

# Technical Information

## Deltabar FMD71, FMD72

Level measurement with electronic differential pressure



Electronic differential pressure transmitter with ceramic and metal sensors

### Application

The Deltabar FMD71/FMD72 is used to measure the differential pressure or level, volume or mass of liquids in pressurized or vacuum vessels

### Your benefits

**The electronic differential pressure system eliminates traditional mechanical issues resulting in greater process availability and reliability**

- Safety risks are minimized with the electronic differential pressure system architecture and design
- Lowest total cost of ownership due to reduced installation time, maintenance, downtime and spare requirements, downtime and spare requirements.
- Multivariable level measurement: HART-based differential pressure, head pressure and sensor temperatures from one system
- Continuous health indication of the entire system via HART-based diagnostic
- High reproducibility and long-term stability
- Overload-resistant and function-monitored

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## Document information






**Document function** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

### Symbols used







#### Safety symbols



Symbol	Meaning
	<b>DANGER!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
	<b>WARNING!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	<b>CAUTION!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
	<b>NOTE!</b> This symbol contains information on procedures and other facts which do not result in personal injury.

#### Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	<b>Ground connection</b> A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	<b>Protective Earth (PE)</b> A terminal which must be connected to ground prior to establishing any other connections.  The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> <li>▪ Inner ground terminal: Connects the protective earth to the mains supply.</li> <li>▪ Outer ground terminal: Connects the device to the plant grounding system.</li> </ul>

#### Symbols for certain types of information

Symbol	Meaning
	<b>Permitted</b> Procedures, processes or actions that are permitted.
	<b>Preferred</b> Procedures, processes or actions that are preferred.
	<b>Forbidden</b> Procedures, processes or actions that are forbidden.
	<b>Tip</b> Indicates additional information.
	Reference to documentation
	Reference to page

Symbol	Meaning
	Reference to graphic
	Visual inspection

### Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1. 2. 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections

### Documentation



The document types listed are available:

In the Download Area of the Endress+Hauser Internet site: [www.endress.com](http://www.endress.com) → Download

#### Brief Operating Instructions (KA): getting the 1st measured value quickly

KA01105P:

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

#### Operating Instructions (BA): your comprehensive reference

BA01044P:

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

#### Description of Device Parameters (GP): reference for your parameters

GP01013P:

The document provides a detailed explanation of each individual parameter in the operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

#### Safety Instructions (XA)

Safety Instructions (XA) are supplied with the device depending on the approval. These instructions are an integral part of the Operating Instructions.

Device	Directive	Documentation	Option <sup>1)</sup>
FMD71, FMD72	ATEX II 1/2G Ex ia IIC T6 Ga/Gb	XA00619P	BA
FMD71, FMD72	ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb	XA00620P	BC
FMD71, FMD72	ATEX II 3G Ex nA IIC T6 GC	XA00621P	BD
FMD71, FMD72	IEC Ex ia IIC T6 Ga/Gb	XA00622P	IA
FMD71, FMD72	IEC Ex d [ia] IIC T6 Ga/Gb	XA00623P	IB
FMD71, FMD72	CSA General Purpose	-	CD
FMD71, FMD72	NEPSI Ex ia IIC T4/T6 Ga/Gb	XA01352P	NA
FMD71, FMD72	NEPSI Ex d [ia] IIC T4/T6 Ga/Gb	XA01353P	NB
FMD71, FMD72	INMETRO Ex ia IIC T6...T4 Ga/Gb	XA01378P	MA
FMD71, FMD72	INMETRO Ex d [ia] IIC T6...T4 Ga/Gb	XA01379P	MC
FMD71, FMD72	EAC Ga/Gb Ex ia IIC T6...T4	XA01594P	GA
FMD71, FMD72	EAC Ga/Gb Ex d [ia] IIC T6...T4 X	XA01595P	GB

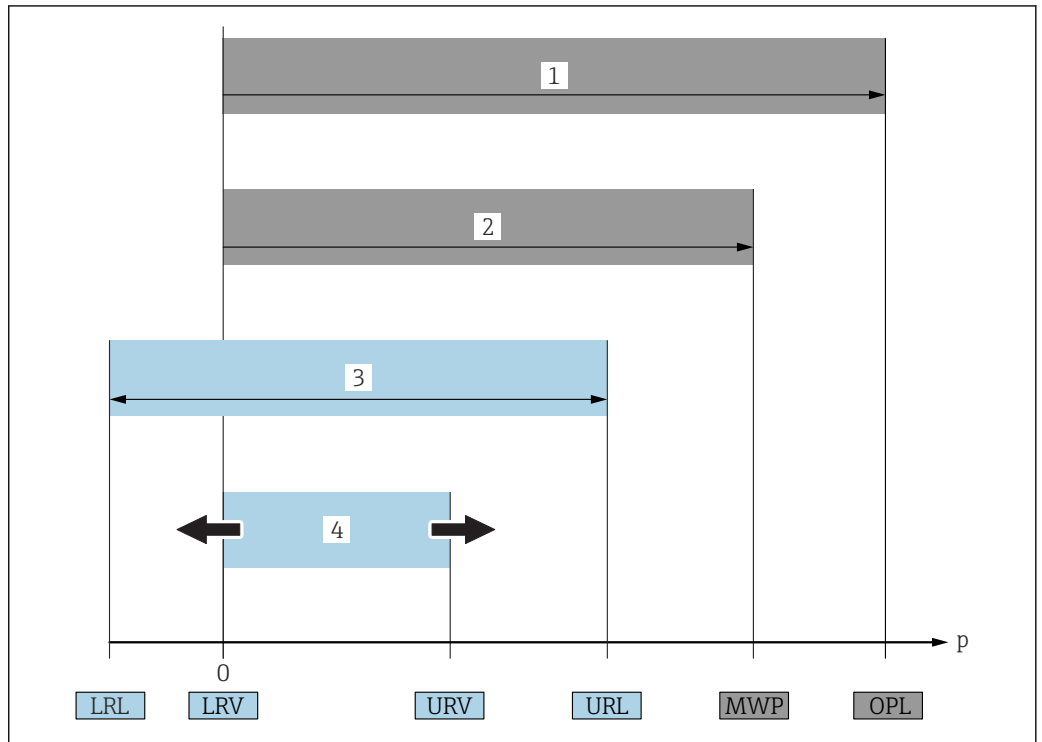
Device	Directive	Documentation	Option <sup>1)</sup>
FMD71	FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00628P	FA
FMD71	FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00629P	FB
FMD71	CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00631P	CB
FMD71	FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00668P	FD
FMD71	CSA C/US NI, Cl.I Div. 2, Gr.A-D Cl.I, Zone 2, IIC	XA00670P	CC
FMD71	CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00630P	CA
FMD72	CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00626P	CA
FMD72	CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00627P	CB
FMD72	CSA C/US NI, Cl.I Div.2 Gr.A-D, Zone 2	XA00671P	CC
FMD72	FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00624P	FA
FMD72	FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00625P	FB
FMD72	FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00669P	FD

1) Product Configurator order code for "Approval"



The nameplate provides information on the Safety Instructions (XA) that are relevant for the device.

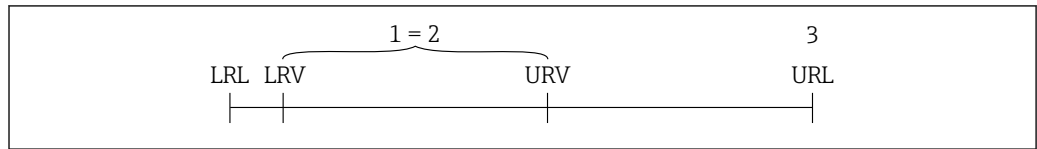
Terms and abbreviations



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Position	Term/ abbreviation	Explanation
1	OPL	The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "Pressure specifications" section → 31. The OPL may only be applied for a limited period of time.
2	MWP	The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "Pressure specifications" section → 31. The MWP may be applied at the device for an unlimited period. The MWP can also be found on the nameplate.
3	Maximum sensor measuring range	Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/ adjustable span.
4	Calibrated/ adjusted span	Span between LRV and URV Factory setting: 0 to URL Other calibrated spans can be ordered as customized spans.
p	-	Pressure
-	LRL	Lower range limit
-	URL	Upper range limit
-	LRV	Lower range value
-	URV	Upper range value
-	TD (Turn down)	Turn down Example - see the following section.

Turn down calculation



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- 1 Calibrated/adjusted span
- 2 Zero point-based span
- 3 URL sensor

Example	
<ul style="list-style-type: none"> <li>▪ Sensor: 10 bar (150 psi)</li> <li>▪ Upper range value (URL) = 10 bar (150 psi)</li> </ul> <p>Turn down (TD):</p> $TD = \frac{URL}{ URV - LRV }$ $TD = \frac{10 \text{ bar (150 psi)}}{ 5 \text{ bar (75 psi)} - 0 \text{ bar (0 psi)} } = 2$ <p>In this example, the TD is 2:1. This span is based on the zero point.</p>	<ul style="list-style-type: none"> <li>▪ Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)</li> <li>▪ Lower range value (LRV) = 0 bar (0 psi)</li> <li>▪ Upper range value (URV) = 5 bar (75 psi)</li> </ul>

Registered trademarks

**HART®**

Registered trademark of the FieldComm Group, Austin, USA



## Function and system design

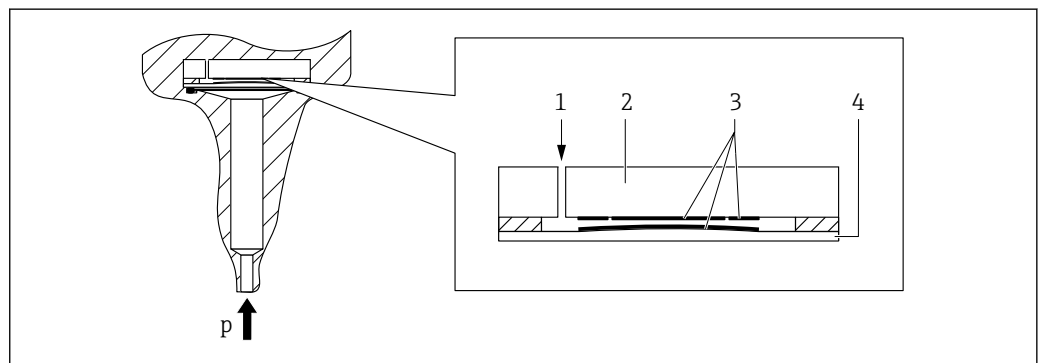
### Measuring principle - electronic differential pressure measurement

#### FMD71 - Devices with ceramic process isolating diaphragm (Ceraphire®)

The ceramic sensor is an oil-free sensor, i.e. the process pressure acts directly on the robust ceramic process isolating diaphragm and causes it to deflect. A pressure-dependent change in capacitance is measured at the electrodes of the ceramic substrate and the process isolating diaphragm. The measuring range is determined by the thickness of the ceramic process isolating diaphragm.

#### Advantages:

- Guaranteed overload resistance up to 40 times the nominal pressure
- The ultrapure 99.9% ceramic (Ceraphire®, see also "www.endress.com/ceraphire") ensures:
  - Extremely high chemical durability
  - Less relaxation
  - High mechanical durability
- Can be used in absolute vacuums up to 150 °C (302 °F)
- Small measuring ranges



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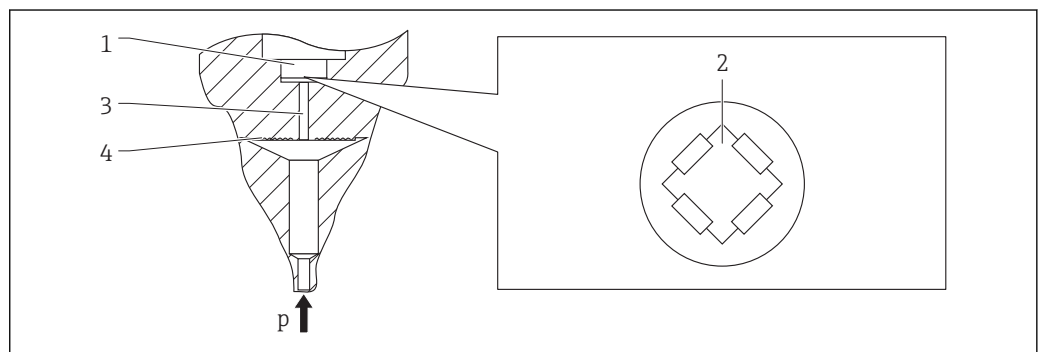
- 1 Air pressure (relative pressure sensors)
- 2 Ceramic substrate
- 3 Electrodes
- 4 Ceramic process isolating diaphragm

#### FMD72 - Devices with metal process isolating diaphragm

The process pressure deflects the metal process isolating diaphragm of the sensor and a fill fluid transfers the pressure to a Wheatstone bridge (semiconductor technology). The pressure-dependent change in the bridge output voltage is measured and evaluated.

#### Advantages:

- Can be used for process pressures up to 40 bar (600 psi)
- Fully welded process isolating diaphragm
- Small, flush-mounted process connections
- Significantly reduced thermal effect e.g. compared to diaphragm seal systems with capillaries



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- 1 Silicon measuring element, substrate
- 2 Wheatstone bridge
- 3 Channel with fill fluid
- 4 Metal process isolating diaphragm

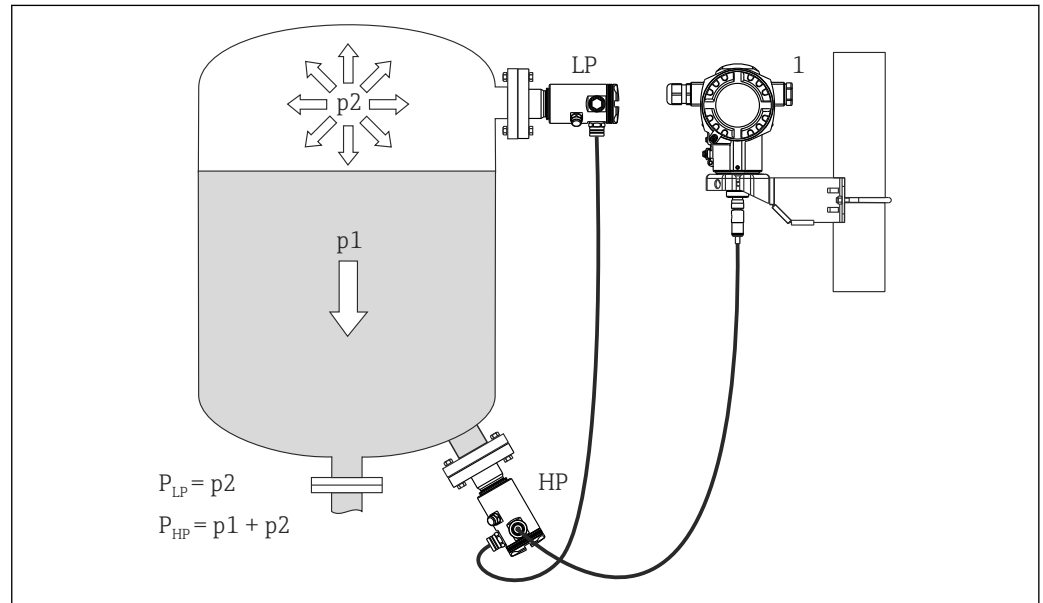
<b>Measuring system</b>	The FMD71/FMD72 consists of 2 sensor modules and one transmitter. One sensor module measures the hydrostatic pressure (high pressure) and the other one the head pressure (low pressure). The level (electronic differential pressure) is calculated in the transmitter using these two digital values.
<b>Device selection</b>	<p data-bbox="408 338 619 365"><b>Field of application</b></p> <ul data-bbox="408 383 643 439" style="list-style-type: none"> <li>▪ Level</li> <li>▪ Differential pressure</li> </ul> <p data-bbox="408 472 628 499"><b>Process connections</b></p> <ul data-bbox="408 517 810 595" style="list-style-type: none"> <li>▪ Thread</li> <li>▪ EN and ASME flanges</li> <li>▪ Flush-mounted hygienic connections</li> </ul> <p data-bbox="408 629 852 656"><b>Measuring ranges (differential pressure)</b></p> <p data-bbox="408 674 852 752"><b>FMD71:</b> from -100 to +100 mbar (-1.5 to +1.5 psi) to -1 to +40 bar (-15 to +600 psi)</p> <p data-bbox="408 770 810 848"><b>FMD72:</b> from -400 to +400 mbar (-6 to +6 psi) to -1 to +40 bar (-15 to +600 psi)</p> <p data-bbox="408 882 1326 938"><b>MWP (depends on the lowest-rated element, with regard to pressure, of the selected components)</b></p> <p data-bbox="408 956 603 1012"><b>FMD71:</b> to 60 bar (900 psi)</p> <p data-bbox="408 1030 633 1086"><b>FMD72:</b> to 160 bar (2 400 psi)</p> <p data-bbox="408 1117 703 1144"><b>Process temperature limits</b></p> <p data-bbox="408 1162 1102 1290"><b>FMD71:</b></p> <ul data-bbox="408 1180 1102 1290" style="list-style-type: none"> <li>▪ Thread / Flanges: -25 to +125 °C (-13 to +257 °F)/150 °C (302 °F)</li> <li>▪ Hygienic process connections: -25 to +130 °C (-13 to +266 °F) , 150 °C (302 °F) for max. 1 hour</li> </ul> <p data-bbox="408 1308 1241 1532"><b>FMD72:</b></p> <ul data-bbox="408 1326 1241 1532" style="list-style-type: none"> <li>▪ Process connections with internal process isolating diaphragm: -40 to +125 °C (-40 to +257 °F)</li> <li>▪ Process connections with flush-mounted process isolating diaphragm: -40 to +100 °C (-40 to +212 °F)</li> <li>▪ Hygienic process connections with flush-mounted process isolating diaphragm: -40 to +130 °C (-40 to +266 °F) , 150 °C (302 °F) for max. 1 hour</li> <li>▪ Higher process temperature limits available on request (up to +250 °C (480 °F))</li> </ul> <p data-bbox="408 1565 716 1592"><b>Ambient temperature range</b></p> <p data-bbox="408 1610 724 1637">-40 to +80 °C (-40 to +176 °F)</p> <p data-bbox="408 1671 890 1697"><b>Reference accuracy of the individual sensors</b></p> <ul data-bbox="408 1715 943 1771" style="list-style-type: none"> <li>▪ Up to ±0.075% of the set span</li> <li>▪ PLATINUM version: up to ±0.05 % of the set span</li> </ul> <p data-bbox="408 1805 568 1832"><b>Supply voltage</b></p> <ul data-bbox="408 1850 975 1906" style="list-style-type: none"> <li>▪ Version for non-hazardous areas: 12 (13) to 45 V DC</li> <li>▪ Ex ia: 12 (13) to 30 V DC</li> </ul> <p data-bbox="408 1939 488 1966"><b>Output</b></p> <p data-bbox="408 1984 884 2011">4 to 20 mA with superimposed HART protocol</p>

### Options

- NACE-compliant materials
- Software pre-configurations

### Product design

Level measurement (level, volume and mass) with Deltabar:



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- LP* Sensor module LP (low pressure)  
*HP* Sensor module HP (high pressure)  
*p2* Head pressure  
*p1* Hydrostatic pressure  
*1* Transmitter

The FMD71/FMD72 is best suited to level measurement in vessels with pressure overlay or in vacuum vessels and tanks, high distillation columns and other vessels with changing ambient temperatures.

The sensor module HP is mounted on the lower measuring connection and the sensor module LP is mounted above the maximum level. The transmitter can be mounted on pipes or walls with the mounting bracket.

The sensor signal is transmitted digitally. In addition, sensor temperatures and the individual process pressures present at the respective sensor modules can be individually evaluated and transmitted.

#### NOTICE

##### Incorrect sizing/order of sensor modules

- ▶ In a closed system, please note that the sensor module is affected by the superimposed head pressure ( $p2$ ) in addition to the hydrostatic pressure ( $p1$ ). This must be taken into account when sizing the sensor module on the high-pressure side (HP).

### System integration

The device can be given a tag name (max. 8 alphanumeric characters).

Measuring point (TAG), see additional specifications.: Product Configurator order code for "Identification", option "Z1"

## Input

### Measured variable

### Measured process variables

- Pressure HP and Pressure LP
- Sensor temperature HP and sensor temperature LP
- Transmitter temperature

### Calculated process variables

- Differential pressure
- Level (level, volume or mass)

### FMD71: measuring range of individual sensors



The maximum span of the differential pressure corresponds to the URL of the HP sensor.

### Gauge pressure

Sensor	Maximum sensor measuring range		MWP	OPL	Vacuum resistance	Option <sup>1)</sup>
	lower (LRL)	upper (URL)				
	[bar (psi)]	[bar (psi)]				
100 mbar (1.5 psi)	-0.1 (-1.5)	+0.1 (+1.5)	2.7 (40.5)	4 (60)	0.7 (10.5)	1C
250 mbar (4 psi)	-0.25 (-4)	+0.25 (+4)	3.3 (49.5)	5 (75)	0.5 (7.5)	1E
400 mbar (6 psi)	-0.4 (-6)	+0.4 (+6)	5.3 (79.5)	8 (120)	0	1F
1 bar (15 psi)	-1 (-15)	+1 (+15)	6.7 (100.5)	10 (150)	0	1H
2 bar (30 psi)	-1 (-15)	+2 (+30)	12 (180)	18 (270)	0	1K
4 bar (60 psi)	-1 (-15)	+4 (+60)	16.7 (250.5)	25 (375)	0	1M
10 bar (150 psi)	-1 (-15)	+10 (+150)	26.7 (400.5)	40 (600)	0	1P
40 bar (600 psi)	-1 (-15)	+40 (+600)	40 (600)	60 (900)	0	1S

1) Product Configurator order code for "Sensor range"

### Absolute pressure

Sensor	Maximum sensor measuring range		MWP	OPL	Vacuum resistance	Option <sup>1)</sup>
	lower (LRL)	upper (URL)				
	[bar <sub>abs</sub> (psi <sub>abs</sub> )]	[bar <sub>abs</sub> (psi <sub>abs</sub> )]				
100 mbar (1.5 psi)	0	+0.1 (+1.5)	2.7 (40.5)	4 (60)	0	2C
250 mbar (4 psi)	0	+0.25 (+4)	3.3 (49.5)	5 (75)	0	2E
400 mbar (6 psi)	0	+0.4 (+6)	5.3 (79.5)	8 (120)	0	2F
1 bar (15 psi)	0	+1 (+15)	6.7 (100.5)	10 (150)	0	2H
2 bar (30 psi)	0	+2 (+30)	12 (180)	18 (270)	0	2K
4 bar (60 psi)	0	+4 (+60)	16.7 (250.5)	25 (375)	0	2M
10 bar (150 psi)	0	+10 (+150)	26.7 (400.5)	40 (600)	0	2P
40 bar (600 psi)	0	+40 (+600)	40 (600)	60 (900)	0	2S

1) Product Configurator order code for "Sensor range"

**FMD72: measuring range of individual sensors**

The maximum span of the differential pressure corresponds to the URL of the HP sensor.

**Gauge pressure**

Sensor	Maximum sensor measuring range		MWP	OPL	Vacuum resistance <sup>1)</sup>	Option <sup>2)</sup>
	lower (LRL)	upper (URL)			silicone oil	
	[bar (psi)]	[bar (psi)]			[bar <sub>abs</sub> (psi <sub>abs</sub> )]	
400 mbar (6 psi)	-0.4 (-6)	+0.4 (+6)	4 (60)	6 (90)	0.01 (0.15)	1F
1 bar (15 psi)	-1 (-15)	+1 (+15)	6.7 (100)	10 (150)	0.01 (0.15)	1H
2 bar (30 psi)	-1 (-15)	+2 (+30)	13.3 (200)	20 (300)	0.01 (0.15)	1K
4 bar (60 psi)	-1 (-15)	+4 (+60)	18.7 (280.5)	28 (420)	0.01 (0.15)	1M
10 bar (150 psi)	-1 (-15)	+10 (+150)	26.7 (400.5)	40 (600)	0.01 (0.15)	1P
40 bar (600 psi)	-1 (-15)	+40 (+600)	100 (1500)	160 (2400)	0.01 (0.15)	1S

- 1) The vacuum resistance applies for the measuring cell under reference operating conditions. (see "Reference operating conditions" section)  
 2) Product Configurator order code for "Sensor range"

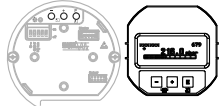
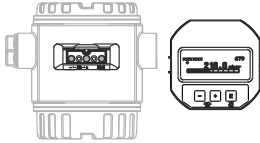
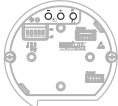
**Absolute pressure**

Sensor	Maximum sensor measuring range		MWP	OPL	Vacuum resistance <sup>1)</sup>	Option <sup>2)</sup>
	lower (LRL)	upper (URL)			silicone oil	
	[bar <sub>abs</sub> (psi <sub>abs</sub> )]	[bar <sub>abs</sub> (psi <sub>abs</sub> )]			[bar <sub>abs</sub> (psi <sub>abs</sub> )]	
1 bar (15 psi)	0	+1 (+15)	6.7 (100)	10 (150)	0.01 (0.15)	2H
2 bar (30 psi)	0	+2 (+30)	13.3 (200)	20 (300)	0.01 (0.15)	2K
4 bar (60 psi)	0	+4 (+60)	18.7 (280.5)	28 (420)	0.01 (0.15)	2M
10 bar (150 psi)	0	+10 (+150)	26.7 (400.5)	40 (600)	0.01 (0.15)	2P
40 bar (600 psi)	0	+40 (+600)	100 (1500)	160 (2400)	0.01 (0.15)	2S

- 1) The vacuum resistance applies for the measuring cell under reference operating conditions. (see "Reference operating conditions" section)  
 2) Product Configurator order code for "Sensor range"

## Output

**Output Signal** 4 to 20 mA with superimposed digital communication protocol HART 6.0, 2-wire

Software operation	Internal + LCD	External <sup>1)</sup> + LCD	Internal
			
Order code option <sup>2)</sup>	4	5	8

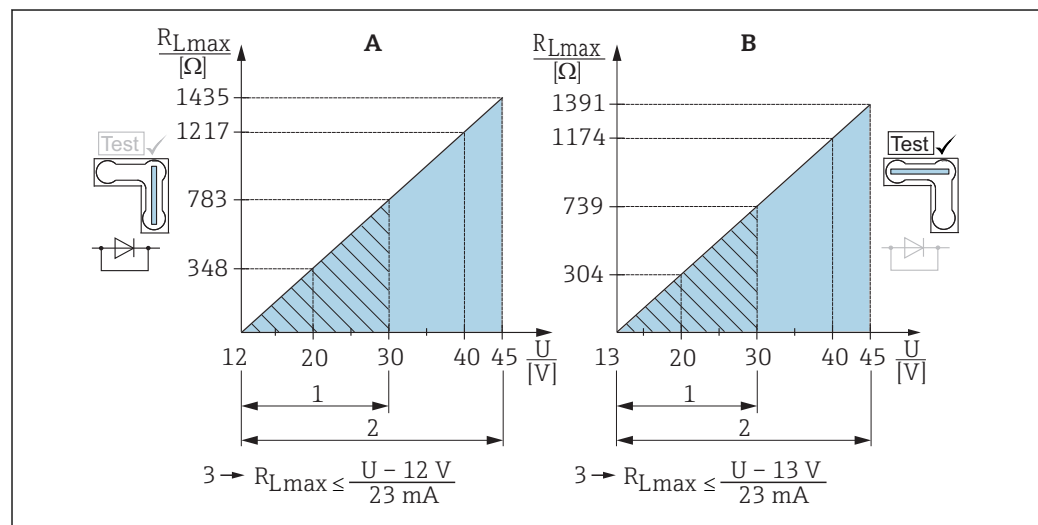
- 1) In the case of the T17 transmitter housing, the operating keys are always arranged internally on the electronic insert.  
 2) Product Configurator order code for "Display, operation:"

**Signal range 4 to 20 mA** 3.8 mA to 20.5 mA


**Signal on alarm 4 to 20 mA** As per NAMUR NE43

- Max. alarm: (factory setting: 22 mA) can be set from 21 to 23 mA
- Hold measured value: last measured value is held
- Min. alarm: 3.6 mA

**Maximum load** In order to guarantee sufficient terminal voltage in two-wire devices, a maximum load resistance R (including line resistance) must not be exceeded depending on the supply voltage U<sub>0</sub> of the supply unit. In the following load diagrams, observe the position of the jumper and the explosion protection:

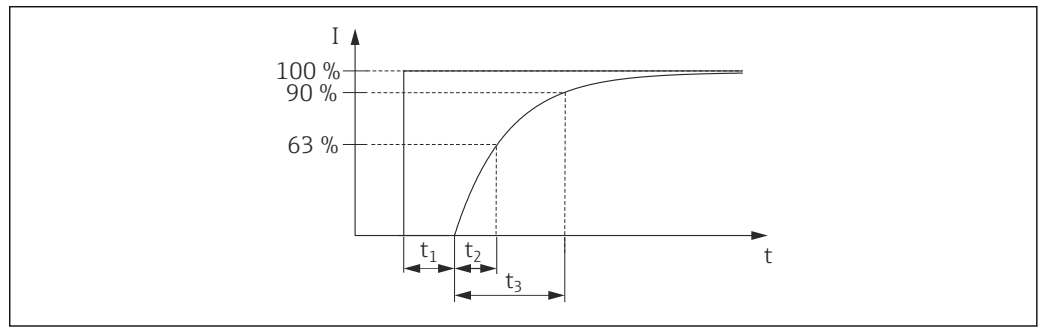


- A Jumper for 4 to 20 mA test signal set to "Non-test" position  
 B Jumper for 4 to 20 mA test signal set to "Test" position  
 1 Power supply for II 1/2 G Ex ia, FM IS, CSA IS  
 2 Power supply for devices for the non-hazardous area, 2 G Ex d, 3 G Ex nA, FM XP, FM NI, CSA XP, CSA dust ignition-proof  
 3 R<sub>Lmax</sub> maximum load resistance  
 U Supply voltage

 When operating via a handheld terminal or via a PC with an operating program, a minimum communication resistance of 250 Ω must be taken into account.

**Dead time, Time constant**

Presentation of the dead time and the time constant:



A0019786

**Dynamic behavior, current output**

	Dead time ( $t_1$ ) [ms]	Time constant (T63), $t_2$	Time constant (T90), $t_3$
max.	120	120	280

**Dynamic behavior, HART**

	Dead time ( $t_1$ ) [ms]	Dead time ( $t_1$ ) [ms] + Time constant T63 (= $t_2$ ) [ms]	Dead time ( $t_1$ ) [ms] + Time constant T90 (= $t_3$ ) [ms]
min.	280	400	560
max.	1100	1220	1380

**Reading cycle**

- Acyclic: max. 3/s, typical 1/s (depends on command # and number of preambles)
- Cyclic (Burst): max. 3/s, typical 2/s

The Deltabar FMD71/FMD72 offers BURST MODE functionality for cyclical value transmission via the HART communication protocol.

**Cycle time (update time)**

Cyclic (burst): min. 300 ms

**Response time**

- Acyclic: min. 330 ms, typically 590 ms (depending on command # and number of preambles)
- Cyclic (burst): min. 160 ms, typically 350 ms (depending on command # and number of preambles)

**Damping**

A damping affects all outputs (output signal, display):

- Via onsite display, handheld terminal or PC with operating program, continuous from 0 to 999 s
- Via DIP switch on the electronic insert, switch position "on" = set value and "off"
- Factory setting: 2 s

Damping can be switched on or off using a switch on the electronic insert. If the switch is on, the time constant can be set via a parameter in the menu and if the switch is off, the output signal is not damped (time constant = 0.0).

**alarm current setting**

Adjusted min. alarm current: Product configurator order code for "Service", option "IA"

**Firmware version**

Description	Option <sup>1)</sup>
01.00.zz, HART, DevRev01	78

1) Product Configurator, order code for "Firmware version"

**Protocol-specific data**

Manufacturer ID	17 (0x11)
Device type ID	39 (0x27)
HART specification	6.0
Device description files (DTM, DD)	Information and files can be found: <ul style="list-style-type: none"> <li>▪ <a href="http://www.endress.com">www.endress.com</a></li> <li>▪ <a href="http://www.fieldcommgroup.org">www.fieldcommgroup.org</a></li> </ul>
HART device variables	<p><b>Measured values for PV (primary variable)</b></p> <ul style="list-style-type: none"> <li>▪ Differential pressure</li> <li>▪ Level linear (before lin.)</li> <li>▪ Level after linearization table</li> </ul> <p><b>Measured values for SV, TV, QV (second, third and fourth variable)</b></p> <ul style="list-style-type: none"> <li>▪ Measured differential pressure</li> <li>▪ Corrected pressure</li> <li>▪ Measured pressure HP</li> <li>▪ Sensor pressure HP</li> <li>▪ Sensor temperature HP</li> <li>▪ Measured pressure LP</li> <li>▪ Sensor pressure LP</li> <li>▪ Sensor temperature LP</li> <li>▪ Level before linearization</li> <li>▪ Tank content</li> <li>▪ Electronic temperature</li> </ul>
Supported functions	<ul style="list-style-type: none"> <li>▪ Burst mode</li> <li>▪ Additional transmitter status</li> </ul>



## Power supply

**⚠ WARNING**

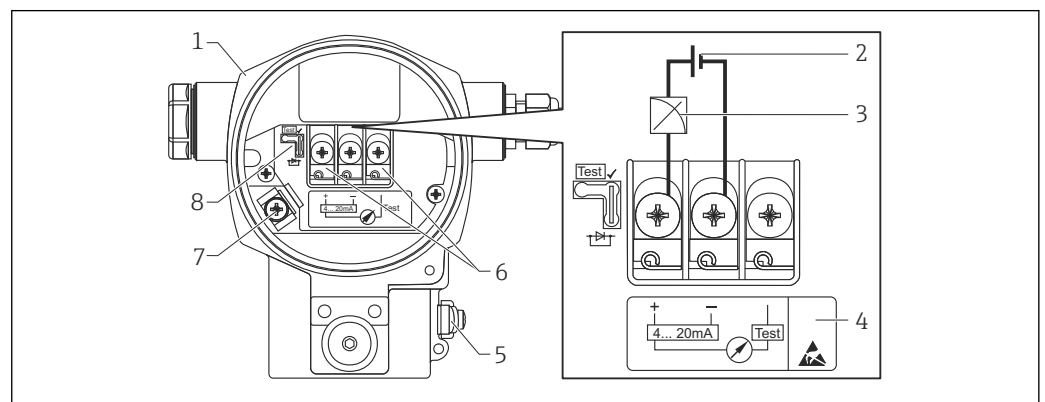
**Electrical safety is compromised by an incorrect connection!**

- ▶ In accordance with IEC/EN61010 a separate circuit breaker must be provided for the device .
- ▶ When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- ▶ All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.
- ▶ Devices with integrated overvoltage protection must be grounded.
- ▶ Protective circuits against reverse polarity, HF influences and overvoltage peaks are integrated.

**Terminals**

- Supply voltage and internal ground terminal: 0.5 to 2.5 mm<sup>2</sup> (20 to 14 AWG)
- External ground terminal: 0.5 to 4 mm<sup>2</sup> (20 to 12 AWG)

**Terminal assignment**




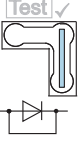
- 1 Housing
- 2 Supply voltage
- 3 4 to 20 mA
- 4 Devices with integrated overvoltage protection are labeled "OVP" (overvoltage protection) here.
- 5 External ground terminal
- 6 4 to 20 mA test signal between positive and test terminal
- 7 Internal ground terminal, minimum supply voltage = 12 V DC, jumper is set as illustrated in the diagram.
- 8 Jumper for 4 to 20 mA test signal

**Supply voltage**

Electronic version	Jumper for 4 to 20 mA test signal in "Test" position (delivery status)	Jumper for 4 to 20 mA test signal in "Non-test" position
4 to 20 mA HART, version for non-hazardous areas	13 to 45 V DC	12 to 45 V DC

**Measuring a 4 to 20 mA test signal**

A 4 to 20 mA test signal may be measured via the positive and test terminal without interrupting the measurement. The minimum supply voltage of the device can be reduced by simply changing the position of the jumper. As a result, operation is also possible with a lower supply voltage. To keep the measured error below 0.1 %, the current measuring device should exhibit an internal resistance of <0.7Ω. Observe the position of the jumper in accordance with the following table.

Jumper position for test signal	Description
 <p>A0019992</p>	<ul style="list-style-type: none"> <li>Measurement of 4 to 20 mA test signal via the positive and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.)</li> <li>Delivery status</li> <li>Minimum supply voltage: 13 V DC</li> </ul>
 <p>A0019993</p>	<ul style="list-style-type: none"> <li>Measurement of 4 to 20 mA test signal via positive and test terminal: not possible.</li> <li>Minimum supply voltage: 12 V DC</li> </ul>

**Cable entries**

Explosion protection	Cable gland	Permitted cable diameter	Permitted wire cross-sections
<ul style="list-style-type: none"> <li>Standard</li> <li>Ex ia</li> <li>Ex ic</li> </ul>	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)	0.5 to 2.5 mm <sup>2</sup> (20 to 14 AWG)
<ul style="list-style-type: none"> <li>Ex tD</li> <li>Ex nA</li> <li>FM approval</li> <li>CSA approval</li> </ul>	Metal M20 x 1.5	7 to 10.5 mm (0.28 to 0.41 in)	

**Cable specification for transmitter connection**

- Endress+Hauser recommends using twisted, shielded two-wire cables.
- Terminals for core cross-sections 0.5 to 2.5 mm<sup>2</sup> (20 to 14 AWG)
- The cable outer diameter depends on the cable entry used.

**Residual ripple**

Without influence on 4 to 20 mA signal up to ±5 % residual ripple within the permitted voltage range [according to HART hardware specification HCF\_SPEC-54 (DIN IEC 60381-1)]

**Influence of power supply**

≤0.0006 % of URL/1 V

**Overvoltage protection**

**Standard version**

The standard version of the pressure instruments does not contain any special elements to protect against overvoltage ("wire to ground"). Nevertheless the requirements of the applicable EMC standard EN 61000-4-5 (testing voltage 1kV EMC wire/ground) are met.

**Optional overvoltage protection**

Devices showing version "NA" in feature 610 "Accessory Mounted" in the order code are equipped with overvoltage protection.

- Overvoltage protection:
  - Nominal functioning DC voltage: 600 V
  - Nominal discharge current: 10 kA
- Surge current check  $\hat{i} = 20$  kA satisfied as per DIN EN 60079-14: 8/20  $\mu$ s
- Arrester AC current check  $I = 10$  A satisfied

**NOTICE**

**Device could be destroyed!**

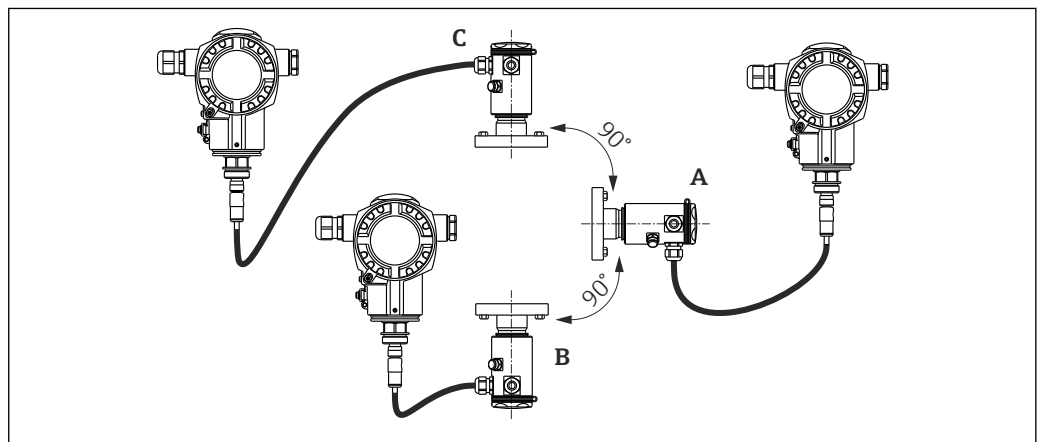
- ▶ Devices with integrated overvoltage protection must be grounded.

## Performance characteristics of ceramic process isolating diaphragm

### Reference operating conditions

- As per IEC 60770
- Ambient temperature  $T_A$  = constant, in the range of: +21 to +33 °C (+70 to +91 °F)
- Humidity  $\phi$  = constant, in the range of: 5 to 80 % RH
- Ambient pressure  $p_A$  = constant, in the range of: 860 to 1 060 mbar (12.47 to 15.37 psi)
- Position of measuring cell = constant, in range: horizontal  $\pm 1^\circ$  (see also "Influence of the installation position" section → 19)
- Input of Lo Trim Sensor and Hi Trim Sensor for lower range value and upper range value
- Zero based span
- Material of process isolating diaphragm:  $Al_2O_3$  (aluminum-oxide ceramic, Ceraphire®)
- Supply voltage: 24 V DC  $\pm 3$  V DC
- Load with HART: 250  $\Omega$


### Influence of the installation position depending on sensor



A0016465

Process isolating diaphragm axis is horizontal (A)	Process isolating diaphragm pointing upwards (B)	Process isolating diaphragm pointing downwards (C)
Calibration position, no measuring error	< +0.2 mbar (+0.003 psi)	< -0.2 mbar (-0.003 psi)

This effect can be corrected using the function to adjust the position (position adjustment) for the differential pressure. Additional position adjustments for individual pressure signals are not available.

 A position-dependent zero shift can be corrected on the device.

### Resolution

- Current output: 1  $\mu A$
- Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

### Vibration effects

Test standard	Vibration effects
IEC 61298-3	$\leq$ Reference accuracy up to 10 to 60 Hz: $\pm 0.35$ mm ( $\pm 0.01$ in); 60 to 500 Hz: 2 g

### Application limits

A high ratio between the level and head pressure or between the differential pressure and static pressure can result in large measured errors. A maximum ratio of 1:10 is recommended. For calculation purposes, please use the free "Applicator" calculation tool, which is available online at "www.endress.com/applicator" or on CD-ROM.

**Reference accuracy**

The reference accuracy contains the non-linearity [DIN EN 61298-2 3.11] including the pressure hysteresis [DIN EN 61298-23.13] and non-repeatability [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 60770].

Measuring cell	Sensor	Reference accuracy (A) [%URL for every sensor]		Calculated reference accuracy (A <sub>Diff</sub> ) of the differential pressure
		Standard	Platinum	
100 mbar (1.5 psi)	Gauge pressure	A = ±0.075 A = ±0.15 <sup>1)</sup>	-	Calculation (mbar, bar or psi):  $A_{Diff} = \sqrt{\left(\frac{A_{HP} \cdot URL_{HP}}{100}\right)^2 + \left(\frac{A_{LP} \cdot URL_{LP}}{100}\right)^2}$ <small>A0016468</small>
250 mbar (3.75 psi)	Gauge pressure	A = ±0.075 A = ±0.15 <sup>1)</sup>	-	
400 mbar (6 psi)	Gauge pressure	A = ±0.075 A = ±0.15 <sup>1)</sup>	-	
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Gauge pressure/ Absolute pressure	A = ±0.075 A = ±0.15 <sup>1)</sup>	A = ±0.05 ±0.075 <sup>1)</sup>	Percentage calculation of URL dP:  $A_{Diff} [\%] = \frac{A_{Diff} \cdot 100}{P_{Diff}}$ <small>A0016469</small>

1) For hygienic process connections

*Ordering Information*

Description	Option <sup>1)</sup>
Platinum	D
Standard	G

1) Product Configurator order code for "Reference accuracy"

**Thermal change in the zero output and the output span****Standard version**

Measuring cell	-10 °C (+14 °F) to ≤ +60 °C (+140 °F)	-20 to -10 °C (-4 to +14 °F) > +60 to +125 °C (+140 to +257 °F)	Calculated thermal change (T <sub>Diff</sub> ) of the differential pressure
	% of the set span for every sensor		
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	T <sub>total</sub> = ±0.176	T <sub>total</sub> = ±0.276	Calculation (mbar, bar or psi):  $T_{Diff} = \sqrt{\left(\frac{T_{HP} \cdot URL_{HP}}{100}\right)^2 + \left(\frac{T_{LP} \cdot URL_{LP}}{100}\right)^2}$ <small>A0016474</small>  Percentage calculation of URL dP:  $T_{Diff} [\%] = \frac{T_{Diff} \cdot 100}{P_{Diff}}$ <small>A0016475</small>
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	T <sub>total</sub> = ±0.092	T <sub>total</sub> = ±0.250	

High temperature version and hygienic version

Measuring cell	Sensor	-10 °C (+14 °F) to ≤ +60 °C (+140 °F)	> +60 to +150 °C (140 to +302 °F)	Calculated thermal change (T <sub>Diff</sub> ) of the differential pressure
		% of the set span for every sensor		
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	Gauge pressure	T <sub>total</sub> = ±0.176 T <sub>total</sub> = ±0.352 <sup>1)</sup>	T = ±0.75 T = ±1.25 <sup>1)</sup>	Calculation (mbar, bar or psi):  $T_{Diff} = \sqrt{\frac{(T_{HP} \cdot URL_{HP})^2}{100} + \frac{(T_{LP} \cdot URL_{LP})^2}{100}}$ Percentage calculation of URL dP:  $T_{Diff} [\%] = \frac{T_{Diff} \cdot 100}{P_{Diff}}$
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Gauge pressure	T <sub>total</sub> = ±0.092 T <sub>total</sub> = ±0.184 <sup>1)</sup>	T = ±0.5 T = ±0.75 <sup>1)</sup>	
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi)	Absolute pressure	T <sub>total</sub> = ±0.092 T <sub>total</sub> = ±0.184 <sup>1)</sup>	T = ±0.75 T = ±1.25 <sup>1)</sup>	
40 bar (600 psi)	Absolute pressure	T <sub>total</sub> = ±0.092 T <sub>total</sub> = ±0.184 <sup>1)</sup>	T = ±0.5 T = ±0.75 <sup>1)</sup>	

1) For hygienic process connections

Total performance

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change in the zero point. All specifications apply to the temperature range -10 to +60 °C (+14 to +140 °F).

Measuring cell	% of URL for every sensor - standard version	% of URL for every sensor - high-temperature version	% of URL for every sensor - hygienic version	Calculated total performance (TP <sub>Diff</sub> ) of the differential pressure
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	TP = ±0.2	TP = ±0.46	TP = ±0.575	Calculation (mbar, bar or psi):  $TP_{Diff} = \sqrt{\frac{(TP_{HP} \cdot URL_{HP})^2}{100} + \frac{(TP_{LP} \cdot URL_{LP})^2}{100}}$ Percentage calculation of URL dP:  $TP_{Diff} [\%] = \frac{TP_{Diff} \cdot 100}{P_{Diff}}$
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	TP = ±0.15	TP = ±0.46	TP = ±0.5	



The "Applicator Sizing Electronic dp" selection tool, available free of charge on the Endress +Hauser web site ([www.endress.com/applicator](http://www.endress.com/applicator)), enables detailed calculations for your respective applications.

Long-term stability

Measuring ranges	Sensor	Standard version		Calculated long-term stability (L <sub>Diff</sub> ) of the differential pressure
		1 year	10 years	
		% of URL for every sensor		
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	Gauge pressure	L = ±0.1 L = ±0.25 <sup>1)</sup>	L = ±0.2 L = ±0.45 <sup>1)</sup>	Calculation (mbar, bar or psi):  $L_{Diff} = \sqrt{\frac{(L_{HP} \cdot URL_{HP})^2}{100} + \frac{(L_{LP} \cdot URL_{LP})^2}{100}}$ Percentage calculation of URL dP/year:
	Absolute pressure		L = ±0.3 L = ±0.55 <sup>1)</sup>	

Measuring ranges	Sensor	Standard version		Calculated long-term stability (L <sub>Diff</sub> ) of the differential pressure
		1 year	10 years	
		% of URL for every sensor		
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Gauge pressure Absolute pressure	L = ±0.05 L = ±0.1 <sup>1)</sup>	L = ±0.2 L = ±0.3	$L_{Diff} [\%] = \frac{L_{Diff} \cdot 100}{P_{Diff}}$ <p style="text-align: right;">A0016464</p>

1) For hygienic process connections

**Total error** The total error comprises the total performance and long-term stability. All specifications apply to the temperature range -10 to +60 °C (+14 to +140 °F).

Measuring cell	% of URL for every sensor - standard version	% of URL for every sensor - high-temperature version	% of URL for every sensor - hygienic version	Calculated total error (TE <sub>Diff</sub> ) of the differential pressure
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	TE = ±0.25	TE = ±0.51	TE = ±0.925	<p>Calculation (mbar, bar or psi):</p> $TE_{Diff} = \sqrt{\left(\frac{TE_{HP} \cdot URL_{HP}}{100}\right)^2 + \left(\frac{TE_{LP} \cdot URL_{LP}}{100}\right)^2}$ <p style="text-align: right;">A0016472</p>
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	TE = ±0.2	TE = ±0.51	TE = ±0.7	<p>Percentage calculation of URL dP:</p> $TE_{Diff} [\%] = \frac{TE_{Diff} \cdot 100}{P_{Diff}}$ <p style="text-align: right;">A0016473</p>

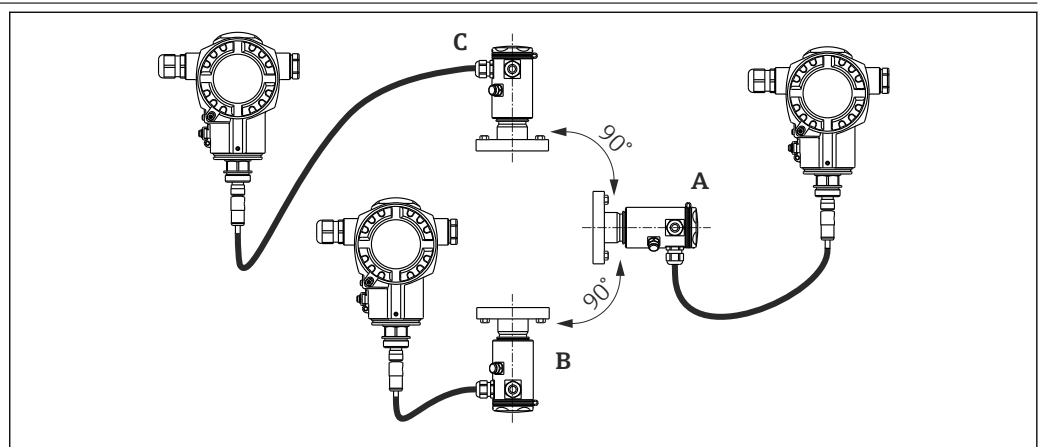
**Warm-up period** 4 to 20 mA HART: < 10 s

## Performance characteristics of metallic process isolating diaphragm

### Reference operating conditions

- As per IEC 60770
- Ambient temperature  $T_U$  = constant, in the range of +21 to +33 °C (+70 to +91 °F)
- Humidity  $\phi$  = constant, in the range of 5 to 80 % rH
- Ambient pressure  $p_A$  = constant, in the range of 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell = constant, in the range of horizontal  $\pm 1^\circ$  (see also "Influence of the installation position" section → 23)
- Input of Lo Trim Sensor and Hi Trim Sensor for lower range value and upper range value
- Zero based span
- Process isolating diaphragm material: AISI 316L (1.4435)
- Filling oil: silicone oil
- Supply voltage: 24 V DC  $\pm 3$  V DC
- Load with HART: 250  $\Omega$

### Influence of the installation position depending on sensor



A0016465

	Process isolating diaphragm axis is horizontal (A)	Process isolating diaphragm pointing upwards (B)	Process isolating diaphragm pointing downwards (C)
Sensor with 1/2" thread and silicone oil	Calibration position, no measurement error	< +4 mbar (+0.06 psi)	< -4 mbar (-0.06 psi)
Sensor with thread > 1/2" and flanges		< +10 mbar (+0.145 psi) The value is doubled for inert oil.	< -10 mbar (-0.145 psi) The value is doubled for inert oil.

This effect can be corrected using the function to adjust the position (position adjustment) for the differential pressure. Additional position adjustments for individual pressure signals are not available.



A position-dependent zero shift can be corrected on the device .

### Resolution

- Current output: 1  $\mu$ A
- Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

### Vibration effects

Test standard	Vibration effects
IEC 61298-3	$\leq$ Reference accuracy up to 10 to 60 Hz: $\pm 0.35$ mm ( $\pm 0.01$ in); 60 to 500 Hz: 2 g

### Application limits

A high ratio between the level and head pressure or between the differential pressure and static pressure can result in large measured errors. A maximum ratio of 1:10 is recommended. For calculation purposes, please use the free "Applicator" calculation tool, which is available online at "www.endress.com/applicator" or on CD-ROM.

**Reference accuracy**

The reference accuracy contains the non-linearity [DIN EN 61298-2 3.11] including the pressure hysteresis [DIN EN 61298-23.13] and non-repeatability [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 60770].

Measuring cell	Sensor	Reference accuracy (A) [%URL for every sensor]		Calculated reference accuracy ( $A_{Diff}$ ) of the differential pressure
		Standard	Platinum	
400 mbar (6 psi)	Gauge pressure	A = $\pm 0.15$ $\pm 0.3$ <sup>1)</sup>	-	Calculation (mbar, bar or psi):  $A_{Diff} = \sqrt{\left(\frac{A_{HP} \cdot URL_{HP}}{100}\right)^2 + \left(\frac{A_{LP} \cdot URL_{LP}}{100}\right)^2}$ <small>A0016468</small>  Percentage calculation of URL dP:  $A_{Diff} [\%] = \frac{A_{Diff} \cdot 100}{P_{Diff}}$ <small>A0016469</small>
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Gauge pressure/ Absolute pressure	A = $\pm 0.075$ A = $\pm 0.15$ <sup>1)</sup>	A = $\pm 0.05$ A = $\pm 0.075$ <sup>1)</sup>	

1) For hygienic process connections

*Ordering information*

Description	Option <sup>1)</sup>
Platinum	D
Standard	G

1) Product Configurator order code for "Reference accuracy"

**Thermal change of the zero output and the output span**

Measuring cell	-10 to +60 °C (+14 to +140 °F)	-40 to -10 °C (-40 to +14 °F) +60 to +80 °C (+140 to +176 °F)	Calculated thermal change ( $T_{Diff}$ ) of the differential pressure
	% of the set span for every sensor		
400 mbar (6 psi)	$T_{total} = \pm 0.215$ $T_{span} = \pm 0.2$ $T_{zero\ point} = \pm 0.015$	$T_{total} = \pm 0.43$ $T_{span} = \pm 0.4$ $T_{zero\ point} = \pm 0.03$	Calculation (mbar, bar or psi):  $T_{Diff} = \sqrt{\left(\frac{T_{HP} \cdot URL_{HP}}{100}\right)^2 + \left(\frac{T_{LP} \cdot URL_{LP}}{100}\right)^2}$ <small>A0016474</small>  Percentage calculation of URL dP:  $T_{Diff} [\%] = \frac{T_{Diff} \cdot 100}{P_{Diff}}$ <small>A0016475</small>
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	$T_{total} = \pm 0.101$ $T_{span} = \pm 0.1$ $T_{zero\ point} = \pm 0.01$	$T_{total} = \pm 0.42$ $T_{span} = \pm 0.4$ $T_{zero\ point} = \pm 0.02$	



**Total performance**

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change of the zero point. All specifications apply to the temperature range -10 to +60 °C (+14 to +140 °F).

Measuring cell	% of URL for every sensor	Calculated total performance (TP <sub>Diff</sub> ) of the differential pressure
400 mbar (6 psi)	TP = ±0.25 TP = ±0.34 <sup>1)</sup>	Calculation (mbar, bar or psi):
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	TP = ±0.15 TP = ±0.25 <sup>1)</sup>	$TP_{Diff} = \sqrt{\left(\frac{TP_{HP} \cdot URL_{HP}}{100}\right)^2 + \left(\frac{TP_{LP} \cdot URL_{LP}}{100}\right)^2}$ Percentage calculation of URL dP: $TP_{Diff} [\%] = \frac{TP_{Diff} \cdot 100}{P_{Diff}}$

1) For hygienic process connections



The "Applicator Sizing Electronic dp" selection tool, available free of charge on the Endress+Hauser web site ([www.endress.com/applicator](http://www.endress.com/applicator)), enables detailed calculations for your respective applications.

**Long-term stability**

	1 year	5 years	10 years	Calculated long-term stability (L <sub>Diff</sub> ) of the differential pressure
<b>Measuring ranges</b>	<b>% of URL for every sensor</b>			
400 mbar (6 psi)	L = ±0.035 L = ±0.25 <sup>1)</sup>	L = ±0.14	L = ±0.32	Calculation (mbar, bar or psi):
1 bar (15 psi)	L = ±0.020 L = ±0.1 <sup>1)</sup>	L = ±0.08	L = ±0.180	$L_{Diff} = \sqrt{\left(\frac{L_{HP} \cdot URL_{HP}}{100}\right)^2 + \left(\frac{L_{LP} \cdot URL_{LP}}{100}\right)^2}$
2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi)	L = ±0.025 L = ±0.1 <sup>1)</sup>	L = ±0.05	L = ±0.075	Percentage calculation of URL dP/year:
40 bar (600 psi)	L = ±0.025 L = ±0.1 <sup>1)</sup>	L = ±0.075	L = ±0.100	$L_{Diff} [\%] = \frac{L_{Diff} \cdot 100}{P_{Diff}}$

1) For hygienic process connections

**Total error**

The total error comprises the total performance and long-term stability. All specifications apply to the temperature range -10 to +60 °C (+14 to +140 °F).

Measuring cell	% of URL/year for every sensor	Calculated total error (TE <sub>Diff</sub> ) of the differential pressure
400 mbar (6 psi)	TE = ±0.30	Calculation (mbar, bar or psi):
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	TE = ±0.20	$TE_{Diff} = \sqrt{\left(\frac{TE_{HP} \cdot URL_{HP}}{100}\right)^2 + \left(\frac{TE_{LP} \cdot URL_{LP}}{100}\right)^2}$ Percentage calculation of URL dP: $TE_{Diff} [\%] = \frac{TE_{Diff} \cdot 100}{P_{Diff}}$

**Warm-up period**

4 to 20 mA HART : < 10 s

## Installation

- Moisture must not penetrate the housing when mounting the device, establishing the electrical connection and during operation.
- When measuring in media containing solids, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.
- Point the cable and connector downwards where possible to prevent moisture from entering (e.g. rain or condensation water).

### Mounting location

The FMD71/FMD72 is best suited to level measurement in vessels with pressure overlay or in vacuum vessels and tanks, high distillation columns and other vessels with changing ambient temperatures.

The sensor module HP is mounted on the lower measuring connection and the sensor module LP is mounted above the maximum level. The transmitter can be mounted on pipes or walls with the mounting bracket.

### Orientation

- Transmitter: Any orientation.
- Sensor modules: The orientation can cause a zero point shift. This position-dependent zero point shift can be corrected directly at the device via the operating key, and also in hazardous areas in the case of devices with external operation (position adjustment).

### General installation instructions

#### Mounting the sensor modules and transmitter is very easy

- The housings of the sensor modules can be rotated up to 360°.
- The transmitter is freely rotatable in the mounting bracket.

The sensor modules and transmitter can be easily aligned when mounted.

#### Your benefits

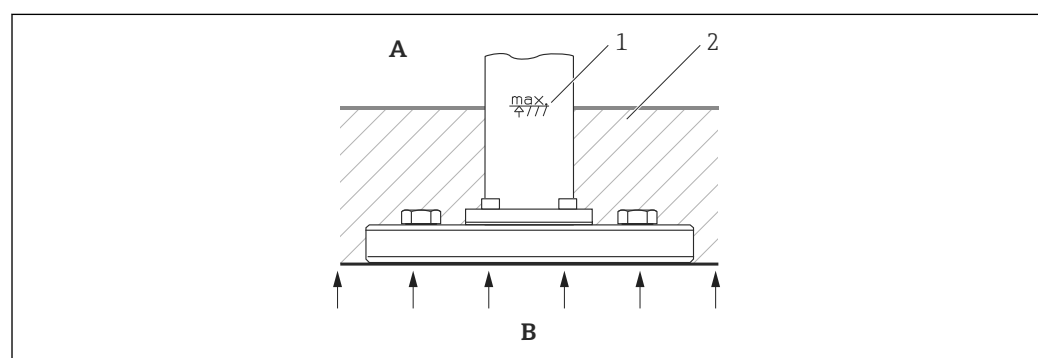
- Easy mounting due to optimum alignment of housing
- Easily accessible device operation
- Optimum readability of the onsite display (optional)
- Easy pipe installation due to optional alignment of the modules.

### Thermal insulation - FMD71 high-temperature version

The FMD71 high-temperature version may only be insulated up to a certain height. The maximum permitted insulation height is indicated on the devices and applies to an insulation material with a heat conductivity  $\leq 0.04 \text{ W}/(\text{m} \times \text{K})$  and to the maximum permitted ambient and process temperature. The insulation height is not indicated on hygienic connections.

- Ambient temperature ( $T_A$ ):  $\leq 70 \text{ °C}$  (158 °F)
- Process temperature ( $T_P$ ):  $\leq 150 \text{ °C}$  (302 °F)

The data were determined under the most critical application "quiescent air".



- A Ambient temperature  
 B Process temperature  
 1 Insulation height  
 2 Insulation material

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### Installing the sensor modules

#### General installation instructions

- Due to the orientation of the sensor modules, there may be a shift in the zero point, i.e. when the vessel is empty or partially full, the measured value does not display zero.
- Always install the sensor module HP below the lowest measuring point.
- Always install the sensor module LP above the highest measuring point.
- Do not mount the sensor modules in the filling curtain or at a point in the tank which could be affected by pressure pulses from an agitator.
- Do not mount the sensor modules in the suction area of a pump.
- The adjustment and functional test can be carried out more easily if you mount the sensor modules downstream of a shutoff device.

### Mounting sensor modules with PVDF installation coupling

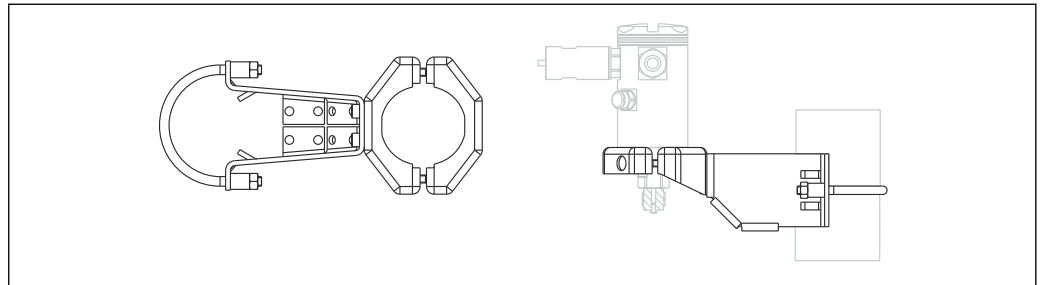
**⚠ WARNING**

#### Risk of damage to process connection!

Risk of injury!

- ▶ Sensor modules with PVDF process connections with threaded connection must be installed with the mounting bracket provided!

The mounting bracket can be installed on pipes with a diameter of 1¼" to 2" or on walls.

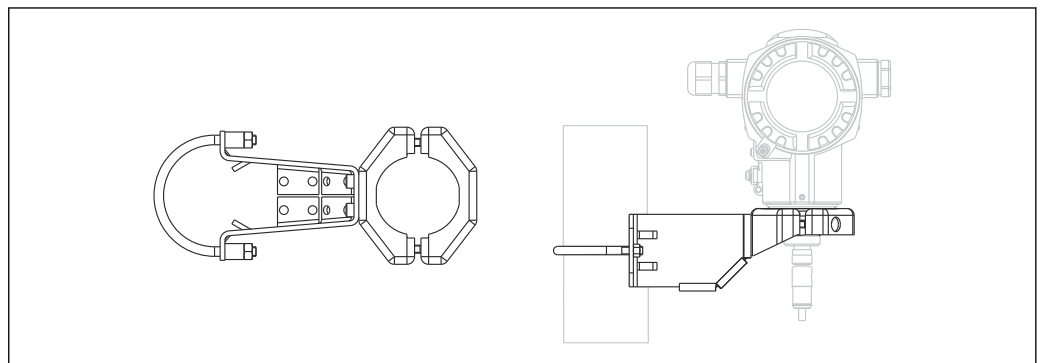


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- The mounting bracket is included in the delivery.
- Ordering information:  
Product Configurator order code for "Enclosed accessories", option "PA" or as a separate accessory (part no.: 71102216).
- Dimensions → 56.

### Installing the transmitter

The transmitter is installed with the mounting bracket supplied. The mounting bracket can be installed on pipes with a diameter of 1¼" to 2" or on walls.



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- The mounting bracket is included in the delivery.
- If an additional mounting bracket is required, this can be ordered as follows:  
Product Configurator order code for "Enclosed accessories", option "PA" or as separate accessory (part number: 71102216).
- Dimensions → 56.

## Sensor and transmitter cable

Description	Length	Option <sup>1)</sup>
Sensor cable PE-X	1.82 m (6 ft)	BC
	4.57 m (15 ft)	CC
	10.67 m (35 ft)	DC
	30.48 m (100 ft)	FC
	45.72 m (150 ft)	GC
Transmitter cable PE-X	1.82 m (6 ft)	BC
	4.57 m (15 ft)	CC
	10.67 m (35 ft)	DC

1) Product Configurator order code for "Cable length"

**Technical data for PE-X cable:**

- Temperature resistance: -40 to +80 °C (-40 to +176 °F)
- Flame resistance: to DIN 60332-1-2 and DIN EN 50266-2-5
- Halogen-free: to DIN VDE 0472 part 815
- Oil-resistant: to DIN EN 60811-2-1
- Other: UV-resistant to DIN VDE 0276-605
- Bending radius: min. 34 mm (1.34 in), permanently installed

## Environment

**Ambient temperature range**

- Without onsite display: -40 to +80 °C (-40 to +176 °F)
- With onsite display: -20 to +70 °C (-4 to +158 °F)

Extended temperature operation range with limitations in optical properties, such as display speed and contrast. -40 to +80 °C (-40 to +176 °F)

For devices for use in hazardous areas, see Safety Instructions .

The device can be used in this temperature range. The values of the specification, such as thermal change, may be exceeded.

**Storage temperature range**      -40 to +80 °C (-40 to +176 °F)

**Climate class**      Class 4K4H (air temperature: -20 to +55 °C (-4 to +131 °F), relative humidity: 4 to 100 %) fulfilled as per DIN EN 60721-3-4 (condensation possible)

**Degree of protection**      IP66/68 NEMA 4x/6P

Degree of protection IP 68: 1.83 mH2O for 24 h

Vibration resistance	Housing	Test standard	Vibration resistance
	Aluminum and steel housing	IEC 61298-3	guaranteed for: 10 to 60 Hz: ±0.15 mm (±0.0059 in); 60 to 500 Hz: 2 g in all 3 planes

**Electromagnetic compatibility**

- Electromagnetic compatibility as per EN 61326 Appendix A and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity.
- Maximum deviation: < 0.5 % of span
- All EMC measurements were performed with a turn down (TD) = 2:1.

## Process

### Process temperature range for devices with ceramic process isolating diaphragm FMD71

- Thread and flanges: -25 to +125 °C (-13 to +257 °F)
- Hygienic connections: -25 to +130 °C (-13 to +266 °F) , 150 °C (302 °F) for a maximum of 60 minutes
- High-temperature version: -15 to +150 °C (+5 to +302 °F); see ordering information, feature 610, option "NB".
- For saturated steam applications, use a device with a metal process isolating diaphragm, or provide a siphon for temperature isolation when installing.
- Pay attention to the process temperature range of the seal. See also the following table.

Seal	Notes	Process temperature range		Option <sup>1)</sup>
		Threaded connection or flange	Hygienic process connections	
FKM Viton	-	-25 to +125 °C (-13 to +257 °F)/ 150 °C (302 °F) <sup>2)</sup>	-	A
FKM Viton	FDA <sup>3)</sup> , 3A Class I, USP Class VI	-5 to +125 °C (+23 to +257 °F)	-5 to +150 °C (+23 to +302 °F)	B
FFKM Perlast G75LT	-	-20 to +125 °C (-4 to +257 °F)	-20 to +150 °C (-4 to +302 °F)	C
Kalrez, Compound 4079	-	+5 to +125 °C (+41 to +257 °F)/ 150 °C (302 °F) <sup>2)</sup>	-	D
NBR	FDA <sup>3)</sup>	-10 to +100 °C (+14 to +212 °F)	-	F
NBR, Low temperature	-	-40 to +100 °C (-40 to +212 °F)	-	H
HNBR <sup>4)</sup>	FDA <sup>3)</sup> , 3A Class II, KTW, AFNOR, BAM	-25 to +125 °C (-13 to +257 °F)/ 150 °C (302 °F) <sup>2)</sup>	-20 to +125 °C (-4 to +257 °F)	G
EPDM 70	FDA <sup>3)</sup>	-40 to +125 °C (-40 to +257 °F)	-	J
EPDM 291 <sup>4)</sup>	FDA <sup>3)</sup> , 3A Class II, USP Class VI, DVGW, KTW, W270, WRAS, ACS, NSF61	-15 to +125 °C (+5 to +257 °F)/ 150 °C (302 °F) <sup>2)</sup>	-15 to +150 °C (+5 to +302 °F)	K
FFKM Kalrez 6375	-	+5 to +125 °C (+41 to +257 °F)	-	L
FFKM Kalrez 7075	-	+5 to +125 °C (+41 to +257 °F)	-	M
FFKM Kalrez 6221	FDA <sup>3)</sup> , USP Class VI	-5 to +125 °C (+23 to +257 °F)	-5 to +150 °C (+23 to +302 °F)	N
Fluoroprene XP40	FDA <sup>3)</sup> , USP Class VI, 3A Class I	+5 to +125 °C (+41 to +257 °F)/ 150 °C (302 °F) <sup>2)</sup>	+5 to +150 °C (+41 to +302 °F)	P
VMQ Silicone	FDA <sup>3)</sup>	-35 to +85 °C (-31 to +185 °F)	-20 to +85 °C (-4 to +185 °F)	S
The process temperature ranges indicated here refer to the permanent operation of the FMD71. In the case of devices with hygienic process connections, a higher temperature (max. 150 °C (302 °F)) may be applied for a short period (max. 60 min.) for cleaning purposes.				

- 1) Product Configurator order code for "Seal"
- 2) 150 °C (302 °F) for high-temperature version
- 3) Food-safe FDA 21 CFR 177.2600
- 4) These seals are used for devices with 3A-approved process connections.

### Applications with jumps in temperature

Frequent extreme changes in temperatures can temporarily cause measuring errors. Temperature compensation takes effect after several minutes. Internal temperature compensation is faster the smaller the jump in temperature and the longer the time interval involved.

**Process temperature range for devices with metallic process isolating diaphragm FMD72**

Device	Limits
Process connections with internal process isolating diaphragm	-40 to +125 °C (-40 to +257 °F)
Process connections with flush-mounted process isolating diaphragm	-40 to +100 °C (-40 to +212 °F)
Hygienic process connections with flush-mounted process isolating diaphragm	-40 to +130 °C (-40 to +266 °F) For a maximum of 60 minutes: +150 °C (+302 °F)

**Pressure specifications**

**⚠ WARNING**

**The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure.**

- ▶ For pressure specifications, see the "Measuring range" section and the "Mechanical construction" section.
- ▶ MWP (maximum working pressure): The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time. Observe temperature dependency of the MWP. The pressure values permitted at higher temperatures can be found in the standards EN 1092-1: 2001 Tab. 18 (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.), ASME B 16.5a – 1998 Tab. 2-2.2 F316, ASME B 16.5a – 1998 Tab. 2.3.8 N10276, JIS B 2220.
- ▶ The test pressure corresponds to the overload limit of the individual sensors (overpressure limit OPL = 1.5 x MWP (formula does not apply to the FMD72 with a 40 bar (600 psi) measuring cell)) and may be applied for a limited period only to ensure that no lasting damage occurs.
- ▶ The Pressure Equipment Directive (EC Directive 97/23/EC) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- ▶ In the case of sensor range and process connections where the over pressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value (1.5 x PN; MWP = PN).
- ▶ Devices with ceramic process isolating diaphragm: Avoid steam hammering! Steam hammering can cause zero point drifts. Recommendation: Residue (such as condensation or drops of water) can remain at the process isolating diaphragm after CIP cleaning and lead to local steam hammering if immediately steam is introduced. In practice, drying the process isolating diaphragm (e.g. by blowing) has proved to prevent steam hammering.

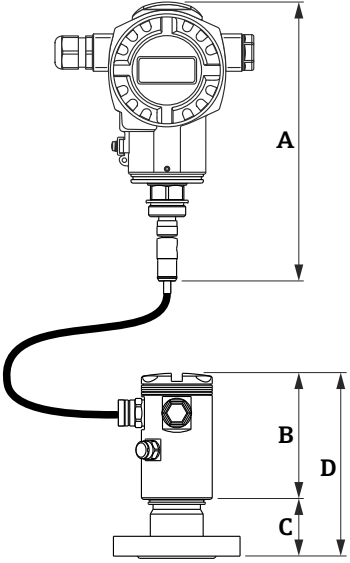
## Mechanical construction

### Device height

The device height is calculated from

- the height of the housing and
- the height of the individual process connection.

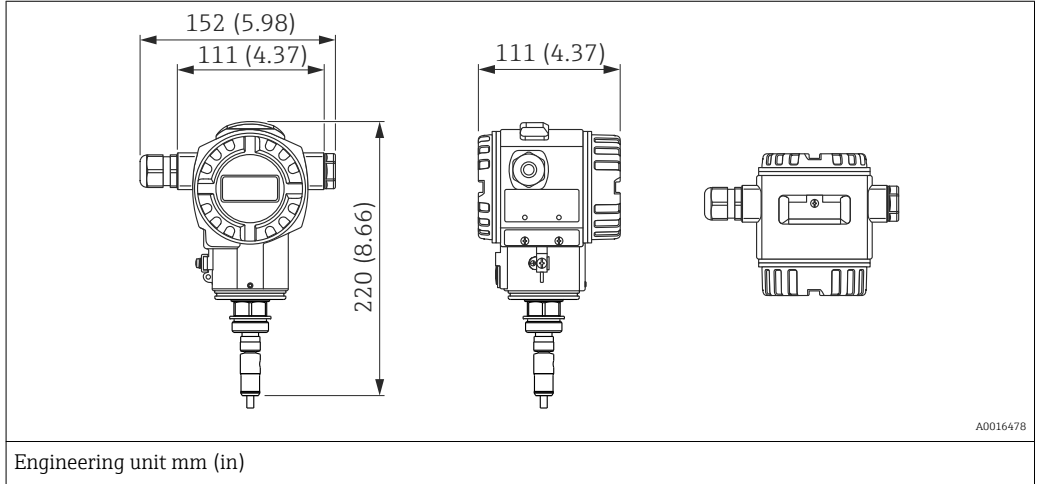
The individual heights of the components can be found in the following sections. To calculate the device height, simply add up the individual heights of the components. If necessary, the installation space (the space used to install the device) must also be taken into account. You can use the following table for this:

Section	Page	Height	Example
Transmitter height	→ 33 ff.	(A)	
Sensor height	→ 34	(B)	
Process connections	→ 36	(C)	
Installation space	-	(D)	
Device height			

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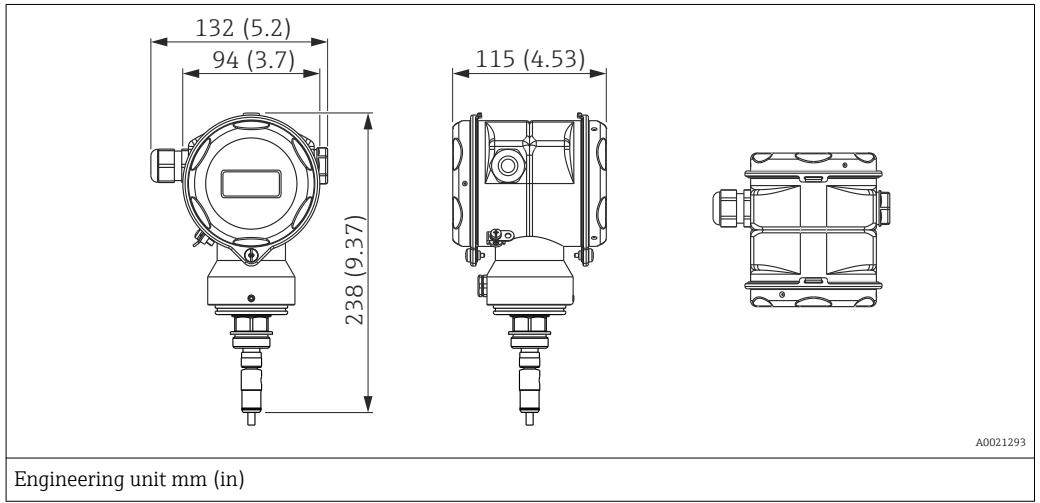
**T14 transmitter housing  
(optional display on the side)**



Material	Degree of protection	Cable entry	Weight kg (lbs)		Option <sup>1)</sup>
			with display	without display	
Aluminum	IP66/68 NEMA 4x/6P	<ul style="list-style-type: none"> <li>■ M20</li> <li>■ G ½"</li> <li>■ NPT ½"</li> </ul>	1.7 (3.75)	1.6 (3.53)	A
Stainless steel	IP66/68 NEMA 4x/6P	<ul style="list-style-type: none"> <li>■ M20</li> <li>■ G ½"</li> <li>■ NPT ½"</li> </ul>	2.6 (5.73)	2.5 (5.51)	B

1) Product Configurator order code for "Transmitter housing"

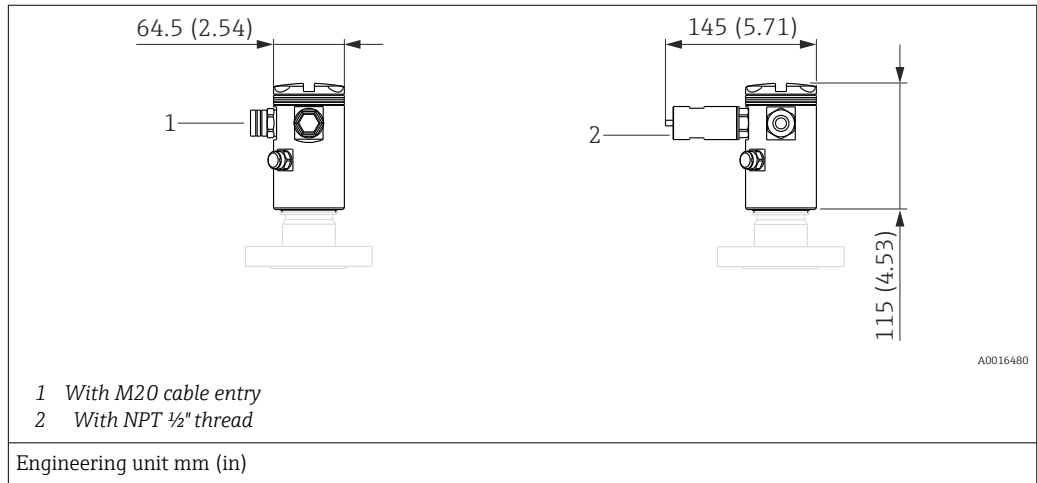
**T17 transmitter housing  
(optional display on the side)**



Material	Degree of protection	Cable entry	Weight kg (lbs)		Option <sup>1)</sup>
			with display	without display	
316L	IP66/68 NEMA 6P	<ul style="list-style-type: none"> <li>■ M20</li> <li>■ G ½"</li> <li>■ NPT ½"</li> </ul>	2.6 (5.73)	2.5 (5.51)	C

1) Product Configurator order code for "Transmitter housing"

**Sensor housing**



Material	Degree of protection	Cable entry	Weight	Option <sup>1)</sup>
			kg (lbs)	
Aluminum	IP66/68 NEMA 4x/6P	<ul style="list-style-type: none"> <li>■ M20 cable entry</li> <li>■ NPT 1/2"</li> </ul>	0.6 (1.32)	A
Stainless steel	IP66/68 NEMA 4x/6P	<ul style="list-style-type: none"> <li>■ M20 cable entry</li> <li>■ NPT 1/2"</li> </ul>	1.35 (2.98)	B

1) Product Configurator order code for "Sensor module housing"

**Selecting the electrical connection**

There is a dependency between the cable entries of the transmitter housing and those of the sensor module housing.

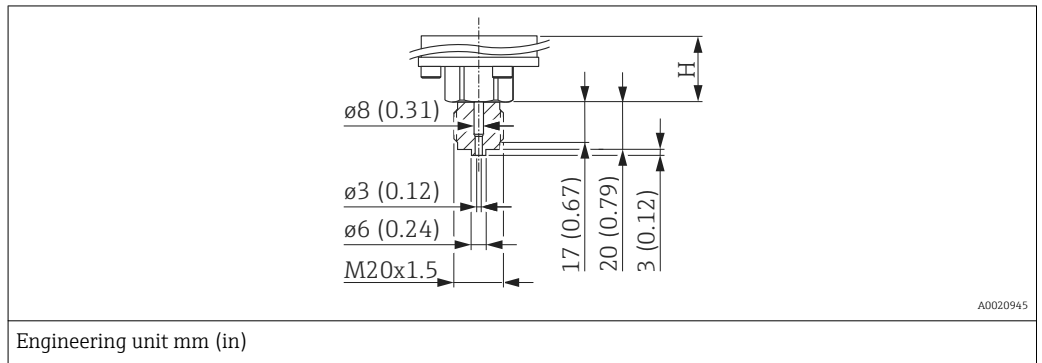
Different cable entries are available in the sensor module housing depending on the cable entry selected for the transmitter housing (see the following table):

Cable entry Transmitter housing	Cable entry Sensor module housing	Option <sup>1)</sup>
M20 cable entry	M20 cable entry	A
Thread G 1/2"	M20 cable entry	C
Thread NPT 1/2"	Thread NPT 1/2"	D

1) Product Configurator order code for "Electrical connection"

**FMD71 process connections,  
internal process isolating  
diaphragm**

**Thread DIN 13**



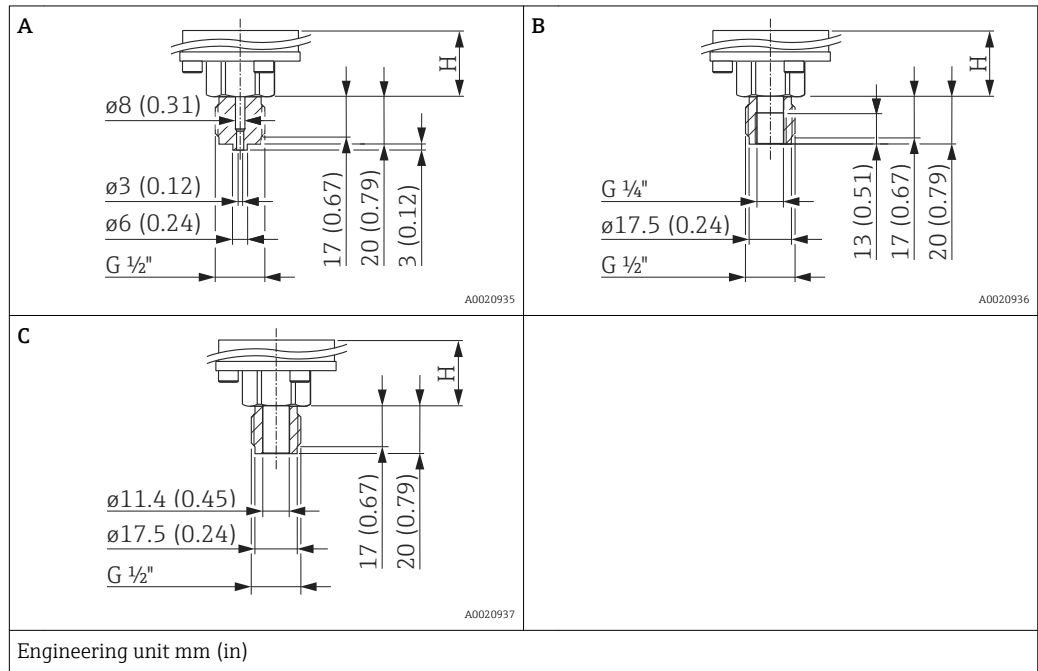
Description	Material	Weight	Option <sup>1)</sup>
		kg (lbs)	
DIN 13 M20 x 1.5, EN 837 3 mm (0.12 in)	AISI 316L	0.63 (1.39)	G1J
	Alloy C276 (2.4819)		G2C

1) Product Configurator, order code for "Process connection"

Description	Height H
Standard height	29 mm (1.14 in)
High-temperature version	107 mm (4.21 in)

FMD71 process connections,  
internal process isolating  
diaphragm

Thread ISO 228 G

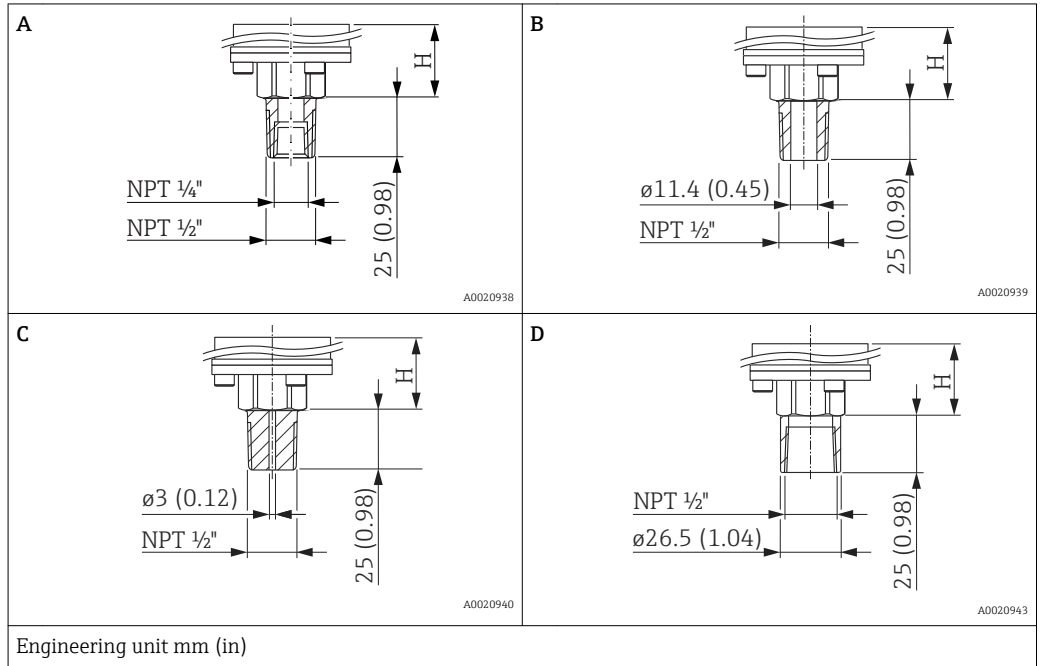


Position	Description	Material	Weight	Approval <sup>1)</sup>	Option <sup>2)</sup>
			kg (lbs)		
A	Thread ISO 228 G $\frac{1}{2}$ " A EN 837	AISI 316L (CRN)	0.63 (1.39)	CRN	GCJ
		Alloy C276 (2.4819) (CRN)		CRN	GCC
		Monel (2.4360)		-	GCD
		<b>PVDF</b> <ul style="list-style-type: none"> <li>▪ Mount only with mounting bracket</li> <li>▪ MWP 10 bar (150 psi), OPL max. 15 bar (225 psi)</li> <li>▪ Process temperature range: +10 to +60 °C (+14 to +140 °F)</li> </ul>		-	GCF
B	Thread ISO 228 G $\frac{1}{2}$ " A, G $\frac{1}{4}$ " (female)	AISI 316L (CRN)	CRN	GLJ	
		Alloy C276 (2.4819) (CRN)	CRN	GLC	
		Monel (2.4360)	-	GLD	
C	Thread ISO 228 G $\frac{1}{2}$ " A, bore hole 11.4 mm (0.45 in)	AISI 316L (CRN)	CRN	GMJ	
		Alloy C276 (2.4819) (CRN)	CRN	GMC	
		Monel (2.4360)	-	GMD	

1) CSA approval: Product Configurator, "Approval" ordering feature  
 2) Product Configurator, order code for "Process connection"

Description	Height H
Standard height	29 mm (1.14 in)
High-temperature version	107 mm (4.21 in)

**FMD71 process connections, internal process isolating diaphragm** thread ANSI

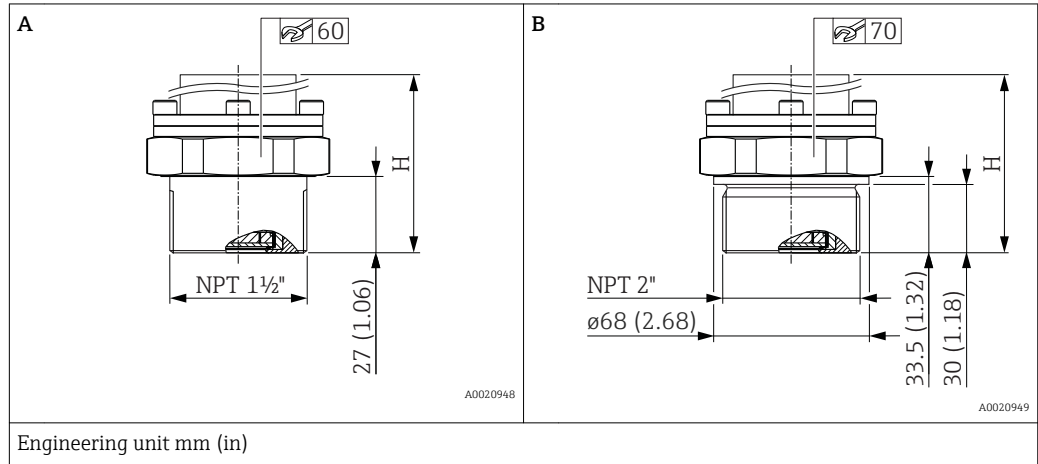


Position	Description	Material	Weight	Approval <sup>1)</sup>	Option <sup>2)</sup>
			kg (lbs)		
A	ANSI 1/2" MNPT, 1/4" FNPT	AISI 316L (CRN)	0.63 (1.39)	CRN	RLJ
		Alloy C276 (2.4819) (CRN)		CRN	RLC
		Monel (2.4360)		-	RLD
B	ANSI 1/2" MNPT, bore hole 11.4 mm (0.45 in)	AISI 316L (CRN)		CRN	RKJ
		Alloy C276 (2.4819) (CRN)		CRN	RKC
		Monel (2.4360)		-	RKD
C	ANSI 1/2" MNPT, bore hole 3 mm (0.12 in)	<b>PVDF</b> <ul style="list-style-type: none"> <li>■ Mount only with mounting bracket</li> <li>■ MWP 10 bar (150 psi), OPL max. 15 bar (225 psi)</li> <li>■ Process temperature range: +10 to +60 °C (+14 to +140 °F)</li> </ul>		-	RJF
D	ANSI 1/2" FNPT 11.4 mm (0.45 in)	AISI 316L (CRN)	CRN	R1J	
		Alloy C276 (2.4819) (CRN)	CRN	R1C	
		Monel (2.4360)	-	R1D	

- 1) CSA approval: Product Configurator, "Approval" ordering feature
- 2) Product Configurator, order code for "Process connection"

Description	Height H
Standard version	29 mm (1.14 in)
High-temperature version	107 mm (4.21 in)

FMD71 process connections, flush-mounted process isolating diaphragm thread ANSI

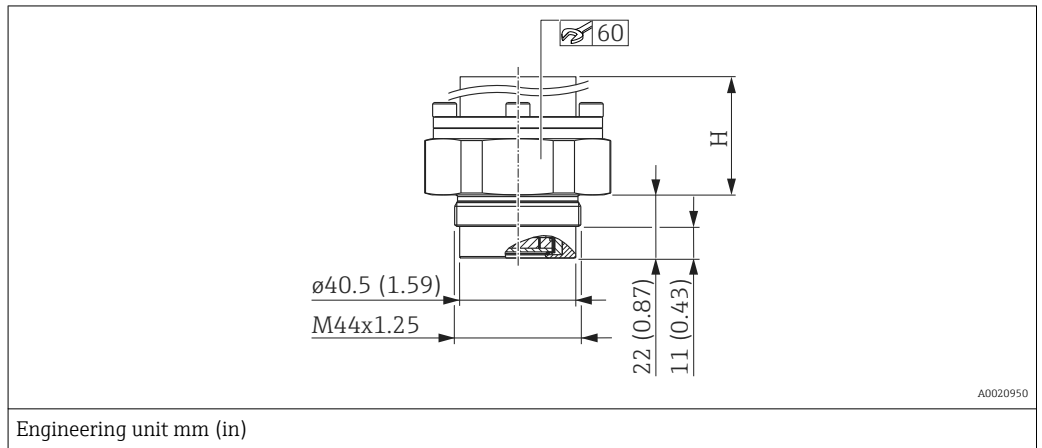


Position	Description	Material	Weight	Approval <sup>1)</sup>	Option <sup>2)</sup>
			kg (lbs)		
A	ANSI 1 1/2" MNPT	AISI 316L (CRN)	0.63 (1.39)	CRN	U7J
		Alloy C276 (2.4819) (CRN)		CRN	U7C
		Monel (2.4360)		-	U7D
B	ANSI 2" MNPT	AISI 316L (CRN)		CRN	U8J
		Alloy C276 (2.4819) (CRN)		CRN	U8C
		Monel (2.4360)		-	U8D

- 1) CSA approval: Product Configurator, "Approval" ordering feature
- 2) Product Configurator, order code for "Process connection"

Position	Description	Height H
A	Standard version	57 mm (2.24 in)
	High-temperature version	64 mm (2.52 in)
B	Standard version	54 mm (2.13 in)
	High-temperature version	61 mm (2.4 in)

**FMD71 process connections, flush-mounted process isolating diaphragm**      **Thread DIN 13**

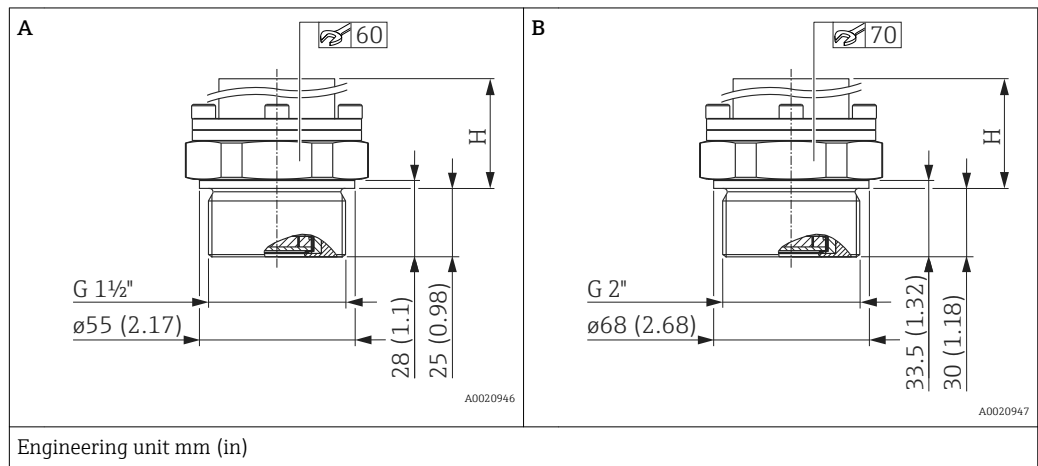


Description	Material	Weight	Option <sup>1)</sup>
		kg (lbs)	
DIN 13 M44 x 1.25	AISI 316L	0.63 (1.39)	G4J
	Alloy C276 (2.4819)		G4C

1) Product Configurator, order code for "Process connection"

Description	Height H
Standard version	62 mm (2.44 in)
High-temperature version	69 mm (2.72 in)

FMD71 process connections, Thread ISO 228 G  
flush-mounted process isolating diaphragm



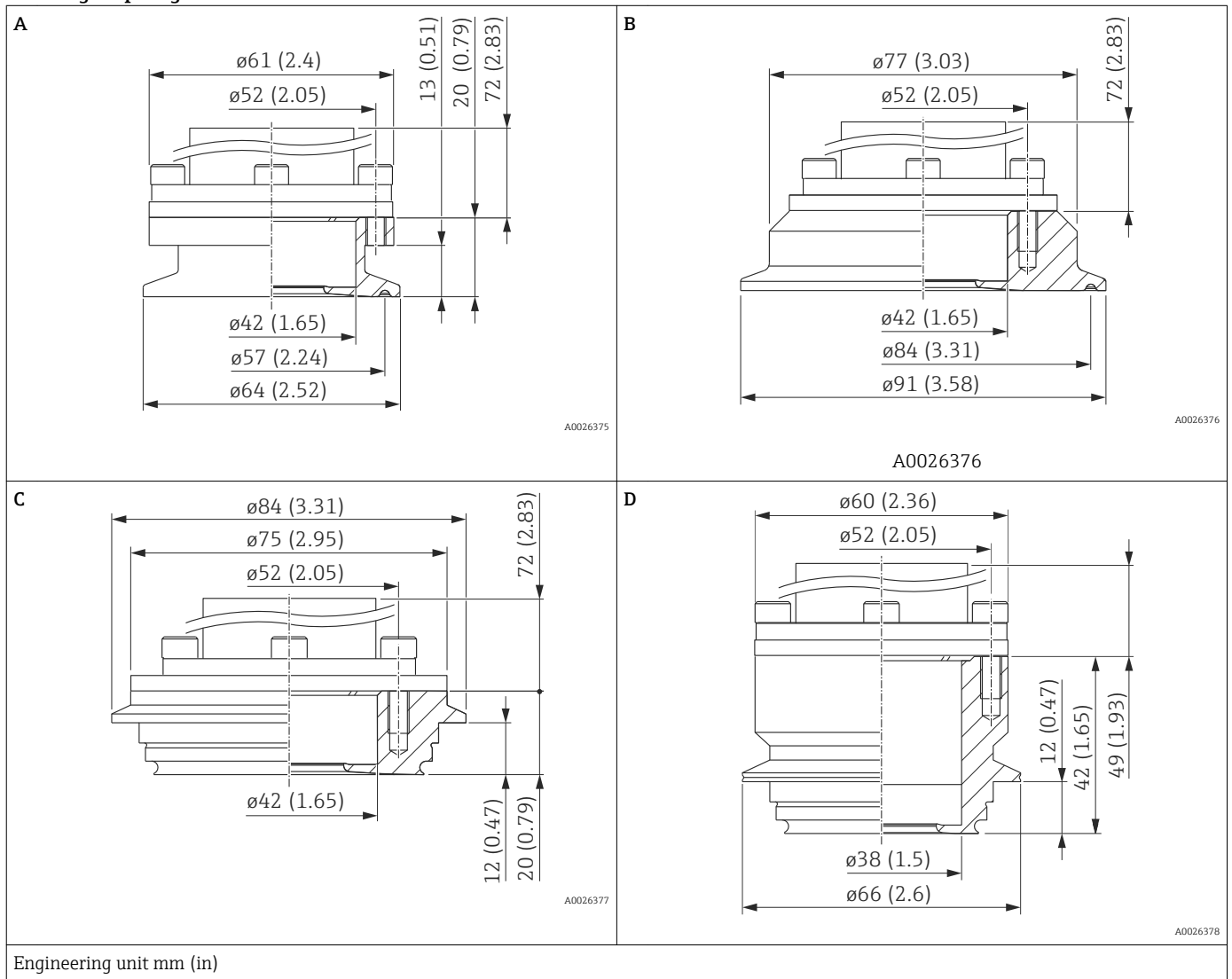
Position	Description	Material	Weight	Option <sup>1)</sup>
			kg (lbs)	
A	Thread ISO 228 G 1 1/2" A	AISI 316L	0.63 (1.39)	GVJ
		Alloy C276 (2.4819)		GVC
		Monel (2.4360)		GVD
B	Thread ISO 228 G 2" A	AISI 316L	0.63 (1.39)	GWJ
		Alloy C276 (2.4819)		GWC
		Monel (2.4360)		GWD

1) Product Configurator, order code for "Process connection"

Position	Description	Height H
A	Standard version	59 mm (2.32 in)
	High-temperature version	66 mm (2.6 in)
B	Standard version	54 mm (2.13 in)
	High-temperature version	61 mm (2.4 in)

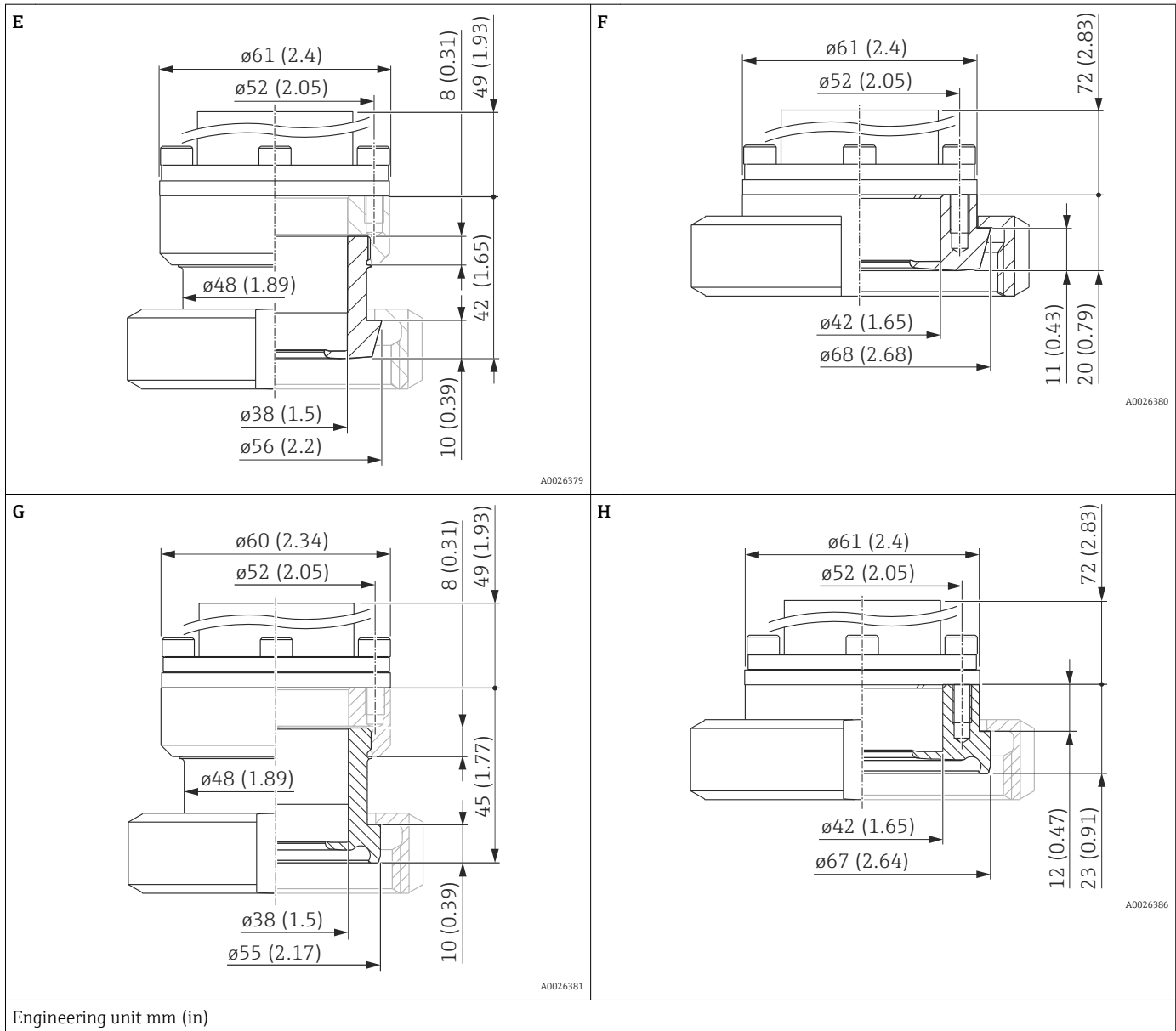


**FMD71 process connections,  
flush-mounted process  
isolating diaphragm** **Hygienic connections**



Position	Description	Material	Weight	Approval <sup>1)</sup>	Option <sup>2)</sup>
			kg (lbs)		
A <sup>3)</sup>	Tri-Clamp ISO 2852 DN 40 - DN 51 (2"), DIN 32676DN 50, EHEDG, 3A (CRN)	AISI 316L (1.4435)	0.7 (1.54)	CRN	TDJ <sup>4)</sup>
B	Tri-Clamp ISO 2852 DN 76.1 (3"), EHEDG, 3A, with FDA seal		0.9 (1.98)	CRN	TFJ <sup>4)</sup>
C <sup>3)</sup>	Varivent Type N for pipes 40 - 162, PN 40, EHEDG, 3A (CRN)		1 (2.21)	CRN	TRJ
D	Varivent Type F for pipes DN25-32 PN 40, 316L, EHEDG, 3A, with FDA seal		0.46 (1)	-	TQJ

- 1) CSA approval: Product Configurator, "Approval" ordering feature
- 2) Product Configurator, order code for "Process connection"
- 3) Roughness of wetted surfaces  $R_a < 0.76 \mu\text{m}$  (30  $\mu\text{in}$ ) as standard. Surface quality  $R_a < 0.38 \mu\text{m}$  (15  $\mu\text{in}$ ) electropolished (wetted) available on request.
- 4) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

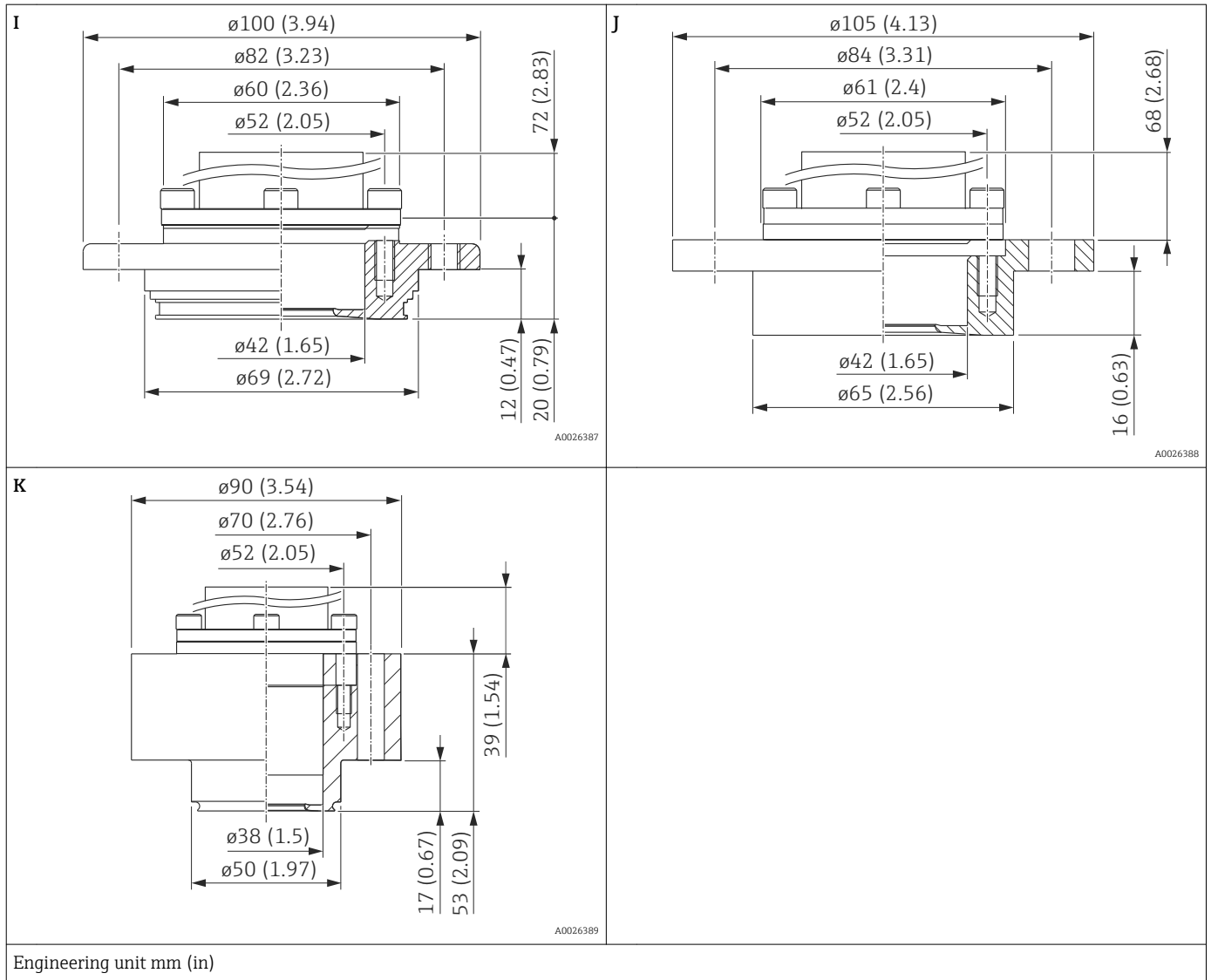


Position	Description	Material	Weight	Approval <sup>1)</sup>	Option <sup>2)</sup>
			kg (lbs)		
E	DIN 11851 DN 40 PN 25, EHEDG, 3A (CRN)	AISI 316L (1.4435)	0.7 (1.54)	CRN	MZJ <sup>3)</sup>
F	DIN 11851 DN 50 PN 25, EHEDG, 3A (CRN)		0.9 (1.98)	CRN	MRJ <sup>3)</sup>
G	DIN11864-1 A DN40 PN16 pipe DIN11866-A, slotted nut, 316L, EHEDG, 3A		1 (2.21)	-	NCJ <sup>3)</sup>
H	DIN11864-1 A DN50 PN40 pipe DIN11866-A, slotted nut, 316L, EHEDG, 3A		1 (2.21)	-	NDJ <sup>3)</sup>

1) CSA approval: Product Configurator, "Approval" ordering feature

2) Product Configurator, order code for "Process connection"

3) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).



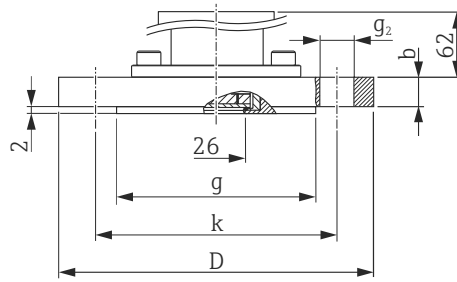
Engineering unit mm (in)

Position	Description	Material	Weight	Approval <sup>1)</sup>	Option <sup>2)</sup>
			kg (lbs)		
I	APV inline DN50 PN40, 316L, 3A, with FDA seal	AISI 316L (1.4435)	1.2 (2.65)	CRN	TMJ
J	DRD DN50 (65 mm) PN 25, slotted nut AISI 304 (1.4301)		0.9 (1.98)	-	TIJ
K	NEUMO BioControl, D50, PN16, 316L, 3A		0.8 (1.76)	-	S4J

- 1) CSA approval: Product Configurator, "Approval" ordering feature
- 2) Product Configurator, order code for "Process connection"

FMD71 process connections,  
flush-mounted process  
isolating diaphragm

EN/DIN flanges, connection dimensions in accordance with EN 1092-1/DIN 2527



A0026336

*D* Diameter of flange  
*b* Thickness  
*g* Raised face  
*k* Hole circle  
*g<sub>2</sub>* Diameter of hole

Engineering unit mm

Flange							Boltholes			Weight	Option <sup>1)</sup>
Nominal diameter	Nominal pressure	Shape <sup>2)</sup>	Material	D	b	g	Number	g <sub>2</sub>	k		
				mm	mm	mm		mm	mm	kg (lbs)	
DN 25	PN 10-40	B1 (D)	AISI 316L	115	18	68	4	14	85	1.4 (3.09)	CNJ
DN 32	PN 10-40	B1 (D)	AISI 316L	140	18	78	4	18	100	2 (4.41)	CPJ
DN 40	PN 10-40	B1 (D)	AISI 316L	150	18	88	4	18	110	2.4 (5.29)	CQJ
DN 40	PN 10-40	B1 (D)	ECTFE <sup>3)</sup>	150	21	88	4	18	110	2.6 (5.73)	CQP
DN 50	PN 10-40	B1 (D)	AISI 316L	165	20	102	4	18	125	3.2 (7.06)	CXJ
DN 50	PN 10-16	B1 (D)	PVDF	165	18	102	4	18	125	2.9 (6.39)	CFF
DN 50	PN 25-40	B1 (D)	ECTFE <sup>3)</sup>	165	20	102	4	18	125	3.2 (7.06)	CRP
DN 50	PN 63 (64)	B2 (D)	AISI 316L	180	26	102	4	22	135	4.6 (10.14)	PDJ
DN 80	PN 10-16	B1 (D)	PVDF	200	21.4	138	8	18	160	1 (2.21)	CGF
DN 80	PN 10-40	B1 (D)	AISI 316L	200	24	138	8	18	160	5.5 (12.13)	CZJ
DN 80	PN 25-40	B1 (D)	ECTFE <sup>3)</sup>	200	24	138	8	18	160	5.5 (12.13)	CSP

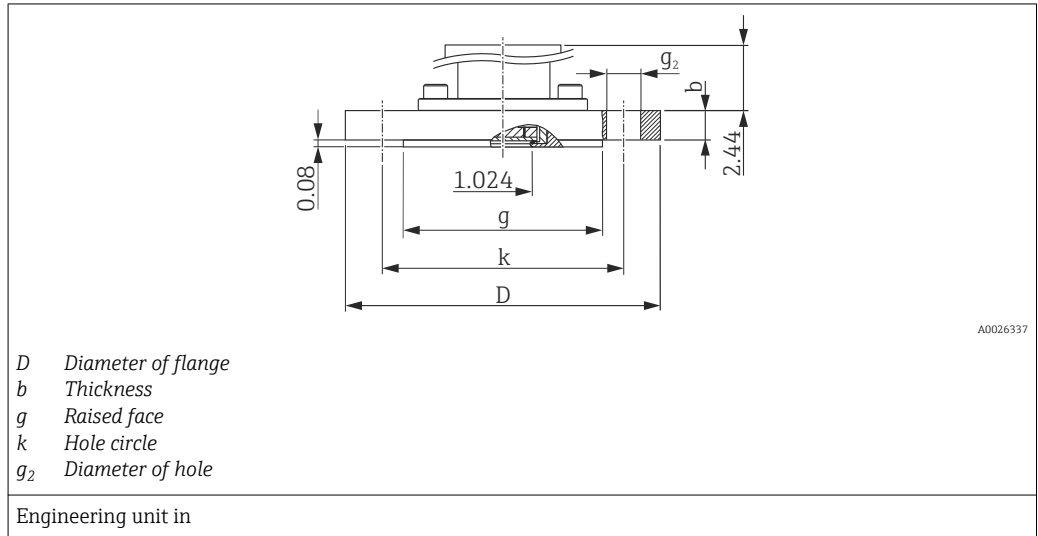
1) Product Configurator, order code for "Process connection"

2) Description as per DIN 2527 provided in brackets

3) ECTFE coating on AISI 316L (1.4404). When using in hazardous areas: avoid electrostatic charge on the plastic surfaces.

**FMD71 process connections,  
flush-mounted process  
isolating diaphragm**

**ASME flanges, connection dimensions in accordance with ASME B 16.5, raised face RF**

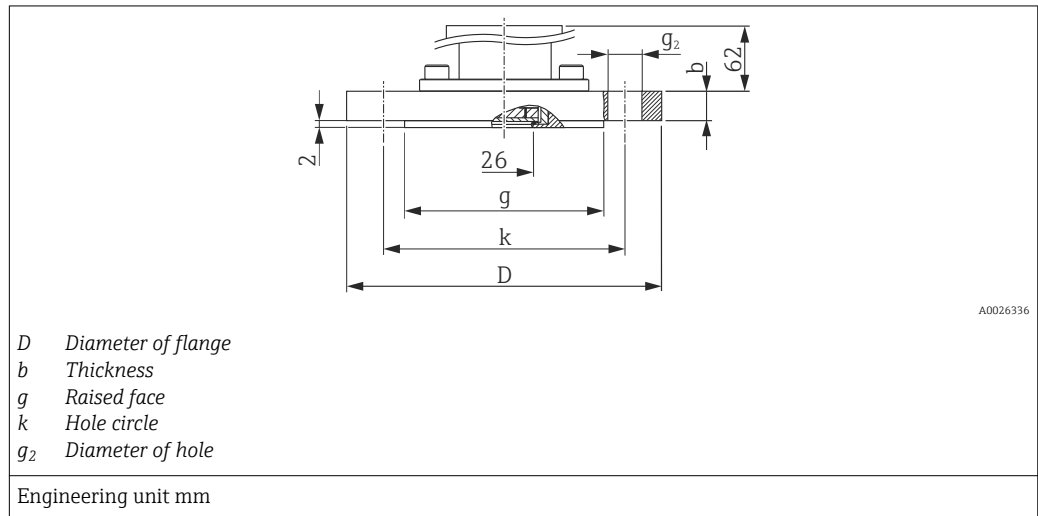


Flange <sup>1)</sup>			Boltholes						Weight		Approval <sup>2)</sup>	Option <sup>3)</sup>
NPS (nominal diameter of pipe)	Class	Material	D	b	g	Number	g <sub>2</sub>	k				
in	lb./sq.in		in	in	in		in	in	kg (lbs)			
1	150	AISI 316/316L <sup>4)</sup>	4.25	1.18	2	4	0.62	3.12	0.9 (1.98)	-	ACJ	
1	300	AISI 316/316L <sup>4)</sup>	4.88	1.18	2	4	0.75	3.5	1.4 (3.09)	-	ANJ	
1 ½	150	AISI 316/316L <sup>4)</sup>	5	0.69	2.88	4	0.62	3.88	2.1 (4.63)	CRN	AEJ	
1 ½	300	AISI 316/316L <sup>4)</sup>	6.12	0.81	2.88	4	0.88	4.5	2.6 (5.73)	CRN	AQJ	
2	150	AISI 316/316L <sup>4)</sup>	6	0.75	3.62	4	0.75	4.75	3.0 (6.62)	CRN	AFJ	
2	150	ECTFE <sup>5)</sup>	6	0.75	3.62	4	0.75	4.75	2.4 (5.29)	-	AFN	
2	150	PVDF	6	0.75	3.62	4	0.75	4.75	0.5 (1.10)	-	AFF	
2	300	AISI 316/316L <sup>4)</sup>	6.5	0.88	3.62	8	0.75	5	3.2 (7.06)	CRN	ARJ	
3	150	AISI 316/316L <sup>4)</sup>	7.5	0.94	5	4	0.75	6	5.7 (12.57)	CRN	AGJ	
3	150	ECTFE <sup>5)</sup>	7.5	0.94	5	4	0.75	6	4.9 (10.80)	-	AGN	
3	150	PVDF	7.5	0.94	5	4	0.75	6	0.9 (1.98)	-	AGF	
3	300	AISI 316/316L <sup>4)</sup>	8.25	1.12	5	8	0.88	6.62	6.8 (14.99)	CRN	ASJ	
4	150	AISI 316/316L <sup>4)</sup>	9	0.94	6.19	8	0.75	7.5	7.8 (17.2)	CRN	AHJ	
4	150	ECTFE <sup>5)</sup>	9	0.94	6.19	8	0.75	7.5	7.1 (15.66)	-	AHN	
4	300	AISI 316/316L <sup>4)</sup>	10	1.25	6.19	8	0.88	7.88	11.6 (25.58)	CRN	ATJ	

- 1) AISI 316L
- 2) CSA approval: Product Configurator, "Approval" ordering feature
- 3) Product Configurator, order code for "Process connection"
- 4) Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
- 5) ECTFE coating on AISI 316/316L. When using in hazardous areas: avoid electrostatic charge on the plastic surfaces.

**FMD71 process connections,  
flush-mounted process  
isolating diaphragm**

**JIS flanges, connection dimensions in accordance with JIS B 2220 BL, raised face RF**

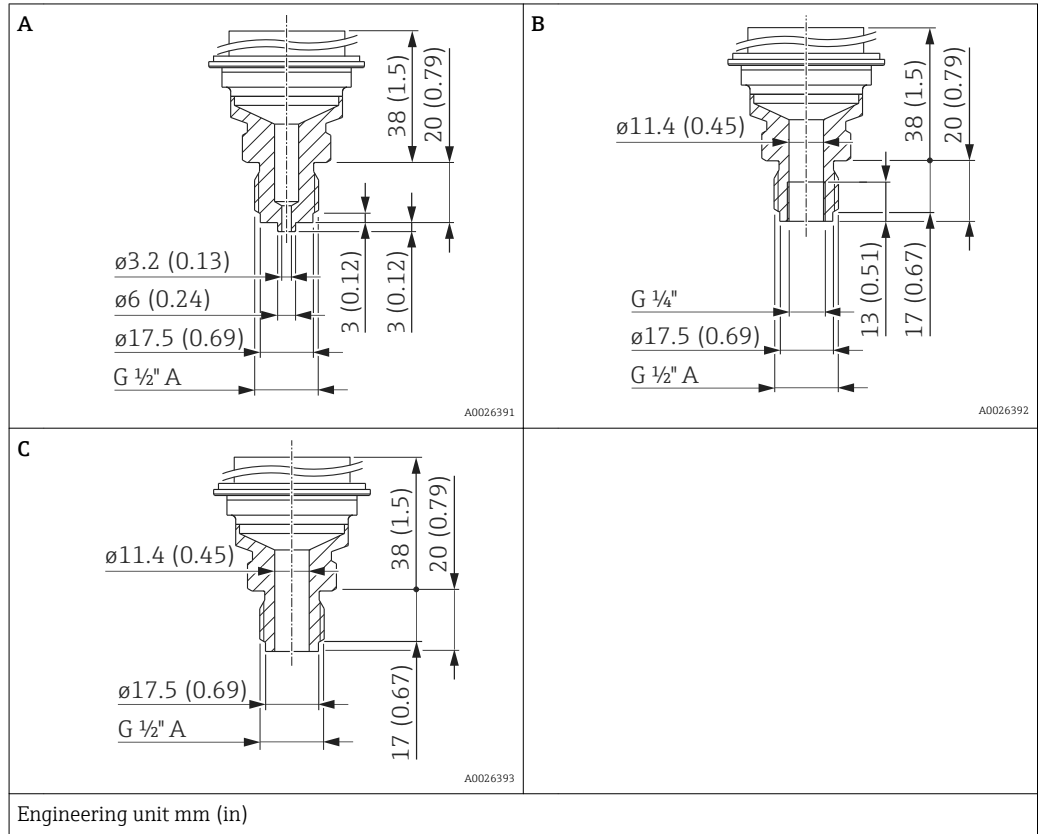


Flange <sup>1) 2)</sup>					Boltholes			Weight	Option <sup>3)</sup>
Nominal diameter	Nominal pressure	D	b	g	Number	g <sub>2</sub>	k		
		mm	mm	mm		mm	mm	kg (lbs)	
50 A	10 K	155	16	96	4	19	120	2.0 (4.41)	KFJ
80 A	10 K	185	18	127	8	19	150	3.3 (7.28)	KGJ
100 A	10 K	210	18	151	8	19	175	4.4 (9.7)	KHJ

- 1) AISI 316L (1.4435)
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges is Ra 0.8 µm (31.5 µin). Lower surface roughness available on request.
- 3) Product Configurator, order code for "Process connection"

FMD72 process connections,  
internal process isolating  
diaphragm

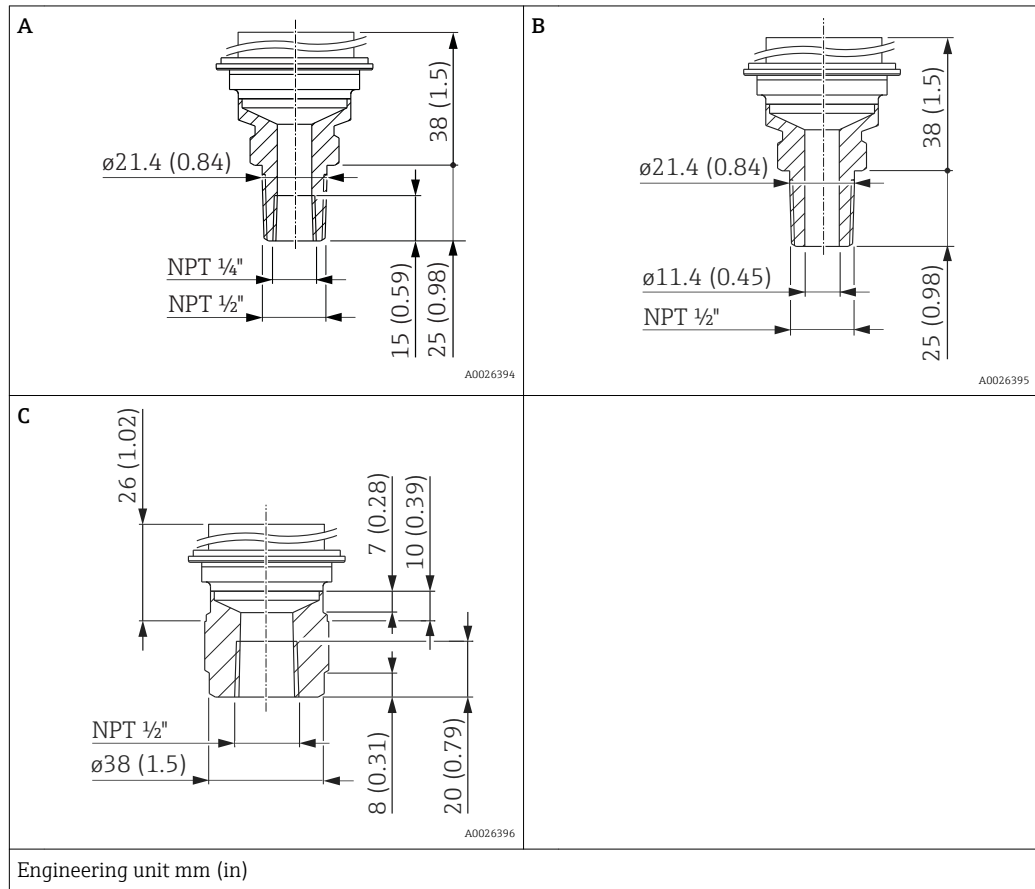
Thread ISO 228 G



Position	Description	Material	Weight		Option <sup>1)</sup>
			kg	(lbs)	
A	Thread ISO 228 G 1/2" A EN 837	AISI 316L (CRN)	0.63	(1.39)	GCJ
		Alloy C276 (2.4819) (CRN)			GCC
B	Thread ISO 228 G 1/2" A, G 1/4" (female) EN 837	AISI 316L (CRN)	0.63	(1.39)	GLJ
		Alloy C276 (2.4819) (CRN)			GLC
C	Thread ISO 228 G 1/2" A EN 837, bore 11.4 mm (0.45 in)	AISI 316L (CRN)	0.63	(1.39)	GMJ
		Alloy C276 (2.4819) (CRN)			GMC

1) Product Configurator, order code for "Process connection"

FMD72 process connections, thread ANSI  
internal process isolating diaphragm

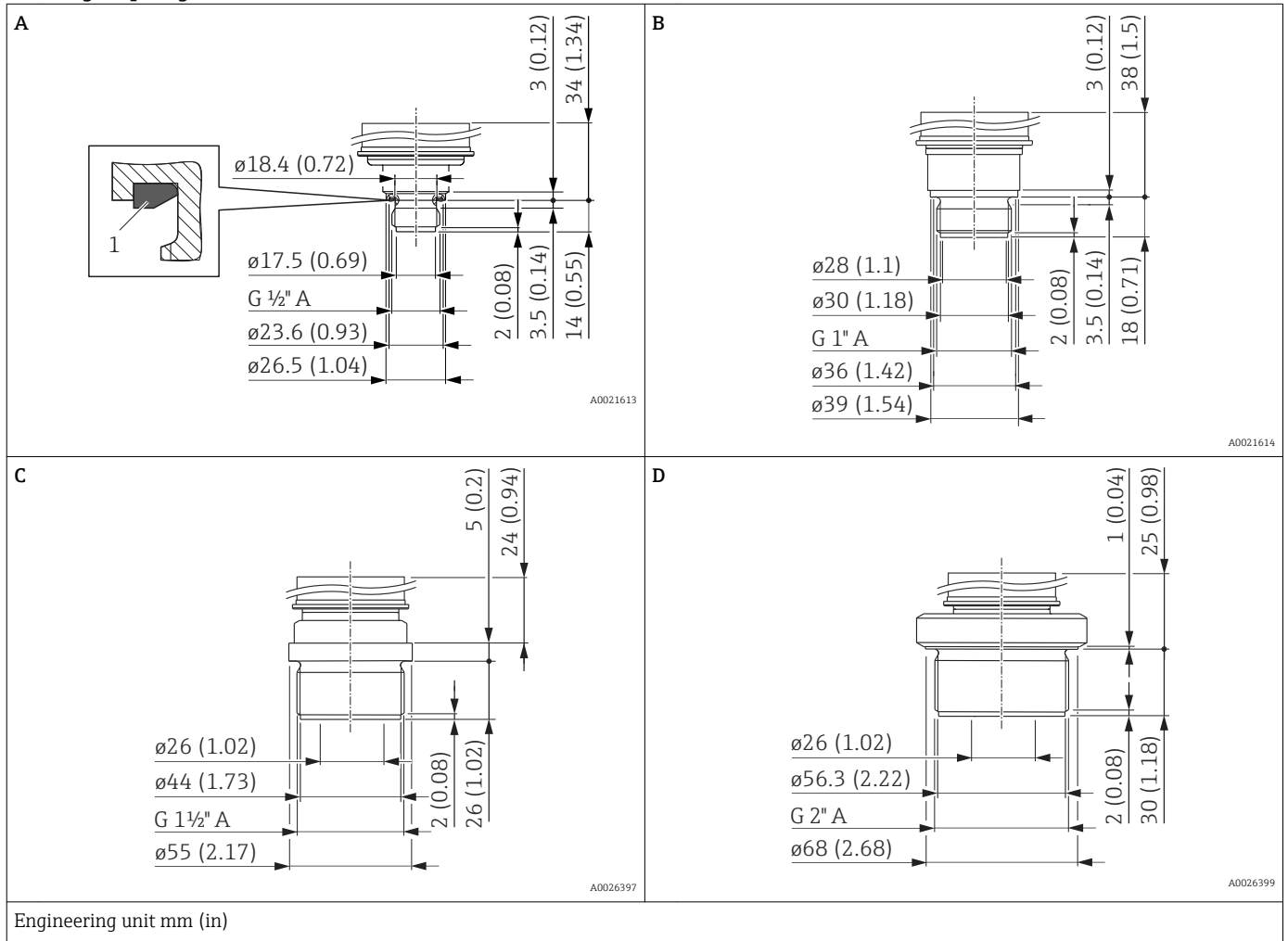


Position	Description	Material	Weight	Approval <sup>1)</sup>	Option <sup>2)</sup>
			kg (lbs)		
A	ANSI 1/2" MNPT, 1/4" FNPT	AISI 316L (CRN)	0.63 (1.39)	CRN	RLJ
		Alloy C276 (2.4819) (CRN)		CRN	RLC
B	ANSI 1/2" MNPT, bore hole 11.4 mm (0.45 in)	AISI 316L (CRN)		CRN	RKJ
		Alloy C276 (2.4819) (CRN)		CRN	RKC
D	ANSI 1/2" FNPT 11.4 mm (0.45 in)	AISI 316L (CRN)		CRN	R1J
		Alloy C276 (2.4819) (CRN)		CRN	R1C

1) CSA approval: Product Configurator, "Approval" ordering feature  
 2) Product Configurator, order code for "Process connection"



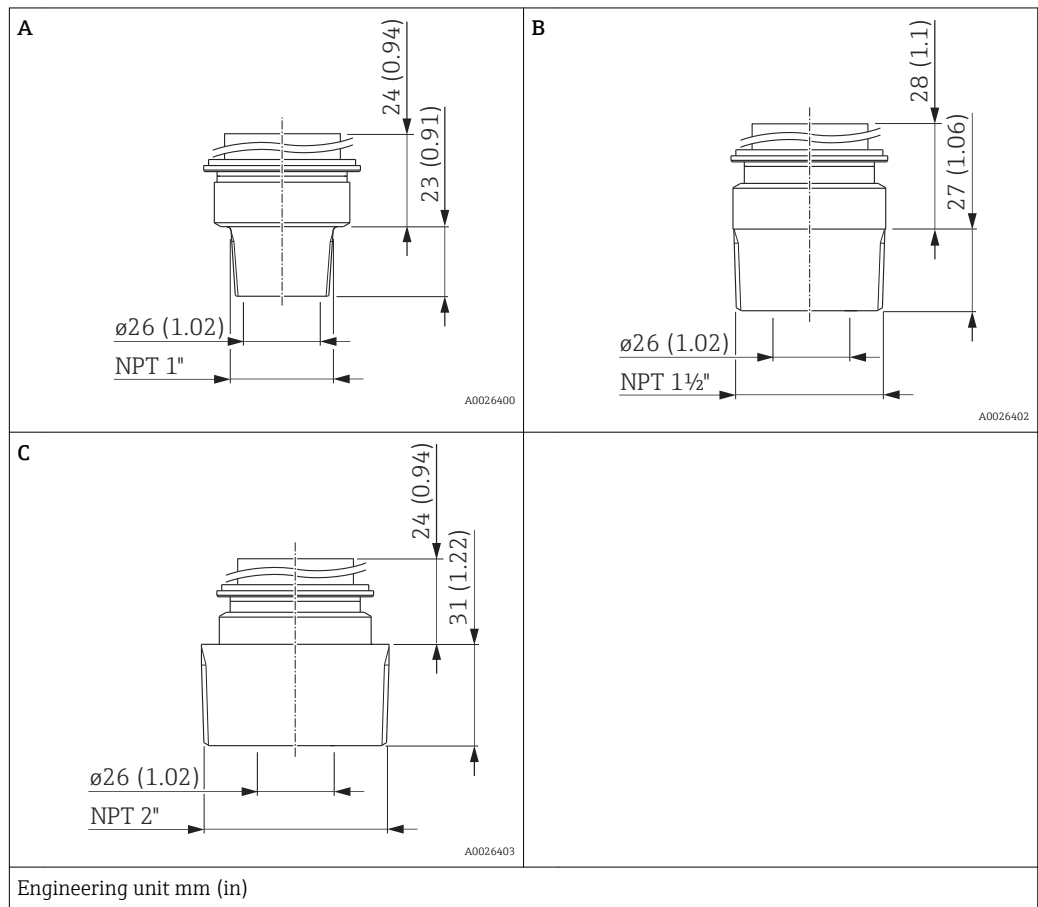
**FMD72 process connections,  
flush-mounted process  
isolating diaphragm**      **Thread ISO 228 G**



Position	Description	Material	Weight	Option <sup>1)</sup>
			kg (lbs)	
A	Thread ISO 228 G ½" A, DIN 3852 FKM molded seal (item 1) pre-installed	AISI 316L	0.4 (0.88)	GRJ
B	Thread ISO 228 G 1" A	AISI 316L	0.7 (1.54)	GTJ
C	Thread ISO 228 G 1 ½" A	AISI 316L	1.1 (2.43)	GVJ
D	Thread ISO 228 G 2" A	AISI 316L	1.5 (3.31)	GWJ

1) Product Configurator, order code for "Process connection"

FMD72 process connections, thread ANSI  
flush-mounted process  
isolating diaphragm

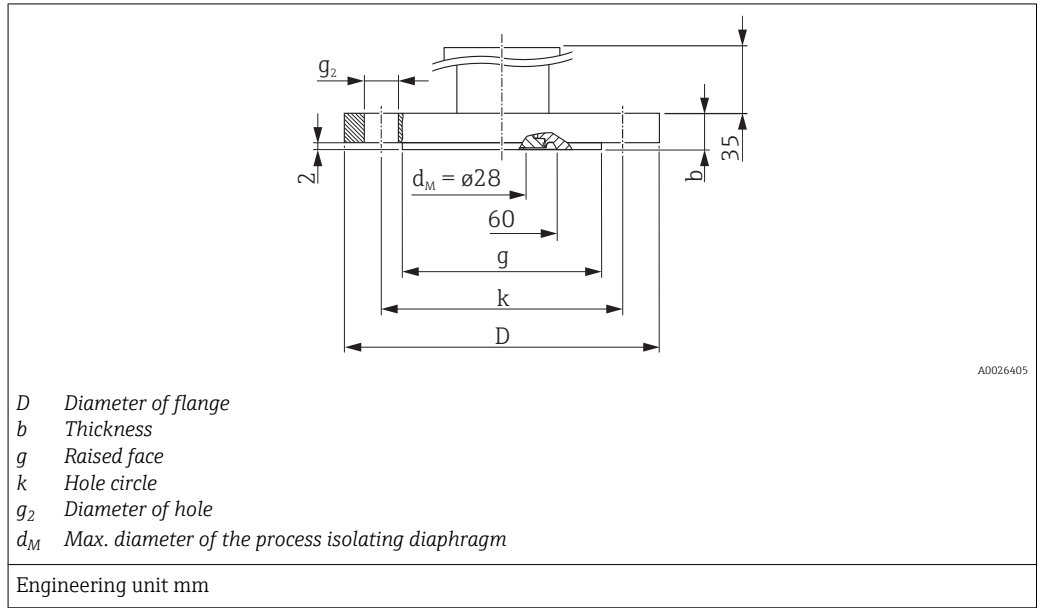


Position	Description	Material	Weight	Approval <sup>1)</sup>	Option <sup>2)</sup>
			kg (lbs)		
A	ANSI 1" MNPT	AISI 316L (CRN)	0.7 (1.54)	CRN	U5J
B	ANSI 1 ½" MNPT	AISI 316L (CRN)	1 (2.21)	CRN	U7J
C	ANSI 2" MNPT	AISI 316L (CRN)	1.3 (2.87)	CRN	U8J

1) CSA approval: Product Configurator, "Approval" ordering feature  
2) Product Configurator, order code for "Process connection"

**FMD72 process connections,  
flush-mounted process  
isolating diaphragm**

**EN/DIN flanges, connection dimensions in accordance with EN 1092-1/DIN 2527**

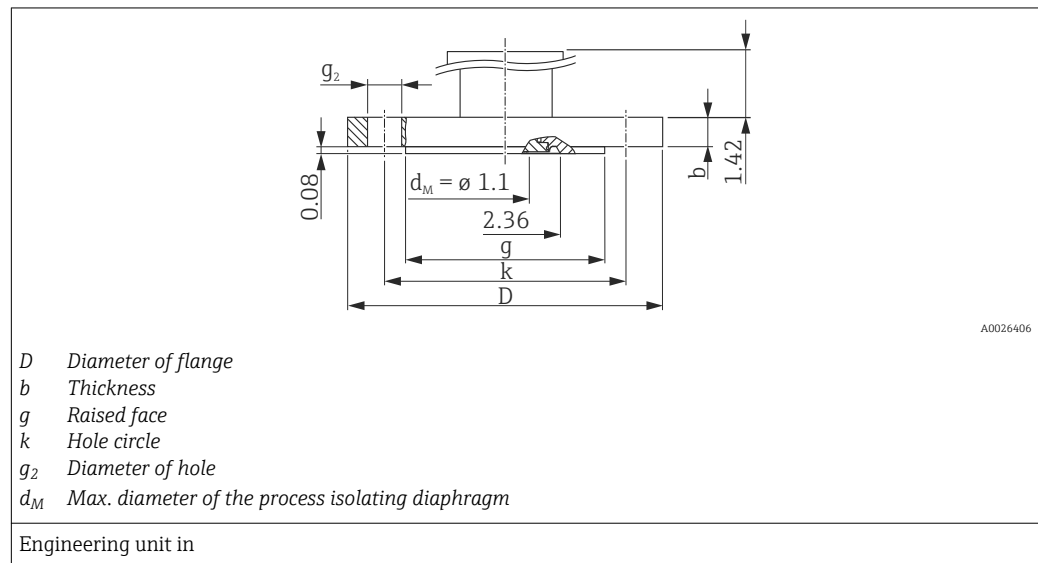


Flange <sup>1) 2)</sup>							Boltholes			Option <sup>3)</sup>
Nominal diameter	Nominal pressure	Shape <sup>4)</sup>	D	b	g	Weight [kg (lbs)]	Number	g <sub>2</sub>	k	
			[mm]	[mm]	[mm]			[mm]	[mm]	
DN 25	PN 10-40	B1 (D)	115	18	68 <sup>5)</sup>	1.2 (2.65)	4	14	85	CNJ
DN 32	PN 10-40	B1 (D)	140	18	78 <sup>5)</sup>	1.9 (4.19)	4	18	100	CPJ
DN 40	PN 10-40	B1 (D)	150	18	88 <sup>5)</sup>	2.2 (4.85)	4	18	110	CQJ
DN 50	PN 10-40	B1 (D)	165	20	102	3.0 (6.62)	4	18	125	CXJ
DN 80	PN 10-40	B1 (D)	200	24	138	5.3 (11.69)	8	18	160	CZJ

- 1) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) is <math>R\_a 0.8 \mu m (31.5 \mu in)</math>. Lower surface roughness on request.
- 2) AISI 316L
- 3) Product Configurator, order code for "Process connection"
- 4) Description as per DIN 2527 provided in brackets
- 5) The sealing surface in these process connections is smaller than what is specified in the standard. Due to the smaller sealing surface, a special seal must be used. Contact a seal manufacturer or your local Endress+Hauser Sales Center.

**FMD72 process connections,  
flush-mounted process  
isolating diaphragm**

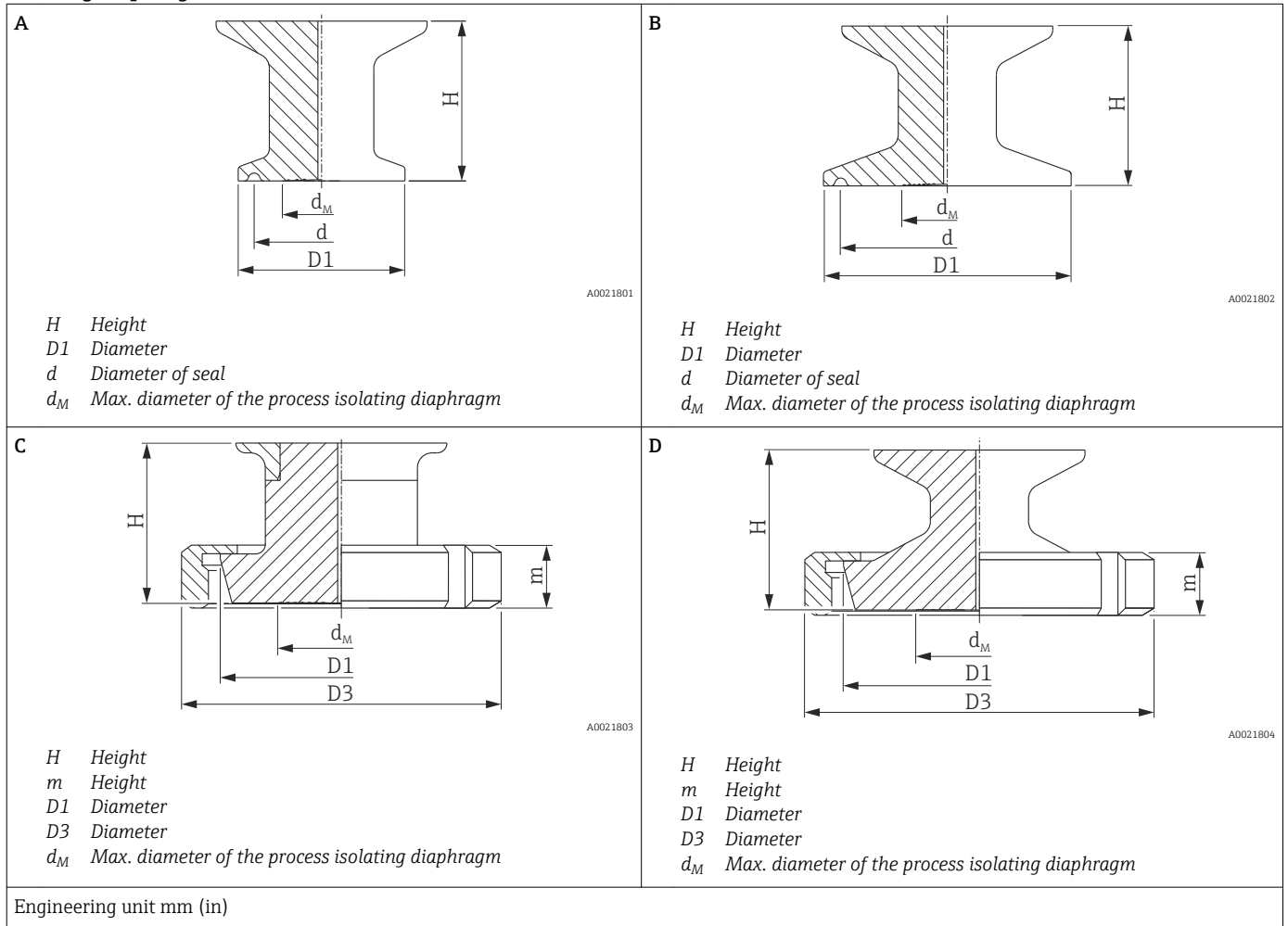
**ASME flanges, connection dimensions in accordance with ASME B 16.5, raised face RF**



Flange <sup>1) 2)</sup>						Boltholes			Approval <sup>3)</sup>	Option <sup>4)</sup>
NPS (nominal diameter of pipe)	Class	D	b	g	Weight	Number	g <sub>2</sub>	k		
[in]	lb./sq.in	[in]	[in]	[in]	[kg (lbs)]		[in]	[in]		
1	300	4.88	0.69	0.06 <sup>5)</sup>	1.3 (2.87)	4	0.75	3.5	-	ANJ
1 ½	150	5	0.69	2.88 <sup>5)</sup>	1.5 (3.31)	4	0.62	3.88	CRN	AEJ
1 ½	300	6.12	0.81	2.88 <sup>5)</sup>	2.6 (5.73)	4	0.88	4.5	CRN	AQJ
2	150	6	0.75	3.62	2.4 (5.29)	4	0.75	4.75	CRN	AFJ
2	300	7.5	0.88	3.62	3.2 (7.06)	8	0.75	5	CRN	ARJ
3	150	7.5	0.94	5	4.9 (10.80)	4	0.75	6	CRN	AGJ
3	300	8.25	1.12	5	6.7 (14.77)	8	0.88	6.62	CRN	ASJ
4	150	9	0.94	6.19	7.1 (15.66)	8	0.75	7.5	CRN	AHJ
4	300	10	1.25	6.19	11.6 (25.88)	8	0.88	7.88	CRN	ATJ

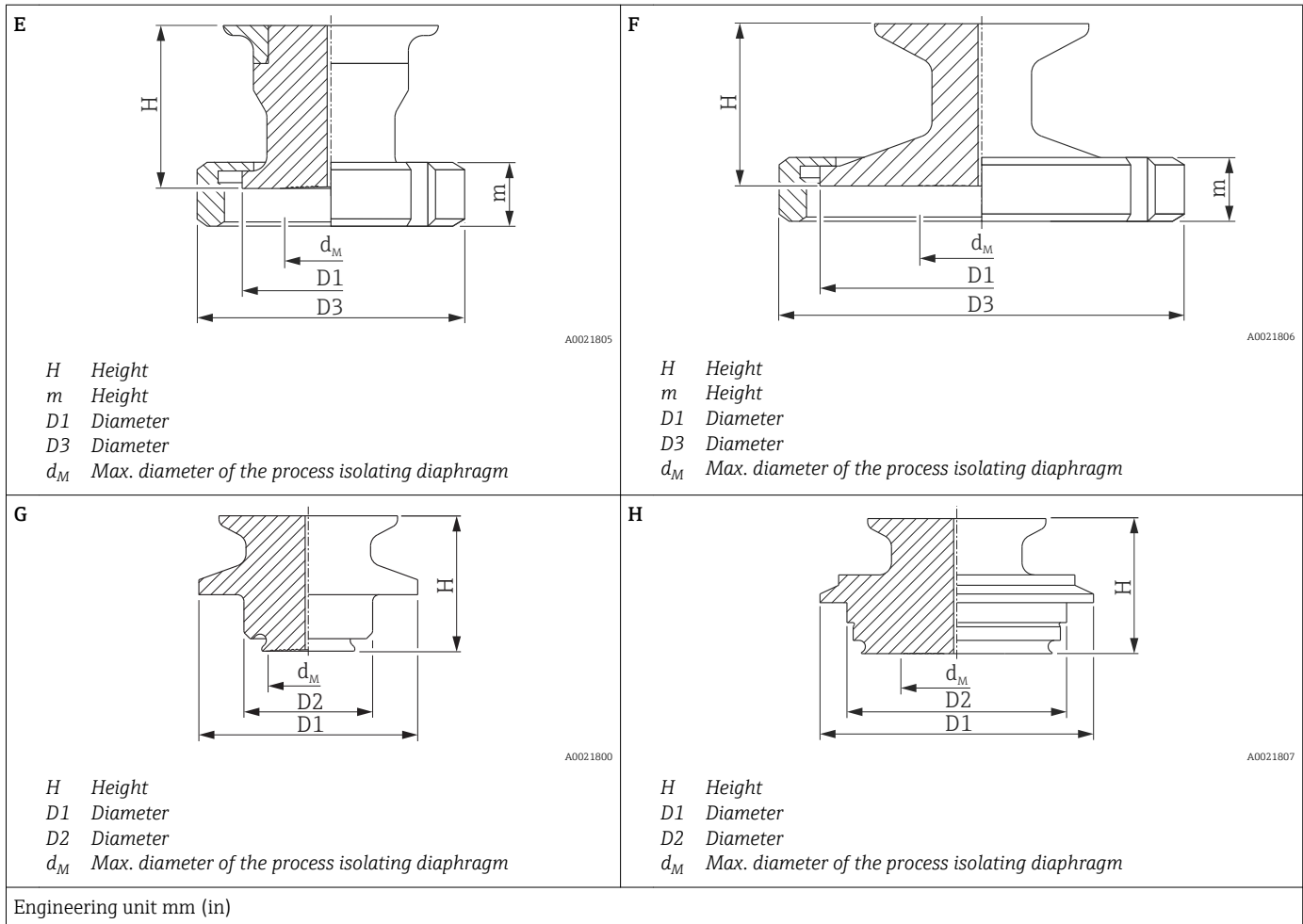
- 1) The roughness of the surface in contact with the medium is <math>R\_a 0.8 \mu m (31.5 \mu in)</math>. Lower surface roughness on request.
- 2) Material AISI 316/316L. (combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated))
- 3) CSA approval: Product Configurator, "Approval" ordering feature
- 4) Product Configurator, order code for "Process connection"
- 5) The sealing surface in these process connections is smaller than what is specified in the standard. Due to the smaller sealing surface, a special seal must be used. For further information, please contact a seal manufacturer or your local Endress+Hauser Sales Center.

**FMD72 process connections, flush-mounted process isolating diaphragm** **Hygienic connections**



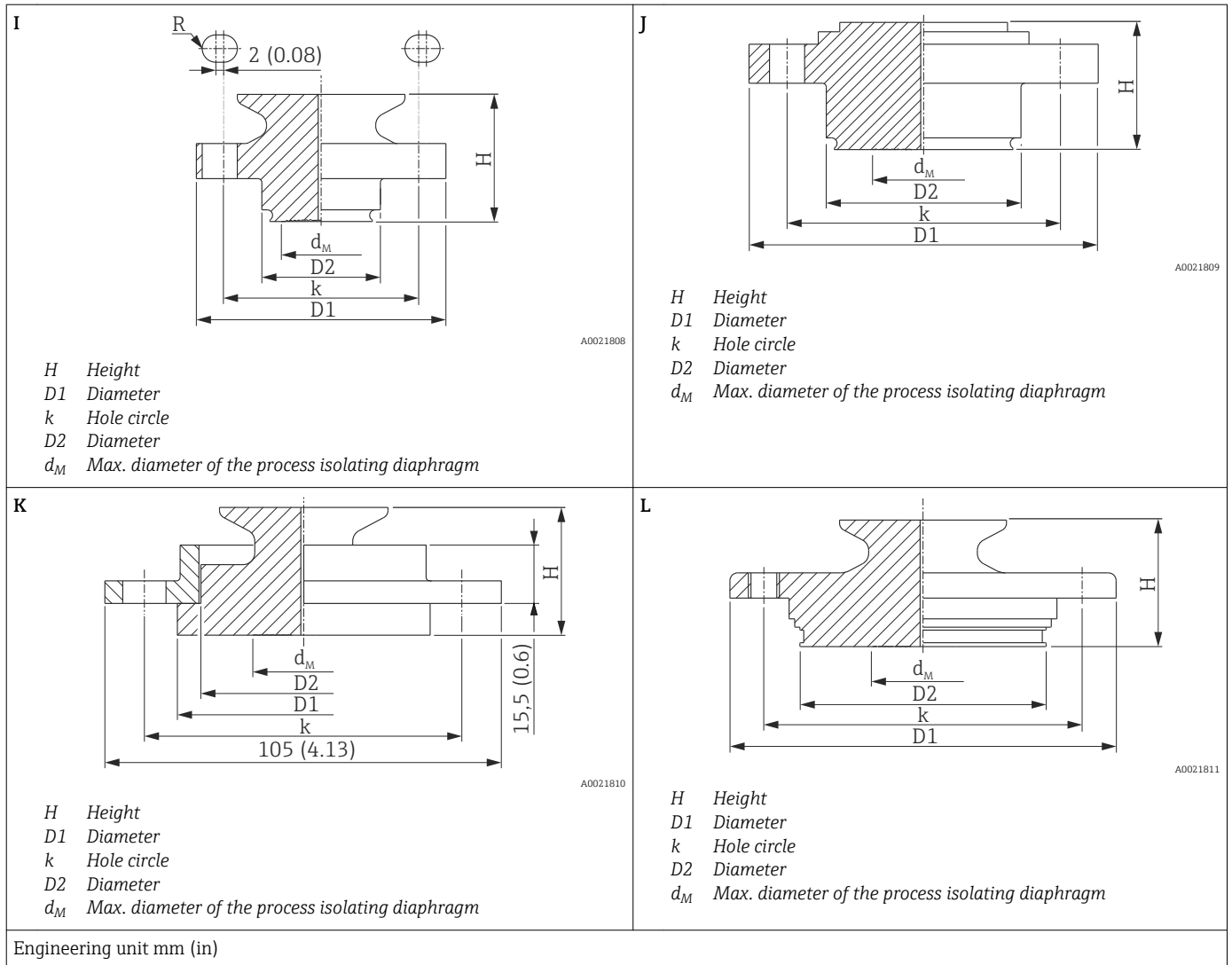
Position	Description	Nominal pressure PN	D1	D3	d	d <sub>M</sub>	H	m	Material	Weight	Option <sup>1)</sup>
										kg (lbs)	
A	Clamp DN18-22, 3A	40	34 (1.34)	-	27.5 (1.08)	17.2 (0.68)	max. 40 (1.57)	-	AISI 316L (1.4435)	0.5 (1.10)	TBJ
B	Clamp 1", 3A	40	50.5 (1.99)	-	43.5 (1.71)	21.65 (0.85)		-		0.6 (1.32)	TCJ
	Clamp 1½", 3A	40	50.5 (1.99)	-	43.5 (1.71)	28 (1.10)		-		0.6 (1.32)	TJJ
	Clamp 2", 3A	40	64 (2.52)	-	56.5 (2.22)	28 (1.10)	-	0.7 (1.54)	TDJ		
C	DIN11851 B25	40	43.4 (1.71)	63 (2.48)	-	28 (1.10)	21 (0.83)	0.7 (1.54)	MXJ		
	DIN11851 B32, 3A	40	49.4 (1.94)	70 (2.76)	-	28 (1.10)	21 (0.83)	0.8 (1.76)	MIJ		
D	DIN11851 B40, 3A	40	55.4 (2.18)	78 (3.07)	-	28 (1.10)	21 (0.83)	0.9 (1.98)	MZJ		
	DIN11851 B50, 3A	40	67.4 (2.65)	92 (3.62)	-	28 (1.10)	22 (0.87)	1.1 (2.43)	MRJ		

1) The roughness of the surface in contact with the medium is R<sub>a</sub> < 0.76 µm (30 µin).



Position	Description	Nominal pressure	D1	D2	D3	d <sub>M</sub>	H	m	Material	Weight	Option <sup>1)</sup>
		PN								kg (lbs)	
E	SMS 1", 3A	25	35.5 (1.4)	-	51 (2.01)	21.65 (0.85)	max. 40 (1.57)	20 (0.79)	AISI 316L (1.4435)	0.7 (1.54)	T6J
F	SMS 1½", 3A	25	55 (2.17)	-	74 (2.91)	28 (1.10)		25 (0.98)		0.8 (1.76)	T7J
	SMS 2", 3A	25	65 (2.56)	-	84 (3.31)	28 (1.10)		26 (1.02)		0.9 (1.98)	TXJ
G	Varivent B, 3A	40	52.7 (2.07)	31 (1.22)	-	21.65 (0.85)		-		0.7 (1.54)	TPJ
H	Varivent F, 3A	40	66 (2.6)	53 (2.09)	-	28 (1.10)		-		0.9 (1.98)	TQJ
	Varivent N, 3A	40	84 (3.31)	71 (2.8)	-	28 (1.10)		-		1.1 (2.43)	TRJ

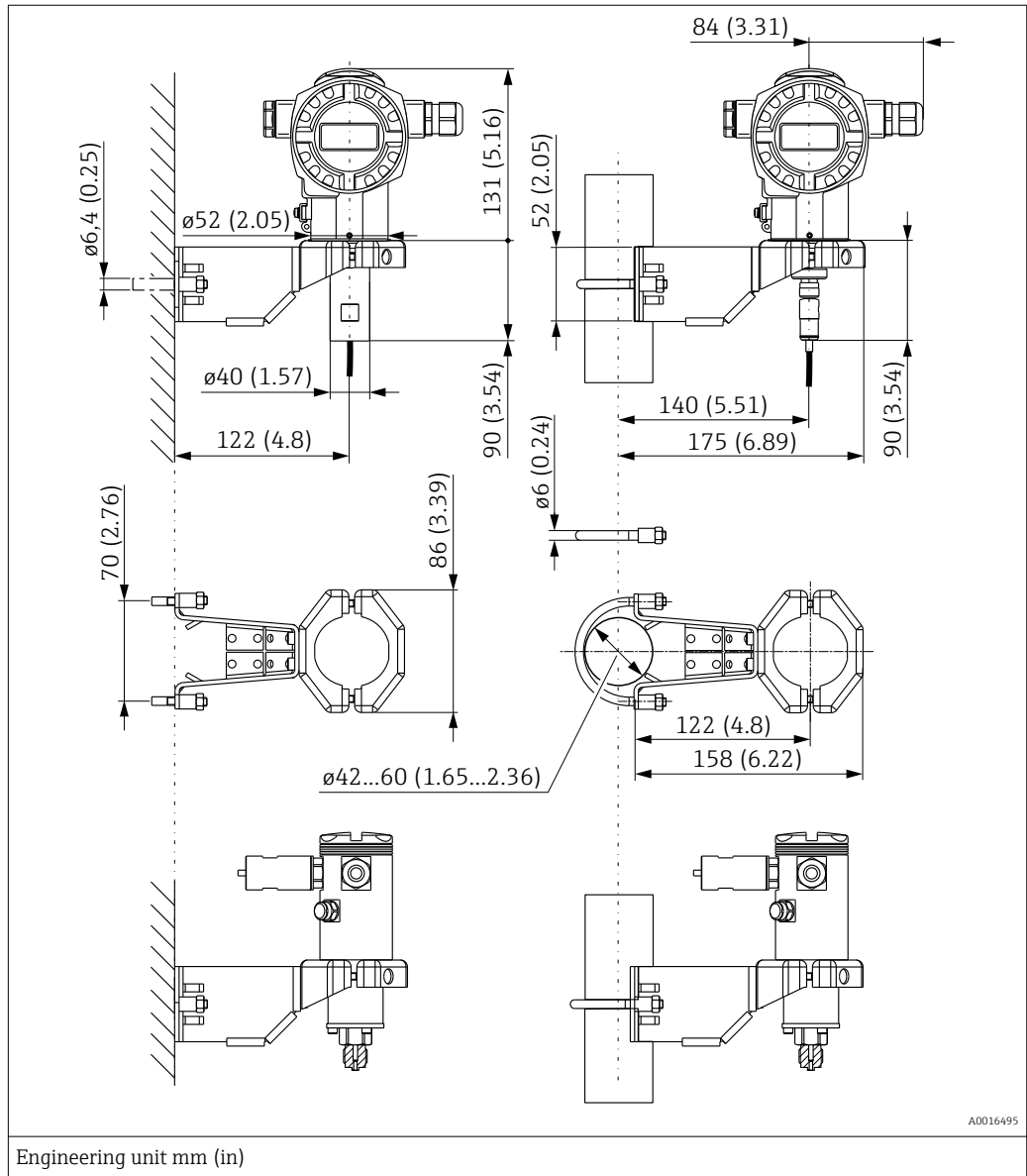
1) The roughness of the surface in contact with the medium is R<sub>a</sub> < 0.76 µm (30 µin).



Position	Description	Nominal pressure	D1	D2	k	d <sub>M</sub>	H	Material	Weight	Option <sup>1)</sup>
		PN							kg (lbs)	
I	Neumo D25, 3A	16	64 (2.52)	30.4 (1.2)	50 (1.97); 4 x, R 3.5 mm (0.14 in)	21.65 (0.85)	max. 40 (1.57)	AISI 316L (1.4435)	0.8 (1.76)	S1J
J	Neumo D50, 3A	16	89.5 (3.52)	49.9 (1.96)	70 (2.76); 4 x ø 9 mm (0.35 in)	28 (1.10)			1.2 (2.65)	S4J
K	DRD	25	64.5 (2.54)	52.5 (2.07)	84 (3.31); 4 x ø 11.5 mm (0.45 in)	28 (1.10)			1.0 (2.21)	TIJ
L	APV Inline	10	99.5 (3.92)	64 (2.52)	82 (3.23); 6 x ø 8.6 mm (0.34 in) + 2 x M8	28 (1.10)			1.2 (2.65)	TMJ

1) The roughness of the surface in contact with the medium is  $R_a < 0.76 \mu\text{m}$  (30  $\mu\text{in}$ ).

Wall and pipe mounting with mounting bracket




Weight kg (lbs)		Option <sup>1)</sup>
Housing	Mounting bracket	
→ 33	0.5 (1.1)	PA

1) Product Configurator, order code for "Process connection"

Also available for order as a separate accessory: part number 71102216



**Materials in contact with process****NOTICE**

- ▶ Device components in contact with the process are listed in the "Mechanical construction" →  32 and "Ordering information" sections.

**TSE Certificate of Suitability**

The following applies to all device components in contact with the process:

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

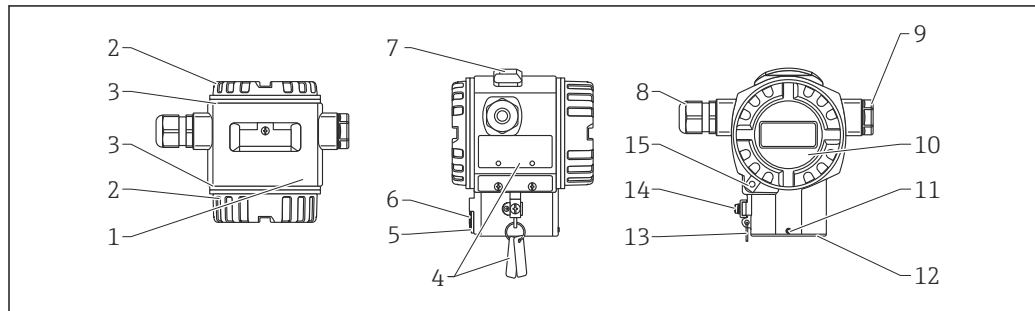
**Process connections**

- Endress+Hauser supplies DIN/EN flanges and threaded connection in stainless steel as per AISI 316L (DIN/ EN material number 1.4404 or 1.4435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.
- "Clamp connections" and "Hygienic process connections": AISI 316L (DIN/EN material number 1.4435)
- Some process connections are also available in alloy C276 (DIN/EN material number 2.4819). For this purpose see the information in the "Mechanical construction" section.

**Process isolating diaphragm**

Sensor	Description	Option <sup>1)</sup>
FMD71	Al <sub>2</sub> O <sub>3</sub> aluminum oxide ceramic FDA <sup>2)</sup> , Ceraphire® (see also <a href="http://www.endress.com/ceraphire">www.endress.com/ceraphire</a> )	-
FMD72	AISI 316L (DIN/EN material number 1.4435)	A
FMD72	AlloyC (on request)	B

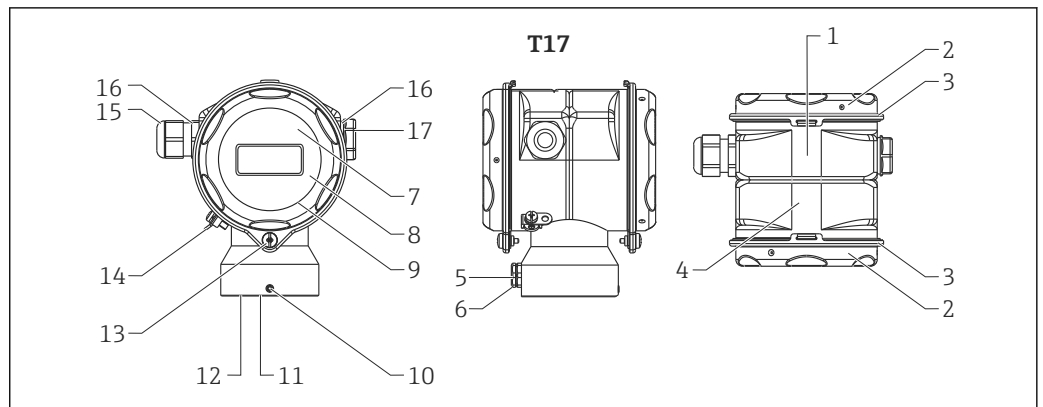
- 1) Product Configurator, order code for "Process connection"
- 2) The US Food & Drug Administration (FDA) has no objections to the use of ceramics made from aluminum oxide as a surface material in contact with foodstuffs. This declaration is based on supporting documents from the FDA furnished by our ceramic suppliers.

**Materials not in contact with process T14 transmitter housing**


A0016496

Item number	Component part	Material
1	T14 housing, RAL 5012 (blue)	Die-cast aluminum with protective powder-coating on polyester base
	T14 housing	Precision cast AISI 316L (1.4435)
2	Cover, RAL 7035 (gray)	<ul style="list-style-type: none"> <li>■ Die-cast aluminum with protective powder-coating on polyester base</li> <li>■ Thread coating: Heat-curing lubricant varnish</li> </ul>
	Cover	<ul style="list-style-type: none"> <li>■ Precision cast AISI 316L (1.4435)</li> <li>■ Thread coating: Heat-curing lubricant varnish</li> </ul>
3	Cover seal	EPDM
4	Nameplates	AISI 304 (1.4404)
5	Pressure compensation filter, O-ring	VMQ or EPDM
6	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
7	External operation (keys and key cover), RAL 7035 (gray)	Polycarbonate PC-FR, screw A4
8	Cable entry	Polyamide (PA)
	Seal	Silicone (VMQ)
9	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)
	Seal	Silicone (VMQ)
10	Sight glass	Mineral glass (polycarbonate on request)
	Sight glass seal	Silicone (VMQ)
11	Screw	A4
12	Sealing ring	EPDM
	Snap ring	PA66-GF25
13	Round strand rope for nameplates	AISI 304 (1.4301) / AISI 316 (1.4401)
14	External ground terminal	AISI 304 (1.4301)
15	Cover clamp	Clamp AISI 316L (1.4435), screw A4

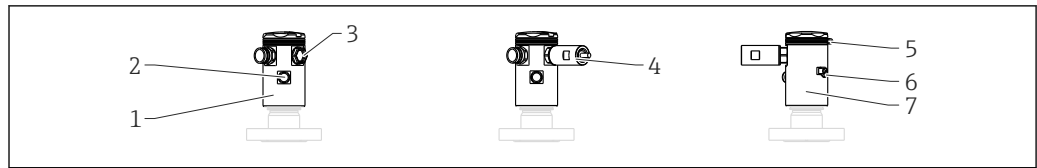
**T17 transmitter housing**



A0020021

Item number	Component part	Material
1	T17 housing	AISI 316L (1.4404)
	Cover	
3	Cover seal	EPDM
4	Nameplates	Lasered on
5	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
6	Pressure compensation filter, O-ring	VMQ or EPDM
7	Sight glass for non-hazardous area, ATEX Ex ia, NEPSI Zone 0/1 Ex ia, IECEx Zone 0/1 Ex ia, FM NI, FM IS, CSA IS	Polycarbonate (PC)
8		
9	Sight glass seal	EPDM
10	Screw	A2-70
11	Sealing ring	EPDM
12	Snap ring	PA6
13	Screw	A4-50 Thread coating: Heat-curing lubricant varnish
14	External ground terminal	AISI 304 (1.4301)
15	Cable entry M20	Polyamide (PA), for dust ignition-proof: CuZn nickel-plated
16	Seal of cable entry and plug	Silicone (VMQ)
17	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)

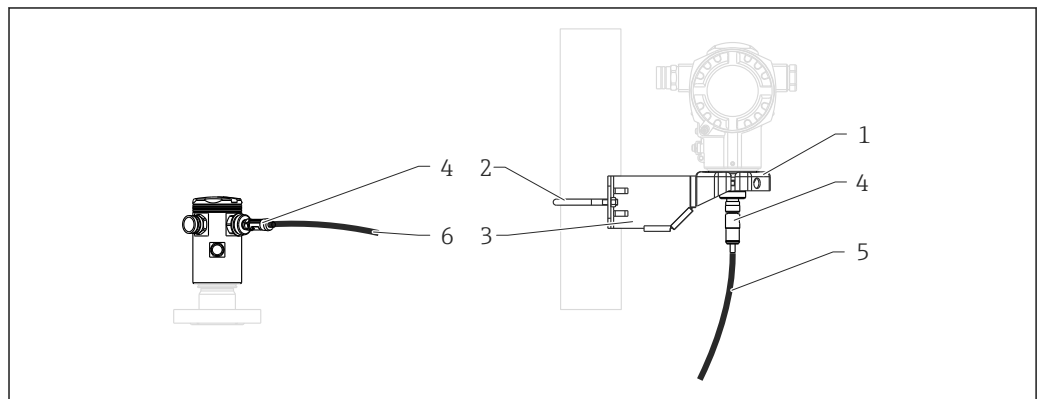
Sensor modules



A0021295

Item number	Component part	Material
1	Sensor module housing and cover	Aluminum with protective powder-coating on polyester base AISI 316L (1.4404)
2	Pressure compensation filter	PA6 GF10 or 316L (1.4404)
3	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)
	Seal	Silicone (VMQ)
4	Conduit adapter NPT 1/2"	316L
5	Snap ring for cover	PP
6	Earth connection box	316L
7	Nameplates	Plastic film

Connecting parts



A0016497

Item number	Component part	Material
1	Mounting bracket	Bracket AISI 316L (1.4404)
2		Screw and nuts A4-70
3		Half-shells: AISI 316L (1.4404)
4	M12 plug	PP and stainless steel
5	Cable for transmitter connection	PE-X halogen-free
6	Cable for sensor connection	PE-X halogen-free

**Filling oil**

Description	Option <sup>1)</sup>
silicone oil	1
Inert oil (on request)	2
Synthetic oil, FDA	3

1) Product Configurator, order code for "Process connection"

## Operability

### Operation concept

#### Operator-oriented menu structure for user-specific tasks

- Commissioning
- Software operation
- Diagnostics
- Expert level

#### Quick and safe commissioning

Guided menus for applications

#### Reliable operation

- Local operation possible in up to two languages
- Standardized operation at the device and in the operating tools
- Parameters relating to measured values can be locked/unlocked using the device's write protection switch, using the device software or via remote operation

#### Efficient diagnostic behavior increases measurement availability

- Remedial measures are integrated in plain text
- Diverse simulation options

### Local operation

#### Functions

Function	External operation (operating keys, optional)	Internal operation (electronic insert)	Onsite display (optional)
Position adjustment (zero point correction)	✓	✓	✓
Setting lower range value and upper range value - reference pressure present at the device	✓	✓	✓
Device reset	✓	✓	✓
Locking and unlocking parameters relevant to the measured value	✓ (only if display is connected)	✓	✓
Value acceptance indicated by the green LED	—	✓	✓
Switching damping on and off	✓ (only if display is connected)	✓	✓
Min. Switch on min. alarm	✓ (only if display is connected)	✓	✓

#### Operating the device using onsite display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The onsite display shows measured values, dialog text as well as fault and notice messages in plain text, thereby supporting the user in every stage of operation.

The display can be removed for easy operation.

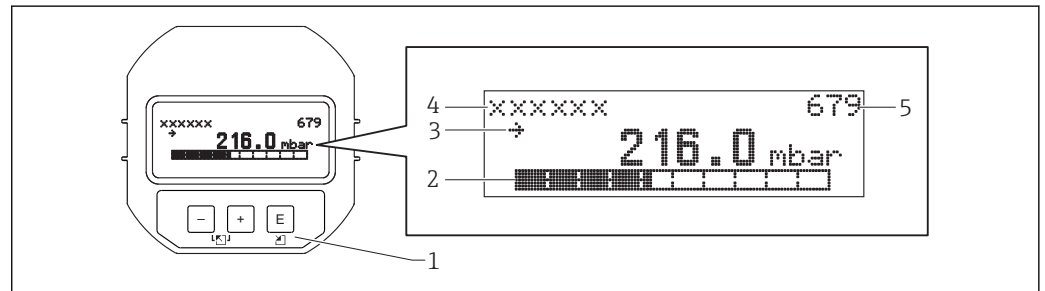
The device display can be turned in 90° steps.

Depending on the installation position of the device, this makes it easy to operate the device and read the measured value.

Functions:

- 8-digit measured value display including sign and decimal point, bargraph for 4 to 20 mA HART as current display.
- Simple and complete menu guidance due to breakdown of parameters into several levels and groups.
- Each parameter is given a 3-digit ID number for easy navigation.
- Option for configuring the display according to individual requirements and preferences, such as language, alternating display, display of other measured values such as sensor temperature, contrast setting.
- Comprehensive diagnostic functions (fault and warning message, peak-hold indicators, etc.).
- Quick and safe commissioning

Overview

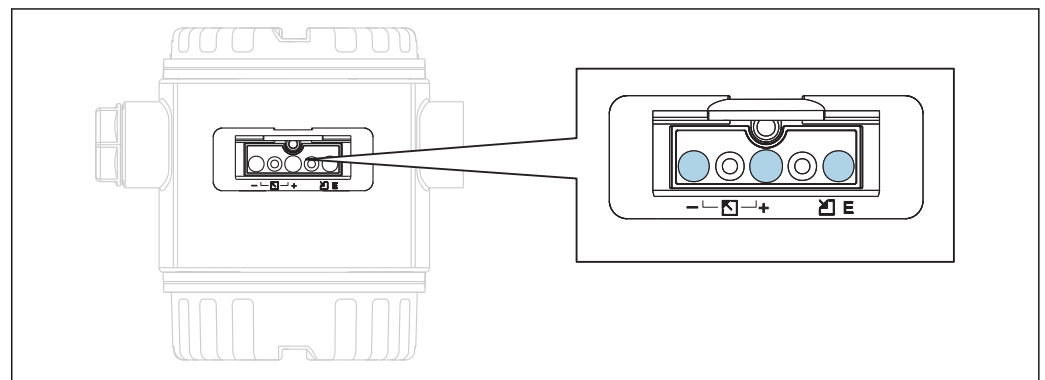


A0016498

- 1 Operating keys
- 2 Bargraph
- 3 Symbol
- 4 Header
- 5 Parameter ID number

Operating keys on the exterior of the device

With the T14 housing (aluminum or stainless steel), the operating keys are located either outside of the housing, under the protection cap or inside on the electronic insert. In addition, devices with an onsite display and a 4 to 20 mA HART electronic insert have operating keys on the onsite display.

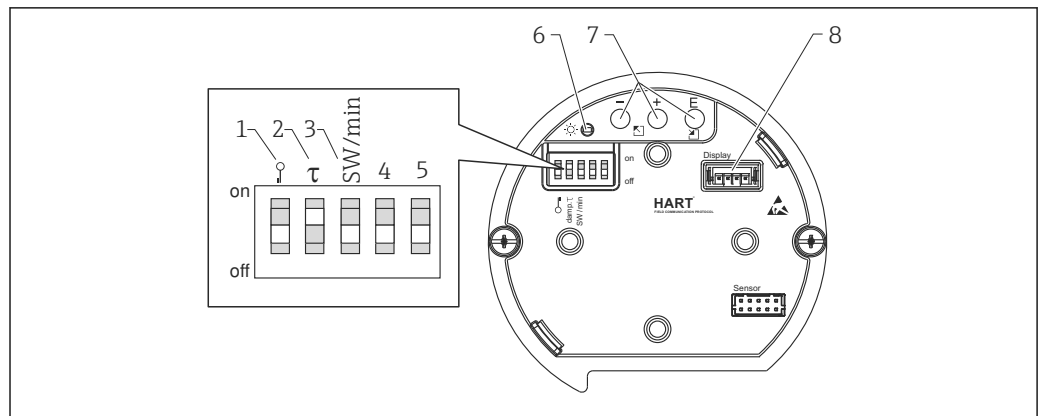


A0016499

The operating keys on the outside of the device make it unnecessary to open the housing. This guarantees:

- Complete protection against environmental influences such as moisture and contamination
- Simple operation without any tools
- No wear.

### Operating keys and elements located internally on the electronic insert



A0016500

- 1 DIP switch for locking/unlocking parameters relevant to the measured value
- 2 DIP switch for switching damping on/off
- 3 DIP switch for alarm current SW/Alarm min (3.6 mA)
- 4...5 Not assigned
- 6 Green LED to indicate value being accepted
- 7 Operating keys
- 8 Slot for optional display

### Operating languages

You can also choose another language in addition to the standard language "English":

Description	Version <sup>1)</sup>
English (standard)	AA
German	AB
French	AC
Spanish	AD
Italian	AE
Portuguese	AG
Chinese simplified	AK
Japanese	AL

1) Product Configurator, "Additional operating language" section



## Certificates and approvals

**CE approval** The device meets the legal requirements of the relevant EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

**RoHS** FMD72:  
The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).

**RCM-Tick marking** The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products are labelled with the RCM- Tick marking on the name plate.



A0029561

**Ex approvals**

- ATEX
- FM
- CSA
- IECEX
- NEPSI

All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all Ex-systems .

**Suitability for hygienic processes** The device is available with hygienic process connections (overview: see order code). The materials of the hygienic process connections in contact with food comply with Regulation (EC) 1935/2004.

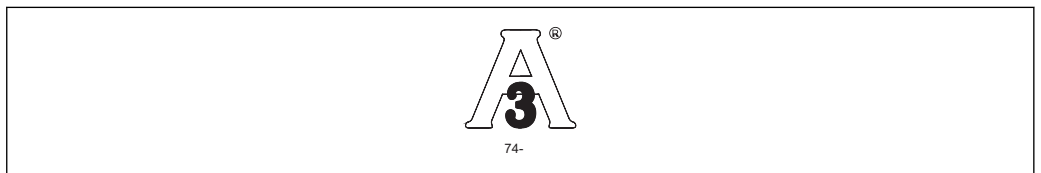
**⚠ CAUTION**

**Contamination in the process!**

Risk of contamination if incorrect seals and parts are used!

- ▶ To avoid the risk of contamination, when installing the device comply with the design principles of EHEDG, Guideline 37 "Hygienic Design and Application of Sensors" and Guideline 16 "Hygienic Pipe Couplings".
- ▶ Suitable assemblies and seals must be used to ensure hygienic design in accordance with 3-A SSI and EHEDG specifications.
- ▶ The leak-proof connections can be cleaned with the cleaning methods typical of this industry (CIP and SIP). Attention must be paid to the pressure and temperature specifications of the sensor and process connections for CIP and SIP processes (clean in place/sterilize in place).

**i** The gap-free connections can be cleaned of all residue using the typical cleaning methods within this industry.



A0029561

**Pressure Equipment Directive 2014/68/EU (PED)** **Pressure equipment with allowable pressure ≤ 200 bar (2 900 psi)**  
Pressure equipment (having a maximum allowable pressure  $PS \leq 200$  bar (2 900 psi)) can be classified as pressurized equipment in accordance with Pressure Equipment Directive 2014/68/EU. If the maximum allowable pressure is  $\leq 200$  bar (2 900 psi) and the pressurized volume of the pressure equipment is  $\leq 0.1$  l, the pressure equipment is subject to the Pressure Equipment Directive (cf. Pressure Equipment Directive 2014/68/EU, Article 4, point 3). The Pressure Equipment Directive only requires that the pressure equipment shall be designed and manufactured in accordance with the "sound engineering practice of a Member State".

*Reasons:*

- Pressure Equipment Directive (PED) 2014/68/EU Article 4, point 3
- Pressure equipment directive 2014/68/EU, Commission's Working Group "Pressure", Guideline A-05 + A-06

*Note:*

A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

**Manufacturer declaration**

Depending on the desired configuration, the following documents can be ordered additionally with the device:

- FDA conformity
- TSE-free, materials free from animal origin
- Regulation (EC) No. 2023/2006 (GMP)
- Regulation (EC) No. 1935/2004 on materials and articles intended to come into contact with food

**Downloading the Declaration of Conformity**

<http://www.endress.com/en/download>

A0031778

1. Select "Approvals & Certificates"
2. Select "Manufact. Declaration"
3. Enter the required product code
4. Click "Search"

The available downloads are displayed.

**Other standards and guidelines**

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity. The following were also applied:

**EN 60529:**

Degrees of protection by housing (IP code)

**DIN EN 60770 (IEC 60770):**

Transmitters for use in industrial process control systems Part 1: Methods for performance evaluation

Methods for evaluating the performance of transmitters for control and regulation in industrial process control systems.

**DIN 16086:**

Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications in data sheets

Procedure for writing specifications in data sheets for electrical pressure measuring instruments, pressure sensors and pressure transmitters.

**EN 61326-X:**

EMC product family standard for electrical equipment for measurement, control and laboratory use.

**NAMUR - 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.

NE32 - Data Retention in the Event of a Power Failure in Field and Control Instruments with Microprocessors

NE44 - Standardization of Status Indicators on PCT Instruments with the Help of Light Emitting Diodes

NE53 - Software of Field Devices and Signal-processing Devices with Digital Electronics

NE107 - Self-monitoring and Diagnosis of Field Devices

**CRN approvals**

Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device. The CRN-approved devices are assigned a registration number.

Ordering information: Product Configurator, order code for "Process connection" (the CRN process connections are indicated appropriately in the "Mechanical construction" section.)

**Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ISA 12.27.01**

Endress+Hauser devices are designed in accordance with ANSI/ISA 12.27.01. allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North-American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids. Please refer to the following table for the seal class assigned (single seal or dual seal):

Device	Approval	Single seal MWP
Deltabar FMD71/FMD72	CSA, FM IS, XP, NI	40 bar (580psi)

Further information can be found in the control drawings of the relevant devices.

**Calibration unit**

Description	Option <sup>1)</sup>
Level range; %	A
Differential pressure range; mbar/bar	B
Differential pressure range; kPa/MPa	C
Differential pressure range; mm/mH2O	D
Differential pressure range; inH2O/ftH2O	E
Differential pressure range; psi	F
Customer-specific level; see additional spec.	K
Customer-specific pressure; see additional spec.	J

1) Product Configurator, order code for "Calibration; unit"

**Calibration**

Description	Option <sup>1)</sup>
Factory calibration certificate, 5-point	F1

1) Product Configurator order code for "Calibration"

**Inspection certificates**

Description	Option <sup>1)</sup>
3.1 Material certificate, wetted metallic parts, EN10204-3.1 inspection certificate	JA <sup>2)</sup>
Conformity to NACE MR0175, wetted metallic parts	JB <sup>2)</sup>
Helium leak test, internal procedure, inspection certificate	KD
Pressure test, internal procedure, inspection certificate	KE
PMI test (XRF), internal procedure, metal parts in contact with the medium, inspection certificate	KG

- 1) Product Configurator order code for "Test, certificate"
- 2) The selection of this feature for coated process isolating diaphragms / process connections refers to the metallic base material.

## Ordering information

Detailed ordering information is available as follows:

- In the Product Configurator on the Endress+Hauser website: [www.endress.com](http://www.endress.com) → Click "Corporate" → Select your country → Click "Products" → Select the product using the filters and search field → Open product page → The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: [www.addresses.endress.com](http://www.addresses.endress.com)



### Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic generation of the order code with its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

### Scope of delivery

- Measuring device
- Optional accessories
- Brief Operating Instructions
- Certificates

### Measuring point (TAG)

<b>Ordering feature</b>	895: Marking
<b>Option</b>	Z1: Tagging (TAG), see additional spec.
<b>Position of the measuring point marking</b>	To be selected in the additional specifications: <ul style="list-style-type: none"> <li>■ Tag plate Stainless Steel</li> <li>■ Self-adhesive paper label</li> <li>■ Supplied label/plate</li> <li>■ RFID TAG</li> <li>■ RFID TAG + Tag plate Stainless Steel</li> <li>■ RFID TAG + Self-adhesive paper label</li> <li>■ RFID TAG + Supplied label/plate</li> </ul>
<b>Definition of the measuring point designation</b>	To be defined in the additional specifications: 3 lines containing up to 18 characters each  The measuring point designation appears on the selected label and/or the RFID TAG.
<b>Identification on electronic nameplate (ENP)</b>	32 characters

## Supplementary documentation

<b>Field of Activities</b>	Pressure measurement, powerful instruments for process pressure, differential pressure, level and flow: FA00004P/00/EN
<b>Technical Information</b>	<ul style="list-style-type: none"> <li>■ EMC test procedures TI00241F/00/EN</li> <li>■ Weld-in adapter, adapter and flanges: TI00426F/00/EN</li> </ul>
<b>Operating Instructions</b>	BA01044P/00/EN
<b>Brief Operating Instructions</b>	KA01105P/00/EN - Brief Operating Instructions for devices SD00354P/00/A2 - Screening with Cable Shield
<b>Safety Instructions (XA)</b>	Safety Instructions (XA) are supplied with the device depending on the approval. These instructions are an integral part of the Operating Instructions.

Device	Directive	Documentation	Option <sup>1)</sup>
FMD71, FMD72	ATEX II 1/2G Ex ia IIC T6 Ga/Gb	XA00619P	BA
FMD71, FMD72	ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb	XA00620P	BC
FMD71, FMD72	ATEX II 3G Ex nA IIC T6 GC	XA00621P	BD
FMD71, FMD72	IEC Ex ia IIC T6 Ga/Gb	XA00622P	IA
FMD71, FMD72	IEC Ex d [ia] IIC T6 Ga/Gb	XA00623P	IB
FMD71, FMD72	CSA General Purpose	-	CD
FMD71, FMD72	NEPSI Ex ia IIC T4/T6 Ga/Gb	XA01352P	NA
FMD71, FMD72	NEPSI Ex d [ia] IIC T4/T6 Ga/Gb	XA01353P	NB
FMD71, FMD72	INMETRO Ex ia IIC T6...T4 Ga/Gb	XA01378P	MA
FMD71, FMD72	INMETRO Ex d [ia] IIC T6...T4 Ga/Gb	XA01379P	MC
FMD71, FMD72	EAC Ga/Gb Ex ia IIC T6...T4	XA01594P	GA
FMD71, FMD72	EAC Ga/Gb Ex d [ia] IIC T6...T4 X	XA01595P	GB
FMD71	FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00628P	FA
FMD71	FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00629P	FB
FMD71	CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00631P	CB
FMD71	FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00668P	FD
FMD71	CSA C/US NI, Cl.I Div. 2, Gr.A-D Cl.I, Zone 2, IIC	XA00670P	CC
FMD71	CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00630P	CA
FMD72	CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00626P	CA
FMD72	CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00627P	CB
FMD72	CSA C/US NI, Cl.I Div.2 Gr.A-D, Zone 2	XA00671P	CC
FMD72	FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00624P	FA
FMD72	FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00625P	FB
FMD72	FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00669P	FD

1) Product Configurator order code for "Approval"



The nameplate provides information on the Safety Instructions (XA) that are relevant for the device.

## Registered trademarks

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**HART®**

Registered trademark of the HART Communication Foundation, Austin, USA



[www.addresses.endress.com](http://www.addresses.endress.com)

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