284F/00/a6

Liquiphant M Density FTL50H, FTL51H
 Electronic insert: FEL50D
 KA285F/00/a6

Liquiphant M Density FTL51C
 Electronic insert: FEL50D
 KA286F/00/a6

Liquiphant M Sliding Sleeve for FTL51, G 1, NPT 1
 KA151F/00/a6

Liquiphant M Sliding Sleeve for FTL51, G 1½, NPT 1½
 KA152F/00/a6

Liquiphant M High-pressure Sliding Sleeve for FTL51, G 1, NPT 1
 KA153F/00/a6

Liquiphant M High-pressure Sliding Sleeve for FTL51, G 1½, NPT 1½
 KA154F/00/a6

Technical Information

Nivotester FTL370/372, switching units in Racksyst design
for Liquiphant M with electronic insert FEL57
TI198F/00/en

Nivotester FTL320, switching unit in Minipac design
for Liquiphant M with electronic insert FEL57
TI203F/00/de

General instructions for electromagnetic compatibility
(Test procedure, installation recommendation)
TI241F/00/en

Liquiphant M FTL51C, wetted parts with highly corrosion-resistant
ECTFE, PFA or enamel coating
TI347F/00/en

Isolating amplifier FTL325P, 1 or 3-channel switching units for top-hat rail mounting
for Liquiphant M/S with electronic insert FEL57
TI350F/00/en

Isolating amplifier FTL325N, 1 or 3-channel switching units for top-hat rail mounting
For Liquiphant M/S with electronic insert FEL56, FEL58
TI353F/00/en

Liquiphant S FTL70/71, for medium temperatures up to 280 °C
TI354F/00/en

Isolating amplifier FTL375P, 1 to 3-channel switching units for top-hat rail mounting
for Liquiphant M/S with electronic insert FEL57
TI360F/00/en

Isolating amplifier FTL375N, 1 to 3-channel switching units for top-hat rail mounting
For Liquiphant M/S with electronic insert FEL56, FEL58
TI361F/00/en

Liquiphant M Density,
Density Computer FML621
TI420F/00/en

Welding neck,
TI426F/00/en

ASME-BPE
Certificate of Compliance
SD310F/00/en

Functional safety (SIL)

Liquiphant M/S with electronic insert FEL51 (MAX)
SD164F/00/en

Liquiphant M/S with electronic insert FEL51 (MIN)
SD185F/00/en

Liquiphant M/S with electronic insert FEL52 (MAX)
SD163F/00/en

Liquiphant M/S with electronic insert FEL52 (MIN)
SD186F/00/en

Liquiphant M/S with electronic insert FEL54 (MAX)
SD162F/00/en

Liquiphant M/S with electronic insert FEL54 (MIN)
SD187F/00/en

Liquiphant M/S with electronic insert FEL55 (MAX)
SD167F/00/en

Liquiphant M/S with electronic insert FEL55 (MIN)
SD279F/00/en

Liquiphant M/S with electronic insert FEL57 + Nivotester FTL325P (MAX)
SD111F/00/en

Liquiphant M/S with electronic insert FEL57 + Nivotester FTL325P (MIN)
SD231F/00/en

Liquiphant M/S with electronic insert FEL57+ Nivotester FTL375P (MAX)
SD113F/00/en

Liquiphant M/S with electronic insert FEL56 + Nivotester FTL325N (MAX)
SD168F/00/en

Liquiphant M/S with electronic insert FEL56 + Nivotester FTL325N (MIN)
SD188F/00/en

Liquiphant M/S with electronic insert FEL58 + Nivotester FTL325N (MAX)
SD161F/00/en

Liquiphant M/S with electronic insert FEL58 + Nivotester FTL325N (MIN)
SD170F/00/en

Safety Instructions (ATEX)

CE II 1/2 G, EEx d IIC/B
(KEMA 99 ATEX 1157)
XA031F/00/a3

CE II 1/2 G, EEx ia/ib IIC/B
(KEMA 99 ATEX 0523)
XA063F/00/a3

CE II 1 G, EEx ia IIC/B
(KEMA 99 ATEX 5172 X)
XA064F/00/a3

CE II 1/2 G, EEx de IIC/B
(KEMA 00 ATEX 2035)
XA108F/00/a3

CE II 3 G, EEx nA/nC II
(EG 01 007-a)
XA182F/00/a3

Safety Instructions (NEPSI)

Ex d IIC/IIB T3-T6, Ex d IIC T2-T6 (NEPSI GYJ06424)
XA401F/00/B2

Ex ia IIC T2-T6, Ex ia IIB T3-T6 (NEPSI GYJ05556, NEPSI GYJ06464)
XC009F/00/b2

Ex nA II T3-T6, Ex nC/nL IIC T3-T6 (NEPSI GYJ04360, NEPSI GYJ071414)
XC010F/00/b2

Control Drawings

Liquiphant M/S (IS and NI) Current output PFM, NAMUR Entity installation
Class I, Div. 1, 2, Groups A, B, C, D
Class I, Zone 0
Class II, Div. 1, 2, Groups E, F, G
Class III
ZD041F-I/00/EN

Liquiphant M, Liquiphant S (cCSAus / IS)
Class I, Div. 1, Groups A, B, C, D Ex ia IIC T6
Class II, Div. 1, Groups E, F, G
Class III
ZD042F-G/00/EN

Liquiphant M/S (NI), FTL50(H), FTL51(H), FTL51C, FTL70, FTL71
Class I, Div. 2, Groups A, B, C, D
Class II, Div. 2, Groups F, G
Class III
ZD043F-C/00/EN

Liquiphant M, Liquiphant S (cCSAus / XP)
Class I, Groups A, B, C, D
Class II, Groups E, F, G
Class III
ZD240F/00/EN

Liquiphant M/S (IS and NI) PROFIBUS PA, FOUNDATION FieldbusClass I, Zone 0, IIC
 Class I, Division 1, 2, Groups A, B, C, D
 Class II, Division 1, 2, Groups E, F, G
 Class III
 ZD244F/00/EN

System information

Liquiphant M
 SI040F/00/en

United States

Endress+Hauser, Inc.
 2350 Endress Place
 Greenwood, IN 46143
 Tel. 317-535-7138
 Sales 888-ENDRESS
 888-363-7377
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 fax 317-535-8498
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 www.us.endress.com

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 Burlington, ON L7L 5Z8
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 800-668-3199
 Fax 905-681-9444
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 Fracc. Industrial San Nicolás
 54030. Tlalnepantla de Baz
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 México
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 Fax +52 55 5321 2099
 eh.mexico@mx.endress.com
 www.mx.endress.com

Section 2.0

Installation, Operation and Maintenance Manuals

Tags:

121-HRDBP-B0-LT-0301
122-LKSDE-B0-LT-0301
123-MTRSP-B0-LT-0301
124-OYENS-B0-LT-0301
125-BDLSS-B0-LT-0301
126-FXVLY-B0-LT-0301
127-PIAPT-B0-LT-0301
128-GRSSY-B0-LT-0301
121-HRDBP-B0-LSHH-0302
122-LKSDE-B0-LSHH-0302
123-MTRSP-B0-LSHH-0302
124-OYENS-B0-LSHH-0302
125-BDLSS-B0-LSHH-0302
126-FXVLY-B0-LSHH-0302
127-PIAPT-B0-LSHH-0302
128-GRSSY-B0-LSHH-0302
121-HRDBP-B0-LT-0303
122-LKSDE-B0-LT-0303
123-MTRSP-B0-LT-0303
124-OYENS-B0-LT-0303
125-BDLSS-B0-LT-0303
126-FXVLY-B0-LT-0303
127-PIAPT-B0-LT-0303
128-GRSSY-B0-LT-0303



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

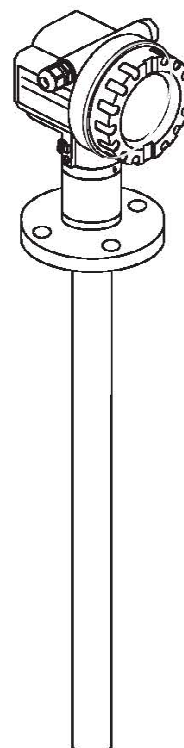
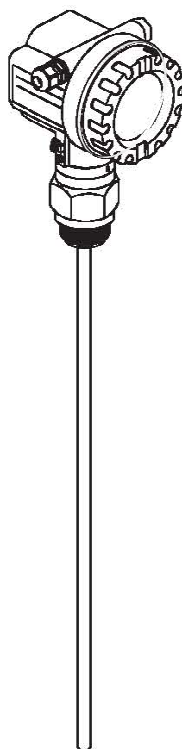
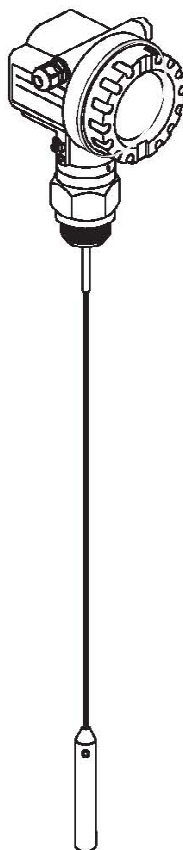


Solutions

Operating Instructions

Levelflex M FMP40

Guided Level-Radar



BA00242F/00/EN/13.10
71120266

Valid as of software version:
01.04.zz

Endress+Hauser 
People for Process Automation

Endress+Hauser



This Operating Instructions explains how to install and commission the level transmitter. All functions that are required for a typical measuring task are taken into account here. In addition, the Levelflex M provides many other functions for optimizing the measuring point and converting measured values. These functions are not included in these Operating Instruction.

The Operating Instructions BA00245F/00/EN "Description of Instrument Functions" provides an **extensive description of all device functions**, which can be found on the enclosed CD-ROM.

The Operating Instructions can also be found on our homepage: www.endress.com

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1 Safety instructions

1.1 Designated use

The Levelflex M is a compact level transmitter for the continuous measurement of solids and liquids, measuring principle: Guided Level Radar / TDR: **T**ime **D**omain **R**eflectometry.

1.2 Installation, commissioning and operation

The Levelflex M has been designed to operate safely in accordance with current technical, safety and EU standards. If installed incorrectly or used for applications for which it is not intended, however, it is possible that application-related dangers may arise, e.g. product overflow due to incorrect installation or calibration. For this reason, the device must be installed, connected, operated and maintained according to the instructions in this manual: personnel must be authorised and suitably qualified. The manual must have been read and understood, and the instructions followed. Modifications and repairs to the device are permissible only when they are expressly approved in the manual.

1.3 Operational safety and process safety

Alternative monitoring measures must be taken to ensure operational safety and process safety during configuration, testing and maintenance work on the device.

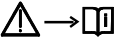
Hazardous areas

Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of this Operating Manual. Strict compliance with the installation instructions and ratings as stated in this Additional documentation is mandatory.

- Ensure that all personnel are suitably qualified.
- Observe the specifications in the certificate as well as national and local regulations.

1.4 Notes on safety conventions and symbols

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding symbol in the margin.

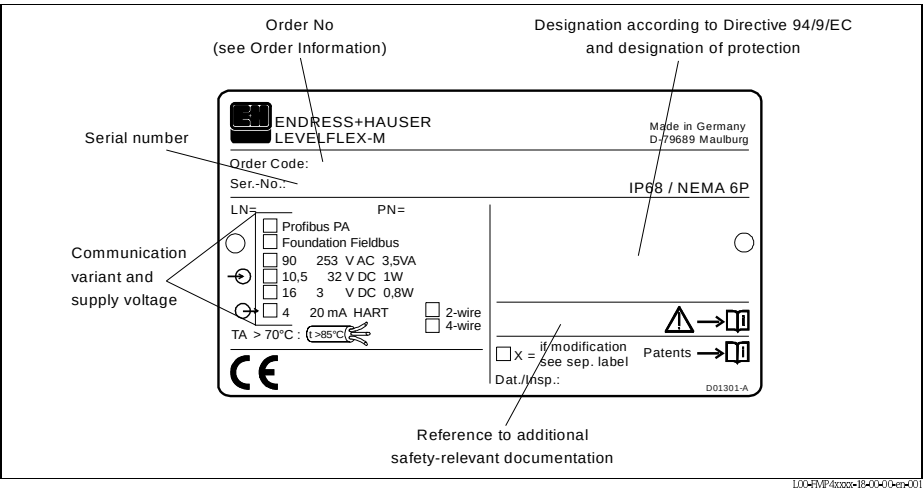
Safety conventions	
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the device.
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the device.
	Note! A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an device response which is not planned.
Explosion protection	
	Device certified for use in explosion hazardous area If the device has this symbol embossed on its name plate it can be installed in an explosion hazardous area.
	Explosion hazardous area Symbol used in drawings to indicate explosion hazardous areas. Devices located in and wiring entering areas with the designation "explosion hazardous areas" must conform with the stated type of protection.
	Safe area (non-explosion hazardous area) Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas.
Electrical symbols	
	Direct voltage A terminal to which or from which a direct current or voltage may be applied or supplied.
	Alternating voltage A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied.
	Grounded terminal A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system.
	Protective grounding (earth) terminal A terminal which must be connected to earth ground prior to making any other connection to the equipment.
	Equipotential connection (earth bonding) A connection made to the plant grounding system which may be of type e.g. neutral star or equipotential line according to national or company practice.
	Temperature resistance of the connection cables States, that the connection cables must be resistant to a temperature of at least 85 °C.
	Safety Instruction For safety instructions refer to the manual for the appropriate device version.

2 Identification

2.1 Device designation

2.1.1 Nameplate

The following technical data are given on the device nameplate:



Information on the nameplate of the Levelflex M FMP40

2.1.2 Product structure

This overview does not mark options which are mutually exclusive.

10	Approval:
	A Non-hazardous area
	F Non-hazardous area, WHG
	1 ATEX II 1/2G Ex ia IIC T6/IECEx Zone 0/1
	2 ATEX II 1/2D/IEC Ex td A20/21, Alu blind cover
	3 ATEX II 2G Ex emb (ia) IIC T6/IECEx Zone I
	4 ATEX II 1/3D/IEC Ex td A20/22
	5 ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D
	6 ATEX II 1/2G Ex ia IIC T6, WHG
	7 ATEX II 1/2G Ex d (ia) IIC T6/ IEC Ex d(ia) IIC T6
	8 ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D, WHG
	G ATEX II 3G Ex nA II T6
	C NEPSI Ex emb (ia) IIC T6
	I NEPSI Ex ia IIC T6
	J NEPSI Ex d (ia) IIC T6
	Q NEPSI DIP
	R NEPSI Ex nA II T6
	M FM DIP CL,II Div.1 Gr. E-G N.I.
	S FM IS CL,I,II,III Div.1 Gr. A-G N.I., zone 0, 1, 2
	T FM XP CL,I,II,III Div.1 Gr. A-G, zone 1, 2
	N CSA General Purpose
	P CSA DIP CL,II Div.1 Gr. G + coal dust, N.I.
	U CSA IS CL,I,II,III Div.1 Gr. A-D, G + coal dust, N.I., zone 0, 1, 2
	V CSA XP CL,I,II,III Div.1 Gr. A-D, G + coal dust, N.I., zone 1, 2
	W IEC Ex td A20/21, Alu blind cover
	X IEC Ex td A20/22
	K TIIS Ex ia IIC T4 (in preparation)
	L TIIS Ex d (ia) IIC T4
	Y Special version, TSP-No. to be spec.

20			Probe:
			A Rope 4mm / 1/6", mainly liquid B Rope 6mm / 1/4", solid H Rope 6mm / 1/4", PA > steel, solid, T _{max} = 100°C / 212°F P Rod 6mm, liquid I Rod 12mm, liquid K Rod 16mm, mainly liquid L Coax, liquid Y Special version, TSP-No. to be spec.
30			Probe length:
			A mm, rope 4mm, 316 B mm, rope 6mm, 316 C inch rope 1/6", 316 D inch, rope 1/4", 316 E mm, rope 6mm, PA > steel F inch, rope 1/4", PA > steel K mm, rod 16mm, 316L L mm, coax, 316L M inch, rod 16mm, 316L N inch, coax, 316L P mm, rod 6mm, 316L R inch, rod 6mm, 316L S mm, rod 16mm, 316L, 500mm divisible T mm, rod 16mm, 316L, 1000mm divisible U inch, rod 16mm, 316L, 20in divisible V inch, rod 16mm, 316L, 40in divisible 1 mm rod 12mm, AlloyC22 2 mm coax, AlloyC22 3 inch, rod 12mm, AlloyC22 4 inch, coax, AlloyC22 Y Special version, TSP-No. to be spec.
40			O-ring Material; Temperature:
			2 Viton; -30...150°C/-22...302°F 3 EPDM; -40...120°C/-40...248°F 4 Kalrez; -5...150°C/23...302°F 9 Special version, TSP-No. to be spec.
50			Process Connection:
			ACJ 1-1/2" 150lbs RF, 316/316L flange ANSI B16.5 ACM 1-1/2" 150lbs, AlloyC22 >316/316L flange ANSI B16.5 ADJ 1-1/2" 300lbs RF, 316/316L flange ANSI B16.5 ADM 1-1/2" 300lbs, AlloyC22 >316/316L flange ANSI B16.5 AEJ 2" 150lbs RF, 316/316L flange ANSI B16.5 AEM 2" 150lbs, AlloyC22 >316/316L flange ANSI B16.5 AFJ 2" 300lbs RF, 316/316L flange ANSI B16.5 AFM 2" 300lbs, AlloyC22 >316/316L flange ANSI B16.5 ALJ 3" 150lbs RF, 316/316L flange ANSI B16.5 ALM 3" 150lbs, AlloyC22 >316/316L flange ANSI B16.5 AMJ 3" 300lbs RF, 316/316L flange ANSI B16.5 AMM 3" 300lbs, AlloyC22 >316/316L flange ANSI B16.5 APJ 4" 150lbs RF, 316/316L flange ANSI B16.5 APM 4" 150lbs, AlloyC22 >316/316L flange ANSI B16.5 AQJ 4" 300lbs RF, 316/316L flange ANSI B16.5 AQM 4" 300lbs, AlloyC22 >316/316L flange ANSI B16.5 AWJ 6" 150lbs RF, 316/316L flange ANSI B16.5 AWM 6" 150lbs, AlloyC22 >316/316L flange ANSI B16.5 A3J 8" 150lbs RF, 316/316L flange ANSI B16.5 CFJ DN40 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C) CFM DN40 PN25/40, AlloyC22 >316L flange EN1092-1 (DIN2527) CGJ DN50 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C) CGM DN50 PN25/40, AlloyC22 >316L flange EN1092-1 (DIN2527) CMJ DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C) CMM DN80 PN10/16, AlloyC22 >316L flange EN1092-1 (DIN2527) CSJ DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C) CSM DN80 PN25/40, AlloyC22 >316L flange EN1092-1 (DIN2527) COJ DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C) COM DN100 PN10/16, AlloyC22 >316L flange EN1092-1 (DIN2527) CTJ DN100 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)

50									Process Connection:
									CTM DN100 PN25/40, AlloyC22 >316L flange EN1092-1 (DIN2527)
									CWJ DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
									CWM DN150 PN10/16, AlloyC22 >316L flange EN1092-1 (DIN2527)
									CXJ DN200 PN16 B1, 316L flange EN1092-1 (DIN2527 C)
									CRJ Thread ISO228 G3/4, 316L
									GRJ Thread ISO228 G1-1/2, 316L
									GRM Thread ISO228 G1-1/2, AlloyC22
									CNJ Thread ANSI NPT3/4, 316L
									GNJ Thread ANSI NPT1-1/2, 316L
									GNM Thread ANSI NPT1-1/2, AlloyC22
									KDJ 10K 40A RF, 316L flange JIS B2220
									KDM 10K 40A, AlloyC22 >316L flange JIS B2220
									KEJ 10K 50A RF, 316L flange JIS B2220
									KEM 10K 50A, AlloyC22 >316L flange JIS B2220
									KLJ 10K 80A RF, 316L flange JIS B2220
									KLM 10K 80A, AlloyC22 >316L flange JIS B2220
									KPJ 10K 100A RF, 316L flange JIS B2220
									KPM 10K 100A, AlloyC22 >316L flange JIS B2220
									YY9 Special version, TSP-No. to be spec.
60									Power Supply; Output:
									B 2-wire; 4-20mA SIL HART
									D 2-wire; PROFIBUS PA
									F 2-wire; FOUNDATION Fieldbus
									K 2-wire; 4-20mA HART, Interface measurement
									G 4-wire 90-250VAC; 4-20mA SIL HART
									H 4-wire 10.5-32VDC; 4-20mA SIL HART
									Y Special version, TSP-No. to be spec.
70									Operation:
									1 W/o display, via communication
									2 4-line display VU331, Envelope curve display on site
									3 Prepared for FHX40, Remote display (Accessory)
									9 Special version, TSP-No. to be spec.
80									Type of Probe:
									B Compact, centering disk d=45mm, 316L, pipe diameter DN50/2"
									C Compact, centering disk d=75mm, 316L, pipe diameter DN80/3" + DN100/4"
									D Spacer, center rod d=45mm, 316L, pipe diameter DN50/2", spacer, 400mm
									E Spacer, center rod d=75mm, 316L, pipe diameter DN80/3" + DN100/4", spacer, 400mm
									F Remote, cable 3m, top, center d=45mm, centering disk d=45mm, 316L pipe diameter DN50/2", 316L
									G Remote, cable 3m, top, center d=75mm, centering disk d=75mm, 316L, pipe diameter DN80/3" + DN100/4", 316L
									H Remote, cable 3m, side, center d=45mm, centering disk d=45mm, 316L, pipe diameter DN50/2"
									I Remote, cable 3m, side, center d=75mm, centering disk d=75mm, 316L, pipe diameter DN80/3" + DN100/4"
									1 Compact, basic version
									2 Spacer, 400mm
									3 Remote, cable 3m, top entry
									4 Remote, cable 3m, side entry
									9 Special version, TSP-No. to be spec.
90									Housing; Cable Entry:
									A F12 Alu, coated IP68; gland M20
									B F12 Alu, coated IP68; thread G1/2
									C F12 Alu, coated IP68; thread NPT1/2
									D F12 Alu, coated IP68; plug M12
									E F12 Alu, coated IP68; plug 7/8"
									G T12 Alu, coated IP68; gland M20 (Ex d > thread M20)
									H T12 Alu, coated IP68; thread G1/2
									J T12 Alu, coated IP68; thread NPT1/2
									K T12 Alu, coated IP68; plug M12
									L T12 Alu, coated IP68; plug 7/8"
									M T12 Alu, coated IP68; gland M20 + OVP ¹⁾
									N T12 Alu, coated IP68; thread G1/2 + OVP ¹⁾
									P T12 Alu, coated IP68; thread NPT1/2+OVP ¹⁾
									Q T12 Alu, coated IP68; plug M12 + OVP ¹⁾
									R T12 Alu, coated IP68; plug 7/8" + OVP ¹⁾

¹⁾ OVP = overvoltage protection

2.2 Scope of delivery



Caution!

It is essential to follow the instructions concerning the unpacking, transport and storage of measuring devices given in the chapter "Incoming acceptance, transport, storage", → 12!

The scope of delivery consists of:

- Assembled device
- Accessories (→ 74)
- Endress+Hauser operating program on the enclosed CD-ROM
- Brief operating instructions KA00189F/00/A2 (basic setup/troubleshooting), housed in the device
- Brief operating instructions KA01038F/00/EN for quick commissioning
- Approval documentation: if this is not included in the operating manual
- CD-ROM with further documentation, e.g.
 - Technical Information
 - Operating Instructions
 - Description of Instrument Functions

2.3 Certificates and approvals

CE mark, declaration of conformity

The device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

2.4 Registered trademarks

KALREZ®, VITON®, TEFLON®

Registered trademark of the company E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®

Registered trademark of the company Ladish & Co., Inc., Kenosha, USA

HART®

Registered trademark of HART Communication Foundation, Austin, USA

ToF®

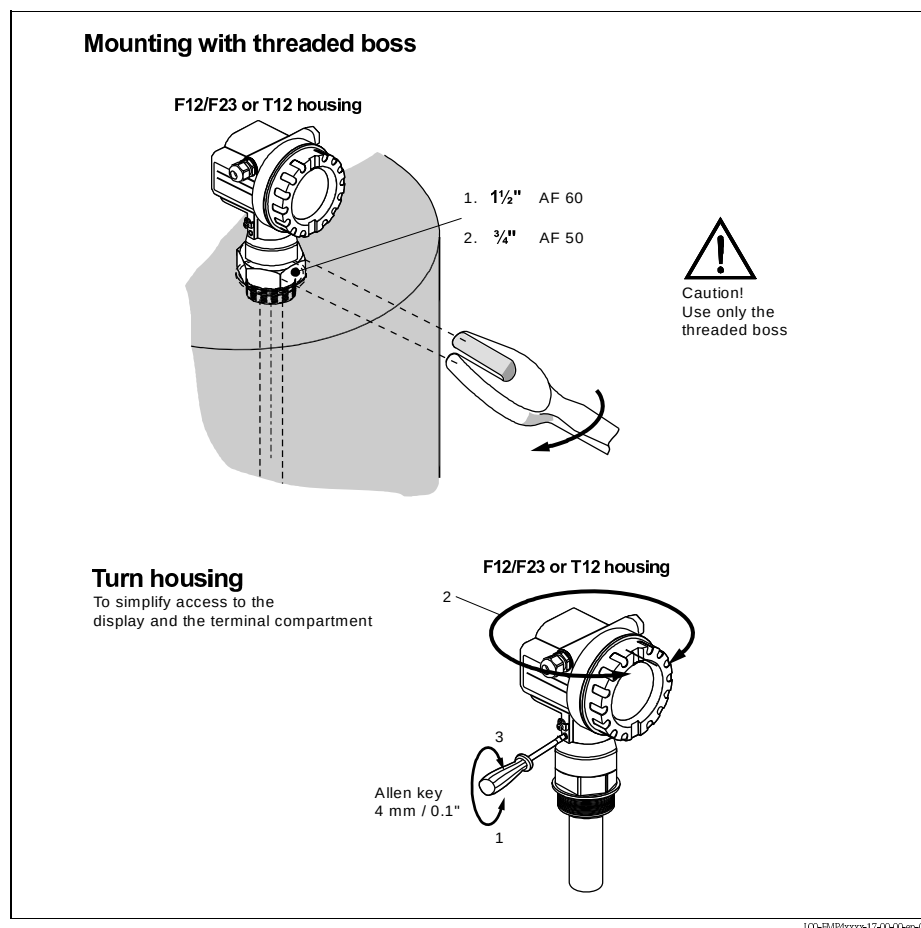
Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

PulseMaster®

Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

3 Mounting

3.1 Quick installation guide



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1. When using an aramid fibre seal and a process pressure of 40 bar: 140 Nm
Maximum permissible torque: 450 Nm
2. When using an aramid fibre seal and a process pressure of 40 bar: 25 Nm
Maximum permissible torque: 45 Nm

3.2 Incoming acceptance, transport, storage

3.2.1 Incoming acceptance

Check the packing and contents for any signs of damage.

Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.2.2 Transport



Caution!

Follow the safety instructions and transport conditions for devices of more than 18 kg.

Do not lift the measuring device by its probe rod in order to transport it.

3.2.3 Storage

Pack the measuring device so that is protected against impacts for storage and transport.

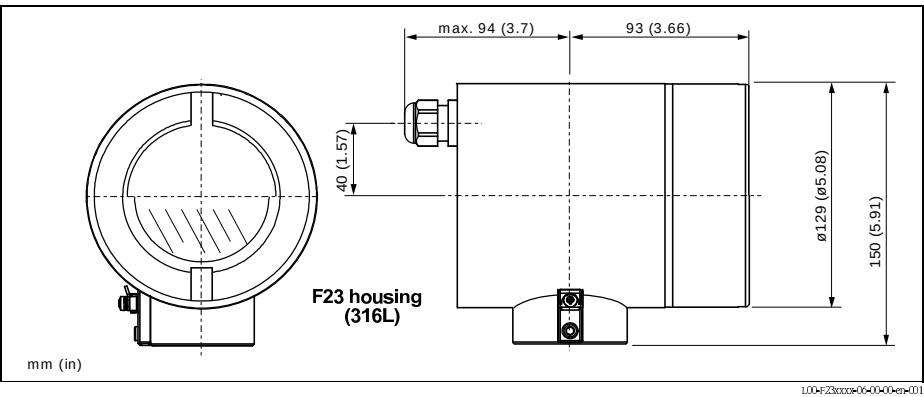
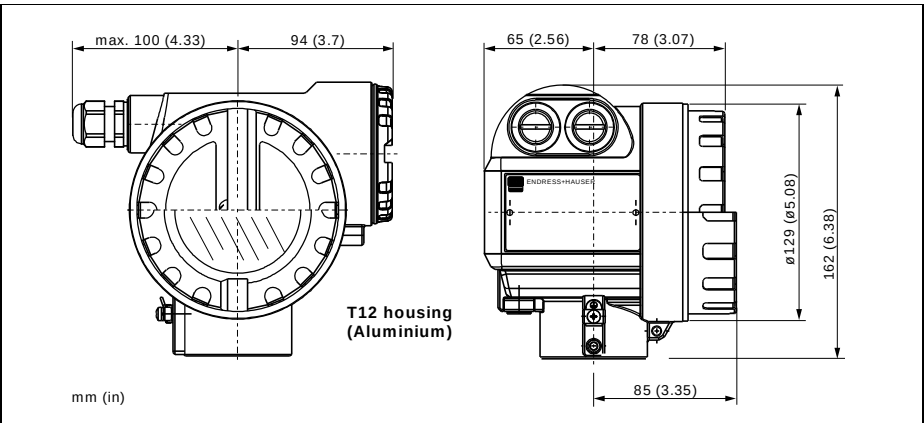
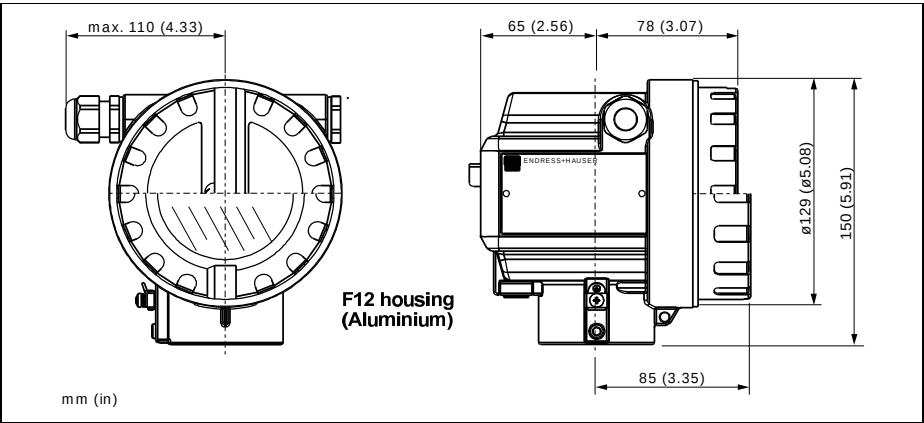
The original packing material provides the optimum protection for this.

The permissible storage temperature is -40 °C to +80 °C.

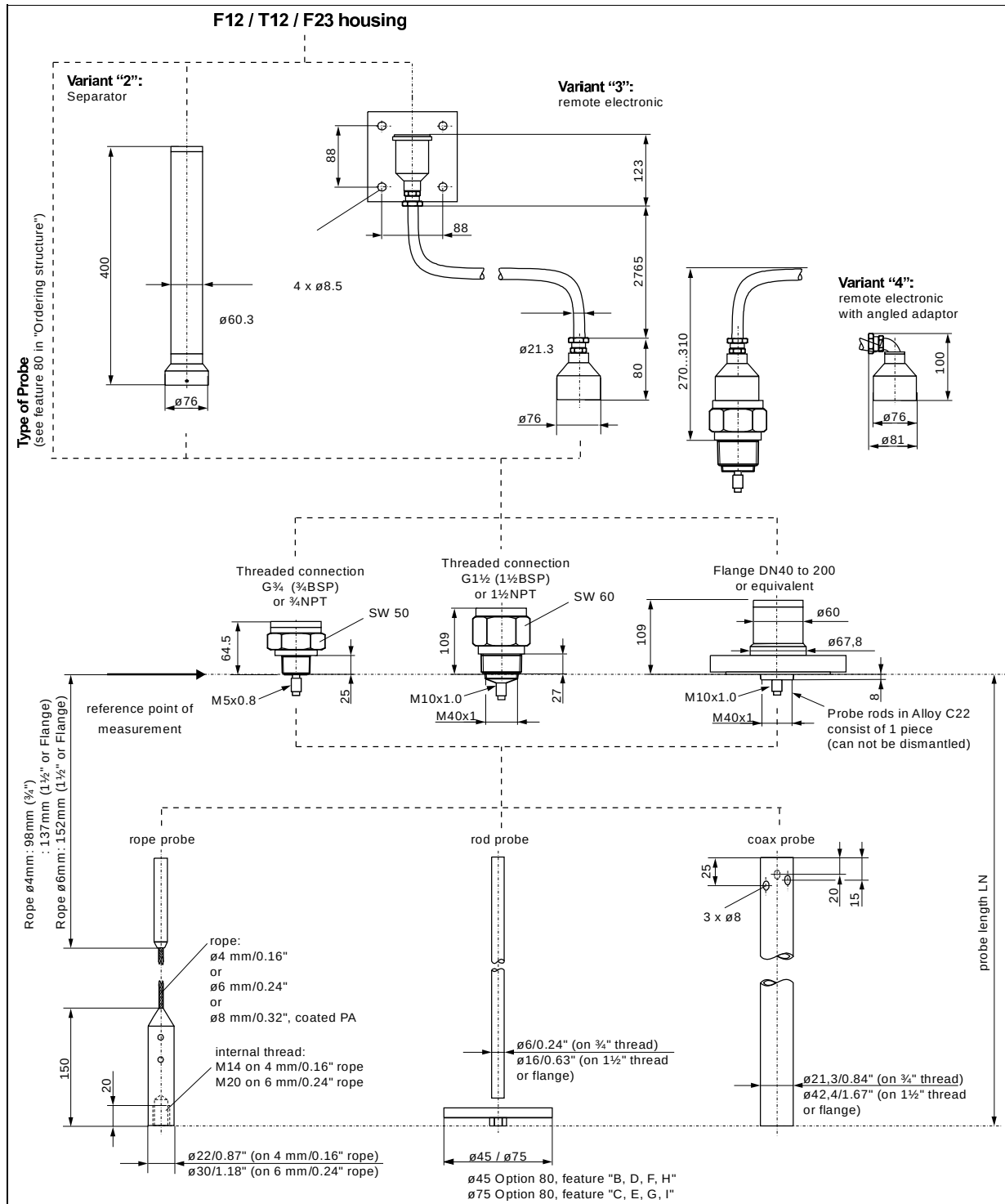
3.3 Installation conditions

3.3.1 Dimensions

Housing dimensions



Process connection, probe type



3.4 Installation

3.4.1 Mounting kit

For the mounting, you will require the following tool:

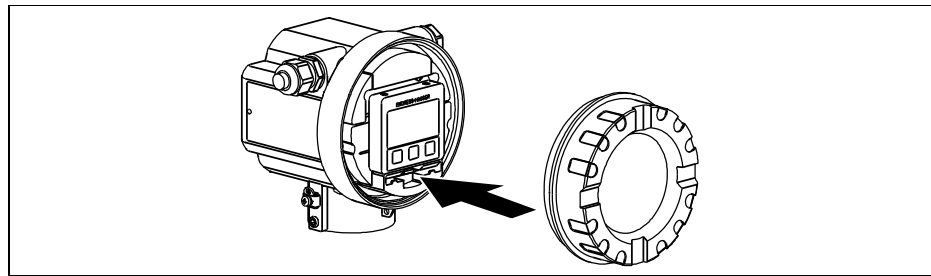
- The tool for flange mounting
- For the mounting of threaded connection:
 - 60 mm Open-end spanner for 1 1/2", 50 mm Open-end spanner for 3/4"
- 4 mm (0.1") Allen wrench for turning the housing

3.4.2 Shortening probes



Note!

When shortening the probe: Enter the new length of probe into the Quick Setup which can be found in the electronics housing under the display module.



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Rod probe

The shortening is necessary if the distance to the container floor or outlet cone is less than 50 mm. The rods of a rod probe are shortened by sawing or separating at the bottom end.

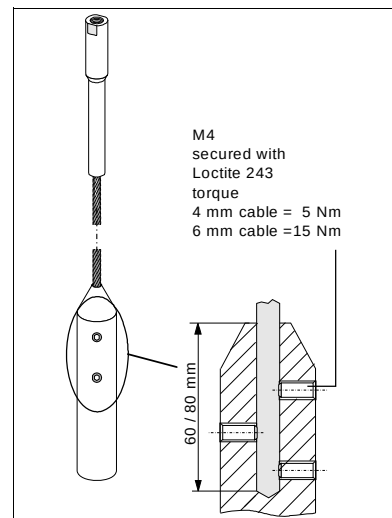
Rope probes

The shortening is necessary if the distance to the container floor or outlet cone is less than 150 mm.

- Remove ballast weight:
 - The weight is fixed to the probe rope with 3 Allen setscrews (M4, Allen key AF3). The screws are secured with Loctite. This may first have to be made plastic with a hot air apparatus.
- Remove released rope from the weight
- Measure off new rope length
- Wrap adhesive tape around the rope at the point to be shortened to prevent it from fanning out.
- Saw off the rope at a right angle or cut it off with a bolt cutter.
- Insert the rope completely into the weight:
 - 4 mm rope: 60 mm deep
 - 6 mm rope: 80 mm deep

The weight is then refixed to the rope:

- Reapply screw locking fluid (we recommend Loctite type 243) to the setscrews and screw into place.
- When doing so, observe the following torques:
 - 4 mm rope: 5 Nm
 - 6 mm rope: 15 Nm



L004FMP40xxxx-17-00-00-00-004

Coax probes

The shortening is necessary if the distance to the container floor or outlet cone is less than 10 mm. Coax probes can be shortened max. 80 mm from the end. They have centering units inside which fix the rod centrally in the pipe. The centerings are held with borders on the rod. Shortening is possible up to approx. 10 mm below the centering.

3.4.3 Mounting probes in an empty silo



Caution!

If there is a risk of electrostatic discharge from the product, then both process connection and rope must be earthed before the probe is lowered into the silo.

Levelflex can be screwed into a threaded socket or flange. Proceed as follows:

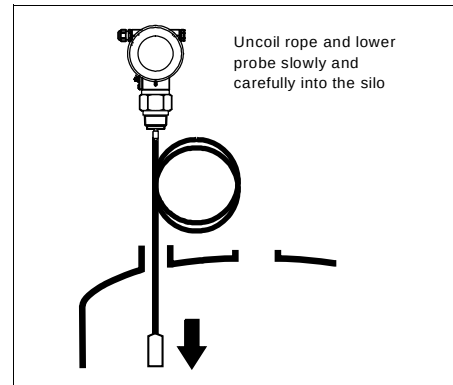
Insert probe

- Uncoil rope and lower it slowly and carefully into the silo.
- Do not kink the rope
- Avoid any backlash, since this might damage the probe or the silo fittings.



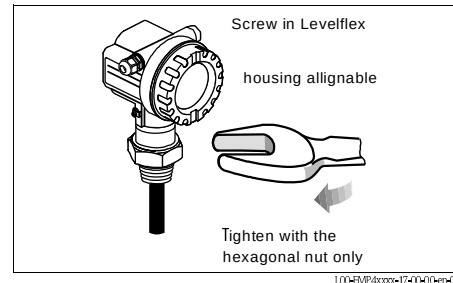
Note!

For flange mounting: if a seal is used, be sure to use unpainted metal bolts to ensure good electrical contact between probe flange and process flange.



Screw down

- Screw the Levelflex into the process connection or to flange.
 - Maximum permissible torque:
 - G3/4": 45 Nm
 - G1-1/2": 450 Nm
- When using an aramid fibre seal and a process pressure of 40 bar:
- G3/4": 25 Nm
 - G1-1/2": 140 Nm
- Levelflex functions in metal, concrete and plastic silos. When installing in metal silos, take care to ensure good metallic contact between the process connection and silo.



3.4.4 Mounting rope probes in a partially full silo

It is not always possible to empty a silo which is already in operation. Because the probe can be turned in the threaded boss, it can also be mounted when the silo is only partially filled. In order to avoid problems when Levelflex is mounted into a partially full silo, the following measures should be taken:

- Mount when the silo is as empty as if possible. A minimum of 2/3 of the silo must be empty.

After mounting, map must be made should the installation conditions require it.

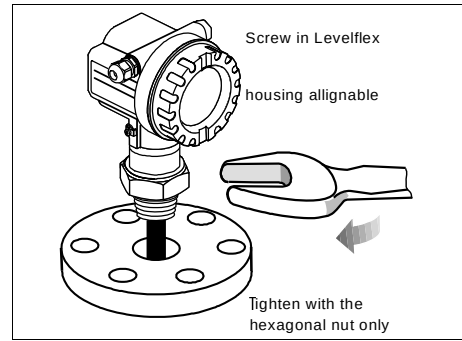


Caution!

If there is a risk of electrostatic discharge from the product, the housing must be earthed before the probe is lowered into the silo.

Screw down

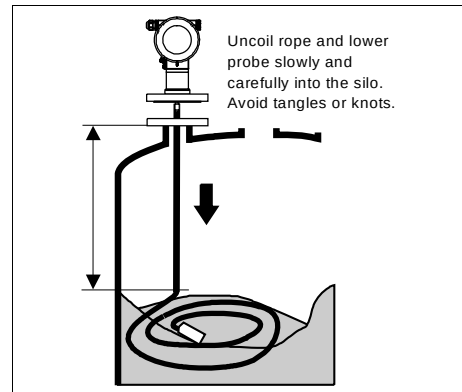
- If appropriate, screw the Levelflex into the threaded flange.
- Maximum permissible torque:
 - G3/4": 45 Nm
 - G1-1/2": 450 Nm
 When using an aramid fibre seal and a process pressure of 40 bar:
 - G3/4": 25 Nm
 - G1-1/2": 140 Nm
- For flange mounting: if a seal is used, be sure to use unpainted metal bolts to ensure good electrical contact between probe flange and process flange.
- When installing in metal silos, take care to ensure good metallic contact between the process connection and silo.



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Insert probe

- Uncoil rope and lower it slowly and carefully into the silo.
- Avoid tangles.
- Avoid any backlash, since this might damage the silo fittings.
- If possible, make a visual check to see that the rope has not tangled or is lying such that it can knot when the level falls.
This is particularly important if a flange was not used. Re-insert the probe if necessary.
- Screw the flange to the counterflange on the nozzle.



1LD-FMP40xxx-17-00-00-en-059



Note!

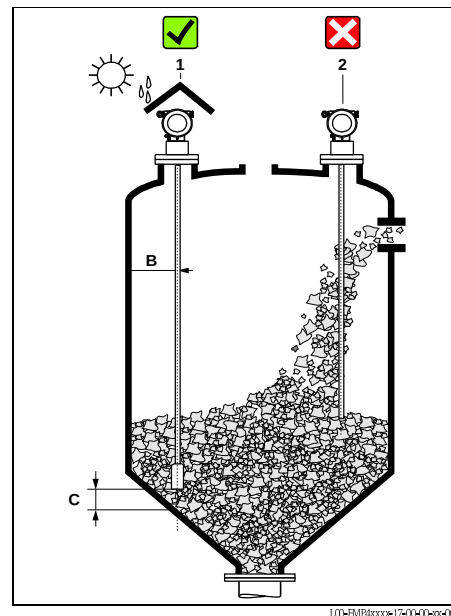
Before full accuracy is obtained the probe rope must hang fully extended.

3.4.5 Engineering hints for level measurement in bulk solids and fluids

- Normally, rope probes should be used for bulk solids, rod probes are only suitable for short measuring ranges up to approx. 2 m in bulk solids. This applies above all to applications in which the probe is installed laterally at an angle and for light and pourable bulk solids.
- Normally use rod or coax probes for liquids. Rope probes are used in liquids for measuring ranges > 4 m and with restricted ceiling clearance which does not allow the installation of rigid probes.
- Coax probes are suited to liquids with viscosities of up to approx. 500 cSt.
Coax probes can measure most liquefied gases, as of dielectric constant 1.4. Moreover, installation conditions, such as nozzles, tank internal fittings etc., have no effect on the measurement when a coax probe is used. A coax probe offers maximum EMC safety when used in plastic tanks.
- In the case of large silos, the lateral pressure on the rope can be so high that a rope with plastic jacketting must be used. We recommend PA-coated ropes be used for cereal products wheat, flour etc.

Mounting location

- Do not mount rod or rope probes in the filling curtain (2).
- Mount rod and rope probes away from the wall (B) at such a distance that, in the event of build-up on the wall, there is still a minimum distance of 100 mm between the probe and the build-up.
- Mount rod and rope probes as far away as possible from installed fittings. "Mapping" must be carried out during commissioning in the event of distances < 300 mm.
- When installing rod and rope probes in plastic containers, the minimum distance of 300 mm also applies to metallic parts outside the container.
- Rod and rope probes may not, at times, contact metallic container walls or floors.
- Minimum distance of probe end to the container floor (C):
 - Rope probe: 150 mm
 - Rod probe: 50 mm
 - Coax probe: 10 mm
- When installing outdoors, it is recommended that you use a protective cover (1) (→ 74, "Accessories").
- Avoid buckling the rope probe during installation or operation (e.g. through product movement against silo wall) by selecting a suitable mounting location.



Minimum distance B of the probe to the container wall:

Wall	Min. distance B
Metal	100 mm for smooth walls
Plastic	100 mm, min. 300 mm to metallic components outside of the tank
Concrete	0,5 m/20", otherwise the max. possible measuring range is reduced

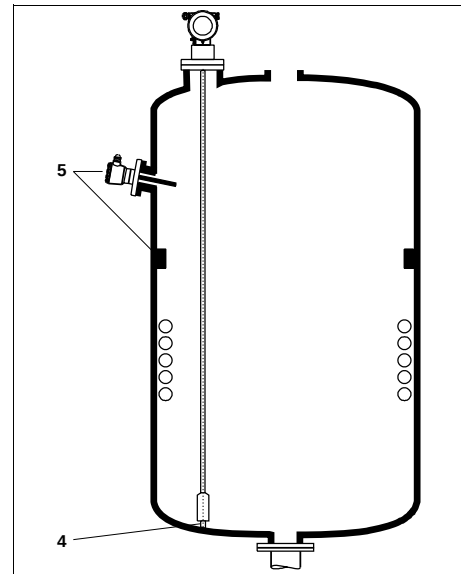
Distance to protruding internals min. 300 mm.

Other installations

- Select the mounting location such that the distance to internals (5) (e.g. limit switch, struts) is > 300 mm over the entire length of the probe, also during operation.
- Probe must within the measuring span not touch any internals during operation.
If necessary: when using rope probes the probe end (4) may be fixed to ensure that (→ 27)!

Optimization options

Interference echo suppression: Measurement can be optimised by electronically tuning out interference echoes.

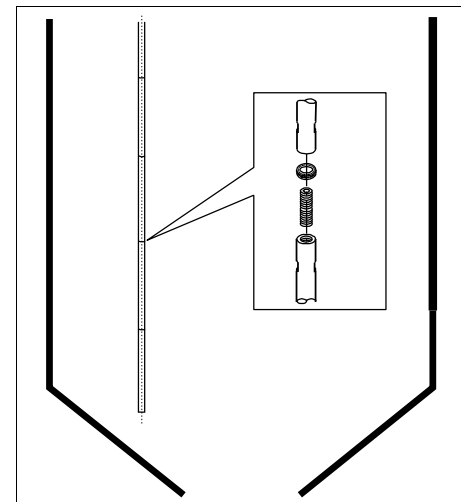


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Separable probes

If there is little mounting space (distance to the ceiling), it is advisable to use separable rod probes ($\varnothing 16$ mm).

- max. probe length 10 m (394 in)
- max. sideways capacity 20 Nm
- probes are separable several times with the lengths:
 - 500 mm (19.68 in)
 - 1000 mm (39.37 in)
- torque: 15 Nm



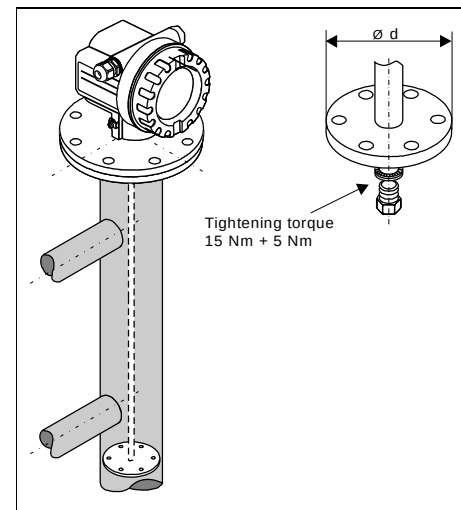
100-FMP40xxx-17-00-00-x-015

Centering of probe end

If the centering disk is mounted at the end of the probe, it enables a reliable measuring. See "Product structure", → 6.

Centering disk for rod probes:

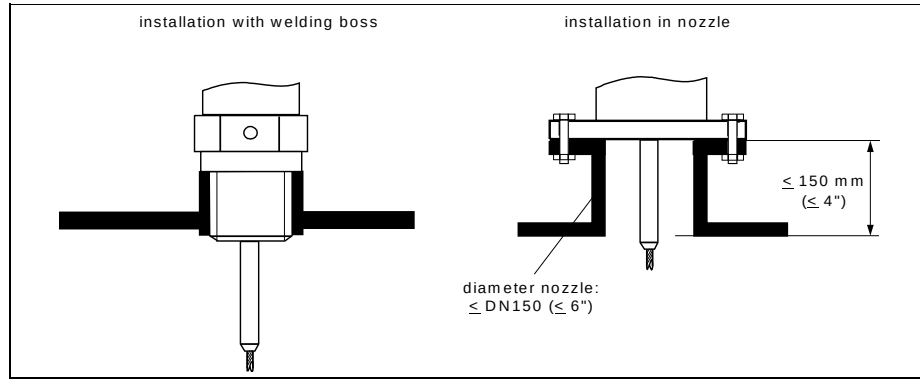
- $d = 45$ mm (DN50 (2"))
- $d = 75$ mm (DN80 (3") + DN100 (4"))



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Type of probe installation

- Probes are mounted to the process connection with threaded connections or flanges and are usually also secured with these. If during this installation there is the danger that the probe end moves so much that it touches the tank floor or cone at times, the probe must, if necessary, be shortened and fixed down. The easiest way to fix the rope probes is to screw them to the internal thread on the lower end of the weight (Thread size, → 27).
- The ideal installation is mounting in a screwed joint / screw-in sleeve which is internally flush with the container ceiling.
- If installation takes place in a nozzle, the nozzle should be 50 to 150 mm in diameter and should not be more than 150 mm high. Installation adapters are available for other dimensions, → 74.



Welding the probe into the vessel



Caution!

Before welding the probe into the vessel, it must be grounded by a low-resistive connection. If this is not possible, the electronics as well as the HF module must be disconnected. Otherwise the electronics may be damaged.

Supporting probes against warping

For WHG approval:

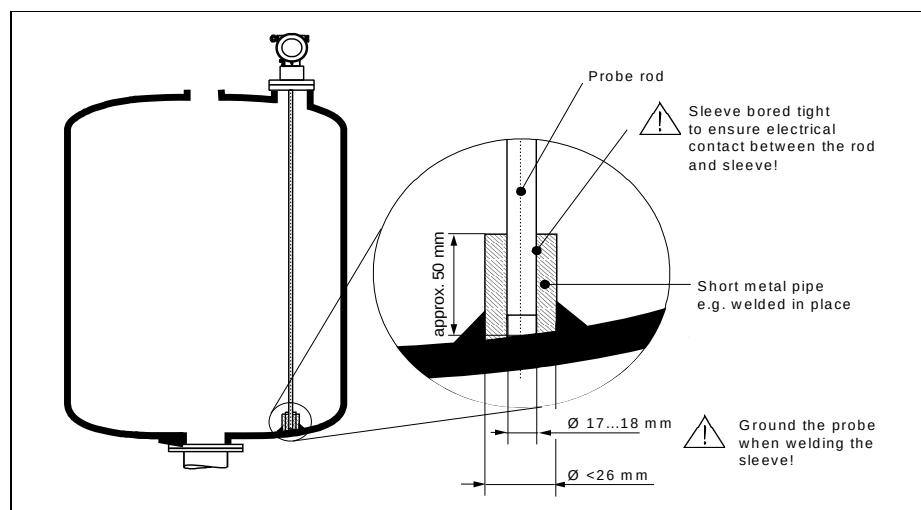
For probe lengths ≥ 3 m a support is required (see figure).

For GL/ABS approval:

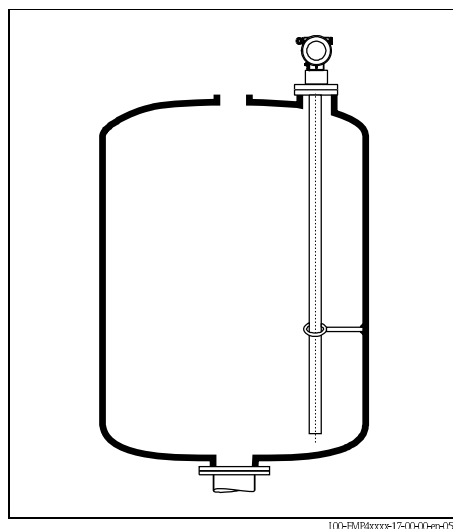
Rod probes $\varnothing 16$ mm ≤ 1 m permissible, Rod probes $\varnothing 6$ mm not permissible.

For coax probes ≥ 1 m a support is required (see figure).

a. Rod probes

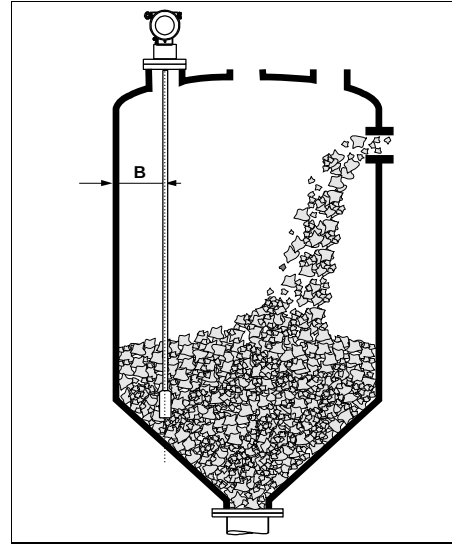


b. Coax probes



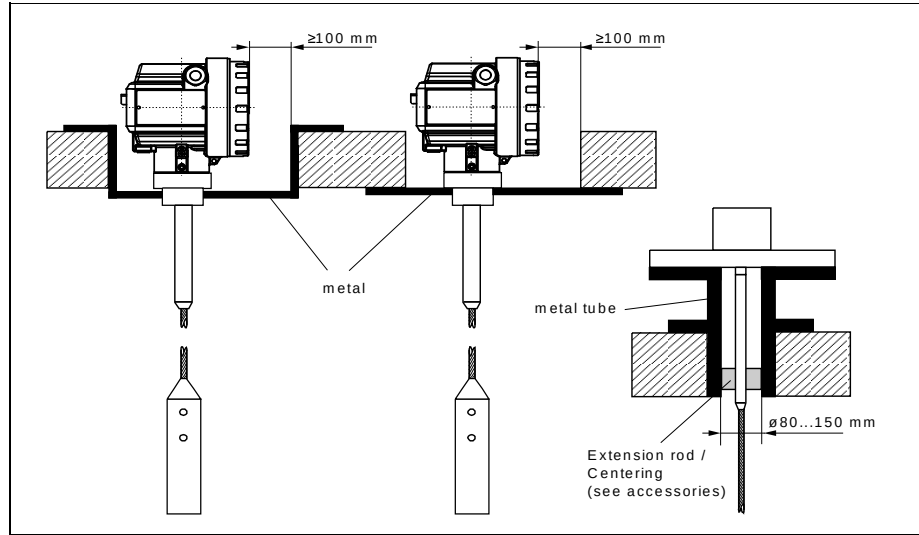
3.4.6 Special notes for bulk solids

- In the case of bulk solids, as great a distance as possible from the filling curtain is especially important to avoid wear.
- In concrete silos, a **large distance** (B) should be observed between the probe and the concrete wall, if possible ≥ 1 m, but at least 0.5 m
- The installation of rope probes must be carried out carefully. If possible, installation should be carried out when the silo is empty.
- Check the probe regularly for defect.



Installation in concrete silos

Installation, for example, into a thick concrete ceiling should be made flush with the lower edge. Alternatively, the probe can also be installed into a pipe that must not protrude over the lower edge of the silo ceiling. The pipe should be kept at a minimum length. Installation suggestions see diagram.



Strong dust generation can lead to build-up behind the center washer. This can cause an interference signal. For other installation possibilities please contact Endress+Hauser.

3.4.7 Installation in bulk solid silos

Tensile load

Bulk solids exert tensile forces on rope probes whose height increases with:

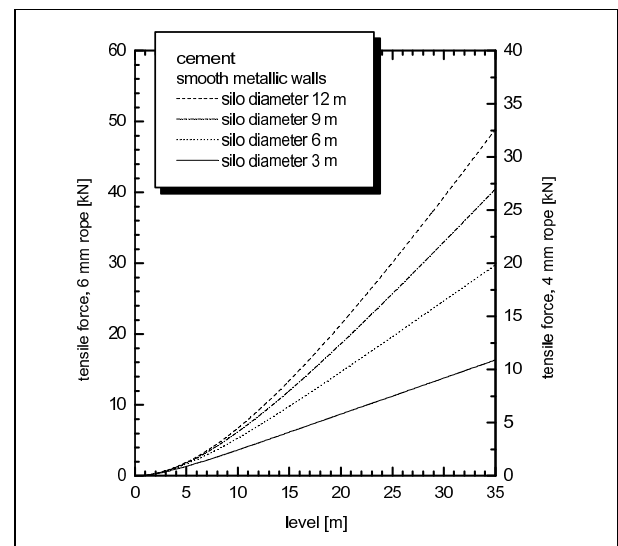
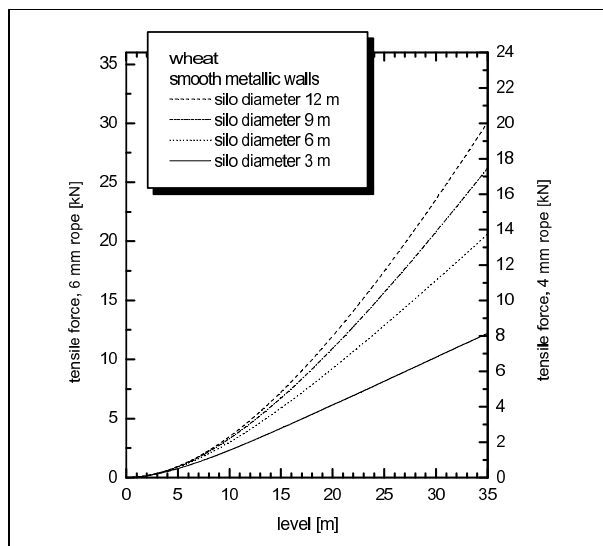
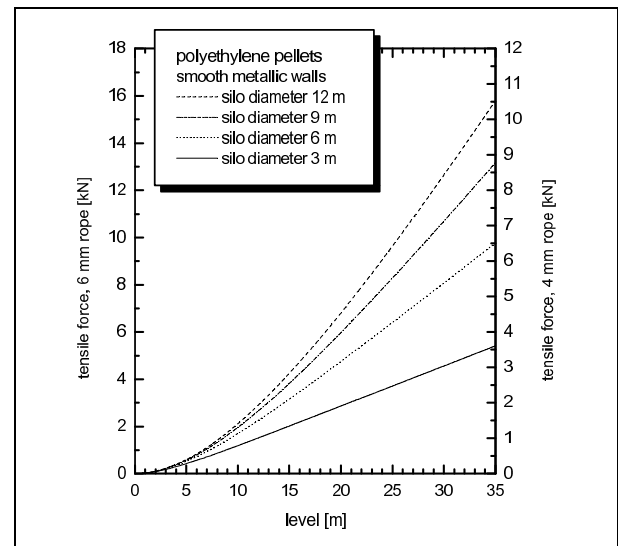
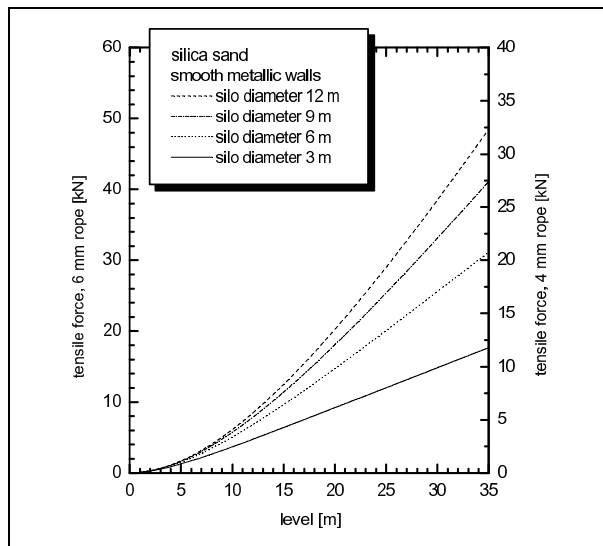
- the length of the probe, i.e. max. cover,
- the bulk density of the product,
- the silo diameter
- the diameter of the probe rope

The following diagrams show typical loads for frequently occurring bulk solids as reference values. The calculation is performed for the following conditions:

- Suspended probe (probe end not fixed at the bottom)
- Free-flowing bulk solid, i.e. mass flow. A calculation for core flow is not possible.

In the event of collapsing cornices, considerably higher loads can occur.

- The specification for tensile forces contains the safety factor 2, which compensates for the normal fluctuation range in pourable bulk solids.



Since the tensile forces are also heavily dependent on the viscosity of the product, a higher safety factor is necessary for highly viscous products and if there is a risk of cornice build-up. In critical cases it is better to use a 6 mm rope instead of a 4 mm one.

The same forces also act on the silo cover.

On a fixed rope, the tensile forces are definitely greater, but this can not be calculated. Observe the tensile strength of the probes or ensure that the tensile strength of the probes is not exceeded.

Options for reducing the tensile forces:

- Shorten the probe
- If the maximum tensile load is exceeded, check whether it would be possible to use a non-contact Ultrasonic or Level-Radar device.

3.4.8 Installation in liquid tanks

- When installing in agitation units, check whether a no-contact process (ultrasonic or radar) would be better suited, especially if the agitator generates large mechanical loads on the probe.
- If Levelflex is, nevertheless, installed in tanks with agitators, it is better to use coax probes which have a greater lateral loading capacity.

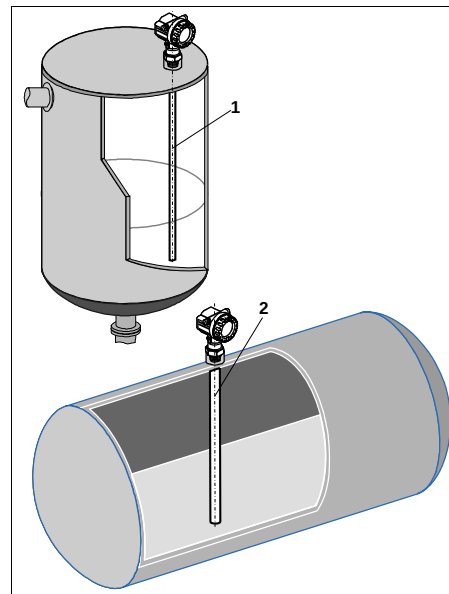
Standard installation

Using a coax probe offers great advantages when the viscosity of the product is ≤ 500 cSt and it is certain that the product does not accumulate build-up:

- Greater reliability:
As of dielectric constant = 1.4, measurement functions independently of all electrical properties in all liquids.
- Internals in the tank and nozzle dimensions do not have any influence on measurement.
- Higher lateral load-bearing capacity than rod probes.
- For higher viscosity a rod probe is recommended, or using a non-contact measuring principle with the Level-Radar Micropilot M.

Installation in horizontal and upright cylindrical tanks

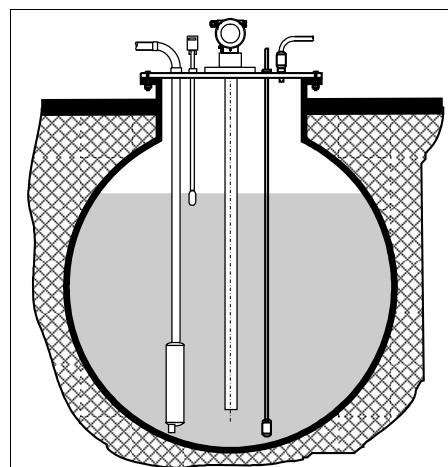
- Use the following types of probe for measuring ranges
 - up to 4 m (13 ft): rod probe (1) or coax probe (2)
 - up to 10 m (33 ft): separable probe
 - above 10 m (33 ft): 4 mm rope probe
- Installation and possible fixing as with bulk solids.
- Any distance from wall, as long as occasional contact is prevented.
- When installing in tanks with a lot of internals or internals situated close to the probe: Use a coax probe.



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Installation in underground tanks

Use coax probe for nozzles with large diameters in order to avoid reflections at the nozzle wall.



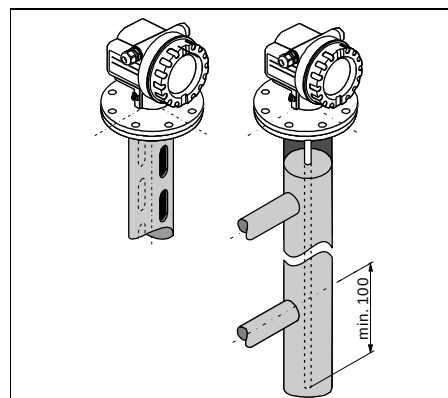
110-F1/F4xxxx-17-00-00-yy-02

Measurement in corrosive fluids

For measurement in corrosive liquids use Levelflex M FMP41 C. When using plastic tanks it is also possible to mount the probe on the outside of the tank (Installation instructions, → 28). Levelflex measures the level through the plastic in both cases.

Installation in stilling well or bypass

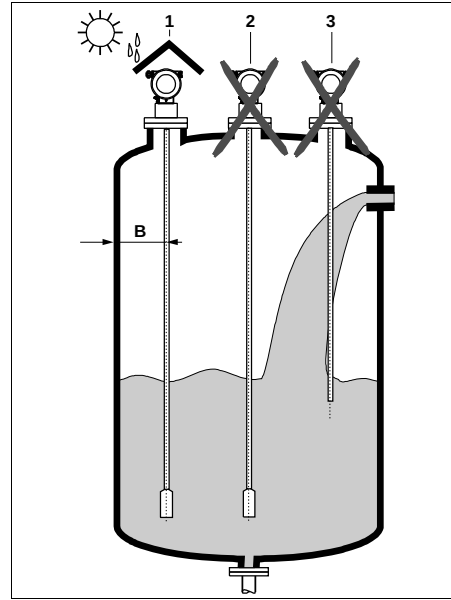
- A rod probe can be used for pipe diameters bigger than 40 mm.
- When installing a rod probe into a metallic pipe with internal diameter of up to 150 mm, you have all the advantages of a coax probe.
- Welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence measurement.
- If a rod probe is used, the probe length must be 100 mm longer than the lower disposal.
- It must be ensured that the probe does not come into contact with the side wall. Where necessary, use a centering disk at the lower end of the probe ("Type of Probe:", → 8)



110-F1/F4xxxx-17-00-00-yy-02.3

Mounting Location

- Recommended distance B wall-mounted rope probe: $\sim 1/6$ to $1/4$ of the container diameter.
- Not central (2) in metallic tanks.
- Not in the filling curtain (3).
- Please order the probe length such that it ends approx 30 mm above the floor of the tank.
- Temperature conditions must be met.
- It is recommended that a protective cover (1) be used, in order to protect the transmitter against direct sunlight or rain. Mounting and demounting are carried out simply with a clamp ("Accessories", → 78).



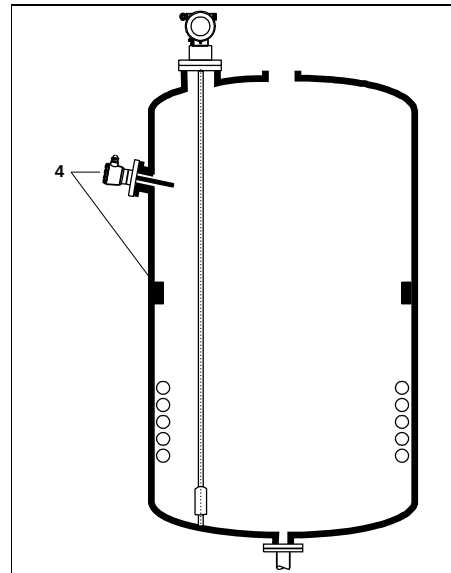
LQ-FMP40xxx-17-00-00-xx-001

Tank installations

Select the mounting location such that the distance to internals (4) (e.g. limit switch, struts) is > 300 mm.

Optimization options

- Interference echo suppression: Measurement can be optimised by electronically tuning out interference echoes.
- Bypass pipe and stilling well (only for liquids): for viscosities of up to 500 cSt, a bypass pipe, stilling well or a coax probe can be used to prevent interference.



LQ-FMP40xxx-17-00-00-xx-002

3.4.9 Notes on special installation situations

Welding the probe into the vessel

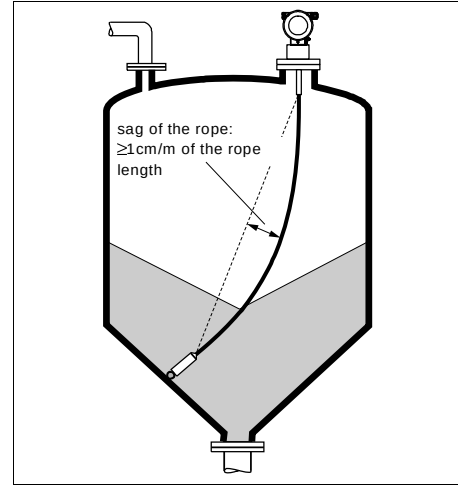


Caution!

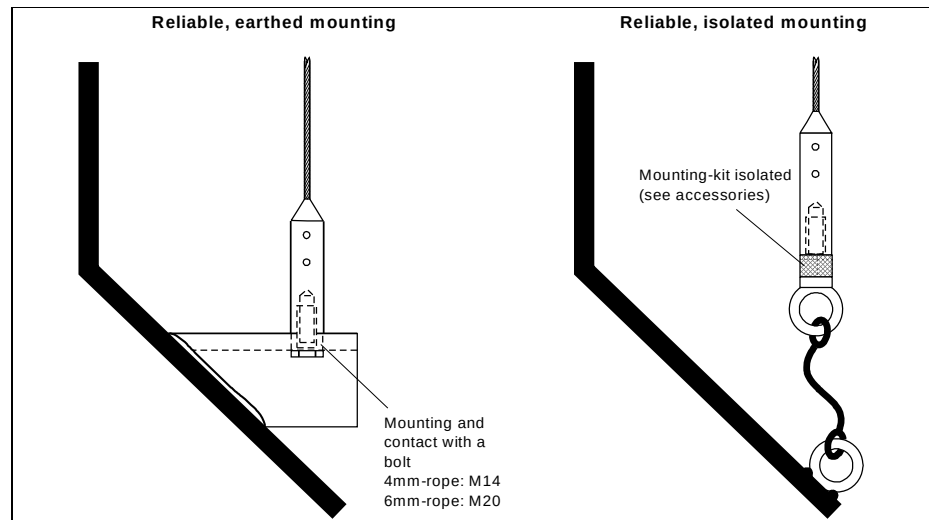
Before welding the probe into the vessel, it must be grounded by a low-resistive connection. If this is not possible, the electronics as well as the HF module must be disconnected. Otherwise the electronics may be damaged.

Fixing rope probe

- The end of the probe needs to be secured if the probe would otherwise touch the silo wall, the cone or another part, or the probe comes closer than 0.5 m to a concrete wall. This is what the internal thread in the probe weight is intended for:
 - 4 mm rope: M14
 - 6 mm rope: M20
- Preferably use the 6 mm rope probe due to the higher tensile strength when fixing a rope probe.
- The fixing must be either reliably grounded or reliably insulated ("Accessories", → 80)! If it is not possible to mount the probe weight with a safe earthed connection, it can be secured using an isolated eyelet, which is available as an accessory (→ 80).
- In order to prevent an extremely high tensile load and the risk of rope crack, the rope has to be slack. Make the rope longer than the required measuring range such that there is a sag in the middle of the rope that is $\geq 1 \text{ cm/m}$ of the rope length.



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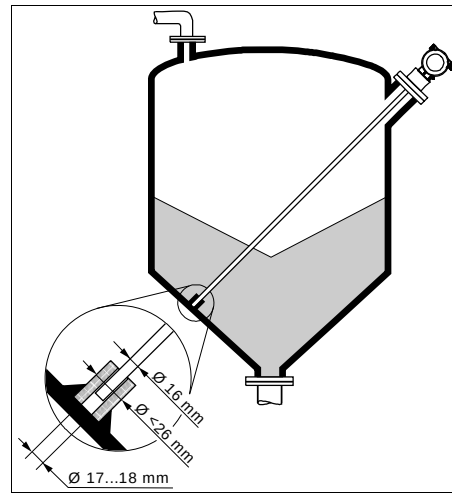


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Installation from the side

- If installation from above is not possible, the Levelflex can also be mounted from the side.
- In this case, always fix the rope probe (see "Fixing rope probe").
- Support coax probe if the lateral load-bearing capacity is exceeded. Only fix rod probes at the probe end.
- Connect rod probe metallically with the container wall.

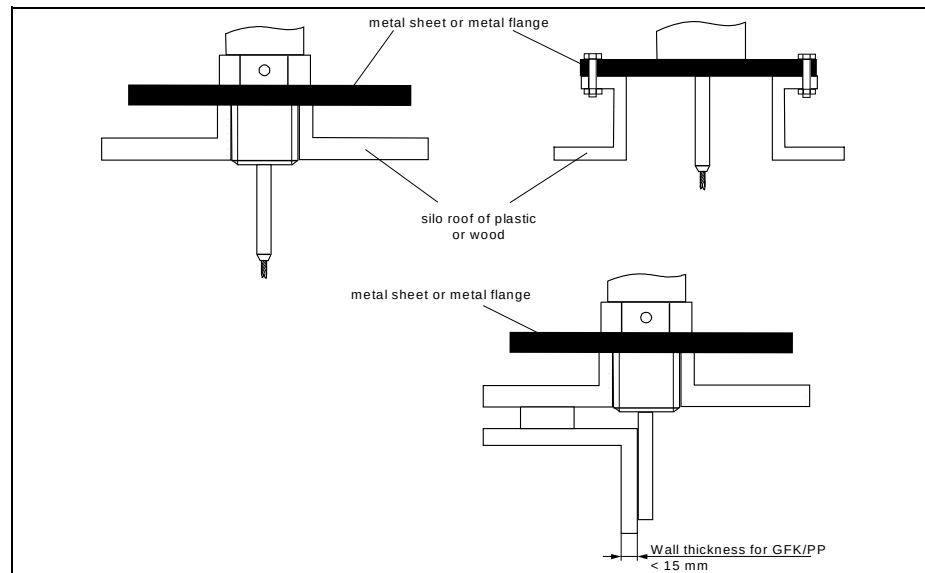
⚠ **Caution!**
Remove or ground the electronics when welding the sleeve as the device will otherwise be destroyed!



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Installation in plastic containers

Please note that the "guided level radar" measuring principle requires a metallic surface at the process connection! When installing rod or rope probes in plastic silos, whose silo cover is also made of plastic or silos with wood cover, the probes must either be mounted in a $\geq$ DN50 (2") metallic flange, or a metal sheet with diameter of $\geq$ 200 mm must be mounted under the screw-in piece.

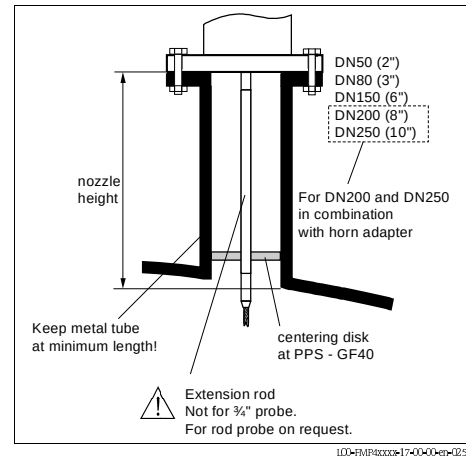


100-FMP40xxxx-17-00-00-eth-018

- It is also possible to mount the probe externally on the tank wall for measuring in Aqueous solutions. Measurement then takes place through the tank wall without contacting the medium. If people are in the vicinity of the probe mounting location, a plastic half pipe with a diameter of approx. 200 mm, or some other protective unit, must be affixed externally to the probe to prevent any influences on the measurement.
- There must not be any metallic reinforcement rings secured to the tank.
- The wall thickness should be at Fibre-Glass Reinforced Plastic/PP < 15 mm.
- There must be no open space between the tank wall and the probe.
- If measuring externally, an automatic probe length determination and a two point linearisation must be performed in order to compensate for the time-of-flight change caused by the plastic wall.

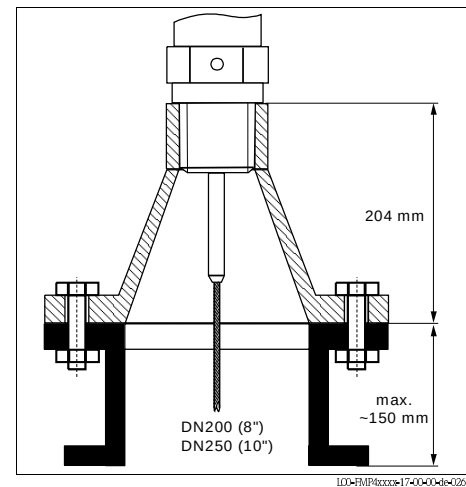
Installation in nozzles > 150 mm high

If, when installing probes in nozzles DN40 (1½") to DN250 (10") with nozzle height of > 150 mm (6"), the probe could touch the lower edge due to moving materials in the container, we recommend using an extension rod with or without centering disk. This accessory consists of the extension rod corresponding to the nozzle height, on which a centering disk is also mounted if the nozzles are narrow or when working in bulk solids. This component is delivered separately from the device. Please order the probe length correspondingly shorter. For the exact length of the rod see "Extension rod / Centering", → 74. Order codes for specific nozzle nominal diameters and heights can be found on → 79. Only use centering disks with small diameters (DN40 and DN50) if there is no significant build-up in the nozzle above the disk.



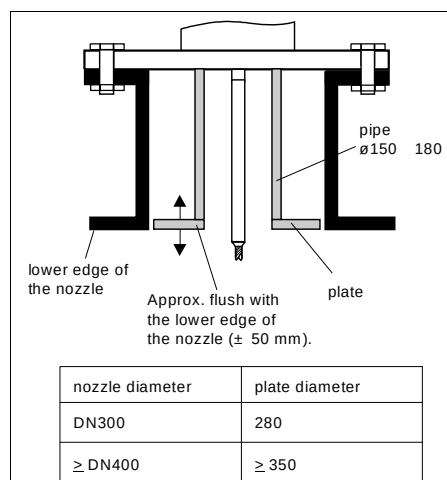
Installation in DN200 (8") and DN250 (10") nozzles

When installing the Levelflex in nozzles of > 200 mm (8"), signals are generated by reflections on the nozzle wall, which can sometimes lead to faulty measurements in the case of products with small dielectric constants. With nozzle diameters of 200 mm (8") or 250 mm (10"), therefore, a special flange with a "horn adaptor" must be fitted. Nozzles with nominal diameters greater than DN250 (10") should be avoided. If the rope probe is strongly deflected; use an extension rod/centering HMP40, additionally.



Installation in $\geq$ DN300 (12") nozzles

If installation in ≥ 300 mm (12") nozzles is unavoidable, installation must be carried out in accordance with the sketch on the right.



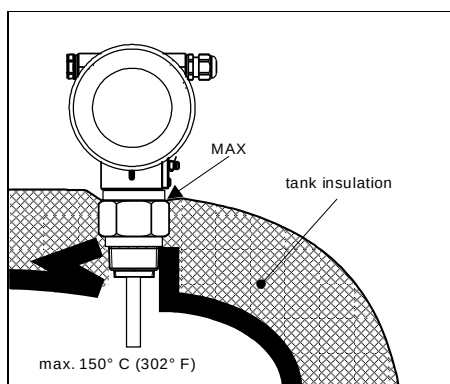
100-FMP40xxx-17-00-00-en-034

Installing FMP40 with heat insulation

- If process temperatures are high, FMP40 must be included in normal tank insulation to prevent the electronics heating up as a result of heat radiation or convection.
- The insulation may not exceed beyond the points labelled "MAX" in the drawing.

Process connection with adapter

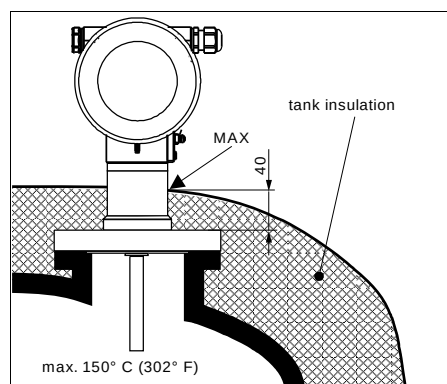
$G\frac{3}{4}$, $G1\frac{1}{2}$, $\frac{3}{4}$ NPT or $1\frac{1}{2}$ NPT



100-FMP40xxx-17-00-00-en-003

Process connection with flange

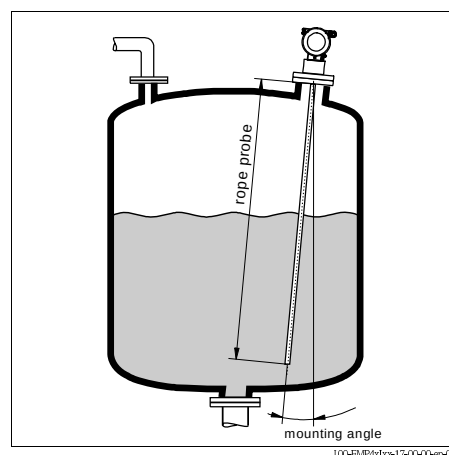
DN40 to DN200



100-FMP40xxx-17-00-00-en-002

Installation at an angle

- For mechanical reasons, the probe should be installed as vertically as possible.
- With inclined installations the probe length has to be adjusted in dependence to the installation angle.
 - up to 1 m = 30°
 - up to 2 m = 10°
 - up to 4 m = 5°



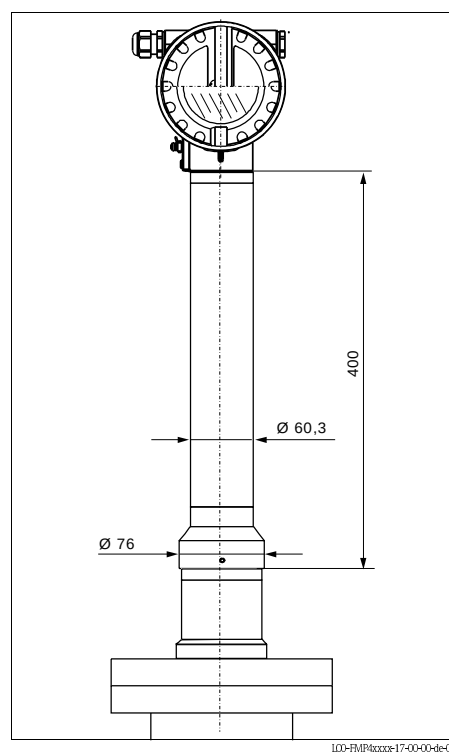
Installation for difficult to access process connections

For tight spaces or temperatures above that in the graphic, the electronics housing can be ordered with distance pipe or connecting cable (seperate housing).

Installation with distance pipe

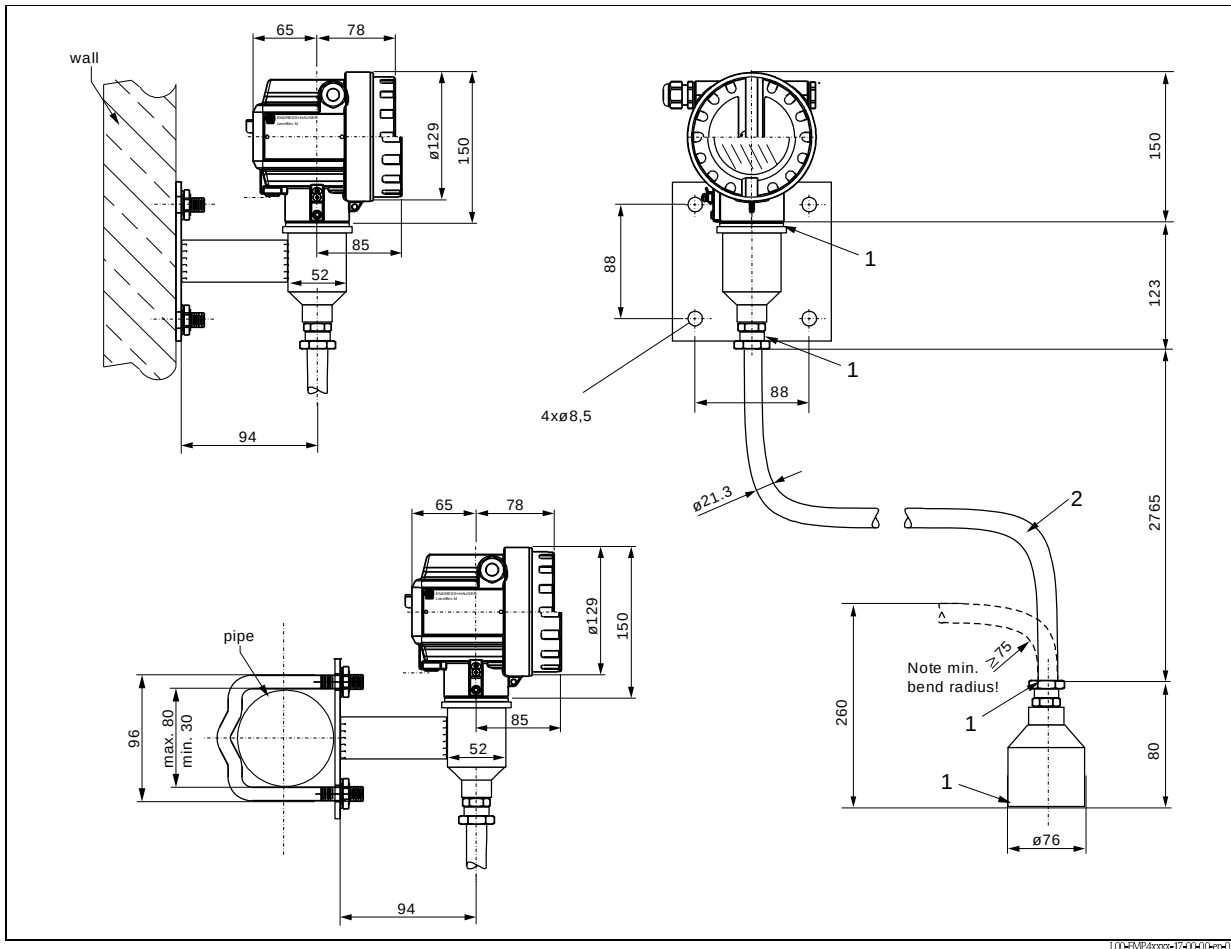
When installing, please observe the installation instructions (→ 18) and the following points:

- After mounting, the housing can be turned 350°, in order make access to the display and the connection compartment easier.
- The max. measuring range is reduced to 34 m.



Installation with remote electronic

- Wall and pipe bracket is contained in the scope of delivery and already mounted.
- Follow installation instructions, → 18
- Mount housing on a wall or pipe as shown in the diagram.

**Note!**

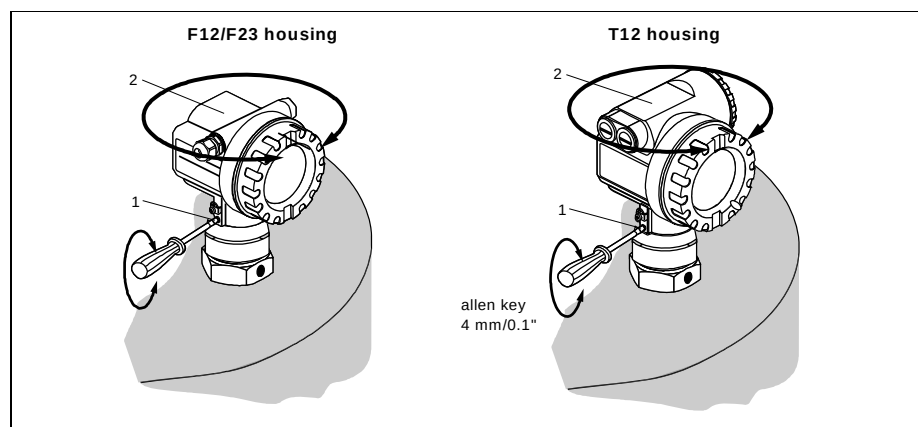
The protective hose cannot be disassembled at these points (1).

The ambient temperature for the connecting line (2) between the probe and the electronics must not be greater than 105 °C. The version with remote electronics consists of the probe, a connecting cable and the housing. If they are ordered as a complete unit they will be delivered assembled and cannot be separated.

3.4.10 Turn housing

After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment. Proceed as follows to turn the housing to the required position:

- Undo the fixing screws (1)
- Turn the housing (2) in the required direction
- Tighten up the fixing screws (1)



3.5 Post-installation check

After the measuring device has been installed, perform the following checks:

- Is the measuring device damaged (visual check)?
- Does the measuring device correspond to the measuring point specifications such as process temperature/pressure, ambient temperature, measuring range, etc.?
- Are the measuring point number and labeling correct (visual check)?
- Is the measuring device adequately protected against rain and direct sunlight (→ 74)?

4 Wiring

4.1 Quick wiring guide

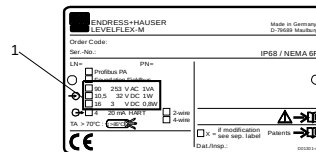
Wiring in F12/F23 housing



Caution!

Before connection please note the following:

- The power supply must be identical to the data on the nameplate (1).
- Switch off power supply before connecting up the device.
- Connect Equipotential bonding to transmitter ground terminal (7) before connecting up the device.
- Tighten the locking screw (8):
It forms the connection between the probe and the housing ground potential.



When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's). Make sure you use the specific cable gland.



On devices supplied with a certificate, the explosion protection is designed as follows:

- Housing F12 - Ex ia:
Power supply must be intrinsically safe.
- The electronics and the current output are galvanically separated from the probe circuit.

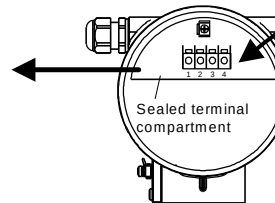
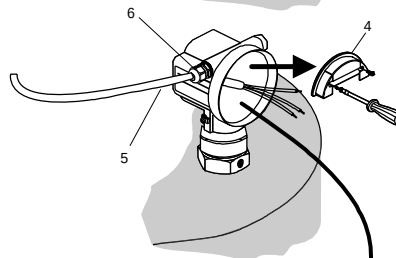
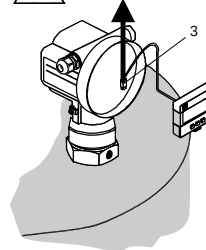
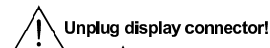
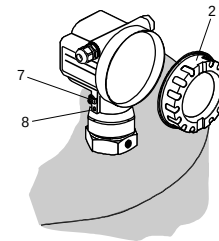
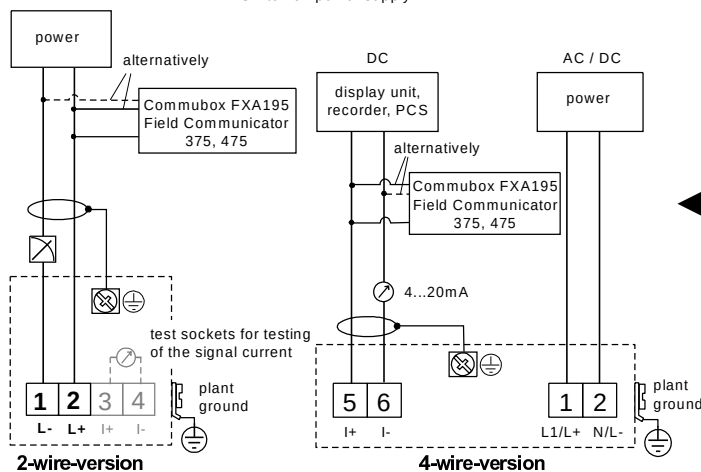
Connect up the Levelflex M as follows:

- Unscrew housing cover (2).
 - Remove any display (3) if fitted.
 - Remove cover plate from terminal compartment (4).
 - Pull out terminal module slightly using "pulling loop" (only 2-wire).
 - Insert cable (5) through gland (6).
- A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).



Only ground screening of the line (7) on sensor side.

- Make connection (see pin assignment).
- Re-insert terminal module.
- Tighten cable gland (6). Max. torque 10...12 Nm!
- Tighten screws on cover plate (4).
- Insert display if fitted.
- Screw on housing cover (2).
(on dust-Ex torque » 40 Nm).
- Switch on power supply.



Note!
If 4-wire for dust-Ex-applications is used,
the current output is intrinsically safe.

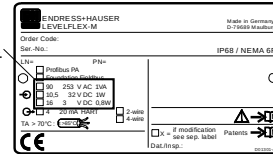
Wiring in T12 housing



Before connection please note the following:

Caution!

- The power supply must be identical to the data on the nameplate (1)..
- Switch off power supply before connecting up the device.
- Connect Equipotential bonding to transmitter ground terminal (7) before connecting up the device..
- Tighten the locking screw (8):
It form the connection between the probe and the housing ground potential.



When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's). Make sure you use the specific cable gland.



Connect up the Levelflex M as follows:

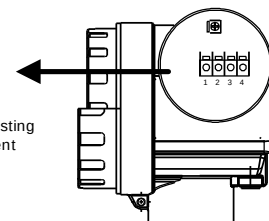
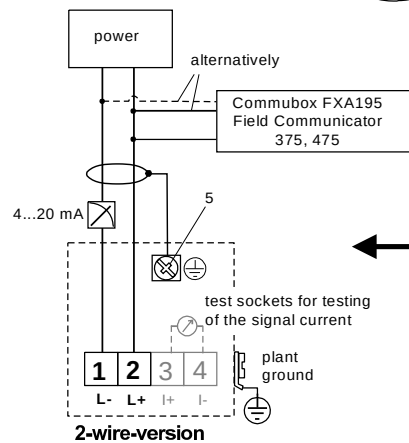
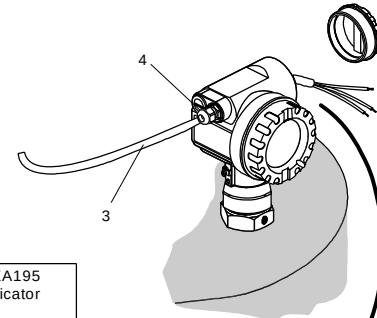
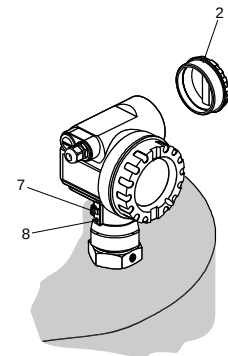
Before unscrew housing cover (2) at separate connection room turn off the power supply!

- Insert cable (3) through gland (4).
A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).



Only ground screening of the line (5) on sensor side:

- Make connection (see pin assignment).
- Tighten cable gland (4).
Max. torque 10...12 Nm!
- Screw on housing cover (2).
(on dust-Ex torque » 40 Nm).
- Switch on power supply.



100-BMP40ccc04-00-00-en-002

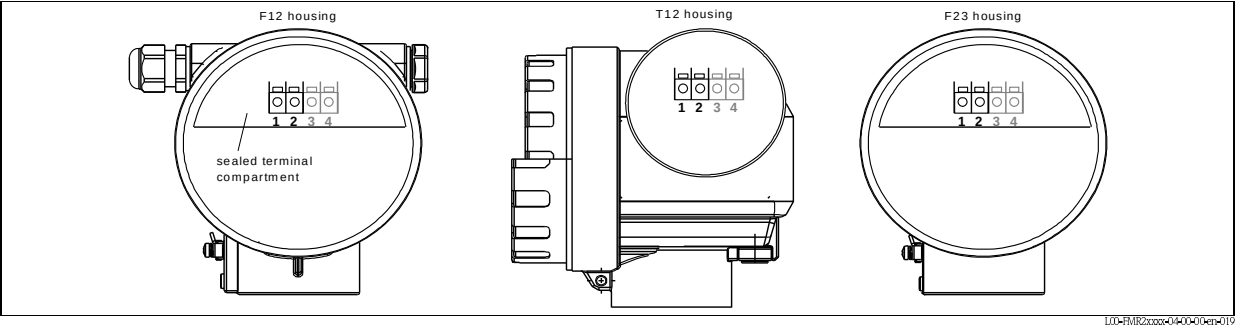
4.2 Connecting the measuring unit

Terminal compartment

Three housings are available:

- Aluminium housing F12 with additionally sealed terminal compartment for:
 - standard,
 - Ex ia,
 - Dust-Ex
- Aluminium housing T12 with separate terminal compartment for:
 - standard,
 - Ex e,
 - Ex d
 - Ex ia (with overvoltage protection),
 - Dust-Ex
- Stainless steel 316L (1.4435) housing F23 for:
 - standard,
 - Ex ia,
 - Dust Ex.

After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.



The device data are given on the nameplate together with important information regarding the analog output and voltage supply.
Housing orientation regarding the wiring see "Turn housing", → 33.

Load HART

Minimum load for Hart communication: 250 Ω

Ground connection

It is necessary to make a good ground connection to the ground terminal on the outside of the housing, in order to achieve EMC security.

Cable gland

Type		Clamping area
Standard, Ex ia, IS	Plastic M20x1,5	5 to 10 mm
Ex em, Ex nA	Metal M20x1.5	7 to 10.5 mm

Terminals

For wire cross-sections of 0,5 to 2,5 mm²

Cable gland

- Cable gland: M20x1.5 (only cable entry for Ex d)
- Cable entry: G½ or ½NPT

Supply voltage

HART, 2-wire

The following values are the voltages across the terminals directly at the device:

Communication		Current consumption	Terminal voltage
HART	standard	4 mA	16 V to 36 V
		20 mA	7.5 V to 36 V
	Ex ia	4 mA	16 V to 30 V
		20 mA	7.5 V to 30 V
	Ex em Ex d	4 mA	16 V to 30 V
		20 mA	11 V to 30 V
Fixed current, adjustable e.g. for solar power operation (measured value transferred at HART)	standard	11 mA	10 V to 36 V
	Ex ia	11 mA	10 V to 30 V
Fixed current for HART Multidrop mode	standard	4 mA ¹⁾	16 V to 36 V
	Ex ia	4 mA ¹⁾	16 V to 30 V

1) Start up current 11 mA.

HART residual ripple, 2-wire: $U_{ss} \leq 200 \text{ mV}$

HART, 4-wire active

Version	Voltage	Max. load
DC	10.5 to 32 V	600 Ω
AC 50/60 Hz	90 to 253 V	600 Ω

HART residual ripple, 4-wire, DC version: $U_{ss} = 2 \text{ V}$, voltage incl. ripple within the permitted voltage (10.5 to 32 V).

Current consumption

Communication	Output current	Current consumption	Power consumption
HART, 2-wire	3.6 to 22 mA ¹⁾	—	min. 60 mW, max. 900 mW
HART, 4-wire (90 to 250 V _{AC})	2.4 to 22 mA	~ 3 to 6 mA	~ 3,5 VA
HART, 4-wire (10.5 to 32 V _{DC})	2.4 to 22 mA	~ 100 mA	~ 1 W

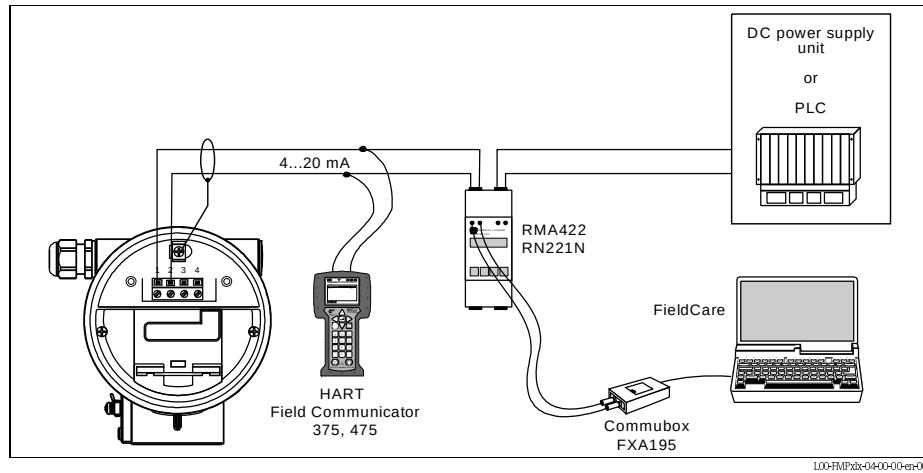
1) For HART-Multidrop: start up current is 11 mA.

Overvoltage protection

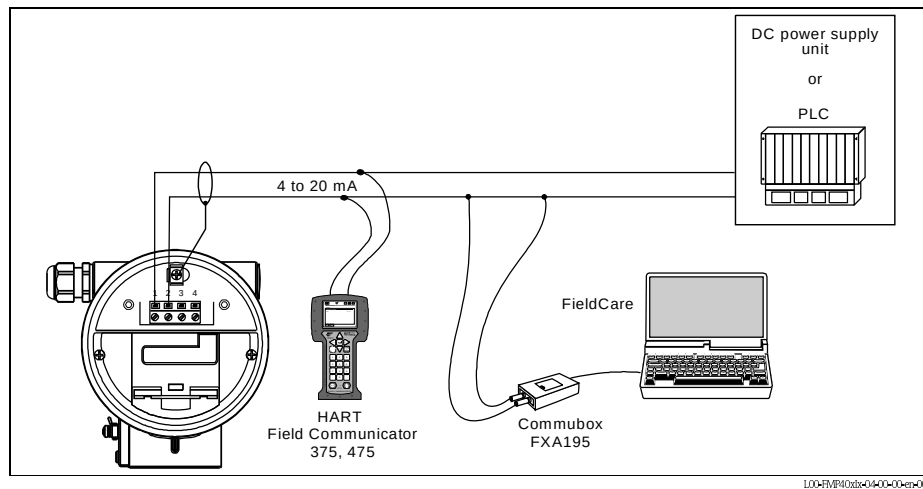
If the measuring device is used for the level measurement in flammable liquids which requires the use of an overvoltage protection according to EN/IEC 60079-14 or EN/IEC 60060-1 (10 kA, Puls 8/20 μ s) it has to be ensured that

- the measuring device with integrated overvoltage protection with gas discharge tubes within the T12-enclosure is used, refer to "Product structure", → 6
- or
- this protection is achieved by the use of other appropriate measures (external protection devices e.g. HAW562Z).

4.2.1 HART connection with Endress+Hauser RMA422 / RN221N



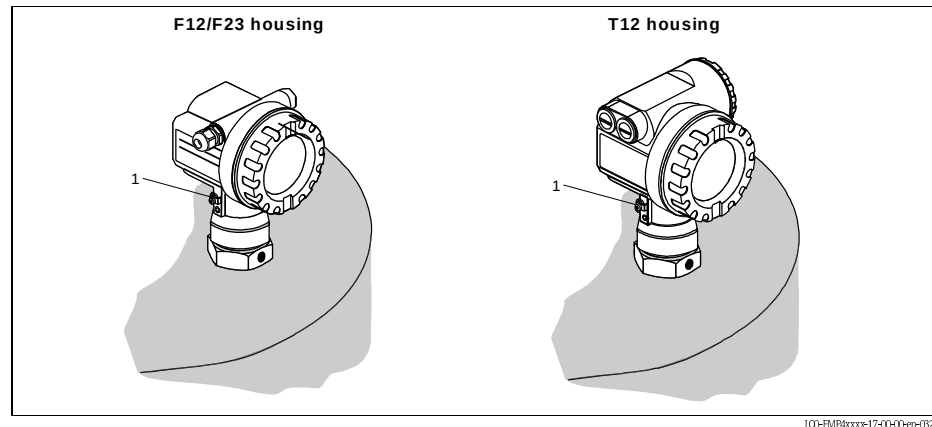
4.2.2 HART connection with other supplies



4.3 Recommended connection

4.3.1 Equipotential bonding

Connect the Equipotential bonding to the external ground terminal (1) of the transmitter.



1CO-FMP40xxxx-17-00-00-en-032

4.3.2 Wiring screened cable



Caution!

In Ex applications, the device must only be grounded on the sensor side. Further safety instructions are given in the separate documentation for applications in explosion hazardous areas.

4.4 Degree of protection

- with closed housing tested according to
 - IP68, NEMA 6P (24 h at 1.83 m under water surface)
 - IP66, NEMA 4X
- with open housing: IP20, NEMA 1 (also ingress protection of the display)

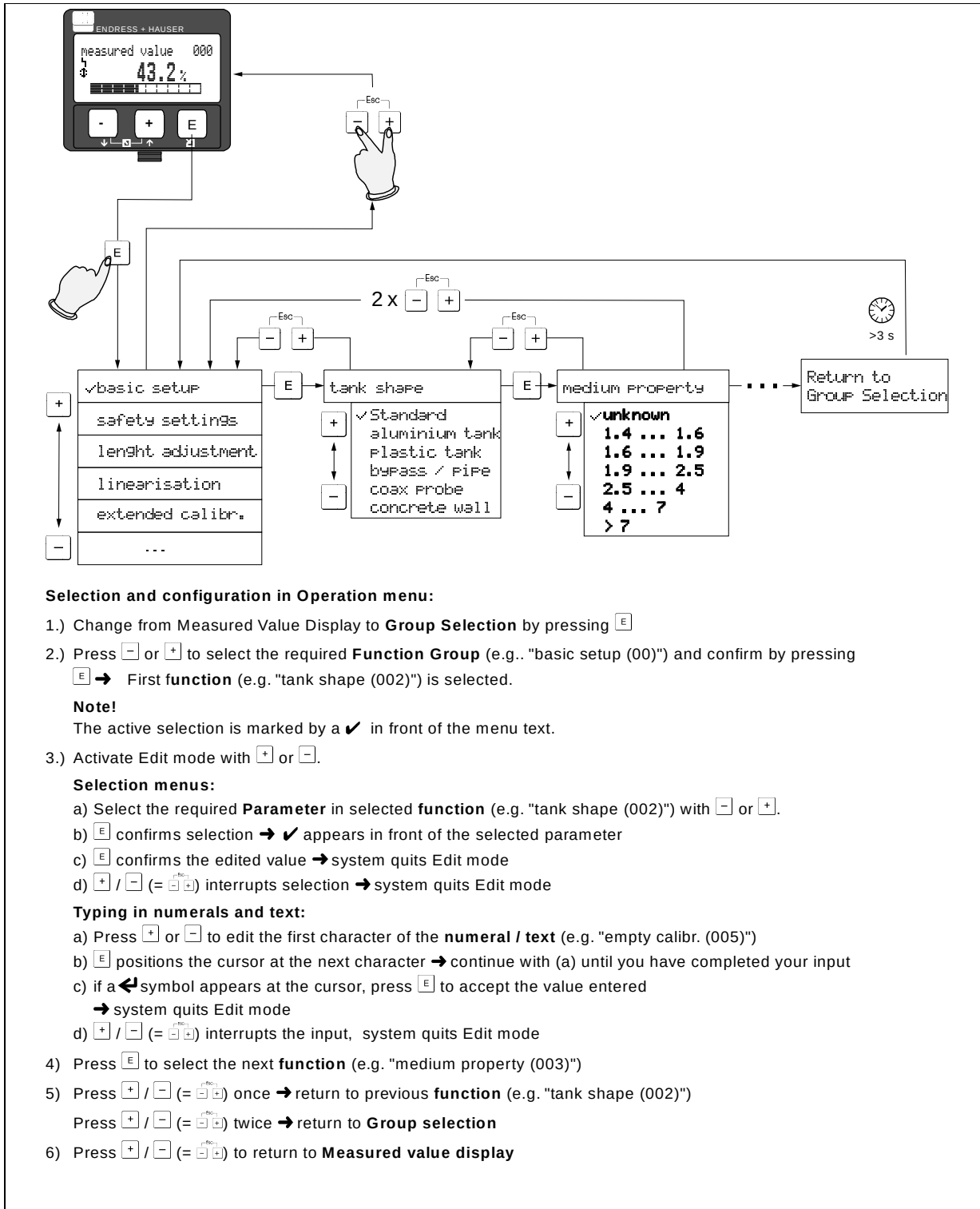
4.5 Post-connection check

After wiring the measuring device, perform the following checks:

- Is the terminal allocation correct (→ 34, 35)?
- Is the cable gland tight?
- Is the housing cover screwed tight?
- If auxiliary power is available:
 - Is the device ready for operation and is the liquid crystal display visible?

5 Operation

5.1 Quick operation guide



1.004FMP40xxxxx1040000xxxx001

5.1.1 General structure of the operating menu

The operating menu is made up of two levels:

■ **Function groups (00, 01, 03, ..., 0C, 0D):**

The individual operating options of the device are split up roughly into different function groups. The function groups that are available include, e.g.: "basic setup", "safety settings.", "output", "display", etc.

■ **Functions (001, 002, 003, ..., 0D8, 0D9):**

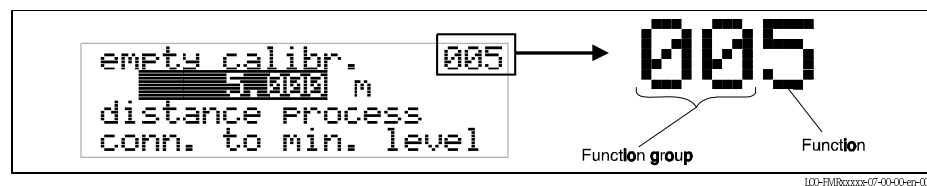
Each function group consists of one or more functions. The functions perform the actual operation or parameterisation of the device. Numerical values can be entered here and parameters can be selected and saved. The available functions of the "basic setup" (00) function group include, e.g.: "tank properties" (002), "medium property" (003), "process cond." (004), "empty calibr." (005), etc.

If, for example, the application of the device is to be changed, carry out the following procedure:

1. Select the "basic setup" (00) function group.
2. Select the "tank properties" (002) function (where the existing tank shape is selected).

5.1.2 Identifying the functions

For simple orientation within the function menus, for each function a position is shown on the display.



The first two digits identify the function group:

- **basic setup** 00
- **safety settings** 01
- **linearisation** 04

...

The third digit numbers the individual functions within the function group:

- **basic setup** 00 → ■ **tank properties** 002
- **medium property** 003
- **process cond.** 004

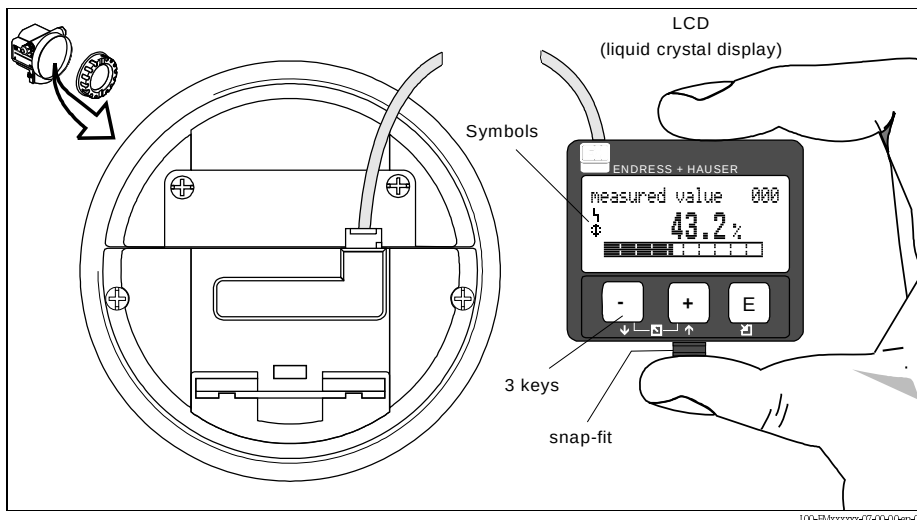
...

Here after the position is always given in brackets (e.g. "tank properties" (002)) after the described function.

5.2 Display and operating elements

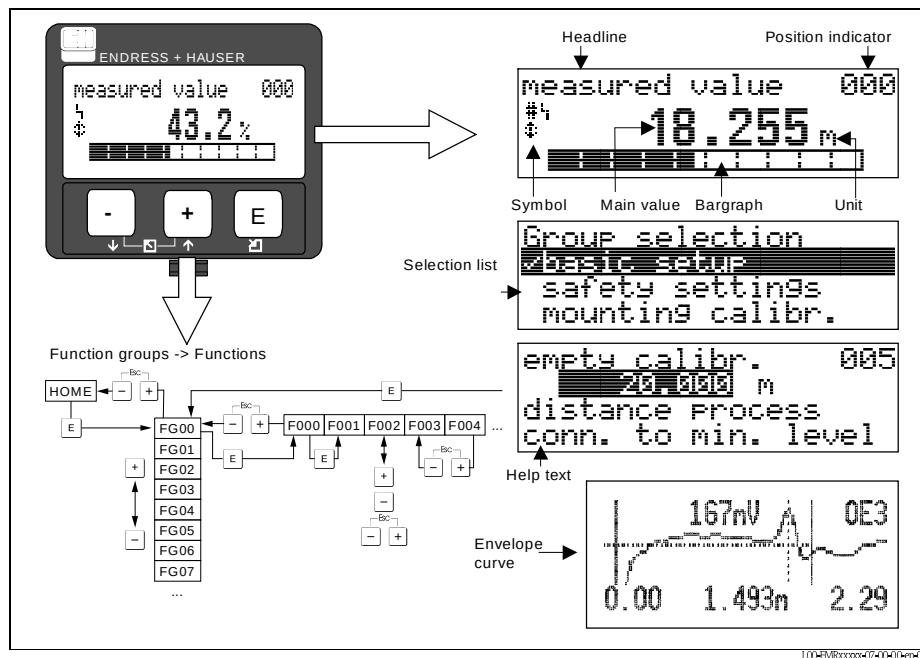
5.2.1 Liquid crystal display (LCD)

Four lines with 20 characters each. Display contrast adjustable through key combination.



The VU331 LCD display can be removed to ease operation by simply pressing the snap-fit (see graphic above). It is connected to the device by means of a 500 mm cable.

5.2.2 Display



5.2.3 Display symbols

The following table describes the symbols that appear on the liquid crystal display:

Sybmol	Meaning
	ALARM_SYMBOL This alarm symbol appears when the device is in an alarm state. If the symbol flashes, this indicates a warning.
	LOCK_SYMBOL This lock symbol appears when the device is locked, i.e. if no input is possible.
	COM_SYMBOL This communication symbol appears when a data transmission via e.g. HART, PROFIBUS PA or FOUNDATION Fieldbus is in progress.

5.2.4 Key assignment

The operating elements are located inside the housing and are accessible for operation by opening the lid of the housing.

Function of the keys

Key(s)	Meaning
 or 	Navigate upwards in the selection list. Edit numeric value within a function.
 or 	Navigate downwards in the selection list. Edit numeric value within a function.
 or 	Navigate to the left within a function group.
	Navigate to the right within a function group, confirmation.
 and  or  and 	Contrast settings of the LCD.
 and  and 	Hardware lock / unlock After a hardware lock, an operation of the device via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

5.3 Local operation

5.3.1 Locking of the configuration mode

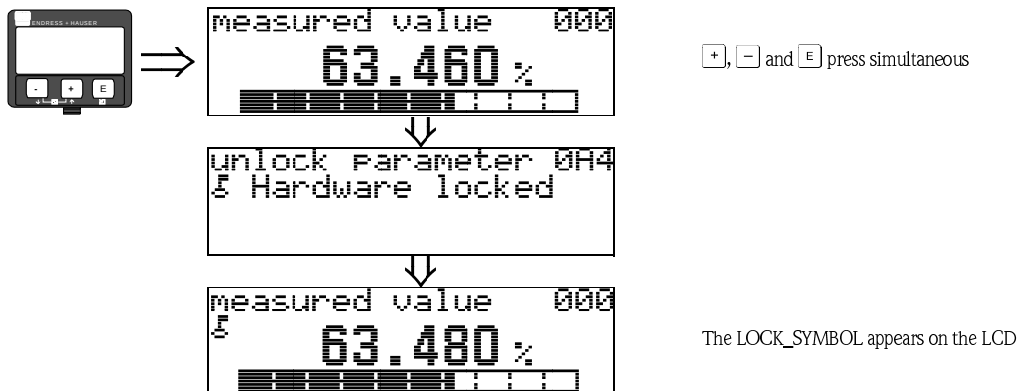
The Levelflex can be protected in two ways against unauthorised changing of device data, numerical values or factory settings:

Function "unlock parameter" (0A4):

A value $\diamond 100$ (e.g. 99) must be entered in "unlock parameter" (0A4) in the "diagnostics" (0A) function group. The lock is shown on the display by the  symbol and can be released again either via the display or by communication.

Hardware lock:

The device is locked by pressing the ,  and  keys at the same time. The lock is shown on the display by the  symbol and can **only** be unlocked again via the display by pressing the ,  and  keys at the same time again. It is **not** possible to unlock the hardware by communication. All parameters can be displayed even if the device is locked.



5.3.2 Unlocking of configuration mode

If an attempt is made to change parameters when the device is locked, the user is automatically requested to unlock the device:

Function "unlock parameter" (0A4):

By entering the unlock parameter (on the display or via communication)

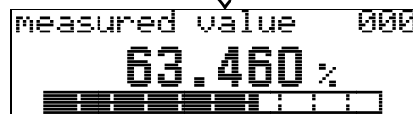
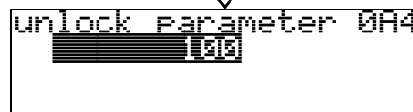
100 = for HART devices

the Levelflex is released for operation.

Hardware unlock:

After pressing the **+**, **-** and **E** keys at the same time, the user is asked to enter the unlock parameter

100 = for HART devices



+, **-** and **E** press simultaneous

Please enter unlock code and confirm with **E**



Caution!

Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organization. Please contact Endress+Hauser if you have any questions.

5.3.3 Factory settings (Reset)



Caution!

A reset sets the device back to the factory settings. This can lead to an impairment of the measurement. Generally, you should perform a basic setup again following a reset.

A reset is only necessary if the device...

- ... no longer functions
- ... must be moved from one measuring point to another
- ... is being de-installed /put into storage/installed



User input ("reset" (0A3)):

- 333 = customer parameters

333 = reset customer parameters

This reset is recommended whenever an device with an unknown "history" is to be used in an application:

- The Levelflex is reset to the default values.
- **The customer specific tank map is not deleted.**
- The mapping can also be deleted in the "cust. tank map" (055) function of the "extended calibr" (05) function group.
- A linearisation is switched to "linear" although the table values are retained. The table can be reactivated in the "linearisation" (04) function group.

List of functions that are affected by a reset:

- | | |
|------------------------------|---------------------------|
| ■ tank properties (002) | ■ max. scale (046) |
| ■ medium cond. (003) | ■ diameter vessel (047) |
| ■ process proper. (004) | ■ check distance (051) |
| ■ empty calibr. (005) | ■ range of mapping (052) |
| ■ full calibr. (006) | ■ start mapping (053) |
| ■ output on alarm (010) | ■ offset (057) |
| ■ output on alarm (011) | ■ output damping (058) |
| ■ outp. echo loss (012) | ■ low output limit (062) |
| ■ ramp %span/min (013) | ■ curr. output mode (063) |
| ■ delay time (014) | ■ fixed cur. value (064) |
| ■ safety distance. (015) | ■ 4mA value (068) |
| ■ in safety dist. (016) | ■ language (092) |
| ■ overspill protection (018) | ■ back to home (093) |
| ■ end of probe (030) | ■ format display (094) |
| ■ level/ullage (040) | ■ no of decimals (095) |
| ■ linearisation (041) | ■ sep. character (096) |
| ■ customer unit (042) | ■ unlock parameter (0A4) |

A complete "basic setup" (00) must be activated.

5.4 Display and acknowledging error messages

Type of error

Errors that occur during commissioning or measuring are displayed immediately on the local display. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:

■ A (Alarm):

Device goes into a defined state (e.g. max 22 mA)

Indicated by a constant  symbol.

(For a description of the codes, →  82)

■ W (Warning):

Device continue measuring, error message is displayed.

Indicated by a flashing  symbol.

(For a description of the codes, →  82)

■ E (Alarm / Warning):

Configurable (e.g. loss of echo, level within the safety distance)

Indicated by a constant/flashing  symbol.

(For a description of the codes, →  82)



Error messages

Error messages appear as four lines of plain text on the display. In addition, a unique error code is also output. A description of the error codes, →  82.

- The "diagnostics" (0A) function group can display current errors as well as the last errors that occurred.
- If several current errors occur, use  or  to page through the error messages.
- The last occurring error can be deleted in the "diagnostics" (0A) function group with the function "clear last error" (0A2).

5.5 HART communication

Apart from local operation, you can also parameterise the measuring device and view measured values by means of a HART protocol. There are two options available for operation:

- Operation via the universal handheld operating unit, the Field Communicator 375, 475.
- Operation via the Personal Computer (PC) using the operating program (e.g. FieldCare: for connection, → 38).

5.5.1 Operation with the Field Communicator 375, 475

All device functions can be adjusted via a menu operation with the Field Communicator 375, 475.



Note!

Further information on the HART handheld unit is given in the respective operating manual included in the transport bag of the Field Communicator 375, 475.

5.5.2 Endress+Hauser operating program

The operating program FieldCare is an Endress+Hauser Plant Asset Management Tool based on FDT technology. You can use Field-Care to configure all your Endress+Hauser devices, as well as devices from other manufacturers that support the FDT standard. Hardware and software requirements you can find on the internet:

www.endress.com → select your country → search: FieldCare → FieldCare → Technical Data.

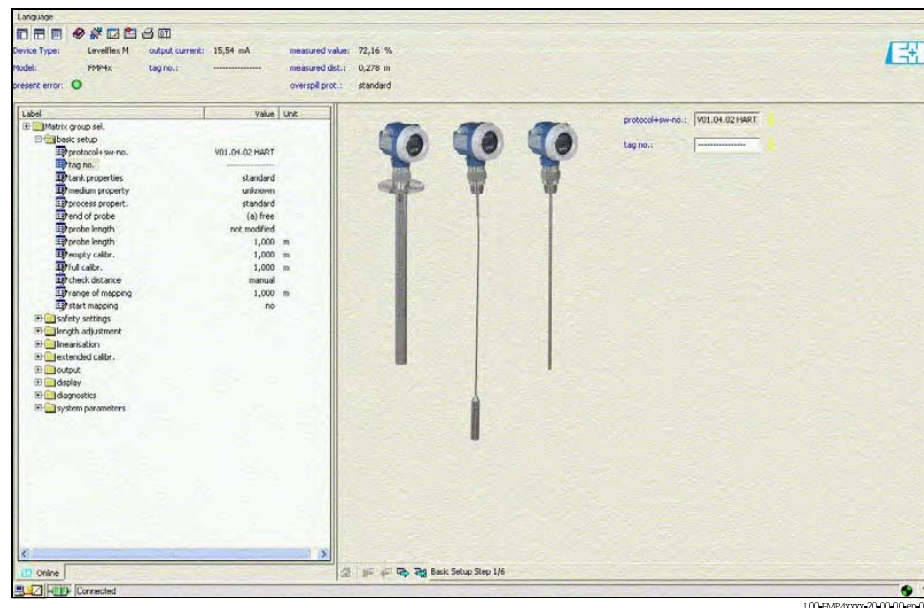
FieldCare supports the following functions:

- Online configuration of transmitters
- Signal analysis via envelope curve
- Tank linearization
- Loading and saving of device data (upload/download)
- Documentation of the measuring point

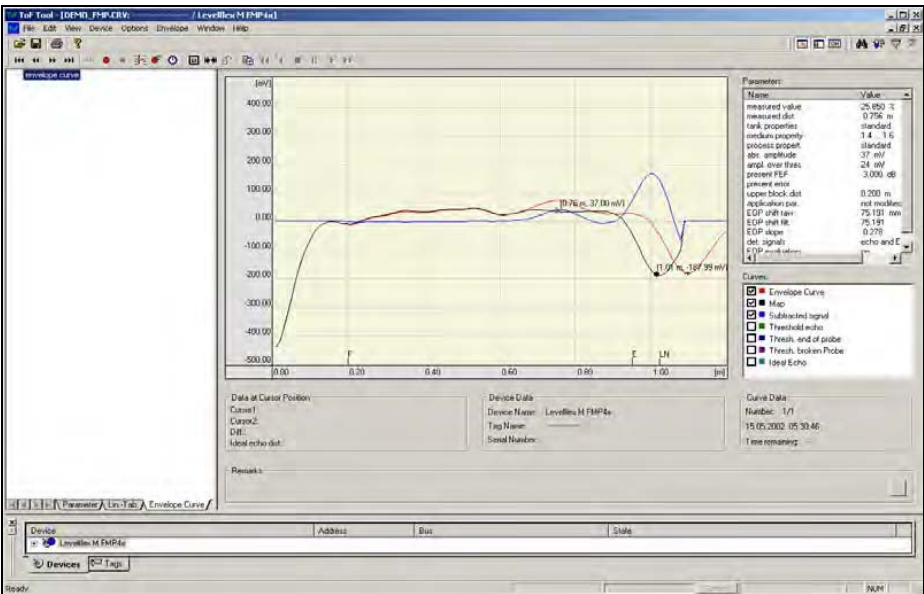
Connection options:

- HART via Commubox FXA195 and the USB port of a computer
- Commubox FXA291 with ToF Adapter FXA291 via service interface

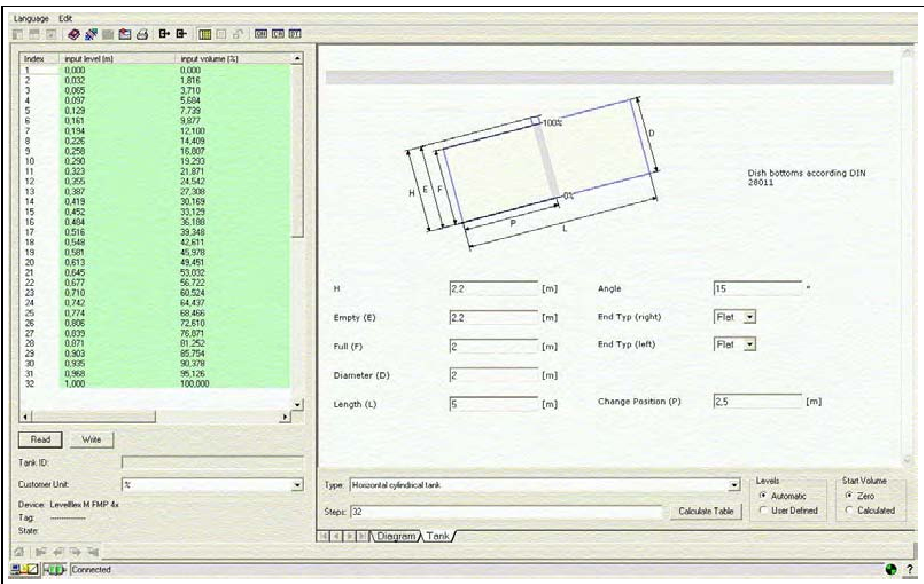
Menu-guided commissioning



Signal analysis via envelope curve



Tank linearization



6 Commissioning

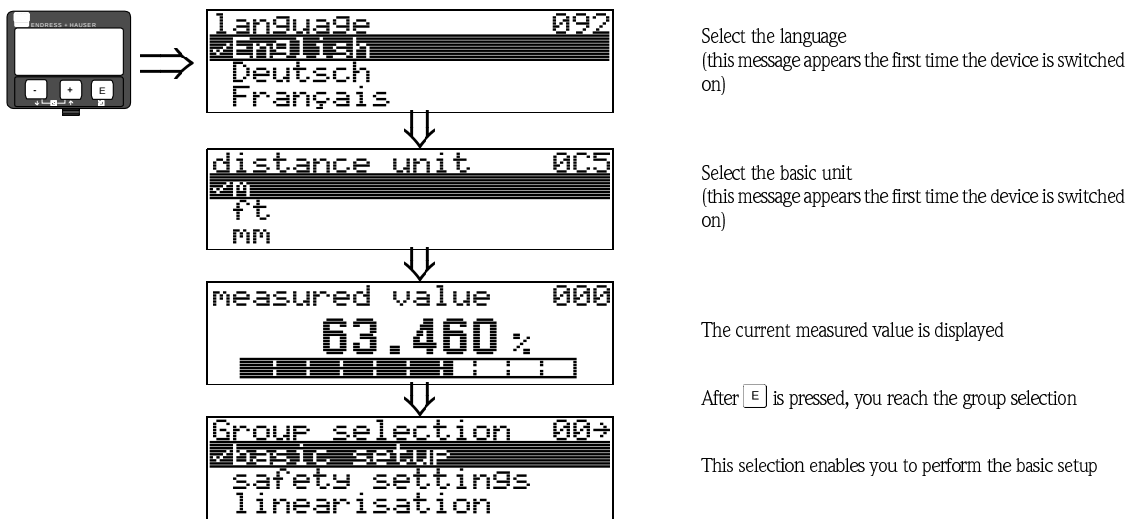
6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:

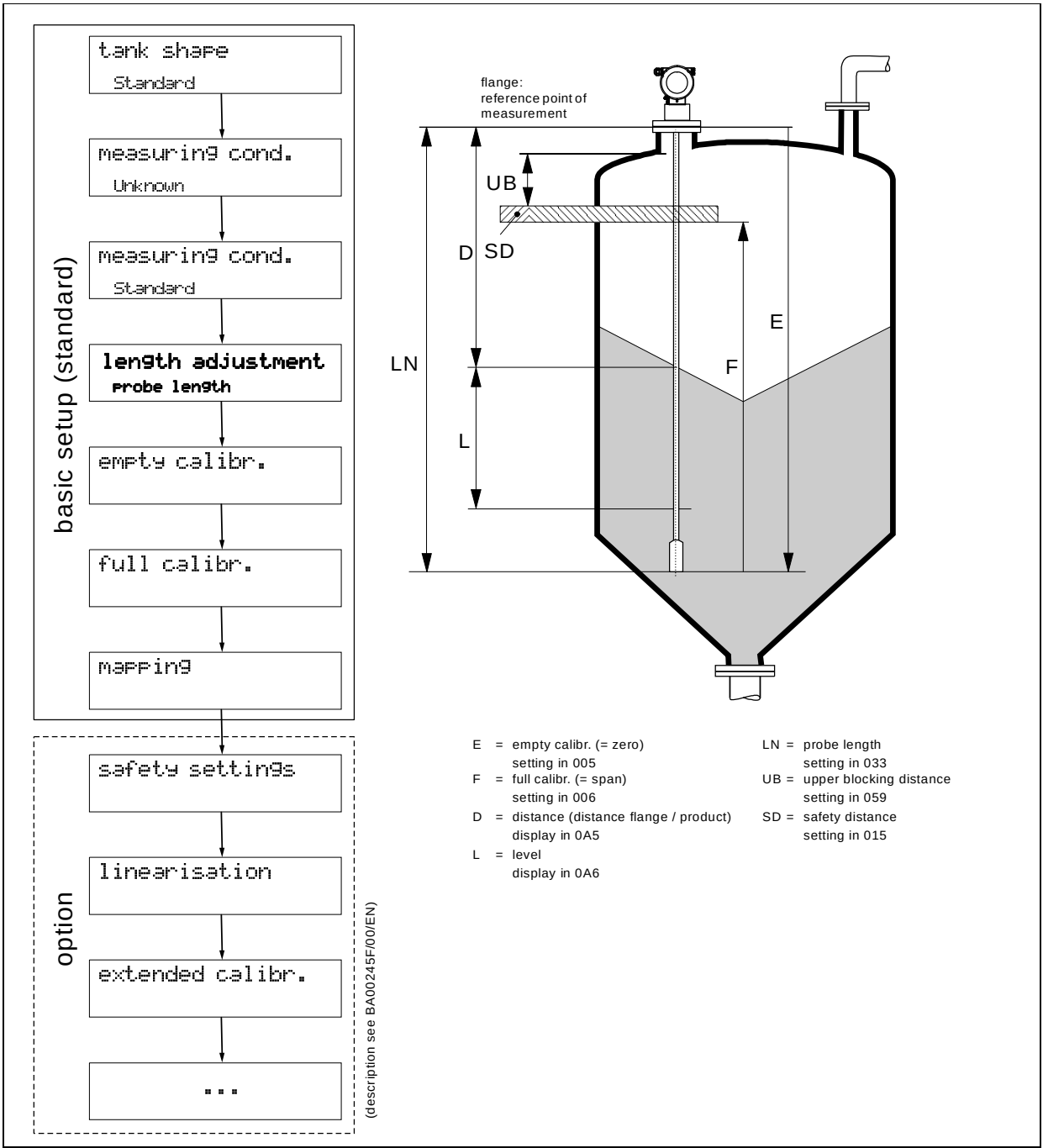
- Checklist "Post-installation check", → 33.
- Checklist "Post-connection check", → 39.

6.2 Switching on the measuring device

When the device is switched on for the first time, the following messages appear in a sequence of 5 s on the display: software version, communication protocol and language selection.



6.3 Basic Setup



LD-FMP40xxx-19-00-00-en-031

**Caution!**

The basic setup is sufficient for successful commissioning in most applications.

The Levelflex is initially adjusted at the factory to the probe length ordered, so that in most cases only the application parameters, that automatically adapt the device to the measuring conditions, need to be entered. For models with current output, the factory adjustment for zero point "E" and span "F" is 4 mA and 20 mA. For digital outputs and the display module, the factory adjustment for zero point "E" and span "F" is 0 % and 100 %.

A linearisation function with max. 32 points, that is based on a manually or semi-automatically input table, can be activated on-site or via remote operation. This function enables, for example, the conversion of the level into units of volume or weight.

**Note!**

The Levelflex M allows to check for broken probe. On delivery, this function is switched off, because otherwise shortening of the probe would be mistaken for a broken probe.

In order to activate this function, perform the following steps:

1. With the probe uncovered, perform a mapping ("**range of mapping**" (052) and "**start mapping**" (053)).
2. Activate the "**broken probe det**" (019) function in the "**safety settings**" (01) function group.

Complex measuring operations necessitate additional functions that the user can use to customise the Levelflex as necessary to suit his specific requirements. The functions available to do this are described in detail in the BA00245F/00/EN.

Comply with the following instructions when configuring the functions in the "**basic setup**" (00):

- Select the functions as described, → 40.
- Certain functions (e.g. starting an interference echo mapping (053)) prompt you to confirm your data entries. Press $\boxed{+}$ or $\boxed{-}$ to select "**YES**" and press $\boxed{E}$ to confirm. The function is now started.
- If you do not press a key during a configurable time period (→ function group "**display** (09)"), an automatic return is made to the home position (measured value display).

**Note!**

- The device continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the envelope curve mode is active on the display, the measured values are updated in a slower cycle time. Thus, it is advisable to leave the envelope curve mode after the measuring point has been optimised.
- If the power supply fails, all preset and parameterised values remain safely stored in the EEPROM.
- All functions are described in detail, as is the overview of the operating menu itself, in the manual "**BA00245F – Description of Instrument Functions**" on the enclosed CD-ROM.

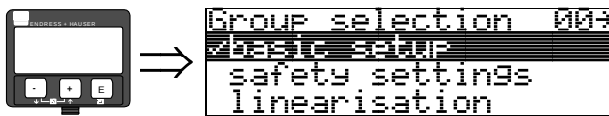
6.4 Basic Setup with the VU331

Function "measured value" (000)

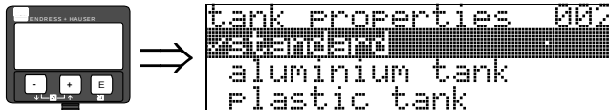


This function displays the current measured value in the selected unit (see "customer unit" (042) function). The number of digits after decimal point can be selected in the "no.of decimals" (095) function.

6.4.1 Function group "basic setup" (00)



Function "tank properties" (002)



This function is used to select the tank properties.

Selection:

- standard
- aluminium tank
- plastic tank
- bypass / pipe
- coax probe
- concrete wall

standard

The "standard" option is recommended for normal containers for rod and rope probes.

aluminium tank

The "aluminium tank" option is designed especially for high aluminium silos that cause an increased level of noise when empty. This option is only useful for probes longer than 4 m. For short probes (< 4 m) select the "standard" option!



Note!

If "aluminium tank" is selected, the device calibrates of its own accord when first filled, depending on the medium's properties. Slope errors can, therefore, occur when beginning the first filling procedure.

plastic tank

Select the "plastic tank" option when installing probes in wood or plastic containers **without** metallic surfaces at the process connection (see installation in plastic containers). When using a metallic surface at the process connection, the "standard" option is sufficient!



Note!

In principle the employment of a metallic surface area should be preferred at the process connection!

bypass / pipe

The "**bypass / pipe**" option is designed especially for the installation of probes in a bypass or a stilling well. If this option is selected, the upper blocking distance is preset to 100 mm.

coax probe

Select the "**coax probe**" option when using a coaxial probe. When this setting is made, the evaluation is adapted to the high sensitivity of the coax probe. This option should, therefore, **not** be selected when using rope or rod probes.

concrete wall

The "**concrete wall**" option takes into account the signal-damping property of concrete walls when mounting with < 1 m distance to the wall.

Function "medium property" (003)

This function is used to select the dielectric constant.

Selection:

- **unknown**
- 1.4 ... 1.6 (use coaxial or Rod probe with installation in metallic pipes ≤ DN150)
- 1.6 ... 1.9
- 1.9 ... 2.5
- 2.5 ... 4.0
- 4.0 ... 7.0
- > 7.0

Media group	DC (εr)	Typical bulk solids	Typical liquids	Measuring range	
				bare metallic probes	PA-coated rope probes
1	1.4 to 1.6		– Condensed gases, e.g. N ₂ , CO ₂	4 m (157"), only coax probe	—
2	1.6 to 1.9	– Plastic granulate – White lime, special cement – Sugar	– Liquefied gas, e.g. Propane – Solvent – Frigen / Freon – Palm oil	25 m to 30 m (984" to 1181")	12,5 m to 15 m (492" to 590")
3	1.9 to 2.5	– Portland cement, plaster	– Mineral oils, fuels	30 m to 35 m (1181" to 1378")	—
		– Flour	—	—	15 m to 25 m (590" to 984")
4	2.5 to 4	– Grain, seeds	—	—	25 m to 30 m (984" to 1181")
		– Ground stones – Sand	– Benzene, styrene, toluene – Furan – Naphthalene	35 m (1378")	25 m to 30 m (984" to 1181")
5	4 to 7	– Naturally moist (ground) stones, ores – Salt	– Chlorobenzene, chloroform – Cellulose spray – Isocyanate, aniline	35 m (1378")	35 m (1378")
6	> 7	– Metallic powder – Carbon black – Coal	– Aqueous solutions – Alcohols – Ammonia	35 m (1378")	35 m (1378")

The lower group applies to very loose or loosened bulk solids. Reduction of the max. possible measuring range by means of:

- Extremely loose surfaces of bulk solids, e.g. bulk solids with low piled density when filled pneumatically.
- Build-up, primarily of moist products.



Note!

Due to the high diffusion rate of ammonia it is recommended to use the FMP45 with gas-tight bushing for measurements in this medium.

Function "process propert." (004)



```
Process Propert. 004
standard
fast change
slow change
```

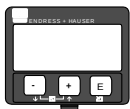
Use this function to adapt the device reaction to the filling speed in the tank. The setting impacts on an intelligent filter.

Selection:

- **standard**
- fast change
- slow change
- test:no filter

Selection:	standard	fast change	slow change	test:no filter
Application:	For all normal applications, bulk solids and fluids at low to medium filling speed and sufficiently large tanks.	Small tanks, primarily with fluids, at high filling speeds.	Applications with strong surface movement, e.g. caused by stirrer, primarily large tanks with slow to medium filling speed.	Shortest reaction time: ■ For test purposes ■ Measurement in small tanks at high filling speeds, if "rapid change" setting is too slow.
2-wire electronics:	Dead time: 4 s Rise time: 18 s	Dead time: 2 s Rise time: 5 s	Dead time: 6 s Rise time: 40 s	Dead time: 1 s Rise time: 0 s
4-wire electronics:	Dead time: 2 s Rise time: 11 s	Dead time: 1 s Rise time: 3 s	Dead time: 3 s Rise time: 25 s	Dead time: 0,7 s Rise time: 0 s

Function "end of probe" (030)



```
end of probe 030
free
tie down isol.
tie down gnd.
```

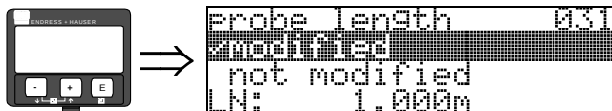
Use this function to select the polarity of the probe end signal. If the probe end is uncovered or in an insulated attachment, there is a negative probe end signal.

The signal from the probe end is positive if the attachment is grounded.

Selection:

- **free**
- tie down isol.
- tie down gnd.¹⁾

1) If using a metallic centering of probe end.

Function "probe length" (031)

Use this function to select whether the probe length was changed after factory calibration. Only then is it necessary to enter or correct the probe length.

Selection:

- not modified
- modified



Note!

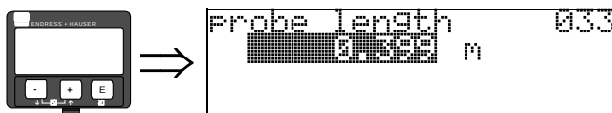
If "modified" was selected in the **"probe length" (031)** function, the probe length is defined in the next step.

Function "probe" (032)

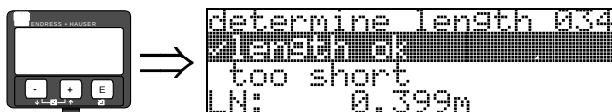
Use this function to select whether the probe is at the time of the commissioning uncovered or covered. If the probe is uncovered, the Levelflex can determine the probe length automatically **"determine length" (034)** function. If the probe is covered, a correct entry is required in the **"probe length" (033)** function.

Selection:

- free
- covered

Function "probe length" (033)

Use this function, the probe length can be entered manually.

Function "determine length" (034)

Use this function, the probe length can be determined automatically.

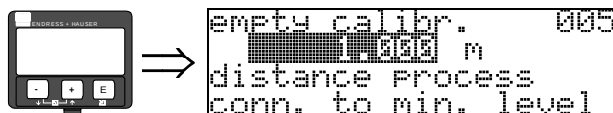
Due to the mounting conditions, the automatically determined probe length may be larger than the actual probe (typically 20 to 30 mm longer). This has no influence on the measuring accuracy. When entering the empty value for a linearisation, please use the "empty calibration" instead of the automatically determined probe length.

Selection:

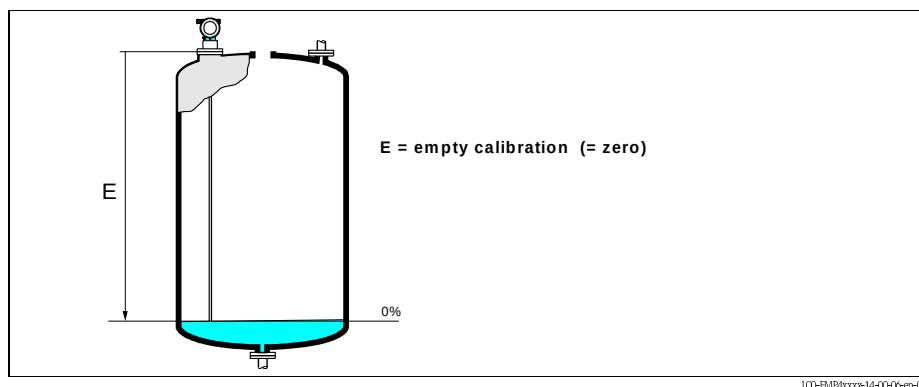
- length ok
- too short
- too long

After selection "length too short" or "length too long", the calculation of the new value need approx. 10 s.

Function "empty calibr." (005)

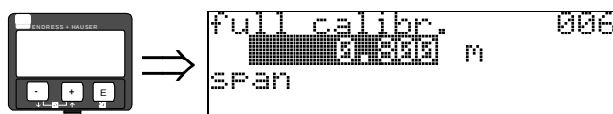


This function is used to enter the distance from the flange (reference point of the measurement) to the minimum level (= zero).

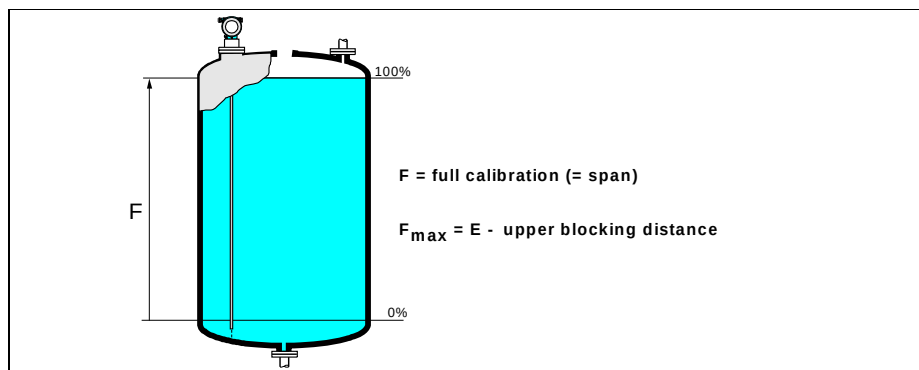


100-FMP40xxxx-14-00-06-en-008

Function "full calibr." (006)



This function is used to enter the distance from the minimum level to the maximum level (= span).



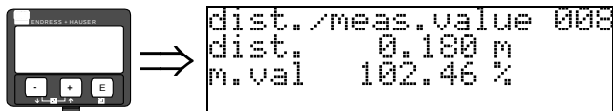
100-FMP40xxxx-14-00-06-en-009



Note!

The usable measuring range lies between the upper blocking distance and the probe end. The values for empty distance "E" and span "F" can be set independently of this.

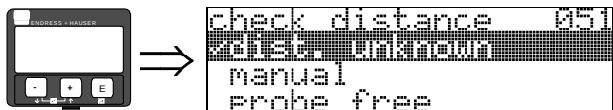
Function "dist./meas.value" (008)



The **distance** measured from the reference point to the product surface and the **meas. value** calculated with the aid of the empty adjustment are displayed. Check whether the values correspond to the actual meas. value or the actual distance. The following cases can occur:

- Distance correct – meas. value correct → continue with the next function "**check distance**" (051)
- Distance correct – meas. value incorrect → Check "**empty calibr.**" (005)
- Distance incorrect – meas. value incorrect → continue with the next function "**check distance**" (051)

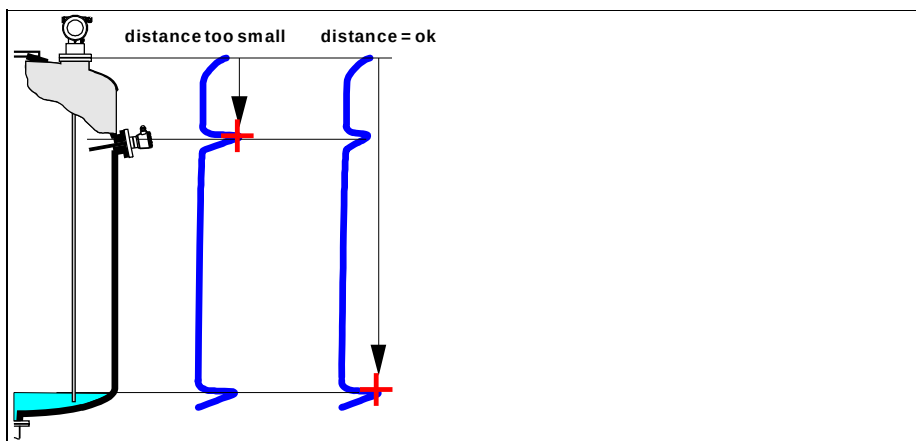
Function "check distance" (051)



This function triggers the mapping of interference echoes. To do so, the measured distance must be compared with the actual distance to the product surface. The following options are available for selection:

Selection:

- distance = ok
- dist. too small
- dist. too big
- dist. unknown
- **manual**
- probe free



1.004FMP40xxxx-1400406en010

distance = ok

Use this function at part-covered probe. Choosing function "**manual**" or "**probe free**" at free probe.

- mapping is carried out up to the currently measured echo
- The range to be suppressed is suggested in the "**range of mapping**" (052) function

Anyway, it is wise to carry out a mapping even in this case.



Note!

At free probe, the mapping should be confirmed with the choice "**probe free**".

dist. too small

- At the moment, an interference is being evaluated
- Therefore, a mapping is carried out including the presently measured echoes
- The range to be suppressed is suggested in the "**range of mapping**" (052) function

dist. too big

- This error cannot be remedied by interference echo mapping
- Check the application parameters (002), (003), (004) and "**probe length**." (031)

dist. unknown

If the actual distance is not known, no mapping can be carried out.

manual

A mapping is also possible by manual entry of the range to be suppressed. This entry is made in the "**range of mapping**" (052) function.



Caution!

The range of mapping must end 0.3 m (20") before the echo of the actual level. In case of empty vessel it is possible to make a map over the whole probe length.

probe free

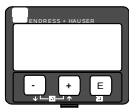
If the probe is uncovered, mapping is carried out along the whole probe length.



Caution!

Only begin mapping in this function if the probe is safely uncovered. Otherwise, the device will not make correct measurements!

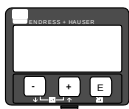
Function "range of mapping" (052)



```
range of mapping 052
  0.000 m
input of
mapping range
```

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (→ 51). This value can be edited by the operator. For manual mapping, the default value is 0,3 m.

Function "start mapping" (053)



```
start mapping 053
off
on
```

This function is used to start the interference echo mapping up to the distance given in "**range of mapping**" (052).

Selection:

- **off**: no mapping is carried out
- **on**: mapping is started

Function "dist./meas.value" (008)

```
dist./meas.value 008
dist.      2.463 m
meas.v.    63.422 %
```

The distance measured from the reference point to the product surface and the meas. value calculated with the aid of the empty alignment are displayed again. Check whether the values correspond to the actual meas. value or the actual distance. The following cases can occur:

- Distance correct – meas. value correct → basic setup completed
- Distance correct – meas. value incorrect → check "**empty calibr**" (005)
- Distance incorrect – meas. value incorrect → a further interference echo mapping must be carried out "**check distance**" (051).



```
Return to
Group Selection
```



```
Group selection 008
✓basic setup
safety settings
length adjustment
```

After 3 s, the following message appears

**Note!**

After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("**envelope curve**" (0E) function group) is recommended (→ 63).

6.5 Blocking distance

Function "upper block. dist" (059)



For rod probes and for rope probes with lengths of up to 8 m, the upper blocking distance is preset to 0.2 m on delivery. For rope probes with lengths of more than 8 m, the upper blocking distance is preset to 2.5 % of the probe length. For media with $DC > 7$, the upper blocking distance for rod and rope probes can be reduced to 0.1 m, if the probe is mounted flush with the wall or in a nozzle of maximum 50 mm.

Blocking distance and measuring range

At the lower end of the probe there is no blocking distance but a transition region with reduced accuracy, see section "Maximum measured error", → 62.

FMP40	LN [m] min	LN [m] max	UB [m] min
Rope probe	1	35 ¹⁾	0,2 ²⁾
6 mm rod probe	0,3		0,2 ²⁾
16 mm rod probe	0,3	4	0,2 ²⁾
Coax probe	0,3	4	0

- 1) Larger measuring range available on request.
- 2) The indicated blocking distances are preset. At media with $DC > 7$, the upper blocking distance UB can be reduced to 0.1 m for rod and rope probes. The upper blocking distance UB can be entered manually.



Note!
Within the upper and lower blocking distance, a reliable measurement can not be guaranteed.

For stilling well applications

The upper blocking distance (UB) is preset to 100 mm when the "bypass/pipe" parameter has been selected in the **"tank properties" (002)** function.

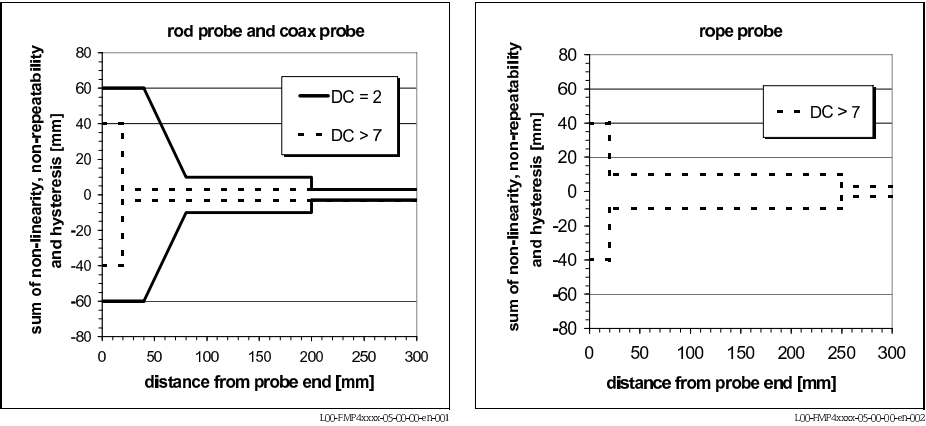
Maximum measured error

Typical statements for reference conditions:
DIN EN 61298-2, percentage of the span.

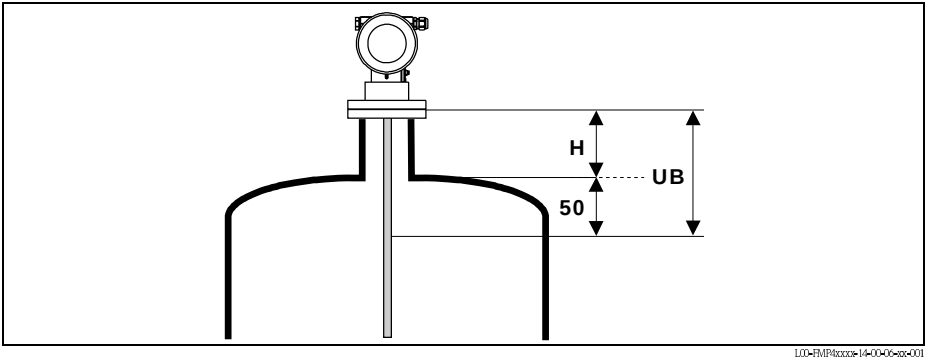
Output:	digital	analogue
sum of non-linearity, non-repeatability and hysteresis	measuring range: - up to 10 m: ±3 mm - > 10 m: ±0.03 % for PA coated rope measuring range: - up to 5 m: ±5 mm - > 5 m: ±0.1 %	±0.06 %
Offset / Zero	±4 mm	±0.03 %

If the reference conditions are not met, the offset/zero arising from the mounting situation may be up to ±12 mm. This additional offset/zero can be compensated for by entering a correction (function "offset" (057)) during commissioning.

Differing from this , the following measuring error is present in the vicinity of the probe end:



Note!
Please reenter the blocking distance in the function group "extended calibr." (05) function "upper block.dist" (059) when installing the device in a high nozzle:
upper blocking distance (UB) = nozzle height (H) + 50 mm.



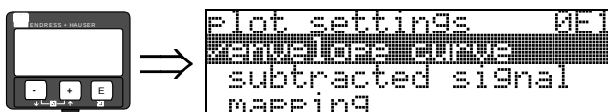
6.6 Envelope curve with VU331

After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("envelope curve" (0E)) function group) is recommended.

6.6.1 Function "plot settings" (0E1)

Here you can select which information is shown on the display:

- **envelope curve**
- subtracted signal
- mapping



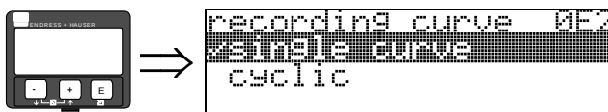
Note!

The interference echo suppression (map) are explained in BA00245F/00/EN "Description of Instrument Functions".

6.6.2 Function "recording curve" (0E2)

This function determines whether the envelope curve is read as

- **single curve** or
- cyclic

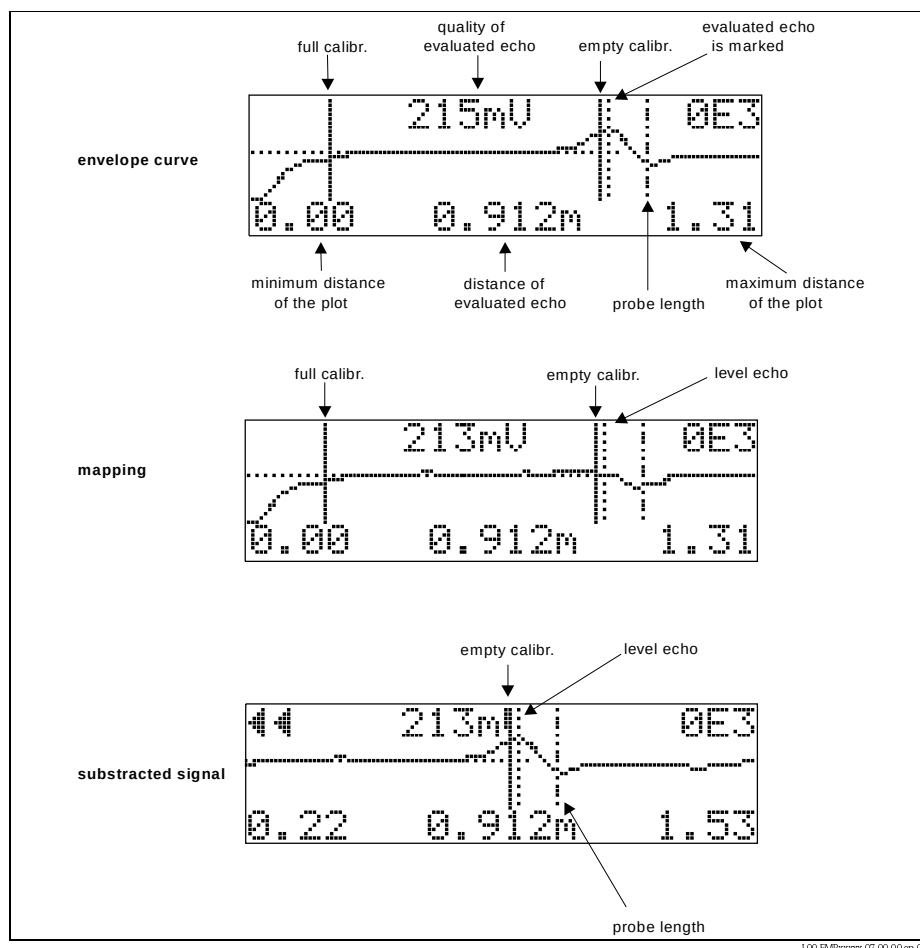


Note!

If the envelope curve mode is active on the display, the measured values are updated in a slower cycle time. Thus, it is advisable to leave the envelope curve mode after the measuring point has been optimised.

6.7 Function "envelope curve display" (0E3)

You can obtain the following information from the envelope curve display in this function:



6.7.1 Envelope curve

The Levelflex emits individual pulses in quick succession and scans their reflection with a slightly variable delay. The energy values received are ordered by their time-of-flight. The graphic representation of this sequence is known as an "envelope curve".

6.7.2 Mapping (empty curve) and difference curve

To suppress interference signals, the envelope curve is not directly evaluated in the Levelflex.

The mapping (empty curve) is first subtracted from the envelope curve.

The system looks for level echoes in the resulting difference curve.

Difference curve = envelope curve - mapping (empty curve)

The mapping (empty curve) should be a good representation of the probe and the empty tank or silo. Ideally, only the signals from the medium being measured remain in the difference curve.

6.7.3 Mapping

■ Factory mapping

Mapping (empty curve) is already available in the device when the device is delivered.

■ Customer mapping

In a partially filled state, the distance up to 10 cm before the actual total level can be mapped (range of mapping = actual distance from total level - 10 cm), or values > LN can be mapped in the case of empty tanks.

■ Dynamic mapping

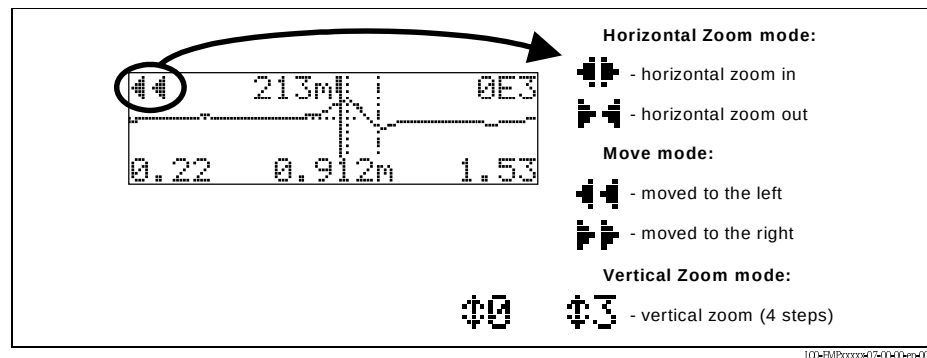
It is not static like factory and customer-specific interference echo suppression. Instead, it follows directly from static mapping and constantly adapts to the changing features of the probe environment during ongoing operation. Thus, dynamic mapping does not have to be recorded explicitly.

6.7.4 Echo threshold

Maximum points in the difference curve are only accepted as reflection signals if they are above a specified threshold. This threshold depends on the location and is automatically calculated from the ideal echo curve of the probe used. The calculation of the threshold in question depends on the "Installation" customer parameter in the extended calibration function.

6.7.5 Navigation in the envelope curve display

Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.

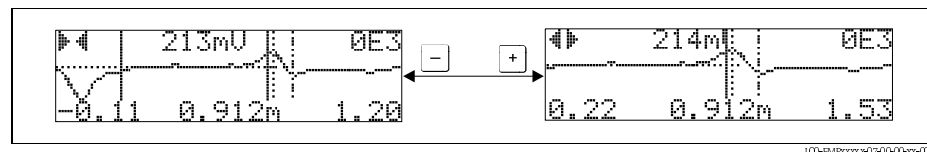


Horizontal-Zoom-Modus

Press $\boxed{+}$ or $\boxed{-}$, to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either $\boxed{\leftarrow}$ or $\boxed{\rightarrow}$ is displayed.

You now have the following options:

- $\boxed{+}$ increases the horizontal scale.
- $\boxed{-}$ decreases the horizontal scale.

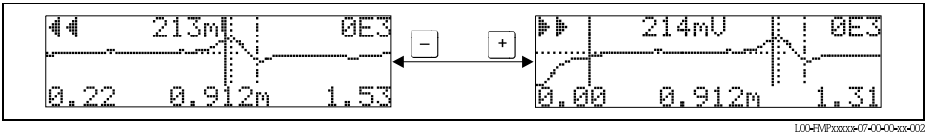


Move-Modus

Then press **[E]**, to switch to Move mode. Either **↔** or **↔** is displayed.

You now have the following options:

- **+** shifts the curve to the right.
- **-** shifts the curve to the left.



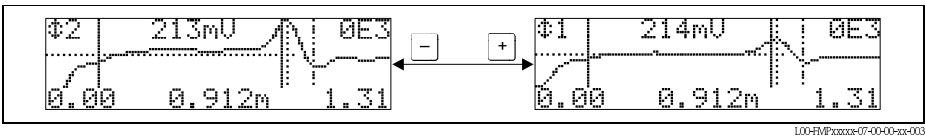
Vertical-Zoom-Modus

Press **[E]**, once more to switch to Vertical Zoom mode. **⌕1** is displayed.

You now have the following options:

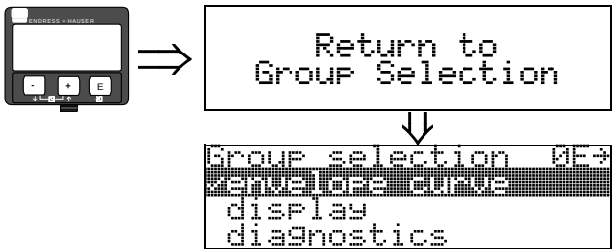
- **+** increases the vertical scale.
- **-** decreases the vertical scale.

The display icon shows the current zoom factor (**⌕0** to **⌕3**).



Exiting the navigation

- Press **[E]** again to run through the different modes of the envelope curve navigation.
- Press **+** and **-** to exit the navigation. The set increases and shifts are retained. Only when you reactivate the "recording curve"(OE2) function does the Levelflex use the standard display again.



After 3 s, the following message appears

6.8 Basic setup with the Endress+Hauser operating program

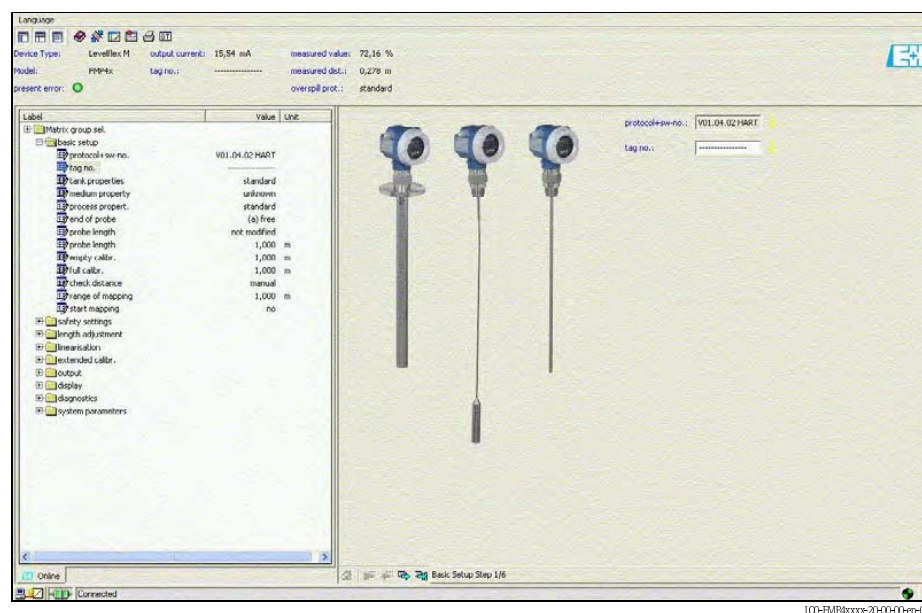
To carry out the basic setup with the operating program, proceed as follows:

- Start the operating program and establish a connection.
- Select the "**basic setup**" function group in the navigation window.

The following display appears on the screen:

Basic setup step 1/6:

- Status image
- The TAG number can be entered.

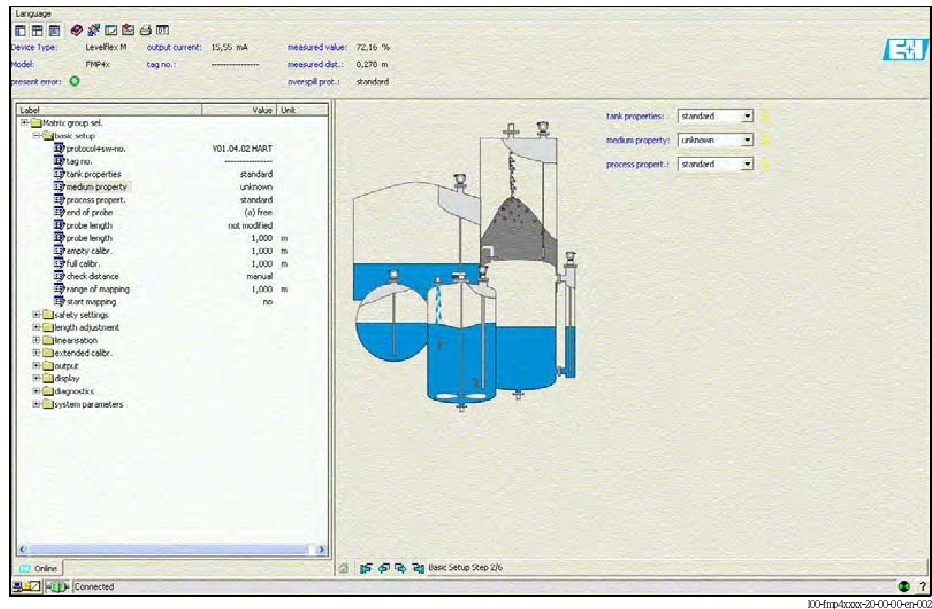


Note!

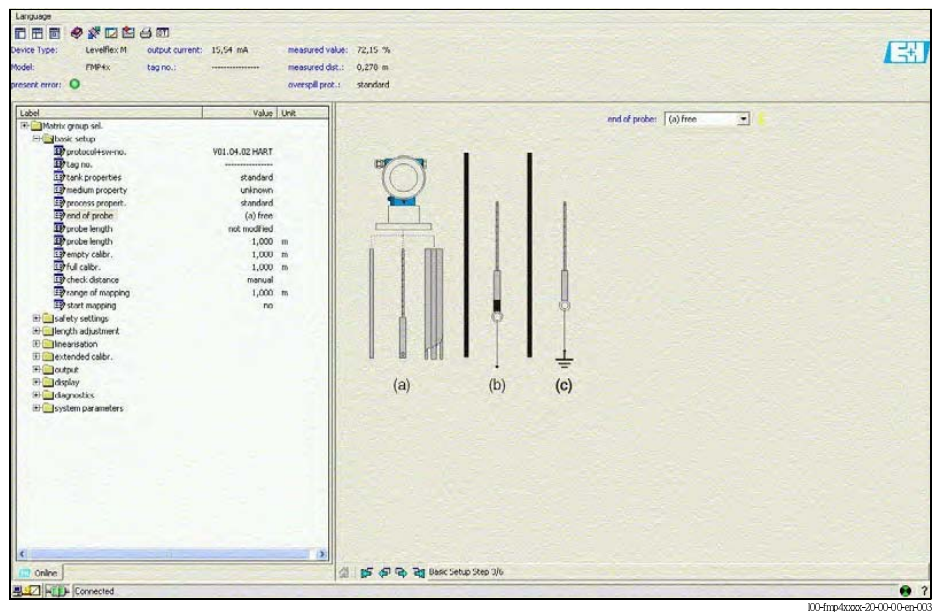
- Each parameter that is changed must be confirmed with the **RETURN** key!
- The "**Next**" button takes you to the next screen:

Basic setup step 2/6:

- Enter the application parameters (see chapter basic setup with "VU331"):
 - Tank properties
 - Medium properties
 - Process properties

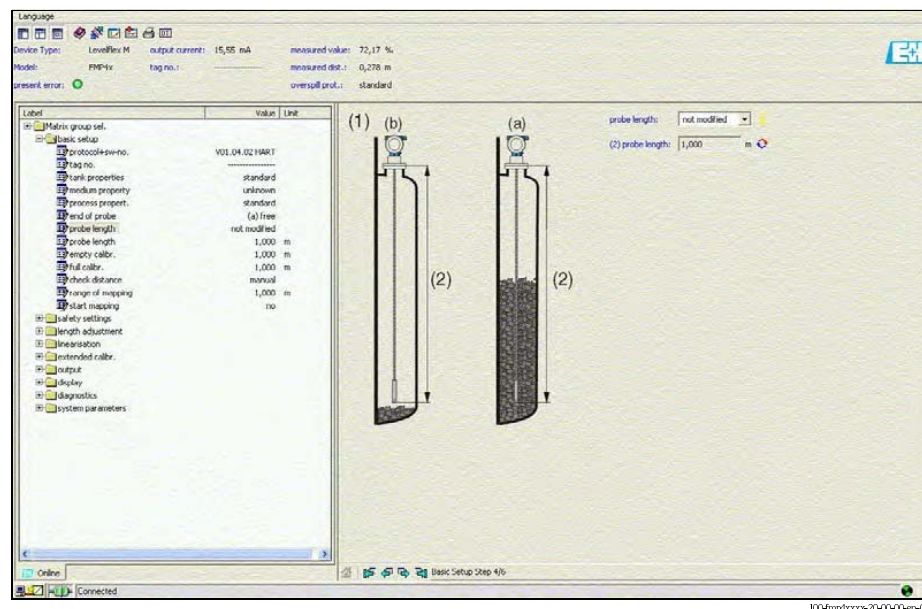
**Basic setup step 3/6:**

- Enter the application parameters (see chapter basic setup with "VU331"):
 - End of probe



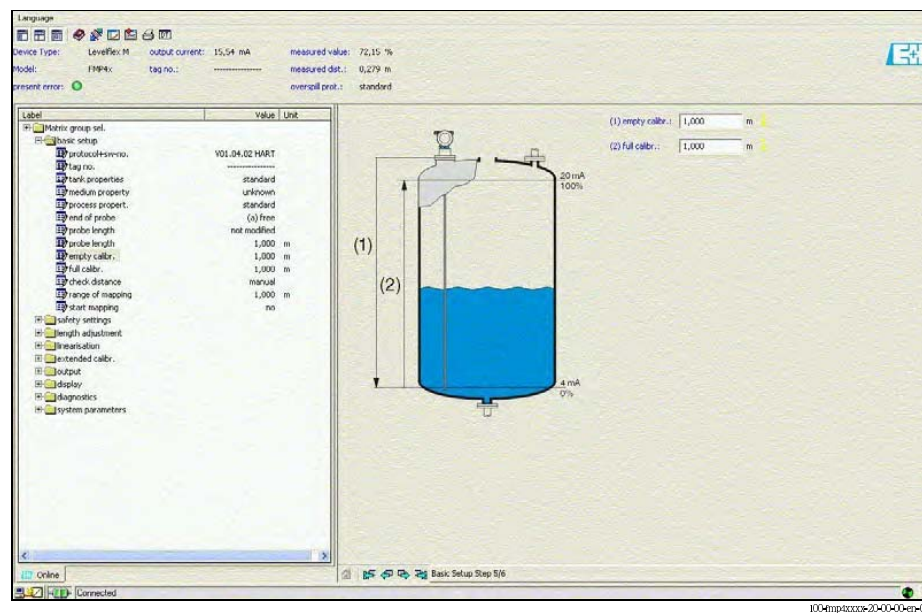
Basic setup step 4/6:

- Enter the application parameters (see chapter basic setup with "VU331"):
- Probe length
- Probe
- Probe length
- Determine length



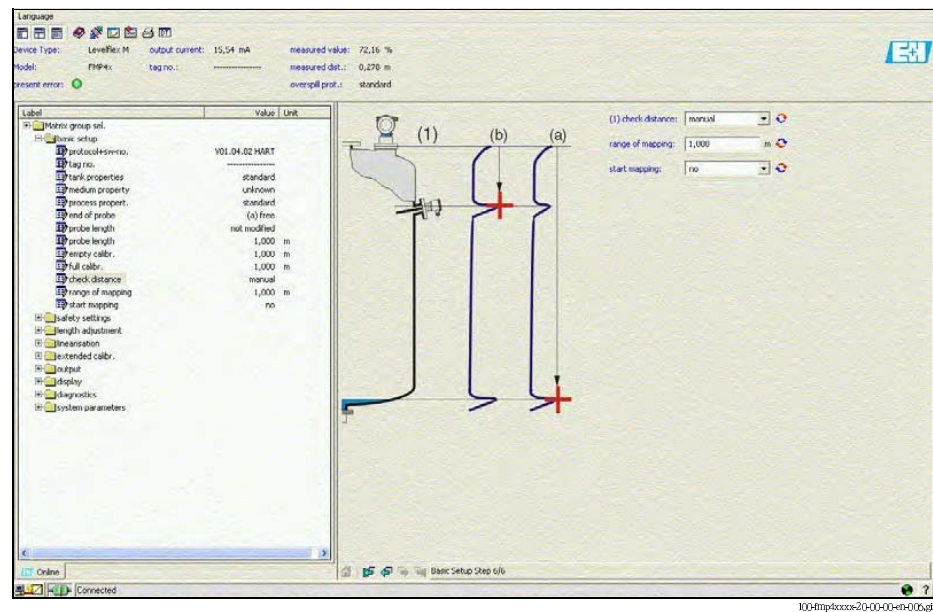
Basic setup step 5/6:

- Enter the application parameters (see chapter basic setup with "VU331"):
- Empty calibration
- Full calibration

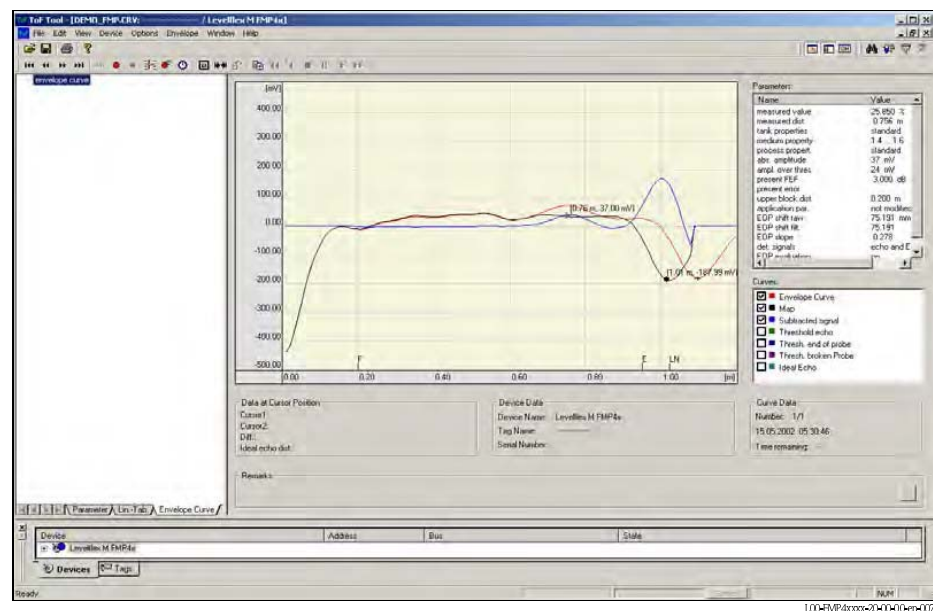


Basic setup step 6/6:

- Interference echo suppression takes place in this step
- The measured distance and the current measured value are always displayed in the header

**6.8.1 Signal analysis via envelope curve**

After the basic setup, it is recommended to evaluate the measurement with the aid of the envelope curve.

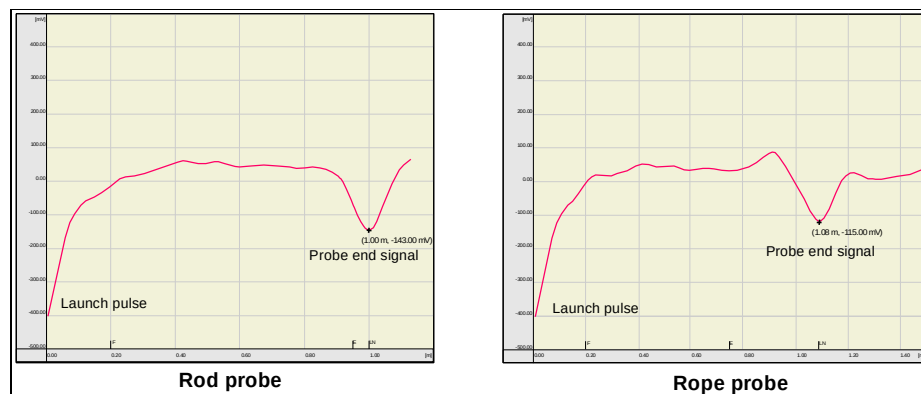
**Note!**

In the event of severe interference echoes, installing the Levellflex at another point can optimize the measurement routine.

Evaluating the measurement with the aid of the envelope curve

Typical curve shapes:

The following examples display typical curve shapes for a rope or rod probe in an empty tank. For all probe types, a negative probe end signal is shown. For rope probes, the end weight causes an additional preliminary positive echo (see rope probe diagram).

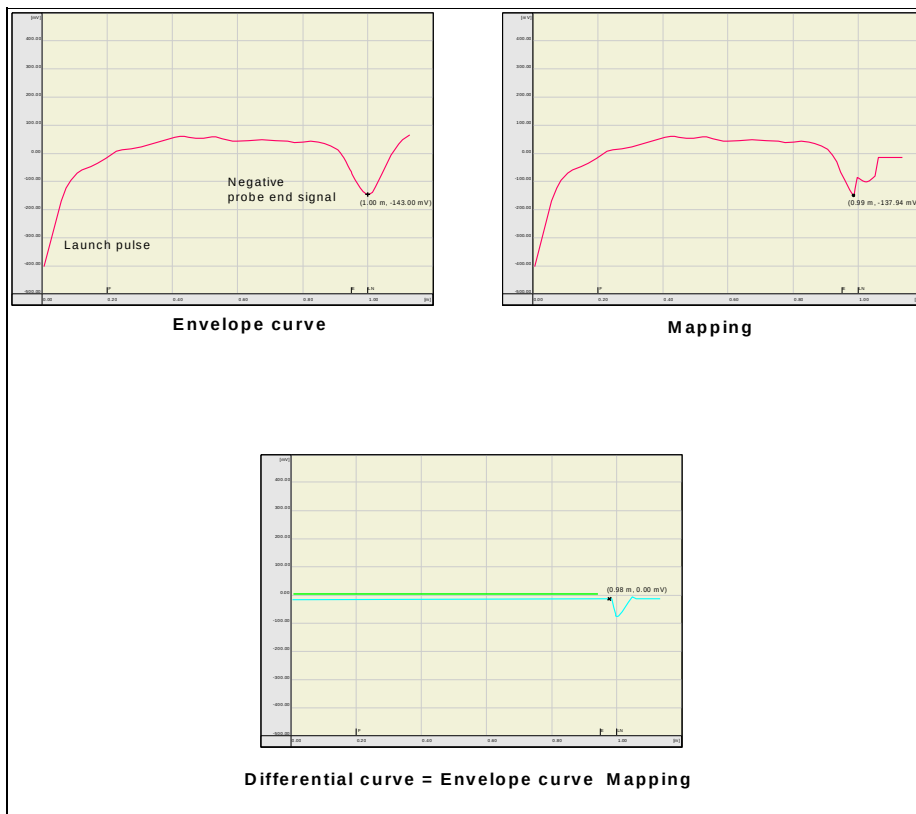


100-BMP40xxx-05-00-00-en-024

Level echoes are indicated as positive signals in the envelope curve. Interference echoes can be both positive (e.g. reflections from internals) and negative (e.g. nozzles). The envelope curve, the map and the differential curve are used for the evaluation. Level echoes are searched for in the differential curve.

Evaluating the measurement:

- The map must correspond to the course of the envelope curve (for rod probes up to approx. 5 cm and for rope probes up to approx. 25 cm before the end of the probe) when the tank is empty.
- Amplitudes in the differential curve should be at a level of 0 mV when the tank is empty and lie within the span that is specified by the probe-specific blocking distances. In order to not detect any interference echoes, there must be no signals that exceed the echo threshold when the tank is empty.
- For partially-filled tanks, the map may only differ from the envelope curve at the position of the level echo. The level signal is then detected unequivocally as a positive signal in the differential curve. For detecting the level echo, the amplitude must lie above the echo threshold.



1.00-FMP40.000-05-00-00-00-00-00

6.8.2 User-specific applications (operation)

For details of setting the parameters of user-specific applications, see separate documentation BA00245F/00/EN "Description of Instrument Functions" on the enclosed CD-ROM.

7 Maintenance

The Levellflex M measuring device requires no special maintenance.

7.1 Exterior cleaning

When cleaning the Levellflex M, always use cleaning agents that do not attack the surface of the housing and the seals.

7.2 Repairs

The Endress+Hauser repair concept assumes that the measuring devices have a modular design and that customers are able to undertake repairs themselves ("Spare Parts", →  86). Please contact Endress+Hauser Service for further information on service and spare parts.

7.3 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, please note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

7.4 Replacement

After a complete Levellflex M or electronic module has been replaced, the parameters can be downloaded into the device again via the communication interface. Prerequisite to this is that the data were uploaded to the PC beforehand using the FieldCare. Measurement can continue without having to carry out a new setup.

- You may have to activate linearisation (see BA00245F/00/EN on the enclosed CD-ROM.)
- You may need to record the tank map again (see Basic Setup)

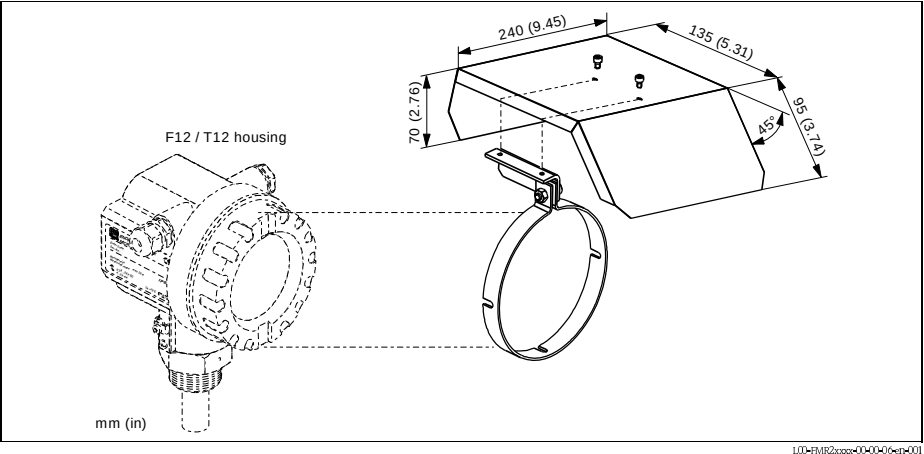
After an probe or electronic has been replaced, a new calibration must be carried out. This is described in the repair instructions.

8 Accessories

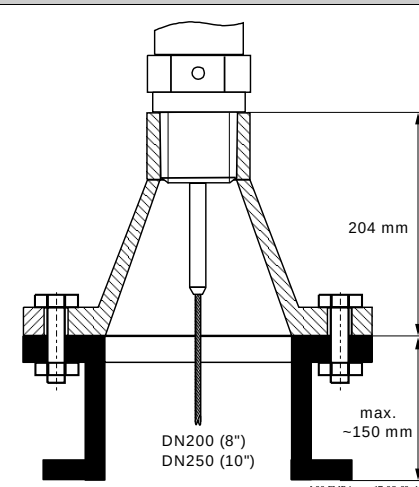
Various accessories, which can be ordered separately from Endress+Hauser, are available for the Levelflex M.

8.1 Weather protection cover

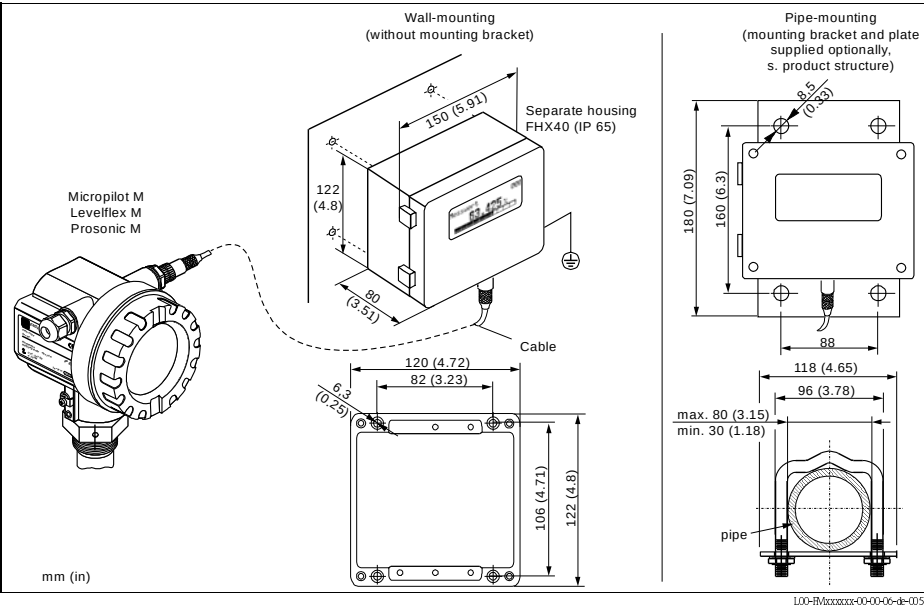
A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



8.2 Flange with horn adapter to adapt on the following nozzles

Horn adapter	Order-No.	
G1-1/2" at DN200 / PN16	52014251	
G1-1/2" at DN250 / PN16	52014252	
NPT1-1/2" at 8" / 150 psi	52014253	
NPT1-1/2" at 10" / 150 psi	52014254	
Material: 316L (1.4435)		

8.3 Remote display and operation FHX40



Technical data (cable and housing) and product structure:

Max. cable length	20 m (65 ft)
Temperature range	-30 °C to +70 °C (-22 °F to +158 °F)
Degree of protection	IP65/67 (housing); IP68 (cable) acc. to IEC 60529
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm (in)]	122x150x80 (4.8x5.91x3.15) / HxWxD

010	Approval:
	A Non-hazardous area
	2 ATEX II 2G Ex ia IIC T6
	3 ATEX II 2D Ex ia IIIC T80°C
	G IECEx Zone1 Ex ia IIC T6/T5
	S FM IS Cl. I Div.1 Gr. A-D, zone 0
	U CSA IS Cl. I Div.1 Gr. A-D, zone 0
	N CSA General Purpose
	K TIS Ex ia IIC T6
	C NEPSI Ex ia IIC T6/T5
	Y Special version, TSP-Nr. to be spec.
020	Cable:
	1 20m / 65ft: for HART
	5 20m / 65ft: for PROFIBUS PA/FOUNDATION Fieldbus
	9 Special version, TSP-Nr. to be spec.
030	Additional option:
	A Basic version
	B Mounting bracket, pipe 1" / 2"
	Y Special version, TSP-Nr. to be spec.
FHX40 -	Complete product designation

For connection of the remote display FHX40 use the cable which fits the communication version of the respective device.

8.4 Centering disks

If the probes with rod version are used in stilling well or bypass, it must be ensured that the probe does not come into contact with the wall. The centering disk fixes the rod probe in the middle of the pipe.

8.4.1 Centering disk PEEK Ø 1.89 – 3.74 inch

The centering disk is suitable for probes with a rod diameter of Ø 0.63in and can be used in pipes from DN40 (1½") up to DN100 (4"). Markings on the 4-leg centering disk ensure a simple tailoring. Hence the centering disk can be adapted to the pipe diameter.

See also Operating Instruction BA00377F/00/EN.

- PEEK (statically dissipative)
- Measuring range: -60 °C to +250 °C

Order-no. 71069064

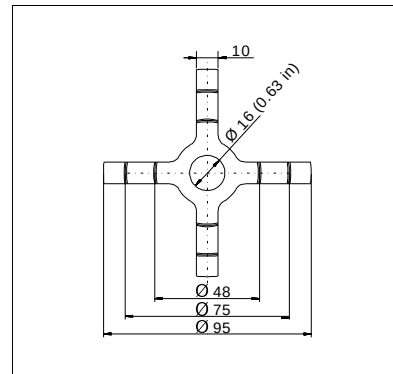
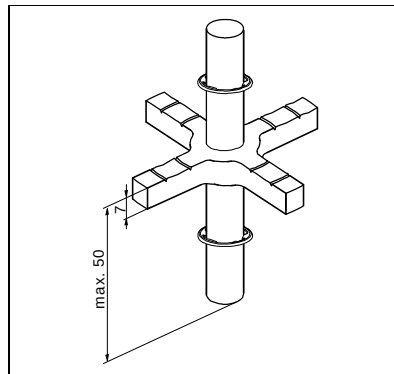


Note!

If the centering disk is inserted in an bypass, it must be positioned below the lower bypass outlet. The has to be accounted for when choosing the probe length.

Generally, the centering disk should not be mounted higher than 50 mm from the probe end.

It is recommended not to insert the PEEK centering disk in the measuring range of the rod probe.



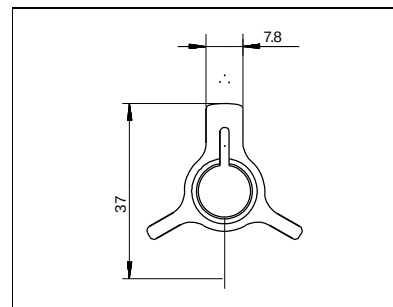
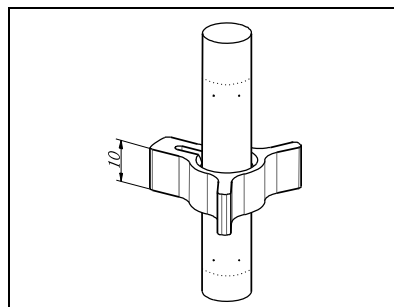
8.4.2 Centering disk PFA Ø 1.46 inch

The centering disk is suitable for probes with a rod diameter of 0.63 inch (also coated rod probes) and can be used in pipes from DN40 (1½") upto DN50 (2").

See also Operating Instruction BA00378F/00/EN.

- Measuring range: -200 °C to +150 °C

Order-no. 71069065



8.5 Commubox FXA195 HART

For intrinsically safe communication with FieldCare via the USB interface.
For details refer to TI00404F/00/EN.

8.6 Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field devices with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI00405C/07/EN.



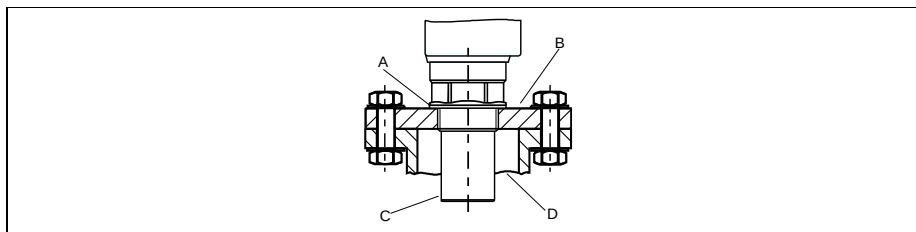
Note!

For the device you need the "ToF Adapter FXA291" as an additional accessory.

8.7 ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the device. For details refer to KA00271F/00/A2.

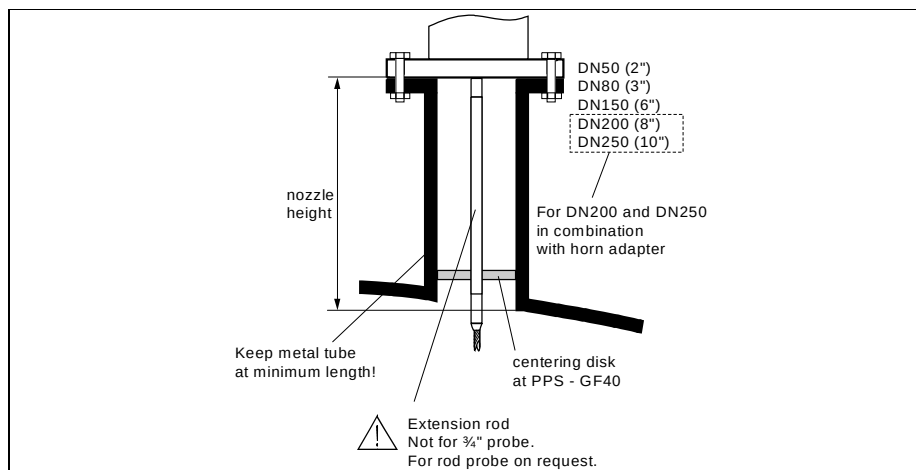
8.8 Screw in flange FAX50



100-FM150ccc-00-00-00-001

015	Diameter; Material	
	BR1	DN50 PN10/16 A, Steel, Flange EN1092-1
	BS1	DN80 PN10/16 A, Steel, Flange EN1092-1
	BT1	DN100 PN10/16 A, Stahl, Flansch EN1092-1
	JF1	2" 150lbs FF, Steel, Flange ANSI B16.5
	JG1	3" 150lbs FF, Steel, Flange ANSI B16.5
	JH1	4" 150lbs FF, Steel, Flange ANSI B16.5
	JK2	8" 150lbs FF, PP, max. 3bar abs / 44psia, Flange ANSI B16.5
	XIF	UNI Flange 2"/DN50/50, PVDF, max. 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XIG	UNI Flange 2"/DN50/50, PP, max. 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XIJ	UNI Flange 2"/DN50/50, 316L, max. 3bar abs/44psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XJF	UNI Flange 3"/DN80/80, PVDF, max. 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XIG	UNI Flange 3"/DN80/80, PP, max. 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XIJ	UNI Flange 3"/DN80/80, 316L, max. 3bar abs/44psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	KKF	UNI Flange 4"/DN100/100, PVDF, max. 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XKG	UNI Flange 4"/DN100/100, PP, max. 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XKJ	UNI Flange 4"/DN100/100, 316L, max. 3bar abs/44psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XLF	UNI Flange 6"/DN150/150, PVDF, max. 3bar abs/44psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XLG	UNI Flange 6"/DN150/150, PP, max. 3bar abs/44psia, suitable for 6"/DN150 PN16/10K 150
	XLJ	UNI Flange 6"/DN150/150, 316L, max. 3bar abs/44psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XMG	UNI Flange DN200/200, PP, max. 3bar abs/44psia, suitable for DN200 PN16/10K 200
	XNG	UNI Flange DN250/250, PP, max. 3bar abs/44psia, suitable for DN250 PN16/10K 250
	YYY	Special version, TSP-No. to be spec.
020	Sensor connection	
	A	Thread ISO228 G3/4
	B	Thread ISO228 G1
	C	Thread ISO228 G1-1/2
	D	Thread ISO228 G2
	E	Thread ANSI NPT3/4
	F	Thread ANSI NPT1
	G	Thread ANSI NPT1-1/2
	H	Thread ANSI NPT2
	Y	Special version, TSP-No. to be spec.
FAX50		Complete product designation

8.9 Extension rod / Centering



010	Approval	
	A	Non-hazardous area
	M	FM DIP CL.II Div.1 Gr. E-G N.I., zone 21, 22
	P	CSA DIP CL.II Div.1 Gr. G + Coal dust, N.I.
	S	FM CL.I, II, III Div.1 Gr. A-G, N.I., zone 0, 1, 2, 20, 21, 22
	U	CSA CL.I, II, III Div.1 Gr. A-G N.I., zone 0, 1, 2
	1	ATEX II 1G
	2	ATEX II 1D
020	Extension rod; Nozzle Height	
	1	115mm; 150-250mm / 6-10"
	2	215mm; 250-350mm / 10-14"
	3	315mm; 350-450mm / 14-18"
	4	415mm; 450-550mm / 14-22"
	9	Special version, TSP-No. to be spec.
030	Center washer	
	A	Not selected
	B	DN40 / 1-1/2", inside-d.= 40-45mm, PPS
	C	DN50 / 2", inside-d.= 50-57mm, PPS
	D	DN80 / 3", inside-d.= 80-85mm, PPS
	E	DN80 / 3", inside-d.= 76-78mm, PPS
	G	DN100 / 4", inside-d.= 100-110mm, PPS
	H	DN150 / 6", inside-d.= 152-164mm, PPS
	J	DN200 / 8", inside-d.= 210-215mm, PPS
	K	DN250 / 10", inside-d.= 253-269mm, PPS
	Y	Special version, TSP-No. to be spec.
HMP40-	Complete product designation	

8.10 Isolated tie down

Mounting-kit	Order - No.
for 4mm rope probe	52014249
for 6mm rope probe	52014250

If a rope probe has to be fixed and a secure grounded mounting is not possible, we recommend using the insulating sleeve made of PEEK-GF30 with accompanying DIN 580 eye-bolt made of stainless steel.
Max. process temp. 150 °C.

Due to the risk of electrostatic charge, the insulating sleeve is not suitable for use in hazardous areas. In these cases the fixing must be reliably grounded (→ 27).

Reliable, isolated mounting

Insulating sleeve

eye-bolt
D = 20 mm at
M8 DIN580 for 4 mm rope
D = 25 mm at
M10 DIN580 for 6 mm rope

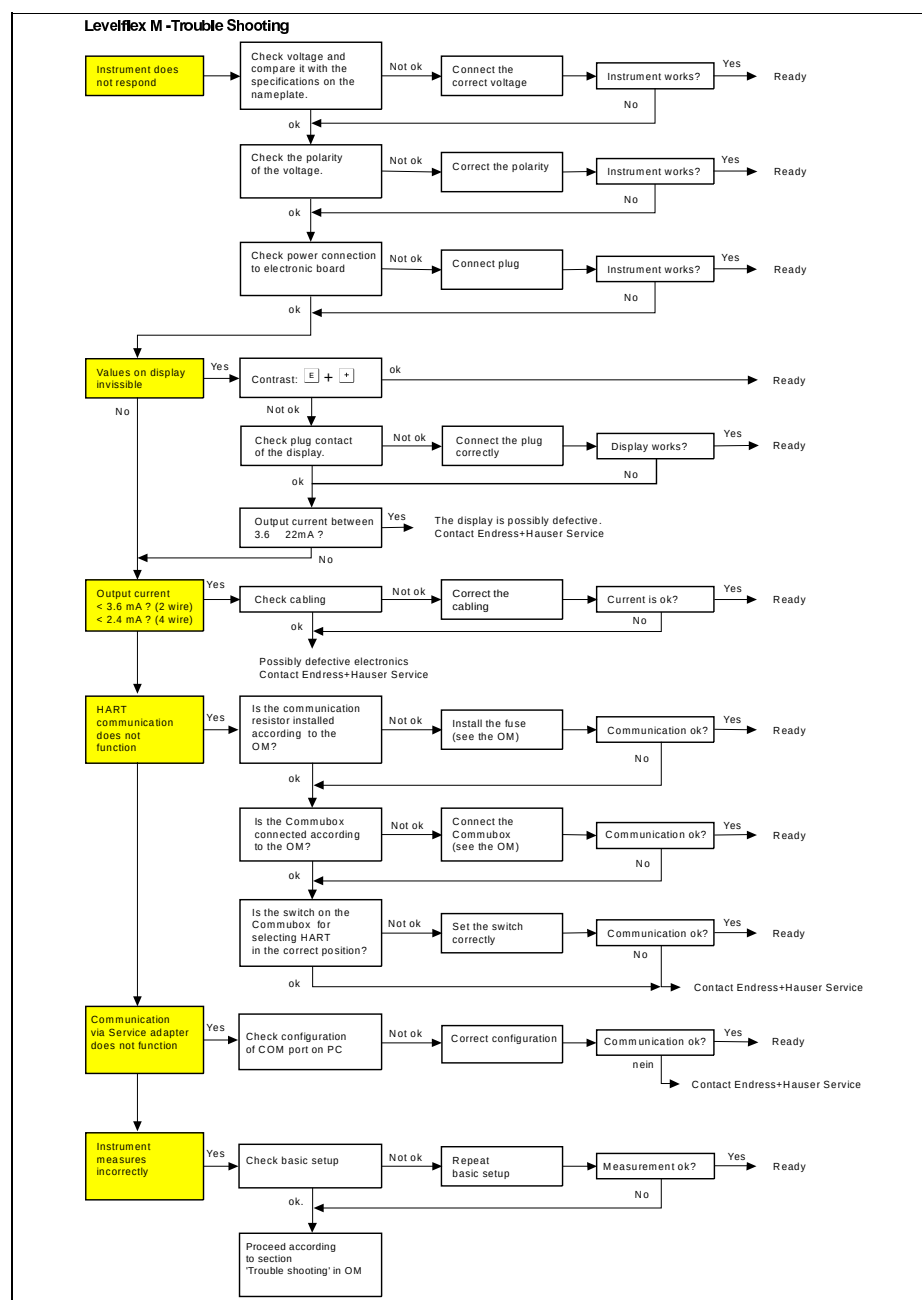
L004FMP40xxx-17-00-00-en-036

8.11 HART Loop Converter HMX50

The HART loop converter HMX50 can be acquired using the order number 71063562.
Additional documentation: TI00429F/00/EN and BA00371F/00/EN.

9 Trouble-shooting

9.1 Trouble-shooting instructions

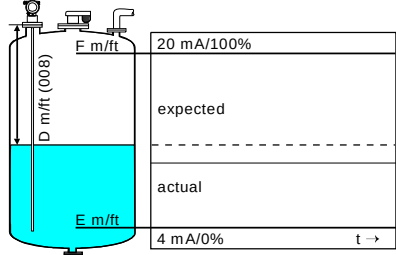
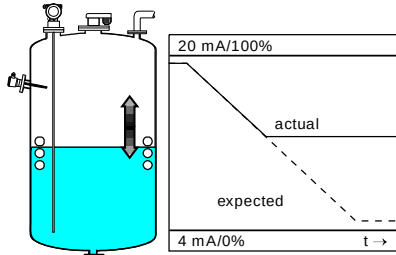


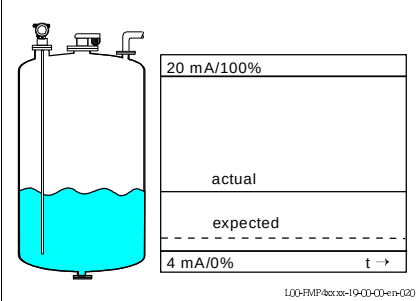
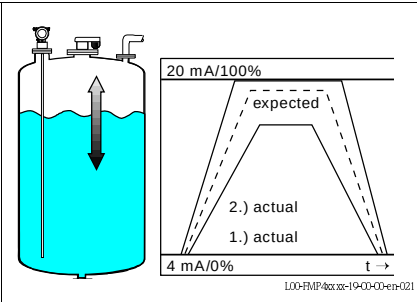
9.2 System error messages

Code	Description	Possible cause	Remedy
A102	checksum error general reset & new calibr. required	device has been powered off before data could be stored; emc problem; EEPROM defect	reset avoid emc problem; if alarm prevails after reset, exchange electronics
W103	initialising - please wait	EEPROM storage not yet finished	wait some seconds; if warning prevails, exchange electronics
A106	downloading please wait	processing data download	wait until warning disappears
A110	checksum error general reset & new calibr. required.	device has been powered off before data could be stored; emc problem; EEPROM defect	reset avoid emc problem; if alarm prevails after reset, exchange electronics
A111	electronics defect	RAM defective	reset if alarm prevails after reset, exchange electronics
A113	electronics defect	ROM defective	reset if alarm prevails after reset, exchange electronics
A114	electronics defect	EEPROM defective	reset if alarm prevails after reset, exchange electronics
A115	electronics defect	general hardware problem	Reset if alarm prevails after reset, exchange electronics
A116	download error repeat download	checksum of stored data not correct	restart download of data
A121	electronics defect	no factory calibration existant; EEPROM defective	contact service
W153	initialising - please wait	initialisation of electronics	wait some seconds; if warning prevails, power off device and power on again
A160	checksum error general reset & new calibr. required.	device has been powered off before data could be stored; emc problem; EEPROM defect	reset avoid emc problem; if alarm prevails after reset, exchange electronics
A164	electronics defect	hardware problem	reset if alarm prevails after reset, exchange electronics
A171	electronics defect	hardware problem	reset if alarm prevails after reset, exchange electronics
A221	Probe pulse deviation from average values	HF module or cable between HF module and electronics defective	Check contacts on HF module If fault cannot be eliminated: Replace HF module
A241	Broken probe	Broken probe or value for probe length is too long	Check the probe length in 033, Check the probe itself, if the probe is broken, change the probe, or change to a non contact system
		probe break monitoring enabled without mapping beforehand	disable probe break monitoring, perform mapping and then reactivate probe break monitoring

Code	Description	Possible cause	Remedy
A251	Feedthrough	Lost contact in the process feedthrough	Replace process feedthrough
A261	HF cable defective	HF cable defective or HF connector removed	Check HF connector, replace cable if defective
W275	Offset too high	Temperature at the electronics too high or HF module defective	Check temperature, replace HF module if defective
W512	recording of mapping please wait	mapping active	wait some seconds until alarm disappears
W601	linearisation ch1 curve not monotone	linearization not monotonously increasing	correct linearisation table
W611	less than 2 linearisation points for channel 1	number of entered linearization points < 2	correct linearisation table
W621	simulation ch. 1 on	simulation mode is active	switch off simulation mode
E641	no usable echo channel 1 check calibr.	echo lost due to application conditions of built up on antenna	check installation; clean probe (cf. Operating Instructions)
W650	Signal/noise ratio too low or no echo	noise on signal too high	eliminate electromagnetic interference
E651	level in safety distance - risk of overspill	level in safety distance	alarm will disappear as soon as level leaves safety distance
A671	linearisation ch1 not complete, not usable	linearisation table is in edit mode	activate linearisation table
W681	current ch1 out of range	current out of range (3.8 mA to 20.5 mA)	check calibration and linearisation

9.3 Application errors

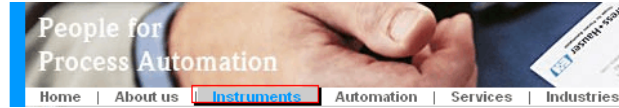
Error	Output	Possible cause	Remedial action
A warning or alarm has occurred	Depending on the configuration	See table of error messages (→ 82)	1. See table of error messages (→ 82)
Measured value (00) is incorrect	 L00-FMP40xxxx-19-00-00-en-01.9	Measured distance (008) OK? yes → no ↓	yes → 1. Check empty calibr. (005) and full calibr. (006) 2. Check linearisation: → level/ullage (040) → max. scale (046) → diameter vessel (047) → Check table
No change off measured value on filling/emptying	 L00-FMP40xxxx-19-00-00-en-01.4	Interference echo from installations, nozzle or extension on the probe	1. Carry out tank mapping → basic setup 2. If necessary, clean probe 3. If necessary, select better mounting position
E641 (loss of echo) after turn on the power supply	If the device is configured to Hold by loss of echo the output is set to any value/current.	noise level during the initialisation phase to high	Repeat once more empty calibr. (005). Caution! Before conformation change with  or  to the edit mode.

Error	Output	Possible cause	Remedial action
Device displays a level when the tank is empty.	 LQ0-FMP40cx-xx-19-00-Q0-nr-020	Incorrect probe length	1. Carry out automatic probe length detection when the tank is empty. 2. Carry out mapping over entire probe when the tank is empty (probe free!).
Measured value incorrect (slope error in the entire measuring range)	 LQ0-FMP40cx-xx-19-00-Q0-nr-021	Tank properties incorrect Medium properties incorrect	LN < 4 m and "Aluminium tank" tank properties selected → Calibration not possible. → Selection → Select standard → Thresholds too high Select lower medium properties.

9.4 Spare Parts

An overview of the spare parts for your device is available in the internet at www.endress.com. To obtain information on the spare parts, proceed as follows:

1. Go to "www.endress.com" and select your country.
2. Click "Instruments".



3. Enter the product name into the "product name" field.

Endress+Hauser product search

Via product name

Enter the product name

4. Select the device.
5. Click the "Accessories/Spare parts" tab.

General information
Technical information
Documents/Software
Service
Accessories/
Spare parts

► Accessories

▼ All Spare parts

- Housing/housing accessories
- Sealing
- Cover
- Terminal module
- HF module
- Electronic
- Power supply
- Antenna module

Advice

Here you'll find a list of all available accessories and spare parts. To only view accessories and spare parts specific to your product(s), please contact us and ask about our Life Cycle Management Service.

◀ | 1 / 2 | ▶ | 🔍

6. Select the required spare parts (You may also use the overview drawing on the right side of the screen.)

When ordering spare parts, always quote the serial number indicated on the nameplate. As far as necessary, the spare parts also include replacement instructions.

9.5 Return

The following procedures must be carried out before a transmitter is sent to Endress+Hauser e.g. for repair or calibration:

- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
- Always enclose a duly completed "Declaration of contamination" form (a copy of the "Declaration of contamination" is included at the end of this operating manual).
Only then can Endress +Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.

Additionally specify:

- An exact description of the application
- The chemical and physical characteristics of the product
- A short description of the error that occurred (specify error code if possible)
- If necessary, give the error code

9.6 Disposal

In case of disposal please separate the different components according to their material consistence.

9.7 Software history

Date	Software version	Software modifications	Dokumentation	Description of Instrument Functions
04.2004	01.02.00	Original software. Operated via: – ToF Tool – Commuwin II (ab Version 2.05.03) – HART-Communicator DXR375 mit Rev.1 , DD1.	BA242F/00/en/03.02 52011930 BA242F/00/en/06.02 52011930 BA242F/00/en/01.03 52011930 BA242F/00/en/02.03 52011930 BA242F/00/en/02.04 52011930	BA245F/00/en/03.02 52011936 BA245F/00/en/06.02 52011936 BA245F/00/en/02.03 52011936 BA245F/00/en/02.04 52011936
08.2003	01.02.02	■ Function group: envelope curve display ■ Katakana (japanese) ■ current turn down (HART only) ■ the customer tank map can be edited Operated via: – ToF Tool – Commuwin II (ab Version 2.08-1 Update C) – HART-Communicator DXR375 mit Rev.1 , DD1.	—	—
07.2004	01.02.04	■ "mapping" function improved ■ Specification of the measuring accuracy at the end of probe	BA242F/00/en/06.04 52011930 BA242F/00/en/01.06 52011930	BA245F/00/en/06.04 52011936 BA245F/00/en/01.06 52011936
01.2005	01.02.06	Function "echo lost" improved	—	—
03.2006	01.04.00	■ Function "detection window" ■ Description of Instrument Functions ■ Operating menu extended	BA242F/00/en/05.06 52011930 BA242F/00/en/11.06 52011930 BA242F/00/en/03.09 71074787 BA00242F/00/EN/13.10 71120266	BA245F/00/en/06.06 52011936

9.8 Contact addresses of Endress+Hauser

Contact addresses can be found on our homepage: www.endress.com/worldwide. If you have any questions, please do not hesitate to contact your Endress+Hauser representative.

10 Technical data

10.1 Additional technical data

10.1.1 Input

Measured variable	The measured variable is the distance between a reference point (see Fig., → 14) and the product surface. Subject to the input empty distance "E" (see Fig., → 51)the level is calculated. Alternatively, the level can be converted by means of linearisation (32 points) into other variables (volume, mass).
-------------------	--

10.1.2 Output

Output signal	4 to 20 mA (invertible) with HART protocol.
---------------	---

Signal on alarm	Error information can be accessed via the following interfaces: ■ Local display: – Error symbol (→ 43) – Plain text display ■ Current output, signal on error can be selected (e.g. according to NAMUR recommendation NE43) ■ Digital interface
-----------------	--

Linearization	The linearization function of the Levelflex M allows the conversion of the measured value into any unit of length or volume and mass or %. Linearization tables for calculating the volume in cylindrical tanks are preprogrammed. Other tables of up to 32 value pairs can be entered manually or semi-automatically. The creation of a linearization table with FieldCare is particularly convenient.
---------------	---

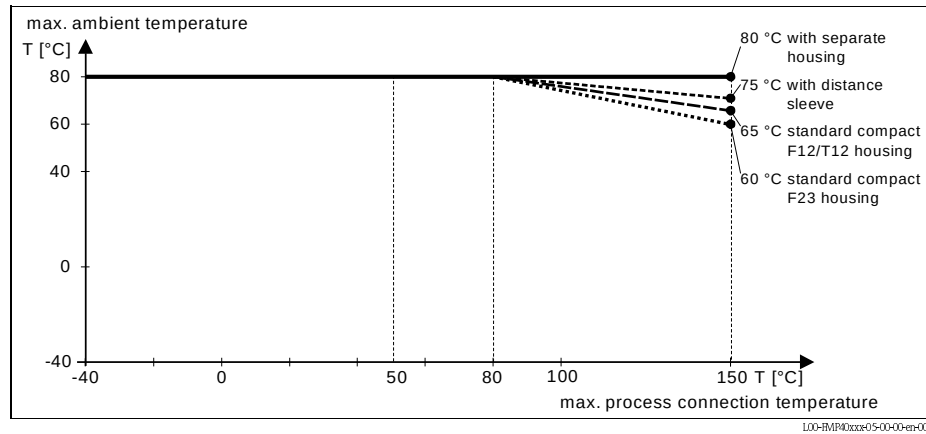
10.1.3 Performance characteristics

Reference operating conditions	■ Temperature = +20 °C ±5 °C ■ Pressure = 1013 mbar abs. ±20 mbar ■ Humidity = 65 % ±20 % ■ Reflection factor ≥ 0.8 (surface of the water for coax probe, metal plate for rod and rope probe with min. 1 m Ø) ■ Flange for rod or rope probe ≥ 30 cm Ø ■ Distance to obstructions ≥ 1 m
Maximum measured error	Is in Function group "basic setup" (00), →  53.
Resolution	■ Digital: 1 mm ■ Analog: 0.03 % of the measuring range
Reaction time	The reaction time is dependent on the configuration. Shortest time: ■ 2-wire electronics: 1 s ■ 4-wire electronics: 0.7 s
Influence of ambiente temperature	The measurements are carried out in accordance with EN 61298-3: ■ digital output: – average T_K: 0.6 mm/10 K, max. ±3.5 mm over the entire temperature range -40 °C to +80 °C 2-wire: ■ Current output (additional error, in reference to the span of 16 mA): ■ Zero point (4 mA) - average T_K: 0.032 %/10 K, max. 0.35 % over the entire temperature range -40 °C to +80 °C ■ Span (20 mA) - average T_K: 0.05 %/10 K, max. 0.5 % over the entire temperature range -40 °C to +80 °C 4-wire: ■ Current output (additional error, in reference to the span of 16 mA): ■ Zero point (4 mA) - average T_K: 0.02 %/10 K, max. 0.29 % over the entire temperature range -40 °C to +80 °C ■ Span (20 mA) - average T_K: 0.06 %/10 K, max. 0.89 % over the entire temperature range -40 °C to +80 °C

10.1.4 Operating conditions: Environment

Ambient temperature range Ambient temperature for the transmitter: -40 °C to +80 °C. The functionality of the LCD display may be limited for temperatures $T_a < -20$ °C and $T_a > +60$ °C. A weather protection cover should be used for outdoor operation if the device is exposed to direct sunlight.

Ambient temperature limits If temperatures above 80 °C are present at the process connection, the permitted ambient temperature is reduced according to the following diagram (temperature derating):



Storage temperature -40 °C to +80 °C

Climate class DIN EN 60068-2-38 (test Z/AD)

Vibration resistance DIN EN 60068-2-64 / IEC 68-2-64: 20 to 2000 Hz, 1 (m/s²)/Hz

Cleaning the probe Depending on the application, contamination or build-up can accumulate on the probe. A thin, even layer only influences measurements slightly. Thick layers can dampen the signal and then reduce the measuring range. Severe, uneven build-up, adhesion e.g. through crystallization, can lead to incorrect measurement. In this case, we recommend that you use a non-contact measuring principle, or check the probe regularly for soiling.

Electromagnetic compatibility (EMC) Electromagnetic compatibility to EN 61326 and NAMUR Recommendation EMC (NE21). Details are provided in the Declaration of Conformity. A standard installation cable is sufficient if only the analog signal is used. Use a shielded cable when working with a superimposed communications signal (HART).

When installing the probes in metal and concrete tanks and when using a coax probe:

- Interference emission to EN 61326 - x series, electrical equipment Class B.
- Interference immunity to EN 61326 - x series, requirements for industrial areas and NAMUR Recommendation NE21 (EMC).

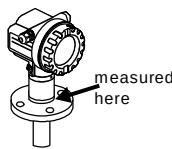
The measured value can be affected by strong electromagnetic fields when installing rod and rope probes without a shielding/metallic wall, e.g. plastic, and in wooden silos.

- Interference emission to EN 61326 - x series, electrical equipment Class A.
- Interference Immunity: the measured value can be affected by strong electromagnetic fields.

10.1.5 Operating conditions: Process

Process temperature range

The maximum permitted temperature at the process connection (see Fig. for measuring point) is determined by the O-ring version ordered:

O-ring-material	min. Temperature	max. Temperature ¹⁾	
FKM (Viton)	-30 °C (-22 °F)	+150 °C (302 °F)	
EPDM	-40 °C (-40 °F)	+120 °C (248 °F)	
FFKM (Kalrez)	-5 °C (23 °F) ²⁾	+150 °C (302 °F)	

1) For PA coated probes, the maximal admissible temperature is 100 °C (212 °F).

2) The min. temperature of FFKM may be -15 °C (5 °F) if the max. temperature of +80 °C (176 °F) is not exceeded.



Note!

- The medium temperature can be higher.
However, when using rope probes the stability of the probe rope is reduced by structural changes at temperatures over 350 °C.
- The bare metallic probes are only insulated in the area of the bushing. Thus there is no danger of electrostatic charging. The PA-coated rope has been tested and there is no dangerous electrostatic charging. As a result, there are no restrictions on use in Ex-areas for any of the probes.

Process pressure limits

All models: -1 to 40 bar.

The specified range may be reduced by the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C, for ASME flanges 100 °F.

Observe pressure-temperature dependency.

Please refer to the following standards for the pressure values permitted for higher temperatures:

- EN 1092-1: 2001 Tab.18
With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5a - 1998 Tab. 2-2.2 F316
- ASME B 16.5a - 1998 Tab. 2.3.8 N10276
- JIS B 2220



Note!

All Levelflex probes have two levels of sealing. There is an O-ring seal and a moulded seal behind that.

Dielectric constant

- with coax probe: $\epsilon_r \geq 1,4$
- Rod and rope probe: $\epsilon_r \geq 1,6$

Extension of the rope probes through tension and temperature

4 mm rope:

- Elongation through tension: at max. permitted tensile load (12 kN): 11 mm / m rope length
- Elongation through temperature increase from 30 °C to 150 °C: 2 mm / m rope length

6 mm rope:

- Elongation through tension: at max. permitted tensile load (30 kN): 13 mm / m rope length
- Elongation through temperature increase from 30 °C to 150 °C: 2 mm / m rope length

10.1.6 Mechanical construction

Material Refer to TI00358F/00/EN, chapter "Material (not in contact with process)" and "Material (in contact with process)".

Tolerance of probe length

	Rod probes				Rope probes			
über (m (ft))		1 (3.2)	3 (9.8)	6 (20)		1 (3.2)	3 (9.8)	6 (20)
bis (m (ft))	1 (3.2)	3 (9.8)	6 (20)		1 (3.2)	3 (9.8)	6 (20)	
admissible tolerance (mm (in))	-5 (-0.2)	-10 (-0.4)	-20 (-0.8)	-30 (-1.2)	-10 (-0.4)	-20 (-0.8)	-30 (-1.2)	-40 (-1.6)

Weight

Levellflex M	FMP40 + rope probe 4 mm	FMP40 + rod or rope probe 6 mm	FMP40 + rod probe 16 mm	FMP40 coax probe
Weight for F12 or T12 housing	Approx. 4 kg + Approx. 0.1 kg/m probe length + weight of flange	Approx. 4 kg + Approx. 0.2 kg/m probe length + weight of flange	Approx. 4 kg + Approx. 1.6 kg/m probe length + weight of flange	Approx. 4 kg + Approx. 3.5 kg/m probe length + weight of flange
Weight for F23 housing	Approx. 7.4 kg + Approx. 0.1 kg/m probe length + weight of flange	Approx. 7.4 kg + Approx. 0.2 kg/m probe length + weight of flange	Approx. 7.4 kg + Approx. 1.6 kg/m probe length + weight of flange	Approx. 7.4 kg + Approx. 3.5 kg/m probe length + weight of flange

Process connection See "Product structure", → 6.

Seal See "Product structure", → 6.

Probe See "Product structure", → 6.

10.1.7 Certificates and approvals

CE mark	The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
Overfill protection	WHG. See "Product structure", →  6 (see ZE00256F/00/DE). SIL 2, for 4 to 20 mA output (see SD00174F/00/EN "Functional safety manual").
Telecommunications	Complies with "Part 15" of the FCC rules for an "Unintentional Radiator". All probes meet the requirements for a "Class A Digital Device". Coax probes and probes mounted in closed metallic vessels also meet the requirement for a "Class B Digital Device".
External standards and guidelines	The European directives and standards applied can be taken from the associated EC Declarations of Conformity. In addition, the following also applied for Levellflex M: EN 60529 Protection class of housing (IP-code) NAMUR - international user association of automation technology in process industries. ■ NE21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment. ■ NE43 Standardization of the signal level for the failure information of digital transmitters.

- Correlation of the certificates (XA, ZD, ZE) to the device:

1) Housing F12/F23/T12-OVP: In combination with electronics B, D or F supply intrinsically safe.
** In preparation*

10.1.8 Additional documentation

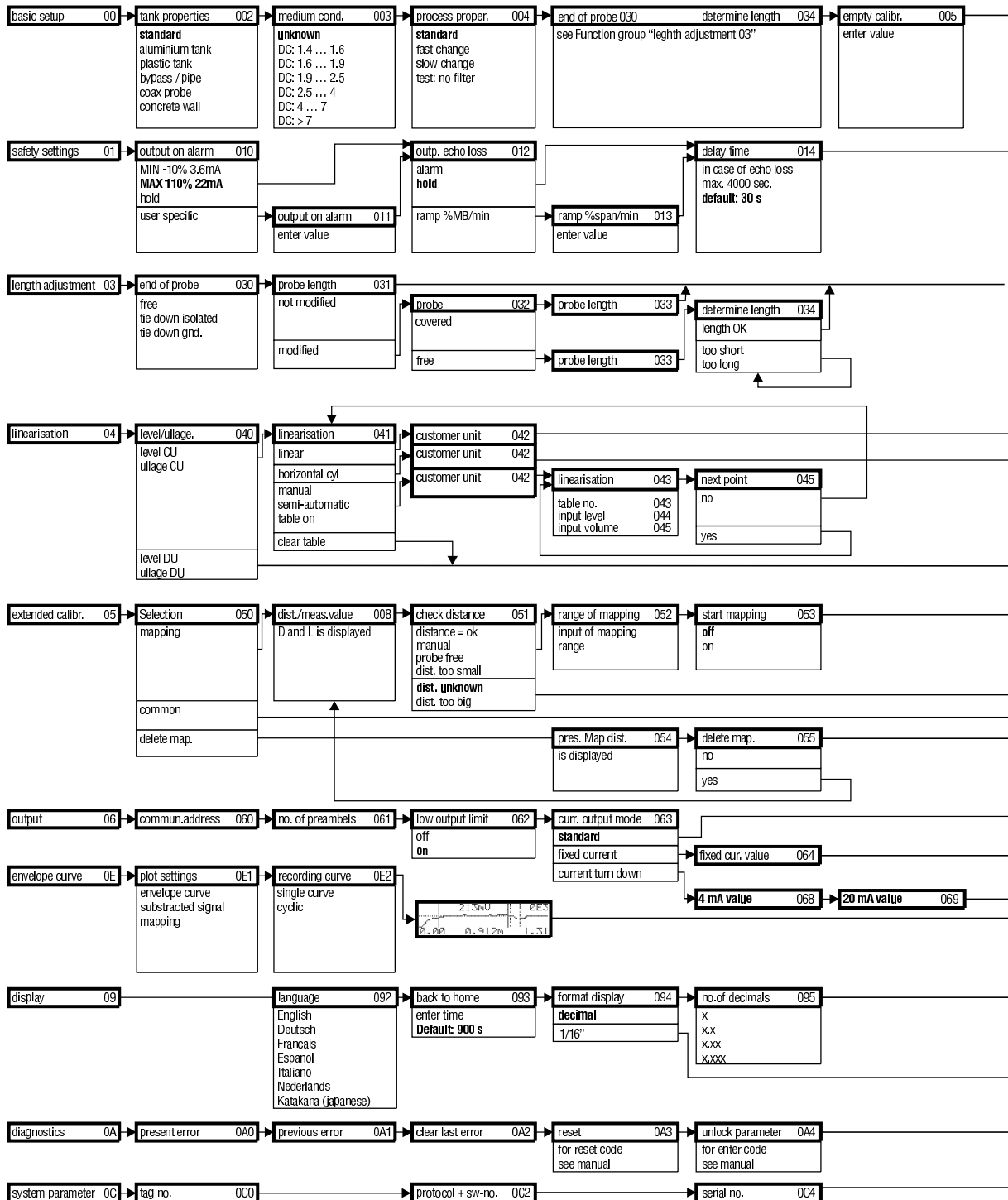
Additional documentation

This additional documentation can be found on our product pages on www.endress.com

- Technical Information (TI00358F/00/EN)
- Safety Manual "Functional safety manual" (SD00174F/00/EN)
- Certificate "Allgemeine bauaufsichtliche Zulassung" (ZE00256F/00/DE)
- Brief operating instructions (KA01038F/00/EN)

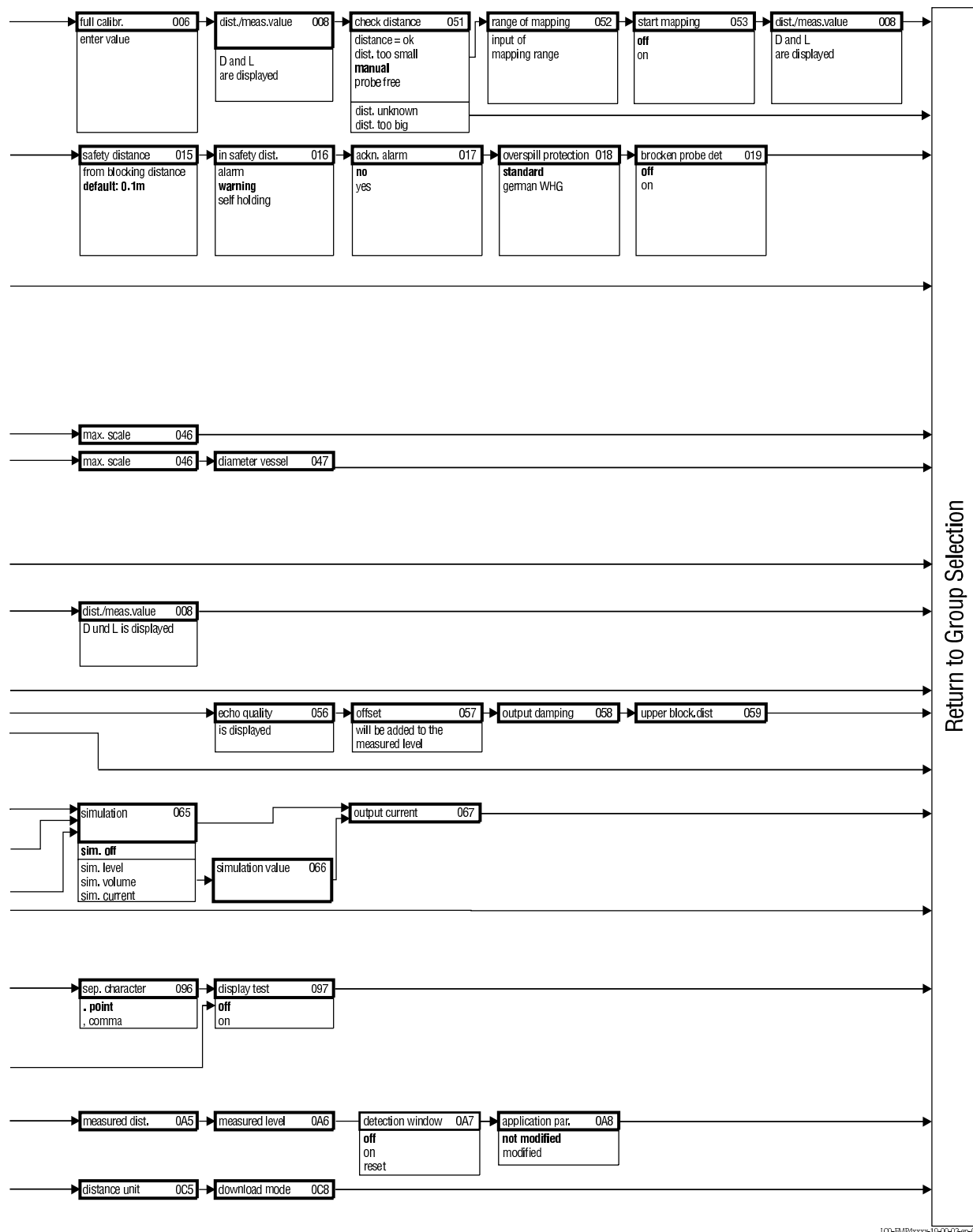
11 Appendix

11.1 Operating menu HART (Display modul)



Note! The default values of the parameters are typed in boldface.

L00-FMP40xxx-10-00-01-en-002



100-FMP40xxx-19-00-02-en-02

11.2 Patents

This product may be protected by at least one of the following patents.
Further patents are pending.

- US 5,661,251 $\cong$ EP 0 780 664
- US 5,827,985 $\cong$ EP 0 780 664
- US 5,884,231 $\cong$ EP 0 780 665
- US 5,973,637 $\cong$ EP 0 928 974

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Level



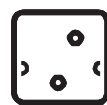
Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



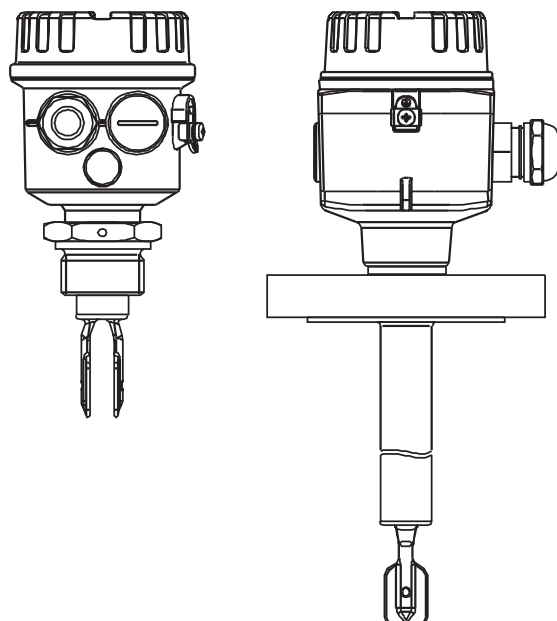
Services



Solutions

Operating Instructions

Liquiphant M FTL50, FTL51



de - Grenzschalter

en - Point Level Switch

fr - Détecteur de niveau

es - Detector de nivel

it - Interruttore di livello

nl - Niveauschakelaar

KA143F/00/a6/07.10
71118926

Endress+Hauser 
People for Process Automation

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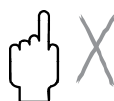
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Achtung!

= verboten;
führt zu fehlerhaftem Betrieb
oder Zerstörung.



Caution!

= forbidden;
leads to incorrect operation
or destruction.



Attention!

= interdit; peut provoquer
des dysfonctionnements
ou la destruction.

es - Indice

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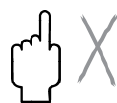
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**Atención!**

= Prohibido; peligro
de mal funcionamiento
o de destrucción.

**Attenzione!**

= Vietato; pericolo
di malfunzionamento
o di distruzione.

**Opgelet!**

= verboden;
leidt tot foutieve werking
of storing.

de - Sicherheitshinweise

Der Liquiphant M FTL50, FTL51 darf nur als Grenzscharter für Flüssigkeiten verwendet werden.

Bei unsachgemäßem Einsatz können Gefahren von ihm ausgehen.

Das Gerät darf **nur von**

qualifiziertem und autorisiertem Fachpersonal

unter strenger Beachtung dieser Betriebsanleitung, der einschlägigen Normen, der gesetzlichen Vorschriften und der Zertifikate (je nach Anwendung) eingebaut, angeschlossen, in Betrieb genommen und gewartet werden.

In der Gebäudeinstallation ist ein Netzschalter für das Gerät leicht erreichbar in dessen Nähe zu installieren.

Er ist als Trennvorrichtung für das Gerät zu kennzeichnen.

en - Notes on Safety

The Liquiphant M FTL50, FTL51 is designed for point level detection in liquids.

If used incorrectly it is possible that application-related dangers may arise.

The level limit switch

Liquiphant M FTL50, FTL51 may be installed, connected, commissioned, operated and maintained **by qualified and authorised personnel only**, under strict observance of these operating instructions, any relevant standards, legal requirements, and, where appropriate, the certificate. Install an easily accessible power switch in the proximity of the device.

Mark the power switch as a disconnecter for the device.

fr - Conseils de sécurité

Le Liquiphant M FTL50, FTL51 doit être exclusivement utilisé comme détecteur de niveau pour liquides.

Il peut être source de danger en cas d'utilisation non conforme aux prescriptions.

L'appareil ne doit être installé, raccordé, mise en service et entretenu **que par un personnel qualifié et autorisé**, qui tiendra compte des indications contenues dans la présente mise en service, des normes en vigueur et des certificats disponibles (selon l'application).

Installer un commutateur réseau à proximité immédiate de l'appareil, en veillant à ce qu'il soit facilement accessible.

Marquer ce commutateur comme prise de coupure de l'appareil.

es - Notas sobre seguridad

El detector de nivel Liquiphant M FTL50, FTL51 ha sido diseñado para la detección de límite en fluidos.

Su empleo inapropiado puede resultar peligroso.

El equipo deberá ser montado, conectado, instalado y mantenido

única y exclusivamente por personal cualificado y

autorizado, bajo rigurosa

observación de las presentes

instrucciones de servicio,

de las normativas y

legislaciones vigentes,

así como de los certificados

(dependiendo de la aplicación).

Instalar un interruptor de fácil acceso en las proximidades del equipo.

Identificar el interruptor como desconector del equipo.

it - Note sulla sicurezza

Il Liquiphant M FTL50, FTL51 è particolarmente studiato per l'impiego come soglia di livello in liquidi.

Un'installazione non corretta può determinare pericolo.

Lo strumento può essere montato **solamente da personale qualificato ed autorizzato**.

La messa in esercizio e la manutenzione devono rispettare le indicazioni di collegamento, le norme e i certificati di seguito riportati.

Installare un interruttore per l'alimentazione in prossimità del dispositivo.

Marcare l'interruttore come disconnessione del dispositivo.

nl - Veiligheidsinstructies

Gebruik de Liquiphant M FTL50, FTL51 alleen als niveauschakelaar voor vloeistoffen. Indien niet correct gebruikt kunnen gevaarlijke situaties ontstaan.

Het instrument **alleen door gekwalificeerd en geautoriseerd personeel** laten inbouwen, aansluiten, in bedrijf nemen en onderhouden.

Neem de instructies in deze Inbedrijfstellingsvoorschriften, de desbetreffende normen, de wettelijke voorschriften en eventuele certificaten in acht.

Installeer een makkelijk bereikbare voedingschakelaar in de nabijheid van het instrument.

Kenmerk de voedingschakelaar specifiek voor het instrument.

de - Behandlung

Am Gehäuse, Flansch oder Verlängerungsrohr anfassen.

en - Handling

Hold by housing, flange or extension tube.

fr - Manipulation

Tenir par le boîtier, la bride ou le tube prolongateur.

es - Modo de empleo

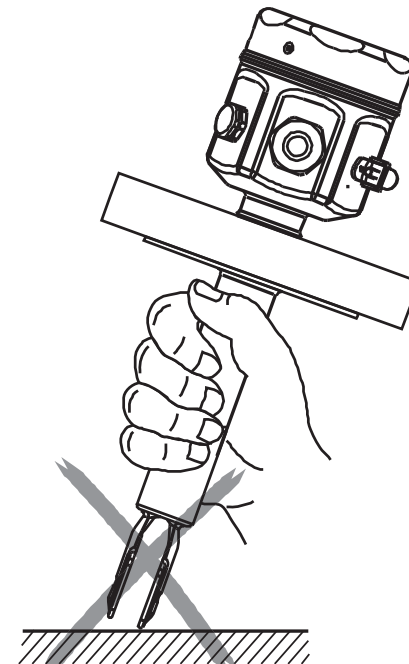
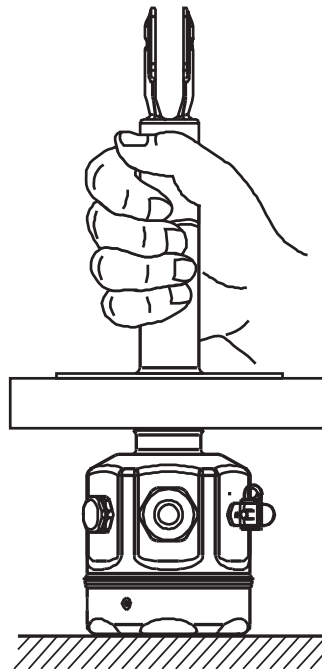
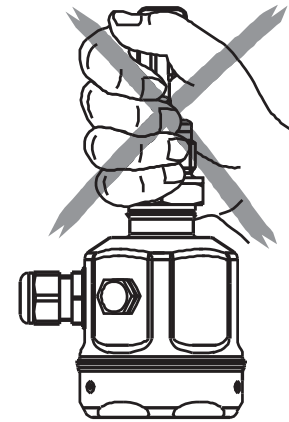
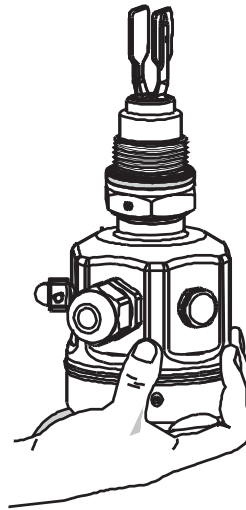
Coger por el cabezal, brida o tubo de extensión.

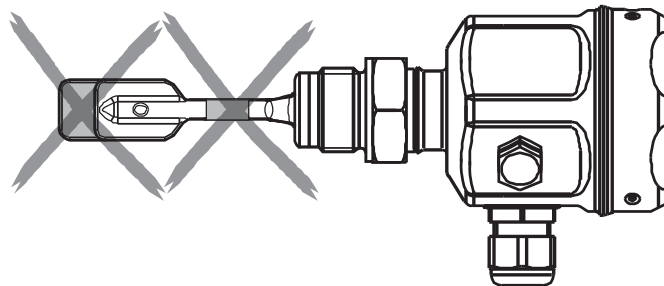
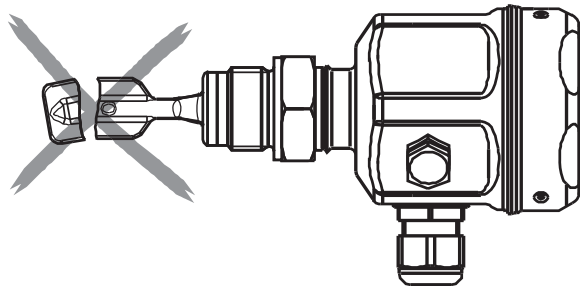
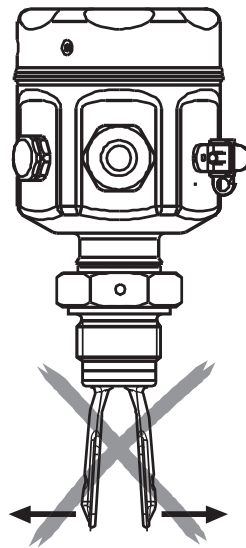
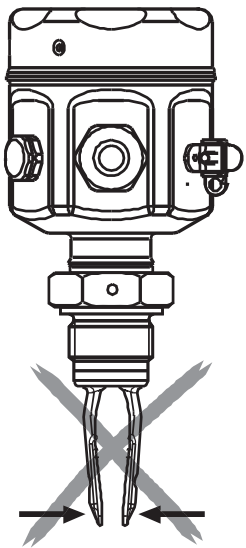
it - Accorgimenti

Afferrare la custodia, per la flangia o per il tubo di estensione.

nl - Behandeling

Vastpakken via behuizing, flens of verlengbuis.





de - Nicht verbiegen
Nicht kürzen
Nicht verlängern

en - Do not bend
Do **not** shorten
Do **not** lengthen

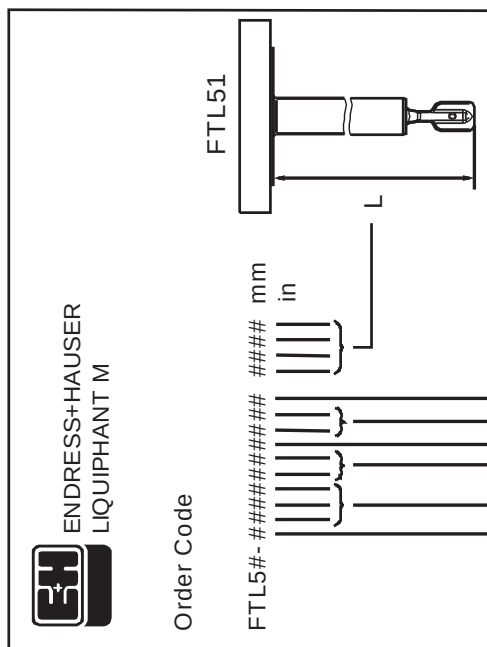
fr - Ne pas déformer
Ne pas raccourcir
Ne pas rallonger

es - No torcer
No acortar
No alargar

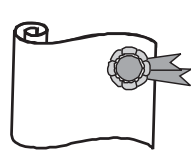
it - Non stringere o allargare
Non accorciare o allungare
Non piegare

nl - Niet verbuigen
Niet inkorten
Niet verlengen

de - Geräte-Identifikation
en - Device Identification
fr - Dénomination
es - Identificación del equipo
it - Identificazione dello strumento
nl - Instrument-identificatie



A	^{*1}	ATEX	II 3 G	EEx nC II	T6, WHG
B		ATEX	II 3 D	T85°C ^{*3}	
C		ATEX	II 3 G	EEx nA II	T6, WHG
D		ATEX	II 3 D	T85°C ^{*3}	
E	^{*1}	ATEX	II 1/2 G	EEx de IIC T6,	WHG
F		ATEX	II 1/2 G	EEx ia IIC T6,	WHG
G		ATEX	II 1/2 D	T80°C ^{*3}	
H		ATEX	II 1/2 G	EEx ia IIC T6	
I		ATEX	II 1 G	EEx ia IIC T6	
J		ATEX	II 1/2 G	EEx de IIC T6	
K		ATEX	II 1 G	EEx ia IIC T6,	WHG
L		ATEX	II 1/2 G	EEx d IIC T6	
M		ATEX	II 1/2 G	EEx d IIC T6,	WHG
N		NEPSI	EEx ia IIC T6		
P		NEPSI	EEx d IIC T6		
Q		FM	IS, Cl. I, II, III,	Div. 1, Gr. A-G	
R		FM	XP, Cl. I, II, III,	Div. 1, Gr. B-G, E5 => Gr. A-G	
S		FM	NI, Cl. I,	Div. 2, Gr. A-D	
T		CSA	IS, Cl. I, II, III,	Div. 1, Gr. A-G	
U		CSA	XP, Cl. I, II, III,	Div. 1, Gr. A-G	
V		CSA	General purpose		
W		TIIS	EEx ia IIC T3		
X		TIIS	EEx d IIB T3		
7		TIIS	EEx ia IIC T6		
8		TIIS	EEx d IIC T3		
Y	^{*2}	TIIS	EEx d IIC T6		



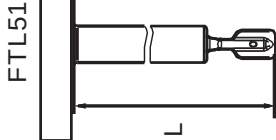

$$1^* \quad 2^* \quad 3^*$$



ENDRESS+HAUSER
LIQUIPHANT M

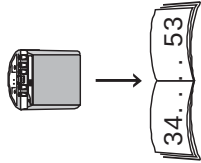
Order Code

FTL5#- ##### mm
 ##### in



AA ² *			Ra < 3.2 µm/80 grit (FTL50)
BB	. mm, 316L,		Ra < 3.2 µm/80 grit
BE	. mm, AlloyC4,		Ra < 3.2 µm/80 grit
CB	. in, 316L,		Ra < 3.2 µm/80 grit
CE	. in, AlloyC4,		Ra < 3.2 µm/80 grit
DB	"L II", 316L,		Ra < 3.2 µm/80 grit
DE	"L II", AlloyC4,		Ra < 3.2 µm/80 grit
IA ² *		+ "T" (FTL50)	
JB	. mm, 316L	+ "T"	
JE	. mm, AlloyC4	+ "T"	
KB	. in, 316L	+ "T"	
KE	. in, AlloyC4	+ "T"	
LB	"L II", 316L	+ "T"	
LE	"L II", AlloyC4	+ "T"	
QA ² *		+ "p" (FTL50)	
RB	. mm, 316L	+ "p"	
RE	. mm, AlloyC4	+ "p"	
SB	. in, 316L	+ "p"	
SE	. in, AlloyC4	+ "p"	
TB	"L II", 316L	+ "p"	
TE	"L II", AlloyC4	+ "p"	
YY ² *			

A	FEL50A, PROFIBUS PA
1	FEL51, 19 253 VAC
2	FEL52, 10 55 V DC, PNP
4	FEL54, 19 253 VAC, 19 55 V DC, DPDT
5	FEL55, 11 36 V DC, 8/16 mA
6	FEL56, NAMUR, L-H
7	FEL57, PFM
8	FEL58, NAMUR, H-L
9 ² *	



E1	F27	NEMA6P, NPT ¾	F16 (PBT)
E4	F16,	NEMA4X, NPT ½	
E5	F13/17, NEMA4X,	NPT ¾	
E6	F15,	NEMA4X, NPT ½	
F1	F27,	IP68, G ½	
F4	F16,	IP66, G ½	
F5	F13/17, IP66,	G ½	F13/17 (Alu) F27 (316L)
F6	F15,	IP66, G ½	
G1	F27,	IP68, M20	
G4	F16,	IP66, M20	
G5	F13/17, IP66,	M20	
G6	F15,	IP66, M20	
N4	F16,	IP66, M12	
N5	F13/17, IP66,	M12	
N6	F15,	IP66, M12	
Y9	* ²		
#3	Kompakt-Gehäuse / compact housing / boîtier compact / cabezal compacto / testa compatta / compacte behuizing		KA220
#7	Alu/sep.		KA163
A	* ¹		
B	PVIS free		
C	EN 10204 - 3.1, 316L		
K	Spec. adjustment density H20		
L	Spec. adjustment density H20, EN10204-3.1		
N	EN 10204 - 3.1, NACE MR0175, 316L		
P	100 bar (FTL51)		
R	100 bar, EN 10204 - 3.1, NACE MR0175, 316L (FTL51)		
S	GL/ABS marine certificate (FTL51: max. 1600 mm)		
Y	* ²		

¹
* ohne / without / sans / sin / senza / zonder

² * andere / others / autres / otros / altri / andere

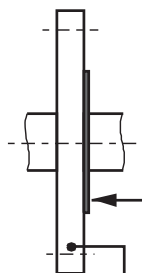
"L II" Schalterpunkt / Switchpoint / Point de commutation /
Punto de conmutación / Punto di commutazione / Schakelpunt

Liquiphant II FTL 360/365, FDL 30/35

"T"
Temperaturdistanzstück / Temperature spacer /
Élément de refroidissement / Tramo dissipador de temperatura /
Distanziale per temperatura / Temperatuurreductiestuk

"p" Druckdichte Durchführung / Pressure sealed bushing /
Entrée résistante à la pression / Extensión resistente a la presión /
Passacavo a tenuta di pressione / Gasdichte doorvoering

de - Flansche
en - Flanges
fr - Brides
es - Brida
it - Flangia
nl - Flens



ANSI B 16.5

AA2	1¼", 150 lbs, RF, 316/316L	
AB2	1¼", 300 lbs, RF, 316/316L (FTL51)	
AC2	1½", 150 lbs, RF, 316/316L	
AD2	1½", 300 lbs, RF, 316/316L (FTL51)	
AE2	2", 150 lbs, RF, 316/316L	
AE5	2", 150 lbs, RF, Alloy C4 >316/316L	
AE6	2", 300 lbs, RF, Alloy C22 >316/316L	
AF2	2", 300 lbs, RF, 316/316L	
AG2	2", 600 lbs, RF, 316/316L (FTL51)	
AJ2	2½", 300 lbs, RF, 316/316L (FTL51)	
AL2	3", 150 lbs, RF, 316/316L	
AM2	3", 300 lbs, RF, 316/316L (FTL51)	
AN2	3", 600 lbs, RF, 316/316L (FTL51)	
AP2	4", 150 lbs, RF, 316/316L	
AQ2	4", 300 lbs, RF, 316/316L (FTL51)	
AR2	4", 600 lbs, RF, 316/316L (FTL51)	
A82	1", 150 lbs, RF, 316/316L	

EN 1092-1

BA2	DN32, PN6 A, 316L	
BB2	DN32, PN25/40 A, 316L	
BC2	DN40, PN6 A, 316L	
BD2	DN40, PN25/40 A, 316L	
BE2	DN50, PN6 A, 316L	
BG2	DN50, PN25/40 A, 316L	
BH2	DN65, PN6 A, 316L	
BJ2	DN50, PN100 A, 316L (FTL51)	
BK2	DN65, PN25/40 A, 316L	
BM2	DN80, PN10/16 A, 316L	
BN2	DN80, PN25/40 A, 316L	
BQ2	DN100, PN10/16 A, 316L	
BR2	DN100, PN25/40 A, 316L	

B12	DN80,	PN100 A,	316L (FTL51)
B82	DN25,	PN25/40 A,	316L
CA2	DN32,	PN6 B1,	316L
CA5	DN32,	PN6,	AlloyC4 >316L
CA6	DN32,	PN6,	AlloyC22 >316L
CE2	DN50,	PN6 B1,	316L
CE5	DN50,	PN6,	AlloyC4 >316L
CE6	DN50,	PN6,	AlloyC22 >316L
CG2	DN50,	PN25/40 B1,	316L
CG5	DN50,	PN25/40,	AlloyC4 >316L
CG6	DN50,	PN25/40,	AlloyC22 >316L
CJ2	DN50,	PN100 B2,	316L (FTL51)
CN2	DN80,	PN25/40 B1,	316L
CN5	DN80,	PN25/40,	AlloyC4 >316L
CN6	DN80,	PN25/40,	AlloyC22 >316L
CQ2	DN100,	PN10/16 B1,	316L
CQ5	DN100,	PN10/16,	AlloyC4 >316L
CQ6	DN100,	PN10/16,	AlloyC22 >316L
C12	DN80,	PN100 B2,	316L (FTL51)
C82	DN25,	PN25/40 B1,	316L
C85	DN25,	PN25/40,	AlloyC4 >316L
C86	DN25,	PN25/40,	AlloyC22 >316L
DG2	DN50,	PN40 B1,	316L
DN2	DN80,	PN40 B1,	316L
D82	DN25,	PN40 B1,	316L
FG2	DN50,	PN40 C,	316L
NG2	DN50,	PN40 D,	316L

JIS B2220

KA2	10K 25,	RF,	316L
KC2	10K 40,	RF,	316L
KE2	10K 50,	RF,	316L
KE5	10K 50,	RF,	AlloyC4 >316L
KE6	10K 50,	RF,	AlloyC22 >316L
KL2	10K 80,	RF,	316L
KP2	10K 100,	RF,	316L

de - Verwendung

Grenzstanddetektion in
Flüssigkeiten

en - Application

Level limit detection in liquids

fr - Utilisation

Détection de niveau dans les
liquides

es - Aplicación

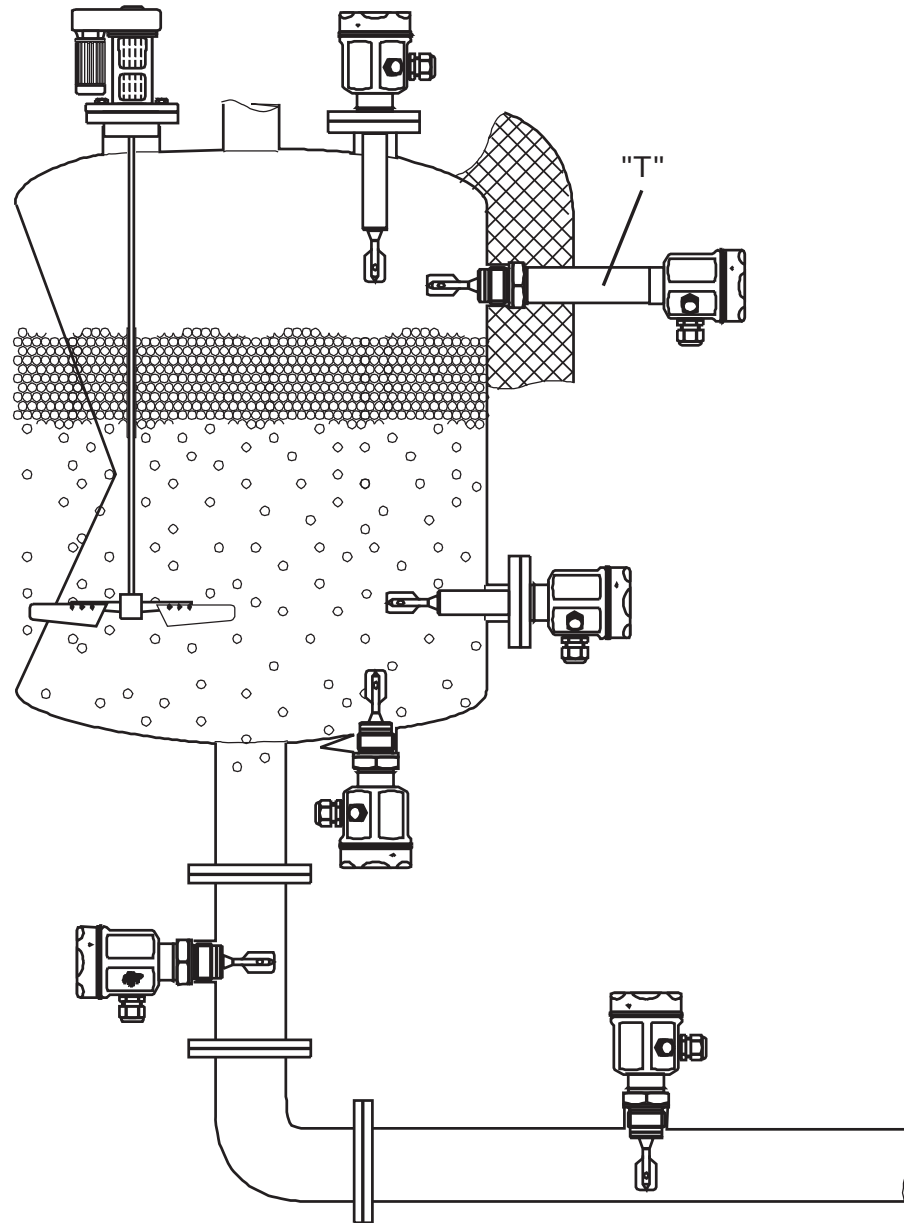
Detección de nivel en líquidos

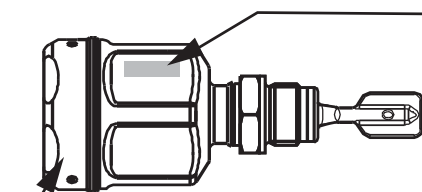
it - Applicazione

Controllo livello nei liquidi

nl - Toepassing

Niveaudetectie in vloeistoffen

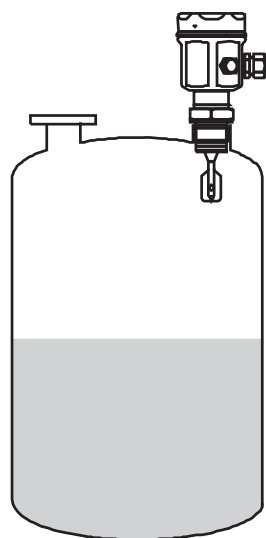




Order code:
FTL5# - # ### ## # ## #

Elektronikeinsätze
Electronic inserts
Electronique
Electrónica
Inserti elettronici
Elektronica-insert

FEL51
FEL52
FEL54



*)

*) Externe Last
External load
Charge externe
Carga externa
Carico esterno
Externe belasting

de - Messeinrichtung
für direkten Anschluss

en - Measuring system
for direct connection

**fr - Ensemble de détection
de niveau**
pour raccordement direct

es - Sistema de medida
para conexión directa

it - Sistema di misura
per connessione diretta

nl - Meetopstelling
voor directe aansluiting

de - Messeinrichtung

für Anschluss über Schaltgerät

en - Measuring system

for connection via switching unit

**fr - Ensemble de détection
de niveau**

pour raccordement via détecteur

es - Sistema de medida

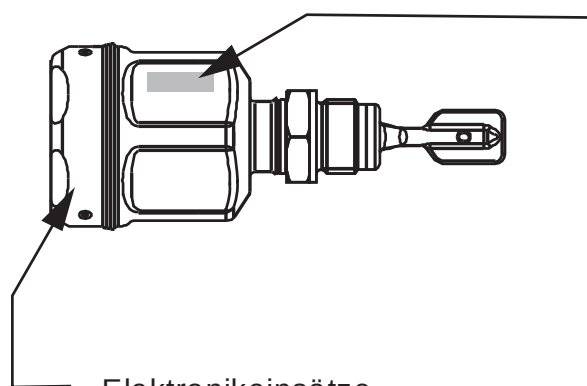
para conexión vía interruptores

it - Sistema di misura

per connessione mediante
unità di commutazione

nl - Meetopstelling

voor aansluiting aan een
schakelversterker



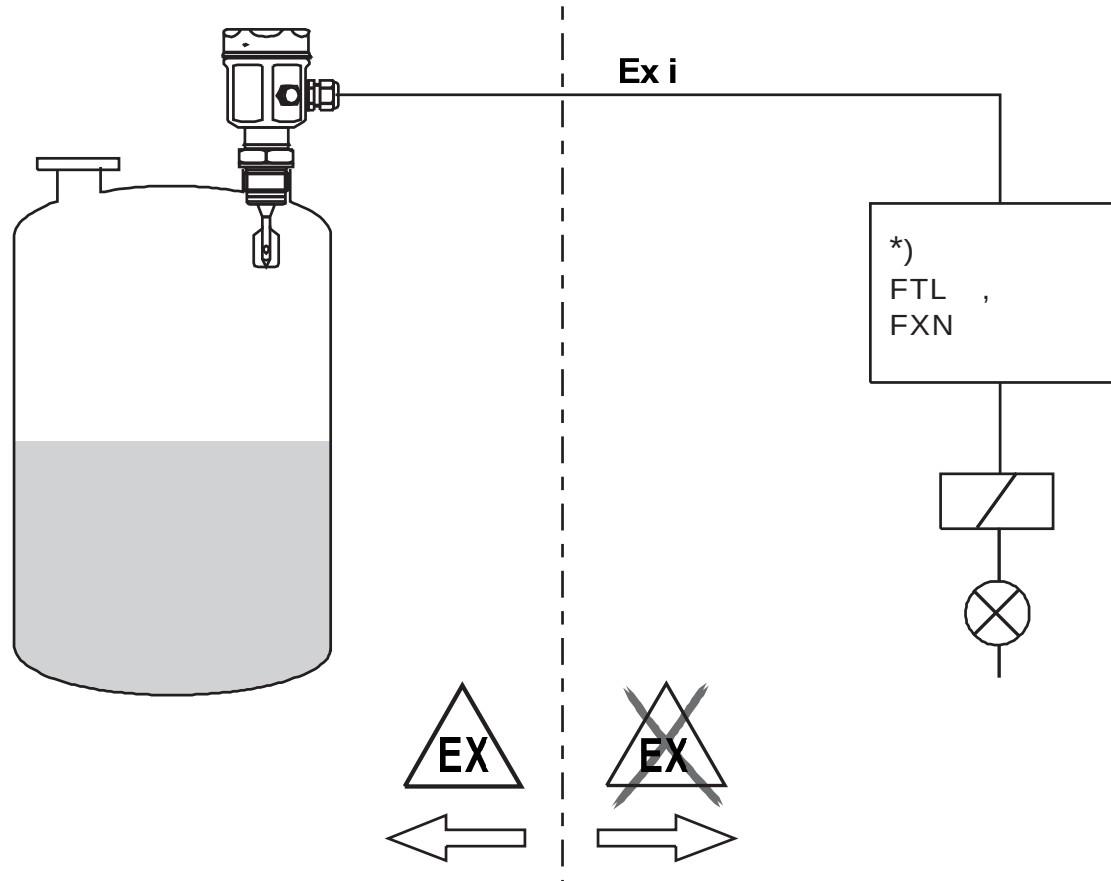
Elektronikeinsätze
Electronic inserts
Electronique
Electrónica
Inserti elettronici
Elektronica-insert

Order code:

FTL5# - # ### ## # ## #



FEL55
FEL56
FEL57
FEL58



*) Schaltgerät, SPS, Trennverstärker
 Switching unit, PLC, isolating amplifier
 Détecteur, API, convertisseur/ séparateur
 Interruptor, PLC, amplificador aislado
 Unità di commutazione, PLC, barriera di separazione
 Schakelversterker, PLC, scheidingsverstärker

de - Messeinrichtung

für Anschluss an PROFIBUS PA

en - Measuring system

for connection to PROFIBUS PA

**fr - Ensemble de détection
de niveau**

pour le raccordement à
PROFIBUS PA

es - Sistema de medida

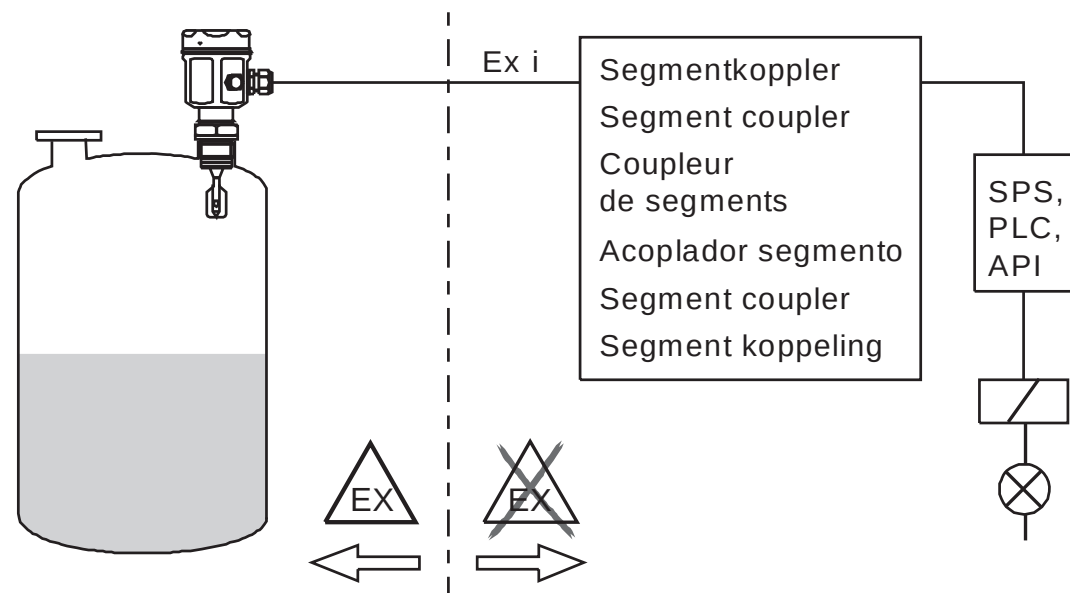
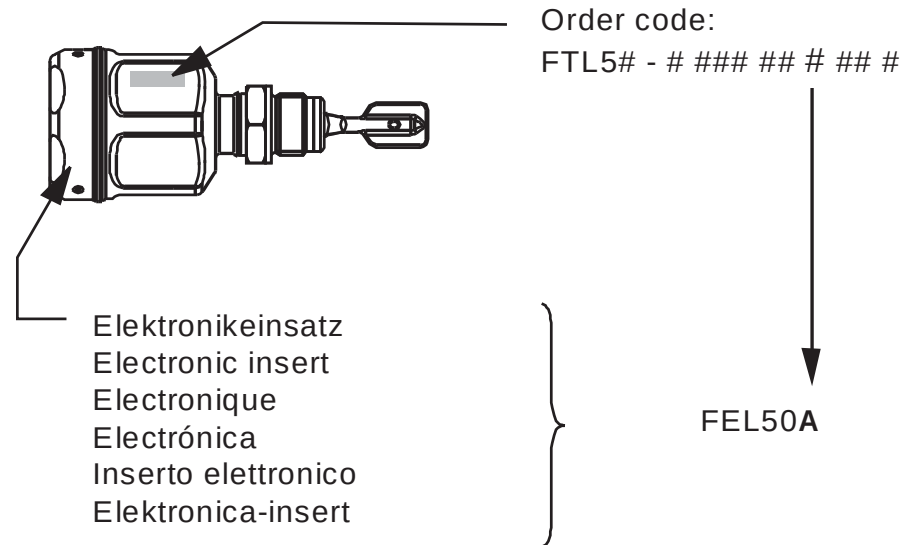
para conexión a PROFIBUS PA

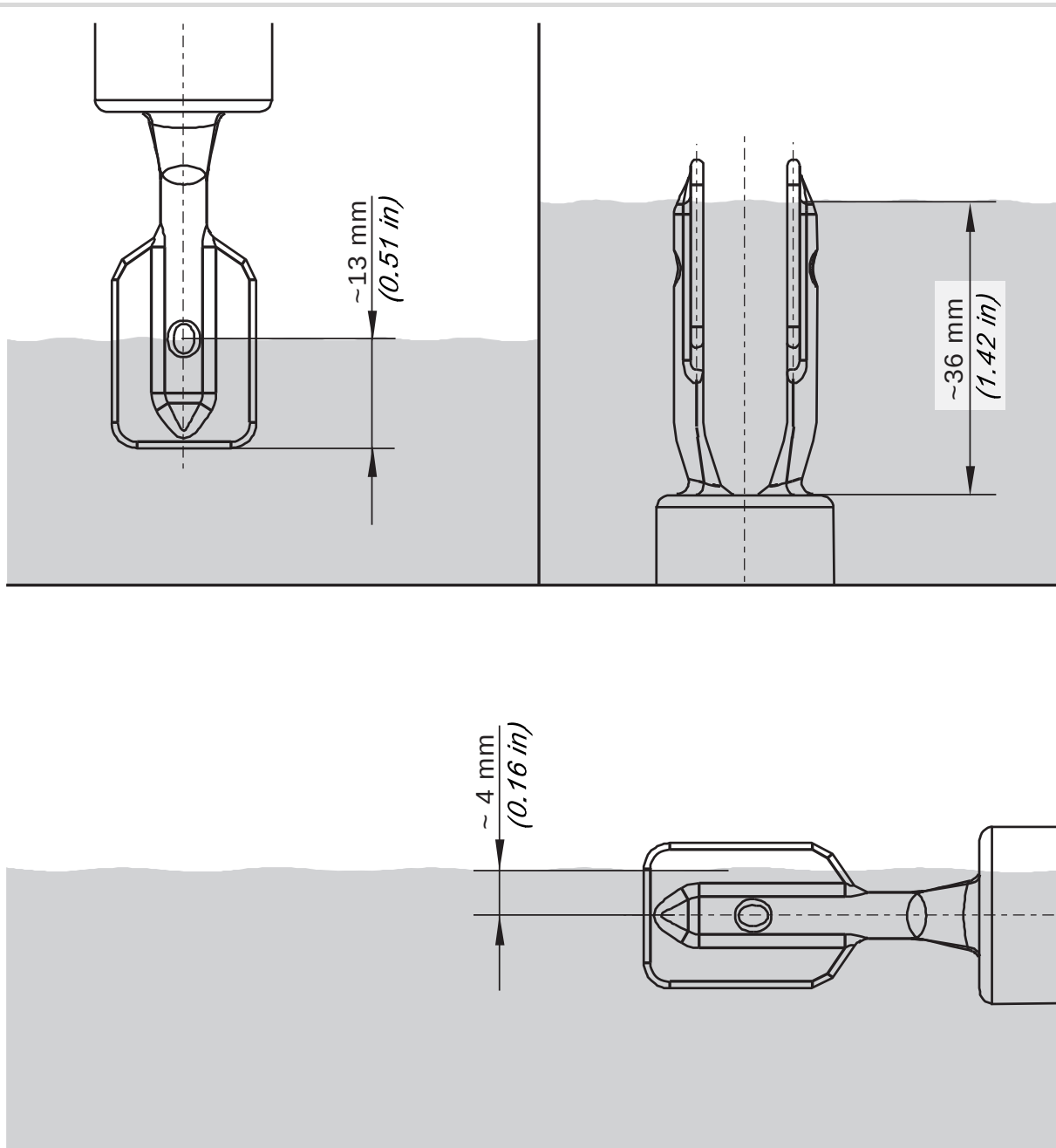
it - Sistema di misura

per connessione a PROFIBUS PA

nl - Meetopstelling

voor aansluiting aan PROFIBUS PA





de - Einbau

Schaltpunkt in Abhängigkeit vom Einbau

en - Installation

Switchpoint depends on mounting position

fr - Montage

Point de commutation en fonction de l'implantation

es - Montaje

Punto de conmutación dependiendo de la posición de montaje

it - Montaggio

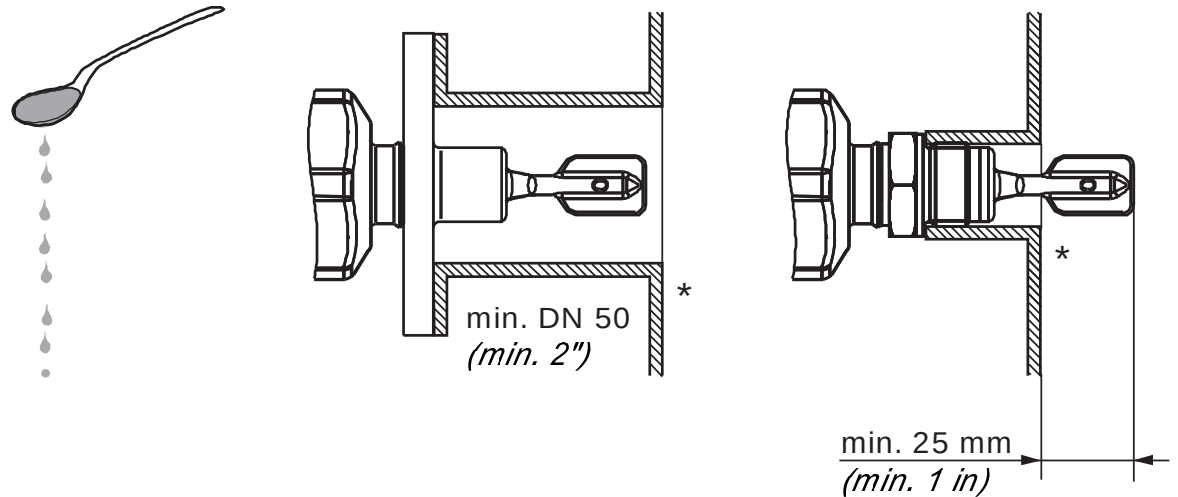
Punto di commutazione in funzione della posizione di montaggio

nl - Inbouw

Schakelpunt afhankelijk van inbouw

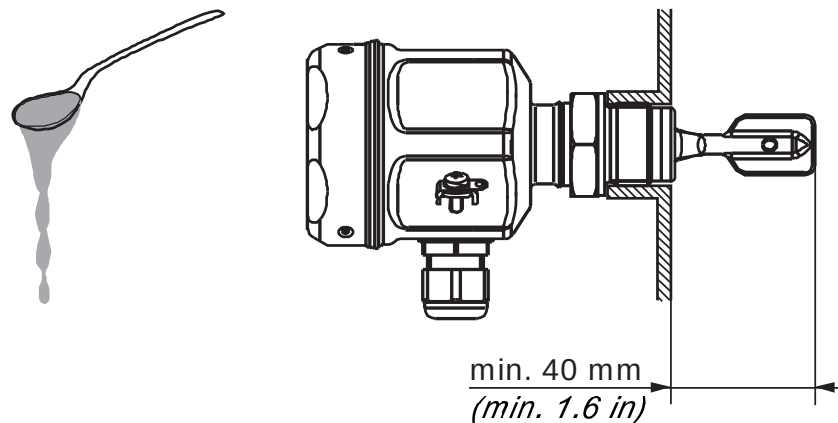
- de** - Einbaubeispiele
in Abhängigkeit von der
Viskosität ν der Flüssigkeit
- en** - Mounting examples
as a function of liquid viscosity ν
- fr** - Exemples d'implantation
dépendant de la viscosité ν
du liquide
- es** - Ejemplos de montaje
dependiendo de la viscosidad ν
del líquido
- it** - Esempi di montaggio
come funzione di viscosità ν
del liquido
- nl** - Inbouwvoorbeelden
afhankelijk van de viscositeit ν
van de vloeistof

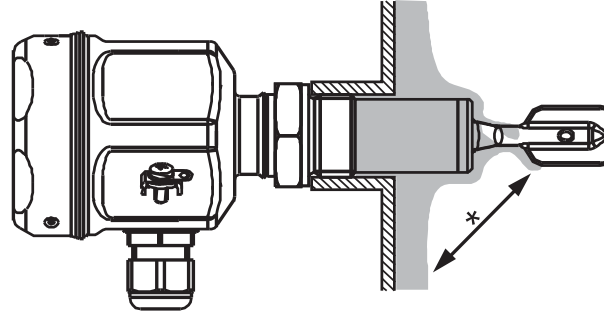
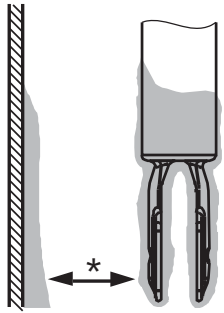
$\nu = 0 \dots 2000 \text{ mm}^2/\text{s}$
($\nu = 0 \dots 2000 \text{ cSt}$)



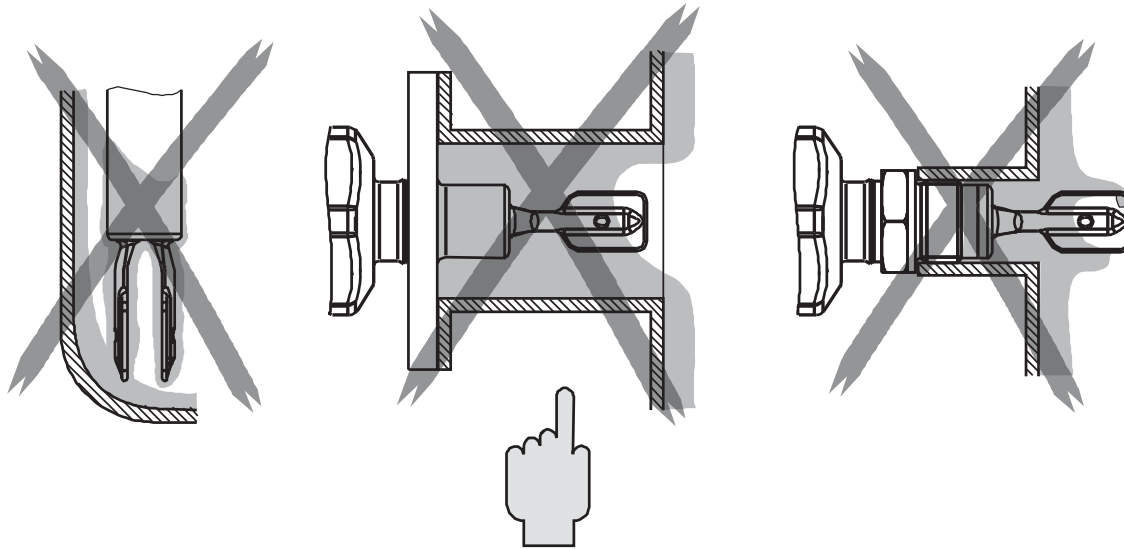
* entgraten / deburr / ébarber / libre / sbavare / ontbramen

$\nu = 0 \dots 10000 \text{ mm}^2/\text{s}$
($\nu = 0 \dots 10000 \text{ cSt}$)



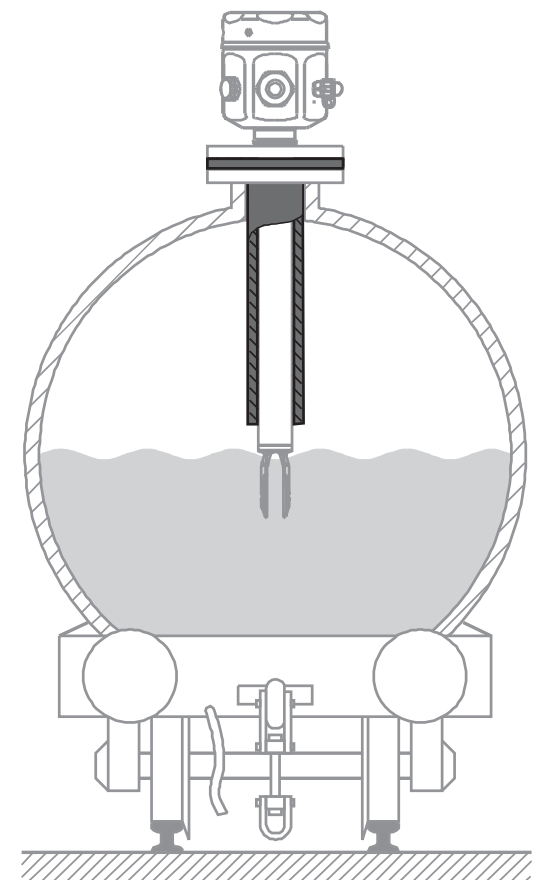
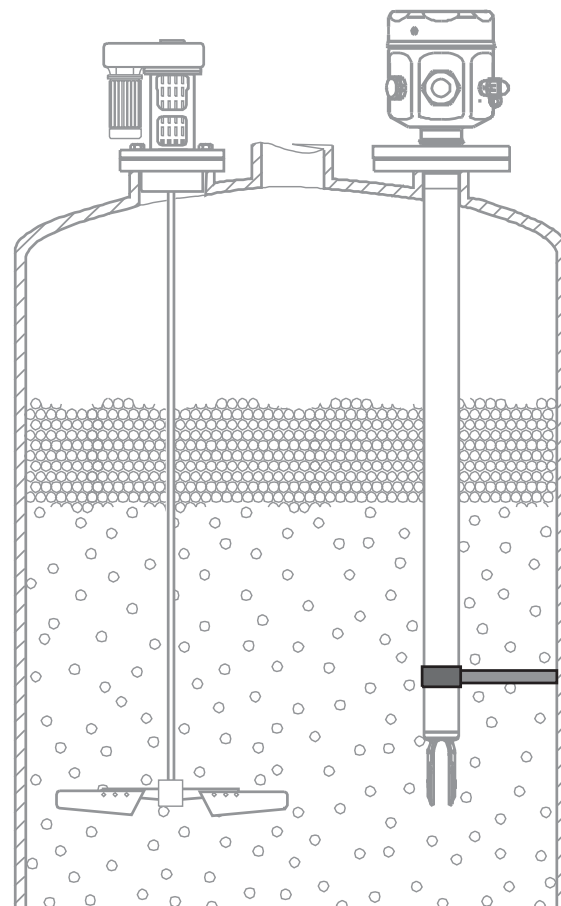


* Abstand! / Distance! / Distance! / ¡Distancia! / Distanza! / Afstand!

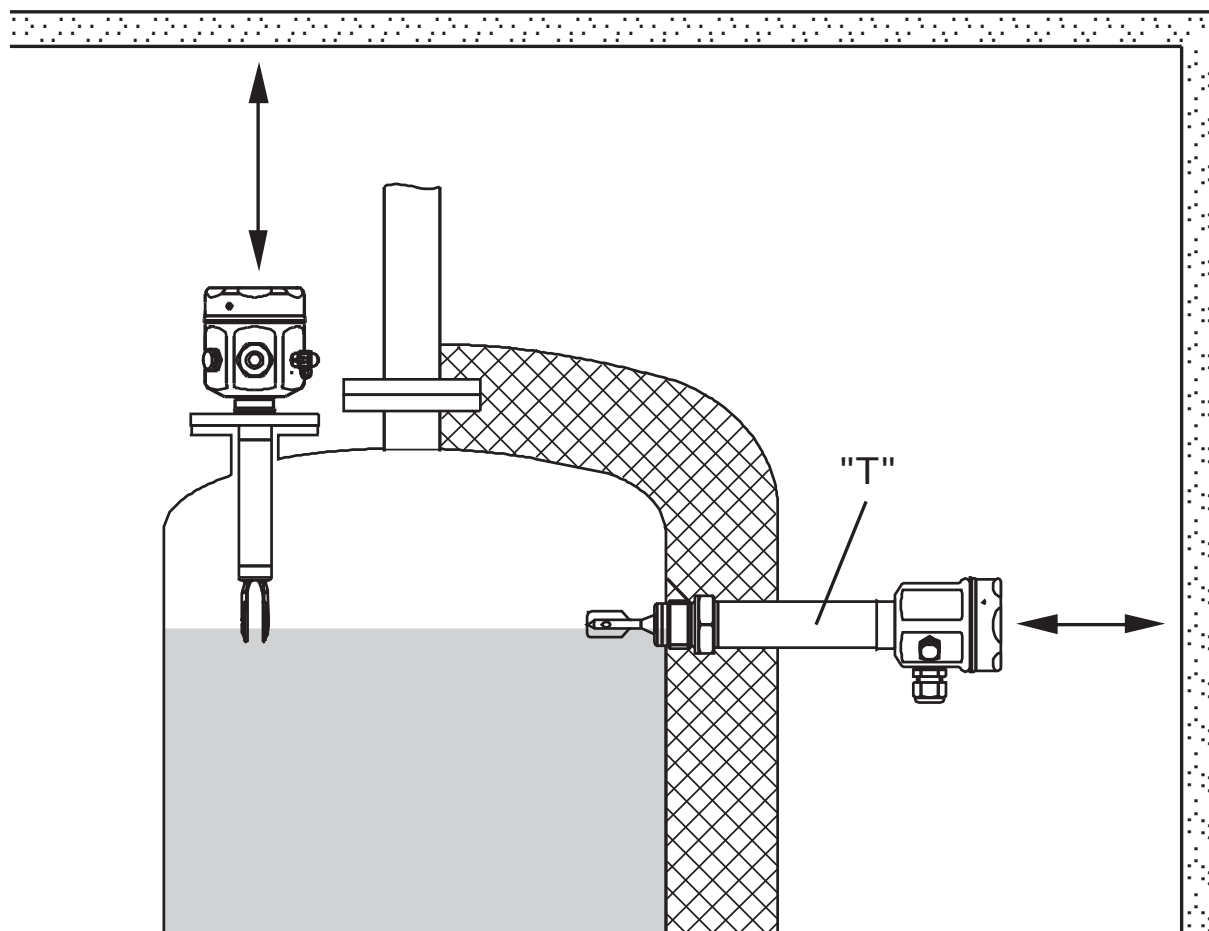


- de** - Ansatzbildung berücksichtigen.
Schwinggabel darf Ansatz nicht berühren.
- en** - Consider build-up.
Fork may not contact the build-up.
- fr** - Tenir compte du colmatage.
Fourche ne doit pas entrer en contact avec le dépôt.
- es** - Tener en cuenta las adherencias.
Las horquillas no deben estar en contacto con las adherencias.
- it** - Tenere conto dei depositi.
La forcella non deve entrare in contatto con i depositi.
- nl** - Rekening houden met aangroei.
Trilvork mag de aangroei niet aanraken.

- de** - Bei dynamischer Belastung
abstützen
- en** - In cases of dynamic forces support
- fr** - En cas de contraintes dynamiques,
étayer le tube
- es** - En caso de cargas dinámicas altas
debe ser apoyado
- it** - In caso di carichi dinamici,
rinforzare con un supporto
meccanico
- nl** - Bij mechanische belasting
verstevigen



"T" = mit Temperaturdistanzstück für isolierten Tank
 "T" = with temperature spacer for insulated tanks
 "T" = avec élément de refroidissement pour réservoir isolé
 "T" = con tramo disipador de temperatura para tanques aislados
 "T" = con distanziale di temperatura per serbatoi isolati
 "T" = met temperatuurreductiestuk voor geïsoleerde tanks



de - Freiraum vorsehen

en - Allow clearance

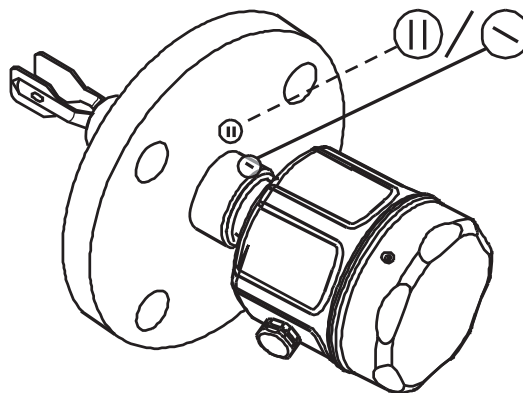
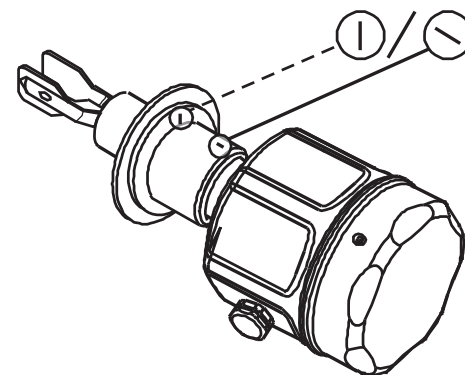
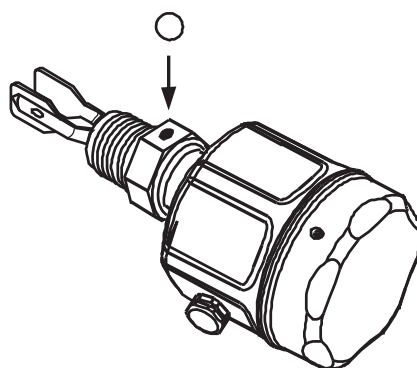
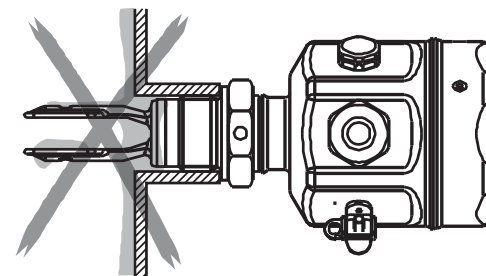
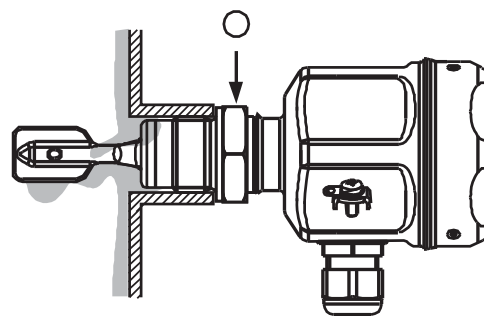
fr - Prévoir un espace libre

es - Prever espacio

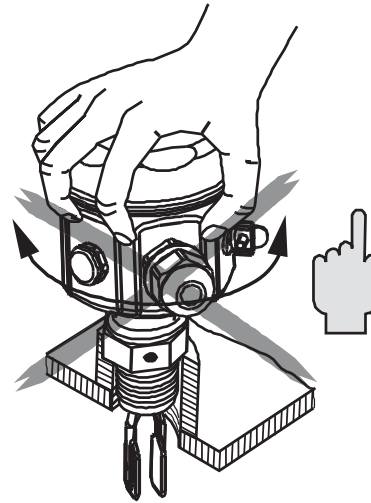
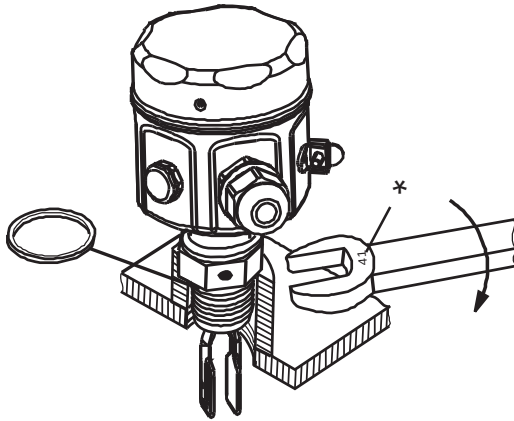
it - Lasciare spazio per estrazione

nl - Ruimte vrijhouden

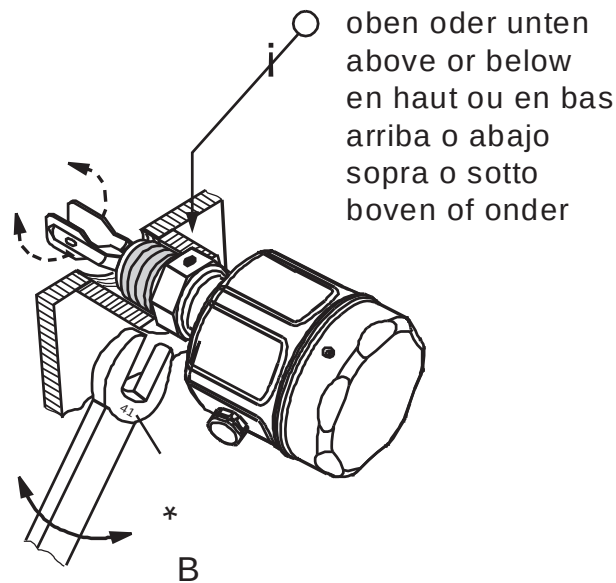
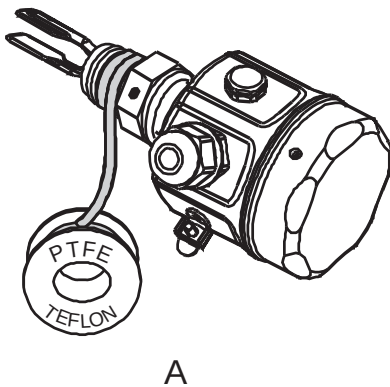
- de** - Schwinggabel ausrichten:
Markierung oben oder unten
- en** - Orientation of fork tines:
Marking above or below
- fr** - Orientation des lames vibrantes:
Repères en haut ou en bas
- es** - Orientación de la horquilla:
Marca arriba o abajo
- it** - Allineamento della forcella:
Marcatura in alto o in basso
- nl** - Vork uitrichten:
Markering boven of onder



G $\frac{3}{4}$, 32 mm (1 $\frac{1}{4}$ ")*
G 1, 41 mm (1 $\frac{5}{8}$ ")*



NPT $\frac{3}{4}$, R $\frac{3}{4}$, G $\frac{3}{4}$, 32 mm (1 $\frac{1}{4}$ ")*
NPT 1, R 1, G 1, 41 mm (1 $\frac{5}{8}$ ")*



de - Liquiphant einschrauben.
Nicht am Gehäuse drehen.

en - Screw Liquiphant into process connection.
Don't use housing to turn.

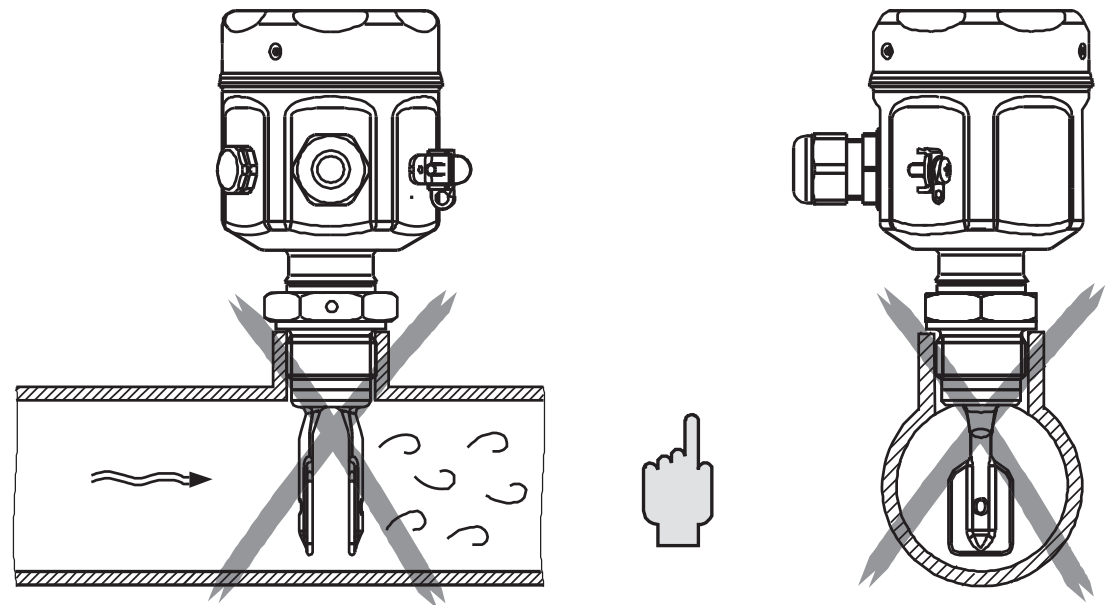
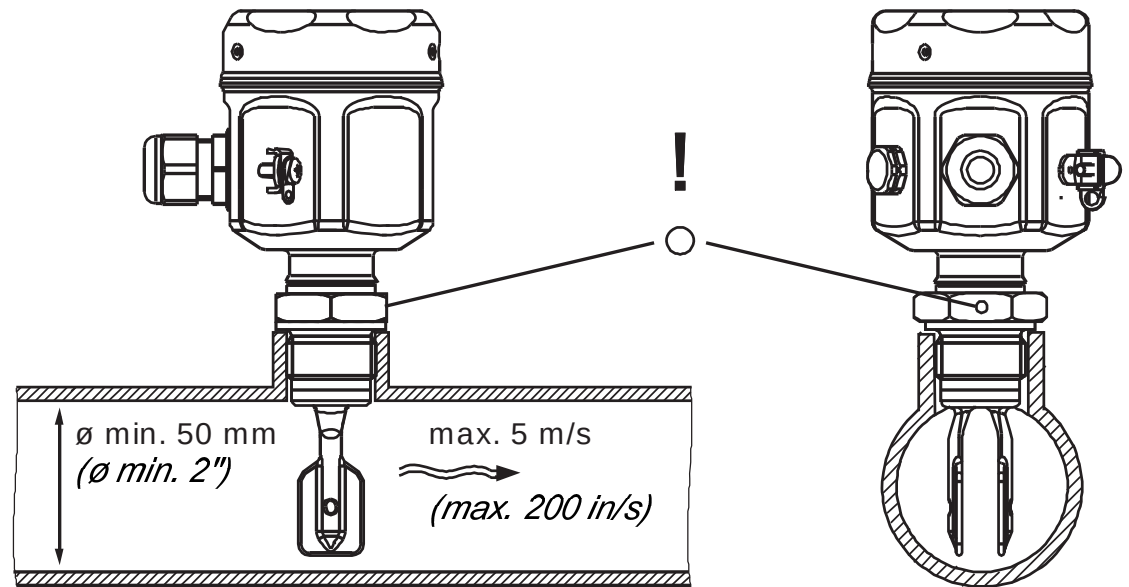
fr - Visser le Liquiphant.
Ne pas se servir du boîtier.

es - Roscar el Liquiphant a la conexión a proceso.
No girar el cabezal.

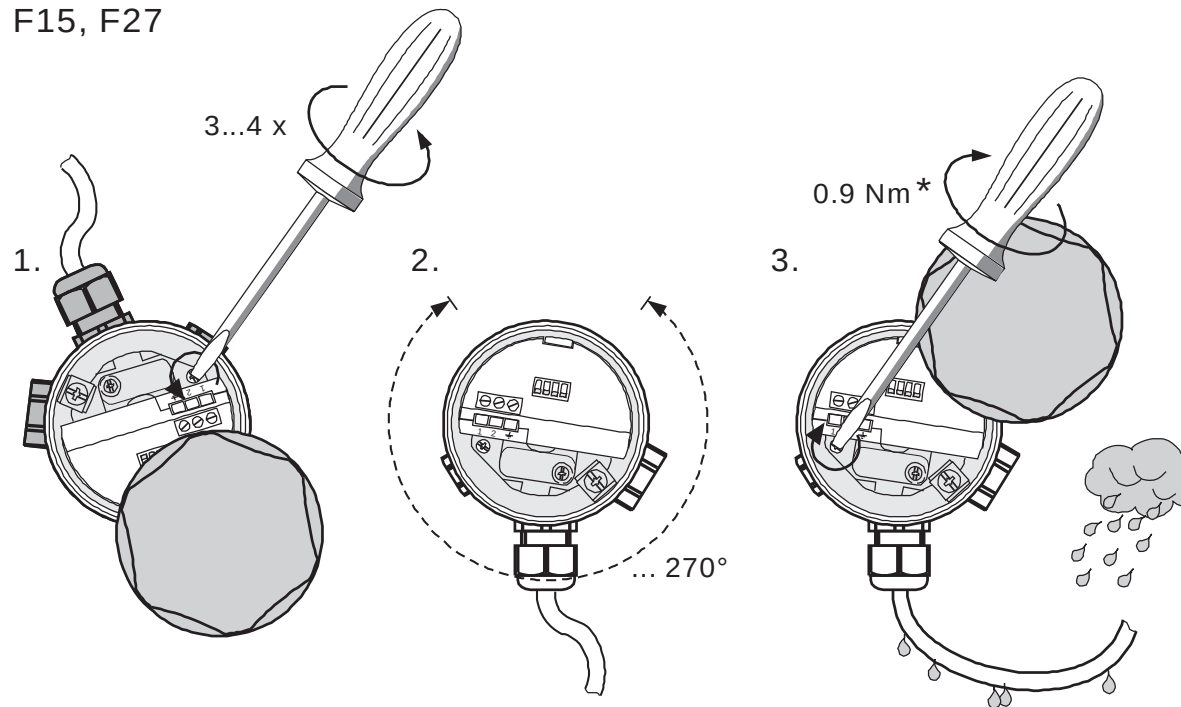
it - Avvitare il Liquiphant all'attacco di processo.
Allo scopo **non** utilizzare la custodia.

nl - Schroef de Liquiphant in de procesaansluiting.
Draai hierbij **niet** aan de behuizing.

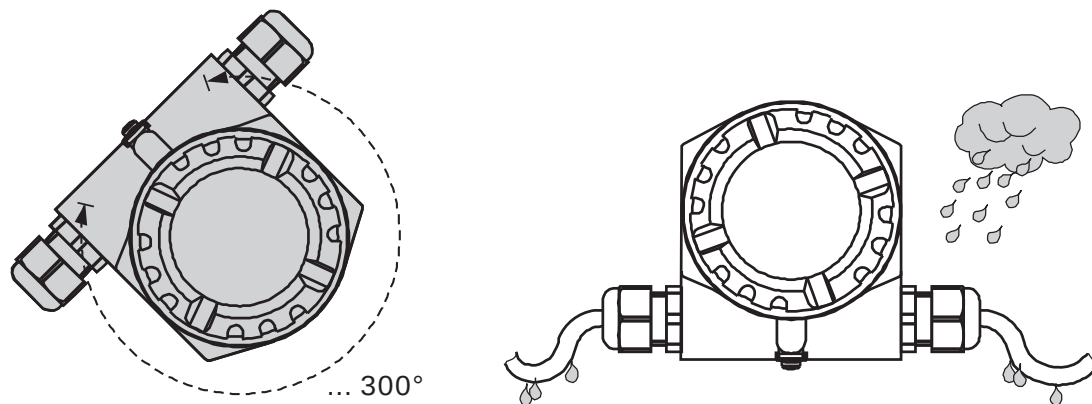
- de** - Ausrichten in Rohrleitungen:
Markierung in Fließrichtung
- en** - Orientation in pipes:
Marking in direction of flow
- fr** - Orientation dans une conduite:
Repère dans le sens de
l'écoulement
- es** - Montaje y orientación dentro
de tuberías:
Marca en dirección del caudal
- it** - Allineamento per montaggio
in tubazioni:
Marcatura nella direzione
del flusso
- nl** - Opstelling in leidingen:
Markering in de stroomrichting



F15, F27



F16, F13, F17



de - Kabeleinführung ausrichten

en - Cable gland orientation

fr - Positionnement de l'entrée de câble

es - Ajuste del prensaestopa

it - Posizionamento del passacavo

nl - Kabelinvoer uitrichten

* Anzugsdrehmoment /
Torque /
Couple de serrage /
Esfuerzo de torsión /
Coppia di torsione /
Aandraaimoment

de - Einstellungen

Minimum-/Maximum-
Sicherheitsschaltung

en - Setting-up

Minimum/maximum
fail-safe mode

fr - Réglage

Sécurité minimum/maximum

es - Ajuste

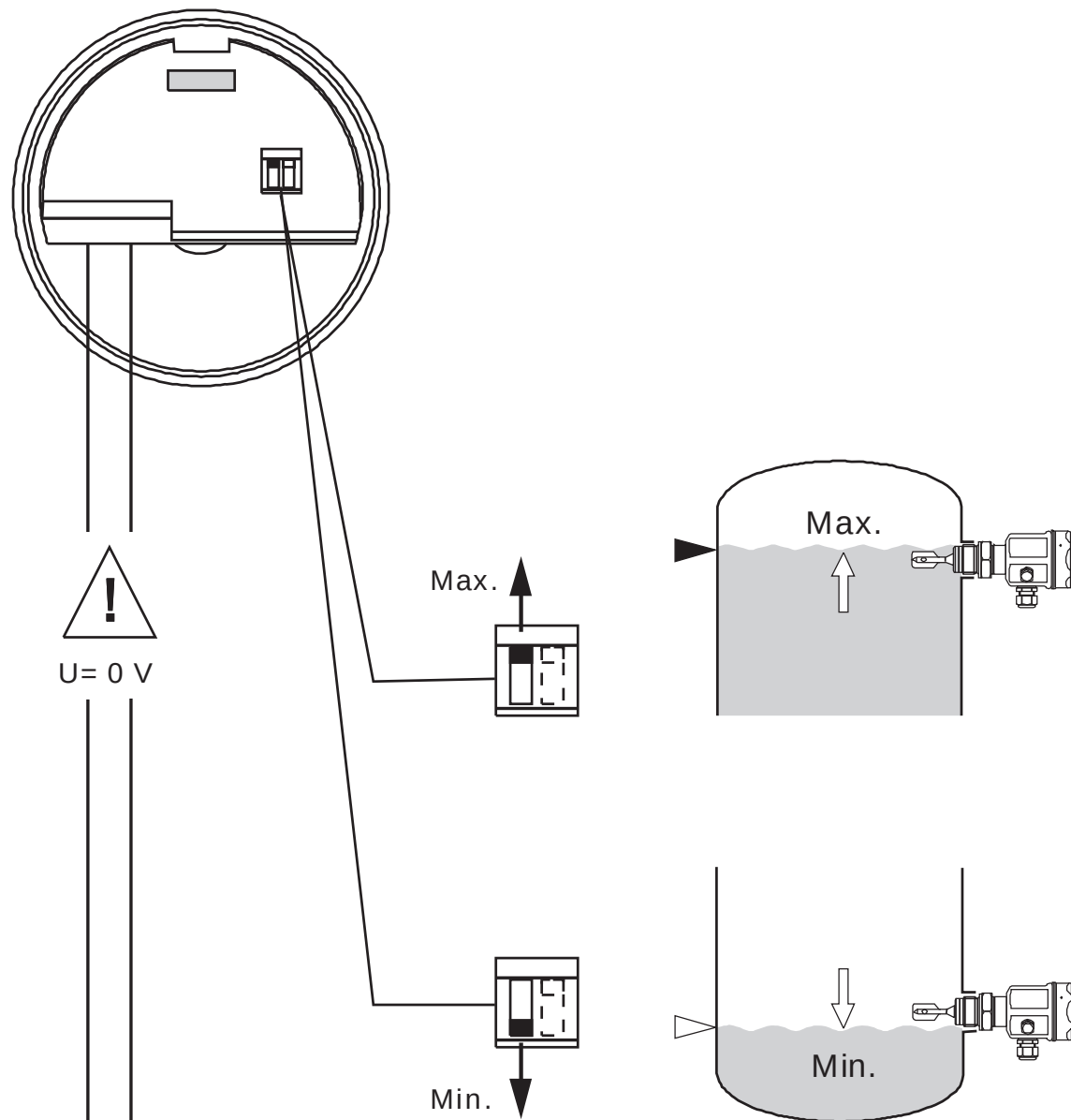
Conmutador de seguridad
mín./máx.

it - Messa in servizio

Selezione della modalità
di sicurezza min./max.

nl - Instellingen

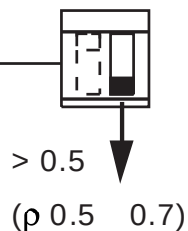
Minimum/maximum
veiligheidsschakeling



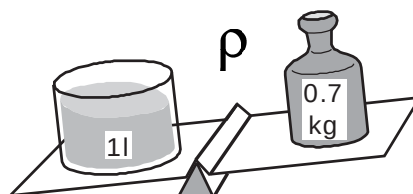
FEL51, FEL52, FEL54,
FEL55, FEL56, FEL57, FEL58



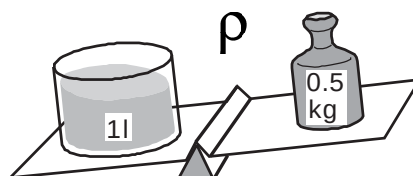
Standard / Standard / Standard /
Estándar / Standard / Standaard



z.B. Propan / e.g. Propane / Exemple: Propane /
Ejemplo: propano / Esempio: propano / bijv. propaan



$1 \text{ l (1 dm}^3\text{)} = \text{min } 0.7 \text{ kg}$
 $(1 \text{ imp.gal} = \text{min. } 7.0 \text{ lbs})$
 $(1 \text{ US. gal} = \text{min. } 5.9 \text{ lbs})$



$1 \text{ l (1 dm}^3\text{)} = 0.5 \dots 0.7 \text{ kg}$
 $(1 \text{ imp.gal} = 5.0 \dots 0.7 \text{ lbs})$
 $(1 \text{ US. gal} = 4.2 \dots 5.9 \text{ lbs})$

de - Dichte der Flüssigkeit.

Dichte ρ gemessen in g/cm^3
oder in kg/l .

en - Liquid density.

Density ρ measured in g/cm^3
or in kg/l .

fr - Densité du liquide.

Unité de mesure de la densité ρ :
 g/cm^3 ou kg/l .

es - Densidad de líquidos.

Densidad ρ medida en g/cm^3
o en kg/l .

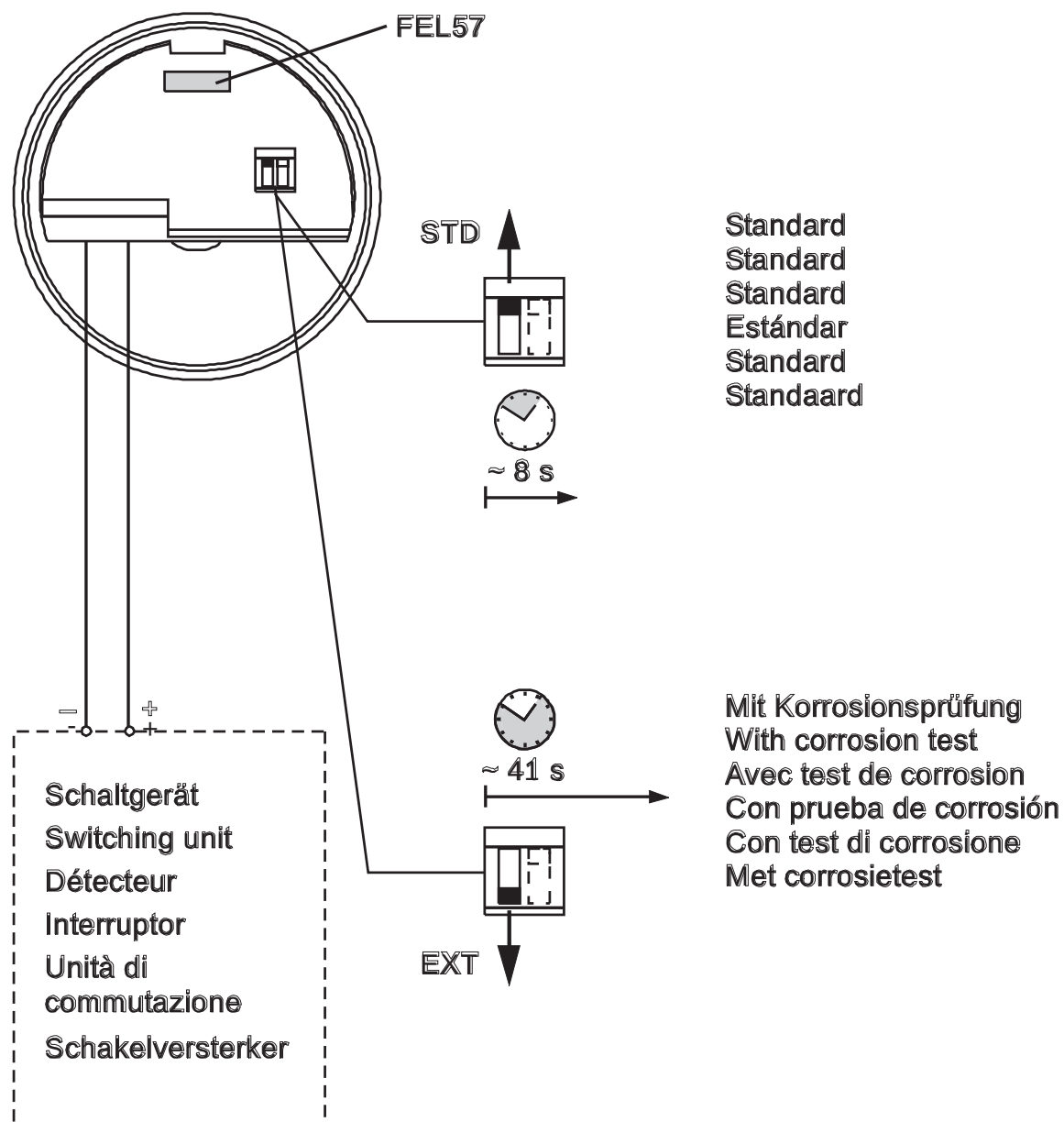
it - Densità del liquido.

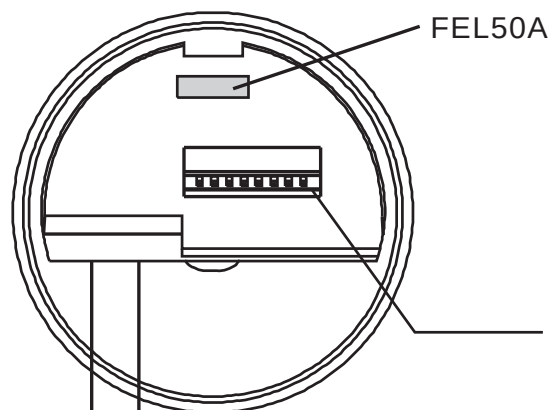
Densità ρ misurata in g/cm^3
o in kg/l .

nl - Dichtheid van de vloeistof.

Dichtheid ρ gemeten in g/cm^3
of in kg/l .

- de** - Selbsttest FEL57
(Funktion siehe Seite 46, 47 und Schaltgerät)
- en** - Selftest FEL57
(see page 46, 47 and switching unit for sequence)
- fr** - Auto-test FEL57
(voir pages 46, 47 et détecteur)
- es** - Prueba automática FEL57
(ver pág. 46, 47 e interruptor para secuencia)
- it** - Prova automatica FEL57
(vds. pag. 46, 47 e unità di commutazione)
- nl** - Functietest FEL57
(zie voor functie pag 46, 47 en schakelversterker)





ON	1	2	4	8	16	32	64	SW
OFF	0	0	0	0	0	0	0	HW
	1	2	3	4	5	6	7	8

Beispiel / Example / Exemple / Ejemplo /
Esempio / Bijv. :

2 + 8 = 10 = Adresse
Address
Adresse
Dirección
Indirizzo
Adres

Segmentkoppler
Segment coupler
Coupleur de segments
Acoplador segmento
Segment coupler
Segment koppeling

z.B. SPS / e. g. PLC /
p. e. API / por ej. PLC /
p. e. PLC / bijv. PLC /

de - Geräteadresse einstellen
(Einstellung der Parameter
siehe BA141F)

en - Setting Device Address
(Setting the parameters,
see BA141F)

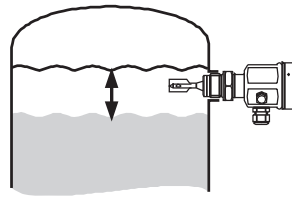
fr - Réglage de l'adresse d'appareil
(Réglage des paramètres
voir BA141F)

es - Configuración de la dirección
del equipo
(Ver configuración parámetros
en BA141F)

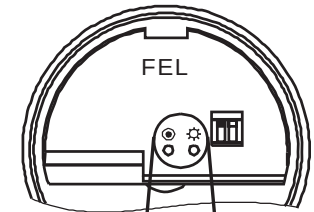
it - Impostare indirizzo del dispositivo
(Per impostazione parametri
vds. BA141F)

nl - Instrumentadres instellen
(Parameter instelling zie BA141F)

de - Lichtsignale
en - Light signals
fr - Signaux lumineux
es - Señales luminosas
it - Segnali luminosi
nl - Lichtsignalen



Füllstand variieren
Vary level
Varier le niveau
Nivel variable
Variare livello
Niveau variëren



GN RD
O O
(YE)

Leuchtdioden / LEDs / DEL / LEDs / LED / LED's



Betrieb / Stand-by / Fonctionnement /
Reposo / Attesa / stand-by



Schaltzustand / Switching status / Etat de commutation /
Estado conexión / Stato di commutazione / schakelstand



FEL57, FEL50A: Bedeckung / Covering / Recouvrement /
Cubierto / Copertura / bedekking



leuchtet / on / allumée / iluminado / on / aan



blinkt / flashes / clignote / parpadea / lampeggia / knippert



aus / off / éteinte / apagado / off / uit



Ausgangssignal / Output signal / Signal de sortie /
Señal de salida / Segnale uscita / uitgangssignaal

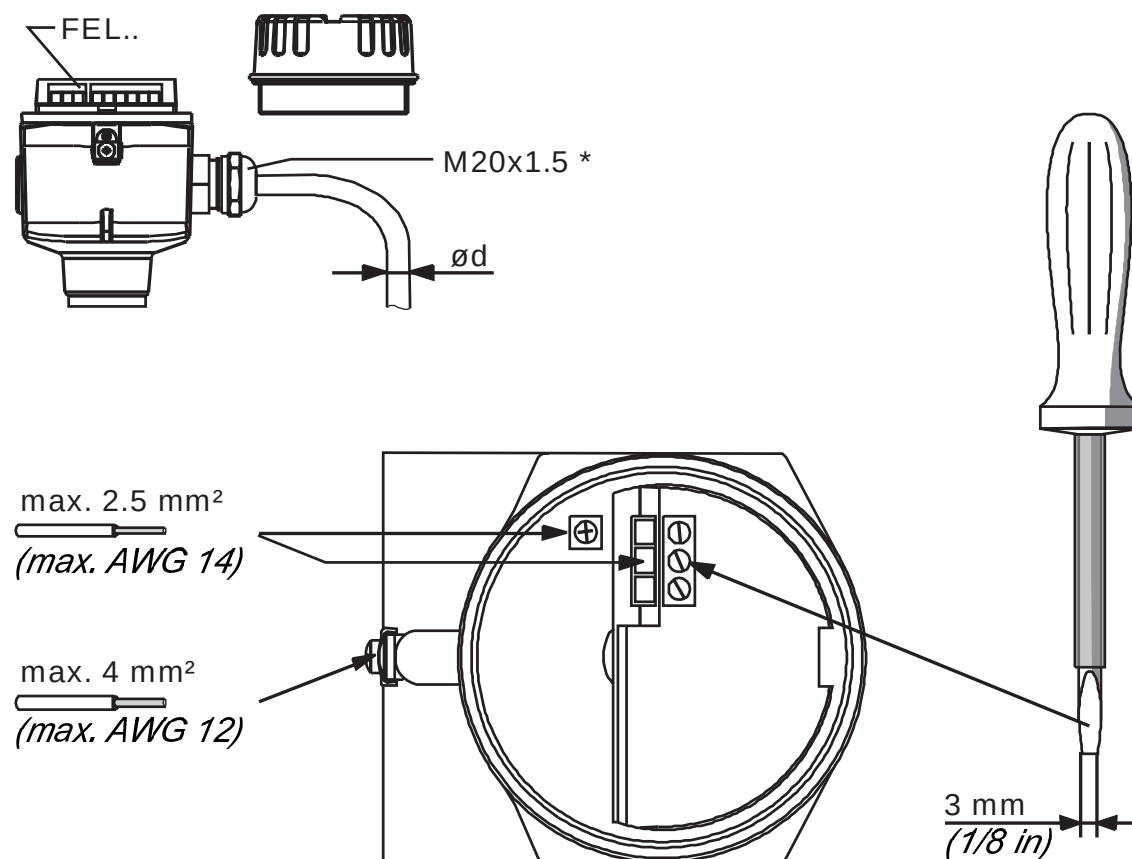


Störung / Fault / Défaute / Fallo / Guasto / storing



Nationale Normen und Vorschriften beachten!
Note national regulations!
Respecter les lois et règles locales en vigueur!
Considere reglamentaciones nacionales
Osservare le norme nazionali!
Nationale voorschriften in acht nemen!

de - Anschluss
en - Connections
fr - Raccordement
es - Conexiones
it - Collegamenti elettrici
nl - Aansluiting



***Cable entry**

Nickel-plated brass:

Ød = 7...10,5 mm (0,28...0,41 in)

Plastic:

Ød = 5...10 mm (0,2...0,38 in)

Stainless steel:

Ød = 7...12 mm (0,28...0,47 in)

de - Anschluss FEL51

Zweileiter-
Wechselstromanschluss

en - Connections FEL51

Two-wire AC connection

fr - Raccordement FEL51

Raccordement 2 fils
courant alternatif

es - Conexiones FEL51

Conexión a corriente alterna
a dos hilos

it - Collegamenti elettrici FEL51

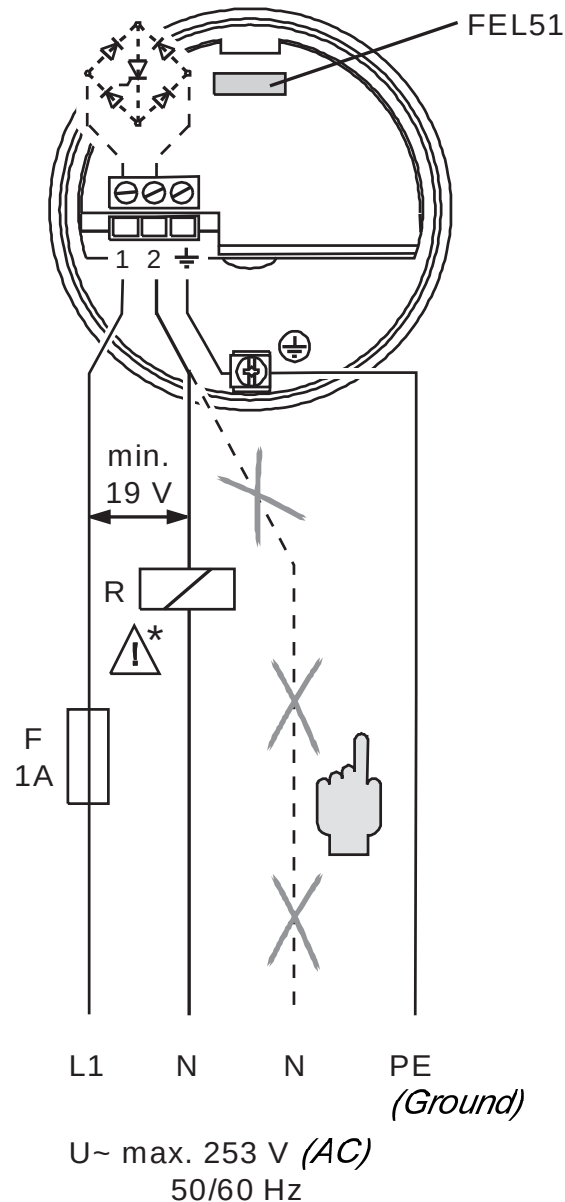
Collegamento bifilare
con corrente alternata

nl - Aansluiting FEL51

2- draads
wisselspanningsaansluiting



Zerstörung
Destruction
Destrucción
Distruzione
Storing



Externe Last R muss
angeschlossen werden

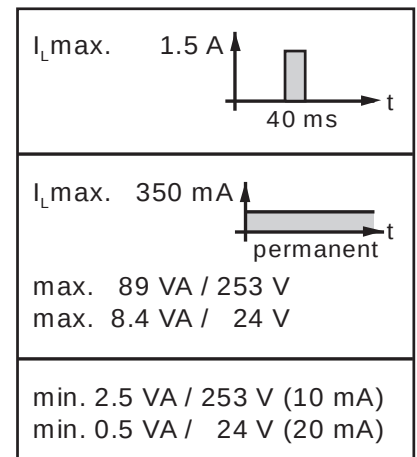
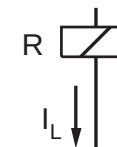
External load R must
be connected

Charge externe R doit
être raccordée

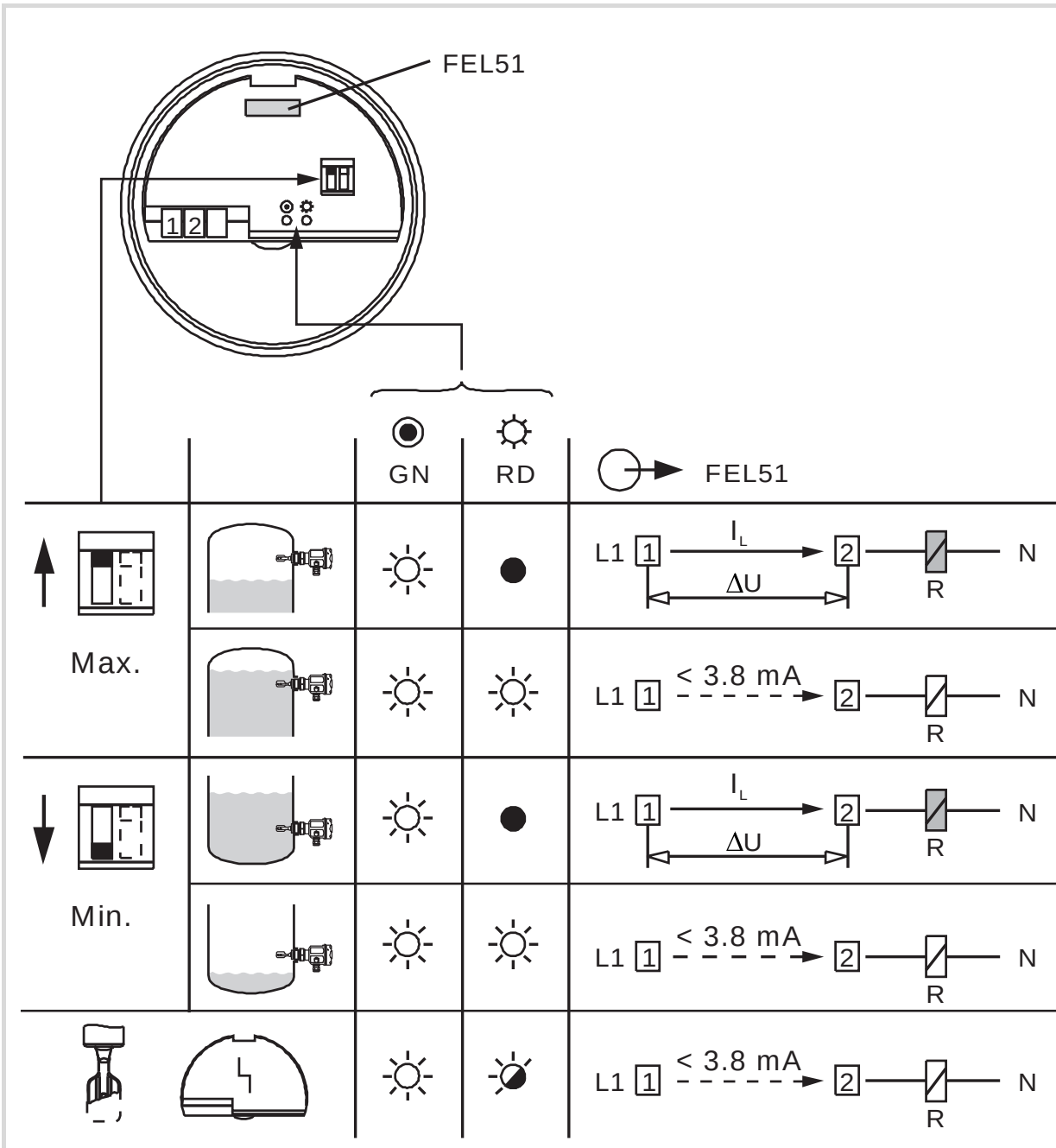
La carga externa R
debe estar conectada

Il carico esterno R
deve essere connesso

Externe belasting R
moet aangesloten worden

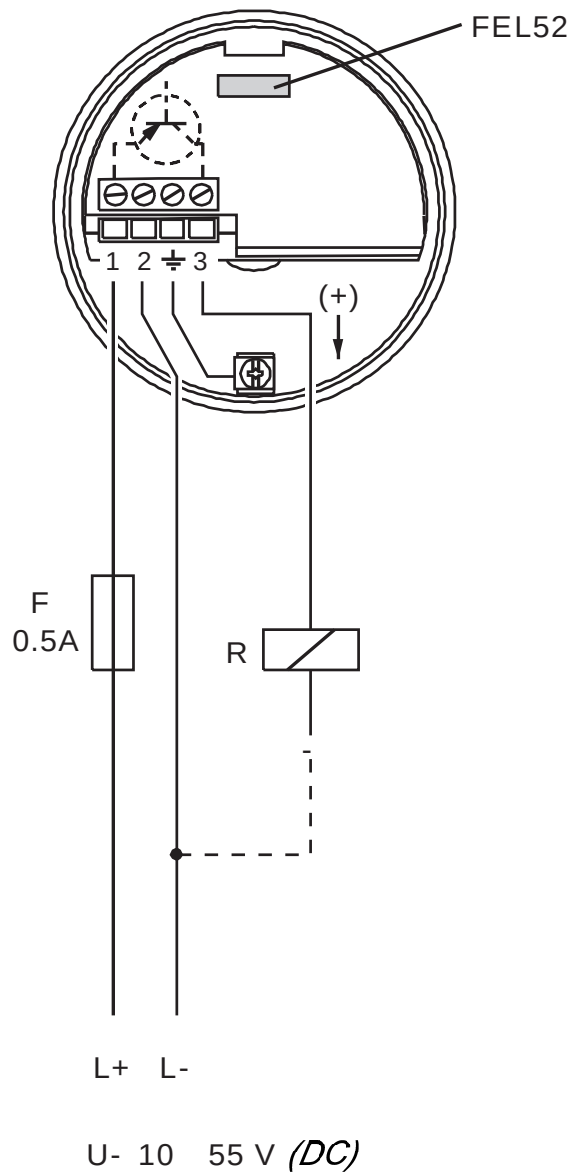


de - Funktion FEL51
en - Function FEL51
fr - Fonction FEL51
es - Funcionamiento FEL51
it - Funzione FEL51
nl - Functie FEL51



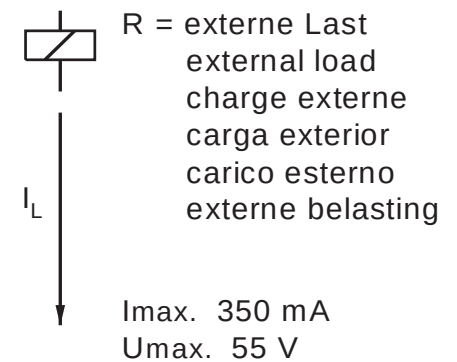
ΔU_{FEL51} max. 12 V

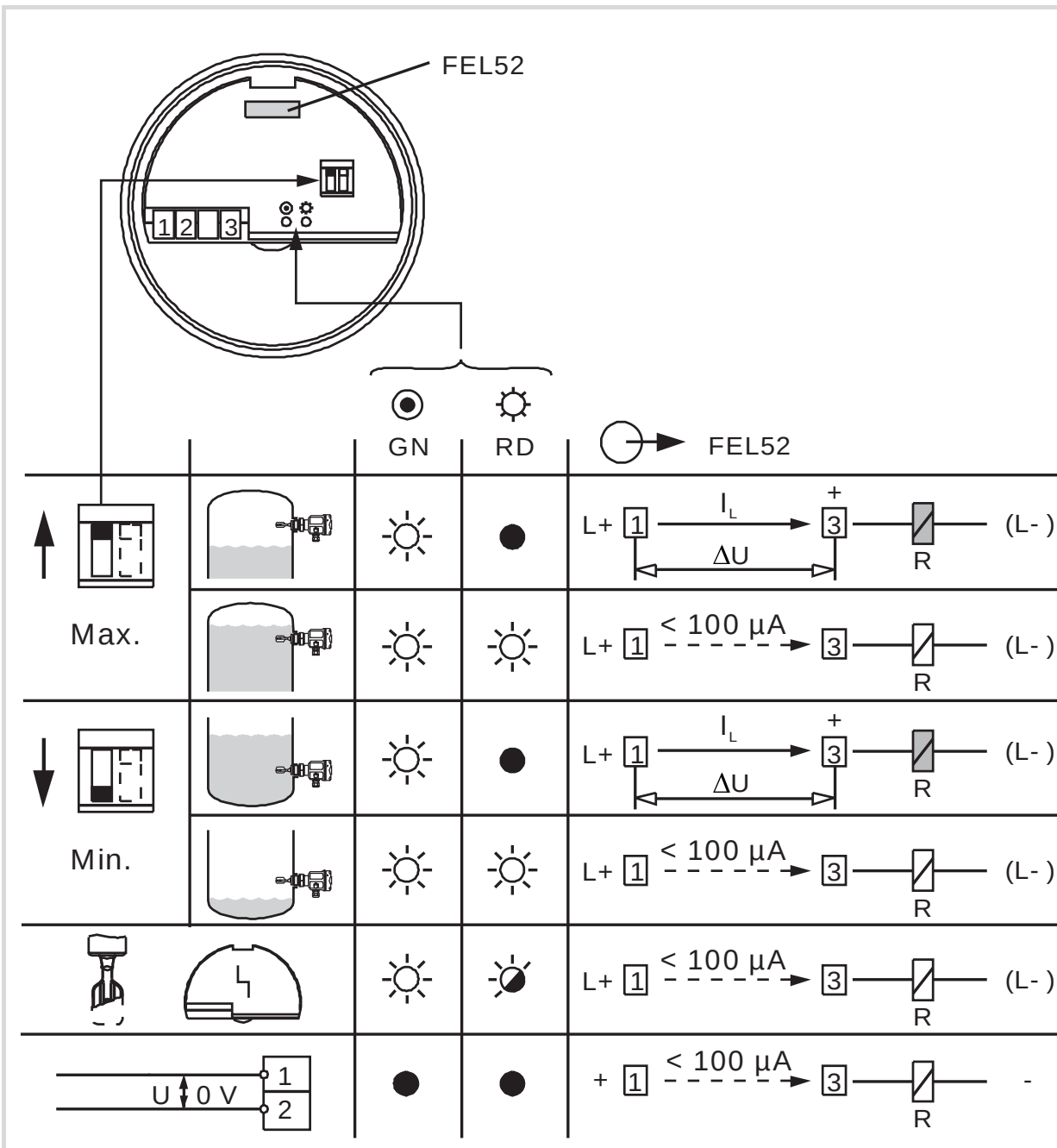
- de** - Anschluss FEL52
Gleichstromanschluss (PNP)
- en** - Connections FEL52
DC connection (PNP)
- fr** - Raccordement FEL52
Courant continu (PNP)
- es** - Conexiones FEL52
Alimentación CC (PNP)
- it** - Collegamenti elettrici FEL52
Collegamento CC (PNP)
- nl** - Aansluiting FEL52
Gelijkspanningsaansluiting (PNP)



auch für DI-Module
also for DI modules
également pour des modules DI
también para módulos DI
anche per DI modules
aan de DI-module

EN 61131-2





de - Funktion FEL52
en - Function FEL52
fr - Fonction FEL52
es - Funcionamiento FEL52
it - Funzione FEL52
nl - Functie FEL52

$\Delta U_{FEL52} \text{ max. } 3 \text{ V}$

de - Anschluss FEL54
Allstromanschluss
Relaisausgang

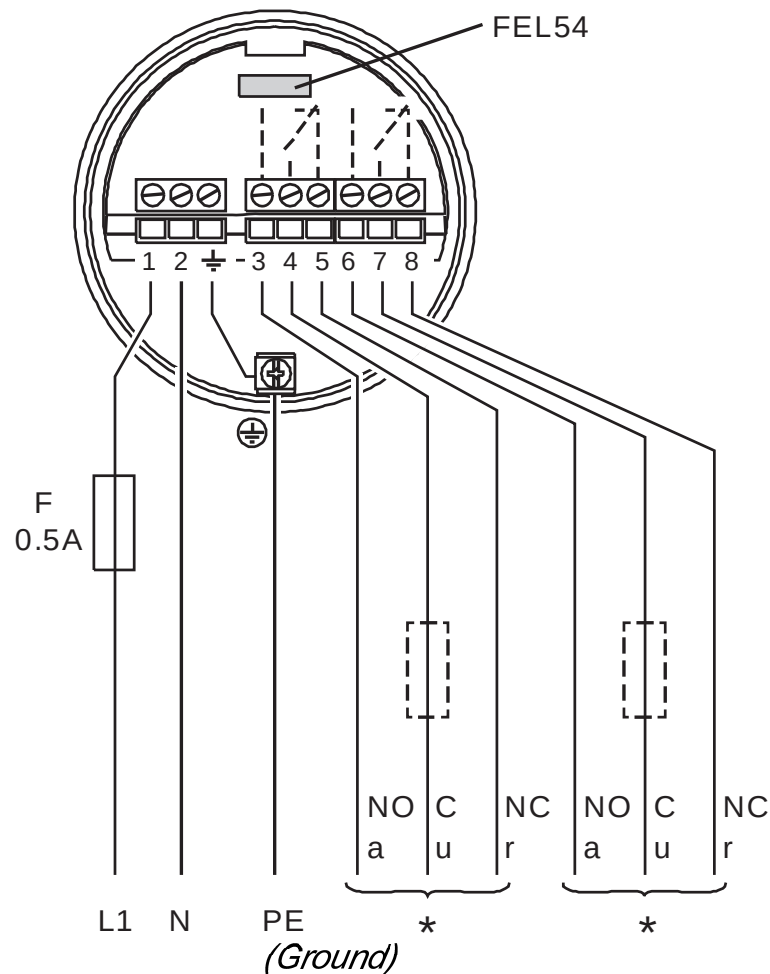
en - Connections FEL54
Universal connection
Relay output

fr - Raccordement FEL54
Tous courants
Sorties relais

es - Conexiones FEL54
Conexión universal
Salida por relé

it - Collegamenti elettrici FEL54
Collegamento corrente universale
Uscita relè

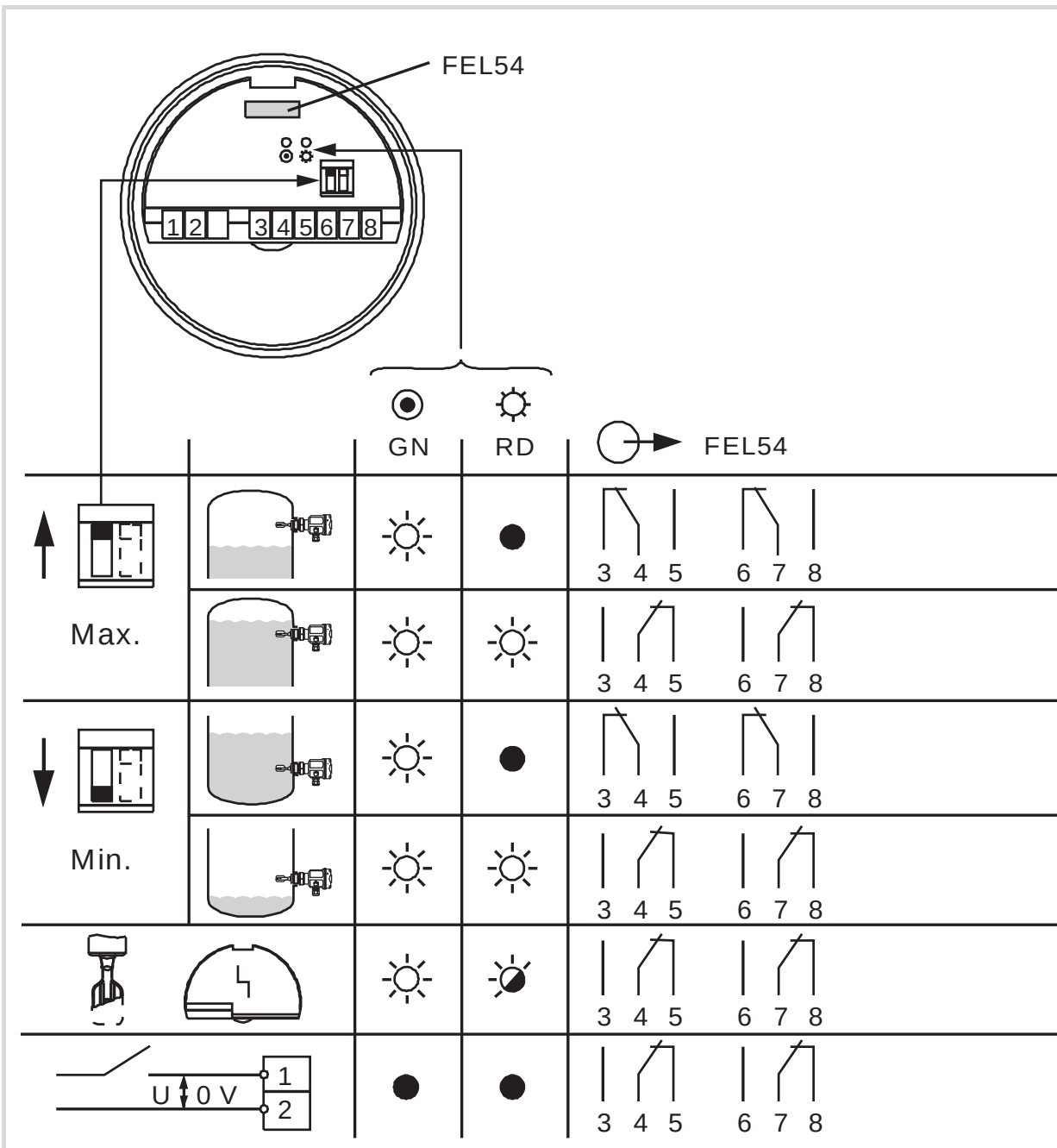
nl - Aansluiting FEL54
Universele spanningsaansluiting
Relaisuitgang



U~ 19 253 V (AC)

L+ L-
U- 19 55 V (DC)

$\left\{ \begin{array}{l} U\sim \text{max. } 253 \text{ V, } I\sim \text{max. } 6 \text{ A} \\ P\sim \text{max. } 1500 \text{ VA, } \cos \varphi = 1 \\ * \left\{ \begin{array}{l} P\sim \text{max. } 750 \text{ VA, } \cos \varphi > 0.7 \\ I\sim \text{max. } 6 \text{ A, } U- < 30 \text{ V} \\ I\sim \text{max. } 0.2 \text{ A, } U- < 125 \text{ V} \end{array} \right. \end{array} \right.$



de - Funktion FEL54
en - Function FEL54
fr - Fonction FEL54
es - Funcionamiento FEL54
it - Funzione FEL54
nl - Functie FEL54

de - Anschluss FEL55

Ausgang
8/16 mA

en - Connections FEL55

Output
8/16 mA

fr - Raccordement FEL55

Sortie
8/16 mA

es - Conexiones FEL55

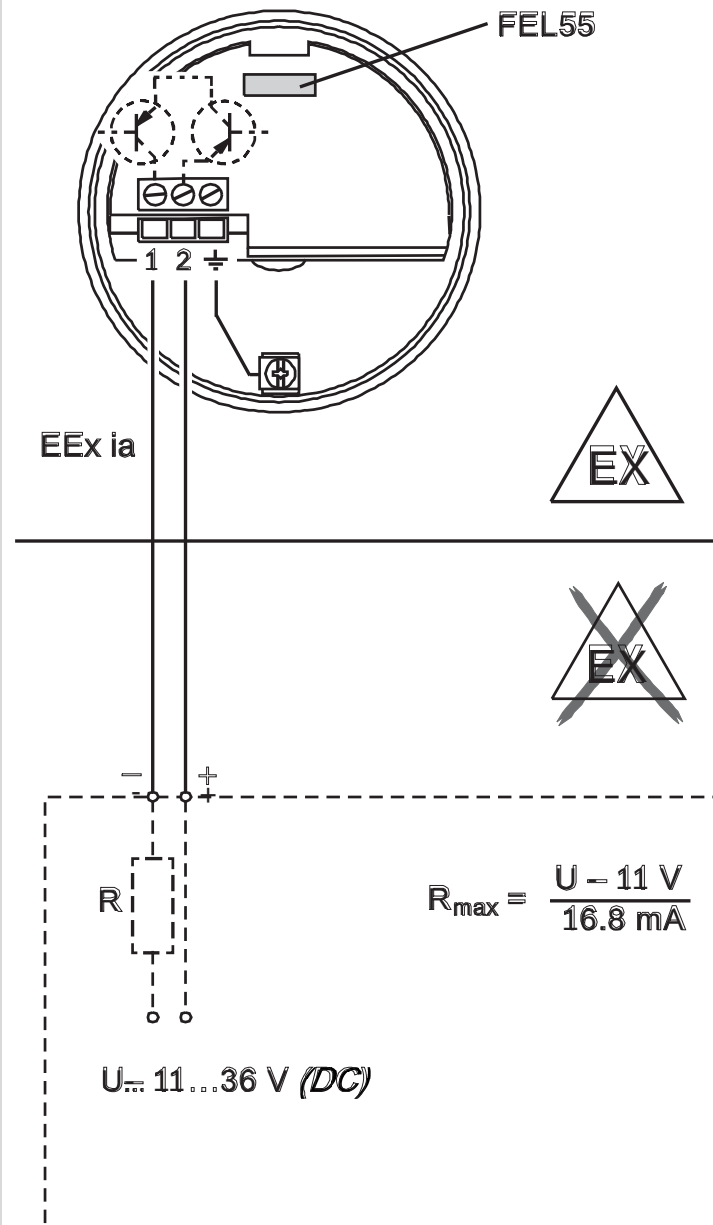
Salida
8/16 mA

it - Collegamenti elettrici FEL55

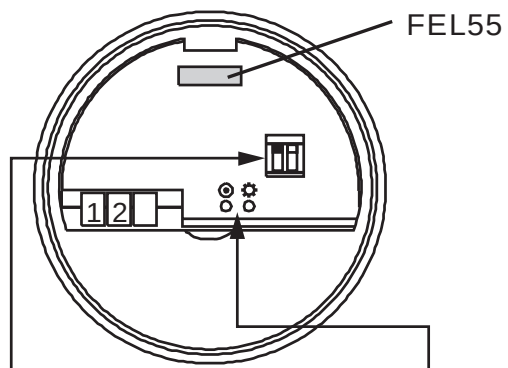
Uscita
8/16 mA

nl - Aansluiting FEL55

Uitgang
8/16 mA



z.B. SPS, AI-Module
e. g. PLC, AI modules
p. e. API, modules AI
por ej. PLC, módulos AI
p. e. PLC, AI modules
bijv. PLC, AI-module
4...20 mA
EN 61131-2



		GN	RD	FEL55
 Max.				$+ [2] \xrightarrow{\sim 16 \text{ mA}} [1]$
				$+ [2] \xrightarrow{\sim 8 \text{ mA}} [1]$
 Min.				$+ [2] \xrightarrow{\sim 16 \text{ mA}} [1]$
				$+ [2] \xrightarrow{\sim 8 \text{ mA}} [1]$
				$+ [2] \xrightarrow{\leq 3.6 \text{ mA}} [1]$

- de** - Funktion FEL55
- en** - Function FEL55
- fr** - Fonction FEL55
- es** - Funcionamiento FEL55
- it** - Funzione FEL55
- nl** - Functie FEL55

de - Anschluss FEL56
NAMUR- Ausgang L-H
< 1,0 mA / > 2,2 mA

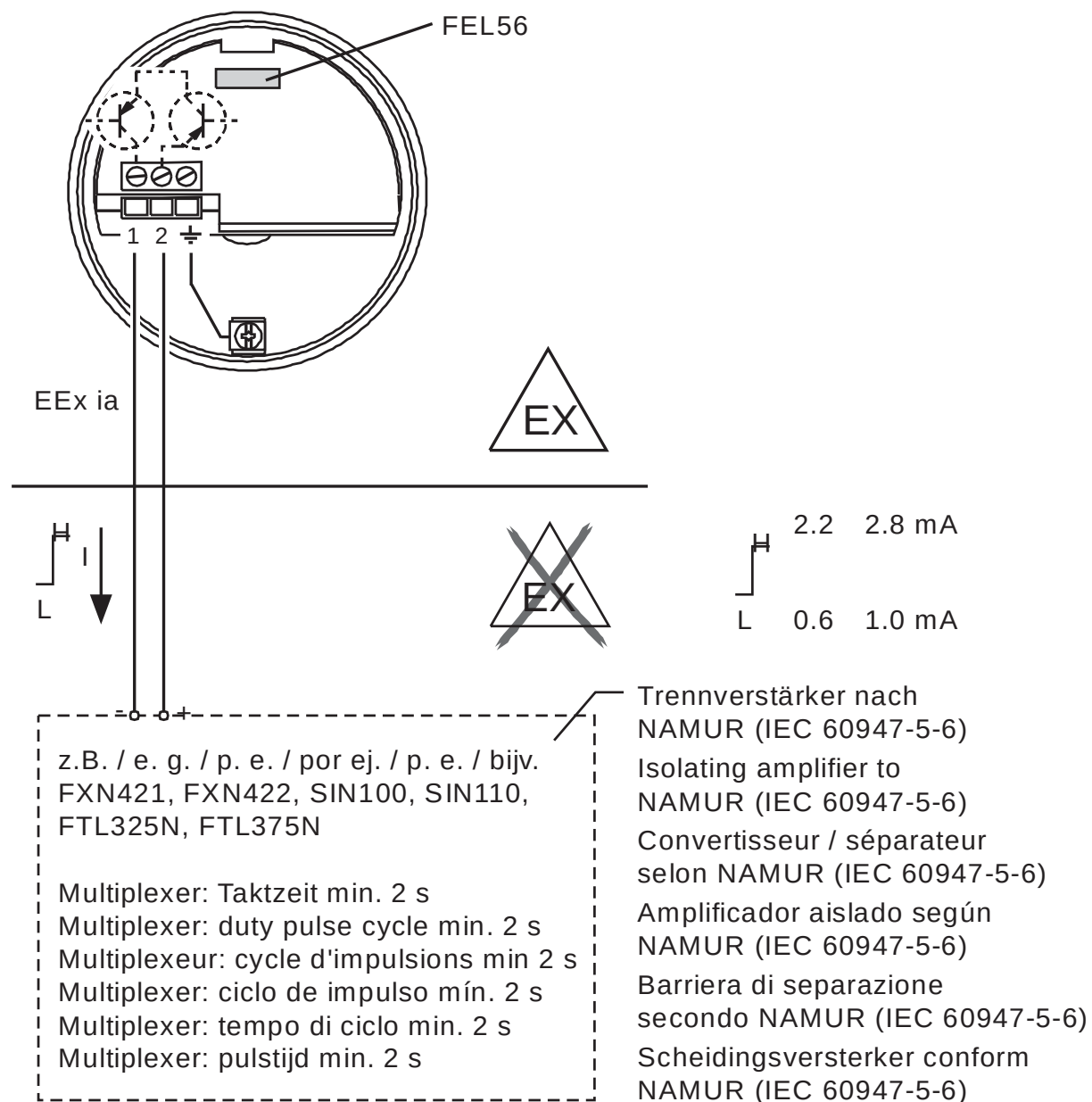
en - Connections FEL56
NAMUR output L-H
< 1,0 mA / > 2,2 mA

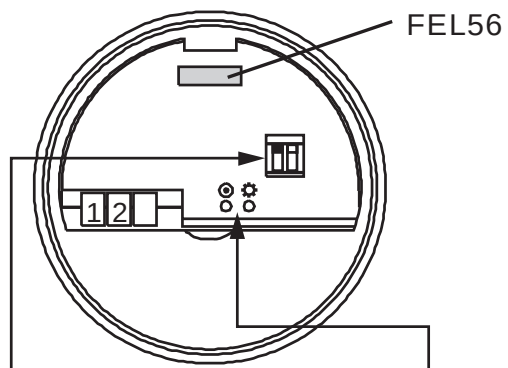
fr - Raccordement FEL56
Sortie NAMUR L-H
< 1,0 mA / > 2,2 mA

es - Conexiones FEL56
Salida NAMUR L-H
< 1,0 mA / > 2,2 mA

it - Collegamenti elettrici FEL56
NAMUR uscita L-H
< 1,0 mA / > 2,2 mA

nl - Aansluiting FEL56
NAMUR uitgang L-H
< 1,0 mA / > 2,2 mA





		GN	RD	FEL56
 Max.				$+ \boxed{2} \xrightarrow[1.0 \text{ mA}]{0.6} \boxed{1}$
				$+ \boxed{2} \xrightarrow[2.8 \text{ mA}]{2.2} \boxed{1}$
 Min.				$+ \boxed{2} \xrightarrow[1.0 \text{ mA}]{0.6} \boxed{1}$
				$+ \boxed{2} \xrightarrow[2.8 \text{ mA}]{2.2} \boxed{1}$
				$+ \boxed{2} \xrightarrow[2.8 \text{ mA}]{2.2} \boxed{1}$

de - Funktion FEL56
en - Function FEL56
fr - Fonction FEL56
es - Funcionamiento FEL56
it - Funzione FEL56
nl - Functie FEL56

de - Anschluss FEL57

Ausgang PFM
150 Hz / 50 Hz

en - Connections FEL 57

PFM output
150 Hz / 50 Hz

fr - Raccordement FEL57

Sortie PFM
150 Hz / 50 Hz

es - Conexiones FEL57

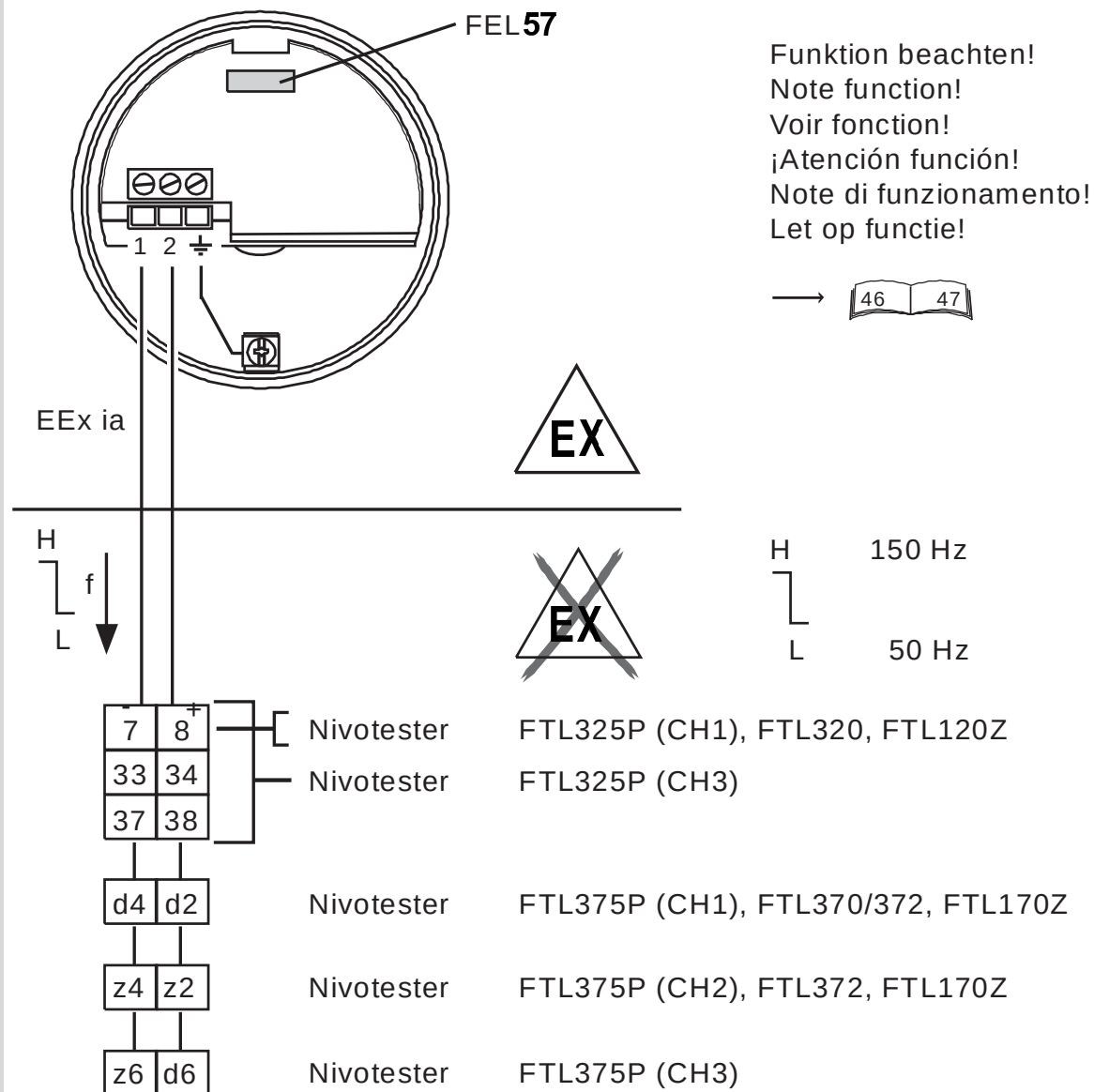
Salida PFM
150 Hz / 50 Hz

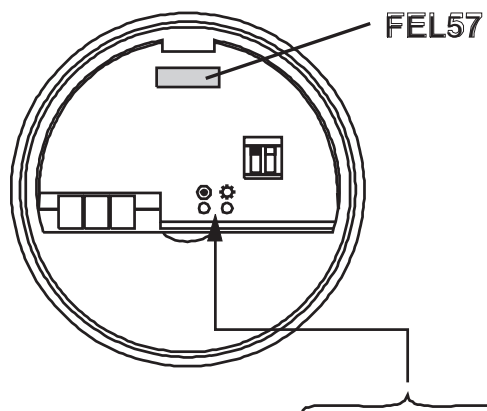
it - Collegamenti elettrici FEL57

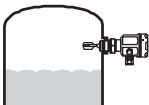
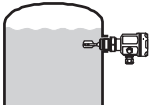
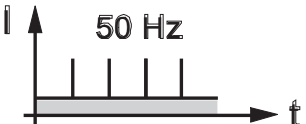
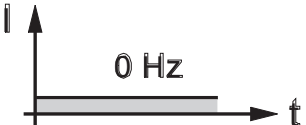
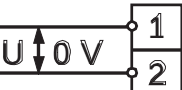
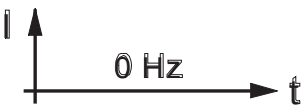
PFM uscita
150 Hz / 50 Hz

nl - Aansluiting FEL57

PFM uitgang
150 Hz / 50 Hz





	 GN	 YE	 FEL57
			
			
 			
 			

* Einschaltverhalten / Switch-on behaviour /
Comportement à la mise sous tension / Comportamiento del cambio de estado /
Comportamento accensione / Inschakelgedrag



de - Funktion FEL57
en - Function FEL57
fr - Fonction FEL57
es - Funcionamiento FEL57
it - Funzione FEL57
nl - Functie FEL57

de - Einschaltverhalten
Selbsttest (STD)

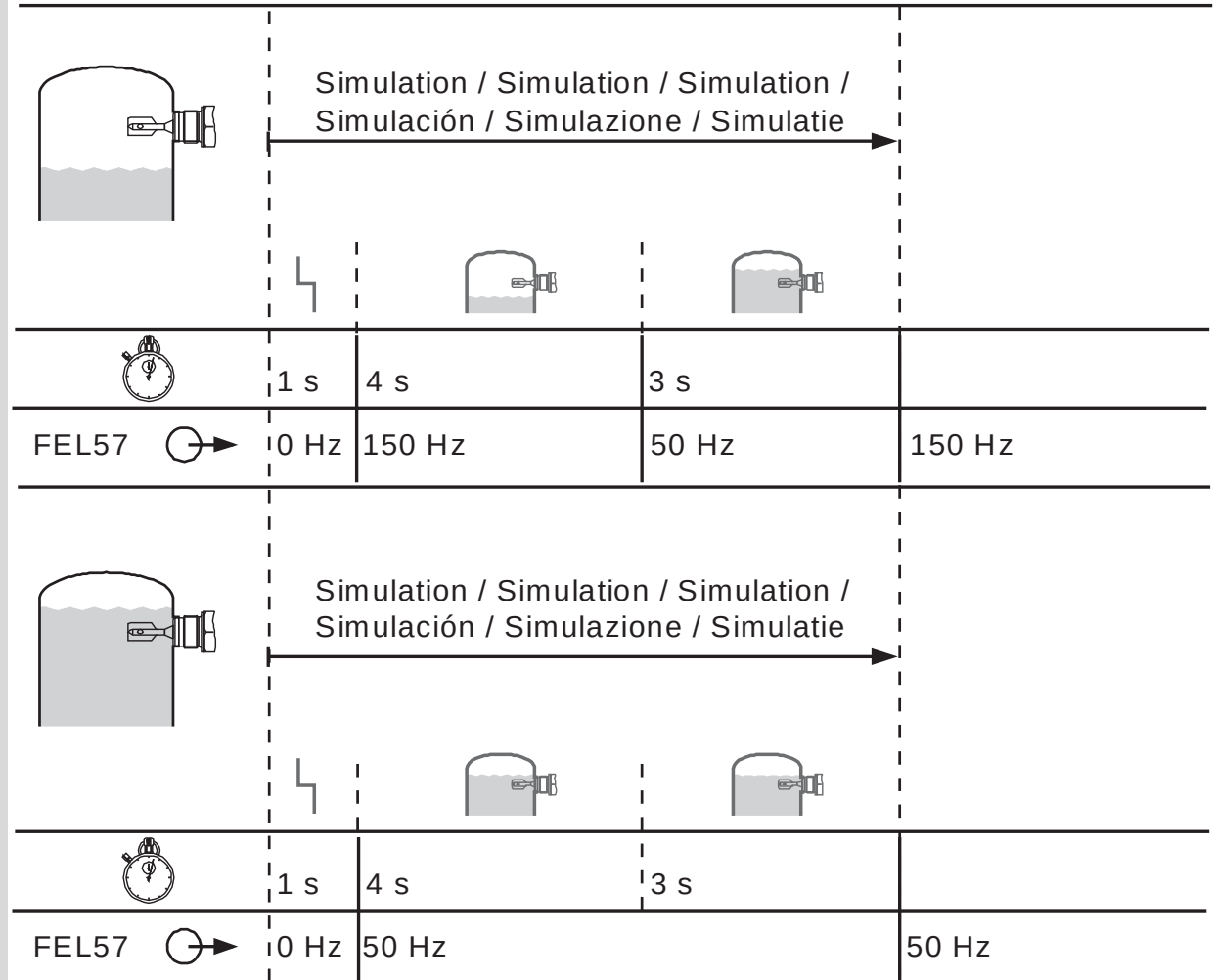
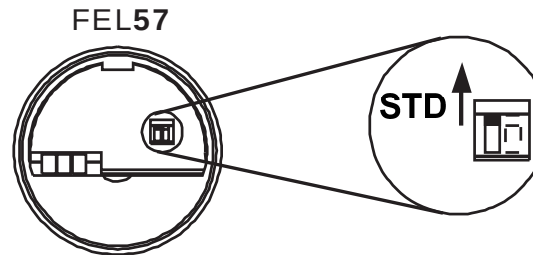
en - Switch-on behaviour
Selftest (STD)

fr - Comportement à la mise
sous tension
Auto-test (STD)

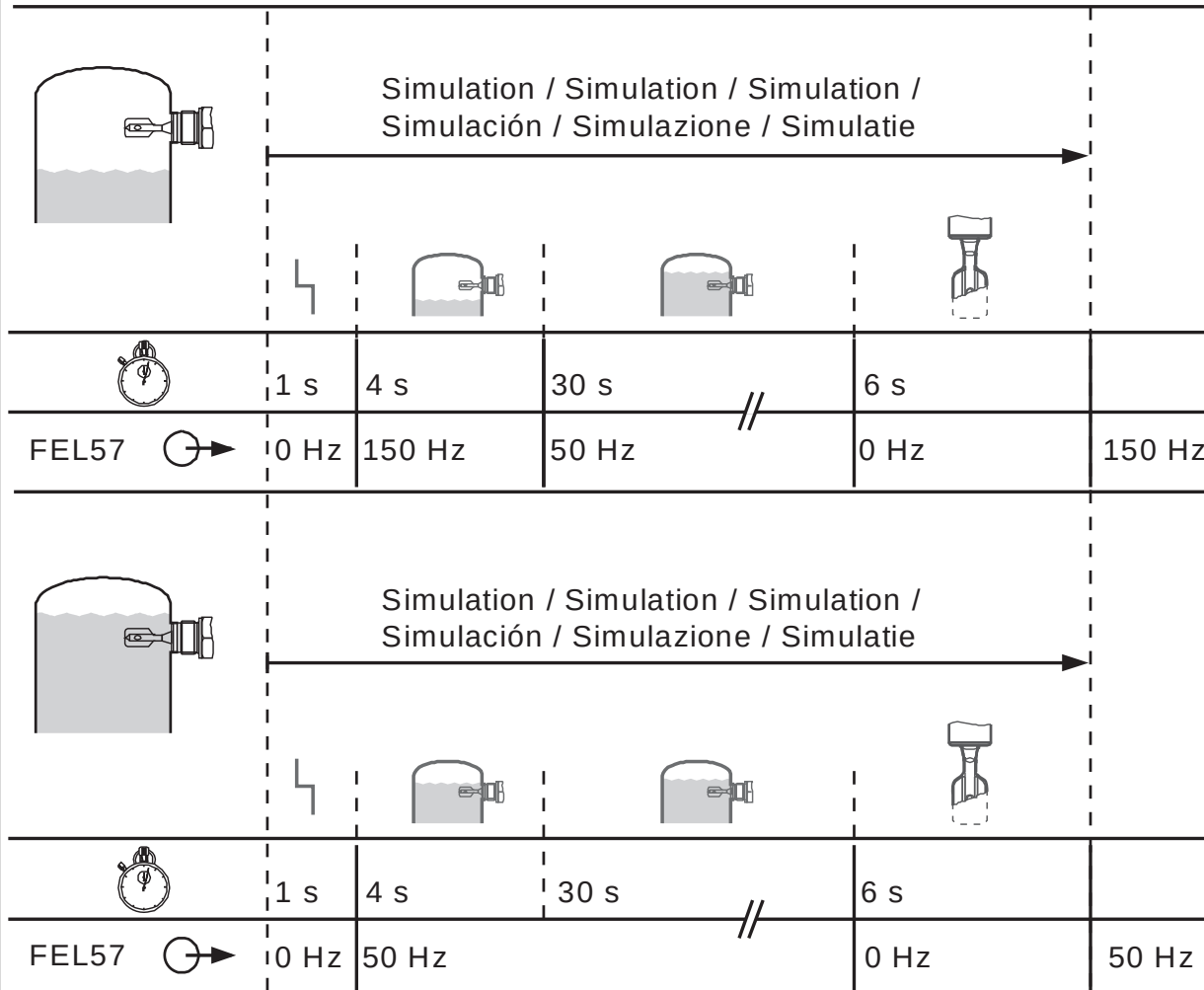
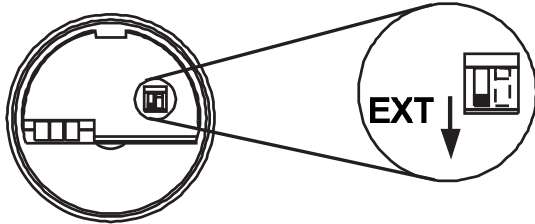
es - Comportamiento del cambio
de e stado
Prueba automática (STD)

it - Comportamento in fase di
accensione
Prova automatica (STD)

nl - Inschakelgedrag
Functietest (STD)



FEL57



de - Einschaltverhalten
Selbsttest (EXT)

en - Switch-on behaviour
Selftest (EXT)

fr - Comportement à la mise
sous tension
Auto-test (EXT)

es - Comportamiento del cambio
de e stado
Prueba automática (EXT)

it - Comportamento in fase di
accensione
Prova automatica (EXT)

nl - Inschakelgedrag
Functietest (EXT)

de - Anschluss FEL50A

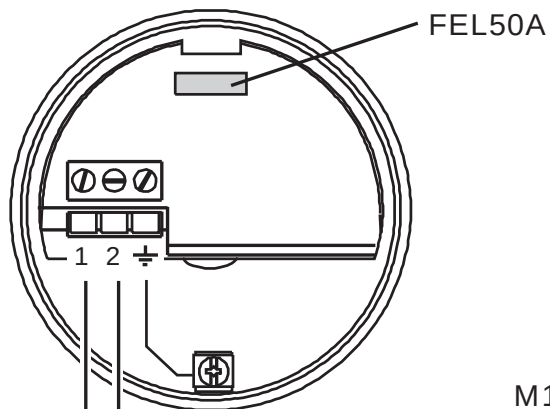
en - Connections FEL50A

fr - Raccordement FEL50A

es - Conexiones FEL50A

it - Collegamenti elettrici FEL50A

nl - Aansluiting FEL50A



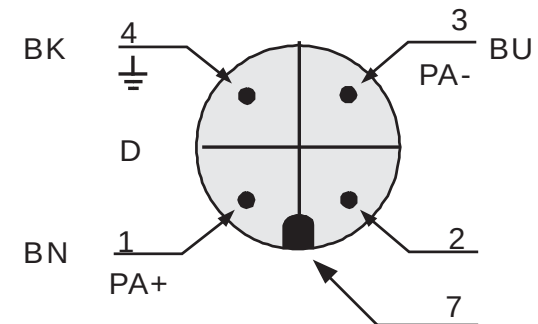
PA- PA+

U_~ 9...32 V (DC)

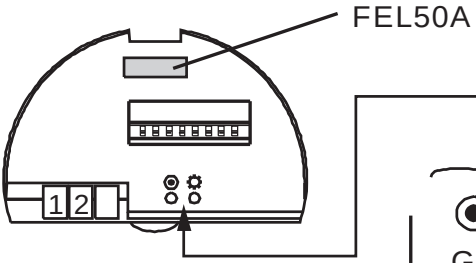
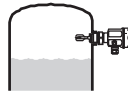
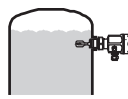
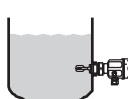
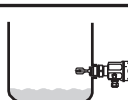
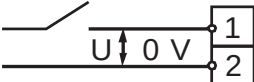
Segmentkoppler
Segment coupler
Coupleur de segments
Acoplador segmento
Segment coupler
Segment koppeling

z.B. SPS / e. g. PLC
p. e. API / por ej. PLC
p. e. PLC / bijv. PLC

M12-Stecker / M12 Plug /
Connecteur M12 / M12 Conector /
Connettore M12 / M12 Connector



Gerätestecker am Gehäuse (male)
Device plug on housing (male)
Connecteur d'appareil sur le boîtier (mâle)
Conector del equipo en cabezal (macho)
Connettore del dispositivo (maschio)
Instrumentstecker op behuizing (male)

				PA-Bussignal / PA Bus Signal / Signal bus PA / Señal Bus PA / Segnale bus PA / PA bussignaal	
		 GN	 YE		
nicht invertiert not inverted non inversé no invertido non invertito niet geïnverteerd				OUT_D = 0	
				OUT_D = 1	
invertiert inverted inversé invertido invertito geïnverteerd				OUT_D = 0	
				OUT_D = 1	
			-	Kommunikation/ Communication/ Communication / Comunicación / Comunicazione / Communicatie	
		-		Status siehe BA141F Status, see BA141F Etat, voir BA141F Estado, ver BA141F Stato, vedere BA141F Status, zie BA141F	
				../..	

de - Funktion FEL50A
en - Function FEL50A
fr - Fonction FEL50A
es - Funcionamiento FEL50A
it - Funzione FEL50A
nl - Functie FEL50A

de - Anschluss FEL58
NAMUR- Ausgang H-L
> 2,2 mA / < 1,0 mA

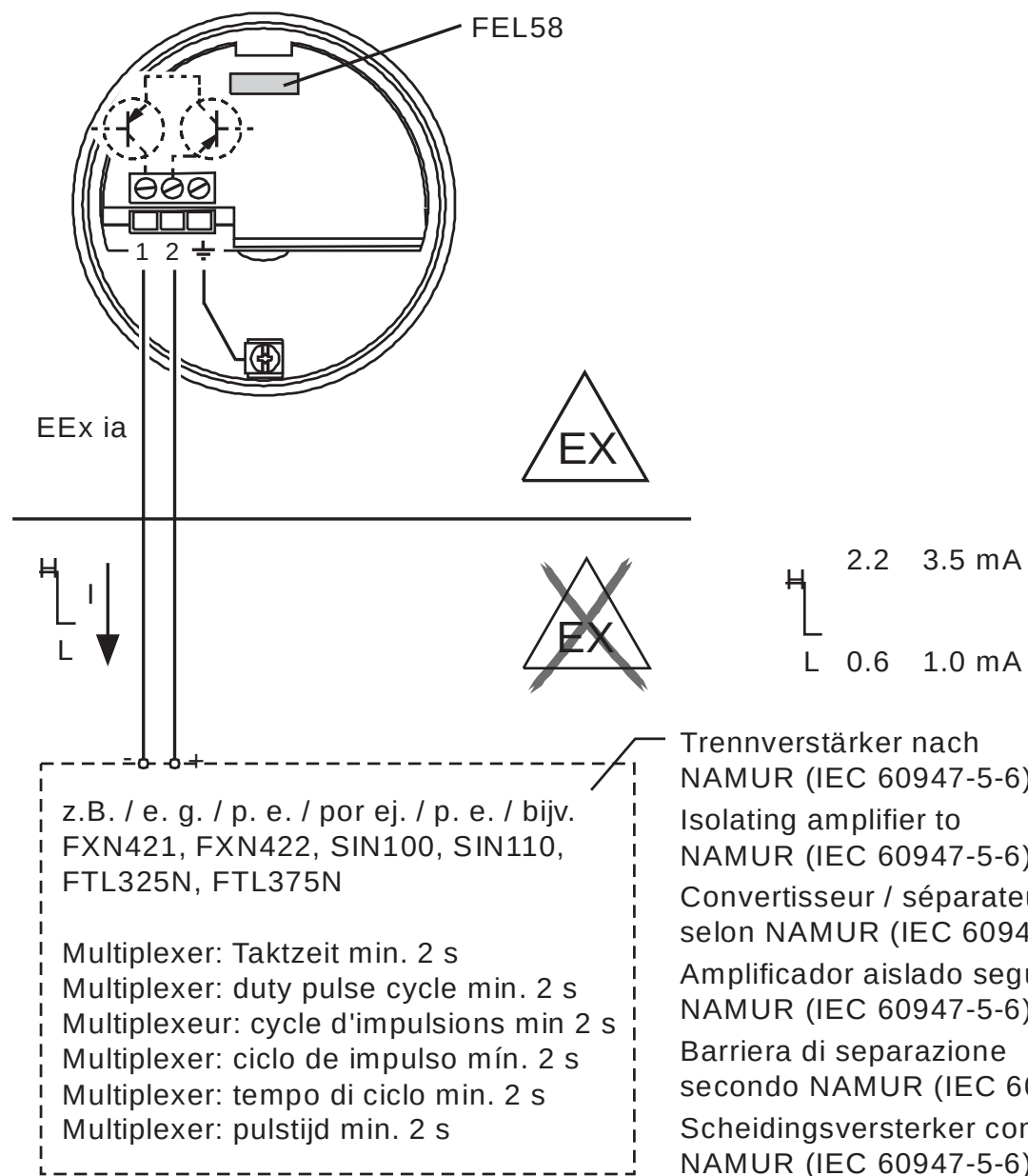
en - Connections FEL58
NAMUR output H-L
> 2,2 mA / < 1,0 mA

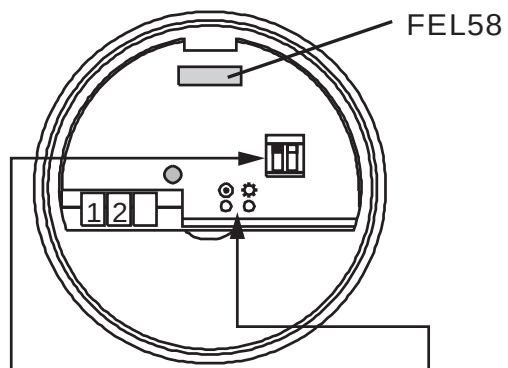
fr - Raccordement FEL58
Sortie NAMUR H-L
> 2,2 mA / < 1,0 mA

es - Conexiones FEL58
Salida NAMUR H-L
> 2,2 mA / < 1,0 mA

it - Collegamenti elettrici FEL58
NAMUR uscita H-L
> 2,2 mA / < 1,0 mA

nl - Aansluiting FEL58
NAMUR uitgang H-L
> 2,2 mA / < 1,0 mA

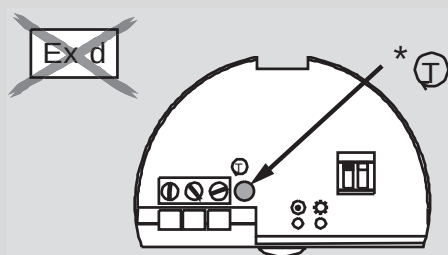




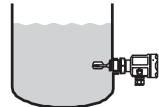
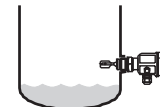
- de** - Funktion FEL58
- en** - Function FEL58
- fr** - Fonction FEL58
- es** - Funcionamiento FEL58
- it** - Funzione FEL58
- nl** - Functie FEL58

		GN	YE	FEL58
 Max.		 1 Hz		$+ \boxed{2} \xrightarrow[3.5 \text{ mA}]{2.2} \boxed{1}$
		 1 Hz		$+ \boxed{2} \xrightarrow[1.0 \text{ mA}]{0.6} \boxed{1}$
 Min.		 1 Hz		$+ \boxed{2} \xrightarrow[3.5 \text{ mA}]{2.2} \boxed{1}$
		 1 Hz		$+ \boxed{2} \xrightarrow[1.0 \text{ mA}]{0.6} \boxed{1}$
		 0.3 Hz		$+ \boxed{2} \xrightarrow[< 1.0 \text{ mA}]{< 1.0 \text{ mA}} \boxed{1}$

- de** - Funktion Prüftaste FEL58
Sicherheitschaltung MAX
- en** - Function test button FEL58
Fail-safe mode MAX
- fr** - Fonction touche test FEL58
Sécurité MAX
- es** - Funcionamiento
botón de prueba FEL58
Conmutador de seguridad MAX
- it** - Funzione pulsante test FEL58
Selezione della modalità di
sicurezza MAX
- nl** - Functie testknop FEL58
Veiligheidsschakeling MAX



  		
1. Normaler Betrieb / Normal operation / Fonctionnement normal / Funcionamiento normal / Funzionamento normale / Normaal bedrijf	GN YE   1 Hz + 2.2... 2 3.5 mA → 1	GN YE   1 Hz + 0.6... 2 1.0 mA → 1
2. Prüftaste drücken / Press test button / Appuyer sur la touche test / Pulse el botón de prueba / Premere il pulsante test / Testknop indrukken	GN YE   + 0 mA 2 - - - - - → 1	GN YE   + 0 mA 2 - - - - - → 1
3. Prüftaste loslassen, nach ~2 s normaler Betrieb / Release the test button, after ~2 s normal operation / Relâcher la touche test, après ~2 s fonctionnement normal / Deje de presionar el botón de prueba, después de ~2 s funcionamiento normal / Rilasciare il pulsante test, dopo ~2 s funzionamento normale / De testknop loslaten, na ~2 s normaal bedrijf	GN YE   1 Hz + 2.2... 2 3.5 mA → 1	GN YE   1 Hz + 0.6... 2 1.0 mA → 1

		
1. Normaler Betrieb / Normal operation / Fonctionnement normal / Funcionamiento normal / Funzionamento normale / Normaal bedrijf	GN YE   1 Hz + 2.2... 2 3.5 mA → 1	GN YE   1 Hz + 0.6... 2 1.0 mA → 1
2. Prüftaste drücken / Press test button / Appuyer sur la touche test / Pulse el botón de prueba / Premere il pulsante test / Testknop indrukken	 GN YE   + 0 mA 2 → 1	GN YE   + 0 mA 2 → 1
3. Prüftaste loslassen, nach ~2 s normaler Betrieb / Release the test button, after ~2 s normal operation / Relâcher la touche test, après ~2 s fonctionnement normal / Deje de presionar el botón de prueba, después de ~2 s funcionamiento normal / Rilasciare il pulsante test, dopo ~2 s funzionamento normale / De testknop loslaten, na ~2 s normaal bedrijf	 GN YE   1 Hz + 2.2... 2 3.5 mA → 1	GN YE   1 Hz + 0.6... 2 1.0 mA → 1

de - Funktion Prüftaste FEL58
Sicherheitschaltung MIN

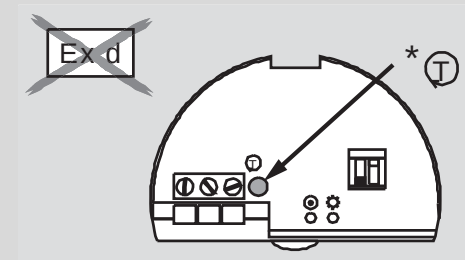
en - Function test button FEL58
Fail-safe mode MIN

fr - Fonction touche test FEL58
Sécurité MIN

es - Funcionamiento
botón de prueba FEL58
Conmutador de seguridad MIN

it - Funzione pulsante test FEL58
Selezione della modalità di
sicurezza MIN

nl - Functie testknop FEL58
Veiligheidsschakeling MIN



de - Wartung, Reinigung

Anbackungen entfernen

en - Maintenance, Cleaning

Removal of encrustation

fr - Entretien, Nettoyage

Enlever les incrustations

es - Mantenimiento, Limpieza

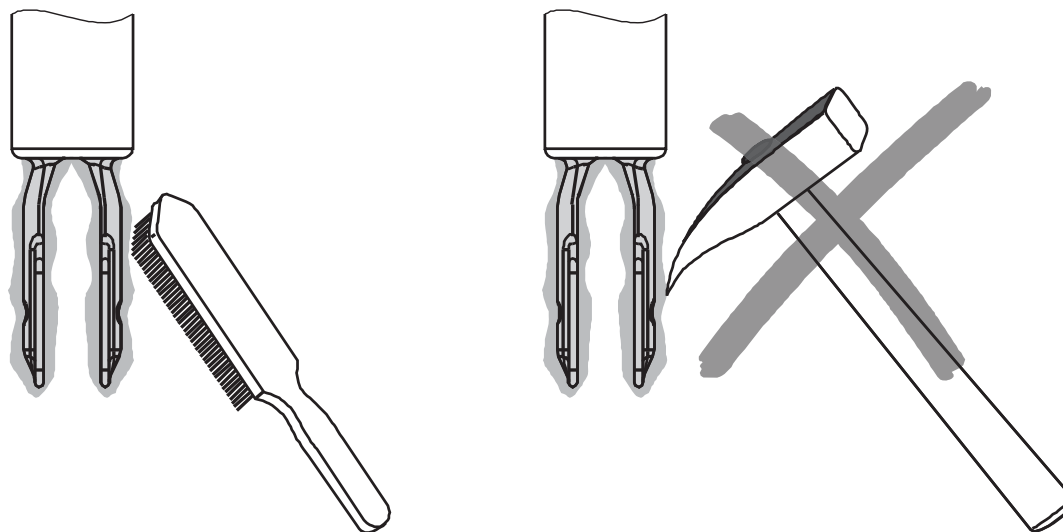
Eliminación de adherencias

it - Manutenzione, Pulizia

Rimozione dei depositi

nl - Onderhoud, Reiniging

Aangroei verwijderen



Nicht besteigen!

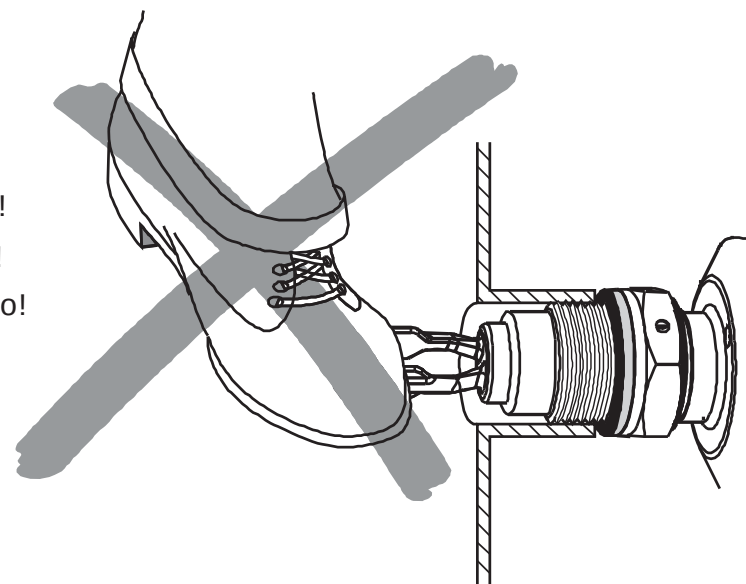
Don't use as a step!

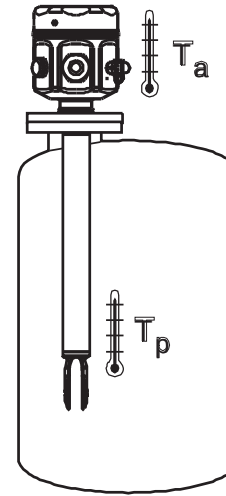
Ne pas marcher
sur les lames vibrantes!

No usar como peldaño!

Non usare come scalino!

Niet op staan!





de - Technische Daten

Umgebungstemperatur T_a

Prozesstemperatur T_p

en - Technical Data

Ambient temperature T_a

Process temperature T_p

fr - Caractéristiques techniques

Température ambiante T_a

Température de process T_p

es - Datos técnicos

Temperatura ambiente T_a

Temperatura del proceso T_p

it - Dati tecnici

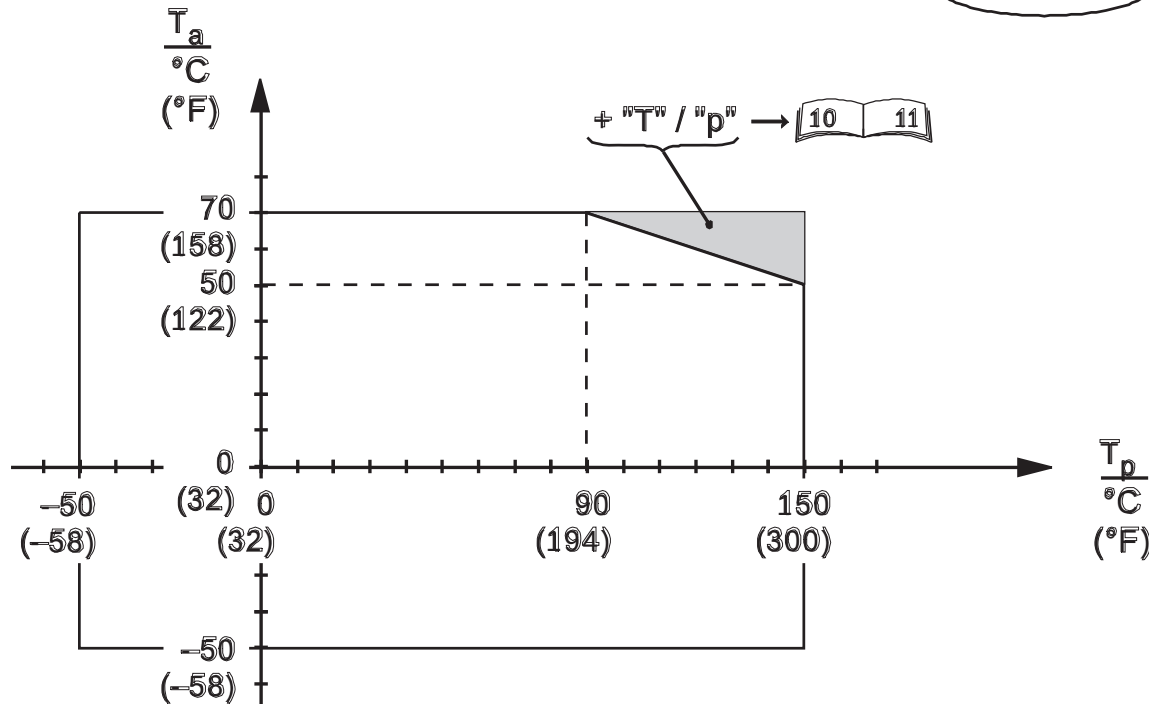
Temperatura ambiente T_a

Temperatura di processo T_p

nl - Technische gegevens

Omgevingstemperatuur T_a

Procestemperatuur T_p



de - Prozessdruck p_e
 Prozesstemperatur T_p

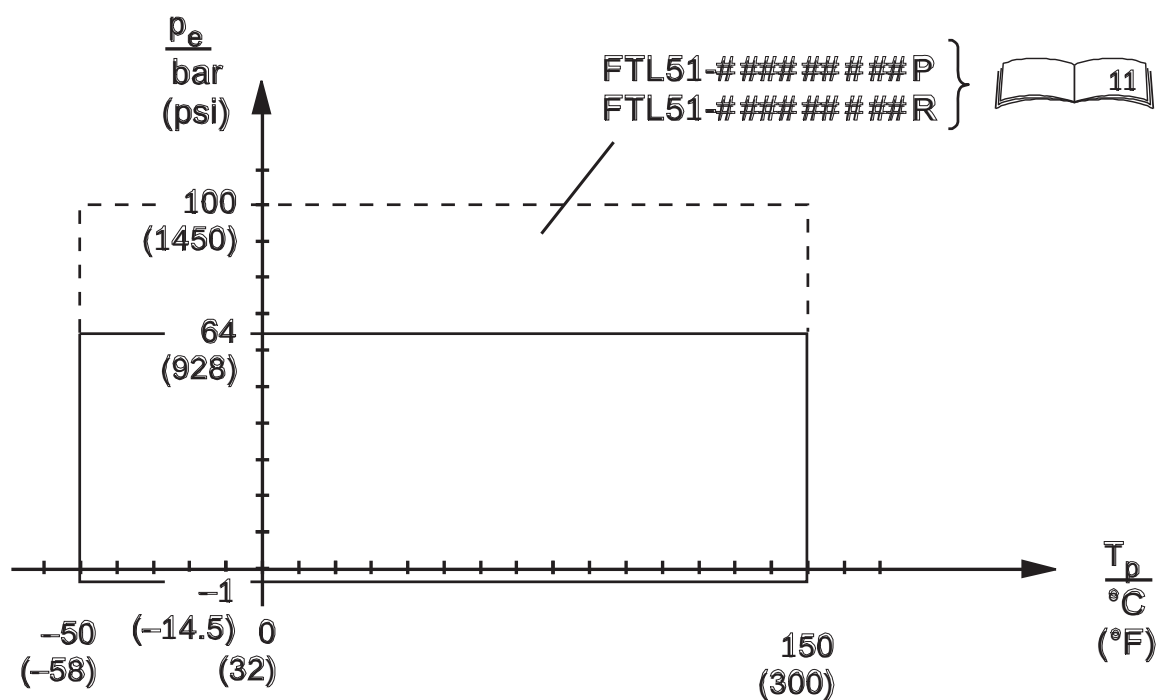
en - Process pressure p_e
 Process temperature T_p

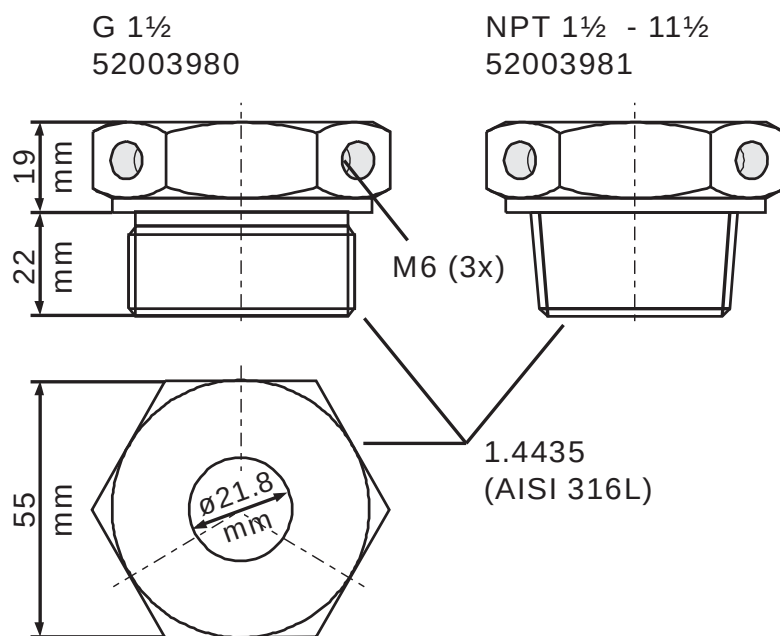
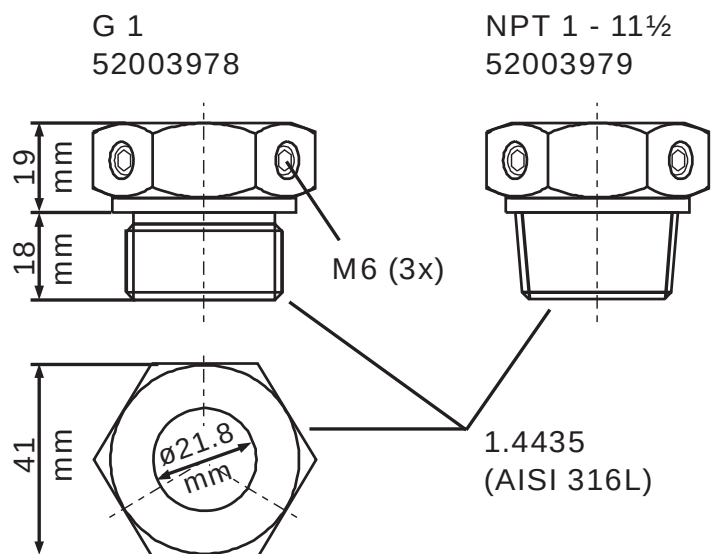
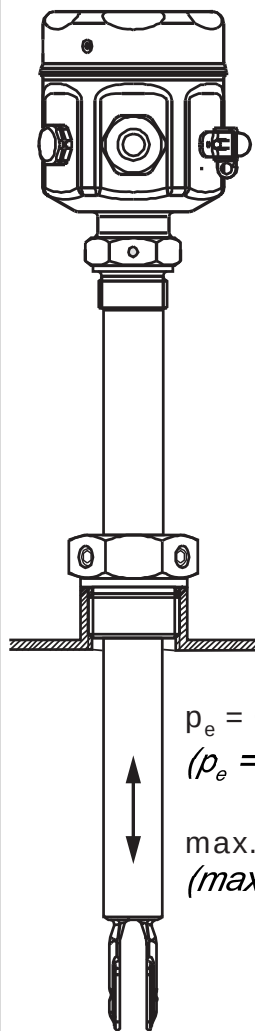
fr - Pression de process p_e
 Température de process T_p

es - Presión del proceso p_e
 Temperatura del proceso T_p

it - Pressione di processo p_e
 Temperatura di processo T_p

nl - Procesdruk p_e
 Procestemperatuur T_p





de - Zubehör

Schiebemuffen für drucklosen Betrieb

en - Accessories

Sliding sleeves for unpressurised operation

fr - Accessoires

Manchons coulissants pour applications sans pression

es - Accesorios

Manguitos deslizantes para operación sin presión

it - Accessori

Manicotto scorrevole per impieghi privi di pressione

nl - Toebehoren

Schuifmof voor drukloze toepassing

siehe / see / voir / ver / vedi / zie :

KA151F (G 1, NPT 1)

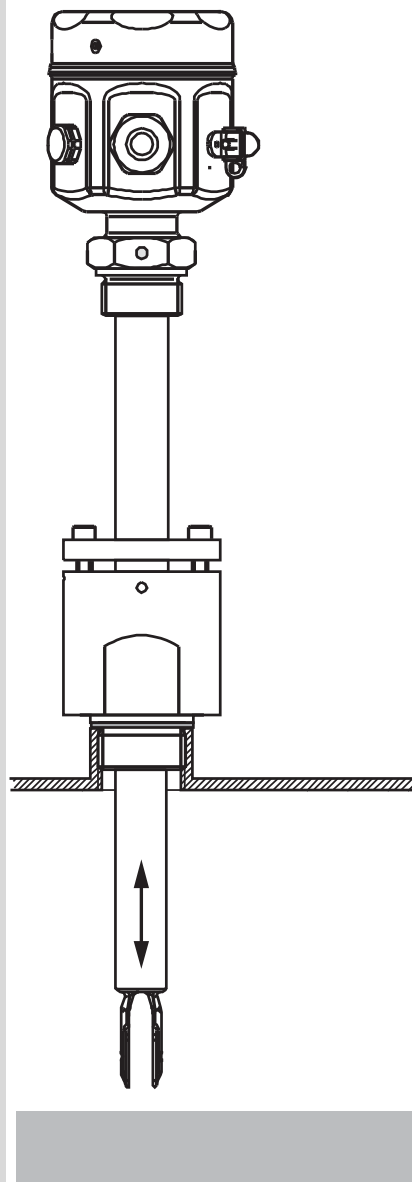
KA152F (G 1 1/2, NPT 1 1/2)

100 mm = 3.94 in

de - Hochdruck-Schiebemuffen
en - High pressure sliding sleeves
fr - Manchons coulissants
 haute pression
es - Manguitos deslizantes
 para alta presión
it - Manicotto scorrevole
 per impieghi ad alta pressione
nl - Schuifmof
 voor toepassing onder druk

siehe / see / voir / ver / vedi / zie :
 KA153F (G 1, NPT 1)
 KA154F (G 1½, NPT 1½)

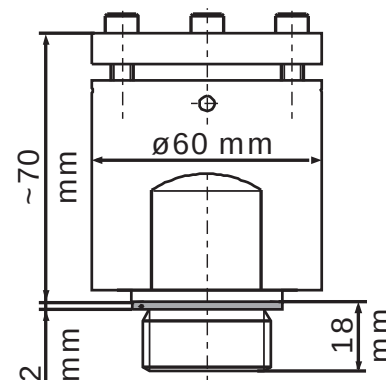
100 mm = 3.94 in



G 1

1.4435 (AISI 316L)
 52003663

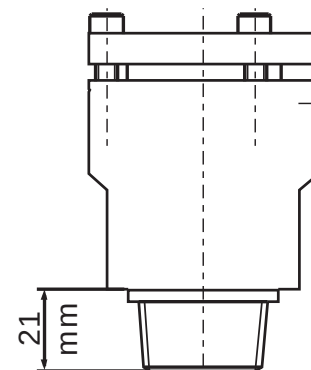
AlloyC4: 52003664
 AlloyC22: 71118691



NPT 1 - 11½

1.4435 (AISI 316L)
 52003667

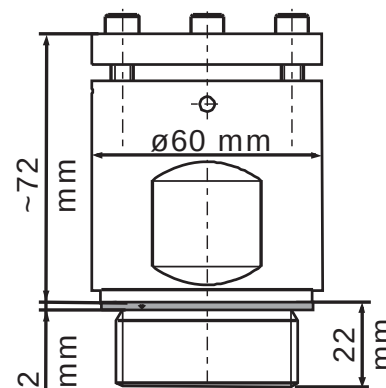
AlloyC4: 52003668
 AlloyC22: 71118694



G 1½

1.4435 (AISI 316L)
 52003665

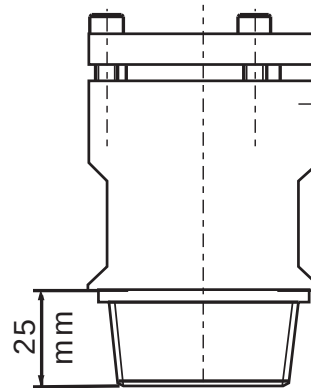
AlloyC4: 52003666
 AlloyC22: 71118693

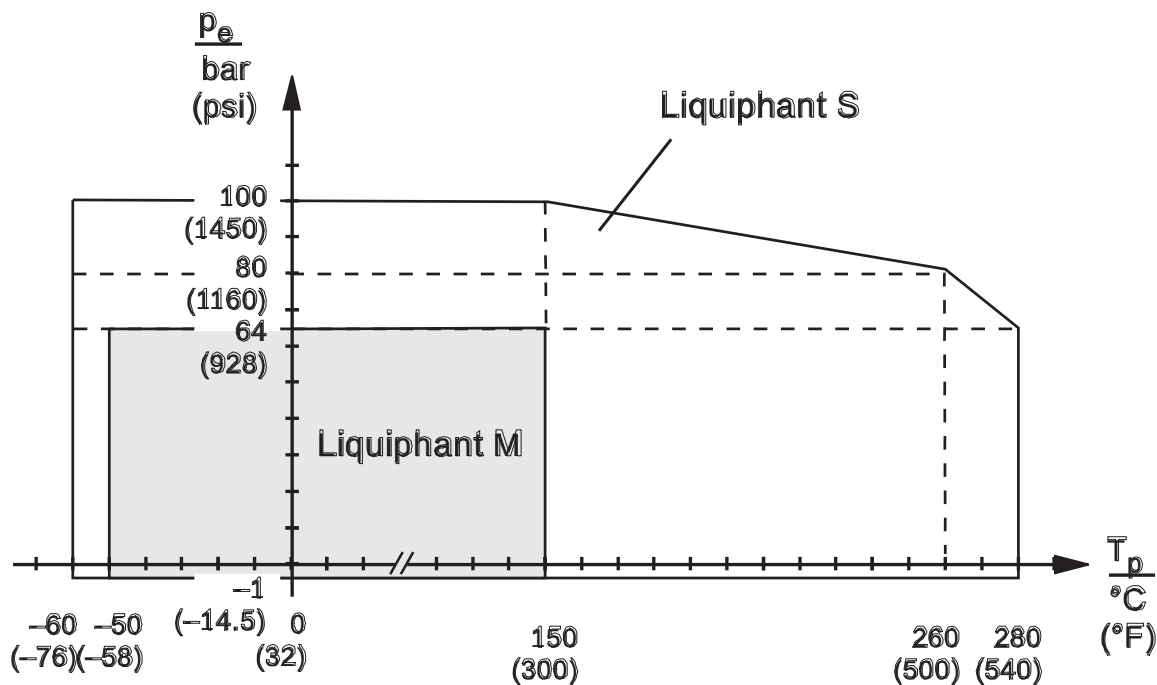


NPT 1½ - 11½

1.4435 (AISI 316L)
 52003669

AlloyC4: 52003670
 AlloyC22: 71118695





- de** - Hochdruck-Schiebemuffen:
Prozessdruck p_e
Prozesstemperatur T_p
- en** - High pressure sliding sleeves:
Process pressure p_e
Process temperature T_p
- fr** - Manchons coulissants
haute pression:
Pression de process p_e
Température de process T_p
- es** - Manguitos deslizantes
para alta presión:
Presión del proceso p_e
Temperatura del proceso T_p
- it** - Manicotto scorrevole
per impieghi ad alta pressione:
Pressione di processo p_e
Temperatura di processo T_p
- nl** - Schuifmof
voor toepassing onder druk:
Procesdruk p_e
Procestemperatuur T_p

de - Fehlersuche

Fehlfunktion	Ursache	Maßnahme
Schaltet nicht	Versorgungsspannung fehlt	Versorgung prüfen
	Signalleitung defekt	Signalleitung prüfen
	Elektronikeinsatz defekt - FEL51 direkt an L1 und N angeschlossen	Austauschen - FEL51 immer über externe Last anschließen
	Dichte der Flüssigkeit zu gering	Am Elektronikeinsatz Dichte auf > 0,5 einstellen
	Schwinggabel verkrustet	Schwinggabel säubern
	Schwinggabel korrodiert (Anzeige am FEL: rot/gelb blinkt, FEL58: grün blinkt 0,3 Hz)	Schwinggabel komplett mit Prozessanschluss austauschen
	FEL51: Relais mit zu großem Innenwiderstand angeschlossen	Geeignetes Relais anschließen
	FEL51: Relais mit zu geringem Haltestrom angeschlossen	Widerstand parallel zum Relais anschließen
	FEL54: Kontakte verschweißt (nach einem Kurzschluss)	FEL54 austauschen; Sicherung in den Kontaktstromkreis
Schaltet falsch	Minimum-/Maximum- Sicherheits-schaltung vertauscht	Am Elektronikeinsatz Sicherheitsschaltung richtig einstellen
Fehlschaltung, sporadisch	Dichter schwerer Schaum, wilde Turbulenzen, aufgeschäumte Flüssigkeit	Liquiphant im Bypass montieren
	Extreme Funkstörung	Verbindungskabel abschirmen
	Extreme Vibrationen	Entkoppeln, dämpfen, Schwinggabel 90° drehen
	Wasser im Gehäuse	Deckel und Kabeldurchführungen fest zuschrauben
	FEL52: Ausgang überlastet	Last, (Leitungs-) Kapazität verringern
Fehlschaltung nach Netzausfall	FEL57, Verhalten beim Einschalttest (wiederkehrende Prüfung)	Schaltverhalten FEL57 beachten; Anlagensteuerung nach Netzausfall bis ca. 45 s blockieren

Fault	Reason	Remedy
Does not switch	No power	Check power
	Faulty signal line	Check signal line
	Faulty electronic insert - FEL51 connected directly to L1 and N	Exchange - always connect FEL51 via external load
	Density of liquid too low	Set density to > 0.5 at electronic insert
	Fork encrusted	Clean fork
	Fork corroded (Indication on FEL: red/yellow flashes, FEL58: green flashes 0.3 Hz)	Exchange fork and process connection
	FEL51: Internal resistance of connected relay too large	Connect suitable relay
	FEL51: Holding current of connected relay too low	Connected resistor in parallel with relay
	FEL54: Contacts welded together (after short-circuit)	Exchange FEL54; put fuse in contact circuit
Switches incorrectly	Min-/Max- fail-safe mode set wrongly	Set correct mode at electronic insert
Sporadic faulty switching	Thick heavy foam, very turbulent conditions, foaming liquid	Mount Liquiphant in bypass
	Extreme RFI	Use screened cable
	Extreme vibration	Decouple, damp, turn fork 90°
	Water in housing	Screw cover and cable gland tight
	FEL52: Output overloaded	Reduce load, (cable) capacitance
Switches incorrectly after power failure	FEL57, behaviour during switch-on test (functional test)	Observe switching behaviour of FEL57; After power failure blockplant control for up to 45 s

en - Trouble-shooting

fr - Recherche de défauts

Défaut	Cause	Mesure
Ne commute pas	Tension d'alimentation manquante	Vérifier la tension d'alimentation
	Câble de signal défectueux	Vérifier le câble de signal
	Electronique défectueuse - FEL51 relié directement à L1 et N	Remplacer - Relier FEL51 toujours via la charge externe
	Densité du liquide trop faible	Régler la densité sur > 0,5 sur l'électronique
	Lames vibrantes encroûtées	Nettoyer les lames vibrantes
	Lames vibrantes corrodées (Sur FEL: rouge/jaune clignote, FEL58: vert clignote 0,3 Hz)	Remplacer les lames vibrantes ainsi que le raccord process
	FEL51: relais avec résistance interne trop élevée	Raccorder un relais approprié
	FEL51: relais avec courant de maintien trop faible	Raccorder une résistance en parallèle au relais
	FEL54: contacts soudés (après un court-circuit)	Remplacer FEL54; fusible dans le circuit courant
Mauvaise commutation	Sécurité min/max inversée	Régler correctement le circuit de sécurité sur l'électronique
Mauvaise commutation, sporadique	Mousse dense et lourde, fortes turbulences, liquide émulsionné	Monter le Liquiphant en bypass
	Parasites puissants	Blinder le câble de liaison
	Vibrations importantes	Découpler, amortir, tourner la fourche de 90°
	Eau dans le boîtier	Visser fermement le couvercle et les entrées de câble
	FEL52: surcharge de la sortie	Réduire la charge et la capacité (de ligne)
Mauvaise commutation après coupure	FEL57, comportement lors du test de mise sous tension (test cyclique)	Observer le comportement du FEL57 à la mise sous tension; bloquer la commande de l'installation après coupure de courant pendant max. 45 s

Fallo	Causa	Solución
No conmuta	No hay alimentación	Comprobar alimentación
	Señal defectuosa	Comprobar cable de señal
	Electrónica defectuosa - FEL51 conectada directamente a L1 y N	Cambio - Siempre conectar FEL51 vía una carga externa
	Densidad del líquido demasiado baja	Fijar densidad a > 0.5 en la electrónica
	Horquillas con adherencias	Limpiar horquillas
	Horquillas corroidas (En FEL: rojo/amarillo parpadea, FEL58: verde parpadea 0.3 Hz)	Cambiar la horquilla y la conexión a proceso
	FEL51: Relé con resistencia interna demasiado grande	Conectar un relé adecuado
	FEL51: El relé conectado retiene muy poca corriente	Resistencia conectada en paralelo con el relé
	FEL54: Contactos soldados juntos (después del corto circuito)	Cambiar FEL54; poner fusible en el circuito de contacto
Conmuta incorrectamente	El modo de fallo mín./máx. está mal ajustado	Ajustar el modo correcto en la electrónica
Fallos de conmutación esporádicos	Espuma muy densa, turbulencias, líquidos espumosos	Montar el Liquiphant en bypass
	RFI extremo	Utilizar cable apantallado
	Vibraciones extremas	Desacoplar, amortiguar y girar las horquillas 90°
	Agua en el cabezal	Roscar la cubierta y el prensaestopas firmemente
	FEL52: Salida con sobretensión	Reducir carga, capacidad (cable)
Conmuta incorrectamente después de un fallo de alimentación	FEL57, comportamiento durante la comprobación de conmutación (test de funcionamiento)	Observar el comportamiento de conmutación del FEL57; del fallo de alimentación, bloqueo del control de la planta durante 45 s aprox.

es - Identificación de fallos

it - Individuazione e eliminazione delle anomalie

Guasto	Motivo	Rimedio
Non commuta	Mancanza alimentazione	Controllare l'alimentazione
	Linea segnale guasta	Controllare segnale linea
	Inserto elettronico guasto - FEL51 connesso direttamente a L1 e N	Sostituire - connettere sempre FEL51 mediante carico esterno
	Densità del liquido troppo bassa	Impostare la densità a $> 0,5$ sull'inserto elettronico
	Forcella incrostata	Pulire la forcella
	Forcella corrosa (Sul FEL: rosso/giallo lampeggiano, FEL58: verde lampeggiano 0,3 Hz)	Sostituire la forcella e la connessione al processo
	FEL51: resistenza interna del relè connesso troppo grande	Collegare il relè adeguato
	FEL51: corrente di mantenimento del relè connesso troppo grande	Connettere resistenza in parallelo al relè
	FEL54: contatti saldati insieme (dopo il corto circuito)	Sostituire FEL54; mettere il fusibile nel circuito di contatto
Commuta non correttamente	Modalità di sicurezza min-/max-impostata in modo errato	Impostare la modalità corretta nell'inserto elettronico
Commutazione sporadicamente difettosa	Schiuma pesante e torbida condizioni molto turbolente, liquido che produce schiuma	Montare il Liquiphant nel bypass
	RFI forte	Usare cavo schermato
	Forte vibrazione	Disaccoppiare, smorzare, ruotare la forcella di 90°
	Acqua nella custodia	Avvitare correttamente il coperchio e il passacavi
	FEL52: Uscita sovraccaricata	Ridurre il carico, capacità (cavo)
Commutazione non corretta dopo la mancanza alimentazione	FEL57, comportamento durante la fase di test all'accensione (test di funzionamento)	Osservare il comportamento di commutazione del FEL57; dopo il ripristino di una mancanza di alimentazione inibire il controllo dell'impianto per 45 s

Fout	Oorzaak	Maatregel
Schakelt niet	Voeding ontbreekt	Voeding controleren
	Signaalleiding defect	Signaalleiding controleren
	Insert defect - FEL51 direct op L1 en N aangesloten	Ver vangen - FEL51 altijd via een belasting aansluiten
	Dichtheid van de vloeistof te gering	Op elektronica- insert dichtheid op > 0,5 instellen
	Trilvork te veel vervuild	Trilvork reinigen
	Trilvork gecorrodeerd (LED op FEL knippert rood/geel, FEL58: groen knippert 0,3 Hz)	Trilvork compleet met procesaansluiting vervangen
	FEL51: Relais met te grote inwendige weerstand aangesloten	Passender relais aansluiten
	FEL51: Relais met te geringe houdstroom aangesloten	Weerstand parallel aan relais aansluiten
	FEL54: Contacten verkleeft (na een kortsluiting)	FEL54 vervangen; zekering in circuit aanbrengen
Schakelt foutief	Minimum- /Maximum-fail-safe instelling verwisseld	FEL fail-safe keuze correct instellen
Sporadische foutschakeling	Dik zwaar schuim, wilde turbulentie, opgeschuimde vloeistof	Liquiphant in by-pass monteren
	Extremes RFI invloed	Verbindingskabel afschermen
	Extremes vibraties	Ontkoppelen, dempen, vork 90° draaien
	Water in de behuizing	Deksel en wartels vast aandraaien
	FEL52: uitgang overbelast	Schakelbelasting verminderen
Foutmelding	FEL57, gedrag bij inschakelen na netuitval (periodieke testfunctie)	Schakelgedrag FEL57 controleren; procesherstart na netuitval ca. 45 s blokkeren

nl -Fout zoeken

de - Ergänzung Fehlersuche

Ist das Schaltverhalten der Gabel ungewöhnlich, kann an PIN 4 der Diagnosebuchse die Gabelfrequenz gemessen werden.
Bei den Elektroneinsätzen FEL51/52/54/55/56/57/58 ist dies eine sinusförmige Schwingung deren Amplitude einen Rückschluss auf den Gabelzustand zulässt.
Bei FEL50A ist aufgrund eines Rechtecksignals nur noch die Gabelfrequenzmessung möglich.

en - Trouble- shooting Supplement

If the switching behaviour of the fork is abnormal, the fork frequency can be measured at PIN 4 of the diagnosis socket.
With electronic inserts FEL51/52/54/55/56/57/58 this is a sinusoidal vibration whose amplitude makes it possible to determine the condition of the fork.
With FEL50A, only the fork frequency measurement is possible due to a rectangular pulse signal.

fr - Additif recherche de défauts

Si la commutation de la fourche est inhabituelle, il est possible de mesurer la fréquence de cette dernière au PIN 4 de la prise diagnostic.
Pour les électroniques FEL51/52/54/55/56/57/58 il s'agit d'une oscillation sinusoïdale dont l'amplitude permet d'évaluer l'état de la fourche.
Pour FEL50A, le signal rectangulaire ne permet qu'une mesure de la fréquence de fourche.

es - Suplemento para la
identificación de fallos

Si el comportamiento de
conmutación de la horquilla es
anormal, puede medir la
frecuencia de la misma en el
PIN 4 del interruptor de diagnosis.
Con las electrónicas
FEL51/52/54/55/56/57/58
se consigue una vibración
sinusoidal cuya amplitud hace
posible determinar la condición de
la horquilla.
Con FEL50A, sólo es posible
medir la frecuencia de la horquilla
debido a una señal de impulsos
rectangular.

it - Suplemento alla ricerca
dei malfunzionamenti

Se le condizioni di commutazione
dei rebbi non è normale la
frequenza di vibrazione può
essere misurata al PIN 4 del
connettore per la diagnosi.
Con gli inserti elettronici
FEL51/52/54/55/56/57/58
è possibile determinare la
condizione dei rebbi anche tramite
l'ampiezza dell'onda sinusoidale.
Con FEL50A il segnale è un onda
quadra, per cui è possibile valutare
solo il valore di frequenza.

nl - Bijlage problemen oplossen

Indien het schakelgedrag van de
trilvork niet normaal verloopt kan
de frequentie van de vork
gemeten worden op pen 4 van de
diagnoseconnector.
Bij de elektronica inserts van de
FEL51/52/54/55/56/57/58
is dit een sinusvormige trilling
waarvan de amplitude een beeld
geeft van de conditie van de vork.
Bij de FEL50A is alleen de
vorkfrequentie te meten als gevolg
van een rechthoekig pulssignaal.

de - Ersatzteile

Elektronikeinsätze

en - Spare parts

Electronic inserts

fr - Pièces de rechange

Electroniques

es - Repuestos

Electrónicas

it - Ricambi

Inserti elettronici

nl - Reserve-onderdelen

Elektronica inserts



FEL51	52002304
FEL52	52002305
FEL54	52002306
FEL55	52002307
FEL56	52002308
FEL57	52002309
FEL58	52006454
FEL50A	52010527

Installationsregel: Bei der Installation ist zu beachten, dass elektrische Betriebsmittel (Elektronikeinsätze) die mit nichteigensicheren Stromkreisen gespeist wurden, grundsätzlich nicht mehr mit eigensicheren Stromkreisen zusammengeschaltet werden dürfen.

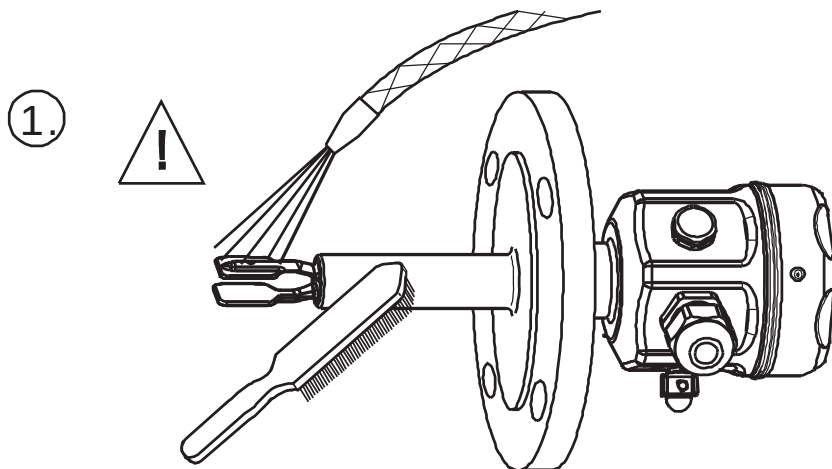
Installation specification: During installation, please keep in mind that electrical resources (electronic inserts) which are powered by non-intrinsically-safe circuits may no longer be interconnected with intrinsically-safe circuits.

Directive d'installation : Lors de l'installation, tenir compte du fait que les matériels électriques (électroniques) alimentés par des circuits sans sécurité intrinsèque ne doivent plus être connectés à des circuits à sécurité intrinsèque.

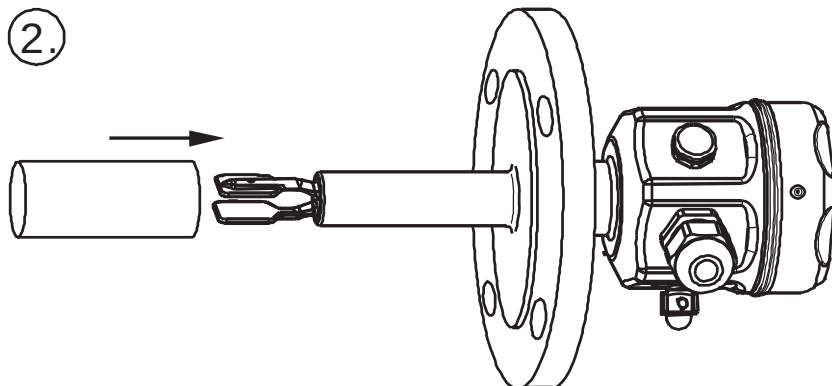
Normas de instalación: Durante la instalación, tenga en cuenta que los elementos eléctricos (electrónicas) alimentadas por circuitos no intrínsecamente seguros, no podrán estar interconectadas con circuitos intrínsecamente seguros.

Specifiche di installazione: Durante l'installazione è necessario tenere presente che gli impianti elettrici (inserti elettronici) alimentati da circuiti elettrici non a sicurezza intrinseca non possono più essere collegati con circuiti elettrici a sicurezza intrinseca.

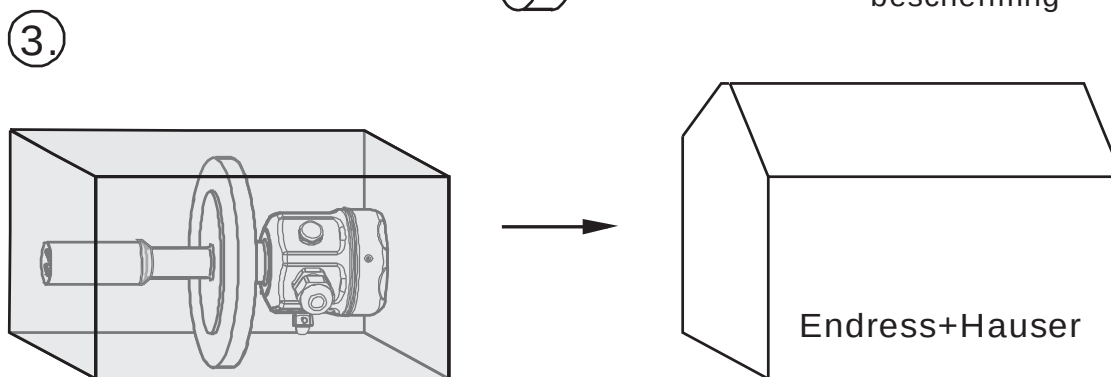
Installatievoorschrift: Bij de installatie moet erop worden gelet, dat elektrisch materieel (elektronica-units) die via niet-intrinsiekveilige circuits worden gevoed, in principe niet meer met intrinsiekveilige circuits mogen worden samengeschakeld.



säubern
clean
nettoyer
limpio
pulire
reinigen



Transportschutz
Transport protection
Protection de
transport
Protección para el
transporte
Protezione trasporto
Transport
bescherming



de - Reparatur

bei Endress+Hauser

en - Repair

at Endress+Hauser

fr - Réparations

chez Endress+Hauser

es - Reparaciones

en Endress+Hauser

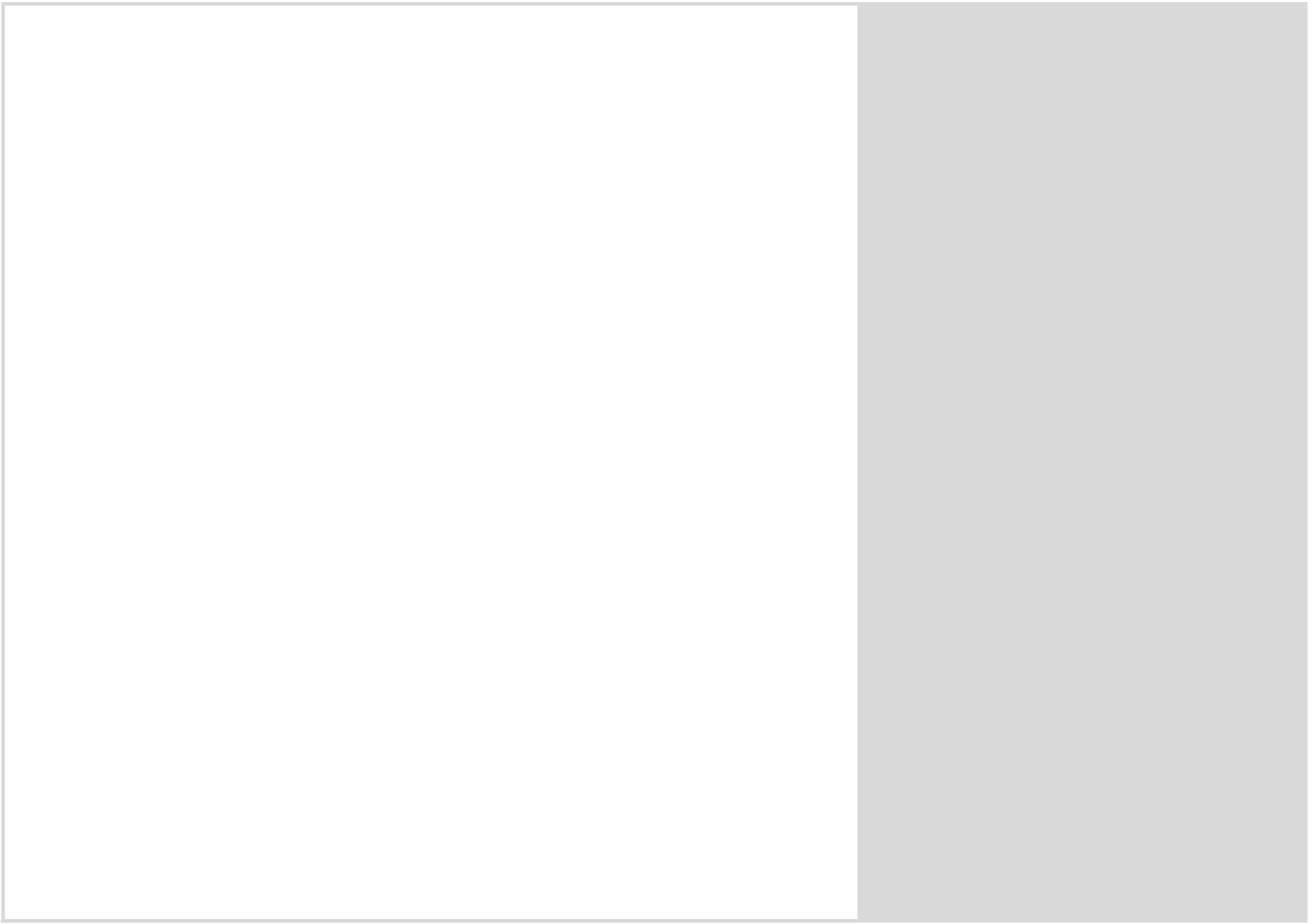
it - Riparare

presso la Endress+Hauser

nl - Reparatie

bij Endress+Hauser

de- Ergänzende Dokumentation	Technische Information / Technical Information / Information technique / Información técnica / Informazioni tecniche / Technische Informatie	
en - Supplementary Documentation	TI328F	Liquiphant FTL50, FTL50H, FTL51, FTL51H
fr - Documentation complémentaire	TI426F	Weld-in adapter, leven and pressure
es - Documentación adicional		
it - Documentazione supplementare		
nl - Aanvullende documentatie		





www.endress.com/worldwide

KA143F/00/a6/07.10, 71118926, CCS/FM6



71118926

Section 3.0

Quality Assurance/Control Data

Tags:

121-HRDBP-B0-LT-0301
122-LKSDE-B0-LT-0301
123-MTRSP-B0-LT-0301
124-OYENS-B0-LT-0301
125-BDLSS-B0-LT-0301
126-FXVLY-B0-LT-0301
127-PIAPT-B0-LT-0301
128-GRSSY-B0-LT-0301
121-HRDBP-B0-LSHH-0302
122-LKSDE-B0-LSHH-0302
123-MTRSP-B0-LSHH-0302
124-OYENS-B0-LSHH-0302
125-BDLSS-B0-LSHH-0302
126-FXVLY-B0-LSHH-0302
127-PIAPT-B0-LSHH-0302
128-GRSSY-B0-LSHH-0302
121-HRDBP-B0-LT-0303
122-LKSDE-B0-LT-0303
123-MTRSP-B0-LT-0303
124-OYENS-B0-LT-0303
125-BDLSS-B0-LT-0303
126-FXVLY-B0-LT-0303
127-PIAPT-B0-LT-0303
128-GRSSY-B0-LT-0303

Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_170

Seite / page 1 / 2

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000170	1,000	FTL51-TGM2YY5E5C Liquiphant M FTL51	
		S/N F302A615027	TAG 121-HRDBP-B0LSHH -0302 25472-101POA JL10-W0001 #27.00

Kennzeichnung / Marking
● Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05W8K
Adapter / adapter
UGITECH
80987720 000010
116155

Kennzeichnung / Marking
● Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

0515X
Gabel / fork
FEINGUSS BLANK
PZ00997
70123



Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_170

Seite / page 2 / 2

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

04YR0
Rohr / tube
OUTO KUMPU
N1018851/1
4026620

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

0623A
Rohr / tube
Huzhou Zhongli
111113001
YX1109-106

13.04.2012

Endress+Hauser (USA) Autom. Instrum. Inc
US-46143-9772 Greenwood

jeremy shireman
- Abnahmebeauftragter -
- Inspector -

Dieses Zeugnis wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig.
This document was generated electronically acc. to EN 10204 and is valid without signature.



Metalltechnik GmbH . Fabrikstraße 1 . D-79650 Schopfheim

Endress + Hauser GmbH + Co.KG

Hauptstr. 1

79689 Maulburg

UMSTEMPELBESCHEINIGUNG CERTIFICATE OF RE-STAMPING

KOMMISSIONS-NR: 120116-5
consignment no:

IHRE BESTELLUNG: 11977454
your order:

Wir bestätigen, dass die gelieferten Produkte folgende Abmessungen aufweisen:
We confirm, that the supplied semi-finished products have the following dimensions:

Position item	Produkt product	Menge quantity	Dicke thickness	Durchmesser diameter	Breite width	Länge length
1	52027474 Piezorohr/piezo tube	800		Ø21,3 mm		48,5 mm

Position item	Aus Halbzeug der Abmessung out of semis of dimension	Schmelze heat-no.	Los-Probe-Blech-Nr. lot-sample-plate-no.	Hersteller manufacturer
1	Rohr/tube 1.4435	4026620		Outokumpu

ausgewiesen durch Abnahmeprüfzeugnis nach EN10204 gem. Anlage. Zeugnis-Nr. :
As evidenced by: Inspection certificate according to EN10204 as attached. No. Of cert.:

N1018851/1

Die Stempelung ist übertragen worden. Die Fertigteile wurden wie folgt gekennzeichnet :
The marking has been transferred. The finished products are signed with No. :

1.4435 04YR0

Zum Zeichen der ordnungsgemäßen Umstempelung wurden die Produkte mit folg. Zeichen versehen :
As proof of the legal re-stamping the semi-finished products have been signed with :

S1

BESICHTIGUNG UND MASSKONTROLLE: O.B.
Visual & dimensional inspection: o.k.

Das Umstempeln erfolgte mit Genehmigung des TÜV Industrie Service GmbH
The re-stamping was carried out with the approval of: TÜV Industrie Service GmbH

Datum : 16.01.2012
date :

Unterschrift :
signature :

**CERTIFICATE EN 10204:2004/3.1**

This inspection certificate fulfils the requirements of EN 10204:2004 type 3.1
and EN 10204:1991+A1:1995 type 3.1.B.

Page 1(1)

BUYER		DATE 2010-10-31		CERTIFICATE NO N1018851/ 1										
		MANUFACTURES ORDER NO 2010001271		ITEM 21										
		BUYERS ORDER NO		SHIPMENT										
PRODUCT FORM LONGITUDINALLY WELDED STAINLESS STEEL TUBES, PICKLED, PLAIN ENDS, IN MILL LENGTHS, HEAT TREATMENT 1080 C QUENCHED IN AIR/WATER														
SPECIFICATION AD 2000-W2/W10 / EN 10217-7 Tc2 INOX				MANUFACTURES MARK OUTOKUMPU-N										
GRADE EN 1.4435		MANUFACTURES GRADE 4435T		TOLERANCES SS EN ISO 1127 D4 T3										
TUBE MARKING OUTOKUMPU-N; 1.4435; AD-W2 / EN 10217-7; ; W2A; TC2; Z=1,0; MAR-N1; 21,30 X 2,00; 4026620;INOX; MADE IN SWEDEN;														
EXTENT OF DELIVERY														
PCS		METER		DIMENSION 21,30 2,00	BATCH NO 4026620									
				TEST NO A										
CHEMICAL COMPOSITION														
HEAT ANALYSIS 1	C	SI	MN	P	S	CR	NI	MO	N					
	0,018	0,400	1,60	0,033	0,001	17,20	12,60	2,60	0,060					
TEST RESULT														
	TEMP	RP0,2 MPa	RP1,0 MPa	RM MPa	A5 %	HRC HRC		Ferrite %						
	20	190	225	490 690	40	22		0,5						
A1 L	20	284	320	583	53	20		0,1						
A2 L	20	292	326	589	55									
A3 L	20	292	327	588	55									
A4 L	20	291	327	589	55									
A5 L	20	275	309	585	58									
A6 L	20	287	322	584	53									
A7 L	20	289	324	584	54									
A8 L	20	291	326	588	55									
FLARING TEST EN ISO 8493 100% EDDY CURRENT TEST EN 10246-3 E1H / EN 10246-2 MATERIAL IDENTIFICATION TEST VISUAL AND DIMENSIONAL INSPECTION FERRITE CONTROL WELD, ACC TO BN2 HARDNESS ACC TO NACE MR 0175 INTERGRANULAR CORROSION TEST EN ISO 3651-2:A INSPECTION CERTIFICATE EN 10204-3.1 ACC. TO THE LETTER OF AGREEMENT,TUEV NORD DATED JULY 4,2008, FILE NO 1326WL04780-1														
SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY														
 EN ISO 9001 : 2000 No. 44 100 075263		Certified acc: PED 97/23/EC and AD2000-W0/TRD 100 by TÜV Nord gruppe for pressure equipment NOB no: 0045 Certificate no: 07-202-3537WZ-0678/07 (no. 3537WL04770) Procedures and personnel approved by notified bodies. WPS/WPAR: EN 288 / WLD Personnel: EN 1418 / NDT: EN 473				THE REQUIREMENTS ARE FULFILLED AS STIPULATED INSPECTOR / MAR Johan Gemmel ISSUED BY Yvonne Wannestrand								
		MELTING PROCESS: E/AOD Base material from PED 97/23/EC approved suppliers.												

OUTOKUMPU STAINLESS TUBULAR PRODUCTS
Torshälla Box 46 S-64421 Torshälla Sweden

Telephone no
+46 16 34 96 52

Telefax
+46 16 34 97 00

yvonne.wannestrand@outokumpu.com



Feinguss · Fertigkomponenten · Entwicklungspartner

Endress u. Hauser GmbH & Co. KG
Hauptstrasse 1 Wareneing.2
DE-79689 Maulburg

Abnahmeprüfzeugnis 3.1

Inspection certificate

nach/according to DIN EN 10204:2005
Prüf-Nr./Test-No.: PZ00997
BA-Nr.: 1066037
Ident-Nr.: 06748/05

Ihre Bestellung Nr./Your order No.:
117/11964636

vom/dated:
29.11.2011

Gußstück-Bezeichnung/Part-description:
GABEL STANDARD

Zeichnungs-Nr./Drawing-No.:
210011044 (52006900) Index

Prüfergebnisse/Test results

Gußteile gezeichnet mit/Castings signed with:
B1 0515X

Chemische Analyse/Chemical analysis:

Soll/Nom	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N
min	0,000	0,00	0,00	0,000	0,000	17,00	2,50	10,00	0,000	0,000	0,000
max	0,030	1,00	2,00	0,045	0,015	19,00	3,00	10,60	0,100	0,400	0,110
Charge/Los/Lot No.											
70123											
min	0,010	0,70	0,25	0,004	0,005	17,61	2,79	10,04	0,011	0,010	0,011
max	0,014	0,92	0,30	0,005	0,006	17,86	2,85	10,37	0,023	0,010	0,057

Wärmebehandlung/Heat treatment:

lösungsgeglüht u. abgeschreckt max. 241 HB

Härteprüfung/Hardness test:

HV 10 = 151 - 158

Mechanische Prüfung/Mechanical testing:

Soll/Nom	Rp 0,2 (N/mm ²)	Rp 1,0 (N/mm ²)	Rm (N/mm ²)	A (Lo=50mm) (%)
min	200	235	500	30,00
max				
Charge/Los/Lot No.				
70123	246	284	543	59,00

Stichprobe Massprüfung durchgeführt, keine Abweichung festgestellt

100% Sichtprüfung durchgeführt, keine Abweichung festgestellt

Verwechslungsprüfung nach spectrometrischer Prüfung durchgeführt und i.O.

IK Test nach DIN 50914 durchgeführt, keine Abweichung festgestellt

Härtewerte nach NACE/MR 0175

Tüpfeltest i.O.

dimension sampling test done; without deviation

100% visual test done, without findings

mistake examination after spectrometric examination accomplished and in Order

test about intercrystalline corrosion done, without findings

hardness according to NACE/MR 0175

spot test ok.

Die gestellten Anforderungen sind erfüllt/Requirements of order are compiled
Riedlingen, den 27.10.2011

FEINGUSS BLANK GmbH
Qualitätswesen: i.V. SCHAACK

Das Zeugnis wurde maschinell erstellt und ist gemäß EN 10204 ohne Unterschrift rechtsverbindlich.
This certificate was generated by data system, acc. to EN 10204, it need not to be signed for validity.

Usine productrice Hersteller Manufacturer Ugine Avenue Paul Girod 73403 Ugine Frankreich	CERTIFICAT DE RECEPTION 3.1 ABNAHMEPRUEFZEUGNIS 3.1 INSPECTION CERTIFICATE 3.1 ----- EN 10204 / 3.1	UGITECH Providing special steel solutions 3g		
5	3	1		
Numéro / Nummer / Number 80987720 000010	Ordre de fab. / Auftrag / Prod. Order A1125RF44000	N° coulée / Schmelzen Nr / Heat N° 116155	N° lot MM / Chargen / Batch 1125RF4400	
4	11-1	11-2	11-3	
Certification - Werkzeugnis - Certificate AD 2000-MERKBLATT W0/TRD100 Pressure Equipment Directive 97/23/EC ISO 9001 ISO/TS 16949 ISO 14001	ISO 9100 ISO 9120	Marque d'usine Herstellerzeichen Supplier's Mark 	Poinçon de l'expert Prufstempel Inspector's stamp R6	
99	98	97	96	
UGI 4435FGX1 STAB GEWALZT ENTZUNDERT/ÜBERDREHT ABGESCHRECKT K13RUND 35,000MM LONG. 3,000MM +100,000MM -100,000MM Produit UGI 4435FGX1 BARRE LAMINÉ(E) DÉCALAMINÉ(E) HYPERTREMPÉ(E) K13ROND(E) 35,000MM LONG. 3,000MM +100 Erzeugnisform UGI 4435FGX1 STAB GEWALZT ENTZUNDERT/ÜBERDREHT ABGESCHRECKT K13RUND 35,000MM LONG. 3,000MM +100, Product UGI 4435FGX1 BAR ROLLED DESCALED SOLUTION ANNEALED K13ROUND 35,000MM LONG. 3,000MM +100,000MM -1				
6				
Client et/ou destinataire - Besteller und/oder Empfänger - Purchaser and/or Consigner 14112 Endress + Hauser GmbH + Co. KG		N° de commande client - Kundenbestellnummer - Purchase order number 4500183372-2000		
9		10		
Norme de référence / Besugsnorm / Standard for reference AD 2000 W2 ED 02.2009 1.4435 EN 10272 ED08 1.4435 ASTM A484/A484M-09 NACE MR 0103 Ed 2005 S31603 AD 2000 W10 ED 02.2008 1.4435 ASTM A479/A479M-10a TYPE 316L NACE MR0175/ISO 15156-3:2005 316L				
12-2				
Spécification client / Kundenspezifikation / Customer's specification 410000144 A X2CRNIMO18-14-3 A 30.07.08				
12-3				
Nombre Stueckzahl Pieces Nbr 120	Profil Profile Shape RO	Dimension Ausmessung Dimension 35,000 MM	Longueur Laenge Length 3,000	Poids Gewicht Weigh 2877 KG
18	19	21-1	21-2	22
Mode d'élaboration Erchmel zungsart Melting process EAF + AOD + CC	N° prélèvement Probennummer Test number 1T12	Demandé / Vorschrift / Required 42 43 44 45 46 47 48 49 % C % SI % MN % NI % CR % MO % S % P Min Max 0,0300 1,0000 2,0000 14,0000 18,0000 3,0000 0,0170 0,0400 coulée/ Schmelzen / Heat 0,0170 0,4530 1,5780 12,5680 17,0990 2,5340 0,0103 0,0263 Produit / Erzeugnisform/ Product		
38	39A			
Demandé / Vorschrift / Required 50 51 52 53 54 55 70 71 72 73 74 75 % N Min Max 0,1000 coulée/ Schmelzen / Heat 0,0340 Produit / Erzeugnisform/ Product				
50				
Demandé / Vorschrift / Required 76 77 78 79 80 81 82 83 84 85 86 87 Min Max coulée/ Schmelzen / Heat Produit / Erzeugnisform/ Product				
76				
Hiermit erklären wir, dass das zitierte Produkt mit den Anforderungendes Vertrags konform ist und den Anforderungen sowie den geltenden Normen und Vorschriften nach den durchgeführten Kontrollen und Prüfungen REACH-Verordnung in jeder Hinsicht entspricht, vorbehaltlich gelistete Ausnahmen oder Bedenken von dieser Konformitätserklärung; Dieses Dokument ist durch eine digitale Unterschrift gültig. Produkt hergestellt gemäß We declare that the mentioned product is in compliance with the requirements of the contract and that, after checks and tests, it meets in all respects the specified requirements and applicable standards and regulations, except reservations or exceptions as listed in this declaration of conformity; Document validated by electronic signature. Material manufactured in the REACH regulation respect.				
66-1				
Ugine le 09.06.2011 L'agent Réceptionnaire de l'usine Der Werksachverständige The work inspector 				
66-2				
040000484992 Page 1/2 63				

Usine productrice Hersteller Manufacturer Ugine Avenue Paul Girod 73403 Ugine Frankreich	CERTIFICAT DE RECEPTION 3.1 ABNAHMEPRUEFZEUGNIS 3.1 INSPECTION CERTIFICATE 3.1 ----- EN 10204 / 3.1	UGITECH Providing special steel solutions 
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Numéro / Nummer / Number 80987720 000010	Ordre de fab. / Auftrag / Prod. Order A1125RF44000	N° coulée / Schmelzen Nr / Heat N° 116155	N° lot MM / Chargen / Batch 1125RF4400
--	--	---	--

		T°C		Limite d'élasticité Streckgrenze Yield Strength 0,2% 1%		RM Zugfestigkeit Tensile	Allongement Bruchdehnung Elongation A5D A4D		Striction Einschnürung Red area	Dureté-Haerte-Hardness			
				Mpa	Mpa	Mpa	%	%	%	HB	HV	HRB	HRC
24	90	°C											
	Min	20		200	235	500	40	30	40	215			
	Max	20				700							
	Min												
	Max												
N° prélèvement Probennummer Test number	1T12 1T12	1 L 2 L	20 20	334 337	385 292	603 610	48 49	50 51	75 75	173			
39B													
A l'état de Référence / treatment on test sample / Probestreifenbehandlung													

Taux de corroyage Forging ratio Verschmiedungsgrad 39,1		Résilience-Kerbschlagzähigkeit-Notch Toughness									
		Type Form Type	T°C	Sens Richtung Direction	Min	Valeurs individuelles Einzelwerte Individual values		Moyenne Mittelwerte Average	Expansion latérale Seitliche Breitung Lateral Expansion		
		31	33	32	95			35	36	91	
A l'état de livraison / Lieferzustand / As delivered		KISOV	°C		J	J		J			
ABGESCHRECKT 1030° 30MN WASSER			20	L	100	229-245-237 234-246-255		237 245			
A l'état de Référence / treatment on test sample / Probestreifenbehandlung											

ZUSTIMMUNGSSCHREIBEN DER TÜV SÜD LIEGT VOR. AUF GEGENZEICHNUNG WIRD VERZICHTET
 INTERKRISTALLINE KORROSION BESTÄNDIG NACH EN ISO 3651-2
 INTERKRISTALLINE KORROSION BESTÄNDIG NACH ASTM A262 METHOD E
 INNERE FEHLERFREIHEIT DURCH PROZESS-KONTROLLE GARANTIERT
 SPEKTROSKOPISCH VERWECHSLUNGSPRÜFUNG IN ORDNUNG
 FERRIT-GEHALT (> 1%) = 2.1
 LETTER OF APPROVAL OF THE SOUTHERN TÜV IN OUR POSSESSION.WE ABSTAIN OF ONE AGAINST SIGNATURE.
 INTERCRYSTALLINE CORROSION RESISTANT ACC.TO ISO 3651-2.
 INTERCRYSTALLINE CORROSION RESISTANT ACCORDING TO ASTM A262 PRACTICE C.
 FREEDOM FROM INTERNAL DEFECT GUARANTEED BY CONTROL PROCESS
 ANTIMIXING TEST PERFORMED : CONFORM.
 DIN EN 10278 (LN 668)

Endress + Hauser GmbH

Quantité livrée / delivered quantity / gelieferte Quantität 92	93	94
Hiermit erklären wir, dass das zitierte Produkt mit den Anforderungen des Vertrags konform ist und den Anforderungen sowie den geltenden Normen und Vorschriften nach den durchgeführten Kontrollen und Prüfungen REACH-Verordnung in jeder Hinsicht entspricht, vorbehaltlich gelisteter Ausnahmen oder Bedenken von dieser Konformitätserklärung; Dieses Dokument ist durch eine digitale Unterschrift gültig. Produkt hergestellt gemäß		Ugine le 09.06.2011 L'agent Réceptionnaire de l'usine Der Werksachverständige The work inspector
We declare that the mentioned product is in compliance with the requirements of the contract and that, after checks and tests, it meets in all respects the specified requirements and applicable standards and regulations, except reservations or exceptions as listed in this declaration of conformity; Document validated by electronic signature. Material manufactured in the REACH regulation respect.		040000484992 Page 2/2

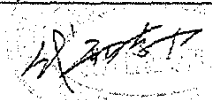
MILL INSPECTION CERTIFICATE

Huzhou Zhongli Stainless Steel Pipe Co., Ltd.

Huang Long Industrial District, Shuanglin Town of Huzhou City Zhejiang Province, P.R. China

ISO 9001:2008 PED BY LLOYD

REGISTRATION No.: QAC6002856

CERTIFICATE NO.: 111113001 COMMODITY: SEAMLESS STAINLESS STEEL TUBING SPECIFICATION: ASTM A213-10 ASME SA213-08 ASTM A269-10 (Average Wall)						PURCHASER: ROBERT-JAMES SALES, INC R. James P.O. No: GS-2392 DATE OF REPORT: 2011.11.30					
Steel Grade	Heat No.	Lot No.	Dimensions			Quantity		Process	Delivery Condition	Macroscopic Inspection	
			O.D.	W.T.	Length	Pieces	(ft)			End Cut	Appearance
TP316/316L	YX1109-610	11A1120341	21.3MM	1.6MM	20ft	42	840	Cold-finished	OD Polished to 240 Grit	Passed	Passed
Chemical Composition (W.T. %)											
Element	C	Mn	P	S	Si	Cr	Ni	Mo	Ti		
Requirements	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00	16.0~18.0	10.0~14.0	2.0~3.0	—		
Ladle Analysis	0.018	0.68	0.034	0.002	0.37	16.50	10.07	2.06			
Product Analysis	0.020	0.67	0.033	0.002	0.39	16.52	10.06	2.05			
Mechanical Properties											
Test Item	Y.S. (Mpa) Rp0.2	T.S. (Mpa) Rm	EL. (%) In 2 in	Reduction of Area Z (%)	Hardness	Cold Bend Test	Flaring Test	Flattening Test	Flange Test		
Requirements	≥205	≥515	≥35	/	HRB≤90	/			/		
Test Results	275/285	575/580	56/58	/	72/73	/	Passed	Passed	/		
Non Destructive Tests				Hydrostatic Test	Inter-granular Corrosion Test	Remarks: - Tubes tested per ASTM A1016-11a - Hardness tested per NACE MR-01-03-2007 - All tubes annealed to above 1900 Deg F and water quenched Below 800 Deg F in 3 minutes - No weld repair performed - Free from mercury contamination - In compliance with EN 10204-3.1 - PED 97/23/EC CERTIFIED - Material to meet NACE MR 01-75-2005 - Billets melt and pipes/tubes manufactured in China					
Test Item	Eddy Current Test	Ultrasonic Test									
Requirements	ASTM E 426	ASTM E213									
Test Results	Passed	/									
We hereby certify that the material described herein has been made and tested completely in accordance with the above specification and with the requirements of the purchase order or contract.					Prepared by:		Approved by: 				



PACKING SLIP

INVOICE

No.00487976 PAGE 01

50# 41921566

KERKAU
MANUFACTURING1321 S. VALLEY CENTER DRIVE
BAY CITY, MICHIGAN 48706
PH (989) 686-0350 • FX (989) 686-0399
Outside Michigan 1-800-248-5060

BILL 005035

TO TEXAS FLANGE & FITTING SUPPLY,

PO BOX 2889

PEARLAND, TX 77588

SHIP E+H USA SALES
TO2350 ENDRESS PLACE
DOCK C
GREENWOOD, IN 46143
TAG: 1005615235

USA

DATE OF ORDER	SALESMAN	OUR ORDER NO.	TERMS	INVOICE DATE	
02/06/12	JLC	367448	NET 30	04/04/12	
CUSTOMER PURCHASE ORDER NO.	F.O.B.	SHIPPED VIA	DATE SHIPPED	PREPAID	COLLECT
4068	BAY CITY, MI	WITH OTHER	04/03/12	3RD	
QUANTITY SHIPPED	PART NO.	DESCRIPTION			
00008	M3582	6 X .75 150# THR FF CLR ZINC A105 - NO HUB			
Kerkau Manufacturing is API Approved * Visit our Web Site: www.kerkau.com FREIGHT CHARGES: SHIPMENT COMPLETE W/MTR W/367446 ORDER NO.00367448 Any damage, shortage, or other discrepancies must be reported to our expediting department at 1-800-248-5060 within 10 days of receipt of shipment. Not adhering to the above may result in denial of claim. Thank you.					

We hereby certify that these goods were produced in compliance with all applicable requirements of sections 6, 7, and 12 of the Fair Labor Standards Act, as amended, and of regulations and orders of the United States Department of Labor issued under Section 14 thereof.



Flanges-Precision Machining

1321 Valley Center Dr.
Bay City, MI 48706

Phone (989) 686-0350
Toll Free (800) 248-5060
Fax (989) 686-0399

Material Test Report

Date: 04/03/2012

Sold To: TEXAS FLANGE & FITTING SUPPLY, INC.
PO BOX 2889

PEARLAND, TX 77588
USA

Ship To: E+H USA SALES
2350 ENDRESS PLACE
DOCK C
GREENWOOD, IN 46143
USA

Order No: 367448

PO No: 4068

Ship Instructions: TI O'DANIEL
1005615235

Item Description

6 X .75 150# THR FF CLR ZINC NO HUB A105/SA105 ASTM 10/ASME 08a

Heat No.

JYM

C%	Mn%	P%	S%	Si%	Cr%	Cu%	Ni%	Mo%	V%	Cb%
0.19	1	0.008	0.025	0.22	0.07	0.28	0.09	0.02	0.004	0.001

Tensile (PSI)	Yield (PSI)	Elong %	Reduction %	BHN	CE
80,400	47,800	30	60	167-167	0.00

NO WELD REPAIR

ELONGATION TAKEN FROM ROUND SPECIMEN

All material supplied under this order is certified to be free of Mercury contamination and no Mercury bearing equipment was used in manufacturing, fabrication or testing.

DIN 50049/EN10204 3.1/ISO 10474 3.1b

Brian Dennis

BRIAN DENNIS/QUALITY CONTROL

Tammy Quaal

TAMMY QUAAL/AUTHORIZED SIGNATURE



Flanges-Precision Machining

1321 Valley Center Dr.
Bay City, MI 48706

Phone (989) 686-0350
Toll Free (800) 248-5060
Fax (989) 686-0399

Material Test Report

Date: 04/03/2012

Sold To: TEXAS FLANGE & FITTING SUPPLY, INC.
PO BOX 2889

PEARLAND, TX 77588
USA

Ship To: E+H USA SALES
2350 ENDRESS PLACE
DOCK C
GREENWOOD, IN 46143
USA

Order No: 367448
PO No: 4068

Ship Instructions: TI O'DANIEL
1005615235

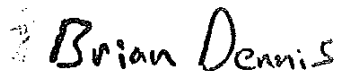
Item Description	Heat No.
6 X .75 150# THR FF CLR ZINC NO HUB A105/SA105 ASTM 10/ASME 08a	SGD

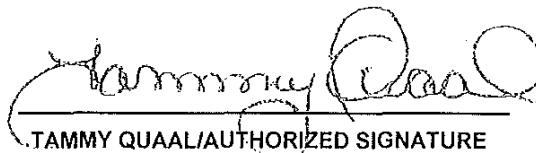
C%	Mn%	P%	S%	Si%	Cr%	Cu%	Ni%	Mo%	V%	Cb%
0.180	0.970	0.007	0.025	0.220	0.100	0.300	0.080	0.020	0.005	0.001

Tensile (PSI)	Yield (PSI)	Elong %	Reduction %	BHN	CE
78,900	45,400	36.0	63.0	149-149	0.39

Impact

DIN 50049/EN 10204 3.1/ISO 10474 3.1b
COMPLIANT WITH NACE MR0175
NO WELD REPAIR/MERCURY FREE


BRIAN DENNIS/QUALITY CONTROL


TAMMY QUAAL/AUTHORIZED SIGNATURE

Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_80

Seite / page 1 / 3

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000080	1,000	FMP40-VYY2YY9B21JB Levelflex M FMP40	
		S/N F301221504E	TAG 128-GRSSY-B0LT0301 25472-101-POA-JL10 -W0001 ITEM 8.00

Kennzeichnung / Marking
● Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05P1N
Adapter / adapter
TALLEY METALS
000791575
742232

Kennzeichnung / Marking
● Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

06485
Flansch / flange
ENLIN STEEL
K354RJ
AL9JD



Abnahmeprüfzeugnis nach EN 10204 - 3.1

Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_80

Seite / page 2 / 3

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

032KC
Mutter / nut
NORTH AMERICAN STAINLESS
669810
9ja8

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

061NA
Mutter / nut
OUTO KUMPU
BOL0209683
E101502

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

043RX
Stab / rod
OLARRA
94169
318600

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05PM4
Stange / bar
OUTO KUMPU
5400093631
101779

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

061N8
mutter / nut
OUTO KUMPU
BOL0209683
E101502

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

061N9
mutter / nut
OUTO KUMPU
BOL0209683
E101502

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05WKM
pipe/coax
BUTTING
30 000 017 209 / 02
403961

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05WP9
pipe/coax
BUTTING
30 000 017 209 / 02
403961

Abnahmeprüfzeugnis nach EN 10204 - 3.1
Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_80

Seite / page 3 / 3

10.04.2012

Endress+Hauser (USA)
Automation Instrumentation Inc.
US-46143 Greenwood

Jonathan Tutwiler
- Abnahmebeauftragter -
- Inspector -

Dieses Zeugnis wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig.
This document was generated electronically acc. to EN 10204 and is valid without signature.

CERTIFICATE OF TESTS

CERT SERIAL# 000791575



TALLEY METALS
A Carpenter Company

Talley Metals Technology, Inc.
205 Talley Metals Lane

McBee, SC. 29101 Tel: (610) 208-2000 (800) 338-4592

10/21/11

CUSTOMER / BESTELLER / CLIENT

COPPER & BRASS SALES

22355 W ELEVEN MILE
SOUTHFIELD MI 48034

ABNAHMEPRUEFZEUGNIS

CERTIFICAT DE CONTROLE

- THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47.
- THE VALUES AND OTHER TECHNICAL DATA REPRESENT THE RESULTS OF ANALYSES AND TESTS MADE ON SAMPLES COLLECTED FROM THE TOTAL LOT. ORIGINAL DATA RECORDS CAN BE TRACED BY REFERENCE TO THE CARPENTER ORDER NUMBER.
- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
- THIS DOCUMENT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF CARPENTER TECHNOLOGY CORPORATION.

SELLER / VERKÄUFER / VENDEUR PAGE 1 OF 2

HVL

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
5400108534-0060	W41340	10/21/11	9940.000

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE :

742232

UNS NUMBER S31603

PRODUCT DESCRIPTION: TYPE 316L MAXX ANNEALED COLD FINISH

PART NUMBER: SSRD00692

SPECIFICATION: TALLEY 316L-T1A (12/21/98)

QQ-S-763F (06/27/96)

AMS 5648 REV K (08/ /02)

AMS 5653 REV G (05/ /11)

ASTM-A182-07 (CHEM ONLY)

ASTM-A193-11

ASTM-A276-10

ASTM-A314-08

ASTM-A320-11 (CHEM ONLY)

ASTM-A479-10A

ASTM-A484-11

ASTM-A580-08 (SIZES .500" AND UNDER ONLY)

ASME-SA182 2010 EDITION (CHEM ONLY)

ASME-SA193 2010 EDITION

ASME-SA320 2010 EDITION (CHEM ONLY)

ASME-SA479 2010 EDITION

AMS-QQ-S-763B (08/ /06)

Date 11-11-11
Customer Endress+Hauser
These Tests Are For Material Shipped On
Your Order 11951679
From Copper And Brass Sales, Inc.
INV/WO 14000853482
WGT 2910 PCS QC
Q. Miller

SIZE 2.625000 IN. (66.68 MM) RD BAR

PRIMARY HEAT CHEMISTRY(WT%): (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN (XRF)	SI (XRF)	P (XRF)	S (COM)	CR (XRF)
0.015	1.48	0.54	0.025	0.023	16.60
NI (XRF)	MO (XRF)	CU (XRF)	CO (XRF)	N (FUS)	
10.26	2.06	0.41	0.35	0.047	

INTERGRANULAR CORROSION TESTED TO ASTM-A262, PRACTICE E - ACCEPTABLE.
ANNEALED MICROSTRUCTURE FREE FROM CONTINUOUS GRAIN BOUNDARY CARBIDE
PRECIPITATION (NETWORK).

EDDY CURRENT TEST PERFORMED

HARDNESS AS SHIPPED, HBW - 155 (MIDRADIUS)

(T) RANSVERSE	(L) ONGITUDINAL	L
YIELD STRENGTH, (0.20 %) KSI (MPA)		38.2 (263)
TENSILE STRENGTH, KSI (MPA)		81.0 (558)
ELONGATION IN 2.00", %		60.0
REDUCTION OF AREA, %		75.0

CONTINUED ON NEXT PAGE

CERTIFICATE OF TESTS

CERT SERIAL# 000791575


TALLEY METALS
 A Carpenter Company

 Talley Metals Technology, Inc.
 205 Talley Metals Lane

McBee, SC. 29101 Tel: (610) 208-2000 (800) 338-4592

10/21/11

CUSTOMER / BESTELLER / CLIENT

COPPER & BRASS SALES

 22355 W ELEVEN MILE
 SOUTHFIELD MI 48034

ABNAHMEPRUEFZEUGNIS
CERTIFICAT DE CONTROLE

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- THE VALUES AND OTHER TECHNICAL DATA REPRESENT THE RESULTS OF ANALYSES AND TESTS MADE ON SAMPLES COLLECTED FROM THE TOTAL LOT. ORIGINAL DATA RECORDS CAN BE TRACED BY REFERENCE TO THE CARPENTER ORDER NUMBER.
- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
- THIS DOCUMENT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF CARPENTER TECHNOLOGY CORPORATION.

SELLER / VERKÄUFER / VENDEUR PAGE 2 OF 2

HVL

CUSTOMER ORDER NO. / BESTELL-NR. / N° DE COMMANDE	CARPENTER NO. / WERKS-NR. / N° DE REFERENCE INTERNE	DATE / DATUM / DATE	WEIGHT / GEWICHT / POIDS
5400108534-0060	W41340	10/21/11	9940.000

 HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE :
 GRAIN SIZE PER ASTM E112: 4

742232

UNS NUMBER S31603

NO WELD REPAIR PERFORMED
 MATERIAL PRODUCED ON THIS ORDER WAS MELTED AND MANUFACTURED IN THE U.S.A.
 MATERIAL HAS BEEN MELTED IN USA OR QUALIFYING COUNTRY TO DFARS REQUIRE-
 MENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1,
 SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.
 THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS
 OPERATIONS QUALITY PROGRAM MANUAL, REVISION 30 DATED 09/28/11.

WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE
 PURCHASE ORDER AND SPECIFICATION REQUIREMENTS. CERTIFICATE OF TEST IS
 PREPARED IN ACCORDANCE WITH PARAGRAPH 3.1 OF EN 10204 (DIN50049)

TIMOTHY DUVAL
 QUALITY ASSURANCE REP.
 CARPENTER TECHNOLOGY CORPORATION

**ENLIN STEEL (PHILS.) CORP**

Block 16-A, Lot 16 Phase IV, Philippine Economic Zone Authority, Rosario, Cavite, Philippines 4106

TEL : (+63) 46-437-1022~25 FAX : (+63)46-437-1018, 21

MILL TEST REPORT

PURCHASER : PRIME STAINLESS PRODUCTS

DATE : 2010/11/13

P.O.NO. : 152

S/C NO. : K354RJ

PRODUCT : STAINLESS STEEL FORGED FLANGE RF

HEAT NO.	Q'TY.	DESIGNATION	SPECIFICATION
AL9JD	1	316L/316 6" BL 150LB	ANSI B16.5-06

CHEMICAL ANALYSIS OF MATERIAL

HEAT NO.	C	Mn	Si	P	S	Cr	Ni	Mo	N	SPECIFICATION
Maxi	0.030	2.00	1.00	0.045	0.030	16.0 - 18.0	10.0 - 15.0	2.0 - 3.0	0.100	ASME SA182-09
AL9JD	0.022	1.27	0.47	0.038	0.006	16.22	10.19	2.14	0.039	ASTM A182-09a

MECHANICAL CHARACTERISTICS

HEAT NO.	T.S-PSI	Y.S-PSI	%-E.L.	%-R.A.	HEAT-TREAT.	HARDNESS	DIMENSION	P.M.I.
Mini	75,000	30,000	30	50	1040 - 1150 °C			
AL9JD	85,600	58,700	52	74	1060 °C		OK	OK

MATERIAL RESISTANT TO INTERCRYSTALLINE CORROSION ICC TEST ACCORDING TO ASTM A262 PRACTICE E. MATERIAL IS MANUFACTURED MERCURY FREE AND FREE FROM MERCURY CONTAMINATION. MATERIAL IN ACCORDANCE WITH NACE MRO 175/ISO 15156, MRO 103-2003 & MRO 103-2007 COMPLIANT. ISO 9001:2008, PED 97/23/EC CERTIFIED. EN10204-3.1 COMPLIANT.

Flange Faces to be 125-250RMS

FACTORY INSPECTOR:

DAVID WANG

1029624

QUALITY ASSURANCE DEPARTMENT

E-1011016067

SM-005-0



6870 HIGHWAY 42 EAST

METALLURGICAL TEST REPORT

NORTH AMERICAN STAINLESS
6870 HIGHWAY 42 EAST
GHENT, KY 41045

Certificate: 669810 1

Customer: 000570 021

Your Order: 8005673

Mail To:

ALRO METALS SERVICE CENTER

CUSTOMER PICKUP

P.O. BOX 764

821 SPRINGFIELD STREET

DAYTON, OH 45401

Ship To:

ALRO METALS SERVICE CENTER

CUSTOMER PICKUP

P.O. BOX 764

821 SPRINGFIELD STREET

DAYTON, OH 45401

Date: 9/08/2011 Page: 1

Steel: 316/316L

Finish: CD

NAS Order: IN 0128345 01

Corrosion: ASTM A262 Prac E OK

PRODUCT DESCRIPTION:

Round Bar, Annealed, Cold Draw

UNS 31600/31603 EN 10204 3.1, ASTM A484/08

ASTM A276/10, ASTM A479/10a, ASTM A182/10 CHEM ONLY,

ASME SA479/10a, ASME SA182/10 CHEM ONLY

AMS 5648K/AMS 5653F, AMS QQS-763B, QQS 763F

REMARKS:

COMPLIES W/REQUIREMENTS OF DFARS EU DIRECTIVE 2002.95.

EC. RoHS. EAF+AOD+CC. NO WELD REPAIR. MELTED AND MFG IN USA

FREE FROM MERCURY AND LOW MELTING ALLOY CONTAMINATION

Product Id	Skid #	Diameter	Size	Weight	-----Length-----	Mark	Pieces	Commodity Code
BD8988 4		.6250		1,038	144.00	1	1	13900755

CHEMICAL ANALYSIS CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan)

HEAT	CM	C	CO	CR	CU	MN	MO	N	NI	P
9JA8	US	.0220	.4525	16.6135	.4560	1.6040	2.0850	.0434	10.6500	.0380
		S	SI							
		.0255	.2390							

MECHANICAL PROPERTIES

Product Id	1 d o i c r	HB No.	.2YS KSI	UTS KSI	RA %	Elong % 4D
BD8988 4	R L	195.00	79.00	98.00	72.00	50.00

ALRO STEEL/METAL



RT06252941

NAS hereby certifies that the analysis on this certification is correct and the material meets the specifications stated.

QC ENGINEER

ERIC HESS

9/08/2011



Certificate of Test

HEAT E101502 ORDER 617901/ 15 BOL 0209683 * CERTIFICATION * 11/30/10

SHIP TO:
COPPER AND BRASS SALES **IP**
8001 THYSSENKRUPP PARKWAY

NORTHWOOD 436190000

----- YOUR ORDER & DATE -----
5400083140 11/30/10 CUST# 0316001 CUST TAG#SSRD00252

----- ITEM DESCRIPTION -----
GRADE 316L/316 Ship Condition CONDA
Size 316L RND CFA CONDA 2.2500 x 144.000 RL
Country of Melt: UNITED KINGDOM Country of Mfg.: UNITED STATES
NAFTA Country of Origin is Country of Melt

No weld repair
Free of mercury contamination, Free of radiation contamination
No WEEE relevant substances; Meets EU electrical ROHS

Total Bundles 2 Total Weight 4044

WO 2016738 Bundles: 1B, 1C

----- SPECIFICATIONS -----
MFG TO FINISHED BAR IN THE USA FROM BILLETS IMPORTED UNITED KINGDOM
AMS 5648K, 5653F SAE AMS-QQ-S-763B
ASME SA479 E07, A07-09, E10 ASTM A182 09
ASTM A262 02a Practice A/E ASTM A276 10
ASTM A479/A479M 09 ASTM A484 09
ASTM E112 96 ASTM A320 08 B8M Class 1
ASTM A193 09 B8M DIN 50049/EN 10204 3.1B
DFARS 252.225.7014 6/05 Federal Spec QQ-S-763F
Copper & Brass 316L MAXX NACE MR0175-03, mid-rad hard

----- MECHANICAL & OTHER TESTS -----
Hardness as shipped 160 HB
Hardness as shipped (82 HRB)
Grain size 7.0 Tensile strength,KSI (MPa) 87.6 (604)
Micro OK 0.2% Yield Strngth,KSI(MPa) 38.9 (268)
Intergranular corrosion OK
Elongation % in 4D 53.0
Reduction of area % 75.8

----- CHEMICAL COMPOSITION -----
Carbon (C) .018 Manganese (Mn) 1.710
Phosphorus (P) .030 Sulphur (S) .025
Silicon (Si) .366 Chromium (Cr) 16.690
Nickel (Ni) 10.270 Cobalt (Co) .259
Copper (Cu) .380 Moly (Mo) 2.060
Nitrogen (N) .072 Columbium (Cb) .041
Titanium (Ti) .001 Aluminum (Al) .004
Tin (Sn) .007 Boron (B) .002
Vanadium (V) .070
Columbium/
Tantalum (Cb+Ta) .041
Iron (Fe) Balance
Melt Practice EAF
Refining Practice AOD
De-long Ferrite

Knowingly & willfully falsifying or concealing a material act on this form,
or making false, fictitious or fraudulent statements or representations
herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and
accurate as contained in the records of the company and are in compliance
with the specifications, codes, and standards listed above.

M.F. Marcanio, Quality Manager

Umstempel-Bescheinigung / Certification of re-marking

Kunde / Customer	Lieferant / Supplier
Besteller: Endress + Hauser GmbH + Co.KG	BA-Nr.: 46259
Orderer:	Contract no.:
Bestell-Nr.: 141/1146010843	Artikel-Nr.: 59877419.1U
Order no.:	Article no.:
Artikelbez.: Stab, 71032615	Stückzahl: 580
Article description:	Quantity:
Artikel-Nr.: 71032615	
Article no.:	

Wir bestätigen, daß der gelieferte Artikel aus folgendem Material
We confirm that the delivered article has been produced from the following material

Werkstoff: 1.4462	Abmessung: RD26
Material no.:	Dimension:
Hersteller: Olarra	Zeugnis-Nr.: 94169
Manufacturer:	Certificate No.:
Schmelze: 318600	
Heat no.:	

ausgewiesen durch Abnahmeprüfzeugnis nach DIN EN 10204 - 3.1 von der
Firma Kohler Präzisionstechnik gefertigt wurde.
and was expelled by inspection certificate in accordance with DIN EN 10204 - 3.1 by Kohler Präzisionstechnik.

Folgende Kennzeichnung wurde übertragen / The following mark was transferred:

Werkstoff-Nr.: 1.4462
Material no.:

Chargennr./Kundencharge: 043RX
Heat no.:

zusätzl. Stempelungen:
Article-description:

Kurzzeichen: 
Abbreviation:

Außerdem wurde das Teil mit dem Stempel unseres Umstempelberechtigten gekennzeichnet.
The product has been marked with the stamp of our authorized person.

Umstempelung durchgef. von: ☒ WOLFGANG GLOWANIA ☐ HEINRICH JOSTEN
Re-marking was carried out by:

Diese Umstempelung erfolgt mit Zustimmung der TÜV SÜD Industrie Service GmbH, Kenn-Nr. 0036
vom 09.02.2009, Auftrags-Nr. 600 111 748.
This re-marking follow with consent of the TÜV SÜD Industrie Service GmbH TÜV of 09.02.2009, contract no.: 600111748.

Datum / Date: 08.12.2011

Unterschrift / Signature: 

Kohler Präzisionstechnik, Heerstraße 13, D-78554 Aldingen

Telefon +49 (0) 74 24 / 98 21 0- 0 Fax +49 (0) 74 24 / 98 21 0- 50

F 08.02/Aktuelle Ausgabe 21.02.2011

Ersteller: J. Holzer

Seite 1/1

Larrondo LOIU (VIZCAYA) España
P.O. Box 1.323/48080 Bilbao
Tel. 34-(4) 4 71 13 00
Fax. 34-(4) 4 53 16 36



Quality
Management
System
Approved
CERT N°
SGI 6000360

ACEROS INOXIDABLES

OLARRA

HEINE & BEISSWENGER STIFTUNG & CO.
HOEHENSTRASSE, 22
70736 FELLBACH-STUTTGART-ALEMANIA

Trade Mark - Zeichen des Lieferwerkes
Anagrama del suministrador



Works Inspector Stamp - Werkssachverständiger
Sello del Inspector



Certificate type - APZ Nach Certificado tipo	EN 10204/3.1	Certificate n° - Prüf-Nr Certificado n°	94169	Date - Datum - Fecha	28 - 10 - 2011
---	---------------------	--	--------------	----------------------	-----------------------

Our order N° Werks - Nr N° de Referencia	451819	Heat Schmelze Colada	318600	Your order N° Bestell - Nr Pedido N°	4500154854
--	---------------	----------------------------	---------------	--	-------------------

Steel Grade Werkstoff Calidad	X-2-CR-NIMON-22-5-3 / 1.4462	According to Entsprechend Corresponde	EN 10.272-2007.
-------------------------------------	-------------------------------------	---	------------------------

Shape and Size - Gegenstad Perfil y dimensión RUND 26 mm	Tolerance - Toleranz Tolerancia h 9 / DIN 671 / EN 10278	Bundles Bunde Bultos	2	Bars Stäbe Barras	Weight Gewicht Peso	878 Kg
---	---	----------------------------	----------	-------------------------	---------------------------	---------------

Requirements - Anforderungen - Exigencias

EN 10.088-3.2005.
ASTM A 479 / A 479M-11.
NACE MR-0175-2003/ISO 15156-3 2009.
UNS.S.31803.
PED 97/23/EC, Annex I, Parag.4.3/DGR 97/23/EG
Anhang I Bsatz 4.3 Certificate/Zertifikat Nr. 348/2008/MUC

Melting process / Erschmelzungsart / Proceso de Fusión E.A.F. / A.O.D.	Heat treatment / Wärmebehandlung / Tratamiento térmico 1060C 4H/Std WATER/WASSER/AGUA
--	---

Solution annealed/Abgeschreckt/Hipertemple-Centerless ground/Geschliffen/Rectificado-

Test results - Ergebnis der Prüfungen - Resultados de los ensayos

Dimension of Specimen Abmessungen des Probestabes Medida de las probetas		Rp0.2% N/mm2 MPA	Rp 1% N/mm2 MPA	Rm N/mm2 MPA	A %L 5D	A %L 4D	Z %	Hardness Härte HBw	Impact test / Kersbschlag / Resiliencia ISO V Jules	
RD. 10,00 mm.		Min.	450		650	25			100	
		Max.			880			270		
Temperature °C 20	Spec. N° Probe Nr. Pro N°	1	544	622	735	35		73	248	284/280/287

	C	Si	Mn	P	S	Cr	Mo	Ni	N		
Min.						21,00	2,50	4,50	0,1000		
Max.	0,030	1,00	2,00	0,035	0,015	23,00	3,50	6,50	0,2200		
	0,014	0,55	0,87	0,030	0,001	22,60	3,11	5,35	0,1700		

Visual and dimensional inspection Besichtigung und Ausmessung Control visual y dimensional	O.K.	Radioactivity inspection Radioaktivitätskontrolle Control de Radioactividad	O.K.	Antimixing test Spektroskop Verwechslungspr Antimezcla	O.K.	Grain Size Korngrösse Tamaño de grano
--	-------------	---	-------------	--	-------------	---

Remarks - Bemerkungen - Observaciones

IC test acc./IK prüfung nach EN ISO 3651-2/98 Met.A. OK

EDV / EDP
Acc. EN 10.204
Alfredo Molina
Certification
Mng.

Works Inspector
Der Werkssachverständige
Inspector de fábrica

Umstempel-Bescheinigung / Certification of re-marking

Kunde / Customer	Lieferant / Supplier
Besteller: Endress + Hauser GmbH + Co.KG	BA-Nr.: 46259
Orderer:	Contract no.:
Bestell-Nr.: 141/1146010843	Artikel-Nr.: 59877419.1U
Order no.:	Article no.:
Artikelbez.: Stab, 71032615	Stückzahl: 580
Article description:	Quantity:
Artikel-Nr.: 71032615	
Article no.:	

Wir bestätigen, daß der gelieferte Artikel aus folgendem Material
We confirm that the delivered article has been produced from the following material

Werkstoff: 1.4462	Abmessung: RD26
Material no.:	Dimension:
Hersteller: Olarra	Zeugnis-Nr.: 94169
Manufacturer:	Certificate No.:
Schmelze: 318600	
Heat no.:	

ausgewiesen durch Abnahmeprüfzeugnis nach DIN EN 10204 - 3.1 von der
Firma Kohler Präzisionstechnik gefertigt wurde.
and was expelled by inspection certificate in accordance with DIN EN 10204 - 3.1 by Kohler Präzisionstechnik.

Folgende Kennzeichnung wurde übertragen / The following mark was transferred:

Werkstoff-Nr.: 1.4462
Material no.:

Chargennr./Kundencharge: 043RX
Heat no.:

zusätzl. Stempelungen:
Article-description:

Kurzzeichen: 
Abbreviation:

Außerdem wurde das Teil mit dem Stempel unseres Umstempelberechtigten gekennzeichnet.
The product has been marked with the stamp of our authorized person.

Umstempelung durchgef. von: ☒ WOLFGANG GLOWANIA ☐ HEINRICH JOSTEN
Re-marking was carried out by:

Diese Umstempelung erfolgt mit Zustimmung der TÜV SÜD Industrie Service GmbH, Kenn-Nr. 0036
vom 09.02.2009, Auftrags-Nr. 600 111 748.
This re-marking follow with consent of the TÜV SÜD Industrie Service GmbH TÜV of 09.02.2009, contract no.: 600111748.

Datum / Date: 08.12.2011

Unterschrift / Signature: 

Kohler Präzisionstechnik, Heerstraße 13, D-78554 Aldingen

Telefon +49 (0) 74 24 / 98 21 0- 0 Fax +49 (0) 74 24 / 98 21 0- 50

F 08.02/Aktuelle Ausgabe 21.02.2011

Ersteller: J. Holzer

Seite 1/1



Certificate of Test

(05PM4)

HEAT 101779 ORDER 620625/ 10 BOL 0211074 * CERTIFICATION * 03/11/11

SHIP TO:
COPPER AND BRASS SALES ***ST***
1137 ATLANTA INDUSTRIAL DRIVE

MARIETTA 300666604

----- YOUR ORDER & DATE -----
5400093631 3/11/11 CUST# 0316001 CUST TAG#SSRD00596

----- ITEM DESCRIPTION -----
GRADE 316L/316 Ship Condition CONDA
Size 316L RND CFA CONDA .6250 x 144.000 RL
Country of Melt: UNITED KINGDOM Country of Mfg.: UNITED STATES
NAFTA Country of Origin is Country of Melt

No weld repair
Free of mercury contamination, Free of radiation contamination
No WEEE relevant substances; Meets EU electrical ROHS

Total Bundles 1 Total Weight 2610

WO 2018544 Bundles: 1E

----- SPECIFICATIONS -----
MFG TO FINISHED BAR IN THE USA FROM BILLETS IMPORTED UNITED KINGDOM
AMS 5648K, 5653F SAE AMS-QQ-S-763B
ASME SA479 E07, A07-09, E10 ASTM A182 09
ASTM A262 02a Practice A/E ASTM A276 10
ASTM A479/A479M 10 ASTM A484 09
ASTM E112 96 DIN 50049/EN 10204 3.1B
DFARS 252.225.7014 6/05 Federal Spec QQ-S-763F
Copper & Brass 316L MAXX NACE MR0175-03, mid-rad hard

----- MECHANICAL & OTHER TESTS -----
Hardness as shipped 167 HB
Hardness as shipped (84 HRC)
Grain size 8.0 Tensile strength, KSI (MPa) 96.1 (663)
Micro OK 0.2% Yield Strngth, KSI (MPa) 43.1 (297)
Intergranular corrosion OK
Elongation % in 4D 53.0
Reduction of area % 78.4

----- CHEMICAL COMPOSITION -----
Carbon (C) .020 Manganese (Mn) 1.780
Phosphorus (P) .033 Sulphur (S) .028
Silicon (Si) .423 Chromium (Cr) 16.700
Nickel (Ni) 10.110 Cobalt (Co) .258
Copper (Cu) .507 Moly (Mo) 2.050
Nitrogen (N) .072 Columbium (Cb) .022
Titanium (Ti) .003 Aluminum (Al) .004
Tin (Sn) .008 Boron (B) .004
Vanadium (V) .070
Columbium/ Tantalum (Cb+Ta) .022
Iron (Fe) Balance
Melt Practice EAF
Refining Practice AOD
De-long Ferrite

Date 3-2-12
Customer ENOVED + HANSEN
These Tests Are For Material Shipped On
Your Order 11995356
From Copper And Brass Sales, Inc.
2401732413
B26 PCS
WGT 826
QC

Knowingly & willfully falsifying or concealing a material act on this form,
or making false, fictitious or fraudulent statements or representations
herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and
accurate as contained in the records of the company and are in compliance
with the specifications, codes, and standards listed above.

M.F. Marcanio, Quality Manager

M.F. Marcanio

Abnahmeprüfzeugnis 3.1 EN10204-3.1



BUTTING

Dokument-Nr.:	30 000 017 209 / 02		
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Bestell-Nr.:	Komm. 1188/75201 / Pos.:	Fertigungs-Auftrags-Nr.:	1031231
Kunden-Material-Nr.:		BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre		
Abmessung:	42,40 x 2,00 mm	Menge:	3.235,050 m = 790 Stück
Werkstoff:	1.4435 / TP316L		

Anforderungen

AD2000-W2/W10/DIN EN 10217-7 TC2/TRB100
Ausnutzung der zulässigen Berechnungsspannung: 100 %.

Geliefert von	Lief.-Charge	Fertigungs-Auftrags-Nr.	Serial-Nr.
OUTOKUMPU	403961	1031231-	9;11;13-14;17-18;20-27;113-121;123-126;128-131;133-141;143-151; 153-156;160-161;163-171;173-181;183-191;193-201;203-211;213-221; 223-231;233-241;243-251;253-261;263-271;273-281;283-291;293-301; 303-311;313-320;325;329-331;333-341;343-351;353-361;363-364;366-372; 374-382;384-392;394-402;404-405;407-413;415-423;425-433;435-443; 445-453;455-463;465-473;475-483;485-490;495-498-501;503-504;506-514; 516-524;526-533;535-543;545-553;555-563;565-573;575-583;585-593; 595-603;605-613;615-623;625-633;635-643;645-653;655-659;661;663-664; 667;669-677;679-687;689-697;699-707;709-717;719-727;729-737;739-747; 749-757;759-767;769-777;779-787;789-797;799-807;809-817;819-827; 829-832;835-837;839-847;849-857;859-867;869-877;879-887;889-897; 899-901;903-908;910-918;920-928;930-938;940-948;950-958;960-968; 970-978;980-988;990-998;1000-1001

Hergestellt aus Band mit Abnahmeprüfzeugnis nach EN 10204-3.1.

Schmelzanalyse

Ergebnisse gemäß Abnahmeprüfzeugnis des Stahlwerkes:

Geliefert von	Lief.-Charge	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	N (%)	Mo (%)
OUTOKUMPU	403961	0,019	0,43	1,62	0,024	0,001	17,2	12,7	0,06	2,54

Kennzeichnung



1.4435 CH.403961

B
K 47

Materialkontrollen

Kontrolle Materialkennzeichnung: OK

Seite 1/3



Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Abnahmeprüfzeugnis 3.1

EN10204-3.1



BUTTING

Dokument-Nr. 30 000 017 209 / 02

Materialverwechslung: durchgeführt (Spektroskop) OK
 Oberflächenkontrolle: außen 100 % OK
 innen 100 % im Gegenlicht OK
 Oberflächenbeschaffenheit entspricht: EN 10217-7 W2Ab gebeizt / passiviert
 Ausführungsart entspricht: EN 10217-7 W2Ab gebeizt / passiviert
 Wärmebehandlung durchgeführt mit: 1040 - 1090 °C, Abkühlung in Wasser
 Maßkontrolle durchgeführt und entspricht: DIN EN ISO 1127 D4/T3 F1/S2

Ergebnisse der zerstörenden Prüfungen

Zugversuch(e)

Serial-Nr.	Lief.-Charge	Pr.-Lage	Temp. (°C)	a (mm)	D (mm)	Rp0.2 (MPa)	Rp1.0 (MPa)	Rm (MPa)	A (%)	B-Lage
19	403961	I	20	1,91	42,25	329	382	617	46,6	GW
242	403961	I	20	1,90	42,33	325	376	619	47,3	GW
634	403961	I	20	1,91	42,41	317	367	614	47,8	GW
748	403961	I	20	1,90	42,38	318	371	617	46,5	GW
1011	403961	I	20	1,92	42,34	318	368	612	45,4	GW
1262	403961	I	20	1,90	42,30	317	365	612	49,6	GW

Pr.-Lage = Probenlage, a = Dicke, b = Breite, d = Durchmesser, D = Rohrdurchmesser, G/GW = Grundwerkstoff, S/SN = Schweißnaht, WEZ = Wärmeeinflusszone, q = quer, l = längs, V1 = R_{t0,5}/R_m, B-Lage = Bruchlage, Z = Brucheinschnürung

Technologische Prüfungen

Benennung	Befund	Bemerkungen
Aufweitversuch gem. DIN EN ISO 8493	OK	

je Los und je Lieferantencharge durchgeführt

Korrosionstest(s)

Benennung	Befund	Bemerkungen
Interkristalliner Korrosionstest gem. DIN EN ISO 3651-2 Verfahren A	OK	

je Los und je Lieferantencharge durchgeführt

Metallografische Untersuchungen

Benennung	Befund	Lief.-Charge	Dokument-Nr.	Bemerkungen
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064198	
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064199	
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064269	

Zerstörungsfreie Prüfungen

Benennung	Befund	Umfang	Bemerkungen
Eddy current test - outside acc. DIN EN 10246-3	OK	100 %	
Water pressure/leak test - with water (hydrostatic)	OK	100 %	70 bar

Bemerkungen

Die Rohre wurden mit chloridfrier Tinte gekennzeichnet.

Wurzeldurchhang max. 0,2 mm.

Seite 2/3



Qualitätsstelle
 H. Butting GmbH & Co. KG
 29379 Kneesebeck · Germany
 Kneesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
 Thomas Knöfel
 Telefon +49 5834 50-433

Durch die DIN-ISO nach DIN EN ISO/IEC 17025
 akkreditierte Prüfungsstelle
 Die Akkreditierung ist in der Liste
 aufgeführten Prüfverfahren.

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Abnahmeprüfzeugnis 3.1

EN10204-3.1



BUTTING

Dokument-Nr. 30 000 017 209 / 02

"Überprüft nach AD2000-Merkblatt W0 und zertifiziert nach Richtlinie 97/23/EG, Anhang I, Ziffer 4.3 durch die TÜV CERT-Zertifizierungsstelle für Druckgeräte der TÜV Nord Gruppe, Benannte Stelle, Kenn-Nr. 0045".

Die Anforderungen an den Hersteller nach AD-Merkblatt W0/HP0 und TRD 100/201 sind erfüllt. Auf eine Gegenzeichnung wird verzichtet.
Das eingesetzte Schweiß- und Prüfpersonal erfüllt die Anforderungen der EN 10217-7.
Die Anforderungen sind erfüllt.

Seite 3/3



Durch die DAKKS nach DIN EN ISO/IEC 17025
zertifizierte Prüforganisation
Die Akkreditierung gilt für die in der Urkunde
angegebenen Prüfverfahren.

Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Knesebeck - Germany
Knesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064198/QLM/DE1/02	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-00019
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

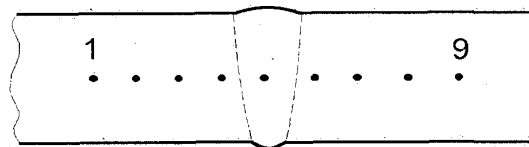
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Abstand zwischen den Eindrücken: 1mm

Messpunkt	Härte
1	170,0
2	174,0
3	180,0
4	178,0
5	170,0
6	169,0
7	163,0
8	165,0
9	168,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Iwan Schwarz
Prüfer 2:
Eingangsdatum: 09.03.2011
Prüfdatum: 11.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064199/QLM/DE1/02	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-00634
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

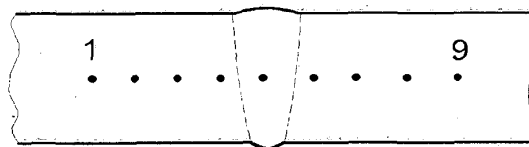
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Abstand zwischen den Eindrücken: 1mm

Messpunkt	Härte
1	160,0
2	164,0
3	152,0
4	151,0
5	157,0
6	153,0
7	152,0
8	150,0
9	148,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Der DAKKS ist nach DIN EN ISO/IEC 17025
akkreditiertes Prüflaboratorium.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Iwan Schwarz
Prüfer 2:
Eingangsdatum: 10.03.2011
Prüfdatum: 11.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064269/QLM/DE1/01	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-01011
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

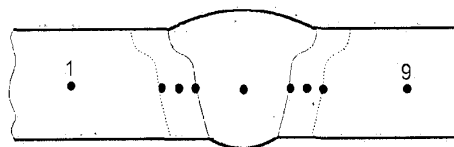
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Messpunkt	Härte
1	159,0
2	190,0
3	177,0
4	185,0
5	144,0
6	180,0
7	179,0
8	188,0
9	167,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Jana Heine
Prüfer 2: Iwan Schwarz
Eingangsdatum: 11.03.2011
Prüfdatum: 14.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no.:	30 000 017 209 / 01		
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	BUTTING order no.:	16060 Pos.: 10
Purchase order no.:	Komm. 1188/75201 / Pos.:	Fabrication order no.:	1031231
Customer material no.:		BUTTING material no.:	100104311
Test object:	longitudinally welded pipes		
Dimension:	42,40 x 2,00 mm	Quantity:	3.235,050 m = 790 Pieces
Material grade:	1.4435 / TP316L		

Requirements

AD2000-W2/W10/DIN EN 10217-7 TC2/TRB100
Weld seam efficiency: 100 %.

Delivered by	Heat no.	Fabrication order no.	Serial no.
OUTOKUMPU	403961	1031231-	9;11;13-14;17-18;20-27;113-121;123-126;128-131;133-141;143-151; 153-156;160-161;163-171;173-181;183-191;193-201;203-211;213-221; 223-231;233-241;243-251;253-261;263-271;273-281;283-291;293-301; 303-311;313-320;325;329-331;333-341;343-351;353-361;363-364;366-372; 374-382;384-392;394-402;404-405;407-413;415-423;425-433;435-443; 445-453;455-463;465-473;475-483;485-490;495-498-501;503-504;506-514; 516-524;526-533;535-543;545-553;555-563;565-573;575-583;585-593; 595-603;605-613;615-623;625-633;635-643;645-653;655-659;661;663-664; 667;669-677;679-687;689-697;699-707;709-717;719-727;729-737;739-747; 749-757;759-767;769-777;779-787;789-797;799-807;809-817;819-827; 829-832;835-837;839-847;849-857;859-867;869-877;879-887;889-897; 899-901;903-908;910-918;920-928;930-938;940-948;950-958;960-968; 970-978;980-988;990-998;1000-1001

Produced from Strip with Inspection certificate acc. EN 10204-3.1.

Heat analysis

Results of chem. Composition of Cast acc. to mill Inspection certificate:

Delivered by	Heat no.	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	N (%)	Mo (%)
OUTOKUMPU	403961	0,019	0,43	1,62	0,024	0,001	17,2	12,7	0,06	2,54

Marking



1.4435 CH.403961



Material inspection

Control of material marking:

OK

Page 1/3



BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

Durch das DAKKS nach DIN EN ISO/IEC 17025
geprüfte und zertifizierte
Die Akkreditierung gilt für alle der Skizze
aufgeführten Prüfverfahren.

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Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no. 30 000 017 209 / 01

Alloy verification (PMI):

Surface inspection:

Surface finish:

Delivery condition:

Heat treatment:

Dimensional control:

carried out (spectroscope) OK

outside 100 % OK

inside 100 % with light OK

EN 10217-7 W2Ab pickled / passivated

EN 10217-7 W2Ab pickled / passivated

1040 - 1090 °C, quenched in water

DIN EN ISO 1127 D4/T3 F1/S2

Results of destructive tests

Tensile test(s)

Serial no.	Heat no.	Test loc.	Temp. (°C)	a (mm)	D (mm)	Rp0.2 (MPa)	Rp1.0 (MPa)	Rm (MPa)	A (%)	Break
19	403961	I	20	1,91	42,25	329	382	617	46,6	GW
242	403961	I	20	1,90	42,33	325	376	619	47,3	GW
634	403961	I	20	1,91	42,41	317	367	614	47,8	GW
748	403961	I	20	1,90	42,38	318	371	617	46,5	GW
1011	403961	I	20	1,92	42,34	318	368	612	45,4	GW
1262	403961	I	20	1,90	42,30	317	365	612	49,6	GW

Test-loc. = Test-location, a = thickness, b = width, d = diameter, D = Pipe diameter, G/GW = Base material, S/SN = weld,

WEZ = Heat affected zone, l = longitudinal, q = transverse, V1 = R_{t0,5}/R_m, B-Lage = Break, Z = Area of reduction

Technological test(s)

Description	Result	Remarks
Drift expanding test acc to DIN EN ISO 8493	OK	

per lot and heat no. of suppliers

Corrosion test(s)

Description	Result	Remarks
Intergranular corrosion test acc. to DIN EN ISO 3651-2 method A	OK	

per lot and heat no. of suppliers

Metallographic examination

Description	Result	Heat no.	Document no.	Remarks
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064198	
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064199	
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064269	

Non destructive tests

Description	Result	Extent	Remarks
Eddy current test - outside acc. DIN EN 10246-3	OK	100 %	
Water pressure/leak test - with water (hydrostatic)	OK	100 %	70 bar

Remarks

The pipes have been marked with ink free of chloride.

Weld reinforcement up to 0,2 mm.

Page 2/3



BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüflaboratorium.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

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Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no. 30 000 017 209 / 01

"Tested acc. to AD2000-Merkblatt W0 and certified acc. to Pressure Equipment Directive 97/23/EC, Annex I, sec. 4.3 by TÜV CERT of the TÜV Nord Gruppe, Notified Body, Identification No. 0045".

The manufacturer fulfils the requirements acc. to "AD-Merkblatt W0/HP0" and "TRD 100/201" without additional countersignature.
The assigned welding and test personnel fulfil the requirements of EN 10217-7.
The requirements are fulfilled.

Page 3/3



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditierte Prüfstelle
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

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Examination Record

Hardness test



BUTTING

Document no.:	20000064198/QLM/EN1/02	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-00019
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

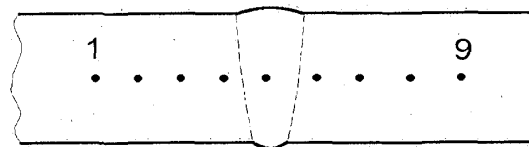
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



Distance between indentations: 1mm

M-point	Hardness
1	170.0
2	174.0
3	180.0
4	178.0
5	170.0
6	169.0
7	163.0
8	165.0
9	168.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Iwan Schwarz
Inspector 2:
Date of receipt: 09/03/2011
Test date: 11/03/2011

Purchaser's
authorized inspector:

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Examination Record

Hardness test



BUTTING

Document no.:	20000064199/QLM/EN1/02	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-00634
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

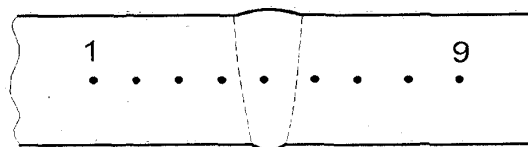
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



Distance between indentations: 1mm

M-point	Hardness
1	160.0
2	164.0
3	152.0
4	151.0
5	157.0
6	153.0
7	152.0
8	150.0
9	148.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum
Die Akkreditierung gilt für alle in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Iwan Schwarz
Inspector 2:
Date of receipt: 10/03/2011
Test date: 11/03/2011

Purchaser's
authorized inspector:

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Examination Record

Hardness test



BUTTING

Document no.:	20000064269/QLM/EN1/01	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-01011
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

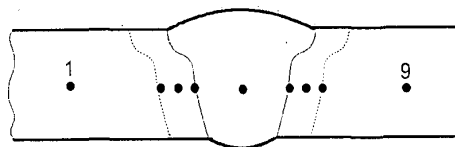
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



M-point	Hardness
1	159.0
2	190.0
3	177.0
4	185.0
5	144.0
6	180.0
7	179.0
8	188.0
9	167.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



Deutsche
Akreditierungsstelle
D-40-11128-01-00

BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Jana Heine
Inspector 2: Iwan Schwarz
Date of receipt: 11/03/2011
Test date: 14/03/2011

Purchaser's
authorized inspector:

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Abnahmeprüfzeugnis 3.1

EN10204-3.1



BUTTING

Dokument-Nr.:	30 000 017 209 / 02		
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Bestell-Nr.:	Komm. 1188/75201 / Pos.:	Fertigungs-Auftrags-Nr.:	1031231
Kunden-Material-Nr.:		BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre		
Abmessung:	42,40 x 2,00 mm	Menge:	3.235,050 m = 790 Stück
Werkstoff:	1.4435 / TP316L		

Anforderungen

AD2000-W2/W10/DIN EN 10217-7 TC2/TRB100
Ausnutzung der zulässigen Berechnungsspannung: 100 %.

Geliefert von	Lief.-Charge	Fertigungs-Auftrags-Nr.	Serial-Nr.
OUTOKUMPU	403961	1031231-	9;11;13-14;17-18;20-27;113-121;123-126;128-131;133-141;143-151; 153-156;160-161;163-171;173-181;183-191;193-201;203-211;213-221; 223-231;233-241;243-251;253-261;263-271;273-281;283-291;293-301; 303-311;313-320;325;329-331;333-341;343-351;353-361;363-364;366-372; 374-382;384-392;394-402;404-405;407-413;415-423;425-433;435-443; 445-453;455-463;465-473;475-483;485-490;495-498-501;503-504;506-514; 516-524;526-533;535-543;545-553;555-563;565-573;575-583;585-593; 595-603;605-613;615-623;625-633;635-643;645-653;655-659;661;663-664; 667;669-677;679-687;689-697;699-707;709-717;719-727;729-737;739-747; 749-757;759-767;769-777;779-787;789-797;799-807;809-817;819-827; 829-832;835-837;839-847;849-857;859-867;869-877;879-887;889-897; 899-901;903-908;910-918;920-928;930-938;940-948;950-958;960-968; 970-978;980-988;990-998;1000-1001

Hergestellt aus Band mit Abnahmeprüfzeugnis nach EN 10204-3.1.

Schmelzanalyse

Ergebnisse gemäß Abnahmeprüfzeugnis des Stahlwerkes:

Geliefert von	Lief.-Charge	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	N (%)	Mo (%)
OUTOKUMPU	403961	0,019	0,43	1,62	0,024	0,001	17,2	12,7	0,06	2,54

Kennzeichnung



1.4435 CH.403961

B
K 47

Materialkontrollen

Kontrolle Materialkennzeichnung: OK

Seite 1/3



Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

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Abnahmeprüfzeugnis 3.1

EN10204-3.1



BUTTING

Dokument-Nr. 30 000 017 209 / 02

Materialverwechslung: durchgeführt (Spektroskop) OK
 Oberflächenkontrolle: außen 100 % OK
 innen 100 % im Gegenlicht OK
 Oberflächenbeschaffenheit entspricht: EN 10217-7 W2Ab gebeizt / passiviert
 Ausführungsart entspricht: EN 10217-7 W2Ab gebeizt / passiviert
 Wärmebehandlung durchgeführt mit: 1040 - 1090 °C, Abkühlung in Wasser
 Maßkontrolle durchgeführt und entspricht: DIN EN ISO 1127 D4/T3 F1/S2

Ergebnisse der zerstörenden Prüfungen

Zugversuch(e)

Serial-Nr.	Lief.-Charge	Pr.-Lage	Temp. (°C)	a (mm)	D (mm)	Rp0.2 (MPa)	Rp1.0 (MPa)	Rm (MPa)	A (%)	B-Lage
19	403961	I	20	1,91	42,25	329	382	617	46,6	GW
242	403961	I	20	1,90	42,33	325	376	619	47,3	GW
634	403961	I	20	1,91	42,41	317	367	614	47,8	GW
748	403961	I	20	1,90	42,38	318	371	617	46,5	GW
1011	403961	I	20	1,92	42,34	318	368	612	45,4	GW
1262	403961	I	20	1,90	42,30	317	365	612	49,6	GW

Pr.-Lage = Probenlage, a = Dicke, b = Breite, d = Durchmesser, D = Rohrdurchmesser, G/GW = Grundwerkstoff, S/SN = Schweißnaht, WEZ = Wärmeeinflusszone, q = quer, l = längs, V1 = R_{t0,5}/R_m, B-Lage = Bruchlage, Z = Brucheinschnürung

Technologische Prüfungen

Benennung	Befund	Bemerkungen
Aufweitversuch gem. DIN EN ISO 8493	OK	

je Los und je Lieferantencharge durchgeführt

Korrosionstest(s)

Benennung	Befund	Bemerkungen
Interkristalliner Korrosionstest gem. DIN EN ISO 3651-2 Verfahren A	OK	

je Los und je Lieferantencharge durchgeführt

Metallografische Untersuchungen

Benennung	Befund	Lief.-Charge	Dokument-Nr.	Bemerkungen
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064198	
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064199	
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064269	

Zerstörungsfreie Prüfungen

Benennung	Befund	Umfang	Bemerkungen
Eddy current test - outside acc. DIN EN 10246-3	OK	100 %	
Water pressure/leak test - with water (hydrostatic)	OK	100 %	70 bar

Bemerkungen

Die Rohre wurden mit chloridfreier Tinte gekennzeichnet.

Wurzeldurchhang max. 0,2 mm.

Seite 2/3



Qualitätsstelle
 H. Butting GmbH & Co. KG
 29379 Kneesebeck · Germany
 Kneesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
 Thomas Knöfel
 Telefon +49 5834 50-433

Durch die DIN-ISO nach DIN EN ISO/IEC 17025
 akkreditierte Prüfungsstelle
 Die Akkreditierung ist in der Liste
 aufgeführten Prüfverfahren.

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Abnahmeprüfzeugnis 3.1

EN10204-3.1



BUTTING

Dokument-Nr. 30 000 017 209 / 02

"Überprüft nach AD2000-Merkblatt W0 und zertifiziert nach Richtlinie 97/23/EG, Anhang I, Ziffer 4.3 durch die TÜV CERT-Zertifizierungsstelle für Druckgeräte der TÜV Nord Gruppe, Benannte Stelle, Kenn-Nr. 0045".

Die Anforderungen an den Hersteller nach AD-Merkblatt W0/HP0 und TRD 100/201 sind erfüllt. Auf eine Gegenzeichnung wird verzichtet.
Das eingesetzte Schweiß- und Prüfpersonal erfüllt die Anforderungen der EN 10217-7.
Die Anforderungen sind erfüllt.

Seite 3/3



Durch die DAKKS nach DIN EN ISO/IEC 17025
anerkannter Prüforganisation
Die Akkreditierung gilt für die in der Urkunde
angegebenen Prüfverfahren.

Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Knesebeck - Germany
Knesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064198/QLM/DE1/02	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-00019
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

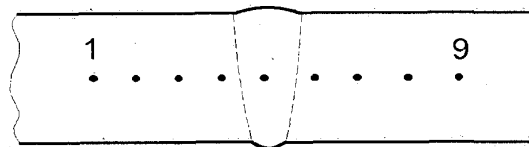
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Abstand zwischen den Eindrücken: 1mm

Messpunkt	Härte
1	170,0
2	174,0
3	180,0
4	178,0
5	170,0
6	169,0
7	163,0
8	165,0
9	168,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Iwan Schwarz
Prüfer 2:
Eingangsdatum: 09.03.2011
Prüfdatum: 11.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064199/QLM/DE1/02	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-00634
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

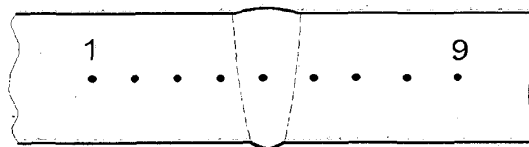
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Abstand zwischen den Eindrücken: 1mm

Messpunkt	Härte
1	160,0
2	164,0
3	152,0
4	151,0
5	157,0
6	153,0
7	152,0
8	150,0
9	148,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Der DAKKS ist nach DIN EN ISO/IEC 17025
akkreditiertes Prüflaboratorium.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Iwan Schwarz
Prüfer 2:
Eingangsdatum: 10.03.2011
Prüfdatum: 11.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064269/QLM/DE1/01	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-01011
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

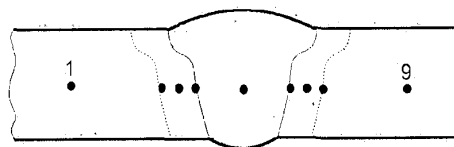
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Messpunkt	Härte
1	159,0
2	190,0
3	177,0
4	185,0
5	144,0
6	180,0
7	179,0
8	188,0
9	167,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Jana Heine
Prüfer 2: Iwan Schwarz
Eingangsdatum: 11.03.2011
Prüfdatum: 14.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no.:	30 000 017 209 / 01		
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	BUTTING order no.:	16060 Pos.: 10
Purchase order no.:	Komm. 1188/75201 / Pos.:	Fabrication order no.:	1031231
Customer material no.:		BUTTING material no.:	100104311
Test object:	longitudinally welded pipes		
Dimension:	42,40 x 2,00 mm	Quantity:	3.235,050 m = 790 Pieces
Material grade:	1.4435 / TP316L		

Requirements

AD2000-W2/W10/DIN EN 10217-7 TC2/TRB100
Weld seam efficiency: 100 %.

Delivered by	Heat no.	Fabrication order no.	Serial no.
OUTOKUMPU	403961	1031231-	9;11;13-14;17-18;20-27;113-121;123-126;128-131;133-141;143-151; 153-156;160-161;163-171;173-181;183-191;193-201;203-211;213-221; 223-231;233-241;243-251;253-261;263-271;273-281;283-291;293-301; 303-311;313-320;325;329-331;333-341;343-351;353-361;363-364;366-372; 374-382;384-392;394-402;404-405;407-413;415-423;425-433;435-443; 445-453;455-463;465-473;475-483;485-490;495-498-501;503-504;506-514; 516-524;526-533;535-543;545-553;555-563;565-573;575-583;585-593; 595-603;605-613;615-623;625-633;635-643;645-653;655-659;661;663-664; 667;669-677;679-687;689-697;699-707;709-717;719-727;729-737;739-747; 749-757;759-767;769-777;779-787;789-797;799-807;809-817;819-827; 829-832;835-837;839-847;849-857;859-867;869-877;879-887;889-897; 899-901;903-908;910-918;920-928;930-938;940-948;950-958;960-968; 970-978;980-988;990-998;1000-1001

Produced from Strip with Inspection certificate acc. EN 10204-3.1.

Heat analysis

Results of chem. Composition of Cast acc. to mill Inspection certificate:

Delivered by	Heat no.	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	N (%)	Mo (%)
OUTOKUMPU	403961	0,019	0,43	1,62	0,024	0,001	17,2	12,7	0,06	2,54

Marking



1.4435 CH.403961



Material inspection

Control of material marking:

OK

Page 1/3



BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

Durch das DAKKS nach DIN EN ISO/IEC 17025
geprüfte und zertifizierte Stelle.
Die Akkreditierung gilt für alle der Skizze
aufgeführten Prüfverfahren.

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Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no. 30 000 017 209 / 01

Alloy verification (PMI):

Surface inspection:

Surface finish:

Delivery condition:

Heat treatment:

Dimensional control:

carried out (spectroscope) OK

outside 100 % OK

inside 100 % with light OK

EN 10217-7 W2Ab pickled / passivated

EN 10217-7 W2Ab pickled / passivated

1040 - 1090 °C, quenched in water

DIN EN ISO 1127 D4/T3 F1/S2

Results of destructive tests

Tensile test(s)

Serial no.	Heat no.	Test loc.	Temp. (°C)	a (mm)	D (mm)	Rp0.2 (MPa)	Rp1.0 (MPa)	Rm (MPa)	A (%)	Break
19	403961	I	20	1,91	42,25	329	382	617	46,6	GW
242	403961	I	20	1,90	42,33	325	376	619	47,3	GW
634	403961	I	20	1,91	42,41	317	367	614	47,8	GW
748	403961	I	20	1,90	42,38	318	371	617	46,5	GW
1011	403961	I	20	1,92	42,34	318	368	612	45,4	GW
1262	403961	I	20	1,90	42,30	317	365	612	49,6	GW

Test-loc. = Test-location, a = thickness, b = width, d = diameter, D = Pipe diameter, G/GW = Base material, S/SN = weld,

WEZ = Heat affected zone, l = longitudinal, q = transverse, V1 = R_{t0,5}/R_m, B-Lage = Break, Z = Area of reduction

Technological test(s)

Description	Result	Remarks
Drift expanding test acc to DIN EN ISO 8493	OK	

per lot and heat no. of suppliers

Corrosion test(s)

Description	Result	Remarks
Intergranular corrosion test acc. to DIN EN ISO 3651-2 method A	OK	

per lot and heat no. of suppliers

Metallographic examination

Description	Result	Heat no.	Document no.	Remarks
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064198	
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064199	
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064269	

Non destructive tests

Description	Result	Extent	Remarks
Eddy current test - outside acc. DIN EN 10246-3	OK	100 %	
Water pressure/leak test - with water (hydrostatic)	OK	100 %	70 bar

Remarks

The pipes have been marked with ink free of chloride.

Weld reinforcement up to 0,2 mm.

Page 2/3



BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

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Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no. 30 000 017 209 / 01

"Tested acc. to AD2000-Merkblatt W0 and certified acc. to Pressure Equipment Directive 97/23/EC, Annex I, sec. 4.3 by TÜV CERT of the TÜV Nord Gruppe, Notified Body, Identification No. 0045".

The manufacturer fulfils the requirements acc. to "AD-Merkblatt W0/HP0" and "TRD 100/201" without additional countersignature.
The assigned welding and test personnel fulfil the requirements of EN 10217-7.
The requirements are fulfilled.

Page 3/3



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditierte Prüfstelle
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

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Examination Record

Hardness test



BUTTING

Document no.:	20000064198/QLM/EN1/02	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-00019
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

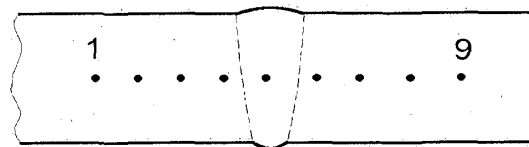
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



Distance between indentations: 1mm

M-point	Hardness
1	170.0
2	174.0
3	180.0
4	178.0
5	170.0
6	169.0
7	163.0
8	165.0
9	168.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Iwan Schwarz
Inspector 2:
Date of receipt: 09/03/2011
Test date: 11/03/2011

Purchaser's
authorized inspector:

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Examination Record

Hardness test



BUTTING

Document no.:	20000064199/QLM/EN1/02	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-00634
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

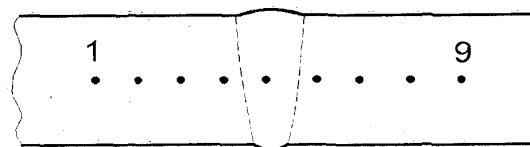
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



Distance between indentations: 1mm

M-point	Hardness
1	160.0
2	164.0
3	152.0
4	151.0
5	157.0
6	153.0
7	152.0
8	150.0
9	148.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum
Die Akkreditierung gilt für alle in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Iwan Schwarz
Inspector 2:
Date of receipt: 10/03/2011
Test date: 11/03/2011

Purchaser's
authorized inspector:

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Examination Record

Hardness test



BUTTING

Document no.:	20000064269/QLM/EN1/01	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-01011
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

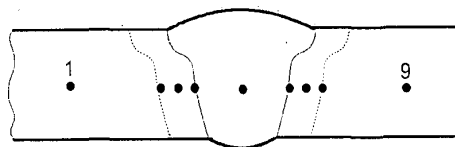
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



M-point	Hardness
1	159.0
2	190.0
3	177.0
4	185.0
5	144.0
6	180.0
7	179.0
8	188.0
9	167.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



DAKKS
Deutsche
Akreditierungsstelle
D-40118 Düsseldorf

BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Jana Heine
Inspector 2: Iwan Schwarz
Date of receipt: 11/03/2011
Test date: 14/03/2011

Purchaser's
authorized inspector:

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Level



Pressure



Flow



Temperature

Liquid
Analysis

Registration

Systems
Components

Services



Solutions

Endress+Hauser GmbH+Co.
2340 Endress Place
Greenwood, In, 46143-9772

Final Inspection Report / Endprüfprotokoll

The manufacturer confirms that all measuring equipment used to assure the quality of the products has been calibrated and is traceable (e.g. DKD/DakkS, NIST, NABL...) to national or international standards. Der Hersteller bestätigt, dass die zu Qualitätsprüfungen des Erzeugnisses eingesetzten Messmittel gültig kalibriert waren und auf nationale (z.B. DKD/DakkS, NIST, NABL...) bzw. internationale Normale rückführbar sind.

Levelflex M

TAG number	Messstellen-Nummer	128-GRSSY-B0LT0301
Order code	Bestellcode	FMP40-VYY2YY9B21JB
Serial number	Seriennummer	F301221504E
Extended order code	Erweiterter Bestellcode	FMP40-VYY2YY9B21JB

Output type	Ausgang	4 ... 20 mA HART
Software version	Softwareversion	V01.04.02
Probe length	Sondenlänge	L=204.0 in.

TRANSCANADA KEYSTONE PIPELINE

Customer order number	Auftragsnummer des Kunden	25472-101-POA-JL10-W0001
E+H sales order number	E+H Auftragsnummer	71178245 000080
Internal order number	Interne Auftragsnummer	41921566/0080
Ambient temperature	Umgebungs- Temperatur	22.2 °C (± 1 °C)

Test step	Testschritt	Test result	Testergebnisse
Current Output (4 to 20 mA)	Stromausgang (4...20 mA)	Pass	Bestanden
Alarm Current Test	Alarmstrom	Pass	Bestanden
Current Drain	Test Stromaufnahme	Pass	Bestanden
SNR Test	Test Signaldynamik	Pass	Bestanden
Distance Test	Distanzprüfung	Pass	Bestanden
Digital Communication Test	Test Digitale Kommunikation	Pass	Bestanden
Display Test	Test Display	Pass	Bestanden



We confirm that all tests, according to the Inspection and Test Plan (ITP), have been performed successfully.

Wir bestätigen, dass alle Tests aus den Inspektions- und Testplänen (ITP) erfolgreich durchgeführt wurden.

At the time of verification, the measuring points of the device indicated above were in compliance to the published valid technical specification (TI).
TI00358F

Das Gerät entsprach zum Zeitpunkt der Prüfung an den aufgeführten Messpunkten den gültigen technischen Spezifikationen (TI).

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Operator /geprüft durch 155357
Date of inspection / Prüfdatum 09. Apr 2012

Endress+Hauser 
People for Process Automation

Abnahmeprüfzeugnis nach EN 10204 - 3.1
Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_70

Seite / page 1 / 3

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000070	1,000	FMP40-VYY2YY9B21JB Levelflex M FMP40	
		S/N F301211504E	TAG 127-PIAPT-B0LT0301 25472-101-POA-JL10 -W0001 ITEM 7.00

Kennzeichnung / Marking
● Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05P1N
Adapter / adapter
TALLEY METALS
000791575
742232

Kennzeichnung / Marking
● Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05NA9
Flansch / flange
MAASS GLOBAL GROUP
-
E111292



Abnahmeprüfzeugnis nach EN 10204 - 3.1

Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_70

Seite / page 2 / 3

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

032KC
Mutter / nut
NORTH AMERICAN STAINLESS
669810
9ja8

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

061NA
Mutter / nut
OUTO KUMPU
BOL0209683
E101502

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

043RX
Stab / rod
OLARRA
94169
318600

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05PM4
Stange / bar
OUTO KUMPU
5400093631
101779

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

061N8
mutter / nut
OUTO KUMPU
BOL0209683
E101502

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

061N9
mutter / nut
OUTO KUMPU
BOL0209683
E101502

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05WKM
pipe/coax
BUTTING
30 000 017 209 / 02
403961

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05WP9
pipe/coax
BUTTING
30 000 017 209 / 02
403961

Abnahmeprüfzeugnis nach EN 10204 - 3.1
Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_70

Seite / page 3 / 3

10.04.2012

Endress+Hauser (USA)
Automation Instrumentation Inc.
US-46143 Greenwood

Jonathan Tutwiler
- Abnahmebeauftragter -
- Inspector -

Dieses Zeugnis wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig.
This document was generated electronically acc. to EN 10204 and is valid without signature.

CERTIFICATE OF TESTS

CERT SERIAL# 000791575



TALLEY METALS
A Carpenter Company

Talley Metals Technology, Inc.
205 Talley Metals Lane

McBee, SC. 29101 Tel: (610) 208-2000 (800) 338-4592

10/21/11

CUSTOMER / BESTELLER / CLIENT

COPPER & BRASS SALES

22355 W ELEVEN MILE
SOUTHFIELD MI 48034

ABNAHMEPRUEFZEUGNIS

CERTIFICAT DE CONTROLE

- THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47.
- THE VALUES AND OTHER TECHNICAL DATA REPRESENT THE RESULTS OF ANALYSES AND TESTS MADE ON SAMPLES COLLECTED FROM THE TOTAL LOT. ORIGINAL DATA RECORDS CAN BE TRACED BY REFERENCE TO THE CARPENTER ORDER NUMBER.
- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
- THIS DOCUMENT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF CARPENTER TECHNOLOGY CORPORATION.

SELLER / VERKÄUFER / VENDEUR PAGE 1 OF 2

HVL

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
5400108534-0060	W41340	10/21/11	9940.000

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE :

742232

UNS NUMBER S31603

PRODUCT DESCRIPTION: TYPE 316L MAXX ANNEALED COLD FINISH

PART NUMBER: SSRD00692

SPECIFICATION: TALLEY 316L-T1A (12/21/98)

QQ-S-763F (06/27/96)

AMS 5648 REV K (08/ /02)

AMS 5653 REV G (05/ /11)

ASTM-A182-07 (CHEM ONLY)

ASTM-A193-11

ASTM-A276-10

ASTM-A314-08

ASTM-A320-11 (CHEM ONLY)

ASTM-A479-10A

ASTM-A484-11

ASTM-A580-08 (SIZES .500" AND UNDER ONLY)

ASME-SA182 2010 EDITION (CHEM ONLY)

ASME-SA193 2010 EDITION

ASME-SA320 2010 EDITION (CHEM ONLY)

ASME-SA479 2010 EDITION

AMS-QQ-S-763B (08/ /06)

Date 11-11-11
Customer Endress+Hauser
These Tests Are For Material Shipped On
Your Order 11951679
From Copper And Brass Sales, Inc.
INV/WO 14000853482
WGT 2910 PCS QC

SIZE 2.625000 IN. (66.68 MM) RD BAR

PRIMARY HEAT CHEMISTRY(WT%): (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN (XRF)	SI (XRF)	P (XRF)	S (COM)	CR (XRF)
0.015	1.48	0.54	0.025	0.023	16.60
NI (XRF)	MO (XRF)	CU (XRF)	CO (XRF)	N (FUS)	
10.26	2.06	0.41	0.35	0.047	

INTERGRANULAR CORROSION TESTED TO ASTM-A262, PRACTICE E - ACCEPTABLE.
ANNEALED MICROSTRUCTURE FREE FROM CONTINUOUS GRAIN BOUNDARY CARBIDE
PRECIPITATION (NETWORK).

EDDY CURRENT TEST PERFORMED

HARDNESS AS SHIPPED, HBW - 155 (MIDRADIUS)

(T) RANSVERSE	(L) ONGITUDINAL	L
YIELD STRENGTH, (0.20 %) KSI (MPA)		38.2 (263)
TENSILE STRENGTH, KSI (MPA)		81.0 (558)
ELONGATION IN 2.00", %		60.0
REDUCTION OF AREA, %		75.0

CONTINUED ON NEXT PAGE

CERTIFICATE OF TESTS

CERT SERIAL# 000791575


TALLEY METALS
 A Carpenter Company

 Talley Metals Technology, Inc.
 205 Talley Metals Lane

McBee, SC. 29101 Tel: (610) 208-2000 (800) 338-4592

10/21/11

CUSTOMER / BESTELLER / CLIENT

COPPER & BRASS SALES

 22355 W ELEVEN MILE
 SOUTHFIELD MI 48034

ABNAHMEPRUEFZEUGNIS
CERTIFICAT DE CONTROLE

- THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47.
- THE VALUES AND OTHER TECHNICAL DATA REPRESENT THE RESULTS OF ANALYSES AND TESTS MADE ON SAMPLES COLLECTED FROM THE TOTAL LOT. ORIGINAL DATA RECORDS CAN BE TRACED BY REFERENCE TO THE CARPENTER ORDER NUMBER.
- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
- THIS DOCUMENT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF CARPENTER TECHNOLOGY CORPORATION.

SELLER / VERKÄUFER / VENDEUR PAGE 2 OF 2

HVL

CUSTOMER ORDER NO. / BESTELL-NR. / N° DE COMMANDE	CARPENTER NO. / WERKS-NR. / N° DE REFERENCE INTERNE	DATE / DATUM / DATE	WEIGHT / GEWICHT / POIDS
5400108534-0060	W41340	10/21/11	9940.000

 HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE :
 GRAIN SIZE PER ASTM E112: 4

742232

UNS NUMBER S31603

NO WELD REPAIR PERFORMED
 MATERIAL PRODUCED ON THIS ORDER WAS MELTED AND MANUFACTURED IN THE U.S.A.
 MATERIAL HAS BEEN MELTED IN USA OR QUALIFYING COUNTRY TO DFARS REQUIRE-
 MENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1,
 SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.
 THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS
 OPERATIONS QUALITY PROGRAM MANUAL, REVISION 30 DATED 09/28/11.

WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE
 PURCHASE ORDER AND SPECIFICATION REQUIREMENTS. CERTIFICATE OF TEST IS
 PREPARED IN ACCORDANCE WITH PARAGRAPH 3.1 OF EN 10204 (DIN50049)

TIMOTHY DUVAL
 QUALITY ASSURANCE REP.
 CARPENTER TECHNOLOGY CORPORATION



6870 HIGHWAY 42 EAST

METALLURGICAL TEST REPORT

NORTH AMERICAN STAINLESS
6870 HIGHWAY 42 EAST
GHENT, KY 41045

Certificate: 669810 1

Customer: 000570 021

Your Order: 8005673

Mail To:

ALRO METALS SERVICE CENTER

CUSTOMER PICKUP

P.O. BOX 764

821 SPRINGFIELD STREET

DAYTON, OH 45401

Ship To:

ALRO METALS SERVICE CENTER

CUSTOMER PICKUP

P.O. BOX 764

821 SPRINGFIELD STREET

DAYTON, OH 45401

Date: 9/08/2011 Page: 1

Steel: 316/316L

Finish: CD

NAS Order: IN 0128345 01

Corrosion: ASTM A262 Prac E OK

PRODUCT DESCRIPTION:

Round Bar, Annealed, Cold Draw

UNS 31600/31603 EN 10204 3.1, ASTM A484/08

ASTM A276/10, ASTM A479/10a, ASTM A182/10 CHEM ONLY,

ASME SA479/10a, ASME SA182/10 CHEM ONLY

AMS 5648K/AMS 5653F, AMS QQS-763B, QQS 763F

REMARKS:

COMPLIES W/REQUIREMENTS OF DFARS EU DIRECTIVE 2002.95.

EC. RoHS. EAF+AOD+CC. NO WELD REPAIR. MELTED AND MFG IN USA

FREE FROM MERCURY AND LOW MELTING ALLOY CONTAMINATION

Product Id	Skid #	Diameter	Size	Weight	-----Length-----	Mark	Pieces	Commodity Code
BD8988 4		.6250		1,038	144.00	1	1	13900755

CHEMICAL ANALYSIS CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan)

HEAT	CM	C	CO	CR	CU	MN	MO	N	NI	P
9JA8	US	.0220	.4525	16.6135	.4560	1.6040	2.0850	.0434	10.6500	.0380
		S	SI							
		.0255	.2390							

MECHANICAL PROPERTIES

Product Id	1 d o i c r	HB No.	.2YS KSI	UTS KSI	RA %	Elong % 4D
BD8988 4	R L	195.00	79.00	98.00	72.00	50.00

ALRO STEEL/METAL



RT06252941

NAS hereby certifies that the analysis on this certification is correct and the material meets the specifications stated.

QC ENGINEER

ERIC HESS

9/08/2011



Certificate of Test

HEAT E101502 ORDER 617901/ 15 BOL 0209683 * CERTIFICATION * 11/30/10

SHIP TO:
COPPER AND BRASS SALES **IP**
8001 THYSSENKRUPP PARKWAY

NORTHWOOD 436190000

----- YOUR ORDER & DATE -----
5400083140 11/30/10 CUST# 0316001 CUST TAG#SSRD00252

----- ITEM DESCRIPTION -----
GRADE 316L/316 Ship Condition CONDA
Size 316L RND CFA CONDA 2.2500 x 144.000 RL
Country of Melt: UNITED KINGDOM Country of Mfg.: UNITED STATES
NAFTA Country of Origin is Country of Melt

No weld repair
Free of mercury contamination, Free of radiation contamination
No WEEE relevant substances; Meets EU electrical ROHS

Total Bundles 2 Total Weight 4044

WO 2016738 Bundles: 1B, 1C

----- SPECIFICATIONS -----
MFG TO FINISHED BAR IN THE USA FROM BILLETS IMPORTED UNITED KINGDOM
AMS 5648K, 5653F SAE AMS-QQ-S-763B
ASME SA479 E07, A07-09, E10 ASTM A182 09
ASTM A262 02a Practice A/E ASTM A276 10
ASTM A479/A479M 09 ASTM A484 09
ASTM E112 96 ASTM A320 08 B8M Class 1
ASTM A193 09 B8M DIN 50049/EN 10204 3.1B
DFARS 252.225.7014 6/05 Federal Spec QQ-S-763F
Copper & Brass 316L MAXX NACE MR0175-03, mid-rad hard

----- MECHANICAL & OTHER TESTS -----
Hardness as shipped 160 HB
Hardness as shipped (82 HRB)
Grain size 7.0 Tensile strength,KSI (MPa) 87.6 (604)
Micro OK 0.2% Yield Strngth,KSI(MPa) 38.9 (268)
Intergranular corrosion OK
Elongation % in 4D 53.0
Reduction of area % 75.8

----- CHEMICAL COMPOSITION -----
Carbon (C) .018 Manganese (Mn) 1.710
Phosphorus (P) .030 Sulphur (S) .025
Silicon (Si) .366 Chromium (Cr) 16.690
Nickel (Ni) 10.270 Cobalt (Co) .259
Copper (Cu) .380 Moly (Mo) 2.060
Nitrogen (N) .072 Columbium (Cb) .041
Titanium (Ti) .001 Aluminum (Al) .004
Tin (Sn) .007 Boron (B) .002
Vanadium (V) .070
Columbium/
Tantalum (Cb+Ta) .041
Iron (Fe) Balance
Melt Practice EAF
Refining Practice AOD
De-long Ferrite

Knowingly & willfully falsifying or concealing a material act on this form,
or making false, fictitious or fraudulent statements or representations
herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and
accurate as contained in the records of the company and are in compliance
with the specifications, codes, and standards listed above.

M.F. Marcanio, Quality Manager

Umstempel-Bescheinigung / Certification of re-marking

Kunde / Customer	Lieferant / Supplier
Besteller: Endress + Hauser GmbH + Co.KG	BA-Nr.: 46259
Orderer:	Contract no.:
Bestell-Nr.: 141/1146010843	Artikel-Nr.: 59877419.1U
Order no.:	Article no.:
Artikelbez.: Stab, 71032615	Stückzahl: 580
Article description:	Quantity:
Artikel-Nr.: 71032615	
Article no.:	

Wir bestätigen, daß der gelieferte Artikel aus folgendem Material

We confirm that the delivered article has been produced from the following material

Werkstoff: 1.4462	Abmessung: RD26
Material no.:	Dimension:
Hersteller: Olarra	Zeugnis-Nr.: 94169
Manufacturer:	Certificate No.:
Schmelze: 318600	
Heat no.:	

ausgewiesen durch Abnahmeprüfzeugnis nach DIN EN 10204 - 3.1 von der Firma Kohler Präzisionstechnik gefertigt wurde.

and was expelled by inspection certificate in accordance with DIN EN 10204 - 3.1 by Kohler Präzisionstechnik.

Folgende Kennzeichnung wurde übertragen / The following mark was transferred:

Werkstoff-Nr.: 1.4462
Material no.:

Chargennr./Kundencharge: 043RX
Heat no.:

zusätzl. Stempelungen:
Article-description:

Kurzzeichen: 
Abbreviation:

Außerdem wurde das Teil mit dem Stempel unseres Umstempelberechtigten gekennzeichnet.
The product has been marked with the stamp of our authorized person.

Umstempelung durchgef. von: ☒ WOLFGANG GLOWANIA ☐ HEINRICH JOSTEN
Re-marking was carried out by:

Diese Umstempelung erfolgt mit Zustimmung der TÜV SÜD Industrie Service GmbH, Kenn-Nr. 0036 vom 09.02.2009, Auftrags-Nr. 600 111 748.

This re-marking follow with consent of the TÜV SÜD Industrie Service GmbH TÜV of 09.02.2009, contract no.: 600111748.

Datum / Date: 08.12.2011

Unterschrift / Signature: 

Kohler Präzisionstechnik, Heerstraße 13, D-78554 Aldingen

Telefon +49 (0) 74 24 / 98 21 0- 0 Fax +49 (0) 74 24 / 98 21 0- 50

F 08.02/Aktuelle Ausgabe 21.02.2011

Ersteller: J.Holzer

Seite 1/1

Larrondo LOIU (VIZCAYA) España
P.O. Box 1.323/48080 Bilbao
Tel. 34-(4) 4 71 13 00
Fax. 34-(4) 4 53 16 36



Quality
Management
System
Approved
CERT N°
SGI 6000360

ACEROS INOXIDABLES

OLARRA

HEINE & BEISSWENGER STIFTUNG & CO.
HOEHENSTRASSE, 22
70736 FELLBACH-STUTTGART-ALEMANIA

Trade Mark - Zeichen des Lieferwerkes
Anagrama del suministrador



Works Inspector Stamp - Werkssachverständiger
Sello del Inspector



Certificate type - APZ Nach Certificado tipo EN 10204/3.1		Certificate n° - Prüf-Nr Certificado n° 94169		Date - Datum - Fecha 28 - 10 - 2011	
Our order N° Werks - Nr N° de Referencia 451819	Heat Schmelze Colada 318600	Your order N° Bestell - Nr Pedido N° 4500154854			
Steel Grade Werkstoff Calidad X-2-CRNiMON-22-5-3 / 1.4462		According to Entsprechend Corresponde EN 10.272-2007.			
Shape and Size - Gegenstad Perfil y dimensión RUND 26 mm	Tolerance - Toleranz Tolerancia h 9 / DIN 671 / EN 10278	Bundles Bunde Bultos 2	Bars Stäbe Barras	Weight Gewicht Peso 878 Kg	
Requirements - Anforderungen - Exigencias EN 10.088-3.2005. ASTM A 479 / A 479M-11. NACE MR-0175-2003/ISO 15156-3 2009. UNS.S.31803. PED 97/23/EC, Annex I, Parag.4.3/DGR 97/23/EG Anhang I Bsatz 4.3 Certificate/Zertifikat Nr. 348/2008/MUC					
Melting process / Erschmelzungsart / Proceso de Fusión E.A.F. / A.O.D.		Heat treatment / Wärmebehandlung / Tratamiento térmico 1060C 4H/Std WATER/WASSER/AGUA			
Solution annealed/Abgeschreckt/Hipertemple-Centerless ground/Geschliffen/Rectificado-					
Test results - Ergebnis der Prüfungen - Resultados de los ensayos					
Dimension of Specimen Abmessungen des Probestabes Medida de las probetas	Rp0.2% N/mm2 MPA	Rp 1% N/mm2 MPA	Rm N/mm2 MPA	A %L 5D	A %L 4D
RD. 10,00 mm.	Min. 450		650	25	
	Max.		880		
Hardness Härte HBw	Impact test / Kerschschlag / Resiliencia ISO V Jules				
270	100				
Temperature °C 20	Spec. N° Probe Nr. Pro N°	1	544	622	735
			35		73
			248	284/280/287	
C	Si	Mn	P	S	Cr
Min.					21,00
Max.	0,030	1,00	2,00	0,035	0,015
	0,014	0,55	0,87	0,030	0,001
					22,60
					3,11
					5,35
					0,1700
Visual and dimensional inspection Besichtigung und Ausmessung Control visual y dimensional O.K.	Radioactivity inspection Radioaktivitätskontrolle Control de Radioactividad O.K.	Antimixing test Spektroskop Verwechslungspr Antimezcla O.K.	Grain Size Korngrösse Tamaño de grano		
Remarks - Bemerkungen - Observaciones					
IC test acc./IK prüfung nach EN ISO 3651-2/98 Met.A. OK					
EDV / EDP Acc. EN 10.204 Alfredo Molina Certification Mng. Works Inspector Der Werkssachverständige Inspector de fábrica					

Umstempel-Bescheinigung / Certification of re-marking

Kunde / Customer	Lieferant / Supplier
Besteller: Endress + Hauser GmbH + Co.KG	BA-Nr.: 46259
Orderer:	Contract no.:
Bestell-Nr.: 141/1146010843	Artikel-Nr.: 59877419.1U
Order no.:	Article no.:
Artikelbez.: Stab, 71032615	Stückzahl: 580
Article description:	Quantity:
Artikel-Nr.: 71032615	
Article no.:	

Wir bestätigen, daß der gelieferte Artikel aus folgendem Material

We confirm that the delivered article has been produced from the following material

Werkstoff: 1.4462	Abmessung: RD26
Material no.:	Dimension:
Hersteller.: Olarra	Zeugnis-Nr. 94169
Manufacturer:	Certificate No.:
Schmelze: 318600	
Heat no.:	

ausgewiesen durch Abnahmeprüfzeugnis nach DIN EN 10204 - 3.1 von der Firma Kohler Präzisionstechnik gefertigt wurde.

and was expelled by inspection certificate in accordance with DIN EN 10204 - 3.1 by Kohler Präzisionstechnik.

Folgende Kennzeichnung wurde übertragen / The following mark was transferred:

Werkstoff-Nr.: 1.4462
Material no.:

Chargennr./Kundencharge: 043RX
Heat no.:

zusätzl. Stempelungen:
Article-description:

Kurzzeichen: 
Abbreviation:

Außerdem wurde das Teil mit dem Stempel unseres Umstempelberechtigten gekennzeichnet.
The product has been marked with the stamp of our authorized person.

Umstempelung durchgef. von: ☒ WOLFGANG GLOWANIA ☐ HEINRICH JOSTEN
Re-marking was carried out by:

Diese Umstempelung erfolgt mit Zustimmung der TÜV SÜD Industrie Service GmbH, Kenn-Nr. 0036 vom 09.02.2009, Auftrags-Nr. 600 111 748.
This re-marking follow with consent of the TÜV SÜD Industrie Service GmbH TÜV of 09.02.2009, contract no.: 600111748.

Datum / Date: 08.12.2011

Unterschrift / Signature: 

Kohler Präzisionstechnik, Heerstraße 13, D-78554 Aldingen

Telefon +49 (0) 74 24 / 98 21 0- 0 Fax +49 (0) 74 24 / 98 21 0- 50

F 08.02/Aktuelle Ausgabe 21.02.2011

Ersteller: J.Holzer

Seite 1/1

Material Test Certification
Certificate Conforms to EN 10204/3.1

**Sold to: ROBERT JAMES SALES - BUFFALO
2585 WALDEN AVENUE
BUFFALO, NY 14225**

Cust. P.O.#: AJ1152
Order#: 191776

Item 18

Qty	Part Number	Part Description	Heatcode	HeatNumber	Material									
58	8200300113	M-FIN F316-316L 3.00 160 RF BLD	C1113	E111014 +	F316-316L									
C	Mn	P	S	Si	Ni	Cr	Mo	N	Cu	Ti	V	Co	Ta	W
0.017	1.590	0.028	0.0260	0.280	10.080	17.270	2.070	0.0810				.28		
Ch	Ch-Ta	Al		Fe		Tensile	Yield	Elong %	R of A %			BHN		Grain
		0.005				78,300	40,500	60.00	65.00			140.00		

Heat Treatment: Solution annealed at 1950F/1065C and water quenched.

Specification: A/SA182/M-07 F316/316L NACE MR-0175 2003/ISO 15156, MR-0103 2007; ASME B16.5-2009 as applicable.

Material free from mercury contamination. No weld repair was performed.

✓ Made in Mexico

Item 17

Qty	Part Number	Part Description	Heatcode	HeatNumber	Material								
100	6200000113	M-FIN F316-316L 6.00 180 RF BLD	C1115	E111292	F316-316L								
C	Cr	P	S	Si	Ni	Co	Mn	N	Cu	Fe	V	Al	W
0.017	1.690	0.027	0.0240	0.320	10.130	17.310	2.050	0.0800				.2	
Ed	Co-Fa	Al	Fe	Tensile	Yield	Elong %	R of A %	BHN	Grain				
		0.005			80,400	45,100	80.00	73.00	148.00				

Heat Treatment: Solution annealed at 1950F/1065C and water quenched.

Specification: A/SA182/M-07 F316/316L NACE MR-0175 2003/ISO 15156, MR-0103 2007; ASME B16.5-2009 as applicable.

Material free from mercury contamination. No weld repair was performed.

Made in Mexico

Item 18

Qty	Part Number	Part Description	Heatcode	HeatNumber	Material								
6	6200075226	M-FIN F316-316L .75 300 FF LJ	C1105	B303	F316-316L								
C	P	S	Si	Ni	Cr	Mo	N	Cu	Ti	V	Co	Fe	W
0.023	1.500	0.038	0.0270	0.390	10.010	16.520	2.020	0.0470					
Cb	Cb-1a	Al	Fe	Tensile	Yield	Elong %	R of A %	BHN	Gram				
				79,600	43,000	59.00	57.00	149.00					

Heat Treatment: Solution annealed at 1950F/1065C and water quenched.

Specification: A/SA182/M-07 F316/316L NACE MR-0175 2003/ISO 15156, MR-0103 2007; ASME B16.5-2009 as applicable.

Material free from mercury contamination. No weld repair was performed.

UnMade in Mexico

We certify that the material represented by this document has been tested and inspected and is in conformance with the purchase order, drawing(s) and specification requirements.

Approved by

Harold Acord
Quality Assurance Inspector



Certificate of Test

(05PM4)

HEAT 101779 ORDER 620625/ 10 BOL 0211074 * CERTIFICATION * 03/11/11

SHIP TO:
COPPER AND BRASS SALES ***ST***
1137 ATLANTA INDUSTRIAL DRIVE

MARIETTA 300666604

----- YOUR ORDER & DATE -----
5400093631 3/11/11 CUST# 0316001 CUST TAG#SSRD00596

----- ITEM DESCRIPTION -----
GRADE 316L/316 Ship Condition CONDA
Size 316L RND CFA CONDA .6250 x 144.000 RL
Country of Melt: UNITED KINGDOM Country of Mfg.: UNITED STATES
NAFTA Country of Origin is Country of Melt

No weld repair
Free of mercury contamination, Free of radiation contamination
No WEEE relevant substances; Meets EU electrical ROHS

Total Bundles 1 Total Weight 2610

WO 2018544 Bundles: 1E

----- SPECIFICATIONS -----
MFG TO FINISHED BAR IN THE USA FROM BILLETS IMPORTED UNITED KINGDOM
AMS 5648K, 5653F SAE AMS-QQ-S-763B
ASME SA479 E07, A07-09, E10 ASTM A182 09
ASTM A262 02a Practice A/E ASTM A276 10
ASTM A479/A479M 10 ASTM A484 09
ASTM E112 96 DIN 50049/EN 10204 3.1B
DFARS 252.225.7014 6/05 Federal Spec QQ-S-763F
Copper & Brass 316L MAXX NACE MR0175-03, mid-rad hard

----- MECHANICAL & OTHER TESTS -----
Hardness as shipped 167 HB
Hardness as shipped (84 HRB)
Grain size 8.0 Tensile strength, KSI (MPa) 96.1 (663)
Micro OK 0.2% Yield Strngth, KSI (MPa) 43.1 (297)
Intergranular corrosion OK
Elongation % in 4D 53.0
Reduction of area % 78.4

----- CHEMICAL COMPOSITION -----
Carbon (C) .020 Manganese (Mn) 1.780
Phosphorus (P) .033 Sulphur (S) .028
Silicon (Si) .423 Chromium (Cr) 16.700
Nickel (Ni) 10.110 Cobalt (Co) .258
Copper (Cu) .507 Moly (Mo) 2.050
Nitrogen (N) .072 Columbium (Cb) .022
Titanium (Ti) .003 Aluminum (Al) .004
Tin (Sn) .008 Boron (B) .004
Vanadium (V) .070
Columbium/ Tantalum (Cb+Ta) .022
Iron (Fe) Balance
Melt Practice EAF
Refining Practice AOD
De-long Ferrite

Date 3-2-12
Customer ENOVED + HANSEN
These Tests Are For Material Shipped On
Your Order 11995356
From Copper And Brass Sales, Inc.
2401732413
B26 PCS
WGT 826
QC

Knowingly & willfully falsifying or concealing a material act on this form,
or making false, fictitious or fraudulent statements or representations
herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and
accurate as contained in the records of the company and are in compliance
with the specifications, codes, and standards listed above.

M.F. Marcanio, Quality Manager

M.F. Marcanio

Abnahmeprüfzeugnis 3.1 EN10204-3.1



BUTTING

Dokument-Nr.:	30 000 017 209 / 02		
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Bestell-Nr.:	Komm. 1188/75201 / Pos.:	Fertigungs-Auftrags-Nr.:	1031231
Kunden-Material-Nr.:		BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre		
Abmessung:	42,40 x 2,00 mm	Menge:	3.235,050 m = 790 Stück
Werkstoff:	1.4435 / TP316L		

Anforderungen

AD2000-W2/W10/DIN EN 10217-7 TC2/TRB100
Ausnutzung der zulässigen Berechnungsspannung: 100 %.

Geliefert von	Lief.-Charge	Fertigungs-Auftrags-Nr.	Serial-Nr.
OUTOKUMPU	403961	1031231-	9;11;13-14;17-18;20-27;113-121;123-126;128-131;133-141;143-151; 153-156;160-161;163-171;173-181;183-191;193-201;203-211;213-221; 223-231;233-241;243-251;253-261;263-271;273-281;283-291;293-301; 303-311;313-320;325;329-331;333-341;343-351;353-361;363-364;366-372; 374-382;384-392;394-402;404-405;407-413;415-423;425-433;435-443; 445-453;455-463;465-473;475-483;485-490;495-498-501;503-504;506-514; 516-524;526-533;535-543;545-553;555-563;565-573;575-583;585-593; 595-603;605-613;615-623;625-633;635-643;645-653;655-659;661;663-664; 667;669-677;679-687;689-697;699-707;709-717;719-727;729-737;739-747; 749-757;759-767;769-777;779-787;789-797;799-807;809-817;819-827; 829-832;835-837;839-847;849-857;859-867;869-877;879-887;889-897; 899-901;903-908;910-918;920-928;930-938;940-948;950-958;960-968; 970-978;980-988;990-998;1000-1001

Hergestellt aus Band mit Abnahmeprüfzeugnis nach EN 10204-3.1.

Schmelzanalyse

Ergebnisse gemäß Abnahmeprüfzeugnis des Stahlwerkes:

Geliefert von	Lief.-Charge	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	N (%)	Mo (%)
OUTOKUMPU	403961	0,019	0,43	1,62	0,024	0,001	17,2	12,7	0,06	2,54

Kennzeichnung



1.4435 CH.403961

B
K 47

Materialkontrollen

Kontrolle Materialkennzeichnung: OK

Seite 1/3



Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Abnahmeprüfzeugnis 3.1 EN10204-3.1



Dokument-Nr. 30 000 017 209 / 02

Materialverwechslung: durchgeführt (Spektroskop) OK
Oberflächenkontrolle: außen 100 % OK
innen 100 % im Gegenlicht OK
Oberflächenbeschaffenheit entspricht: EN 10217-7 W2Ab gebeizt / passiviert
Ausführungsart entspricht: EN 10217-7 W2Ab gebeizt / passiviert
Wärmebehandlung durchgeführt mit: 1040 - 1090 °C, Abkühlung in Wasser
Maßkontrolle durchgeführt und entspricht: DIN EN ISO 1127 D4/T3 F1/S2

Ergebnisse der zerstörenden Prüfungen

Zugversuch(e)

Serial-Nr.	Lief.-Charge	Pr.-Lage	Temp. (°C)	a (mm)	D (mm)	Rp0.2 (MPa)	Rp1.0 (MPa)	Rm (MPa)	A (%)	B-Lage
19	403961	I	20	1,91	42,25	329	382	617	46,6	GW
242	403961	I	20	1,90	42,33	325	376	619	47,3	GW
634	403961	I	20	1,91	42,41	317	367	614	47,8	GW
748	403961	I	20	1,90	42,38	318	371	617	46,5	GW
1011	403961	I	20	1,92	42,34	318	368	612	45,4	GW
1262	403961	I	20	1,90	42,30	317	365	612	49,6	GW

Pr.-Lage = Probenlage, a = Dicke, b = Breite, d = Durchmesser, D = Rohrdurchmesser, G/GW = Grundwerkstoff, S/SN = Schweißnaht, WEZ = Wärmeeinflusszone, q = quer, l = längs, V1 = R_{t0,5}/R_m, B-Lage = Bruchlage, Z = Brucheinschnürung

Technologische Prüfungen

Benennung	Befund	Bemerkungen
Aufweitversuch gem. DIN EN ISO 8493	OK	

je Los und je Lieferantencharge durchgeführt

Korrosionstest(s)

Benennung	Befund	Bemerkungen
Interkristalliner Korrosionstest gem. DIN EN ISO 3651-2 Verfahren A	OK	

je Los und je Lieferantencharge durchgeführt

Metallografische Untersuchungen

Benennung	Befund	Lief.-Charge	Dokument-Nr.	Bemerkungen
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064198	
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064199	
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064269	

Zerstörungsfreie Prüfungen

Benennung	Befund	Umfang	Bemerkungen
Eddy current test - outside acc. DIN EN 10246-3	OK	100 %	
Water pressure/leak test - with water (hydrostatic)	OK	100 %	70 bar

Bemerkungen

Die Rohre wurden mit chloridfrier Tinte gekennzeichnet.

Wurzeldurchhang max. 0,2 mm.

Seite 2/3



Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Durch die DIN-ISO nach DIN EN ISO/IEC 17025
akkreditierte Prüfungsstelle
D-PI-11176-01-00
ausgezeichnete Prüfungen

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Abnahmeprüfzeugnis 3.1

EN10204-3.1



BUTTING

Dokument-Nr. 30 000 017 209 / 02

"Überprüft nach AD2000-Merkblatt W0 und zertifiziert nach Richtlinie 97/23/EG, Anhang I, Ziffer 4.3 durch die TÜV CERT-Zertifizierungsstelle für Druckgeräte der TÜV Nord Gruppe, Benannte Stelle, Kenn-Nr. 0045".

Die Anforderungen an den Hersteller nach AD-Merkblatt W0/HP0 und TRD 100/201 sind erfüllt. Auf eine Gegenzeichnung wird verzichtet.
Das eingesetzte Schweiß- und Prüfpersonal erfüllt die Anforderungen der EN 10217-7.
Die Anforderungen sind erfüllt.

Seite 3/3



Durch die DAKKS nach DIN EN ISO/IEC 17025
zertifizierte Prüfperson
Die Verantwortung für die Richtigkeit der
angegebenen Prüfverfahren

Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Knesebeck - Germany
Knesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064198/QLM/DE1/02	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-00019
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

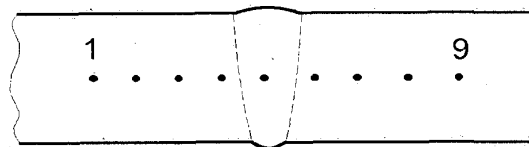
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Abstand zwischen den Eindrücken: 1mm

Messpunkt	Härte
1	170,0
2	174,0
3	180,0
4	178,0
5	170,0
6	169,0
7	163,0
8	165,0
9	168,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Iwan Schwarz
Prüfer 2:
Eingangsdatum: 09.03.2011
Prüfdatum: 11.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064199/QLM/DE1/02	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-00634
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

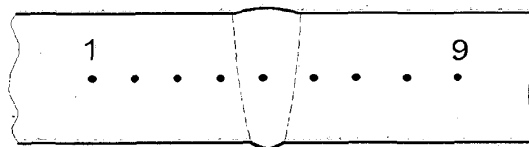
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Abstand zwischen den Eindrücken: 1mm

Messpunkt	Härte
1	160,0
2	164,0
3	152,0
4	151,0
5	157,0
6	153,0
7	152,0
8	150,0
9	148,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Der DAKKS ist nach DIN EN ISO/IEC 17025
akkreditiertes Prüflaboratorium.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Iwan Schwarz
Prüfer 2:
Eingangsdatum: 10.03.2011
Prüfdatum: 11.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064269/QLM/DE1/01	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-01011
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

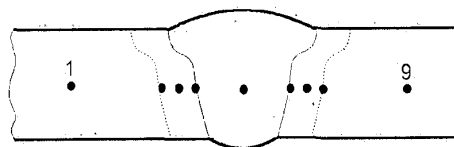
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Messpunkt	Härte
1	159,0
2	190,0
3	177,0
4	185,0
5	144,0
6	180,0
7	179,0
8	188,0
9	167,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Jana Heine
Prüfer 2: Iwan Schwarz
Eingangsdatum: 11.03.2011
Prüfdatum: 14.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no.:	30 000 017 209 / 01		
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	BUTTING order no.:	16060 Pos.: 10
Purchase order no.:	Komm. 1188/75201 / Pos.:	Fabrication order no.:	1031231
Customer material no.:		BUTTING material no.:	100104311
Test object:	longitudinally welded pipes		
Dimension:	42,40 x 2,00 mm	Quantity:	3.235,050 m = 790 Pieces
Material grade:	1.4435 / TP316L		

Requirements

AD2000-W2/W10/DIN EN 10217-7 TC2/TRB100
Weld seam efficiency: 100 %.

Delivered by	Heat no.	Fabrication order no.	Serial no.
OUTOKUMPU	403961	1031231-	9;11;13-14;17-18;20-27;113-121;123-126;128-131;133-141;143-151; 153-156;160-161;163-171;173-181;183-191;193-201;203-211;213-221; 223-231;233-241;243-251;253-261;263-271;273-281;283-291;293-301; 303-311;313-320;325;329-331;333-341;343-351;353-361;363-364;366-372; 374-382;384-392;394-402;404-405;407-413;415-423;425-433;435-443; 445-453;455-463;465-473;475-483;485-490;495-498-501;503-504;506-514; 516-524;526-533;535-543;545-553;555-563;565-573;575-583;585-593; 595-603;605-613;615-623;625-633;635-643;645-653;655-659;661;663-664; 667;669-677;679-687;689-697;699-707;709-717;719-727;729-737;739-747; 749-757;759-767;769-777;779-787;789-797;799-807;809-817;819-827; 829-832;835-837;839-847;849-857;859-867;869-877;879-887;889-897; 899-901;903-908;910-918;920-928;930-938;940-948;950-958;960-968; 970-978;980-988;990-998;1000-1001

Produced from Strip with Inspection certificate acc. EN 10204-3.1.

Heat analysis

Results of chem. Composition of Cast acc. to mill Inspection certificate:

Delivered by	Heat no.	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	N (%)	Mo (%)
OUTOKUMPU	403961	0,019	0,43	1,62	0,024	0,001	17,2	12,7	0,06	2,54

Marking



1.4435 CH.403961



Material inspection

Control of material marking:

OK

Page 1/3



BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

Durch das DAKKS nach DIN EN ISO/IEC 17025
geprüfte und zertifizierte
Zur Akkreditierung ist die durch die
aufgeführten Anforderungen

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Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no. 30 000 017 209 / 01

Alloy verification (PMI):

Surface inspection:

Surface finish:

Delivery condition:

Heat treatment:

Dimensional control:

carried out (spectroscope) OK

outside 100 % OK

inside 100 % with light OK

EN 10217-7 W2Ab pickled / passivated

EN 10217-7 W2Ab pickled / passivated

1040 - 1090 °C, quenched in water

DIN EN ISO 1127 D4/T3 F1/S2

Results of destructive tests

Tensile test(s)

Serial no.	Heat no.	Test loc.	Temp. (°C)	a (mm)	D (mm)	Rp0.2 (MPa)	Rp1.0 (MPa)	Rm (MPa)	A (%)	Break
19	403961	I	20	1,91	42,25	329	382	617	46,6	GW
242	403961	I	20	1,90	42,33	325	376	619	47,3	GW
634	403961	I	20	1,91	42,41	317	367	614	47,8	GW
748	403961	I	20	1,90	42,38	318	371	617	46,5	GW
1011	403961	I	20	1,92	42,34	318	368	612	45,4	GW
1262	403961	I	20	1,90	42,30	317	365	612	49,6	GW

Test-loc. = Test-location, a = thickness, b = width, d = diameter, D = Pipe diameter, G/GW = Base material, S/SN = weld,

WEZ = Heat affected zone, l = longitudinal, q = transverse, V1 = R_{t0,5}/R_m, B-Lage = Break, Z = Area of reduction

Technological test(s)

Description	Result	Remarks
Drift expanding test acc to DIN EN ISO 8493	OK	

per lot and heat no. of suppliers

Corrosion test(s)

Description	Result	Remarks
Intergranular corrosion test acc. to DIN EN ISO 3651-2 method A	OK	

per lot and heat no. of suppliers

Metallographic examination

Description	Result	Heat no.	Document no.	Remarks
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064198	
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064199	
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064269	

Non destructive tests

Description	Result	Extent	Remarks
Eddy current test - outside acc. DIN EN 10246-3	OK	100 %	
Water pressure/leak test - with water (hydrostatic)	OK	100 %	70 bar

Remarks

The pipes have been marked with ink free of chloride.

Weld reinforcement up to 0,2 mm.

Page 2/3



BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

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Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no. 30 000 017 209 / 01

"Tested acc. to AD2000-Merkblatt W0 and certified acc. to Pressure Equipment Directive 97/23/EC, Annex I, sec. 4.3 by TÜV CERT of the TÜV Nord Gruppe, Notified Body, Identification No. 0045".

The manufacturer fulfils the requirements acc. to "AD-Merkblatt W0/HP0" and "TRD 100/201" without additional countersignature.
The assigned welding and test personnel fulfil the requirements of EN 10217-7.
The requirements are fulfilled.

Page 3/3



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditierte Prüfstelle
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

This document is generated by means of computerised programmes and is valid without signature.

Examination Record

Hardness test



BUTTING

Document no.:	20000064198/QLM/EN1/02	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-00019
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

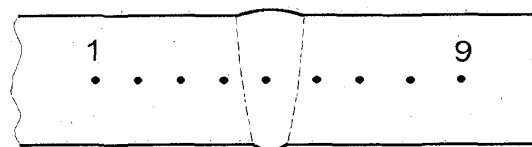
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



Distance between indentations: 1mm

M-point	Hardness
1	170.0
2	174.0
3	180.0
4	178.0
5	170.0
6	169.0
7	163.0
8	165.0
9	168.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



Deutsche
Akreditierungsstelle
D-47111 126-01-00
Durch die DAkkS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Iwan Schwarz
Inspector 2:
Date of receipt: 09/03/2011
Test date: 11/03/2011

Purchaser's
authorized inspector:

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Examination Record

Hardness test



BUTTING

Document no.:	20000064199/QLM/EN1/02	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-00634
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

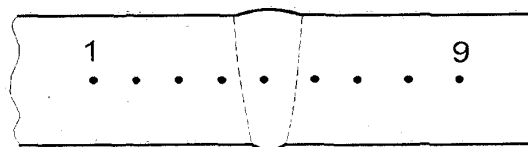
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



Distance between indentations: 1mm

M-point	Hardness
1	160.0
2	164.0
3	152.0
4	151.0
5	157.0
6	153.0
7	152.0
8	150.0
9	148.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

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Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum
Die Akkreditierung gilt für alle in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Iwan Schwarz
Inspector 2:
Date of receipt: 10/03/2011
Test date: 11/03/2011

Purchaser's
authorized inspector:

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Examination Record

Hardness test



BUTTING

Document no.:	20000064269/QLM/EN1/01	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-01011
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

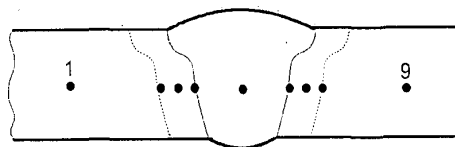
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



M-point	Hardness
1	159.0
2	190.0
3	177.0
4	185.0
5	144.0
6	180.0
7	179.0
8	188.0
9	167.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Jana Heine
Inspector 2: Iwan Schwarz
Date of receipt: 11/03/2011
Test date: 14/03/2011

Purchaser's
authorized inspector:

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Abnahmeprüfzeugnis 3.1 EN10204-3.1



BUTTING

Dokument-Nr.:	30 000 017 209 / 02		
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Bestell-Nr.:	Komm. 1188/75201 / Pos.:	Fertigungs-Auftrags-Nr.:	1031231
Kunden-Material-Nr.:		BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre		
Abmessung:	42,40 x 2,00 mm	Menge:	3.235,050 m = 790 Stück
Werkstoff:	1.4435 / TP316L		

Anforderungen

AD2000-W2/W10/DIN EN 10217-7 TC2/TRB100
Ausnutzung der zulässigen Berechnungsspannung: 100 %.

Geliefert von	Lief.-Charge	Fertigungs-Auftrags-Nr.	Serial-Nr.
OUTOKUMPU	403961	1031231-	9;11;13-14;17-18;20-27;113-121;123-126;128-131;133-141;143-151; 153-156;160-161;163-171;173-181;183-191;193-201;203-211;213-221; 223-231;233-241;243-251;253-261;263-271;273-281;283-291;293-301; 303-311;313-320;325;329-331;333-341;343-351;353-361;363-364;366-372; 374-382;384-392;394-402;404-405;407-413;415-423;425-433;435-443; 445-453;455-463;465-473;475-483;485-490;495-498-501;503-504;506-514; 516-524;526-533;535-543;545-553;555-563;565-573;575-583;585-593; 595-603;605-613;615-623;625-633;635-643;645-653;655-659;661;663-664; 667;669-677;679-687;689-697;699-707;709-717;719-727;729-737;739-747; 749-757;759-767;769-777;779-787;789-797;799-807;809-817;819-827; 829-832;835-837;839-847;849-857;859-867;869-877;879-887;889-897; 899-901;903-908;910-918;920-928;930-938;940-948;950-958;960-968; 970-978;980-988;990-998;1000-1001

Hergestellt aus Band mit Abnahmeprüfzeugnis nach EN 10204-3.1.

Schmelzanalyse

Ergebnisse gemäß Abnahmeprüfzeugnis des Stahlwerkes:

Geliefert von	Lief.-Charge	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	N (%)	Mo (%)
OUTOKUMPU	403961	0,019	0,43	1,62	0,024	0,001	17,2	12,7	0,06	2,54

Kennzeichnung



1.4435 CH.403961

B
K 47

Materialkontrollen

Kontrolle Materialkennzeichnung: OK

Seite 1/3



Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Abnahmeprüfzeugnis 3.1 EN10204-3.1



Dokument-Nr. 30 000 017 209 / 02

Materialverwechslung: durchgeführt (Spektroskop) OK
Oberflächenkontrolle: außen 100 % OK
innen 100 % im Gegenlicht OK
Oberflächenbeschaffenheit entspricht: EN 10217-7 W2Ab gebeizt / passiviert
Ausführungsart entspricht: EN 10217-7 W2Ab gebeizt / passiviert
Wärmebehandlung durchgeführt mit: 1040 - 1090 °C, Abkühlung in Wasser
Maßkontrolle durchgeführt und entspricht: DIN EN ISO 1127 D4/T3 F1/S2

Ergebnisse der zerstörenden Prüfungen

Zugversuch(e)

Serial-Nr.	Lief.-Charge	Pr.-Lage	Temp. (°C)	a (mm)	D (mm)	Rp0.2 (MPa)	Rp1.0 (MPa)	Rm (MPa)	A (%)	B-Lage
19	403961	I	20	1,91	42,25	329	382	617	46,6	GW
242	403961	I	20	1,90	42,33	325	376	619	47,3	GW
634	403961	I	20	1,91	42,41	317	367	614	47,8	GW
748	403961	I	20	1,90	42,38	318	371	617	46,5	GW
1011	403961	I	20	1,92	42,34	318	368	612	45,4	GW
1262	403961	I	20	1,90	42,30	317	365	612	49,6	GW

Pr.-Lage = Probenlage, a = Dicke, b = Breite, d = Durchmesser, D = Rohrdurchmesser, G/GW = Grundwerkstoff, S/SN = Schweißnaht, WEZ = Wärmeeinflusszone, q = quer, l = längs, V1 = R_{t0,5}/R_m, B-Lage = Bruchlage, Z = Brucheinschnürung

Technologische Prüfungen

Benennung	Befund	Bemerkungen
Aufweitversuch gem. DIN EN ISO 8493	OK	

je Los und je Lieferantencharge durchgeführt

Korrosionstest(s)

Benennung	Befund	Bemerkungen
Interkristalliner Korrosionstest gem. DIN EN ISO 3651-2 Verfahren A	OK	

je Los und je Lieferantencharge durchgeführt

Metallografische Untersuchungen

Benennung	Befund	Lief.-Charge	Dokument-Nr.	Bemerkungen
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064198	
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064199	
Härteprüfung gem. NACE (9 Messpunkte)	OK	403961	20000064269	

Zerstörungsfreie Prüfungen

Benennung	Befund	Umfang	Bemerkungen
Eddy current test - outside acc. DIN EN 10246-3	OK	100 %	
Water pressure/leak test - with water (hydrostatic)	OK	100 %	70 bar

Bemerkungen

Die Rohre wurden mit chloridfreier Tinte gekennzeichnet.

Wurzeldurchhang max. 0,2 mm.

Seite 2/3



Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Durch die DIN-ISO nach DIN EN ISO/IEC 17025
akkreditierte Prüfungsstelle
D-PI-11176-01-00
ausgezeichnete Prüfungen

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Abnahmeprüfzeugnis 3.1

EN10204-3.1



BUTTING

Dokument-Nr. 30 000 017 209 / 02

"Überprüft nach AD2000-Merkblatt W0 und zertifiziert nach Richtlinie 97/23/EG, Anhang I, Ziffer 4.3 durch die TÜV CERT-Zertifizierungsstelle für Druckgeräte der TÜV Nord Gruppe, Benannte Stelle, Kenn-Nr. 0045".

Die Anforderungen an den Hersteller nach AD-Merkblatt W0/HP0 und TRD 100/201 sind erfüllt. Auf eine Gegenzeichnung wird verzichtet.
Das eingesetzte Schweiß- und Prüfpersonal erfüllt die Anforderungen der EN 10217-7.
Die Anforderungen sind erfüllt.

Seite 3/3



Durch die DAKKS nach DIN EN ISO/IEC 17025
zertifizierte Prüforganisation
Die Akkreditierung gilt für die in der Urkunde
angegebenen Prüfverfahren.

Qualitätsstelle
H. Butting GmbH & Co. KG
29379 Knesebeck - Germany
Knesebeck, 29.03.2011 / 7156

BUTTING Abnahmebeauftragter
Thomas Knöfel
Telefon +49 5834 50-433

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064198/QLM/DE1/02	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-00019
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

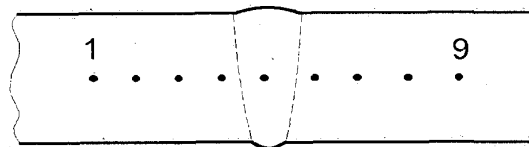
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Abstand zwischen den Eindrücken: 1mm

Messpunkt	Härte
1	170,0
2	174,0
3	180,0
4	178,0
5	170,0
6	169,0
7	163,0
8	165,0
9	168,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Iwan Schwarz
Prüfer 2:
Eingangsdatum: 09.03.2011
Prüfdatum: 11.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064199/QLM/DE1/02	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-00634
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

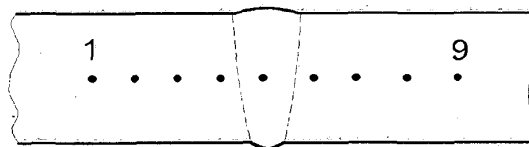
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Abstand zwischen den Eindrücken: 1mm

Messpunkt	Härte
1	160,0
2	164,0
3	152,0
4	151,0
5	157,0
6	153,0
7	152,0
8	150,0
9	148,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Der DAKS ist nach DIN EN ISO/IEC 17025
akkreditiertes Prüflaboratorium.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Iwan Schwarz
Prüfer 2:
Eingangsdatum: 10.03.2011
Prüfdatum: 11.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Prüfprotokoll Härteprüfung



BUTTING

Dokument-Nr.:	20000064269/QLM/DE1/01	Abnahme-Nr.:	
Besteller:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Projekt:	
Bestell-Nr.:	Komm. 1188/75201	BUTTING Auftrags-Nr.:	16060 Pos.: 10
Kunden-Material-Nr.:		Fertigungs-Auftrags-Nr.:	1031231
Prüfart:	041	BUTTING Material-Nr.:	100104311
Prüfgegenstand:	längsnahtgeschweißte Rohre	Prüflos:	40000077491
Abmessung:	42,40 x 2,00 mm	Serial-Nr.:	1031231-01011
Werkstoff:	1.4435/TP316L	Probenidentifik.:	
		Lieferantencharge:	403961

Prüfanforderungen

Härteprüfung gem. NACE (9 Messpunkte)

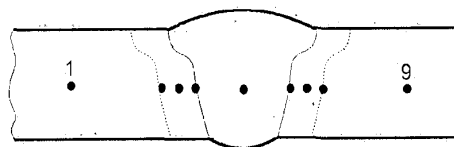
Prüfanweisungen

Prüfnorm: DIN EN ISO 6507-1 (Vickers)
Prüfverfahren: HV10

Sollwerte

GW		SN		WEZ	
min	max	min	max	min	max
--	--	--	--	--	--

Prüfbefunde



Messpunkt	Härte
1	159,0
2	190,0
3	177,0
4	185,0
5	144,0
6	180,0
7	179,0
8	188,0
9	167,0

GW = Grundwerkstoff
SN = Schweißnaht
WEZ = Wärmeeinflusszone

Bemerkungen

Die Härteanforderung nach NACE MR0175 ed. 03 / NACE MR0103-2003 ist erfüllt: max.248HV

Seite 1/1



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

Qualitätsstelle:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Prüfer 1: Jana Heine
Prüfer 2: Iwan Schwarz
Eingangsdatum: 11.03.2011
Prüfdatum: 14.03.2011

Abnahmebeauftragter
des Bestellers:

Dieses Dokument wurde mit Hilfe rechnergestützter Programme erstellt und ist ohne Unterschrift gültig.

Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no.:	30 000 017 209 / 01		
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	BUTTING order no.:	16060 Pos.: 10
Purchase order no.:	Komm. 1188/75201 / Pos.:	Fabrication order no.:	1031231
Customer material no.:		BUTTING material no.:	100104311
Test object:	longitudinally welded pipes		
Dimension:	42,40 x 2,00 mm	Quantity:	3.235,050 m = 790 Pieces
Material grade:	1.4435 / TP316L		

Requirements

AD2000-W2/W10/DIN EN 10217-7 TC2/TRB100
Weld seam efficiency: 100 %.

Delivered by	Heat no.	Fabrication order no.	Serial no.
OUTOKUMPU	403961	1031231-	9;11;13-14;17-18;20-27;113-121;123-126;128-131;133-141;143-151; 153-156;160-161;163-171;173-181;183-191;193-201;203-211;213-221; 223-231;233-241;243-251;253-261;263-271;273-281;283-291;293-301; 303-311;313-320;325;329-331;333-341;343-351;353-361;363-364;366-372; 374-382;384-392;394-402;404-405;407-413;415-423;425-433;435-443; 445-453;455-463;465-473;475-483;485-490;495-498-501;503-504;506-514; 516-524;526-533;535-543;545-553;555-563;565-573;575-583;585-593; 595-603;605-613;615-623;625-633;635-643;645-653;655-659;661;663-664; 667;669-677;679-687;689-697;699-707;709-717;719-727;729-737;739-747; 749-757;759-767;769-777;779-787;789-797;799-807;809-817;819-827; 829-832;835-837;839-847;849-857;859-867;869-877;879-887;889-897; 899-901;903-908;910-918;920-928;930-938;940-948;950-958;960-968; 970-978;980-988;990-998;1000-1001

Produced from Strip with Inspection certificate acc. EN 10204-3.1.

Heat analysis

Results of chem. Composition of Cast acc. to mill Inspection certificate:

Delivered by	Heat no.	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	N (%)	Mo (%)
OUTOKUMPU	403961	0,019	0,43	1,62	0,024	0,001	17,2	12,7	0,06	2,54

Marking



1.4435 CH.403961



Material inspection

Control of material marking:

OK

Page 1/3



BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

Durch das DAKKS nach DIN EN ISO/IEC 17025
geprüfte und zertifizierte
Zur Akkreditierung ist die durch die
aufgeführten Anforderungen

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Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no. 30 000 017 209 / 01

Alloy verification (PMI):

Surface inspection:

Surface finish:

Delivery condition:

Heat treatment:

Dimensional control:

carried out (spectroscope) OK

outside 100 % OK

inside 100 % with light OK

EN 10217-7 W2Ab pickled / passivated

EN 10217-7 W2Ab pickled / passivated

1040 - 1090 °C, quenched in water

DIN EN ISO 1127 D4/T3 F1/S2

Results of destructive tests

Tensile test(s)

Serial no.	Heat no.	Test loc.	Temp. (°C)	a (mm)	D (mm)	Rp0.2 (MPa)	Rp1.0 (MPa)	Rm (MPa)	A (%)	Break
19	403961	I	20	1,91	42,25	329	382	617	46,6	GW
242	403961	I	20	1,90	42,33	325	376	619	47,3	GW
634	403961	I	20	1,91	42,41	317	367	614	47,8	GW
748	403961	I	20	1,90	42,38	318	371	617	46,5	GW
1011	403961	I	20	1,92	42,34	318	368	612	45,4	GW
1262	403961	I	20	1,90	42,30	317	365	612	49,6	GW

Test-loc. = Test-location, a = thickness, b = width, d = diameter, D = Pipe diameter, G/GW = Base material, S/SN = weld,

WEZ = Heat affected zone, l = longitudinal, q = transverse, V1 = R_{t0,5}/R_m, B-Lage = Break, Z = Area of reduction

Technological test(s)

Description	Result	Remarks
Drift expanding test acc to DIN EN ISO 8493	OK	

per lot and heat no. of suppliers

Corrosion test(s)

Description	Result	Remarks
Intergranular corrosion test acc. to DIN EN ISO 3651-2 method A	OK	

per lot and heat no. of suppliers

Metallographic examination

Description	Result	Heat no.	Document no.	Remarks
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064198	
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064199	
Hardness test acc. to NACE (9 measuring points)	OK	403961	20000064269	

Non destructive tests

Description	Result	Extent	Remarks
Eddy current test - outside acc. DIN EN 10246-3	OK	100 %	
Water pressure/leak test - with water (hydrostatic)	OK	100 %	70 bar

Remarks

The pipes have been marked with ink free of chloride.

Weld reinforcement up to 0,2 mm.

Page 2/3



BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Kneesebeck · Germany
Kneesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüflaboratorium.
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

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Inspection certificate 3.1

EN10204-3.1



BUTTING

Document no. 30 000 017 209 / 01

"Tested acc. to AD2000-Merkblatt W0 and certified acc. to Pressure Equipment Directive 97/23/EC, Annex I, sec. 4.3 by TÜV CERT of the TÜV Nord Gruppe, Notified Body, Identification No. 0045".

The manufacturer fulfils the requirements acc. to "AD-Merkblatt W0/HP0" and "TRD 100/201" without additional countersignature.
The assigned welding and test personnel fulfil the requirements of EN 10217-7.
The requirements are fulfilled.

Page 3/3



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditierte Prüfstelle
Die Akkreditierung gilt für die in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department
H. Butting GmbH & Co. KG
29379 Knesebeck · Germany
Knesebeck, 29.03.2011 / 7156

BUTTING authorized inspector
Thomas Knöfel
Phone +49 5834 50-433

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Examination Record

Hardness test



BUTTING

Document no.:	20000064198/QLM/EN1/02	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-00019
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

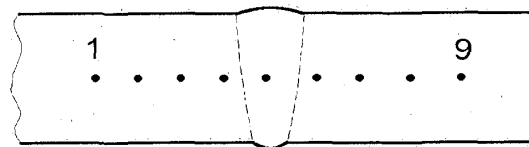
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



Distance between indentations: 1mm

M-point	Hardness
1	170.0
2	174.0
3	180.0
4	178.0
5	170.0
6	169.0
7	163.0
8	165.0
9	168.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Iwan Schwarz
Inspector 2:
Date of receipt: 09/03/2011
Test date: 11/03/2011

Purchaser's
authorized inspector:

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Examination Record

Hardness test



BUTTING

Document no.:	20000064199/QLM/EN1/02	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-00634
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

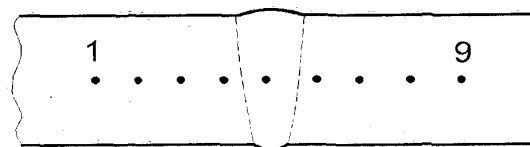
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



Distance between indentations: 1mm

M-point	Hardness
1	160.0
2	164.0
3	152.0
4	151.0
5	157.0
6	153.0
7	152.0
8	150.0
9	148.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

Page 1/1



Durch die DAKKS nach DIN EN ISO/IEC 17025
akkreditiertes Prüfzentrum
Die Akkreditierung gilt für alle in der Urkunde
aufgeführten Prüfverfahren.

BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Iwan Schwarz
Inspector 2:
Date of receipt: 10/03/2011
Test date: 11/03/2011

Purchaser's
authorized inspector:

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Examination Record

Hardness test



BUTTING

Document no.:	20000064269/QLM/EN1/01	Inspection no.:	
Customer:	INOX-Stahlgesellschaft mbH 72622 Nürtingen	Project:	
Purchase order no.:	Komm. 1188/75201	BUTTING order no.:	16060 Pos.: 10
Customer material no.:		Fabrication order no.:	1031231
Test kind:	041	BUTTING material no.:	100104311
Test object:	longitudinally welded pipes	Test lot no.:	40000077491
Dimension:	42.40 x 2.00 mm	Serial no.:	1031231-01011
Material grade:	1.4435/TP316L	Sample identific.:	
		Heat no.:	403961

Examination requirements

Hardness test acc. to NACE (9 measuring points)

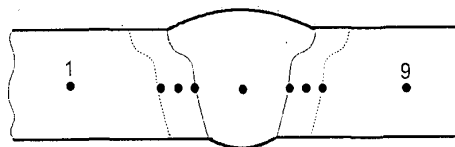
Examination instructions

Test standard: DIN EN ISO 6507-1 (Vickers)
Test method: HV10

Nominal values

BM		W		HAZ	
min	max	min	max	min	max
--	--	--	--	--	--

Examination results



M-point	Hardness
1	159.0
2	190.0
3	177.0
4	185.0
5	144.0
6	180.0
7	179.0
8	188.0
9	167.0

BM = base material
HAZ = heat affected zone
W = weld

Remarks

The hardness requirement acc. to NACE MR0175 ed. 03 / NACE MR0103-2003 is fulfilled: max.248HV

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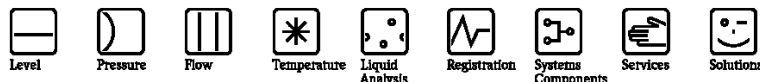


BUTTING QA Department:
H. BUTTING GmbH & Co. KG
29379 Knesebeck · Germany

Inspector 1: Jana Heine
Inspector 2: Iwan Schwarz
Date of receipt: 11/03/2011
Test date: 14/03/2011

Purchaser's
authorized inspector:

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Endress+Hauser GmbH+Co.
2340 Endress Place
Greenwood, In, 46143-9772

Final Inspection Report / Endprüfprotokoll

The manufacturer confirms that all measuring equipment used to assure the quality of the products has been calibrated and is traceable (e.g. DKD/DakS, NIST, NABL...) to national or international standards. Der Hersteller bestätigt, dass die zu Qualitätsprüfungen des Erzeugnisses eingesetzten Messmittel gültig kalibriert waren und auf nationale (z.B. DKD/DakS, NIST, NABL...) bzw. internationale Normale rückführbar sind.

Levelflex M

TAG number	Messstellen-Nummer	127-PIAPT-B0LT0301
Order code	Bestellcode	FMP40-VYY2YY9B21JB
Serial number	Seriennummer	F301211504E
Extended order code	Erweiterter Bestellcode	FMP40-VYY2YY9B21JB

Output type	Ausgang	4 ... 20 mA HART
Software version	Softwareversion	V01.04.02
Probe length	Sondenlänge	L=204.0 in.

TRANSCANADA KEYSTONE PIPELINE

Customer order number	Auftragsnummer des Kunden	25472-101-POA-JL10-W0001
E+H sales order number	E+H Auftragsnummer	71178245 000070
Internal order number	Interne Auftragsnummer	41921566/0070
Ambient temperature	Umgebungs- Temperatur	22.3 °C (± 1 °C)

Test step	Testschritt	Test result	Testergebnisse
Current Output (4 to 20 mA)	Stromausgang (4...20 mA)	Pass	Bestanden
Alarm Current Test	Alarmstrom	Pass	Bestanden
Current Drain	Test Stromaufnahme	Pass	Bestanden
SNR Test	Test Signaldynamik	Pass	Bestanden
Distance Test	Distanzprüfung	Pass	Bestanden
Digital Communication Test	Test Digitale Kommunikation	Pass	Bestanden
Display Test	Test Display	Pass	Bestanden

We confirm that all tests, according to the Inspection and Test Plan (ITP), have been performed successfully.

Wir bestätigen, dass alle Tests aus den Inspektions- und Testplänen (ITP) erfolgreich durchgeführt wurden.

At the time of verification, the measuring points of the device indicated above were in compliance to the published valid technical specification (TI).
TI00358F

Das Gerät entsprach zum Zeitpunkt der Prüfung an den aufgeführten Messpunkten den gültigen technischen Spezifikationen (TI).

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Operator /geprüft durch 155357
Date of inspection / Prüfdatum 09. Apr 2012

Endress+Hauser 
People for Process Automation

Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_290

Seite / page 1 / 2

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000290	1,000	FTL51-TGM2YY5E5C Liquiphant M FTL51	
		S/N F302AC15027	TAG 127-PIAPT-B0LSHH -0302 25472-101POA JL10-W0001 #33.00

Kennzeichnung / Marking
● Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

05W8K
Adapter / adapter
UGITECH
80987720 000010
116155

Kennzeichnung / Marking
● Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

0515X
Gabel / fork
FEINGUSS BLANK
PZ00997
70123



Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_290

Seite / page 2 / 2

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

04YR0
Rohr / tube
OUTO KUMPU
N1018851/1
4026620

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

0623A
Rohr / tube
Huzhou Zhongli
111113001
YX1109-106

13.04.2012

Endress+Hauser (USA) Autom. Instrum. Inc
US-46143-9772 Greenwood

jeremy shireman
- Abnahmebeauftragter -
- Inspector -

Dieses Zeugnis wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig.
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Metalltechnik GmbH . Fabrikstraße 1 . D-79650 Schopfheim

Endress + Hauser GmbH + Co.KG

Hauptstr. 1

79689 Maulburg

UMSTEMPELBESCHEINIGUNG CERTIFICATE OF RE-STAMPING

KOMMISSIONS-NR: 120116-5
consignment no:

IHRE BESTELLUNG: 11977454
your order:

Wir bestätigen, dass die gelieferten Produkte folgende Abmessungen aufweisen:
We confirm, that the supplied semi-finished products have the following dimensions:

Position item	Produkt product	Menge quantity	Dicke thickness	Durchmesser diameter	Breite width	Länge length
1	52027474 Piezorohr/piezo tube	800		Ø21,3 mm		48,5 mm

Position item	Aus Halbzeug der Abmessung out of semis of dimension	Schmelze heat-no.	Los-Probe-Blech-Nr. lot-sample-plate-no.	Hersteller manufacturer
1	Rohr/tube 1.4435	4026620		Outokumpu

ausgewiesen durch Abnahmeprüfzeugnis nach EN10204 gem. Anlage. Zeugnis-Nr. :
As evidenced by: Inspection certificate according to EN10204 as attached. No. Of cert.:

N1018851/1

Die Stempelung ist übertragen worden. Die Fertigteile wurden wie folgt gekennzeichnet :
The marking has been transferred. The finished products are signed with No. :

1.4435 04YR0

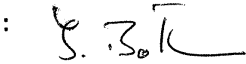
Zum Zeichen der ordnungsgemäßen Umstempelung wurden die Produkte mit folg. Zeichen versehen :
As proof of the legal re-stamping the semi-finished products have been signed with :

S1

BESICHTIGUNG UND MASSKONTROLLE: O.B.
Visual & dimensional inspection: o.k.

Das Umstempeln erfolgte mit Genehmigung des TÜV Industrie Service GmbH
The re-stamping was carried out with the approval of: TÜV Industrie Service GmbH

Datum : 16.01.2012
date :

Unterschrift : 
signature :

**CERTIFICATE EN 10204:2004/3.1**

This inspection certificate fulfils the requirements of EN 10204:2004 type 3.1
and EN 10204:1991+A1:1995 type 3.1.B.

Page 1(1)

BUYER		DATE 2010-10-31		CERTIFICATE NO N1018851/ 1											
		MANUFACTURES ORDER NO 2010001271		ITEM 21											
		BUYERS ORDER NO		SHIPMENT											
PRODUCT FORM LONGITUDINALLY WELDED STAINLESS STEEL TUBES, PICKLED, PLAIN ENDS, IN MILL LENGTHS, HEAT TREATMENT 1080 C QUENCHED IN AIR/WATER															
SPECIFICATION AD 2000-W2/W10 / EN 10217-7 Tc2 INOX				MANUFACTURES MARK OUTOKUMPU-N											
GRADE EN 1.4435		MANUFACTURES GRADE 4435T		TOLERANCES SS EN ISO 1127 D4 T3											
TUBE MARKING OUTOKUMPU-N; 1.4435; AD-W2 / EN 10217-7; ; W2A; TC2; Z=1,0; MAR-N1; 21,30 X 2,00; 4026620;INOX; MADE IN SWEDEN;															
EXTENT OF DELIVERY															
PCS		METER		DIMENSION 21,30 2,00											
				BATCH NO 4026620											
				TEST NO A											
CHEMICAL COMPOSITION															
HEAT ANALYSIS 1		C	SI	MN	P	S	CR	NI	MO	N					
		0,018	0,400	1,60	0,033	0,001	17,20	12,60	2,60	0,060					
TEST RESULT															
	TEMP	RP0,2 MPa	RP1,0 MPa	RM MPa	A5 %	HRC HRC		Ferrite %							
	20	190	225	490 690	40	22		0,5							
A1 L	20	284	320	583	53	20		0,1							
A2 L	20	292	326	589	55										
A3 L	20	292	327	588	55										
A4 L	20	291	327	589	55										
A5 L	20	275	309	585	58										
A6 L	20	287	322	584	53										
A7 L	20	289	324	584	54										
A8 L	20	291	326	588	55										
FLARING TEST EN ISO 8493 100% EDDY CURRENT TEST EN 10246-3 E1H / EN 10246-2 MATERIAL IDENTIFICATION TEST VISUAL AND DIMENSIONAL INSPECTION FERRITE CONTROL WELD, ACC TO BN2 HARDNESS ACC TO NACE MR 0175 INTERGRANULAR CORROSION TEST EN ISO 3651-2:A						SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY									
INSPECTION CERTIFICATE EN 10204-3.1 ACC. TO THE LETTER OF AGREEMENT,TUEV NORD DATED JULY 4,2008, FILE NO 1326WL04780-1															
 EN ISO 9001 : 2000 No. 44 100 075263		Certified acc: PED 97/23/EC and AD2000-W0/TRD 100 by TÜV Nord gruppe for pressure equipment NOB no: 0045 Certificate no: 07-202-3537WZ-0678/07 (no. 3537WL04770) Procedures and personnel approved by notified bodies, WPS/WPAR: EN 288 / WLD Personnel: EN 1418 / NDT: EN 473				THE REQUIREMENTS ARE FULFILLED AS STIPULATED INSPECTOR / MAR Johan Gemmel									
		MELTING PROCESS: E/AOD Base material from PED 97/23/EC approved suppliers.				ISSUED BY Yvonne Wannestrand									

OUTOKUMPU STAINLESS TUBULAR PRODUCTS
Torshälla Box 46 S-64421 Torshälla Sweden

Telephone no
+46 16 34 96 52

Telefax
+46 16 34 97 00

yvonne.wannestrand@outokumpu.com



Feinguss · Fertigkomponenten · Entwicklungspartner

Endress u. Hauser GmbH & Co. KG
Hauptstrasse 1 Wareneing.2
DE-79689 Maulburg

Abnahmeprüfzeugnis 3.1

Inspection certificate

nach/according to DIN EN 10204:2005
Prüf-Nr./Test-No.: PZ00997
BA-Nr.: 1066037
Ident-Nr.: 06748/05

Ihre Bestellung Nr./Your order No.:
117/11964636

vom/dated:
29.11.2011

Gußstück-Bezeichnung/Part-description:
GABEL STANDARD

Zeichnungs-Nr./Drawing-No.:
210011044 (52006900) Index

Prüfergebnisse/Test results

Gußteile gezeichnet mit/Castings signed with:
B1 0515X

Chemische Analyse/Chemical analysis:

Soll/Nom	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N
min	0,000	0,00	0,00	0,000	0,000	17,00	2,50	10,00	0,000	0,000	0,000
max	0,030	1,00	2,00	0,045	0,015	19,00	3,00	10,60	0,100	0,400	0,110
Charge/Los/Lot No.											
70123											
min	0,010	0,70	0,25	0,004	0,005	17,61	2,79	10,04	0,011	0,010	0,011
max	0,014	0,92	0,30	0,005	0,006	17,86	2,85	10,37	0,023	0,010	0,057

Wärmebehandlung/Heat treatment:

lösungsgeglüht u. abgeschreckt max. 241 HB

Härteprüfung/Hardness test:

HV 10 = 151 - 158

Mechanische Prüfung/Mechanical testing:

Soll/Nom	Rp 0,2 (N/mm ²)	Rp 1,0 (N/mm ²)	Rm (N/mm ²)	A (Lo=50mm) (%)
min	200	235	500	30,00
max				
Charge/Los/Lot No.				
70123	246	284	543	59,00

Stichprobe Massprüfung durchgeführt, keine Abweichung festgestellt

100% Sichtprüfung durchgeführt, keine Abweichung festgestellt

Verwechslungsprüfung nach spectrometrischer Prüfung durchgeführt und i.O.

IK Test nach DIN 50914 durchgeführt, keine Abweichung festgestellt

Härtewerte nach NACE/MR 0175

Tüpfeltest i.O.

dimension sampling test done; without deviation

100% visual test done, without findings

mistake examination after spectrometric examination accomplished and in Order

test about intercrystalline corrosion done, without findings

hardness according to NACE/MR 0175

spot test ok.

Die gestellten Anforderungen sind erfüllt/Requirements of order are compiled
Riedlingen, den 27.10.2011

FEINGUSS BLANK GmbH
Qualitätswesen: i.V. SCHAACK

Das Zeugnis wurde maschinell erstellt und ist gemäß EN 10204 ohne Unterschrift rechtsverbindlich.
This certificate was generated by data system, acc. to EN 10204, it need not to be signed for validity.

Usine productrice Hersteller Manufacturer Ugine Avenue Paul Girod 73403 Ugine Frankreich	CERTIFICAT DE RECEPTION 3.1 ABNAHMEPRUEFZEUGNIS 3.1 INSPECTION CERTIFICATE 3.1 ----- EN 10204 / 3.1	UGITECH Providing special steel solutions
5	3	1
Numéro / Nummer / Number 80987720 000010	Ordre de fab. / Auftrag / Prod. Order A1125RF44000	N° coulée / Schmelzen Nr / Heat N° 116155
4	11-1	11-2
Certification - Werkzeugnis - Certificate AD 2000-MERKBLATT W0/TRD100 Pressure Equipment Directive 97/23/EC ISO 9001 ISO/TS 16949 ISO 14001	ISO 9100 ISO 9120	Marque d'usine Herstellerzeichen Supplier's Mark Poinçon de l'expert Prüfstempel Inspector's stamp
99	98	97
UGI 4435FGX1 STAB GEWALZT ENTZUNDERT/ÜBERDREHT ABGESCHRECKT K13RUND 35,000MM LONG. 3,000M +100,000MM -100,000MM Produit UGI 4435FGX1 BARRE LAMINÉ(E) DÉCALAMINÉ(E) HYPERTREMPÉ(E) K13ROND(E) 35,000MM LONG. 3,000M +100 Erzeugnisform UGI 4435FGX1 STAB GEWALZT ENTZUNDERT/ÜBERDREHT ABGESCHRECKT K13RUND 35,000MM LONG. 3,000M +100, Product UGI 4435FGX1 BAR ROLLED DESCALED SOLUTION ANNEALED K13ROUND 35,000MM LONG. 3,000M +100,000MM -1		
6		
Client et/ou destinataire - Besteller und/oder Empfänger - Purchaser and/or Consigner 14112 Endress + Hauser GmbH + Co. KG		
10		
Norme de référence / Bezugsnorm / Standard for reference AD 2000 W2 ED 02.2009 1.4435 EN 10272 ED08 1.4435 ASTM A484/A484M-09 NACE MR 0103 Ed 2005 S31603 AD 2000 W10 ED 02.2008 1.4435 ASTM A479/A479M-10a TYPE 316L NACE MR0175/ISO 15156-3:2005 316L		
12-2		
Spécification client / Kundenspezifikation / Customer's specification 410000144 A X2CRNIMO18-14-3 A 30.07.08		
12-3		
Nombre Stueckzahl Pieces Nbr 120	Profil Profile Shape RO	Dimension Ausmessung Dimension 35,000 MM
18	19	21-1
Longueur Laenge Length 3,000	Poids Gewicht Weigh 2877 KG	Dimension Ausmessung Dimension 3,000
21-2	22	21-1
Mode d'élaboration Erchmel zungsart Melting process EAF + AOD + CC	N° prélèvement Probennummer Test number 1T12	Demandé / Vorschrift / Required 42 43 44 45 46 47 48 49 % C % SI % MN % NI % CR % MO % S % P Min Max 0,0300 1,0000 2,0000 14,0000 18,0000 3,0000 0,0170 0,0400 coulée/ Schmelzen / Heat 0,0170 0,4530 1,5780 12,5680 17,0990 2,5340 0,0103 0,0263 Produit / Erzeugnisform/ Product
38	39A	42
Demandé / Vorschrift / Required 50 51 52 53 54 55 70 71 72 73 74 75 % N Min Max 0,1000 coulée/ Schmelzen / Heat 0,0340 Produit / Erzeugnisform/ Product		
50		
Demandé / Vorschrift / Required 76 77 78 79 80 81 82 83 84 85 86 87 Min Max coulée/ Schmelzen / Heat Produit / Erzeugnisform/ Product		
76		
Hiermit erklären wir, dass das zitierte Produkt mit den Anforderungendes Vertrags konform ist und den Anforderungen sowie den geltenden Normen und Vorschriften nach den durchgeführten Kontrollen und Prüfungen REACH-Verordnung in jeder Hinsicht entspricht, vorbehaltlich gelistete Ausnahmen oder Bedenken von dieser Konformitätserklärung; Dieses Dokument ist durch eine digitale Unterschrift gültig. Produkt hergestellt gemäß We declare that the mentioned product is in compliance with the requirements of the contract and that, after checks and tests, it meets in all respects the specified requirements and applicable standards and regulations, except reservations or exceptions as listed in this declaration of conformity; Document validated by electronic signature. Material manufactured in the REACH regulation respect.		
66-1		
Ugine le 09.06.2011 L'agent Réceptionnaire de l'usine Der Werksachverständige The work inspector 		
66-2		
040000484992 Page 1/2 63		

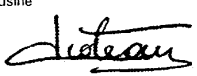
Usine productrice Hersteller Manufacturer	Ugine Avenue Paul Girod 73403 Ugine Frankreich	CERTIFICAT DE RECEPTION 3.1 ABNAHMEPRUEFZEUGNIS 3.1 INSPECTION CERTIFICATE 3.1 EN 10204 / 3.1		UGITECH Providing special steel solutions 
5		3		1

Número / Nummer / Number 80987720 000010	4	Ordre de fab. / Auftrag / Prod. Order A1125RF44000	11-1	N° coulée / Schmelzen Nr / Heat N° 116155	11-2	N° lot MM / Chargen / Batch 1125RF4400	11-3
--	---	--	------	---	------	--	------

		T°C		Limite d'élasticité Streckgrenze Yield Strength 0,2% 1%		RM Zugfestigkeit Tensile	Allongement Bruchdehnung Elongation A5D A4D		Striction Einschnürung Red area	Dureté-Haerte-Hardness			
24		90								HB	HV	HRB	HRC
		Min	°C	Mpa	Mpa	Mpa	%	%	%	215			
13		Max	20	200	235	500	40	30	40				
		Min	20			700							
		Max											
N° prélèvement Probennummer Test number	1T12 1T12	1 2	L L	20 20	334 337	385 292	603 610	48 49	50 51	75 75	173		
39B													
A l'état de Référence / treatment on test sample / Probestreifenbehandlung													
14			25	26A	26B	27	28	89	29	30	88	100	37

Taux de corroyage Forging ratio Verschmiedungsgrad 39,1		Résilience-Kerbschlagzähigkeit-Notch Toughness							
101		Type Form Type	T°C	Sens Richtung Direction	Min	Valeurs individuelles Einzelwerte Individual values		Moyenne Mittelwerte Average	Expansion latérale Seitliche Breitung Lateral Expansion
		31	33	32	95			35	36
A l'état de livraison / Lieferzustand / As delivered			°C		J	J		J	
13		KISOV	20	L	100	229-245-237 234-246-255		237 245	
ABGESCHRECKT 1030° 30MN WASSER						--			
A l'état de Référence / treatment on test sample / Probestreifenbehandlung									
14									

ZUSTIMMUNGSSCHREIBEN DER TÜV SÜD LIEGT VOR. AUF GEGENZEICHNUNG WIRD VERZICHTET		5
INTERKRISTALLINE KORROSION BESTÄNDIG NACH EN ISO 3651-2		6
INTERKRISTALLINE KORROSION BESTÄNDIG NACH ASTM A262 METHOD E		
INNERE FEHLERFREIHEIT DURCH PROZESS-KONTROLLE GARANTIERT		
SPEKTROSKOPISCH VERWECHSLUNGSPRÜFUNG IN ORDNUNG		
FERRIT-GEHALT (> 1%) = 2.1		
LETTER OF APPROVAL OF THE SOUTHERN TÜV IN OUR POSSESSION.WE ABSTAIN OF ONE AGAINST SIGNATURE.		
INTERCRYSTALLINE CORROSION RESISTANT ACC.TO ISO 3651-2.		
INTERCRYSTALLINE CORROSION RESISTANT ACCORDING TO ASTM A262 PRACTICE C.		
FREEDOM FROM INTERNAL DEFECT GUARANTEED BY CONTROL PROCESS		
ANTIMIXING TEST PERFORMED : CONFORM.		
DIN EN 10278 (LN 668)		
Endress + Hauser GmbH		

Quantité livrée / delivered quantity / gelieferte Quantität	92	93	94
Hiermit erklären wir, dass das zitierte Produkt mit den Anforderungen des Vertrags konform ist und den Anforderungen sowie den geltenden Normen und Vorschriften nach den durchgeführten Kontrollen und Prüfungen REACH-Verordnung in jeder Hinsicht entspricht, vorbehaltlich gelisteter Ausnahmen oder Bedenken von dieser Konformitätserklärung; Dieses Dokument ist durch eine digitale Unterschrift gültig. Produkt hergestellt gemäß		Ugine le 09.06.2011 L'agent Réceptionnaire de l'usine	
We declare that the mentioned product is in compliance with the requirements of the contract and that, after checks and tests, it meets in all respects the specified requirements and applicable standards and regulations, except reservations or exceptions as listed in this declaration of conformity; Document validated by electronic signature. Material manufactured in the REACH regulation respect.		Der Werksachverständige The work inspector	
66-2		 040000484992 Page 2/2	63

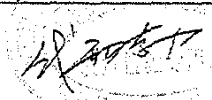
MILL INSPECTION CERTIFICATE

Huzhou Zhongli Stainless Steel Pipe Co., Ltd.

Huang Long Industrial District, Shuanglin Town of Huzhou City Zhejiang Province, P.R. China

ISO 9001:2008 PED BY LLOYD

REGISTRATION No.: QAC6002856

CERTIFICATE NO.: 111113001 COMMODITY: SEAMLESS STAINLESS STEEL TUBING SPECIFICATION: ASTM A213-10 ASME SA213-08 ASTM A269-10 (Average Wall)						PURCHASER: ROBERT-JAMES SALES, INC R. James P.O. No: GS-2392 DATE OF REPORT: 2011.11.30					
Steel Grade	Heat No.	Lot No.	Dimensions			Quantity		Process	Delivery Condition	Macroscopic Inspection	
			O.D.	W.T.	Length	Pieces	(ft)			End Cut	Appearance
TP316/316L	YX1109-610	11A1120341	21.3MM	1.6MM	20ft	42	840	Cold-finished	OD Polished to 240 Grit	Passed	Passed
Chemical Composition (W.T. %)											
Element	C	Mn	P	S	Si	Cr	Ni	Mo	Ti		
Requirements	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00	16.0~18.0	10.0~14.0	2.0~3.0	—		
Ladle Analysis	0.018	0.68	0.034	0.002	0.37	16.50	10.07	2.06			
Product Analysis	0.020	0.67	0.033	0.002	0.39	16.52	10.06	2.05			
Mechanical Properties											
Test Item	Y.S. (Mpa) Rp0.2	T.S. (Mpa) Rm	EL. (%) In 2 in	Reduction of Area Z (%)	Hardness	Cold Bend Test	Flaring Test	Flattening Test	Flange Test		
Requirements	≥205	≥515	≥35	/	HRB≤90	/			/		
Test Results	275/285	575/580	56/58	/	72/73	/	Passed	Passed	/		
Non Destructive Tests				Hydrostatic Test	Inter-granular Corrosion Test	Remarks: - Tubes tested per ASTM A1016-11a - Hardness tested per NACE MR-01-03-2007 - All tubes annealed to above 1900 Deg F and water quenched Below 800 Deg F in 3 minutes - No weld repair performed - Free from mercury contamination - In compliance with EN 10204-3.1 - PED 97/23/EC CERTIFIED - Material to meet NACE MR 01-75-2005 - Billets melt and pipes/tubes manufactured in China					
Test Item	Eddy Current Test	Ultrasonic Test									
Requirements	ASTM E 426	ASTM E213	ASTM A450								
Test Results	Passed	/	/								
We hereby certify that the material described herein has been made and tested completely in accordance with the above specification and with the requirements of the purchase order or contract.						Prepared by:		Approved by: 			

Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_270

Seite / page 1 / 2

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000270	1,000	FTL51-TGM2YY5E5C Liquiphant M FTL51	
		S/N F302AB15027	TAG 126-FXVLY-B0LSHH -0302 25472-101POA JL10-W0001 #32.00

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

01R2N

Adapter / adapter
BGH Edelstahl Freital
266078
329507

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

0515X

Gabel / fork
FEINGUSS BLANK
PZ00997
70123



Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_270

Seite / page 2 / 2

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

04YR0
Rohr / tube
OUTO KUMPU
N1018851/1
4026620

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

0623A
Rohr / tube
Huzhou Zhongli
111113001
YX1109-106

13.04.2012

Endress+Hauser (USA) Autom. Instrum. Inc
US-46143-9772 Greenwood

jeremy shireman
- Abnahmebeauftragter -
- Inspector -

Dieses Zeugnis wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig.
This document was generated electronically acc. to EN 10204 and is valid without signature.



gez.. Beikirch



BGH Edelstahl Freital GmbH

BGH Edelstahl Freital GmbH Am Stahlwerk 1 01705 Freital

Günther + Schramm
GmbH & Co. KGPF 81 02 03
68202 Mannheim-Rheinau
DeutschlandZeugnis-Nr. 266078
Certificate no.
No. de certificatBescheinigung über Werkstoffprüfung nach DIN EN 10204
Certificate of material tests according to DIN EN 10204 3.1
Certificat des essais des matériaux selon DIN EN 10204Die Lieferung entspricht den vereinbarten Lieferbedingungen.
Delivery in accordance with the agreed terms of delivery.
La livraison correspond aux conditions de livraison convenuesZeichen des Lieferwerkes Stempel des Werkstoffsachverständigen
Trade mark Inspector's stamp
Signe du fournisseur Poinçon de l'inspecteurKunden-Bestell-Nr. 4500137166-2000
Customer order no.
Cde. no. du client E+H 11373447BGH-Auftrags-Nr. 40332101/95941
BGH works no.
BGH référence

Erzeugnisform Product		Stab, rund, geschält Round bars, peeled										
Werkstoff / Quality		1.4435 X2CrNiMo18-14-3										
Anforderungen Requirements		TLB 410000120 05/06 1.4435 X 2 CrNiMo 18-14-3 DIN EN 10272 01/01 1.4435 X 2 CrNiMo 18-14-3 AD2000 W 10 10/03 316L - UNS S31603 NACE MR0175/ISO15156 1.4435 X2CrNiMo18-14-3 AD2000 W 2 07/06 316L ASTM A479/A479M 2006a 1.4435 X2CrNiMo18-14-3 BN 2 Ausg. 06/97 DGRL 97/23/EG, Anhg. I, 4.3										
Besichtigung und Maßnachprüfung Inspection and dimensional control Inspection et contrôle de dimension ohne Beanstandung without objection			Erschmelzung/Nachbehandlung Melting process/secondary refining Mode d'élaboration/traitement ultérieur E - VOD					Verwechslungsprüfung (spectroanalytisch) Identification test (spectral analysis) examination d'identification (analyse spectrale) ohne Beanstandung without objection				
Pos. Item	Anzahl Quantity	Abmessung Dimension								Gewicht Weight	kg	Schmelz-Nr. Heat-No.
1	75	40,00 RD								2896		329507
Schmelze Heat %	C	Si	Mn	P	S	Cr	Mo	Ni	Ti	N2		
329507	0,019	0,33	1,90	0,022	0,012	17,23	2,54	13,30	0,006	0,0890		
Wärmebehandlungszustand Condition of heat treat Traitement thermique		abgeschreckt quenched 1040°C Wasser/ water										
Probe-Nr. Test-No.	Lage	Temp. °C	Rp0,2 N/mm ²	Rp1,0 N/mm ²	Rm N/mm ²	A4/A5 %	Z %	Kerbschlagarbeit Impact value J	Probenform Shape of test piece Charpy-V °C	Härte HRC Hardness		
Soll/Req.	L	RT	>=200	>=235	>=500	>=35	>=40	>=100	RT			
	L	RT			<=700					<=22		
106AE1	L	RT	302	347	628	53/55	80	268 264 270	RT	<20		
106AE2	L	RT	300	344	629	54/56	80					
IK-Beständigkeit/ intercrystalline corrosion DIN EN ISO 3651-2: wird gewährleistet- is warranted. US-Prüfung/ us-test: ohne Beanstandung- no objection.												
Anlagen Encl. Annexe					Freital, den Place and date Lieu et date 29.01.2008			Abnahmebeauftragter Inspector representative Inspecteur de réception Kadner				
Das Zeugnis wurde maschinell erstellt und ist auch ohne Unterschrift gültig. Ce certificat a été établi sur système informatique et est valable sans signature aussi.												



Metalltechnik GmbH . Fabrikstraße 1 . D-79650 Schopfheim

Endress + Hauser GmbH + Co.KG

Hauptstr. 1

79689 Maulburg

UMSTEMPELBESCHEINIGUNG CERTIFICATE OF RE-STAMPING

KOMMISSIONS-NR: 120116-5
consignment no:

IHRE BESTELLUNG: 11977454
your order:

Wir bestätigen, dass die gelieferten Produkte folgende Abmessungen aufweisen:
We confirm, that the supplied semi-finished products have the following dimensions:

Position item	Produkt product	Menge quantity	Dicke thickness	Durchmesser diameter	Breite width	Länge length
1	52027474 Piezorohr/piezo tube	800		Ø21,3 mm		48,5 mm

Position item	Aus Halbzeug der Abmessung out of semis of dimension	Schmelze heat-no.	Los-Probe-Blech-Nr. lot-sample-plate-no.	Hersteller manufacturer
1	Rohr/tube 1.4435	4026620		Outokumpu

ausgewiesen durch Abnahmeprüfzeugnis nach EN10204 gem. Anlage. Zeugnis-Nr. :
As evidenced by: Inspection certificate according to EN10204 as attached. No. Of cert.:

N1018851/1

Die Stempelung ist übertragen worden. Die Fertigteile wurden wie folgt gekennzeichnet :
The marking has been transferred. The finished products are signed with No. :

1.4435 04YR0

Zum Zeichen der ordnungsgemäßen Umstempelung wurden die Produkte mit folg. Zeichen versehen :
As proof of the legal re-stamping the semi-finished products have been signed with :

S1

BESICHTIGUNG UND MASSKONTROLLE: O.B.
Visual & dimensional inspection: o.k.

Das Umstempeln erfolgte mit Genehmigung des TÜV Industrie Service GmbH
The re-stamping was carried out with the approval of: TÜV Industrie Service GmbH

Datum : 16.01.2012
date :

Unterschrift :
signature :

**CERTIFICATE EN 10204:2004/3.1**

This inspection certificate fulfils the requirements of EN 10204:2004 type 3.1
and EN 10204:1991+A1:1995 type 3.1.8.

Page 1(1)

BUYER		DATE 2010-10-31		CERTIFICATE NO N1018851/ 1										
		MANUFACTURES ORDER NO 2010001271		ITEM 21										
		BUYERS ORDER NO		SHIPMENT										
PRODUCT FORM LONGITUDINALLY WELDED STAINLESS STEEL TUBES, PICKLED, PLAIN ENDS, IN MILL LENGTHS, HEAT TREATMENT 1080 C QUENCHED IN AIR/WATER														
SPECIFICATION AD 2000-W2/W10 / EN 10217-7 Tc2 INOX				MANUFACTURES MARK OUTOKUMPU-N										
GRADE EN 1.4435		MANUFACTURES GRADE 4435T		TOLERANCES SS EN ISO 1127 D4 T3										
TUBE MARKING OUTOKUMPU-N; 1.4435; AD-W2 / EN 10217-7; ; W2A; TC2; Z=1,0; MAR-N1; 21,30 X 2,00; 4026620;INOX; MADE IN SWEDEN;														
EXTENT OF DELIVERY														
PCS		METER		DIMENSION 21,30 2,00	BATCH NO 4026620									
				TEST NO A										
CHEMICAL COMPOSITION														
HEAT ANALYSIS 1	C	SI	MN	P	S	CR	NI	MO	N					
	0,018	0,400	1,60	0,033	0,001	17,20	12,60	2,60	0,060					
TEST RESULT														
	TEMP	RP0,2 MPa	RP1,0 MPa	RM MPa	A5 %	HRC HRC		Ferrite %						
	20	190	225	490 690	40	22		0,5						
A1 L	20	284	320	583	53	20		0,1						
A2 L	20	292	326	589	55									
A3 L	20	292	327	588	55									
A4 L	20	291	327	589	55									
A5 L	20	275	309	585	58									
A6 L	20	287	322	584	53									
A7 L	20	289	324	584	54									
A8 L	20	291	326	588	55									
FLARING TEST EN ISO 8493 100% EDDY CURRENT TEST EN 10246-3 E1H / EN 10246-2 MATERIAL IDENTIFICATION TEST VISUAL AND DIMENSIONAL INSPECTION FERRITE CONTROL WELD, ACC TO BN2 HARDNESS ACC TO NACE MR 0175 INTERGRANULAR CORROSION TEST EN ISO 3651-2:A INSPECTION CERTIFICATE EN 10204-3.1 ACC. TO THE LETTER OF AGREEMENT,TUEV NORD DATED JULY 4,2008, FILE NO 1326WL04780-1														
SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY														
 No. 44 100 075263		Certified acc: PED 97/23/EC and AD2000-W0/TRD 100 by TÜV Nord gruppe for pressure equipment NOB no: 0045 Certificate no: 07-202-3537WZ-0678/07 (no. 3537WL04770) Procedures and personnel approved by notified bodies, WPS/WPAR: EN 288 / WLD Personnel: EN 1418 / NDT: EN 473				THE REQUIREMENTS ARE FULFILLED AS STIPULATED INSPECTOR / MAR Johan Gemmel ISSUED BY Yvonne Wannestrand								
		MELTING PROCESS: E/AOD Base material from PED 97/23/EC approved suppliers.												

OUTOKUMPU STAINLESS TUBULAR PRODUCTS
Torshälla Box 46 S-64421 Torshälla Sweden

Telephone no
+46 16 34 96 52

Telefax
+46 16 34 97 00

yvonne.wannestrand@outokumpu.com



Feinguss · Fertigkomponenten · Entwicklungspartner

Endress u. Hauser GmbH & Co. KG
Hauptstrasse 1 Wareneing.2
DE-79689 Maulburg

Abnahmeprüfzeugnis 3.1

Inspection certificate

nach/according to DIN EN 10204:2005
Prüf-Nr./Test-No.: PZ00997
BA-Nr.: 1066037
Ident-Nr.: 06748/05

Ihre Bestellung Nr./Your order No.:
117/11964636

vom/dated:
29.11.2011

Gußstück-Bezeichnung/Part-description:
GABEL STANDARD

Zeichnungs-Nr./Drawing-No.:
210011044 (52006900) Index

Prüfresultate/Test results

Gußteile gezeichnet mit/Castings signed with:
B1 0515X

Chemische Analyse/Chemical analysis:

Soll/Nom	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N
min	0,000	0,00	0,00	0,000	0,000	17,00	2,50	10,00	0,000	0,000	0,000
max	0,030	1,00	2,00	0,045	0,015	19,00	3,00	10,60	0,100	0,400	0,110
Charge/Los/Lot No.											
70123											
min	0,010	0,70	0,25	0,004	0,005	17,61	2,79	10,04	0,011	0,010	0,011
max	0,014	0,92	0,30	0,005	0,006	17,86	2,85	10,37	0,023	0,010	0,057

Wärmebehandlung/Heat treatment:

lösungsgeglüht u. abgeschreckt max. 241 HB

Härteprüfung/Hardness test:

HV 10 = 151 - 158

Mechanische Prüfung/Mechanical testing:

Soll/Nom	Rp 0,2 (N/mm ²)	Rp 1,0 (N/mm ²)	Rm (N/mm ²)	A (Lo=50mm) (%)
min	200	235	500	30,00
max				
Charge/Los/Lot No.				
70123	246	284	543	59,00

Stichprobe Massprüfung durchgeführt, keine Abweichung festgestellt

100% Sichtprüfung durchgeführt, keine Abweichung festgestellt

Verwechslungsprüfung nach spectrometrischer Prüfung durchgeführt und i.O.

IK Test nach DIN 50914 durchgeführt, keine Abweichung festgestellt

Härtewerte nach NACE/MR 0175

Tüpfeltest i.O.

dimension sampling test done; without deviation

100% visual test done, without findings

mistake examination after spectrometric examination accomplished and in Order

test about intercrystalline corrosion done, without findings

hardness according to NACE/MR 0175

spot test ok.

Die gestellten Anforderungen sind erfüllt/Requirements of order are compiled
Riedlingen, den 27.10.2011

FEINGUSS BLANK GmbH
Qualitätswesen: i.V. SCHAACK

Das Zeugnis wurde maschinell erstellt und ist gemäß EN 10204 ohne Unterschrift rechtsverbindlich.
This certificate was generated by data system, acc. to EN 10204, it need not to be signed for validity.

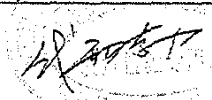
MILL INSPECTION CERTIFICATE

Huzhou Zhongli Stainless Steel Pipe Co., Ltd.

Huang Long Industrial District, Shuanglin Town of Huzhou City Zhejiang Province, P.R. China

ISO 9001:2008 PED BY LLOYD

REGISTRATION No.: QAC6002856

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Product Analysis	0.020	0.67	0.033	0.002	0.39	16.52	10.06	2.05			
Mechanical Properties											
Test Item	Y.S. (Mpa) Rp0.2	T.S. (Mpa) Rm	EL. (%) In 2 in	Reduction of Area Z (%)	Hardness	Cold Bend Test	Flaring Test	Flattening Test	Flange Test		
Requirements	≥205	≥515	≥35	/	HRB≤90	/			/		
Test Results	275/285	575/580	56/58	/	72/73	/	Passed	Passed	/		
Non Destructive Tests				Hydrostatic Test	Inter-granular Corrosion Test	Remarks: - Tubes tested per ASTM A1016-11a - Hardness tested per NACE MR-01-03-2007 - All tubes annealed to above 1900 Deg F and water quenched Below 800 Deg F in 3 minutes - No weld repair performed - Free from mercury contamination - In compliance with EN 10204-3.1 - PED 97/23/EC CERTIFIED - Material to meet NACE MR 01-75-2005 - Billets melt and pipes/tubes manufactured in China					
Test Item	Eddy Current Test	Ultrasonic Test									
Requirements	ASTM E 426	ASTM E213									
Test Results	Passed	/									
We hereby certify that the material described herein has been made and tested completely in accordance with the above specification and with the requirements of the purchase order or contract.					Prepared by:		Approved by: 				

Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_250

Seite / page 1 / 2

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000250	1,000	FTL51-TGM2YY5E5C Liquiphant M FTL51	
		S/N F302AA15027	TAG 125-BDLSS-B0LSHH -0302 25472-101POA JL10-W0001 #31.00

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

01R2N

Adapter / adapter
BGH Edelstahl Freital
266078
329507

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

0515X

Gabel / fork
FEINGUSS BLANK
PZ00997
70123



Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_250

Seite / page 2 / 2

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

04YR0
Rohr / tube
OUTO KUMPU
N1018851/1
4026620

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

0623A
Rohr / tube
Huzhou Zhongli
111113001
YX1109-106

13.04.2012

Endress+Hauser (USA) Autom. Instrum. Inc
US-46143-9772 Greenwood

jeremy shireman
- Abnahmebeauftragter -
- Inspector -

Dieses Zeugnis wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig.
This document was generated electronically acc. to EN 10204 and is valid without signature.



Umstempelbescheinigung

Stamp confirmation certificate

Geschäftsstelle 68219 Mannheim
Location

Besteller: Endress + Hauser
Customer

Kd.-Nr.: 21669
Client-Nr.

Kommissionierauftrag: 81015557
Order-Nr.

Bestell-Nr.: 0011664298

Wir bestätigen, daß von dem Werkskundigen nachstehender Werkstoff mit der TAN-Nr gekennzeichnet wurde
We confirm, that the specified person is authorized to inspect and stamp.

[illegible]

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Gemäß Umstempelvereinbarung 600210493 vom TÜV Süd 13.12.07.
According Stampagreement of TÜV Süd 13.12.2007.

Datum: 15.01.2010
Date

gez.. Beikirch



BGH Edelstahl Freital GmbH

BGH Edelstahl Freital GmbH Am Stahlwerk 1 01705 Freital

Günther + Schramm
GmbH & Co. KGPF 81 02 03
68202 Mannheim-Rheinau
DeutschlandZeugnis-Nr. 266078
Certificate no.
No. de certificatBescheinigung über Werkstoffprüfung nach DIN EN 10204
Certificate of material tests according to DIN EN 10204 3.1
Certificat des essais des matériaux selon DIN EN 10204Die Lieferung entspricht den vereinbarten Lieferbedingungen.
Delivery in accordance with the agreed terms of delivery.
La livraison correspond aux conditions de livraison convenuesZeichen des Lieferwerkes Stempel des Werkstoffsachverständigen
Trade mark Inspector's stamp
Signe du fournisseur Poinçon de l'inspecteurKunden-Bestell-Nr. 4500137166-2000
Customer order no.
Cde. no. du client E+H 11373447BGH-Auftrags-Nr. 40332101/95941
BGH works no.
BGH référence

Erzeugnisform Product		Stab, rund, geschält Round bars, peeled										
Werkstoff / Quality		1.4435 X2CrNiMo18-14-3										
Anforderungen Requirements		TLB 410000120 05/06 1.4435 X 2 CrNiMo 18-14-3 DIN EN 10272 01/01 1.4435 X 2 CrNiMo 18-14-3 AD2000 W 10 10/03 316L - UNS S31603 NACE MR0175/ISO15156 1.4435 X2CrNiMo18-14-3 AD2000 W 2 07/06 316L ASTM A479/A479M 2006a 1.4435 X2CrNiMo18-14-3 BN 2 Ausg. 06/97 DGRL 97/23/EG, Anhg. I, 4.3										
Besichtigung und Maßnachprüfung Inspection and dimensional control Inspection et contrôle de dimension ohne Beanstandung without objection			Erschmelzung/Nachbehandlung Melting process/secondary refining Mode d'élaboration/traitement ultérieur E - VOD					Verwechslungsprüfung (spectroanalytisch) Identification test (spectral analysis) examination d'identification (analyse spectrale) ohne Beanstandung without objection				
Pos. Item	Anzahl Quantity	Abmessung Dimension								Gewicht Weight	kg	Schmelz-Nr. Heat-No.
1	75	40,00 RD								2896		329507
Schmelze Heat %	C	Si	Mn	P	S	Cr	Mo	Ni	Ti	N2		
329507	0,019	0,33	1,90	0,022	0,012	17,23	2,54	13,30	0,006	0,0890		
Wärmebehandlungszustand Condition of heat treat Traitement thermique		abgeschreckt quenched 1040°C Wasser/ water										
Probe-Nr. Test-No.	Lage	Temp. °C	Rp0,2 N/mm ²	Rp1,0 N/mm ²	Rm N/mm ²	A4/A5 %	Z %	Kerbschlagarbeit Impact value J	Probenform Shape of test piece Charpy-V °C	Härte HRC Hardness		
Soll/Req.	L	RT	>=200	>=235	>=500	>=35	>=40	>=100	RT			
	L	RT			<=700					<=22		
106AE1	L	RT	302	347	628	53/55	80	268 264 270	RT	<20		
106AE2	L	RT	300	344	629	54/56	80					
IK-Beständigkeit/ intercrystalline corrosion DIN EN ISO 3651-2: wird gewährleistet- is warranted.												
US-Prüfung/ us-test: ohne Beanstandung- no objection.												
Anlagen Encl. Annexe					Freital, den Place and date Lieu et date 29.01.2008			Abnahmebeauftragter Inspector representative Inspecteur de réception Kadner				
Das Zeugnis wurde maschinell erstellt und ist auch ohne Unterschrift gültig. Ce certificat a été établi sur système informatique et est valable sans signature aussi.												



Metalltechnik GmbH . Fabrikstraße 1 . D-79650 Schopfheim

Endress + Hauser GmbH + Co.KG

Hauptstr. 1

79689 Maulburg

UMSTEMPELBESCHEINIGUNG CERTIFICATE OF RE-STAMPING

KOMMISSIONS-NR: 120116-5
consignment no:

IHRE BESTELLUNG: 11977454
your order:

Wir bestätigen, dass die gelieferten Produkte folgende Abmessungen aufweisen:
We confirm, that the supplied semi-finished products have the following dimensions:

Position item	Produkt product	Menge quantity	Dicke thickness	Durchmesser diameter	Breite width	Länge length
1	52027474 Piezorohr/piezo tube	800		Ø21,3 mm		48,5 mm

Position item	Aus Halbzeug der Abmessung out of semis of dimension	Schmelze heat-no.	Los-Probe-Blech-Nr. lot-sample-plate-no.	Hersteller manufacturer
1	Rohr/tube 1.4435	4026620		Outokumpu

ausgewiesen durch Abnahmeprüfzeugnis nach EN10204 gem. Anlage. Zeugnis-Nr. :
As evidenced by: Inspection certificate according to EN10204 as attached. No. Of cert.:

N1018851/1

Die Stempelung ist übertragen worden. Die Fertigteile wurden wie folgt gekennzeichnet :
The marking has been transferred. The finished products are signed with No. :

1.4435 04YR0

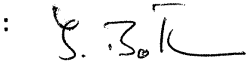
Zum Zeichen der ordnungsgemäßen Umstempelung wurden die Produkte mit folg. Zeichen versehen :
As proof of the legal re-stamping the semi-finished products have been signed with :

S1

BESICHTIGUNG UND MASSKONTROLLE: O.B.
Visual & dimensional inspection: o.k.

Das Umstempeln erfolgte mit Genehmigung des TÜV Industrie Service GmbH
The re-stamping was carried out with the approval of: TÜV Industrie Service GmbH

Datum : 16.01.2012
date :

Unterschrift : 
signature :

**CERTIFICATE EN 10204:2004/3.1**

This inspection certificate fulfils the requirements of EN 10204:2004 type 3.1
and EN 10204:1991+A1:1995 type 3.1.B.

Page 1(1)

BUYER		DATE 2010-10-31		CERTIFICATE NO N1018851/ 1											
		MANUFACTURES ORDER NO 2010001271		ITEM 21											
		BUYERS ORDER NO		SHIPMENT											
PRODUCT FORM LONGITUDINALLY WELDED STAINLESS STEEL TUBES, PICKLED, PLAIN ENDS, IN MILL LENGTHS, HEAT TREATMENT 1080 C QUENCHED IN AIR/WATER															
SPECIFICATION AD 2000-W2/W10 / EN 10217-7 Tc2 INOX				MANUFACTURES MARK OUTOKUMPU-N											
GRADE EN 1.4435		MANUFACTURES GRADE 4435T		TOLERANCES SS EN ISO 1127 D4 T3											
TUBE MARKING OUTOKUMPU-N; 1.4435; AD-W2 / EN 10217-7; ; W2A; TC2; Z=1,0; MAR-N1; 21,30 X 2,00; 4026620; INOX; MADE IN SWEDEN;															
EXTENT OF DELIVERY															
PCS		METER		DIMENSION 21,30 2,00											
				BATCH NO 4026620											
				TEST NO A											
CHEMICAL COMPOSITION															
HEAT ANALYSIS 1		C	SI	MN	P	S	CR	NI	MO	N					
		0,018	0,400	1,60	0,033	0,001	17,20	12,60	2,60	0,060					
TEST RESULT															
	TEMP	RP0,2 MPa	RP1,0 MPa	RM MPa	A5 %	HRC HRC		Ferrite %							
	20	190	225	490 690	40	22		0,5							
A1 L	20	284	320	583	53	20		0,1							
A2 L	20	292	326	589	55										
A3 L	20	292	327	588	55										
A4 L	20	291	327	589	55										
A5 L	20	275	309	585	58										
A6 L	20	287	322	584	53										
A7 L	20	289	324	584	54										
A8 L	20	291	326	588	55										
FLARING TEST EN ISO 8493 100% EDDY CURRENT TEST EN 10246-3 E1H / EN 10246-2 MATERIAL IDENTIFICATION TEST VISUAL AND DIMENSIONAL INSPECTION FERRITE CONTROL WELD, ACC TO BN2 HARDNESS ACC TO NACE MR 0175 INTERGRANULAR CORROSION TEST EN ISO 3651-2:A						SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY									
INSPECTION CERTIFICATE EN 10204-3.1 ACC. TO THE LETTER OF AGREEMENT, TUEV NORD DATED JULY 4, 2008, FILE NO 1326WL04780-1															
 EN ISO 9001:2000 No. 44 100 075263		Certified acc: PED 97/23/EC and AD2000-W0/TRD 100 by TÜV Nord gruppe for pressure equipment NOB no: 0045 Certificate no: 07-202-3537WZ-0678/07 (no. 3537WL04770) Procedures and personnel approved by notified bodies, WPS/WPAR: EN 288 / WLD Personnel: EN 1418 / NDT: EN 473				THE REQUIREMENTS ARE FULFILLED AS STIPULATED INSPECTOR / MAR Johan Gemmel									
		MELTING PROCESS: E/AOD Base material from PED 97/23/EC approved suppliers.				ISSUED BY Yvonne Wannestrand									

OUTOKUMPU STAINLESS TUBULAR PRODUCTS
Torshälla Box 46 S-64421 Torshälla Sweden

Telephone no
+46 16 34 96 52

Telefax
+46 16 34 97 00

yvonne.wannestrand@outokumpu.com



Feinguss · Fertigkomponenten · Entwicklungspartner

Endress u. Hauser GmbH & Co. KG
Hauptstrasse 1 Wareneing.2
DE-79689 Maulburg

Abnahmeprüfzeugnis 3.1

Inspection certificate

nach/according to DIN EN 10204:2005
Prüf-Nr./Test-No.: PZ00997
BA-Nr.: 1066037
Ident-Nr.: 06748/05

Ihre Bestellung Nr./Your order No.:
117/11964636

vom/dated:
29.11.2011

Gußstück-Bezeichnung/Part-description:
GABEL STANDARD

Zeichnungs-Nr./Drawing-No.:
210011044 (52006900) Index

Prüfergebnisse/Test results

Gußteile gezeichnet mit/Castings signed with:
B1 0515X

Chemische Analyse/Chemical analysis:

Soll/Nom	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N
min	0,000	0,00	0,00	0,000	0,000	17,00	2,50	10,00	0,000	0,000	0,000
max	0,030	1,00	2,00	0,045	0,015	19,00	3,00	10,60	0,100	0,400	0,110
Charge/Los/Lot No.											
70123											
min	0,010	0,70	0,25	0,004	0,005	17,61	2,79	10,04	0,011	0,010	0,011
max	0,014	0,92	0,30	0,005	0,006	17,86	2,85	10,37	0,023	0,010	0,057

Wärmebehandlung/Heat treatment:

lösungsgeglüht u. abgeschreckt max. 241 HB

Härteprüfung/Hardness test:

HV 10 = 151 - 158

Mechanische Prüfung/Mechanical testing:

Soll/Nom	Rp 0,2 (N/mm ²)	Rp 1,0 (N/mm ²)	Rm (N/mm ²)	A (Lo=50mm) (%)
min	200	235	500	30,00
max				
Charge/Los/Lot No.				
70123	246	284	543	59,00

Stichprobe Massprüfung durchgeführt, keine Abweichung festgestellt

100% Sichtprüfung durchgeführt, keine Abweichung festgestellt

Verwechslungsprüfung nach spectrometrischer Prüfung durchgeführt und i.O.

IK Test nach DIN 50914 durchgeführt, keine Abweichung festgestellt

Härtewerte nach NACE/MR 0175

Tüpfeltest i.O.

dimension sampling test done; without deviation

100% visual test done, without findings

mistake examination after spectrometric examination accomplished and in Order

test about intercrystalline corrosion done, without findings

hardness according to NACE/MR 0175

spot test ok.

Die gestellten Anforderungen sind erfüllt/Requirements of order are compiled
Riedlingen, den 27.10.2011

FEINGUSS BLANK GmbH
Qualitätswesen: i.V. SCHAACK

Das Zeugnis wurde maschinell erstellt und ist gemäß EN 10204 ohne Unterschrift rechtsverbindlich.
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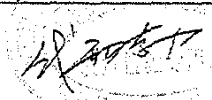
MILL INSPECTION CERTIFICATE

Huzhou Zhongli Stainless Steel Pipe Co., Ltd.

Huang Long Industrial District, Shuanglin Town of Huzhou City Zhejiang Province, P.R. China

ISO 9001:2008 PED BY LLOYD

REGISTRATION No.: QAC6002856

CERTIFICATE NO.: 111113001 COMMODITY: SEAMLESS STAINLESS STEEL TUBING SPECIFICATION: ASTM A213-10 ASME SA213-08 ASTM A269-10 (Average Wall)						PURCHASER: ROBERT-JAMES SALES, INC R. James P.O. No: GS-2392 DATE OF REPORT: 2011.11.30					
Steel Grade	Heat No.	Lot No.	Dimensions			Quantity		Process	Delivery Condition	Macroscopic Inspection	
			O.D.	W.T.	Length	Pieces	(ft)			End Cut	Appearance
TP316/316L	YX1109-610	11A1120341	21.3MM	1.6MM	20ft	42	840	Cold-finished	OD Polished to 240 Grit	Passed	Passed
Chemical Composition (W.T. %)											
Element	C	Mn	P	S	Si	Cr	Ni	Mo	Ti		
Requirements	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00	16.0~18.0	10.0~14.0	2.0~3.0	—		
Ladle Analysis	0.018	0.68	0.034	0.002	0.37	16.50	10.07	2.06			
Product Analysis	0.020	0.67	0.033	0.002	0.39	16.52	10.06	2.05			
Mechanical Properties											
Test Item	Y.S. (Mpa) Rp0.2	T.S. (Mpa) Rm	EL. (%) In 2 in	Reduction of Area Z (%)	Hardness	Cold Bend Test	Flaring Test	Flattening Test	Flange Test		
Requirements	≥205	≥515	≥35	/	HRB≤90	/			/		
Test Results	275/285	575/580	56/58	/	72/73	/	Passed	Passed	/		
Non Destructive Tests				Hydrostatic Test	Inter-granular Corrosion Test	Remarks: - Tubes tested per ASTM A1016-11a - Hardness tested per NACE MR-01-03-2007 - All tubes annealed to above 1900 Deg F and water quenched Below 800 Deg F in 3 minutes - No weld repair performed - Free from mercury contamination - In compliance with EN 10204-3.1 - PED 97/23/EC CERTIFIED - Material to meet NACE MR 01-75-2005 - Billets melt and pipes/tubes manufactured in China					
Test Item	Eddy Current Test	Ultrasonic Test									
Requirements	ASTM E 426	ASTM E213									
Test Results	Passed	/									
We hereby certify that the material described herein has been made and tested completely in accordance with the above specification and with the requirements of the purchase order or contract.					Prepared by:	Approved by: 					

Abnahmeprüfzeugnis nach EN 10204 - 3.1
Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_230

Seite / page 1 / 2

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000230	1,000	FTL51-TGM2YY5E5C Liquiphant M FTL51	
		S/N F302A915027	TAG 124-OYENS-B0LSHH -0302 25472-101POA JL10-W0001 #30.00

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

01R2N

Adapter / adapter
BGH Edelstahl Freital
266078
329507

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

0515X

Gabel / fork
FEINGUSS BLANK
PZ00997
70123



Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_230

Seite / page 2 / 2

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

04YR0
Rohr / tube
OUTO KUMPU
N1018851/1
4026620

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

0623A
Rohr / tube
Huzhou Zhongli
111113001
YX1109-106

13.04.2012

Endress+Hauser (USA) Autom. Instrum. Inc
US-46143-9772 Greenwood

jeremy shireman
- Abnahmebeauftragter -
- Inspector -

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gez.. Beikirch



BGH Edelstahl Freital GmbH

BGH Edelstahl Freital GmbH Am Stahlwerk 1 01705 Freital

Günther + Schramm
GmbH & Co. KGPF 81 02 03
68202 Mannheim-Rheinau
DeutschlandZeugnis-Nr. 266078
Certificate no.
No. de certificatBescheinigung über Werkstoffprüfung nach DIN EN 10204
Certificate of material tests according to DIN EN 10204 3.1
Certificat des essais des matériaux selon DIN EN 10204Die Lieferung entspricht den vereinbarten Lieferbedingungen.
Delivery in accordance with the agreed terms of delivery.
La livraison correspond aux conditions de livraison convenuesZeichen des Lieferwerkes Stempel des Werkstoffverständigen
Trade mark Inspector's stamp
Signe du fournisseur Poinçon de l'inspecteurKunden-Bestell-Nr. 4500137166-2000
Customer order no.
Cde. no. du client E+H 11373447BGH-Auftrags-Nr. 40332101/95941
BGH works no.
BGH référence

Erzeugnisform Product		Stab, rund, geschält Round bars, peeled										
Werkstoff / Quality		1.4435 X2CrNiMo18-14-3										
Anforderungen Requirements		TLB 410000120 05/06 1.4435 X 2 CrNiMo 18-14-3 DIN EN 10272 01/01 1.4435 X 2 CrNiMo 18-14-3 AD2000 W 10 10/03 316L - UNS S31603 NACE MR0175/ISO15156 1.4435 X2CrNiMo18-14-3 AD2000 W 2 07/06 316L ASTM A479/A479M 2006a 1.4435 X2CrNiMo18-14-3 BN 2 Ausg. 06/97 DGRL 97/23/EG, Anhg. I, 4.3										
Besichtigung und Maßnachprüfung Inspection and dimensional control Inspection et contrôle de dimension ohne Beanstandung without objection			Erschmelzung/Nachbehandlung Melting process/secondary refining Mode d'élaboration/traitement ultérieur E - VOD					Verwechslungsprüfung (spectroanalytisch) Identification test (spectral analysis) examination d'identification (analyse spectrale) ohne Beanstandung without objection				
Pos. Item	Anzahl Quantity	Abmessung Dimension								Gewicht Weight	kg	Schmelz-Nr. Heat-No.
1	75	40,00 RD								2896		329507
Schmelze Heat %	C	Si	Mn	P	S	Cr	Mo	Ni	Ti	N2		
329507	0,019	0,33	1,90	0,022	0,012	17,23	2,54	13,30	0,006	0,0890		
Wärmebehandlungszustand Condition of heat treat Traitement thermique		abgeschreckt quenched 1040°C Wasser/ water										
Probe-Nr. Test-No.	Lage	Temp. °C	Rp0,2 N/mm ²	Rp1,0 N/mm ²	Rm N/mm ²	A4/A5 %	Z %	Kerbschlagarbeit Impact value J	Probenform Shape of test piece Charpy-V °C	Härte HRC Hardness		
Soll/Req.	L	RT	>=200	>=235	>=500	>=35	>=40	>=100	RT			
	L	RT			<=700					<=22		
106AE1	L	RT	302	347	628	53/55	80	268 264 270	RT	<20		
106AE2	L	RT	300	344	629	54/56	80					
IK-Beständigkeit/ intercrystalline corrosion DIN EN ISO 3651-2: wird gewährleistet- is warranted.												
US-Prüfung/ us-test: ohne Beanstandung- no objection.												
Anlagen Encl. Annexe					Freital, den Place and date Lieu et date 29.01.2008			Abnahmebeauftragter Inspector representative Inspecteur de réception Kadner				
Das Zeugnis wurde maschinell erstellt und ist auch ohne Unterschrift gültig. Ce certificat a été établi sur système informatique et est valable sans signature aussi.												



Metalltechnik GmbH . Fabrikstraße 1 . D-79650 Schopfheim

Endress + Hauser GmbH + Co.KG

Hauptstr. 1

79689 Maulburg

UMSTEMPELBESCHEINIGUNG CERTIFICATE OF RE-STAMPING

KOMMISSIONS-NR: 120116-5
consignment no:

IHRE BESTELLUNG: 11977454
your order:

Wir bestätigen, dass die gelieferten Produkte folgende Abmessungen aufweisen:
We confirm, that the supplied semi-finished products have the following dimensions:

Position item	Produkt product	Menge quantity	Dicke thickness	Durchmesser diameter	Breite width	Länge length
1	52027474 Piezorohr/piezo tube	800		Ø21,3 mm		48,5 mm

Position item	Aus Halbzeug der Abmessung out of semis of dimension	Schmelze heat-no.	Los-Probe-Blech-Nr. lot-sample-plate-no.	Hersteller manufacturer
1	Rohr/tube 1.4435	4026620		Outokumpu

ausgewiesen durch Abnahmeprüfzeugnis nach EN10204 gem. Anlage. Zeugnis-Nr. :
As evidenced by: Inspection certificate according to EN10204 as attached. No. Of cert.:

N1018851/1

Die Stempelung ist übertragen worden. Die Fertigteile wurden wie folgt gekennzeichnet :
The marking has been transferred. The finished products are signed with No. :

1.4435 04YR0

Zum Zeichen der ordnungsgemäßen Umstempelung wurden die Produkte mit folg. Zeichen versehen :
As proof of the legal re-stamping the semi-finished products have been signed with :

S1

BESICHTIGUNG UND MASSKONTROLLE: O.B.
Visual & dimensional inspection: o.k.

Das Umstempeln erfolgte mit Genehmigung des TÜV Industrie Service GmbH
The re-stamping was carried out with the approval of: TÜV Industrie Service GmbH

Datum : 16.01.2012
date :

Unterschrift :
signature :

**CERTIFICATE EN 10204:2004/3.1**

This inspection certificate fulfils the requirements of EN 10204:2004 type 3.1
and EN 10204:1991+A1:1995 type 3.1.B.

Page 1(1)

BUYER		DATE 2010-10-31		CERTIFICATE NO N1018851/ 1											
		MANUFACTURES ORDER NO 2010001271		ITEM 21											
		BUYERS ORDER NO		SHIPMENT											
PRODUCT FORM LONGITUDINALLY WELDED STAINLESS STEEL TUBES, PICKLED, PLAIN ENDS, IN MILL LENGTHS, HEAT TREATMENT 1080 C QUENCHED IN AIR/WATER															
SPECIFICATION AD 2000-W2/W10 / EN 10217-7 Tc2 INOX				MANUFACTURES MARK OUTOKUMPU-N											
GRADE EN 1.4435		MANUFACTURES GRADE 4435T		TOLERANCES SS EN ISO 1127 D4 T3											
TUBE MARKING OUTOKUMPU-N; 1.4435; AD-W2 / EN 10217-7; ; W2A; TC2; Z=1,0; MAR-N1; 21,30 X 2,00; 4026620;INOX; MADE IN SWEDEN;															
EXTENT OF DELIVERY															
PCS		METER		DIMENSION 21,30 2,00											
				BATCH NO 4026620											
				TEST NO A											
CHEMICAL COMPOSITION															
HEAT ANALYSIS 1		C	SI	MN	P	S	CR	NI	MO	N					
		0,018	0,400	1,60	0,033	0,001	17,20	12,60	2,60	0,060					
TEST RESULT															
	TEMP	RP0,2 MPa	RP1,0 MPa	RM MPa	A5 %	HRC HRC		Ferrite %							
	20	190	225	490 690	40	22		0,5							
A1 L	20	284	320	583	53	20		0,1							
A2 L	20	292	326	589	55										
A3 L	20	292	327	588	55										
A4 L	20	291	327	589	55										
A5 L	20	275	309	585	58										
A6 L	20	287	322	584	53										
A7 L	20	289	324	584	54										
A8 L	20	291	326	588	55										
FLARING TEST EN ISO 8493 100% EDDY CURRENT TEST EN 10246-3 E1H / EN 10246-2 MATERIAL IDENTIFICATION TEST VISUAL AND DIMENSIONAL INSPECTION FERRITE CONTROL WELD, ACC TO BN2 HARDNESS ACC TO NACE MR 0175 INTERGRANULAR CORROSION TEST EN ISO 3651-2:A						SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY									
INSPECTION CERTIFICATE EN 10204-3.1 ACC. TO THE LETTER OF AGREEMENT,TUEV NORD DATED JULY 4,2008, FILE NO 1326WL04780-1															
 No. 44 100 075263		Certified acc: PED 97/23/EC and AD2000-W0/TRD 100 by TÜV Nord gruppe for pressure equipment NOB no: 0045 Certificate no: 07-202-3537WZ-0678/07 (no. 3537WL04770) Procedures and personnel approved by notified bodies, WPS/WPAR: EN 288 / WLD Personnel: EN 1418 / NDT: EN 473				THE REQUIREMENTS ARE FULFILLED AS STIPULATED INSPECTOR / MAR Johan Gemmel									
		MELTING PROCESS: E/AOD Base material from PED 97/23/EC approved suppliers.				ISSUED BY Yvonne Wannestrand									

OUTOKUMPU STAINLESS TUBULAR PRODUCTS
Torshälla Box 46 S-64421 Torshälla Sweden

Telephone no
+46 16 34 96 52

Telefax
+46 16 34 97 00

yvonne.wannestrand@outokumpu.com



Feinguss · Fertigkomponenten · Entwicklungspartner

Endress u. Hauser GmbH & Co. KG
Hauptstrasse 1 Wareneing.2
DE-79689 Maulburg

Abnahmeprüfzeugnis 3.1

Inspection certificate

nach/according to DIN EN 10204:2005
Prüf-Nr./Test-No.: PZ00997
BA-Nr.: 1066037
Ident-Nr.: 06748/05

Ihre Bestellung Nr./Your order No.:
117/11964636

vom/dated:
29.11.2011

Gußstück-Bezeichnung/Part-description:
GABEL STANDARD

Zeichnungs-Nr./Drawing-No.:
210011044 (52006900) Index

Prüfergebnisse/Test results

Gußteile gezeichnet mit/Castings signed with:
B1 0515X

Chemische Analyse/Chemical analysis:

Soll/Nom	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N
min	0,000	0,00	0,00	0,000	0,000	17,00	2,50	10,00	0,000	0,000	0,000
max	0,030	1,00	2,00	0,045	0,015	19,00	3,00	10,60	0,100	0,400	0,110
Charge/Los/Lot No.											
70123											
min	0,010	0,70	0,25	0,004	0,005	17,61	2,79	10,04	0,011	0,010	0,011
max	0,014	0,92	0,30	0,005	0,006	17,86	2,85	10,37	0,023	0,010	0,057

Wärmebehandlung/Heat treatment:

lösungsgeglüht u. abgeschreckt max. 241 HB

Härteprüfung/Hardness test:

HV 10 = 151 - 158

Mechanische Prüfung/Mechanical testing:

Soll/Nom	Rp 0,2 (N/mm ²)	Rp 1,0 (N/mm ²)	Rm (N/mm ²)	A (Lo=50mm) (%)
min	200	235	500	30,00
max				
Charge/Los/Lot No.				
70123	246	284	543	59,00

Stichprobe Massprüfung durchgeführt, keine Abweichung festgestellt

100% Sichtprüfung durchgeführt, keine Abweichung festgestellt

Verwechslungsprüfung nach spectrometrischer Prüfung durchgeführt und i.O.

IK Test nach DIN 50914 durchgeführt, keine Abweichung festgestellt

Härtewerte nach NACE/MR 0175

Tüpfeltest i.O.

dimension sampling test done; without deviation

100% visual test done, without findings

mistake examination after spectrometric examination accomplished and in Order

test about intercrystalline corrosion done, without findings

hardness according to NACE/MR 0175

spot test ok.

Die gestellten Anforderungen sind erfüllt/Requirements of order are compiled
Riedlingen, den 27.10.2011

FEINGUSS BLANK GmbH
Qualitätswesen: i.V. SCHAACK

Das Zeugnis wurde maschinell erstellt und ist gemäß EN 10204 ohne Unterschrift rechtsverbindlich.
This certificate was generated by data system, acc. to EN 10204, it need not to be signed for validity.

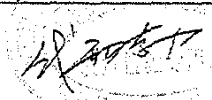
MILL INSPECTION CERTIFICATE

Huzhou Zhongli Stainless Steel Pipe Co., Ltd.

Huang Long Industrial District, Shuanglin Town of Huzhou City Zhejiang Province, P.R. China

ISO 9001:2008 PED BY LLOYD

REGISTRATION No.: QAC6002856

CERTIFICATE NO.: 111113001 COMMODITY: SEAMLESS STAINLESS STEEL TUBING SPECIFICATION: ASTM A213-10 ASME SA213-08 ASTM A269-10 (Average Wall)						PURCHASER: ROBERT-JAMES SALES, INC R. James P.O. No: GS-2392 DATE OF REPORT: 2011.11.30					
Steel Grade	Heat No.	Lot No.	Dimensions			Quantity		Process	Delivery Condition	Macroscopic Inspection	
			O.D.	W.T.	Length	Pieces	(ft)			End Cut	Appearance
TP316/316L	YX1109-610	11A1120341	21.3MM	1.6MM	20ft	42	840	Cold-finished	OD Polished to 240 Grit	Passed	Passed
Chemical Composition (W.T. %)											
Element	C	Mn	P	S	Si	Cr	Ni	Mo	Ti		
Requirements	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00	16.0~18.0	10.0~14.0	2.0~3.0	—		
Ladle Analysis	0.018	0.68	0.034	0.002	0.37	16.50	10.07	2.06			
Product Analysis	0.020	0.67	0.033	0.002	0.39	16.52	10.06	2.05			
Mechanical Properties											
Test Item	Y.S. (Mpa) Rp0.2	T.S. (Mpa) Rm	EL. (%) In 2 in	Reduction of Area Z (%)	Hardness	Cold Bend Test	Flaring Test	Flattening Test	Flange Test		
Requirements	≥205	≥515	≥35	/	HRB≤90	/			/		
Test Results	275/285	575/580	56/58	/	72/73	/	Passed	Passed	/		
Non Destructive Tests				Hydrostatic Test	Inter-granular Corrosion Test	Remarks: - Tubes tested per ASTM A1016-11a - Hardness tested per NACE MR-01-03-2007 - All tubes annealed to above 1900 Deg F and water quenched Below 800 Deg F in 3 minutes - No weld repair performed - Free from mercury contamination - In compliance with EN 10204-3.1 - PED 97/23/EC CERTIFIED - Material to meet NACE MR 01-75-2005 - Billets melt and pipes/tubes manufactured in China					
Test Item	Eddy Current Test	Ultrasonic Test									
Requirements	ASTM E 426	ASTM E213	ASTM A450								
Test Results	Passed	/	/								
We hereby certify that the material described herein has been made and tested completely in accordance with the above specification and with the requirements of the purchase order or contract.						Prepared by:		Approved by: 			

Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_210

Seite / page 1 / 2

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000210	1,000	FTL51-TGM2YY5E5C Liquiphant M FTL51	
		S/N F302A815027	TAG 123-MTRSP-B0LSHH -0302 25472-101POA JL10-W0001 #29.00

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

01R2N

Adapter / adapter
BGH Edelstahl Freital
266078
329507

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

0515X

Gabel / fork
FEINGUSS BLANK
PZ00997
70123



Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_210

Seite / page 2 / 2

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

04YR0
Rohr / tube
OUTO KUMPU
N1018851/1
4026620

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

0623A
Rohr / tube
Huzhou Zhongli
111113001
YX1109-106

13.04.2012

Endress+Hauser (USA) Autom. Instrum. Inc
US-46143-9772 Greenwood

jeremy shireman
- Abnahmebeauftragter -
- Inspector -

Dieses Zeugnis wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig.
This document was generated electronically acc. to EN 10204 and is valid without signature.



Umstempelbescheinigung

Stamp confirmation certificate

Geschäftsstelle 68219 Mannheim
Location

Besteller: Endress + Hauser
Customer

Kd.-Nr.: 21669
Client-Nr.

Kommissionierauftrag: 81015557
Order-Nr.

Bestell-Nr.: 0011664298

Wir bestätigen, daß von dem Werkskundigen nachstehender Werkstoff mit der TAN-Nr gekennzeichnet wurde
We confirm, that the specified person is authorized to inspect and stamp.

[illegible]

Dieses Dokument ist elektronisch erstellt und deswegen ohne Unterschrift gültig.
This document is created electronically and therefore valid without a signature.

Gemäß Umstempelvereinbarung 600210493 vom TÜV Süd 13.12.07.
According Stampagreement of TÜV Süd 13.12.2007.

Datum: 15.01.2010
Date

gez.. Beikirch



BGH Edelstahl Freital GmbH

BGH Edelstahl Freital GmbH Am Stahlwerk 1 01705 Freital

Günther + Schramm
GmbH & Co. KGPF 81 02 03
68202 Mannheim-Rheinau
DeutschlandZeugnis-Nr. 266078
Certificate no.
No. de certificatBescheinigung über Werkstoffprüfung nach DIN EN 10204
Certificate of material tests according to DIN EN 10204 3.1
Certificat des essais des matériaux selon DIN EN 10204Die Lieferung entspricht den vereinbarten Lieferbedingungen.
Delivery in accordance with the agreed terms of delivery.
La livraison correspond aux conditions de livraison convenuesZeichen des Lieferwerkes Stempel des Werkstoffverständigen
Trade mark Inspector's stamp
Signe du fournisseur Poinçon de l'inspecteurKunden-Bestell-Nr. 4500137166-2000
Customer order no.
Cde. no. du client E+H 11373447BGH-Auftrags-Nr. 40332101/95941
BGH works no.
BGH référence

Erzeugnisform Product		Stab, rund, geschält Round bars, peeled										
Werkstoff / Quality		1.4435 X2CrNiMo18-14-3										
Anforderungen Requirements		TLB 410000120 05/06 1.4435 X 2 CrNiMo 18-14-3 DIN EN 10272 01/01 1.4435 X 2 CrNiMo 18-14-3 AD2000 W 10 10/03 316L - UNS S31603 NACE MR0175/ISO15156 1.4435 X2CrNiMo18-14-3 AD2000 W 2 07/06 316L ASTM A479/A479M 2006a 1.4435 X2CrNiMo18-14-3 BN 2 Ausg. 06/97 DGRL 97/23/EG, Anhg. I, 4.3										
Besichtigung und Maßnachprüfung Inspection and dimensional control Inspection et contrôle de dimension ohne Beanstandung without objection			Erschmelzung/Nachbehandlung Melting process/secondary refining Mode d'élaboration/traitement ultérieur E - VOD					Verwechslungsprüfung (spectroanalytisch) Identification test (spectral analysis) examination d'identification (analyse spectrale) ohne Beanstandung without objection				
Pos. Item	Anzahl Quantity	Abmessung Dimension								Gewicht Weight	Schmelz-Nr. Heat-No.	
1	75	40,00 RD								2896	329507	
Schmelze Heat %	C	Si	Mn	P	S	Cr	Mo	Ni	Ti	N2		
329507	0,019	0,33	1,90	0,022	0,012	17,23	2,54	13,30	0,006	0,0890		
Wärmebehandlungszustand Condition of heat treat Traitement thermique		abgeschreckt quenched 1040°C Wasser/ water										
Probe-Nr. Test-No.	Lage	Temp. °C	Rp0,2 N/mm ²	Rp1,0 N/mm ²	Rm N/mm ²	A4/A5 %	Z %	Kerbschlagarbeit Impact value J	Probenform Shape of test piece Charpy-V °C	Härte HRC Hardness		
Soll/Req.	L	RT	>=200	>=235	>=500	>=35	>=40	>=100	RT			
	L	RT			<=700					<=22		
106AE1	L	RT	302	347	628	53/55	80	268 264 270	RT	<20		
106AE2	L	RT	300	344	629	54/56	80					
IK-Beständigkeit/ intercrystalline corrosion DIN EN ISO 3651-2: wird gewährleistet- is warranted.												
US-Prüfung/ us-test: ohne Beanstandung- no objection.												
Anlagen Encl. Annexe					Freital, den Place and date Lieu et date 29.01.2008				Abnahmebeauftragter Inspector representative Inspecteur de réception Kadner			
Das Zeugnis wurde maschinell erstellt und ist auch ohne Unterschrift gültig. Ce certificat a été établi sur système informatique et est valable sans signature aussi.												



Metalltechnik GmbH . Fabrikstraße 1 . D-79650 Schopfheim

Endress + Hauser GmbH + Co.KG

Hauptstr. 1

79689 Maulburg

UMSTEMPELBESCHEINIGUNG CERTIFICATE OF RE-STAMPING

KOMMISSIONS-NR: 120116-5
consignment no:

IHRE BESTELLUNG: 11977454
your order:

Wir bestätigen, dass die gelieferten Produkte folgende Abmessungen aufweisen:
We confirm, that the supplied semi-finished products have the following dimensions:

Position item	Produkt product	Menge quantity	Dicke thickness	Durchmesser diameter	Breite width	Länge length
1	52027474 Piezorohr/piezo tube	800		Ø21,3 mm		48,5 mm

Position item	Aus Halbzeug der Abmessung out of semis of dimension	Schmelze heat-no.	Los-Probe-Blech-Nr. lot-sample-plate-no.	Hersteller manufacturer
1	Rohr/tube 1.4435	4026620		Outokumpu

ausgewiesen durch Abnahmeprüfzeugnis nach EN10204 gem. Anlage. Zeugnis-Nr. :
As evidenced by: Inspection certificate according to EN10204 as attached. No. Of cert.:

N1018851/1

Die Stempelung ist übertragen worden. Die Fertigteile wurden wie folgt gekennzeichnet :
The marking has been transferred. The finished products are signed with No. :

1.4435 04YR0

Zum Zeichen der ordnungsgemäßen Umstempelung wurden die Produkte mit folg. Zeichen versehen :
As proof of the legal re-stamping the semi-finished products have been signed with :

S1

BESICHTIGUNG UND MASSKONTROLLE: O.B.
Visual & dimensional inspection: o.k.

Das Umstempeln erfolgte mit Genehmigung des TÜV Industrie Service GmbH
The re-stamping was carried out with the approval of: TÜV Industrie Service GmbH

Datum : 16.01.2012
date :

Unterschrift :
signature :

**CERTIFICATE EN 10204:2004/3.1**

This inspection certificate fulfils the requirements of EN 10204:2004 type 3.1
and EN 10204:1991+A1:1995 type 3.1.8.

Page 1(1)

BUYER		DATE 2010-10-31		CERTIFICATE NO N1018851/ 1											
		MANUFACTURES ORDER NO 2010001271		ITEM 21											
		BUYERS ORDER NO		SHIPMENT											
PRODUCT FORM LONGITUDINALLY WELDED STAINLESS STEEL TUBES, PICKLED, PLAIN ENDS, IN MILL LENGTHS, HEAT TREATMENT 1080 C QUENCHED IN AIR/WATER															
SPECIFICATION AD 2000-W2/W10 / EN 10217-7 Tc2 INOX				MANUFACTURES MARK OUTOKUMPU-N											
GRADE EN 1.4435		MANUFACTURES GRADE 4435T		TOLERANCES SS EN ISO 1127 D4 T3											
TUBE MARKING OUTOKUMPU-N; 1.4435; AD-W2 / EN 10217-7; ; W2A; TC2; Z=1,0; MAR-N1; 21,30 X 2,00; 4026620; INOX; MADE IN SWEDEN;															
EXTENT OF DELIVERY															
PCS		METER		DIMENSION 21,30 2,00											
				BATCH NO 4026620											
				TEST NO A											
CHEMICAL COMPOSITION															
HEAT ANALYSIS 1		C	SI	MN	P	S	CR	NI	MO	N					
		0,018	0,400	1,60	0,033	0,001	17,20	12,60	2,60	0,060					
TEST RESULT															
	TEMP	RP0,2 MPa	RP1,0 MPa	RM MPa	A5 %	HRC HRC		Ferrite %							
	20	190	225	490 690	40	22		0,5							
A1 L	20	284	320	583	53	20		0,1							
A2 L	20	292	326	589	55										
A3 L	20	292	327	588	55										
A4 L	20	291	327	589	55										
A5 L	20	275	309	585	58										
A6 L	20	287	322	584	53										
A7 L	20	289	324	584	54										
A8 L	20	291	326	588	55										
FLARING TEST EN ISO 8493 100% EDDY CURRENT TEST EN 10246-3 E1H / EN 10246-2 MATERIAL IDENTIFICATION TEST VISUAL AND DIMENSIONAL INSPECTION FERRITE CONTROL WELD, ACC TO BN2 HARDNESS ACC TO NACE MR 0175 INTERGRANULAR CORROSION TEST EN ISO 3651-2:A						SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY									
INSPECTION CERTIFICATE EN 10204-3.1 ACC. TO THE LETTER OF AGREEMENT, TUEV NORD DATED JULY 4, 2008, FILE NO 1326WL04780-1															
 No. 44 100 075263		Certified acc: PED 97/23/EC and AD2000-W0/TRD 100 by TÜV Nord gruppe for pressure equipment NOB no: 0045 Certificate no: 07-202-3537WZ-0678/07 (no. 3537WL04770) Procedures and personnel approved by notified bodies, WPS/WPAR: EN 288 / WLD Personnel: EN 1418 / NDT: EN 473				THE REQUIREMENTS ARE FULFILLED AS STIPULATED INSPECTOR / MAR Johan Gemmel									
		MELTING PROCESS: E/AOD Base material from PED 97/23/EC approved suppliers.				ISSUED BY Yvonne Wannestrand									

OUTOKUMPU STAINLESS TUBULAR PRODUCTS
Torshälla Box 46 S-64421 Torshälla Sweden

Telephone no
+46 16 34 96 52

Telefax
+46 16 34 97 00

yvonne.wannestrand@outokumpu.com



Feinguss · Fertigkomponenten · Entwicklungspartner

Endress u. Hauser GmbH & Co. KG
Hauptstrasse 1 Wareneing.2
DE-79689 Maulburg

Abnahmeprüfzeugnis 3.1

Inspection certificate

nach/according to DIN EN 10204:2005
Prüf-Nr./Test-No.: PZ00997
BA-Nr.: 1066037
Ident-Nr.: 06748/05

Ihre Bestellung Nr./Your order No.:
117/11964636

vom/dated:
29.11.2011

Gußstück-Bezeichnung/Part-description:
GABEL STANDARD

Zeichnungs-Nr./Drawing-No.:
210011044 (52006900) Index

Prüfergebnisse/Test results

Gußteile gezeichnet mit/Castings signed with:
B1 0515X

Chemische Analyse/Chemical analysis:

Soll/Nom	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N
min	0,000	0,00	0,00	0,000	0,000	17,00	2,50	10,00	0,000	0,000	0,000
max	0,030	1,00	2,00	0,045	0,015	19,00	3,00	10,60	0,100	0,400	0,110
Charge/Los/Lot No.											
70123											
min	0,010	0,70	0,25	0,004	0,005	17,61	2,79	10,04	0,011	0,010	0,011
max	0,014	0,92	0,30	0,005	0,006	17,86	2,85	10,37	0,023	0,010	0,057

Wärmebehandlung/Heat treatment:

lösungsgeglüht u. abgeschreckt max. 241 HB

Härteprüfung/Hardness test:

HV 10 = 151 - 158

Mechanische Prüfung/Mechanical testing:

Soll/Nom	Rp 0,2 (N/mm ²)	Rp 1,0 (N/mm ²)	Rm (N/mm ²)	A (Lo=50mm) (%)
min	200	235	500	30,00
max				
Charge/Los/Lot No.				
70123	246	284	543	59,00

Stichprobe Massprüfung durchgeführt, keine Abweichung festgestellt

100% Sichtprüfung durchgeführt, keine Abweichung festgestellt

Verwechslungsprüfung nach spectrometrischer Prüfung durchgeführt und i.O.

IK Test nach DIN 50914 durchgeführt, keine Abweichung festgestellt

Härtewerte nach NACE/MR 0175

Tüpfeltest i.O.

dimension sampling test done; without deviation

100% visual test done, without findings

mistake examination after spectrometric examination accomplished and in Order

test about intercrystalline corrosion done, without findings

hardness according to NACE/MR 0175

spot test ok.

Die gestellten Anforderungen sind erfüllt/Requirements of order are compiled
Riedlingen, den 27.10.2011

FEINGUSS BLANK GmbH
Qualitätswesen: i.V. SCHAACK

Das Zeugnis wurde maschinell erstellt und ist gemäß EN 10204 ohne Unterschrift rechtsverbindlich.
This certificate was generated by data system, acc. to EN 10204, it need not to be signed for validity.

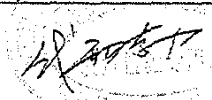
MILL INSPECTION CERTIFICATE

Huzhou Zhongli Stainless Steel Pipe Co., Ltd.

Huang Long Industrial District, Shuanglin Town of Huzhou City Zhejiang Province, P.R. China

ISO 9001:2008 PED BY LLOYD

REGISTRATION No.: QAC6002856

CERTIFICATE NO.: 111113001 COMMODITY: SEAMLESS STAINLESS STEEL TUBING SPECIFICATION: ASTM A213-10 ASME SA213-08 ASTM A269-10 (Average Wall)						PURCHASER: ROBERT-JAMES SALES, INC R. James P.O. No: GS-2392 DATE OF REPORT: 2011.11.30					
Steel Grade	Heat No.	Lot No.	Dimensions			Quantity		Process	Delivery Condition	Macroscopic Inspection	
			O.D.	W.T.	Length	Pieces	(ft)			End Cut	Appearance
TP316/316L	YX1109-610	11A1120341	21.3MM	1.6MM	20ft	42	840	Cold-finished	OD Polished to 240 Grit	Passed	Passed
Chemical Composition (W.T. %)											
Element	C	Mn	P	S	Si	Cr	Ni	Mo	Ti		
Requirements	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00	16.0~18.0	10.0~14.0	2.0~3.0	—		
Ladle Analysis	0.018	0.68	0.034	0.002	0.37	16.50	10.07	2.06			
Product Analysis	0.020	0.67	0.033	0.002	0.39	16.52	10.06	2.05			
Mechanical Properties											
Test Item	Y.S. (Mpa) Rp0.2	T.S. (Mpa) Rm	EL. (%) In 2 in	Reduction of Area Z (%)	Hardness	Cold Bend Test	Flaring Test	Flattening Test	Flange Test		
Requirements	≥205	≥515	≥35	/	HRB≤90	/			/		
Test Results	275/285	575/580	56/58	/	72/73	/	Passed	Passed	/		
Non Destructive Tests				Hydrostatic Test	Inter-granular Corrosion Test	Remarks: - Tubes tested per ASTM A1016-11a - Hardness tested per NACE MR-01-03-2007 - All tubes annealed to above 1900 Deg F and water quenched Below 800 Deg F in 3 minutes - No weld repair performed - Free from mercury contamination - In compliance with EN 10204-3.1 - PED 97/23/EC CERTIFIED - Material to meet NACE MR 01-75-2005 - Billets melt and pipes/tubes manufactured in China					
Test Item	Eddy Current Test	Ultrasonic Test									
Requirements	ASTM E 426	ASTM E213	ASTM A450								
Test Results	Passed	/	/								
We hereby certify that the material described herein has been made and tested completely in accordance with the above specification and with the requirements of the purchase order or contract.						Prepared by:		Approved by: 			

Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_190

Seite / page 1 / 2

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und / oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and / or the additionally ordered inspections have been performed according to the valid procedures and the necessary releases have been given.

The subsequently listed inspections have been performed by especially authorized personnel.

Kunde / Customer: TRANSCANADA KEYSTONE PIPELINE
450 - 1ST STREET S.W.
CA-T2P 5H1 CALGARY

Kunden Bestell-Nr. / Customer order no.: 25472-101-POA-JL10-W0001

E+H Auftrags-Nr. / E+H order no.: 41921566

Pos / item	Menge / Qty	Produktbezeichnung / Description	
000190	1,000	FTL51-TGM2YY5E5C Liquiphant M FTL51	
		S/N F302A715027	TAG 122-LKSDE-B0LSHH -0302 25472-101POA JL10-W0001 #28.00

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

01R2N

Adapter / adapter
BGH Edelstahl Freital
266078
329507

Kennzeichnung / Marking

- Teil / Part
Hersteller / Manufacturer
Zeugnis-Nr. / Certificate No.
Schmelze-Nr. / Heat No.

0515X

Gabel / fork
FEINGUSS BLANK
PZ00997
70123



Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr. / Certificate no. 71178245 / 41921566_190

Seite / page 2 / 2

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

04YR0
Rohr / tube
OUTO KUMPU
N1018851/1
4026620

Kennzeichnung / Marking

- Teil / Part
- Hersteller / Manufacturer
- Zeugnis-Nr. / Certificate No.
- Schmelze-Nr. / Heat No.

0623A
Rohr / tube
Huzhou Zhongli
111113001
YX1109-106

13.04.2012

Endress+Hauser (USA) Autom. Instrum. Inc
US-46143-9772 Greenwood

jeremy shireman
- Abnahmebeauftragter -
- Inspector -

Dieses Zeugnis wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig.
This document was generated electronically acc. to EN 10204 and is valid without signature.



Umstempelbescheinigung

Stamp confirmation certificate

Geschäftsstelle 68219 Mannheim
Location

Besteller: Endress + Hauser
Customer

Kd.-Nr.: 21669
Client-Nr.

Kommissionierauftrag: 81015557
Order-Nr.

Bestell-Nr.: 0011664298

Wir bestätigen, daß von dem Werkskundigen nachstehender Werkstoff mit der TAN-Nr gekennzeichnet wurde
We confirm, that the specified person is authorized to inspect and stamp.

[illegible]

Dieses Dokument ist elektronisch erstellt und deswegen ohne Unterschrift gültig.
This document is created electronically and therefore valid without a signature.

Gemäß Umstempelvereinbarung 600210493 vom TÜV Süd 13.12.07.
According Stampagreement of TÜV Süd 13.12.2007.

Datum: 15.01.2010
Date

gez.. Beikirch



BGH Edelstahl Freital GmbH

BGH Edelstahl Freital GmbH Am Stahlwerk 1 01705 Freital

Günther + Schramm
GmbH & Co. KGPF 81 02 03
68202 Mannheim-Rheinau
DeutschlandZeugnis-Nr. 266078
Certificate no.
No. de certificatBescheinigung über Werkstoffprüfung nach DIN EN 10204
Certificate of material tests according to DIN EN 10204 3.1
Certificat des essais des matériaux selon DIN EN 10204Die Lieferung entspricht den vereinbarten Lieferbedingungen.
Delivery in accordance with the agreed terms of delivery.
La livraison correspond aux conditions de livraison convenuesZeichen des Lieferwerkes Stempel des Werkstoffverständigen
Trade mark Inspector's stamp
Signe du fournisseur Poinçon de l'inspecteurKunden-Bestell-Nr. 4500137166-2000
Customer order no.
Cde. no. du client E+H 11373447BGH-Auftrags-Nr. 40332101/95941
BGH works no.
BGH référence

Erzeugnisform Product		Stab, rund, geschält Round bars, peeled										
Werkstoff / Quality		1.4435 X2CrNiMo18-14-3										
Anforderungen Requirements		TLB 410000120 05/06 1.4435 X 2 CrNiMo 18-14-3 DIN EN 10272 01/01 1.4435 X 2 CrNiMo 18-14-3 AD2000 W 10 10/03 316L - UNS S31603 NACE MR0175/ISO15156 1.4435 X2CrNiMo18-14-3 AD2000 W 2 07/06 316L ASTM A479/A479M 2006a 1.4435 X2CrNiMo18-14-3 BN 2 Ausg. 06/97 DGRL 97/23/EG, Anhg. I, 4.3										
Besichtigung und Maßnachprüfung Inspection and dimensional control Inspection et contrôle de dimension ohne Beanstandung without objection			Erschmelzung/Nachbehandlung Melting process/secondary refining Mode d'élaboration/traitement ultérieur E - VOD					Verwechslungsprüfung (spectroanalytisch) Identification test (spectral analysis) examination d'identification (analyse spectrale) ohne Beanstandung without objection				
Pos. Item	Anzahl Quantity	Abmessung Dimension								Gewicht Weight	kg	Schmelz-Nr. Heat-No.
1	75	40,00 RD								2896		329507
Schmelze Heat %	C	Si	Mn	P	S	Cr	Mo	Ni	Ti	N2		
329507	0,019	0,33	1,90	0,022	0,012	17,23	2,54	13,30	0,006	0,0890		
Wärmebehandlungszustand Condition of heat treat Traitement thermique		abgeschreckt quenched 1040°C Wasser/ water										
Probe-Nr. Test-No.	Lage	Temp. °C	Rp0,2 N/mm ²	Rp1,0 N/mm ²	Rm N/mm ²	A4/A5 %	Z %	Kerbschlagarbeit Impact value J	Probenform Shape of test piece Charpy-V °C	Härte HRC Hardness		
Soll/Req.	L	RT	>=200	>=235	>=500	>=35	>=40	>=100	RT			
	L	RT			<=700					<=22		
106AE1	L	RT	302	347	628	53/55	80	268 264 270	RT	<20		
106AE2	L	RT	300	344	629	54/56	80					
IK-Beständigkeit/ intercrystalline corrosion DIN EN ISO 3651-2: wird gewährleistet- is warranted.												
US-Prüfung/ us-test: ohne Beanstandung- no objection.												
Anlagen Encl. Annexe					Freital, den Place and date Lieu et date 29.01.2008			Abnahmebeauftragter Inspector representative Inspecteur de réception Kadner				
Das Zeugnis wurde maschinell erstellt und ist auch ohne Unterschrift gültig. Ce certificat a été établi sur système informatique et est valable sans signature aussi.												



Metalltechnik GmbH . Fabrikstraße 1 . D-79650 Schopfheim

Endress + Hauser GmbH + Co.KG

Hauptstr. 1

79689 Maulburg

UMSTEMPELBESCHEINIGUNG CERTIFICATE OF RE-STAMPING

KOMMISSIONS-NR: 120116-5
consignment no:

IHRE BESTELLUNG: 11977454
your order:

Wir bestätigen, dass die gelieferten Produkte folgende Abmessungen aufweisen:
We confirm, that the supplied semi-finished products have the following dimensions:

Position item	Produkt product	Menge quantity	Dicke thickness	Durchmesser diameter	Breite width	Länge length
1	52027474 Piezorohr/piezo tube	800		Ø21,3 mm		48,5 mm

Position item	Aus Halbzeug der Abmessung out of semis of dimension	Schmelze heat-no.	Los-Probe-Blech-Nr. lot-sample-plate-no.	Hersteller manufacturer
1	Rohr/tube 1.4435	4026620		Outokumpu

ausgewiesen durch Abnahmeprüfzeugnis nach EN10204 gem. Anlage. Zeugnis-Nr. :
As evidenced by: Inspection certificate according to EN10204 as attached. No. Of cert.:

N1018851/1

Die Stempelung ist übertragen worden. Die Fertigteile wurden wie folgt gekennzeichnet :
The marking has been transferred. The finished products are signed with No. :

1.4435 04YR0

Zum Zeichen der ordnungsgemäßen Umstempelung wurden die Produkte mit folg. Zeichen versehen :
As proof of the legal re-stamping the semi-finished products have been signed with :

S1

BESICHTIGUNG UND MASSKONTROLLE: O.B.
Visual & dimensional inspection: o.k.

Das Umstempeln erfolgte mit Genehmigung des TÜV Industrie Service GmbH
The re-stamping was carried out with the approval of: TÜV Industrie Service GmbH

Datum : 16.01.2012
date :

Unterschrift :
signature :

**CERTIFICATE EN 10204:2004/3.1**

This inspection certificate fulfils the requirements of EN 10204:2004 type 3.1
and EN 10204:1991+A1:1995 type 3.1.B.

Page 1(1)

BUYER		DATE 2010-10-31		CERTIFICATE NO N1018851/ 1											
		MANUFACTURES ORDER NO 2010001271		ITEM 21											
		BUYERS ORDER NO		SHIPMENT											
PRODUCT FORM LONGITUDINALLY WELDED STAINLESS STEEL TUBES, PICKLED, PLAIN ENDS, IN MILL LENGTHS, HEAT TREATMENT 1080 C QUENCHED IN AIR/WATER															
SPECIFICATION AD 2000-W2/W10 / EN 10217-7 Tc2 INOX				MANUFACTURES MARK OUTOKUMPU-N											
GRADE EN 1.4435		MANUFACTURES GRADE 4435T		TOLERANCES SS EN ISO 1127 D4 T3											
TUBE MARKING OUTOKUMPU-N; 1.4435; AD-W2 / EN 10217-7; ; W2A; TC2; Z=1,0; MAR-N1; 21,30 X 2,00; 4026620; INOX; MADE IN SWEDEN;															
EXTENT OF DELIVERY															
PCS		METER		DIMENSION 21,30 2,00											
				BATCH NO 4026620											
				TEST NO A											
CHEMICAL COMPOSITION															
HEAT ANALYSIS 1		C	SI	MN	P	S	CR	NI	MO	N					
		0,018	0,400	1,60	0,033	0,001	17,20	12,60	2,60	0,060					
TEST RESULT															
	TEMP	RP0,2 MPa	RP1,0 MPa	RM MPa	A5 %	HRC HRC		Ferrite %							
	20	190	225	490 690	40	22		0,5							
A1 L	20	284	320	583	53	20		0,1							
A2 L	20	292	326	589	55										
A3 L	20	292	327	588	55										
A4 L	20	291	327	589	55										
A5 L	20	275	309	585	58										
A6 L	20	287	322	584	53										
A7 L	20	289	324	584	54										
A8 L	20	291	326	588	55										
FLARING TEST EN ISO 8493 100% EDDY CURRENT TEST EN 10246-3 E1H / EN 10246-2 MATERIAL IDENTIFICATION TEST VISUAL AND DIMENSIONAL INSPECTION FERRITE CONTROL WELD, ACC TO BN2 HARDNESS ACC TO NACE MR 0175 INTERGRANULAR CORROSION TEST EN ISO 3651-2:A						SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY SATISFACTORY									
INSPECTION CERTIFICATE EN 10204-3.1 ACC. TO THE LETTER OF AGREEMENT, TUEV NORD DATED JULY 4, 2008, FILE NO 1326WL04780-1															
 EN ISO 9001:2000 No. 44 100 075263		Certified acc: PED 97/23/EC and AD2000-W0/TRD 100 by TÜV Nord gruppe for pressure equipment NOB no: 0045 Certificate no: 07-202-3537WZ-0678/07 (no. 3537WL04770) Procedures and personnel approved by notified bodies, WPS/WPAR: EN 288 / WLD Personnel: EN 1418 / NDT: EN 473				THE REQUIREMENTS ARE FULFILLED AS STIPULATED INSPECTOR / MAR Johan Gemmel									
		MELTING PROCESS: E/AOD Base material from PED 97/23/EC approved suppliers.				ISSUED BY Yvonne Wannestrand									

OUTOKUMPU STAINLESS TUBULAR PRODUCTS
Torshälla Box 46 S-64421 Torshälla Sweden

Telephone no
+46 16 34 96 52

Telefax
+46 16 34 97 00

yvonne.wannestrand@outokumpu.com



Feinguss · Fertigkomponenten · Entwicklungspartner

Endress u. Hauser GmbH & Co. KG
Hauptstrasse 1 Wareneing.2
DE-79689 Maulburg

Abnahmeprüfzeugnis 3.1

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nach/according to DIN EN 10204:2005
Prüf-Nr./Test-No.: PZ00997
BA-Nr.: 1066037
Ident-Nr.: 06748/05

Ihre Bestellung Nr./Your order No.:
117/11964636

vom/dated:
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max	0,030	1,00	2,00	0,045	0,015	19,00	3,00	10,60	0,100	0,400	0,110
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70123											
min	0,010	0,70	0,25	0,004	0,005	17,61	2,79	10,04	0,011	0,010	0,011
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Wärmebehandlung/Heat treatment:

lösungsgeglüht u. abgeschreckt max. 241 HB

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HV 10 = 151 - 158

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max				
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100% Sichtprüfung durchgeführt, keine Abweichung festgestellt

Verwechslungsprüfung nach spectrometrischer Prüfung durchgeführt und i.O.

IK Test nach DIN 50914 durchgeführt, keine Abweichung festgestellt

Härtewerte nach NACE/MR 0175

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dimension sampling test done; without deviation

100% visual test done, without findings

mistake examination after spectrometric examination accomplished and in Order

test about intercrystalline corrosion done, without findings

hardness according to NACE/MR 0175

spot test ok.

Die gestellten Anforderungen sind erfüllt/Requirements of order are compiled
Riedlingen, den 27.10.2011

FEINGUSS BLANK GmbH
Qualitätswesen: i.V. SCHAACK

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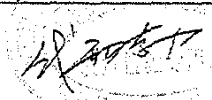
MILL INSPECTION CERTIFICATE

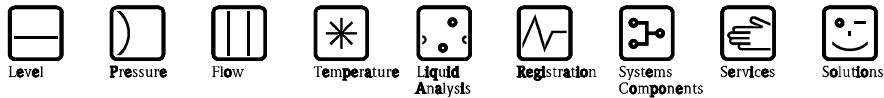
Huzhou Zhongli Stainless Steel Pipe Co., Ltd.

Huang Long Industrial District, Shuanglin Town of Huzhou City Zhejiang Province, P.R. China

ISO 9001:2008 PED BY LLOYD

REGISTRATION No.: QAC6002856

CERTIFICATE NO.: 111113001 COMMODITY: SEAMLESS STAINLESS STEEL TUBING SPECIFICATION: ASTM A213-10 ASME SA213-08 ASTM A269-10 (Average Wall)						PURCHASER: ROBERT-JAMES SALES, INC R. James P.O. No: GS-2392 DATE OF REPORT: 2011.11.30					
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			O.D.	W.T.	Length	Pieces	(ft)			End Cut	Appearance
TP316/316L	YX1109-610	11A1120341	21.3MM	1.6MM	20ft	42	840	Cold-finished	OD Polished to 240 Grit	Passed	Passed
Chemical Composition (W.T. %)											
Element	C	Mn	P	S	Si	Cr	Ni	Mo	Ti		
Requirements	≤0.035	≤2.00	≤0.045	≤0.030	≤1.00	16.0~18.0	10.0~14.0	2.0~3.0	—		
Ladle Analysis	0.018	0.68	0.034	0.002	0.37	16.50	10.07	2.06			
Product Analysis	0.020	0.67	0.033	0.002	0.39	16.52	10.06	2.05			
Mechanical Properties											
Test Item	Y.S. (Mpa) Rp0.2	T.S. (Mpa) Rm	EL. (%) In 2 in	Reduction of Area Z (%)	Hardness	Cold Bend Test	Flaring Test	Flattening Test	Flange Test		
Requirements	≥205	≥515	≥35	/	HRB≤90	/			/		
Test Results	275/285	575/580	56/58	/	72/73	/	Passed	Passed	/		
Non Destructive Tests				Hydrostatic Test	Inter-granular Corrosion Test	Remarks: - Tubes tested per ASTM A1016-11a - Hardness tested per NACE MR-01-03-2007 - All tubes annealed to above 1900 Deg F and water quenched Below 800 Deg F in 3 minutes - No weld repair performed - Free from mercury contamination - In compliance with EN 10204-3.1 - PED 97/23/EC CERTIFIED - Material to meet NACE MR 01-75-2005 - Billets melt and pipes/tubes manufactured in China					
Test Item	Eddy Current Test	Ultrasonic Test									
Requirements	ASTM E 426	ASTM E213									
Test Results	Passed	/									
We hereby certify that the material described herein has been made and tested completely in accordance with the above specification and with the requirements of the purchase order or contract.					Prepared by:		Approved by: 				



Incoming goods inspection

1 Purpose

The purpose of the incoming inspection is to check the quality of the incoming material.

2 Area of application

This procedure is valid for the Maulburg Product Center and associated product centers (APCs).

3 Operational description

- All incoming goods are registered in our ERP-system. Individual inspection plans and procedures are implemented in the system.
- Definition in the system as to whether this particular material is subject to incoming inspection. Production material is usually subject to incoming inspection. If there is a valid quality agreement with the supplier, for example in case of a long and stable good evaluation of the suppliers' quality, only random samples are taken.
- Initial samples are mandatory for new parts developed and defined by Endress+Hauser. Initial samples are defined by the R&D department and implemented in the system.
- The details of the incoming goods inspection are defined in the inspection plan for each material. Each inspection parameter has its own, individual sampling plan. The sampling plans are implemented in tables within the system. The acceptable number of instances of non-conformity within the tables is always zero.
- The individual inspection lots are defined by the system. Inspection results and acceptance or rejection of each lot are recorded in the system.
- In the case of non-conformity of the inspected lot, a complaint is written immediately. The inspection lot will be blocked. The decision on rework, selection or rejection will be taken on a case-by-case basis by the quality inspector.

4 Related documents

PB0190 Endress+Hauser internal process description, Incoming goods inspection
Endress+Hauser internal test plans in accordance with the instrument version



TS003F/00/EN/11.09



MANUFACTURING PROCESS INSTRUCTION

Instruction Number: L11-5-010
Revision Number: 0

Origination Date: 3/14/03
Revision Date: NA

Originated By Ben Bauer
Approved By: Mike Moore

Effective Date: 3/14/03
Number Pages: 3

FOR: All production lines with compact units packaged in the work cell.
General guideline to assure proper packaging and to prevent damage during shipment

DISTRIBUTION: Master File, Level Assembly, Pressure Assembly, Shipping Area, Quality Assurance, Industrial Engineering.

IMPLEMENTED BY: Production

General Guidelines

While it is nearly impossible to establish a package process that covers all possible options and variations of the product combinations this guideline should be used as a reference to describe how product packaging should be done to eliminate potential damage during shipping and handling. Our goal is to provide adequate packages so that the customer will be happy with our product condition when he receives it for use. This instruction and references should be used for training and should be well understood by all personnel involved in product packaging with verification via the training record.

1. Select a box that has adequate room for the padding materials. As a general rule a minimum of 2 inches on all sides of the unit is required for padding. This can be reduced but only in circumstances with a very light weight device. If a device is very heavy and dense relative to its size more padding clearance may be needed. As a general rule always use plenty of paper and a big enough box.
2. When taping a box make sure the tape joint is secure, well bonded and attached. Use only the brown reinforced heavy tape (# 280) 3 inches wide. This is the only tape which has been tested, and which passed the ISTA drop tests.
3. When taping a seam on a box make sure that the tape extends at least half way over the box ends for a good strong seal. Only one piece of tape can be used on each seam. Do not piece tape together.
4. All flanges must be padded with reinforced corrugated pads on all sides where the flange may come in contact with box.
5. Pad Pak paper is environmentally safer than other types of packing however it does not hold up well with heavy devices unless plenty of it is used. Make sure that the unit is wrapped tight with the paper and the box is full to the point the lid must be forced shut. If space is left or when the package is shaken it moves around then more paper must be added. Rolling the paper is a great way to increase the strength with Pad Pak and this can be done as well to fill the box tightly. Due to box size variations, always add paper pads to ensure a tight pack regardless of the instructions.
6. Shake package and make sure it is tightly packed before closing. The product cannot move around in the box. The heavier the unit is the more tightly it must be packed.

7. Always put the protective tubes on full length especially with flanged assemblies and these should extend at least 1 inch below the process end of the unit. Additional cardboard pads should be also be placed on the tube end of the device between the tube and the box end to create a cushion area with packing.
8. Follow the general compact guidelines and photos attached and when in doubt ask your group leader. Remember to put any required literature in the box before taping shut.

Units with protective covers or caps

1. Verify that all units with end covers or caps have the proper end caps and covers.
2. Verify that the end covers and caps fit properly and will not come off during shipment.
3. For Pressure transmitters with diaphragm seals, Tape the protective cap on to the unit with removable type masking tape that leaves no residue when removed.
4. For level transmitters with small tines, Verify that cover is securely taped and will not come off during shipment.
5. For any units with hole plugs, verify that they fit tightly and will not fall out.



Units with interior housing boxes

1. Verify that the box is the correct box for the unit. Use the attached sheet, the Bill of Material or ask your group leader if you are in question about which box, insert, or other packing is to be used.



Loose or spare parts being shipped with units

1. Verify that all loose or spare parts being shipped are properly bagged and attached or placed in the box with the unit they are being shipped with and that the technical literature is placed in the box as well.



For further reference and samples of various products with different options, Check the photo library on the "M" drive.

M:\Packaging Photo Reference

Inspection and test plan		page 1 of 1	
Instrument :	LEVELFLEX-M	Type:	FMP40, FMP41C, FMP43, FMP45
Principle of measurement :	Guided Level – Radar, solids and liquids, bare or coated probe		
Manufacturer:	Endress+Hauser GmbH+Co. KG, Maulburg		

Mode of testing	Test instruction	Inspection criteria	Frequency of testing
Contract review	Internal test specification	Basis of contract DIN EN ISO 9001:2000	100%
Incoming inspection	Internal test specification	Verification of conformance to the specified requirements	Dynamic, CAQ-system
Pressure test	Internal test specification	No test for FMP40, FMP41C, and FMP43. For FMP45 and order code group 40: flange A1J, A2J, and A5J: 355 bar, GJJ and RJJ: 710 bar test pressure	Only for FMP45 100% for test criteria acc. the order code
Calibration and test of current output	Internal test specification	4 mA , 20 mA , fault currents	100% for equipment with HART – communication
Voltage test / insulation test	Internal test specification	VDE 0160 , EN 50 020 In case of technical possibility, one or more of the following specified voltage tests will be executed, test time for the voltage is 2 s : • 600 V AC or alternative 850 V DC • 1200 V AC or alternative 1700 V DC • 2300 V AC or alternative 3250 V DC	100%
Functional test	Internal test specification	Current consumption , adjustment of Z – distance , verification of envelope curve , functions of the instrument	100%
Communication test	Internal test specification	Transmission of measured value , parameterization by means of communication protocol	100%
Final test	Internal test specification	Visual inspection that item(s) complete, correct type label inscriptions	100%
Logistical verification	Internal test specification / work instructions	Visual inspection that markings are complete and correct, accessories and correct packaging	Random sampling
Inspection mark	No special marking is provided on the instrument for standard instrumentation . The attachment of name plate is the validation for the completed inspection test procedure.		
Records	The serial number is the indication by the way of internal documentation, for the date of production as well as the filed test results.		

notice: subject to alteration

Prepared:	Dr. Herbert Schroth / LC4	Drawn:	-	Approved:	Karl Erhart / MST		
Date:	08.11.2007	Date:	-	Date:	14.11.2007	Notification-No.:	-
SAP-Mat. no. ref:	52020142			Release:	REV 04	Docu-No. old:	-



Endress + Hauser GmbH+Co. KG		Inspection and test plan		page 1 of 1	
Instrument :	LIQUIPHANT-M		Typ:	FTL50 , FTL50H , FTL51 , FTL51H	
Principle of measurement :	Level limit switch , liquid , vibration principle , liquid independent , short fork , with extension tube , hygienic version polished surface				
Manufacturer:	Endress+Hauser GmbH+Co. KG		PC -	Maulburg	



Mode of testing	Test instruction	Inspection criteria	Frequency of testing
Contract review	Internal test specification	Basis of contract DIN EN ISO 9001:2000	100%
Incoming inspection	Internal test specification	Verification of conformance to the specified requirements	Dynamic, CAQ-System
Voltage test / insulation test	Internal test specification	VDE 0160 , EN 50020 1800 Veff , U ≥ 90 V / 3 s 600 Veff , U < 90 V / 3 s , dependent on operating voltage	100% for Ex-Equipment according to the requirements of the valid standards
Tightness test	Internal test specification	He - leak rate ≤ 1·10 ⁻⁵ mbar · l/s	100%
Funktional test of sensor	Internal test specification	Determination of operating frequency , amplitude , sensitivity, adjustment (calibration)	100%
Funktional test of instrument	Internal test specification	Verification of switching function	100%
Outgoing check	Internal test specification	Visual check , completeness of markings, accessories and correct packaging	Random sampling

Inspection mark	No special marking is provided on the instrument for standard instruments. The attachment of name plate is the validation for the inspection test carried out. The appropriate test markings are attached on the name plate for Ex-version.
Records	The serial number is the indication by the way of internal documentation, for the date of production as well the filed test results.

Reference conditions acc. to DIN IEC 770 , Ta = 25 °C , if not specified different

notice: subject to alteration

Prepared:	Lut / LS1	Checked:		Release:	Version REV 03
Date:	18.10.00	Date:		Date:	03.06.03
SAP-Mat. No.	52013236			Drawing No.	944231-5000 A

