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Magnetic inductive Flow Meter MFI447

- **Very compact design**
- **High precision (± 0.5 %) with flow speed > 0.5 m/s (optional ± 0.3 % for nominal widths DN3..15) < ± 1% for DN1 and DN2**
- **No moving parts in the medium being measured**
- **Measurement of flowing, pulpy, or pasty media**
- **Continuously variable housing rotation (± 170°)**
- **Operation from outside without aids**
- **Conformity in accordance with 3-A**
- **CIP- / SIP capable**
- **Integrated electronic flow meter**
- **Integrated dosing control (optional)**

Characteristics

A magnetic inductive flow meter is primarily composed of a measuring tube, a magnetic circuit, and two electrodes. Medium with a minimum electrical conductivity flows through the measuring tube. A magnetic field oriented vertically in relation to the flow direction is applied from outside via coils. A voltage is induced in the medium and tapped at the two electrodes on opposite sides. This is proportional to the flow speed of the medium to be measured. Based on the known tube geometry, the electronics calculates the current volume flow rate. The data for the outputs and the integrated volume meter are derived from this value.
The MFI447 has been designed for measurements of flowing, pulpy, or pasty media with a minimum electrical conductivity of > 5 µS.

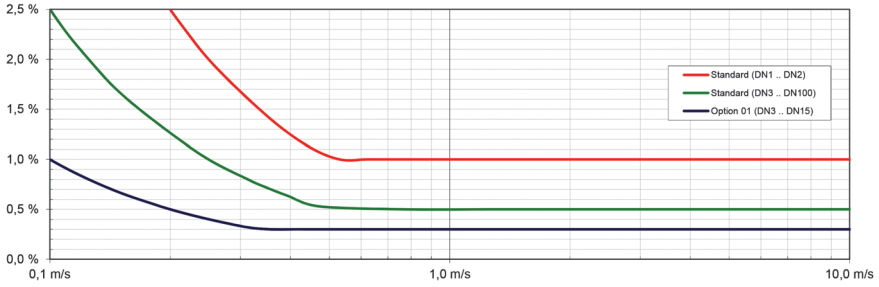
Technical data

Auxiliary energy
Auxiliary voltage : 18..30 V DC, max. 100 mA
Power consumption : max. 5 W
Electrical connection : M12 plug, 5-pin
Galvanic separation : Sensors / auxiliary volt., outputs / housing
CE conformity : EN 61326-1:2013,
EN 61326-2-3:2013

Environmental conditions
Environmental temperature : -20..+60 °C
Climate classification : EN 60068-2-38:2009
Vibrations : EN 60068-2-6:2008, GL Test 2
Approval : Conformity: 3-A
Metering range : 0..12 m/s
Basic precision : ±1 % (DN1 and DN2)
±0.5% optional ±0.3 % v. M. (DN3..15)
Min. conductivity : > 5 µS/cm,
> 20 µS/cm for demineralised water
> 20 µS/cm for DN1..2
Process temperature : -20 .. +130 °C, 150 °C < 60 min
CIP-/SIP-capable ($T_{env.}$ 25°C)
Process pressure : DN3..40 ≤ 40 bar
DN50, DN80 ≤ 16 bar
DN1, DN2, DN65, DN100 ≤ 10 bar
Process material : Coating: PEEK (DN1..2)
PFA (DN3..100)
Electrodes: 1.4539
Pipe connection: 1.4435
Seal: EPDM
FDA-compliant
Conform regulation EC 1935/2004 & 10/2011
Process connection : Weld spigots, Tri-Clamp DIN 32676, DIN11851 milk tube, DIN11864-1 Form A Südmo aseptic connection
Housing : Round stainless steel housing Ø 79 mm
Material : 1.4305
Ingress protection : IP67 / IP69K
Viewing window : Acrylic glass (PMMA)
Electrical outputs
Analogue : Active, 0/4..20 mA, Resistance < 600 Ohm
Switching outputs : 2 x transistor PNP / NPN programmable max. 30 V DC,100 mA
Programmable as:
- Pulse output (max. 10 kHz)
- Switching output
- Control input

Display : backlit graphic LCD
Operation : 4 capacitive buttons

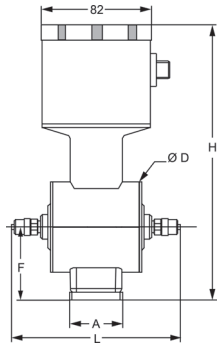
Error curves for basic precision 1 % of the measured value, 0.5 % of the measured value. (Standard) and 0.3 % of the measured value (Option 01)



Flow speed

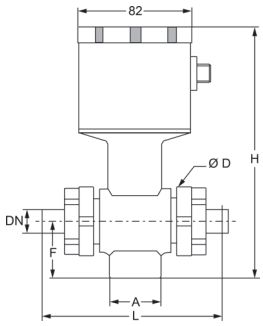
Process connection dimensions

DN1..DN2
1/8“ female thread



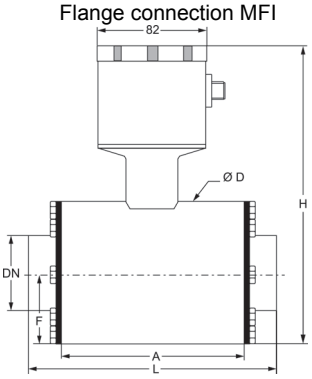
(Figure with PVC hose connection)

DN3..DN40
Process thread MFI



(Figure with welded-on nozzle process connection)

DN50..DN100
Flange connection MFI



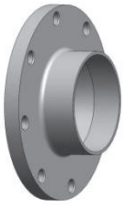
(Figure with welded-on nozzle process connection)

The MFI447 base unit is equipped with a 1/8" sanitary female thread on both sides and is supplied with PV hose connection pieces for hose inside diameter 4 mm / outside diameter = 6mm as standard equipment.

'Welded-on nozzle' process connection with union nut for DN 3..40 devices

For installation size DN3..DN8, the following applies:
With tube widths <DN10, only the measuring tube in the device is adapted to the nominal diameter. The connection nozzle is always DN10.

'Welded-on nozzle' process connection with flange for DN 50..100 devices



Housing dimensions

	DN1..DN2	DN3..DN15	DN20	DN25	DN32	DN40	DN50	DN65	DN80	DN100
H (overall) [mm]	215	175	185	194	203	212	208	230	247	275
F (axis height) [mm]	59	38.5	43	48	53	57	50	58	67	81
D (housing diameter) [mm]	73	44	63	63	78	78	100	116	133	160
A (housing width [mm]	43	37	42	54	62	67	128	114	114	145

Order information

For operation of the MFI447 flow meter, the appropriate process connection is always required in addition to the base unit in order to be able to integrate the device in pipelines.
The process connection is ***not*** included in the scope of supply of the base unit (except for with installation sizes DN1 and DN2), and must be ordered separately. A process connection always comprises two connection nozzles.

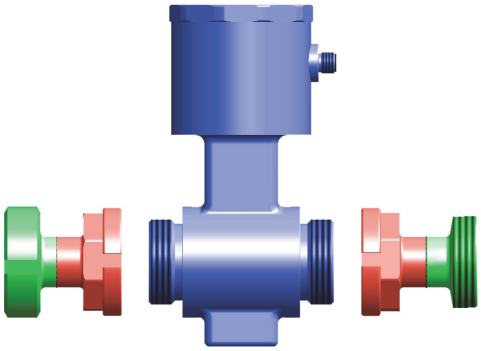


Figure:
MFI447 DN25 base unit with process connection AP232-025 milk tube screw coupling in accordance with DIN 11851.

left: reduction nozzle with union nut
right: threaded nozzle

Overview of process connections with union nut, DN 3..40

Process process connection	Figure	Pipe standard	Ordering code – DN (nominal Ø) see also page 15
Welded-on nozzle both sides		DIN EN 10357, Series B DIN EN 10357, Series A DIN 11866 Series A DIN 11866 Series B DIN 11866 Series C OD tube ISO2037	APF 110-□□□-00 APF 210-□□□-00 APF 310-□□□-00 APF 410-□□□-00 APF 510-□□□-00 APF 610-□□□-00 APF 710-□□□-00
Tri-Clamp in accordance with DIN 32676 both sides		DIN EN 10357, Series A DIN 11866 Series A DIN 11866 Series B DIN 11866 Series C OD Tube ISO2037	APF 220-□□□-00 APF 320-□□□-00 APF 420-□□□-00 APF 520-□□□-00 APF 620-□□□-00 APF 720-□□□-00
Milk tube threaded nozzle in accordance with DIN 11851, both sides		DIN EN 10357, Series A	APF 230-□□□-00
Milk tube reduction nozzle with union nut in accordance with DIN 11851 one side **Milk tube threaded nozzle** opposite side		DIN EN 10357, Series A	APF 232-□□□-00
Aseptic threaded nozzle in accordance with DIN 11864-1 (Form A with O-ring) both sides		DIN EN 10357, Series A DIN 11866 Series A DIN 11866 Series B DIN 11866 Series C OD tube ISO2037	APF 240-□□□-00 APF 340-□□□-00 APF 440-□□□-00 APF 540-□□□-00 APF 640-□□□-00 APF 740-□□□-00
Aseptic collared nozzle with union nut in accordance with DIN 11864-1, one side **Aseptic threaded nozzle** opposite side		DIN EN 10357, Series A DIN 11866 Series A DIN 11866 Series B DIN 11866 Series C OD tube ISO2037	APF 242-□□□-00 APF 342-□□□-00 APF 442-□□□-00 APF 542-□□□-00 APF 642-□□□-00 APF 742-□□□-00
Hose nozzles both sides			APF 860-□□□-□□-00

Additional process connections are available on request.

Overview of process connections with flange, DN 50..100

Process process connection	Figure	Pipe standard	Ordering code – DN (nominal Ø) see also page 15
Welded-on nozzle both sides		DIN EN 10357, Series B DIN EN 10357, Series A DIN 11866 Series A DIN 11866 Series B DIN 11866 Series C OD tube ISO2037	APF 110-□□□-00 APF 210-□□□-00 APF 310-□□□-00 APF 410-□□□-00 APF 510-□□□-00 APF 610-□□□-00 APF 710-□□□-00
Tri-Clamp in accordance with DIN 32676 both sides		DIN EN 10357, Series A DIN 11866 Series A DIN 11866 Series B DIN 11866 Series C OD Tube ISO2037	APF 220-□□□-00 APF 320-□□□-00 APF 420-□□□-00 APF 520-□□□-00 APF 620-□□□-00 APF 720-□□□-00
Milk tube threaded nozzle in accordance with DIN 11851, both sides		DIN EN 10357, Series A	APF 230-□□□-00
Milk tube reduction nozzle with union nut in accordance with DIN 11851 one side **Milk tube threaded nozzle** opposite side		DIN EN 10357, Series A	APF 232-□□□-00
Aseptic threaded nozzle in accordance with DIN 11864-1 (Form A with O-ring) both sides		DIN EN 10357, Series A DIN 11866 Series A DIN 11866 Series B DIN 11866 Series C OD tube ISO2037	APF 240-□□□-00 APF 340-□□□-00 APF 440-□□□-00 APF 540-□□□-00 APF 640-□□□-00 APF 740-□□□-00
Aseptic collared nozzle with union nut in accordance with DIN 11864-1, one side **Aseptic threaded nozzle** opposite side		DIN EN 10357, Series A DIN 11866 Series A DIN 11866 Series B DIN 11866 Series C OD tube ISO2037	APF 242-□□□-00 APF 342-□□□-00 APF 442-□□□-00 APF 542-□□□-00 APF 642-□□□-00 APF 742-□□□-00
Hose nozzles both sides			APF 860 see page 15

Additional process connections are available on request.

Pipe dimensions and installation lengths (MFI447 with process connection on both sides)

Installation lengths with process connection in accordance with DIN EN 10357, Series A (formerly DIN 11850, Series 2): (APF2XX, material 1.4404) and DIN 11866 Series A (APF3XX, material 1.4435)

DIN EN 10357, Series A DIN 11866, Series A			Welded-on nozzle both sides	Tri-Clamp DIN 32676 both sides	Milk tube screw coupling DIN 11851 (only for DIN EN 10357, Series A)		Aseptic thread connection DIN 11864-1 Form A	
Ø MFI DN	Nominal pipe width DN	Pipe dimensions Outside Ø x wall thickness Do x S [mm]			Threaded nozzle both sides	Threaded nozzle - Reduction nozzle	Threaded nozzle both sides	Threaded nozzle - Collared nozzle
Order code			APF210-... APF310-...	APF220-... APF320-...	APF230-...	APF232-...	APF240-... APF340-...	APF242-... APF342-...
3	010	13x1.5	127	163	169	165	165	163
4	010	13x1.5	127	163	169	165	165	163
6	010	13x1.5	127	163	169	165	165	163
8	010	13x1.5	127	163	169	165	165	163
10	010	13x1.5	127	163	169	165	165	163
15	015	19x1.5	127	163	169	165	165	163
20	020	23x1.5	132	168	180	174	174	171
25	025	29x1.5	149	192	207	200	201	197
32	032	35x1.5	166	209	230	223	226	221
40	040	41x1.5	171	214	237	230	233	228
50	050	53x1.5	173	216	243	236	235	234
65	065	70x2.0	165	221	245	237	237	235
80	080	85x2.0	169	225	259	251	253	249
100	100	104x2.0	199	255	307	297	299	295

Installation lengths with process connection in accordance with DIN EN 10357, Series B (formerly DIN 11850, Series 1): (APF110, material 1.4404)

DIN EN 10357, series B (material 1.4404)			Welded-on nozzle both sides	Tri-Clamp DIN 32676 both sides	Milk tube screw coupling DIN 11851		Aseptic thread connection DIN 11864-1 Form A	
Ø MFI DN	Nominal pipe width DN	Pipe dimensions Outside Ø x wall thickness Do x S [mm]			Threaded nozzle both sides	Threaded nozzle - Reduction nozzle	Threaded nozzle both sides	Threaded nozzle - Collared nozzle
Order code			APF110-...					
3	010	12x1	127	-	-	-	-	-
4	010	12x1	127	-	-	-	-	-
6	010	12x1	127	-	-	-	-	-
8	010	12x1	127	-	-	-	-	-
10	010	12x1	127	-	-	-	-	-
15	015	18x1	127	-	-	-	-	-
20	020	22x1	132	-	-	-	-	-
25	025	28x1	149	-	-	-	-	-
32	032	34x1	166	-	-	-	-	-
40	040	40x1	171	-	-	-	-	-
50	050	52x1	173	-	-	-	-	-

Installation lengths with process connection in accordance with DIN 11866 Series B / DIN EN ISO1127 (APF4XX, material 1.4435)

DIN 11866 Series B / DIN EN ISO 1127			Welded-on nozzle	Tri-Clamp DIN 32676	Milk tube screw coupling DIN 11851		Aseptic thread connection DIN 11864-1 Form A	
Ø MFI DN	Nominal pipe width DN	Pipe dimensions Outside Ø x wall thickness Do x S [mm]	both sides	both sides	Threaded nozzle both sides	Threaded nozzle - Reduction nozzle	Threaded nozzle both sides	Threaded nozzle - Collared nozzle
Order code			APF410-...	APF420-...			APF440-...	APF442-...
3	008	13,5x1.6	127	162.6	-	-	165	163
4	008	13,5x1.6	127	162.6	-	-	165	163
6	008	13,5x1.6	127	162.6	-	-	165	163
8	008	13,5x1.6	127	162.6	-	-	165	163
10	010	17.2x1.6	127	162.6	-	-	165	163
15	015	21.3x1.6	127	162.6	-	-	169	166
20	020	26.9x1.6	132	162.6	-	-	184	180
25	025	33.7x1.6	149	267.0	-	-	209	204
32	032	42.4x2.0	166	267.0	-	-	228	223
40	040	48.3x2.0	171	280.0	-	-	233	232
50	050	60.3x2.0	173	280.0	-	-	245	243
65	065	76.1x2.0	165	225.0	-	-	249	245
80	080	88.9x2.0	169	225.0	-	-	269	265

Installation lengths with process connection in accordance with DIN 11866, Series C (APF 5XX, material 1.4435) and OD tube (APF 6XX, material 1.4404)

DIN 11866, Series C OD tube			Welded-on nozzle	Tri-Clamp DIN 32676	Milk tube screw coupling DIN 11851		Aseptic thread connection DIN 11864-1 Form A	
Ø MFI DN	Nominal pipe width DN	Pipe dimensions Outside Ø x wall thickness Do x S [mm]	both sides	both sides	Threaded nozzle both sides	Threaded nozzle - Reduction nozzle	Threaded nozzle both sides	Threaded nozzle - Collared nozzle
Ordering code			APF510-... APF610-...	APF520-... APF620-...			APF540-... APF640-...	APF542-... APF642-...
3	3/8	9.53x0.89	127	152.4	-	-	165	163
4	3/8	9.53x0.89	127	152.4	-	-	165	163
6	3/8	9.53x0.89	127	152.4	-	-	165	163
8	3/8	9.53x0.89	127	152.4	-	-	165	163
10	½	12.7x1.65	127	152.4	-	-	165	163
20	¾	19.05x1.65	132	152.4	-	-	170	168
25	1	25.4x1.65	149	192.0	-	-	201	197
40	1½	38.1x1.65	171	214.0	-	-	233	228
50	2	50.8x1.65	173	229.0	-	-	235	224
65	2½	63.5x1.65	165	221.0	-	-	237	235
80	3	76.2x1.65	169	225.0	-	-	253	249
100	4	101.6x2.11	199	225.0	-	-	299	295

Installation lengths with process connection in accordance with ISO 2037 (APF 7X0, material 1.4404)
-> new standard EN10357-C

ISO 2037			Welded-on nozzle	Tri-Clamp DIN 32676	Milk tube screw coupling DIN 11851		Aseptic thread connection DIN 11864-1 Form A	
Ø MFI DN	Nominal pipe width DN	Pipe dimensions Outside Ø x wall thickness Do x S [mm]	both sides	both sides	Threaded nozzle both sides	Threaded nozzle - Reduction nozzle	Threaded nozzle both sides	Threaded nozzle - Collared nozzle
Order code			APF710-...	APF720-...			APF740-...	APF742-...
25	1"	25.0x1.6	149	192	-	-	201	197
32	1 ¼"	31.8x1.6	-	-	-	-	-	-
40	1 ½"	31.8x1.6	171	214	-	-	233	228
50	2"	51x1.6	173	216	-	-	235	234
65	2 ½"	63.5x1.6	165	221	-	-	237	235
80	3"	76.1x1.6	169	225	-	-	253	249
100	4"	101.6x2.01	199	255	-	-	299	295

Hose nozzle process connection (APF 860, material 1.4404)

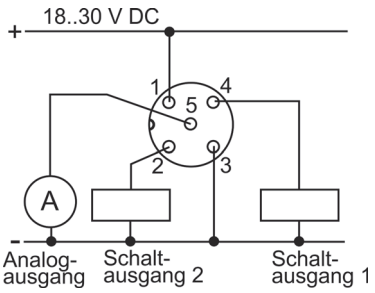
available for all nominal device diameters, specify hose inside diameters –XX in the ordering code)

Ø MFI DN	Hose inside Ø Di [mm]	Hose nozzle both sides
Order code		
1	4	APF860-001-XX-00
2	4	APF860-002-XX-00
3	13	APF860-003-XX-00
4	13	APF860-004-XX-00
6	13	APF860-006-XX-00
8	13	APF860-008-XX-00
10	13	APF860-010-XX-00
15	19	APF860-015-XX-00
20	23	APF860-020-XX-00
25	29	APF860-025-XX-00
32	35	APF860-032-XX-00
40	41	APF860-040-XX-00
50	53	APF860-050-XX-00
65	70	APF860-065-XX-00
80	85	APF860-080-XX-00
100	104	APF860-100-XX-00

Wiring

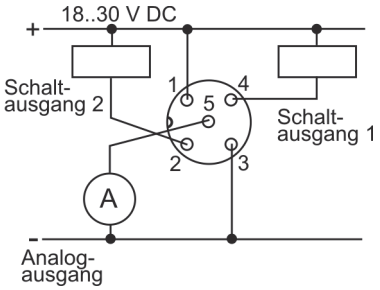
M12 plug connection

PNP (Push)



M12 plug connection

NPN (Pull)



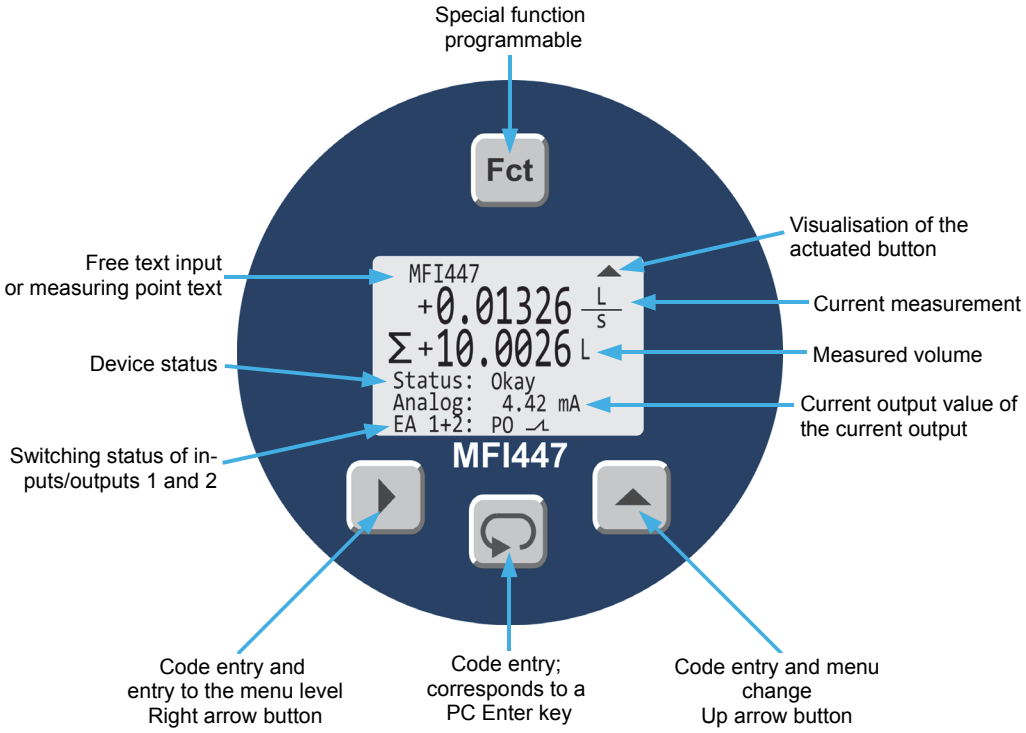
Cable colours: 1 = brown, 2 = white, 3 = blue, 4 = black, 5 = grey

Display and operation

Four capacitive buttons are provided. The function of the individual buttons depends on the operating status of the MFI447.

NOTE: Capacitive buttons react to the change in capacity due to the approach of the finger. They have not moving parts and are thus very durable. However, gloves, dirt, and moisture can cause malfunctions.
The LC display shows measurements and status information during measuring operation. The display values change depending on the parameterisation and status of the device.

The display is generally divided as follows:



List of parameters - operating structure of the MFI447

1. Menu level	2. Menu level
	Parameter
	0.2 Read data
1 - Application data	1.1 Measuring point
	1.2 Operating language
	1.3 Reset meter
	1.4 Function key
2 - Sensor input	2.1 Measuring range
	2.2 Time constant
	2.3 Leak flow volume
	2.4 Flow direction
	2.5 Zero point
3 – Input/output 1	3.1 I/O function
	If switching output has been selected
	3.2 Hardware config.
	3.3 Switching function
	If switching point has been selected
	3.4 ON switching point
	3.5 OFF switching point
	If pulse output has been selected
	3.2 Hardware config.
	3.3 Output version
	3.4 Pulse value
	3.5 Pulse width
	If control input has been selected
	3.2 Hardware config.
	3.3 Control function
	If analogue input has been selected
	3.2 Scaling 1
	3.3 Scaling 2
4 – Input/output 2	4.1 I/O function
	If switching output has been selected
	4.2 Hardware config.
	4.3 Switching function
	If switching point has been selected
	4.4 ON Switching value
	4.5 OFF Switching value
	If pulse output has been selected
	4.2 Hardware config.
	4.3 Output version
	4.4 Pulse value
	4.5 Pulse width
	If control input has been selected
	4.2 Hardware config.
	4.3 Control function
	If analogue input has been selected
	4.2 Scaling 1
	4.3 Scaling 2

1. Menu level	2. Menu level
	Parameter
5 - Analogue output	5.1 Function
	5.2 Range
6 - Filling function	6.1 Fill function
	6.2 Target volume
7 - LC display	7.1 Flow rate display
	7.2 Flow speed
	7.3 Positive meter
	7.4 Negative meter
	7.5 Totaliser
	7.6 Status display
	7.7 Display change
	7.8 LCD contrast
	7.9 LCD brightness
8 - Test functions	8.1 Input/output 1
	8.2 Input/output 2
	8.3 Analogue output
9 - Information	9.1 ADW version
	9.2 IO version
	9.3 Nominal width
	9.4 Field frequency
	9.5 Nominal frequency
	9.6 Calibration value
	9.7 Operating hours

Installation conditions

Potential equalisation

With the metal connection between welded-on nozzle and/or a different process connection and the pipeline, it is assured that the measuring sensor housing has the same potential as the pipeline. The additional connection of earthing cables is only necessary with the use of plastic pipelines.

Installation

The following must be observed:

- The measuring tube must be completely filled
- The mark of the flow direction on the measuring tube must match flow direction of the pipeline
- Installation must take place without mechanical forces (torsion, bending) on the process adapter for the measuring sensor
- Seals may not protrude into the pipe cross-section, because they influence the accuracy of the device
- The transducer may not be exposed to direct sunlight

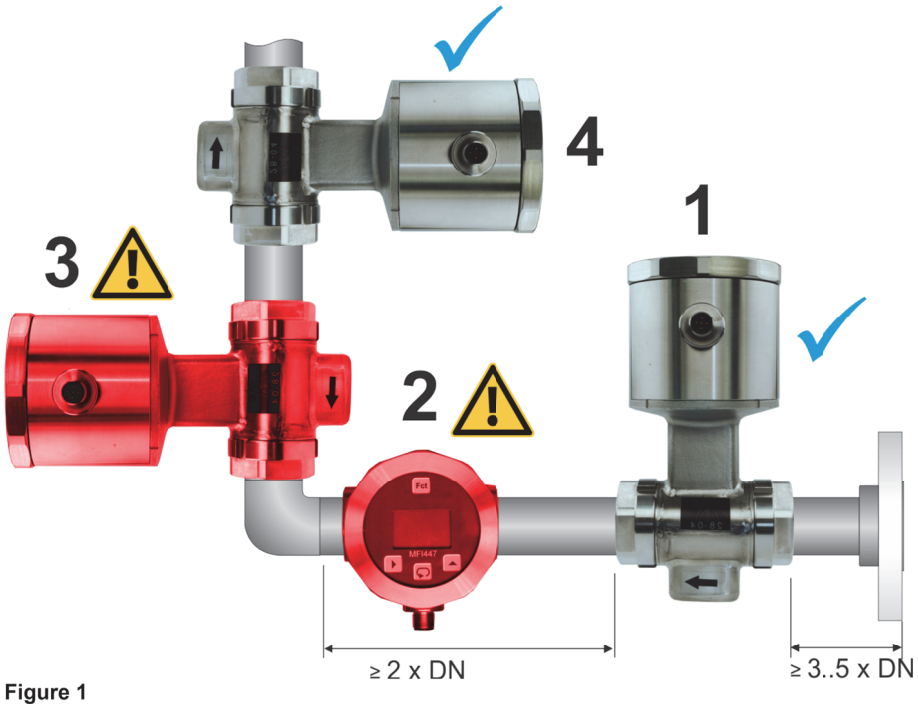


Figure 1

Position	Characteristics
1	*Ideal:* Good measuring result if no air bubbles form. Minimum distance from the pipe angle 3..5 x DN in the inlet and 2 x DN in the outlet. (DN=nominal diameter)
2	*Not recommended:* Fault-free functionality cannot be assured due to the arrangement of measuring electrodes allowing for incorrect measurements (with penetration of air).
3	*Questionable (only with free outlet):* A falling flow direction can lead to incorrect measurements.
4	*Ideal:* Good measuring result if no air bubbles form. Same minimum distance from the pipe angle as 1.

Table 1

Inlet and outlet section (Figure 1)
To avoid incorrect measurements, a straight, uninterrupted inlet section of ≥ 3..5 x DN on the inlet side of the measuring sensor and section ≥ 2 x DN on the outlet side of the measuring sensor are required.
Valves and other actuators should be installed after the measuring sensor, downstream from the outlet section.

Electrode axis, horizontal installation position (Table 1, position 1, 2).
The electrode axis should be horizontal. If this is not possible, it must be ensured that the electrode axis comes into contact in the pipeline at the 2:00 position, and not at the highest point (12:00 installation position).

Free outlet, fall pipe (Table 1, position 3).
In order to prevent the accumulation of gas and air, do not install the measuring device at the highest point (risk of air accumulation) or immediately before a free outlet or in a fall pipe. With fall pipes having a distance to the upper point of the measuring point of > 5 m, a siphon or degassing valve must be provided. This will prevent a breakaway of the liquid flow and thus the penetration of air.

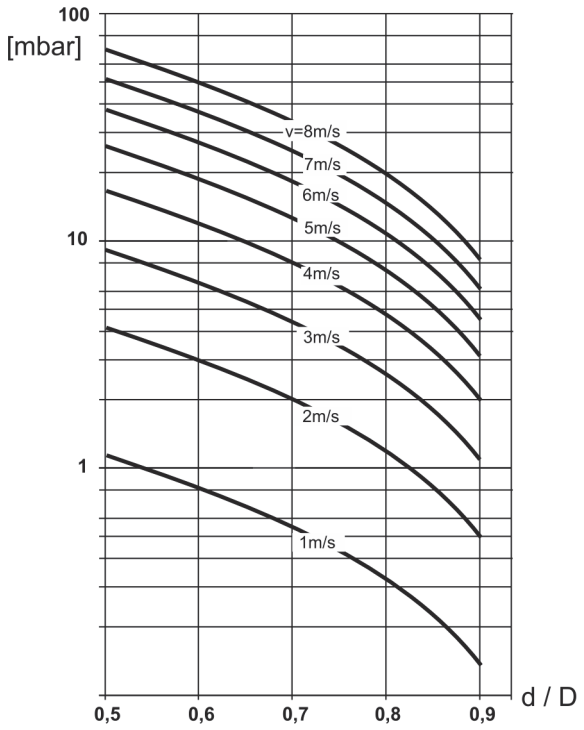
Installation near pumps
Do not install the device on the suction side of pumps in order to avoid negative pressure and damage to the pipe cladding. In order to avoid the transmission of vibrations to the measuring device, the use of pulsation attenuators and/or vibration compensators is recommended. This can compensate for pulsations arising during the pumping process with dosing pumps.

Vertical installation position (Table 1, position 4)
Installation of a rising pipe is ideal for a vertical pipeline. Only in this way can it be ensured that the measuring tube is always completely full and that gas bubbles can escape.

Partially filled pipelines
Installation similar to an inverted siphon is necessary for partially filled pipelines. In order to avoid disruptive deposits due to accumulation of solid matter, the measuring sensor may not be installed at the lowest point of the inverted siphon.

Increase of flow speed, installation in pipelines with larger nominal widths
With an appropriate adapter piece, the measuring sensor can also be installed in a pipeline with a larger nominal width. The flow speed can be increased as a result and the accuracy can be improved. With the use of a reducing adapter, the pressure loss can be determined as follows:

1. Determine the diameter ratio d/D (d = measuring sensor nominal width, D = pipeline inside diameter).
2. Refer to the flow diagram for the flow speed.
3. Read the pressure loss on the Y-axis in the diagram.



Instructions for flow meter layout

Abrasive media

… comprising a mixture of water and floating substances and/or solid particles varying in grain size, such as clay, sand, cement, concrete, etc., which can have very sharp edges, depending on the production process. Depending on the flow speed, this can wear away the pipe cladding and heavily reduced product service life.

In order to avoid this, the following must be observed for the use of MIDs for abrasive media:

- Discuss the application with the manufacturer during the planning phase.
- Select the minimum suitable flow speed (< 1 m/s). This can be achieved by choosing a larger measuring sensor.
- Installation in a vertical rising pipe is ideal.

Highly adhesive media

Deposits and adhering material can be prevented with an appropriately high flow speed. The flow speed can be increased by selecting a smaller measuring sensor.

Filmy, greasy media

Tip electrodes (special design) should be used for this type of media (e.g. cream). Due to their design, these electrodes have a self-cleaning effect, wherein the isolation of the electrodes and thus a disturbance of the measuring signal can be avoided.

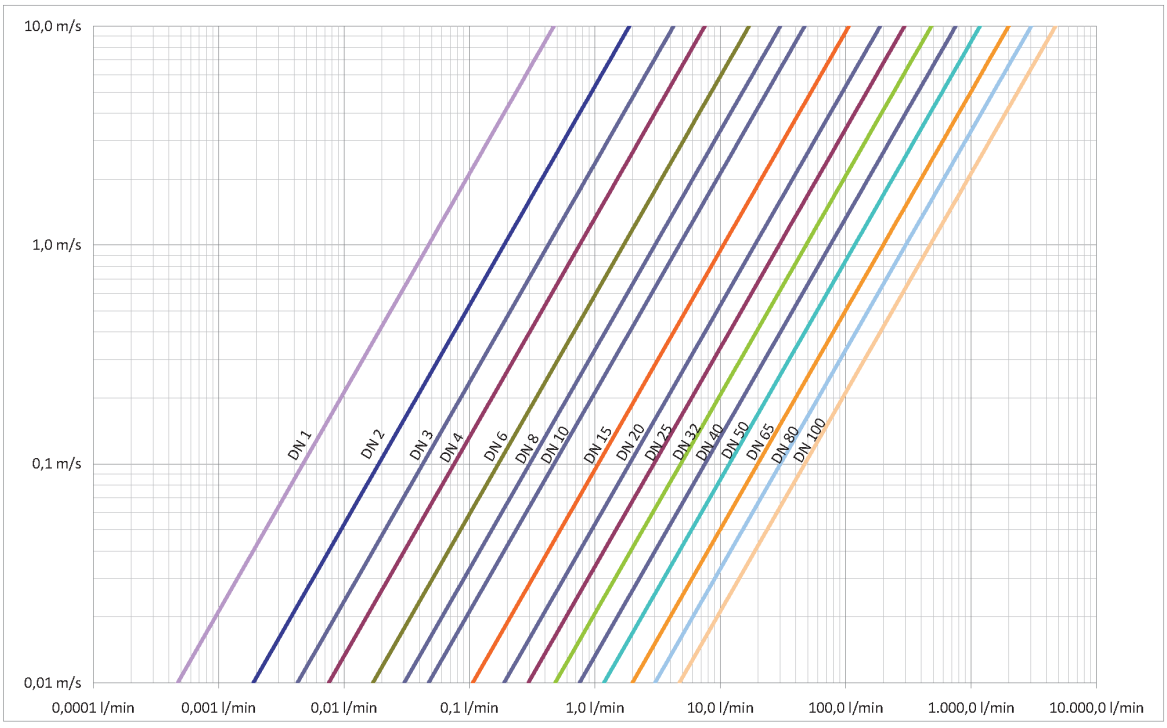
Vacuum resistance

The measuring sensor fulfils the highest requirements with its high-quality, vacuum-resistant, dimensionally stable, and smooth PFA cladding. It is resistant to rapid temperature increases (hot-cold change in the CIP process) or vacuum suction which can arise with the emptying of pipelines.

Dimensioning

If flow speeds are too low, the pipeline must be reduced to a suitable MFI diameter.
With nominal pipe widths < DN10, reduction to a smaller diameter takes place in the measuring tube of the MFI.

Conversion table l/min ⇔ m/s



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Nominal-width-dependent conversion table for flow speed (m/s) to volume flow (l/min)

Sensor diameter DN in mm	1	2	3	4	6	8	10	15	20	25	32	40	50	65	80	100
Flow speed in m/s	in litres/min															
0.20	0.009	0.038	0.085	0.151	0.34	0.60	0.94	2.12	3.77	5.89	9.65	15.07	23.55	39.80	60.29	94.20
0.40	0.019	0.075	0.170	0.301	0.68	1.21	1.88	4.24	7.54	11.78	19.29	30.14	47.10	79.60	120.58	188.40
0.60	0.028	0.113	0.254	0.452	1.02	1.81	2.83	6.36	11.30	17.66	28.94	45.22	70.65	119.40	180.86	282.60
0.80	0.038	0.151	0.339	0.603	1.36	2.41	3.77	8.48	15.07	23.55	38.58	60.29	94.20	159.20	241.15	376.80
1.00	0.047	0.188	0.424	0.754	1.70	3.01	4.71	10.60	18.84	29.44	48.23	75.36	117.75	199.00	301.44	471.00
1.20	0.057	0.226	0.509	0.904	2.03	3.62	5.65	12.72	22.61	35.33	57.88	90.43	141.30	238.80	361.73	565.20
1.40	0.066	0.264	0.593	1.055	2.37	4.22	6.59	14.84	26.38	41.21	67.52	105.50	164.85	278.60	422.02	659.40
1.60	0.075	0.301	0.678	1.206	2.71	4.82	7.54	16.96	30.14	47.10	77.17	120.58	188.40	318.40	482.30	753.60
1.80	0.085	0.339	0.763	1.356	3.05	5.43	8.48	19.08	33.91	52.99	86.81	135.65	211.95	358.20	542.59	847.80
2.00	0.094	0.377	0.848	1.507	3.39	6.03	9.42	21.20	37.68	58.88	96.46	150.72	235.50	398.00	602.88	942.00
2.50	0.118	0.471	1.060	1.884	4.24	7.54	11.78	26.49	47.10	73.59	120.58	188.40	294.38	497.49	753.60	1177.50
3.00	0.141	0.565	1.272	2.261	5.09	9.04	14.13	31.79	56.52	88.31	144.69	226.08	353.25	596.99	904.32	1413.00
4.00	0.188	0.754	1.696	3.014	6.78	12.06	18.84	42.39	75.36	117.75	192.92	301.44	471.00	795.99	1205.76	1884.00
5.00	0.236	0.942	2.120	3.768	8.48	15.07	23.55	52.99	94.20	147.19	241.15	376.80	588.75	994.99	1507.20	2355.00
6.00	0.283	1.130	2.543	4.522	10.17	18.09	28.26	63.59	113.04	176.63	289.38	452.16	706.50	1193.99	1808.64	2826.00
7.00	0.330	1.319	2.967	5.275	11.87	21.10	32.97	74.18	131.88	206.06	337.61	527.52	824.25	1392.98	2110.08	3297.00
8.00	0.377	1.507	3.391	6.029	13.56	24.12	37.68	84.78	150.72	235.50	385.84	602.88	942.00	1591.98	2411.52	3768.00
9.00	0.424	1.696	3.815	6.782	15.26	27.13	42.39	95.38	169.56	264.94	434.07	678.24	1059.75	1790.98	2712.96	4239.00
10.00	0.471	1.884	4.239	7.536	16.96	30.14	47.10	105.98	188.40	294.38	482.30	753.60	1177.50	1989.98	3014.40	4710.00

= The measuring precision is optimal in the green range

Adjustable measuring range end value

Nominal width	smallest	largest	smallest	largest	smallest	largest	smallest	largest	smallest	largest	smallest	largest
[mm]	[cm³/s]		[cm³/min]		[cm³/h]		[l/s]		[l/min]		[l/h]	
1	0.15708	7.85398	9.425	471.239	565.5	28274.3			0.00942	0.47124	0.5655	28.2743
2	0.6283	31.4159	37.70	1884.96	2262	113097	0.00063	0.03142	0.03770	1.88496	2.262	113.097
3	1.4137	70.6858	84.82	4241.15	5089	254469	0.00141	0.07069	0.08482	4.24115	5.089	254.469
4	2.5133	125.6637	150.80	7539.82	9048	452389	0.00251	0.12566	0.15080	7.53982	9.048	452.389
6	5.655	282.743	339.3	16964.6			0.00565	0.28274	0.3393	16.9646	20.36	1017.88
8	10.053	502.655	603.2	30159.3			0.01005	0.50265	0.6032	30.1593	36.19	1809.56
10	15.708	785.398	942.5	47123.9			0.01571	0.78540	0.9425	47.1239	56.55	2827.43
15	35.34	1767.15	2121	106029			0.03534	1.76715	2.121	106.029	127.23	6361.73
20	62.83	3141.59	3770	188496			0.06283	3.14159	3.770	188.496	226.2	11309.7
25	98.17	4908.74	5890	294524			0.09817	4.90874	5.890	294.524	353.4	17671.5
32	160.85	8042.48	9651	482549			0.16085	8.04248	9.651	482.549	579.1	28952.9
40	251.3	12566.4	15080	753982			0.2513	12.5664	15.080	753.982	904.8	45238.9
50	392.7	19635.0					0.3927	19.6350	23.56	1178.10	1413.7	70685.8
65	663.7	33183.1					0.6637	33.1831	39.82	1990.98	2389	119459
80	1005.3	50265.5					1.0053	50.2655	60.32	3015.93	3619	180956
100	1570.8	78539.8					1.5708	78.5398	94.25	4712.39	5655	282743

Nominal width	smallest	largest	smallest	largest	smallest	largest	smallest	largest	smallest	largest	smallest	largest	smallest	largest
[mm]	[l/s]		[hl/min]		[hl/h]		[m³/s]		[m³/min]		[m³/h]		[gal/min]	
1					0.00565	0.28274							0.00249	0.12449
2					0.02262	1.13097					0.00226	0.11310	0.00996	0.49795
3					0.05089	2.54469					0.00509	0.25447	0.02241	1.12039
4			0.00151	0.07540	0.09048	4.52389					0.00905	0.45239	0.03984	1.99181
6			0.00339	0.16965	0.2036	10.1788			0.00034	0.01696	0.02036	1.01788	0.08963	4.48157
8	0.00010	0.00503	0.00603	0.30159	0.3619	18.0956			0.00060	0.03016	0.03619	1.80956	0.15934	7.96724
10	0.00016	0.00785	0.00942	0.47124	0.5655	28.2743			0.00094	0.04712	0.05655	2.82743	0.2490	12.4488
15	0.00035	0.01767	0.02121	1.06029	1.2723	63.6173			0.00212	0.10603	0.12723	6.36173	0.5602	28.0098
20	0.00063	0.03142	0.03770	1.88496	2.262	113.097			0.00377	0.18850	0.2262	11.3097	0.9959	49.7953
25	0.00098	0.04909	0.05890	2.94524	3.534	176.715			0.00589	0.29452	0.3534	17.6715	1.5561	77.8051
32	0.00161	0.08042	0.09651	4.82549	5.791	289.529			0.00965	0.48255	0.5791	28.9529	2.550	127.476
40	0.00251	0.12566	0.15080	7.53982	9.048	452.389	0.00025	0.01257	0.01508	0.75398	0.9048	45.2389	3.984	199.181
50	0.00393	0.19635	0.2356	11.7810	14.137	706.858	0.00039	0.01963	0.02356	1.17810	1.4137	70.6858	6.224	311.220
65	0.00664	0.33183	0.3982	19.9098	23.89	1194.59	0.00066	0.03318	0.03982	1.99098	2.389	119.459	10.519	525.962
80	0.01005	0.50265	0.6032	30.1593	36.19	1809.56	0.00101	0.05027	0.06032	3.01593	3.619	180.956	15.934	796.724
100	0.01571	0.78540	0.9425	47.1239	56.55	2827.43	0.00157	0.07854	0.09425	4.71239	5.655	282.743	24.90	1244.88

= no value can be specified due to display numerical resolution

Note:
An MFI always comprises a base unit and its process connections. Please specify both when ordering.

MFI447 base unit order code

MFI447 - 1. - 2. - 3. - 4. - 5.

1.	**Nominal width**	
	001[a]	DN 1
	002[a]	DN 2
	003[b]	DN 3
	004[b]	DN 4
	006[b]	DN 6
	008	DN 8
	010	DN 10
	015	DN 15
	020	DN 20
	025	DN 25
	032	DN 32
	040	DN 40
	050	DN 50
	065	DN 65
	080	DN 80
	100	DN 100
2.	**Electrode material**	
	0	stainless steel 1.4539 (standard)
3.	**Electrode shape**	
	0	flush mounted (standard)
4.	**Options**	
	00	no options
	01	accuracy ± 0.3 % for DN ≥ 3..15
	02	dosing control
5.	**Certificate DIN EN 10204 (indicate only when required, multiple responses possible)**	
	WZ2.2	factory certification 2.2
	APZ2P	acceptance test certificate 3.1 with 2 measuring points (0°C / 70°C)
	APZ4P	acceptance test certificate 3.1 with 4 measuring points (0°C, 70°C + 2 test points freely selectable)

[a] incl. 1/8" sanitary connection (PVC)
[b] with nominal pipe widths < DN10 the measuring tube in the sensor is reduced a smaller DN.

Order codes Process connection foodstuffs

APF 1. **1** 2. 3. **0** - 4. - 5. - 6.

Area of application: foodstuffs; Material 1.4404, Seal EPDM

1.	**Connection standard**	
	1	DIN EN 10357 series B / DIN 11850 series 1
2.	**Type**	
	1	welding nozzle
3.	**Type standards**	
	0	standard (as described above under construction)
4.	**Nominal pipe width DN**	
	010, 015, 020, 025, 032, 040, 050	
5.	**Options**	
	00	without option
6.	**Certificate DIN EN 10204. Indicate only when required.**	
	WZ2.2	factory certification 2.2

APF 1. **2** 2. 3. - 4. - 5. - 6.

Area of application: foodstuffs; Material 1.4404

1.	**Connection standard**	
	2	DIN EN 10357 series A / DIN 11850 series 2
2.	**Type**	
	1	welding nozzle
	2	Tri-Clamp DIN 32676
	3	milk pipe DIN 11851 process connection; threaded connections on both sides
	4	aseptic-thread nozzle DIN 11864; threaded connectors on both sides
3.	**Type standards**	
	0	standard (as described above under type)
	1	milk pipe DIN 11851 on both sides conical port with union nut
	2	milk tube DIN 11851 thread-/conical port with union nut
	1	aseptic-thread nozzle DIN 11864 on both sides nozzle with union nut
	2	aseptic-thread nozzle DIN 11864 thread/female union with union nut
4.	**Nominal pipe width DN [mm]**	
	010	DN 10
	015	DN 15
	020	DN 20
	025	DN 25
	032	DN 32
	040	DN 40
	050	DN 50
	065	DN 65
	080	DN 80
	100	DN 100
5.	**Options**	
	00	without option
6.	**Certificate DIN EN 10204. Specify only when required.**	
	WZ2.2	factory certification 2.2

APF 1. **6** 2. 3. - 4. - 5. - 6.

Area of application: foodstuffs; Material 1.4404

1.	**Connection standard**	
	6	**OD-Tube (ASME)**
2.	**Type**	
	1	welding nozzle
	2	Tri-Clamp (from ½") DIN 32676
	4	aseptic-thread nozzle DIN 11864-1 (from ½") threaded connectors on both sides
3.	**Type standards**	
	0	standard (as described above under type)
	1	aseptic-thread nozzle DIN 11864; on both sides female union with slotted nut
	2	aseptic-thread nozzle DIN 11864; thread/female union with slotted nut
4.	**Nominal pipe width in inch ["]**	
	008	3/8
	010	1/2
	020	3/4
	025	1
	040	1 1/2
	050	2
	065	2 1/2
	080	3
	100	4
5.	**Options**	
	00	without option
6.	**Certificate DIN EN 10204. Specify only when required.**	
	WZ2.2	factory certification 2.2

APF 7 [ ][ ] - [ ] - [ ] - [ ]

Area of application: foodstuffs; Material 1.4404

1.	**Connection standard**	
	7	**ISO 2037**
2.	**Type**	
	1	welding nozzle
	4	aseptic-thread nozzle DIN 11864-1; threaded connectors on both sides
3.	**Type standards**	
	0	standard (as described above under type)
	1	aseptic-thread nozzle DIN 11864; on both sides female union with slotted nut
	2	aseptic-thread nozzle DIN 11864; thread/female union with slotted nut
4.	**Nominal pipe width DN [mm]**	
	025	DN 25
	032	DN 32
	040	DN 40
	050	DN 50
	065	DN 65
	080	DN 80
	100	DN 100
5.	**Options**	
	00	without option
6.	**Certificate DIN EN 10204. Specify only when required.**	
	WZ2.2	factory certification 2.2

APF 8 [ ] 0 - [ ] - [ ] - [ ]

Area of application: foodstuffs; material 1.4404; seal EPDM

1.	**Connection standard**	
	8	process thread sensor MFI
2.	**Type**	
	6	hose connection
3.	**Type standards**	
	0	standard (as described above under type)
4.	**Nominal width MFI [mm]**	
	010	DN 10
	015	DN 15
5.	**Hose inner diameter [mm]**	
	13	13,4 mm (suitable to DN 10)
	19	19,0 mm (suitable to DN 15)
	xx	on request
6.	**Options**	
	00	without option
7.	**Certificate DIN EN 10204. Specify only when required.**	
	WZ2.2	factory certification 2.2

Process connections for pharma

APF 3 [ ][ ] - [ ] - [ ] - [ ]

Pharmacy industry; material 1.4435; incl. 3.1 certificate

1.	**Connection standard**	
	3	**DIN 11866 Line A**
2.	**Type**	
	1	welding nozzle
	2	Tri-Clamp DIN 32676
	4	aseptic-thread nozzle DIN 11864-1 threaded connectors on both sides
3.	**Type standards**	
	0	standard (as described above under type)
	1	aseptic-thread nozzle DIN 11864; on both sides female union with slotted nut
	2	aseptic-thread nozzle DIN 11864; thread/female union with slotted nut
4.	**Nominal pipe width DN [mm]**	
	010	DN 10
	015	DN 15
	020	DN 20
	025	DN 25
	032	DN 32
	040	DN 40
	050	DN 50
	065	DN 65
	080	DN 80
	100	DN 100
5.	**Options**	
	00	without option
6.	**Certificate DIN EN 10204. Specify only when required.**	
	WZ2.2	factory certification 2.2

APF 4 [ ][ ] - [ ] - [ ] - [ ]

Pharmacy industry; material 1.4435; incl. 3.1 certificate

1.	**Connection standard**	
	4	**DIN 11866 Line B (ISO 1127)**
2.	**Type**	
	1	welding nozzle
	2	Tri-Clamp DIN 32676
	4	aseptic-thread nozzle DIN 11864-1 threaded connectors on both sides
3.	**Type standards**	
	0	standard (as described above under type)
	1	aseptic-thread nozzle DIN 11864; on both sides female union with slotted nut
	2	aseptic-thread nozzle DIN 11864; thread/female union with slotted nut
4.	**Nominal pipe width DN [mm]**	
	008	DN 8
	010	DN 10
	015	DN 15
	020	DN 20
	025	DN 25
	032	DN 32
	040	DN 40
	050	DN 50
	065	DN 65
	080	DN 80
5.	**Options**	
	00	without option
6.	**Certificate DIN EN 10204. Specify only when required.**	
	WZ2.2	factory certification 2.2

	1.	2.	3.		4.		5.		6.
APF	**5**			-		-		-	

Pharmacy industry; material 1.4435; incl. 3.1 certificate

1.	**Connection standard**	
	5	**DIN 11866 Line C (ASME)**
2.	**Type**	
	1	welding nozzle
	2	Tri-Clamp DIN 32676
	4	aseptic-thread nozzle DIN 11864-1 threaded connectors on both sides
3.	**Type standards**	
	0	standard (as described above under type)
	1	aseptic-thread nozzle DIN 11864; on both sides female union with slotted nut
	2	aseptic-thread nozzle DIN 11864; thread/female union with slotted nut
4.	**Nominal pipe width in inch ["]**	
	008	3/8
	010	1/2
	020	3/4
	025	1
	040	1 1/2
	050	2
	065	2 1/2
	080	3
5.	**Options**	
	00	without option
6.	**Certificate DIN EN 10204. Specify only when required.**	
	WZ2.2	factory certification 2.2

Further information

Overview of standards

DIN EN 10357 - Austenitic, austenitic-ferritic and ferritic longitudinally welded stainless steel tubes for the food and chemical industry

This standard has been valid since March 2014 and replaces DIN 11850.

Pipes in accordance with DIN EN 10357 are classified in Series A, B, C, and D, depending on their dimensions (Series A corresponds to Series 2 of the old standard 11850, Series B corresponds to

Series 1 of the old standard 11850, and Series C corresponds to the dimension in accordance with DIN EN ISO 1127 and DIN 11866 Series B).
The surface finish is classified as CC, CD, BC, and BD (exactly the same as the old DIN standard 11850). Pipes with a ground outside surface (CD, BD) must have an Ra value of <= 1.0µm on the outside surface. The standard roughness on the inside is Ra <= 0.8µ/weld seam <=1.6µm. Standard materials are stainless steel 1.4301, 1.4307, 1.4404, 1.4432 and 1.4435. The material 1.4404 is predominantly used.
Pipes according to this standard are primarily used in the foodstuffs and beverage industry, as well as for cosmetics and fine chemicals.

GHM offers the following process connections in accordance with this standard:

DIN EN 10357, Series A (formerly DIN 11850, Series 2):
Material 1.4404 welded-on nozzle
- Tri-Clamp in accordance with DIN 32676
- Milk tube thread and
- Reduction nozzle in accordance with DIN 11851
- Sterile thread and collared nozzle in accordance with DIN 11864-1

DIN EN 10357, Series B (formerly DIN 11850, Series 1):
Material 1.4404
- Welded-on nozzle
- Hose nozzle

DIN 11850 (10/1999) Pipes for foodstuffs, chemicals, and pharmaceuticals - pipes made of non-rusting steels - dimensions, materials.

The standard DIN 11850 has not longer been valid since March 2014 and has been replaced by DIN EN 10357. However, since it was applicable for many decades, it should be mentioned. The standard 11850 was developed for welded pipes made of non-rusting steels for pipeline systems in the foodstuffs, pharmaceutical, and chemical industries. The pipes are classified in Series 1 and 2 depending on their dimensions (ISO dimensions are listed in DIN EN 1127) and, depending on their surface finish, as CC (pickled inside and out), CD (pickled inside and ground outside), BC (annealed inside and out and pickled or bright-annealed), and BD (annealed inside and pickled or bright-annealed and ground outside).
The standard roughness inside has the value Ra < 0.8µm/SN 1.6µm (wherein 'SN' is the German abbreviation for weld seam). Standard materials in accordance with the standard are 1.4301, 1.4307, and 1.4404. The material 1.4404 is predominantly used.

GHM offers the following process connections in accordance with this standard:
DIN 11850, Series 1 (new standard DIN EN 10357, Series B):
Material 1.4404
- Welded-on nozzle
- Hose nozzle

DIN 11850, Series 2 (new standard DIN EN 10357, Series A):
Material 1.4404
- Welded-on nozzle
- Tri-Clamp in accordance with DIN 32676
- Milk tube thread and
- Reduction nozzle in accordance with DIN 11851
- Sterile thread and collared nozzle in accordance with DIN 11864-1
- Hose nozzle

DIN 11866 (1/2003)Pipes made of non-rusting steel for aseptic, chemical, and pharmaceutical applications

The standard was developed for welded and seamless pipes of Test Class 2 in accordance with DIN 17457 and DIN 17458 made of non-rusting steels for pipeline systems in aseptic, chemical, and pharmaceutical applications. They are classified in Series A to C according to the pipe dimensions.
Series A corresponds to the dimensions according to DIN EN 10357 Series A (formerly DIN 11850 Series 2), Series B corresponds to the dimensions according to DIN EN 10357 Series C and/or DIN EN ISO 1127.
Series C corresponds to the dimensions according to ASME-BPE 2005 (American Society of Mechanical Engineers- Bioprocessing Equipment Standard).
The surface finishes are classified in hygiene classes H1 (1.6µm/SN3.2µm). H2 (0.8µm/SN 1.6µm). H3 (0.8µm/SN 0.8µm). H4 (0.4µm/SN 0.4µm) and H5 (0.25µm/SN 0.25µm). Standard materials in accordance with the standard are 1.4404, 1.4435, and 1.4539. The material 1.4435 is predominantly used.

GHM offers everything in accordance with this standard, including 3.1 certificate: DIN 11866 Series A,B,C:
Material 1.4435
- Welded-on nozzle
- Tri-Clamp in accordance with DIN 32676
- Sterile thread and collared nozzle in accordance with DIN 11864-1
- Hose nozzle

OD tube accord to ASME standard
OD = outside diameter,
ASME = American Society of Mechanical Engineers

These pipe sizes correspond to DIN11866, Series C. The process connections are made of the material 1.4404.

GHM offers the following process connections in accordance with this standard:
OD tube: Material 1.4404
- Welded-on nozzle
- Tri-Clamp in accordance with DIN 32676
- Sterile thread and collared nozzle in accordance with DIN 11864-1
- Hose nozzle

ISO 2037 pipes made of non-rusting steels for foodstuffs
Standard of the International Organization for Standardization.
The standard includes pipe dimensions, surface roughness, and materials for welded and seamless pipes.

GHM offers the following process connections in accordance with this standard:
ISO2037: Material 1.4404
- Welded-on nozzle
- Tri-Clamp in accordance with DIN 32676
- Sterile thread and collared nozzle in accordance with DIN 11864-1
- Hose nozzle