Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Proline Promass 84F, 84M

Coriolis Mass Flow Measuring System
The universal and multivariable flowmeter for liquids and gases for custody transfer

Applications
The Coriolis measuring principle operates independently of the physical fluid properties, such as viscosity and density.

- Extremely accurate, verified measurement of liquids (other than water) and for gases under high pressure (>100 bar)
- Fluid temperatures up to +350 °C
- Process pressures up to 350 bar
- Mass flow measurement up to 2200 t/h

Approvals for custody transfer:
- PTB, NMi, METAS, BEV, NTEP, MC

Approvals for hazardous area:
- ATEX, FM, CSA, TIIS, IECEx, NEPSI

Approvals in the food industry/hygiene sector:
- 3A, FDA, EHEDG

Connection to process control system:
- HART, MODBUS

Relevant safety aspects:
- Secondary containment (up to 100 bar), Pressure Equipment Directive, AD 2000
- Purge connections or rupture disk (optional)

Your benefits
The Promass measuring devices make it possible to simultaneously record several process variables (mass/density/temperature) for various process conditions during measuring operation.

The **Proline transmitter concept** comprises:
- Modular device and operating concept resulting in a higher degree of efficiency
- Diagnostic ability and data back-up for increased process quality

The **Promass sensors,** tried and tested in over 100000 applications, offer:
- Best performance due to PremiumCal
- Multivariable flow measurement in compact design
- Insensitivity to vibrations thanks to balanced two-tube measuring system
- Immune from external piping forces due to robust design
- Easy installation without taking inlet and outlet runs into consideration

TI067D/06/en/07.08
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Endress+Hauser
People for Process Automation

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Function and system design

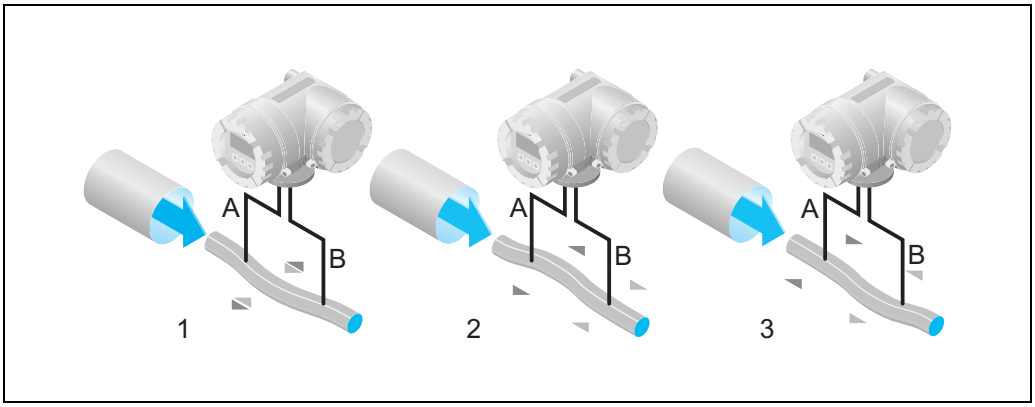
Measuring principle

The measuring principle is based on the controlled generation of Coriolis forces. These forces are always present when both translational and rotational movements are superimposed.

$F_C = 2 \cdot \Delta m\ (v \cdot \omega)$
F_C = Coriolis force
Δm = moving mass
ω = rotational velocity
v = radial velocity in rotating or oscillating system

The amplitude of the Coriolis force depends on the moving mass Δm, its velocity v in the system, and thus on the mass flow. Instead of a constant angular velocity ω, the Promass sensor uses oscillation.

In the Promass F and M sensors, two parallel measuring tubes containing flowing fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):
- At zero flow, in other words when the fluid is at a standstill, the two tubes oscillate in phase (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).



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The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet.
System balance is ensured by the antiphase oscillation of the two measuring tubes. The measuring principle operates independently of temperature, pressure, viscosity, conductivity and flow profile.

Density measurement

The measuring tubes are continuously excited at their resonance frequency. A change in the mass and thus the density of the oscillating system (comprising measuring tubes and fluid) results in a corresponding, automatic adjustment in the oscillation frequency. Resonance frequency is thus a function of fluid density. The microprocessor utilises this relationship to obtain a density signal.

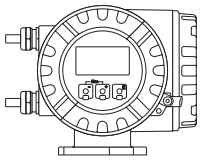
Temperature measurement

The temperature of the measuring tubes is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output.
The temperature measurement cannot be used to generate data for invoicing in applications subject to legal metrology controls.

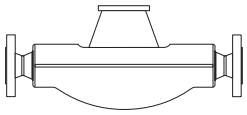
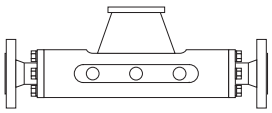
Measuring system

The measuring system consists of a transmitter and a sensor. Two versions are available:
- Compact version: transmitter and sensor form a single mechanical unit.
- Remote version: transmitter and sensor are installed separately.

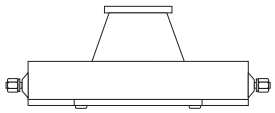
Transmitter

Promass 84  a0003672	■ Four-line liquid-crystal display ■ Operation with "Touch control" ■ Application-specific Quick Setup ■ Mass flow, volume flow, density and temperature measurement as well as calculated variables (e.g. corrected volume flow)	

Sensor

F  a0003673	■ Universal sensor for fluid temperatures up to 350 °C ■ Nominal diameters DN 8 to 250 ■ Material: Stainless Steel EN 1.4539/ASTM 904L, EN 1.4404/ASTM 316L, Alloy C-22 DIN 2.4602	Documentation No. TI 067D/06/en
M  a0003676	■ Robust sensor for extreme process pressures, high requirements for the secondary containment and fluid temperatures up to 150 °C ■ Nominal diameters DN 8 to 80 ■ Material: Titanium, Ti Grade 2, Ti Grade 9	

Other sensors can be found in the separate documentation

A  a0003679	■ Single-tube system for highly accurate measurement of very small flows ■ Nominal diameters DN 2 to 4 ■ Material: Stainless Steel EN 1.4539/ASTM 904L, EN 1.4404/ASTM 316L (process connection), Alloy C-22 DIN 2.4602	Documentation No. TI 068D/06/en

Input

Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube to register a phase shift in the oscillation)
- Fluid density (proportional to resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

Measuring range in non-custody transfer mode

Measuring ranges for liquids

DN [mm]	Promass	Range for full scale values (liquids) $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$ [kg/h]
8	F, M	0 to 2000
15	F, M	0 to 6500
25	F, M	0 to 18000
40	F, M	0 to 45000
50	F, M	0 to 70000
80	F, M	0 to 180000
100	F	0 to 350000
150	F	0 to 800000
250	F	0 to 2200000

Measuring ranges for gases

The full scale values depend on the density of the gas. Use the formula below to calculate the full scale values:

$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} \div x$ [kg/m³]

$\dot{m}_{max(G)}$ = Max. full scale value for gas [kg/h]
$\dot{m}_{max(F)}$ = Max. full scale value for liquid [kg/h]

DN [mm]	Promass	x [kg/h]
8	F, M	60
15	F, M	80
25	F, M	90
40	F, M	90
50	F, M	90
80	F, M	110
100	F	130
150	F	200
250	F	200

Here, $\dot{m}_{max(G)}$ can never be greater than $\dot{m}_{max(F)}$

Calculation example for gas:

- Sensor type: Promass F, DN 50
- Gas: air with a density of 60.3 kg/m³ (at 20 °C and 50 bar)
- Measuring range: 70000 kg/h
- x = 90 (for Promass F DN 50)

Max. possible full scale value:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_{(G)} \div x$ [kg/m³] = 70000 kg/h · 60.3 kg/m³ ÷ 90 kg/m³ = 46900 kg/h

Recommended full scale values

See information in chapter "Limiting flow" → Page 22 ff.

Measuring range in custody transfer mode

The following are example data for German PTB approval (liquids other than water).

Measuring ranges for liquids in mass flow for Promass F

DN [mm]	Mass flow (liquids) Q_{min} to Q_{max} [kg/min]	Smallest measured quantity [kg]
8	1.5 to 30	0.5
15	5 to 100	2
25	15 to 300	5
40	35 to 700	20
50	50 to 1000	50
80	150 to 3000	100
100	200 to 4500	200
150	350 to 12000	500
250	1500 to 35000	1000

Measuring ranges for liquids in mass flow for Promass M

DN [mm]	Mass flow (liquids) Q_{min} to Q_{max} [kg/min]	Smallest measured quantity [kg]
8	1.5 to 30	0.5
15	5 to 100	2
25	15 to 300	5
40	35 to 700	20
50	50 to 1000	50
80	150 to 3000	100

Measuring ranges for liquids in volume flow (also LPG) for Promass F

DN [mm]	Volume flow (liquids) Q_{min} to Q_{max} [l/min]	Smallest measured quantity [l]
8	1.5 to 30	0.5
15	5 to 100	2.0
25	15 to 300	5.0
40	35 to 700	20
50	50 to 1000	50
80	150 to 3000	100
100	200 to 4500	200
150	350 to 12000	500
250	1500 to 35000	1000

Measuring ranges for liquids in volume flow (also LPG) for Promass M

DN [mm]	Volume flow (liquids) Q_{min} to Q_{max} [l/min]	Smallest measured quantity [l]
80	150 to 3000	100

Measuring ranges for high pressure fuel gases CNG for Promass M

DN [mm]	Mass flow (liquids) Q_{min} to Q_{max} [kg/min]	Smallest measured quantity [kg]
8	0.1 to 10	0.2
15	0.3 to 40	0.5
25	1.0 to 100	2.0
Max. Pressure = 250 bar resp. 350 bar for high pressure version		

Note!
For information about the other approvals → see corresponding certificate.

Operable flow range

Over 20 : 1 for verified device

Input signal

Status input (auxiliary input), HART:

U = 3 to 30 V DC, R_i = 5 kΩ, galvanically isolated.
Configurable for: totalizer reset, positive zero return, error message reset, zero point adjustment start.

Status input (auxiliary input), MODBUS RS485:

U = 3 to 30 V DC, R_i = 3 kΩ, galvanically isolated, switch level: ±3 to ±30 V DC, independent of polarity.
Configurable for: totalizer reset, positive zero return, error message reset, zero point adjustment start.

Output

Output signal

Current output:

Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), full scale value selectable, temperature coefficient: typically 0.005% o.r./°C, resolution: 0.5 µA
- Active: 0/4 to 20 mA, R_L < 700 Ω (for HART: $R_L \geq 250$ Ω)
- Passive: 4 to 20 mA; supply voltage V_S 18 to 30 V DC; $R_i \geq 150$ Ω

o.r. = of reading

Pulse / frequency output, HART:

For custody transfer measurement, two pulse outputs can be operated.
Passive, galvanically isolated, open collector, 30 V DC, 250 mA

- Frequency output:
  Full scale frequency 2 to 10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 2 s.
  In "Phase-shifted pulse outputs" operating mode, the end frequency is limited to a maximum of 5000 Hz.
- Pulse output:
  Pulse value and pulse polarity selectable, pulse width configurable (0.05 to 2000 ms)

Pulse / frequency output, MODBUS RS485:

Active/passive selectable, galvanically isolated
- Active: 24 V DC, 25 mA (max. 250 mA during 20 ms), R_L > 100 Ω
- Passive: Open Collector, 30 V DC, 250 mA

- Frequency output:
  Full scale frequency 2 to 10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 2 s.
- Pulse output:
  Pulse value and pulse polarity selectable, pulse width configurable (0.05 to 2000 ms)

MODBUS RS485

- MODBUS device type: slave
- Address range: 1 to 247
- Functions codes supported: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Physical interface: RS485 in accordance with standard EIA/TIA-485
- Baudrate supported: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Transmission mode: RTU oder ASCII
- Response time:
  Direct data access = typically 25 to 50 ms
  Auto-scan buffer (data area) = typically 3 to 5 ms
- Possible output combinations → Page 10

Relay output:

Normally closed (NC or break) or normally open (NO or make) contacts available
max. 30 V / 0.5 A AC; 60 V / 0.1 A DC,
galvanically isolated.

Signal on alarm

- **Current output:** Failsafe mode selectable (e.g. in accordance with NAMUR Recommendation NE 43).
- **Pulse/frequency output:** Failsafe mode selectable.
- **Relay output:** De-energised by fault or power supply failure.
- **MODBUS RS485:** If an error occurs, the value NaN (not a number) is output for the process variables.

Load

See "Output signal"

Low flow cutoff

Switch points for low flow are selectable.

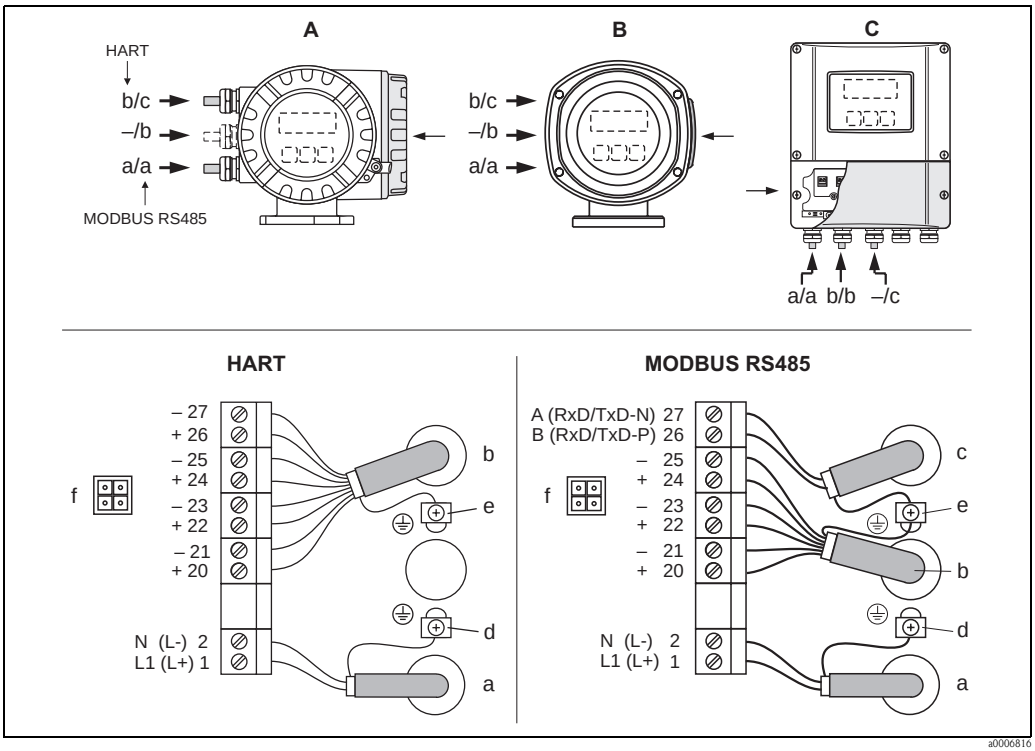
DN [mm]	Low flow / factory settings (v ~ 0.04 m/s) [kg/h]
8	8.00
15	26.0
25	72.0
40	180
50	300
80	720
100	1200
150	2600
250	7200

Galvanic isolation

All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

Power supply

Electrical connection measuring unit



Connecting the transmitter, cable cross-section: max. 2.5 mm²

A View A (aluminium field housing)
B View B (stainless steel field housing)
C View C (wall-mount housing)

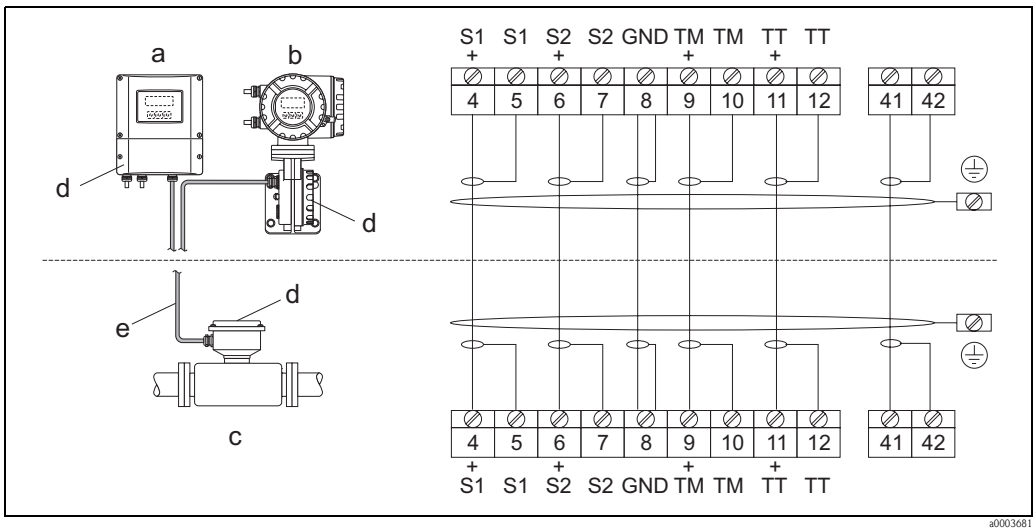
a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
– Terminal No. 1: L1 for AC, L+ for DC
– Terminal No2: N for AC, L- for DC
b Signal cable: Terminal assignment → Page 10
c Fieldbus cable: Terminal assignment → Page 10
d Ground terminal for protective earth
e Ground terminal for Signal cable/Fieldbus cable
f Service connector for connecting service interface FXA193 (Fieldcheck, ToF Tool - Fieldtool Package)

Terminal assignment

Replacements for modules which are defective or which have to be replaced can be ordered as accessories.

Order variant	Terminal No. (inputs/outputs) 20 (+) / 21 (–)	22 (+) / 23 (–)	24 (+) / 25 (–)	26 (+) / 27 (–)
Fixed communication boards (permanent assignment)				
84***-**********S	–	–	Pulse/freq. output Ex i, passive	Current output HART, Ex i, active
84***-**********T	–	–	Pulse/freq. output Ex i, passive	Current output HART, Ex i, passive
Flexible communication boards				
84***-**********D	Status input	Relay output	Pulse/frequency output	Current output HART
84***-**********M	Status input	Pulse/frequency output 2	Pulse/frequency output 1	Current output HART
84***-**********N	Current output	Pulse/frequency output	Status input	MODBUS RS485
84***-**********Q	–	–	Status input	MODBUS RS485
84***-**********1	Relay output	Pulse/frequency output 2	Pulse/frequency output 1	Current output HART
84***-**********2	Relay output	Current output 2	Pulse/frequency output	Current output 1 HART
84***-**********7	Relay output 1	Relay output 2	Status input	MODBUS RS485

Electrical connection remote version



Connection of remote version

a Wall-mount housing: non-hazardous area and ATEX II3G / Zone 2
b Wall-mount housing: ATEX II2G / Zone 1 /FM/CSA
c Flange version remote version

Terminal No.:
4/5 = gray
6/7 = green
8 = yellow
9/10 = pink
11/12 = white
41/42 = brown

Supply voltage	85 to 260 V AC, 45 to 65 Hz 20 to 55 V AC, 45 to 65 Hz 16 to 62 V DC
Switching on the power supply in custody transfer mode	If the device is started in custody transfer mode, for example also after a power outage, system error No. 271 "POWER BRK. DOWN" flashes on the local display. The fault message can be acknowledged or reset using the "Enter" key or by means of the status input configured accordingly.
Cable entries	Power-supply and signal cables (inputs/outputs): ■ Cable entry M20 × 1.5 (8 to 12 mm) ■ Thread for cable entries, ½" NPT, G ½" Connecting cable for remote version: ■ Cable entry M20 × 1.5 (8 to 12 mm) ■ Thread for cable entries, ½" NPT, G ½"
Remote version cable specifications	■ 6 × 0.38 mm² PVC cable with common shield and individually shielded cores ■ Conductor resistance: ≤ 50 Ω/km ■ Capacitance: core/shield: ≤ 420 pF/m ■ Cable length: max. 20 m ■ Operating temperature: max. +105 °C Operation in zones of severe electrical interference: The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of ICE/EN 61326, and NAMUR recommendation NE 21/43.
Power consumption	AC: <15 VA (including sensor) DC: <15 W (including sensor) Switch-on current ■ Max. 13.5 A (< 50 ms) at 24 V DC ■ Max. 3 A (< 5 ms) at 260 V AC
Power supply failure	Lasting min. 1 power cycle: ■ EEPROM or T-DAT save measuring system data if the power supply fails. ■ S-DAT: exchangeable data storage chip with sensor specific data (nominal diameter, serial number, calibration factor, zero point, etc.) ■ See Note on Page 11 "Switching on the power supply in custody transfer mode"
Potential equalisation	No special measures for potential equalization are required. For instruments for use in hazardous areas, observe the corresponding guidelines in the specific Ex documentation.

Performance characteristics

Note!
The accuracy solely refers to the measuring device suitable for custody transfer measurement and not to the measuring system.

Reference operating conditions

Error limits following ISO/DIS 11631:
- 20 to 30 °C; 2 to 4 bar
- Accuracy based on accredited calibration rigs according to ISO 17025
- Zero point calibrated under operating conditions
- Field density calibrated (or special density calibration)

Maximum measured error

The following values refer to the pulse/frequency output. Deviation at the current output is typically ±5 µA.

Mass flow (liquid):

- ±0.10% ± [(zero point stability ÷ measured value) · 100]% o.r.
- ±0.05% ± [(zero point stability ÷ measured value) · 100]% o.r., PremiumCal (optional)

Mass flow (gas):

- Promass F: ±0.35% ± [(zero point stability ÷ measured value) · 100]% o.r.
- Promass M: ±0.50% ± [(zero point stability ÷ measured value) · 100]% o.r.

Volume flow (liquid)

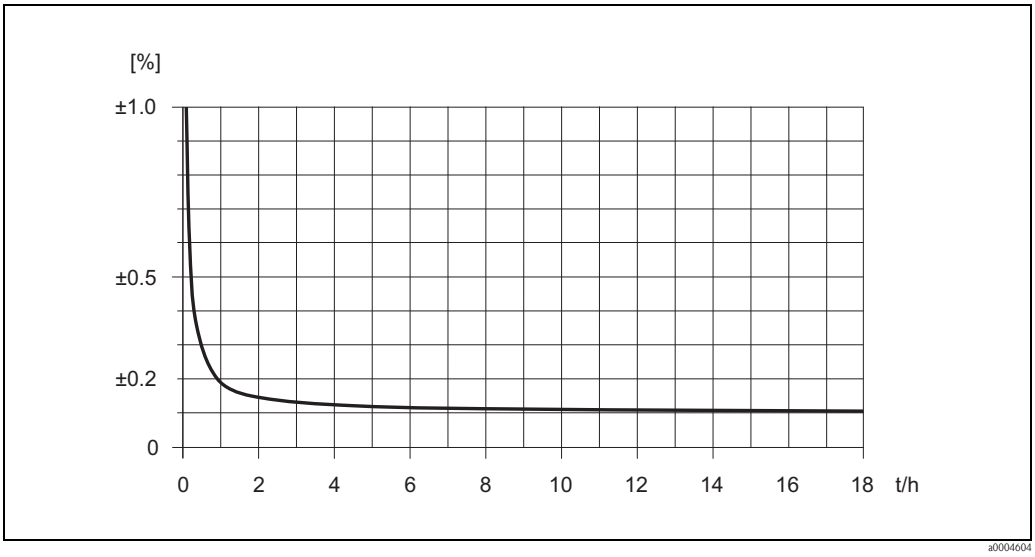
- Promass F: ±0.15% ± [(zero point stability ÷ measured value) · 100]% o.r.
- Promass M: ±0.25% ± [(zero point stability ÷ measured value) · 100]% o.r.

o.r. = of reading

Zero point stability

DN	Max. full scale value	Zero point stability		
		Promass F	Promass F (High Temperature)	Promass M
[mm]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
8	2000	0.03	–	0.10
15	6500	0.20	–	0.325
25	18000	0.54	1.80	0.90
40	45000	2.25	–	2.25
50	70000	3.50	7.00	3.50
80	180000	9.00	18.0	9.00
100	350000	14.0	–	–
150	800000	32.0	–	–
250	2 200 000	88.0	–	–

Sample calculation



Maximum measured error in % of reading (example: Promass 84F / DN 25)

Calculation example (mass flow, liquid):
Given: Promass 84F / DN 25, measured value flow = 8000 kg/h
Max. measured error: ±0.10% ± [(zero point stability ÷ measured value) · 100]% o.r.
Maximum measured error → ±0.10% ± 0.54 kg/h ÷ 8000 kg/h · 100% = ±0.107%

Density (liquid)

- Standard calibration (1g/cc = 1 kg/l)
  - Promass F: ±0.01 g/cc
  - Promass M: ±0.02 g/cc
- Special density calibration (optional), not for high temperature version
  - Promass F: ±0.001 g/cc
  - Promass M: ±0.002 g/cc
- After field density calibration or under reference conditions
  - Promass F: ±0.0005 g/cc
  - Promass M: ±0.0010 g/cc

Temperature

±0.5 °C ±0.005 · T (T = fluid temperature in °C)

Repeatability

Mass flow (liquid):

±0.05% ± [½ · (zero point stability ÷ measured value) · 100]% o.r.

Mass flow (gas):

±0.25% ± [½ · (zero point stability ÷ measured value) · 100]% o.r.

Volume flow (liquid):

- Promass F: ±0.05% ± [½ · (zero point stability ÷ measured value) · 100]% o.r.
- Promass M: ±0.10% ± [½ · (zero point stability ÷ measured value) · 100]% o.r.

o.r. = of reading
Zero point stability: see "Max. measured error"

Calculation example (mass flow, liquid):
Given: Promass 84F / DN 25, measured value flow = 8000 kg/h
Repeatability: ±0.05% ± [(½ · (zero point stability ÷ measured value) · 100]% o.r.
Repeatability: ±0.05% ± ½ · 0.54 kg/h ÷ 8000 kg/h · 100% = ±0.053%

Density measurement (liquid)

1 g/cc = 1 kg/l

- Promass F: ±0.00025 g/cc
- Promass M: ±0.0005 g/cc

Temperature measurement

±0.25 °C ±0.0025 · T; (T = fluid temperature in °C)

Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the Promass sensor is ±0.0002% of the full scale value / °C.

Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN [mm]	Promass F, Promass F High temperature [% o.r./bar]	Promass M [% o.r./bar]	Promass M High pressure [% o.r./bar]
8	No influence	0.009	0.006
15	No influence	0.008	0.005
25	No influence	0.009	0.003
40	–0.003	0.005	–
50	–0.008	No influence	–
80	–0.009	No influence	–
100	–0.012	–	–
150	–0.009	–	–
250	–0.009	–	–
o.r. = of reading			

Operating conditions: Installation

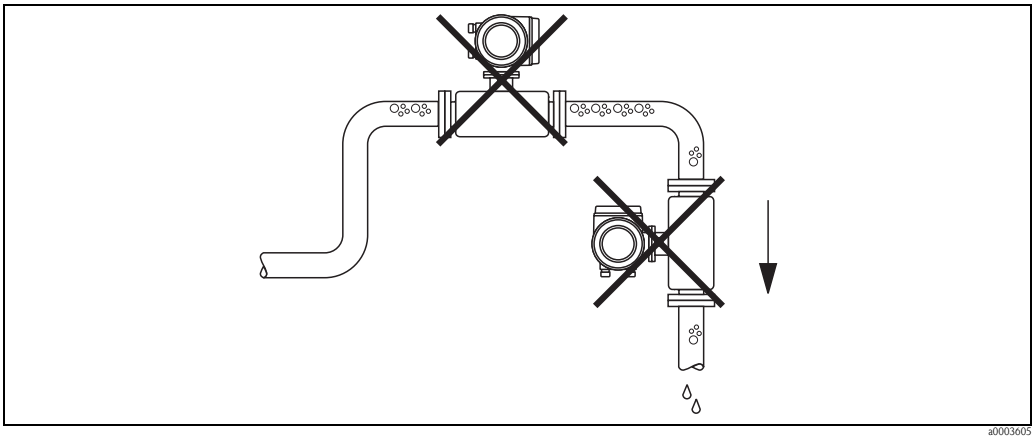
Installation instructions

Note the following points:
- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument, for example the secondary containment.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations.
- No special precautions need to be taken for fittings which create turbulence (valves, elbows, T-pieces, etc.), as long as no cavitation occurs.
- For mechanical reasons and in order to protect the pipe, it is advisable to support heavy sensors.
- Please refer to the verification ordinances for the installation conditions of the approval for custody transfer in question.

Note!
The necessary steps for creating a measuring system and obtaining approval from the Standards Authorities must be clarified with the authority for legal metrology controls responsible.

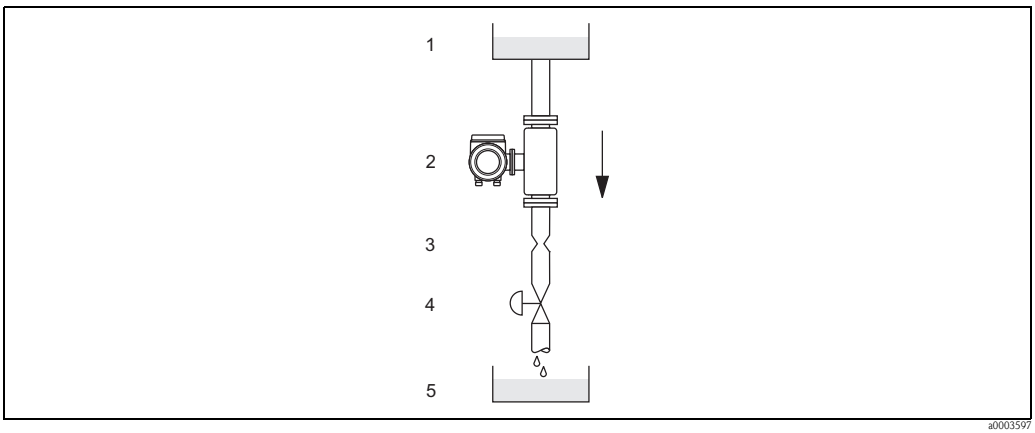
Mounting location

Entrained air or gas bubbles in the measuring tube can result in an increase in measuring errors.
Avoid the following mounting locations in the pipe:
- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream from a free pipe outlet in a vertical pipeline



Mounting location

Notwithstanding the above, the installation proposal below permits installation in an open vertical pipeline. Pipe restrictions or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.



Installation in a down pipe (e.g. for batching applications)

1 = Supply tank, 2 = Sensor, 3 = Orifice plate, pipe restriction (see Table), 4 = Valve, 5 = Batching tank

DN	8	15	25	40	50	80	100[1)]	150[1)]	250[1)]
∅ Orifice plate, pipe restriction [mm]	6	10	14	22	28	50	65	90	150
1) only Promass F									

Orientation

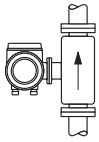
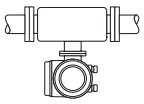
Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

Vertical

Recommended orientation with upward direction of flow (View V). When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids build-up.

Horizontal

The measuring tubes must be horizontal and beside each other. When installation is correct the transmitter housing is above or below the pipe (View H1/H2). Always avoid having the transmitter housing in the same horizontal plane as the pipe.

	Promass F, M Standard, compact	**Promass F, M Standard, remote**	**Promass F High-temperature, compact**	**Promass F High-temperature, remote**
Fig. V Vertical orientation  a0004572	✔✔	✔✔	✔✔	✔✔
Fig. H1 Horizontal orientation Transmitter head up  a0004576	✔✔	✔✔	✘ TM = >200 °C ①	✔ TM = >200 °C ①
Fig. H2 Horizontal orientation Transmitter head down  a0004580	✔✔ ②	✔✔ ②	✔✔ ②	✔✔ ②
✔✔ = Recommended orientation ✔ = Orientation recommended in certain situations ✘ = Impermissible orientation				

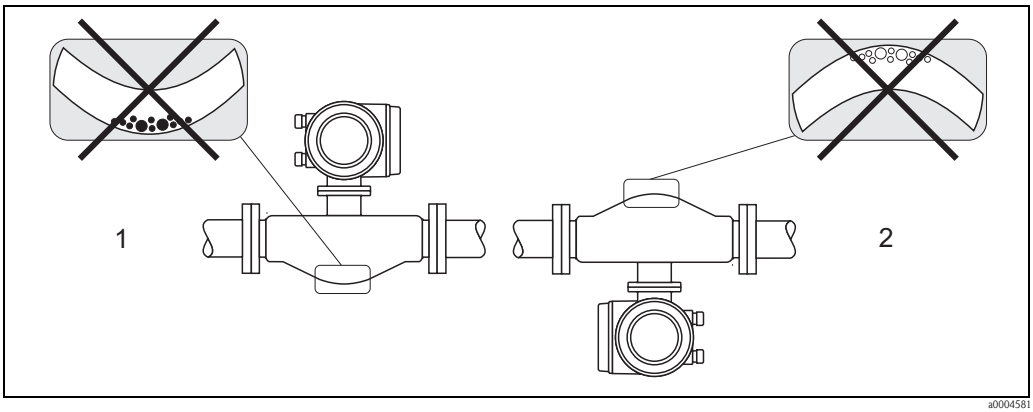
In order to ensure that the maximum permissible ambient temperature for the transmitter (–20 °C to +60 °C, optional –40 °C to +60 °C) is not exceeded, we recommend the following orientations:

① = For fluids with very high temperatures (>200 C), we recommend the horizontal orientation with the transmitter head pointing downwards (Fig. H2) or the vertical orientation (Fig. V).

② = For fluids with low temperatures, we recommend the horizontal orientation with the transmitter head pointing upwards (Fig. H1) or the vertical orientation (Fig. V).

Special installation instructions for Promass F

Caution!
The two measuring tubes for Promass F are slightly curved. The position of the sensor, therefore, has to be matched to the fluid properties when the sensor is installed horizontally .



Promass F, installed horizontally

1 Not suitable for fluids with entrained solids. Risk of solids accumulating.
2 Not suitable for outgassing fluids. Risk of air accumulating.

Heating

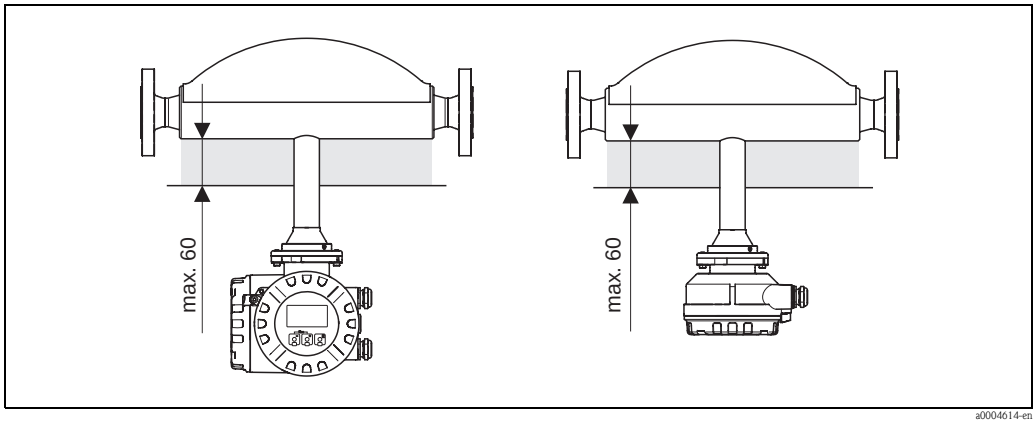
Some fluids require suitable measures to avoid loss of heat at the sensor. Heating can be electric, e.g. with heated elements, or by means of hot water or steam pipes made of copper or heating jackets.

Caution!
- Risk of electronics overheating! Make sure that the maximum permissible ambient temperature for the transmitter is not exceeded. Consequently, make sure that the adapter between sensor and transmitter and the connection housing of the remote version always remain free of insulating material. Note that a certain orientation might be required, depending on the fluid temperature.
- With a fluid temperature between 200 °C to 350 °C the remote version of the high-temperature version is preferable.
- When using electrical heat tracing whose heat is regulated using phase control or by pulse packs, it cannot be ruled out that the measured values are influenced by magnetic fields which may occur, (i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m)). In such cases, the sensor must be magnetically shielded (except for Promass M).
  The secondary containment can be shielded with tin plates or electric sheets without privileged direction (e.g. V330-35A) with the following properties:
  – Relative magnetic permeability $\mu_r \geq 300$
  – Plate thickness $d \geq 0.35$ mm
- Information on permissible temperature ranges → Page 21

Special heating jackets which can be ordered as accessories from Endress+Hauser are available for the sensors.

Thermal insulation

Some fluids require suitable measures to avoid loss of heat at the sensor. A wide range of materials can be used to provide the required thermal insulation.



In the case of the Promass F high-temperature version, a maximum insulation thickness of 60 mm must be observed in the area of the electronics/neck.

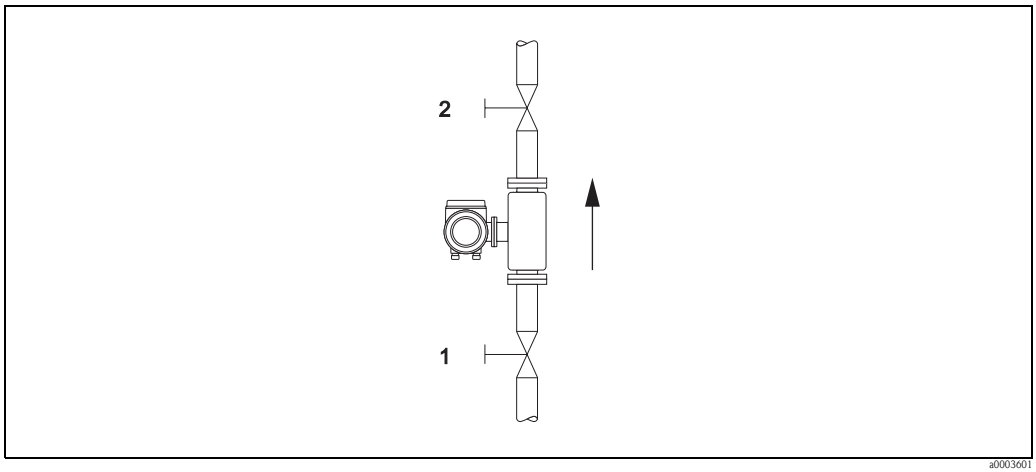
If the Promass F high-temperature version is installed horizontally (with transmitter head pointing upwards), an insulation thickness of min. 10 mm is recommended to reduce convection. The maximum insulation thickness of 60 mm must be observed.

Zero point adjustment

All Promass measuring devices are calibrated with state-of-the-art technology. The zero point determined in this way is imprinted on the nameplate. Calibration takes place under reference operating conditions.
→ Page 12 ff.
Consequently, the zero point adjustment is generally **not** necessary for Promass!

Experience shows that the zero point adjustment is advisable only in special cases:
- To achieve highest measuring accuracy also with very small flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high viscosity fluids).

Note the following before you perform a zero point adjustment:
- A zero point adjustment can be performed only with fluids that contain no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shut-off valves upstream and/or downstream of the sensor or by using existing valves and gates.
  – Normal operation → valves 1 and 2 open
  – Zero point adjustment *with* pump pressure → Valve 1 open / valve 2 closed
  – Zero point adjustment *without* pump pressure → Valve 1 closed / valve 2 open



Zero point adjustment and shut-off valves

Inlet and outlet runs	There are no installation requirements regarding inlet and outlet runs.
Length of connecting cable remote version	max. 20 m
System pressure	It is important to ensure that cavitation does not occur, because it would influence the oscillation of the measuring tube. No special measures need to be taken for fluids which have properties similar to water under normal conditions. In the case of liquids with a low boiling point (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important to ensure that pressure does not drop below the vapour pressure and that the liquid does not start to boil. It is also important to ensure that the gases that occur naturally in many liquids do not outgas. Such effects can be prevented when system pressure is sufficiently high. Consequently, it is generally best to install the sensor: ■ downstream from pumps (no danger of vacuum), ■ at the lowest point in a vertical pipe.

Operating conditions: Environment

Ambient temperature range

Sensor and transmitter
Standard: –20 to +60 °C
Optional: –40 to +60 °C

Note!
- Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- At ambient temperatures below –20 °C the readability of the display may be impaired.

Storage temperature

–40 to +80 °C, preferably +20 °C

Ambient class

B, C, I

Degree of protection

Standard: IP 67 (NEMA 4X) for transmitter and sensor

Shock resistance

According to IEC 68-2-31

Vibration resistance

Acceleration up to 1 g, 10 to 150 Hz, following IEC 68-2-6

CIP cleaning

yes

SIP cleaning

yes

Electromagnetic compatibility (EMC)

To ICE/EN 61326 and NAMUR recommendation NE 21

Operating conditions: Process

Medium temperature range

Sensor

- Promass F: –50 to +200 °C
- Promass F (High temperature version): –50 to +350 °C
- Promass M: –50 to +150 °C

Seals

- Promass F:
  No internal seals
- Promass M:
  – Viton: –15 to 200 °C
  – EPDM: –40 to +160 °C
  – Silikon: –60 to +200 °C
  – Kalrez: –20 to +275 °C
  – FEP sheathed (not for gas applications): –60 to +200 °C

Medium pressure range (nominal pressure)

Flanges

Promass F:
According to DIN PN 16 to 100 / according to ASME B16.5 Cl 150, Cl 300, Cl 600 / JIS 10K, 20K, 40K, 63K

Promass M:
According to DIN PN 40 to 100 / according to ASME B16.5 Cl 150, Cl 300, Cl 600 / JIS 10K, 20K, 40K, 63K

Promass M (high pressure version)

Measuring tubes, connector, couplings: max. 350 bar

Note!
Material load diagrams for the process connections can be found on → Page 58 ff.

Pressure ranges of secondary containment

- Promass F
  – DN 8 to 50: 40 bar
  – DN 80: 25 bar
  – DN 100 to 150: 16 bar
  – DN 250: 10 bar
- Promass M
  – 100 bar

Warning!
In case a danger of measuring tube failure exists due to process characteristics, e.g. with corrosive process fluids, we recommend the use of sensors whose secondary containment is equipped with special pressure monitoring connections or rupture disks (ordering option). With the help of these connections, fluid collected in the secondary containment in the event of tube failure can be bled off. This is especially important in high pressure gas applications. These connections can also be used for gas circulation and/or detection.
Dimensions → Page 53

Rupture disk (optional, only Promass F)

Further informationen → Page 54.

Limiting flow

See "Measuring range" section. → Page 68 ff.

Select nominal diameter by optimising between required flow range and permissible pressure loss. An overview of max. possible full scale values can be found in the "Measuring range" Section.

- The minimum recommended full scale value is approx. 1/20 of the max. full scale value.
- In most applications, 20 to 50% of the maximum full scale value can be considered ideal.
- Select a lower full scale value for abrasive substances such as fluids with entrained solids (flow velocity <1 m/s).
- For gas measurement the following rules apply:
  - Flow velocity in the measuring tubes should not be more than half the sonic velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula → Page 5 ff.

Pressure loss in metric units

Pressure loss depends on the properties of the fluid and on its flow.
The following formulas can be used to approximately calculate the pressure loss:

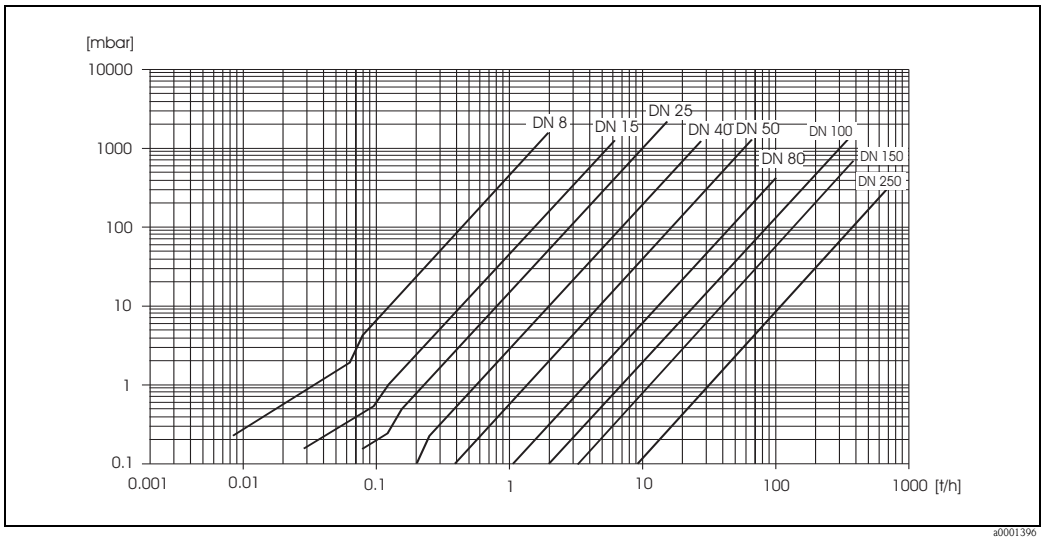
Reynolds number	$Re = \frac{2 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$ a0004623
$Re \geq 2300$[1)]	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$ a0004626
$Re < 2300$	$\Delta p = K1 \cdot \nu \cdot \dot{m} + \frac{K2 \cdot \nu^{0.25} \cdot \dot{m}^{2}}{\rho}$ a0004628

Δp = pressure loss [mbar] — ρ = fluid density [kg/m3]
ν = kinematic viscosity [m2/s] — d = inside diameter of measuring tubes [m]
$\dot{m}$ = mass flow [kg/s] — K to K2 = constants (depending on nominal diameter)

1) To compute the pressure loss for gases, always use the formula for $Re \geq 2300$.

Pressure loss coefficient for Promass F

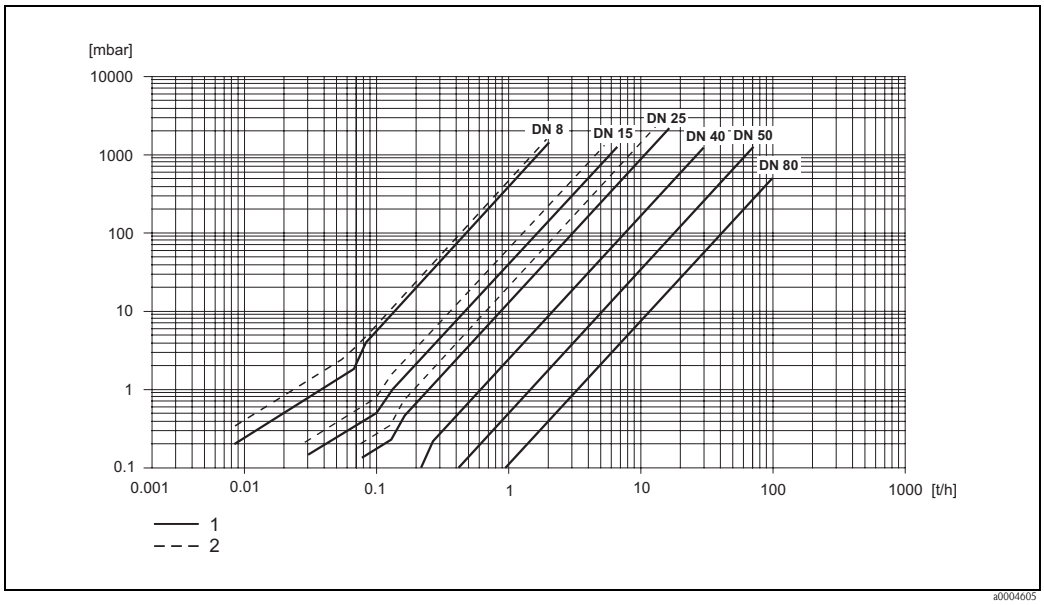
DN	d[m]	K	K1	K2
8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^{7}$	$9.60 \cdot 10^{7}$	$1.90 \cdot 10^{7}$
15	$8.30 \cdot 10^{-3}$	$5.80 \cdot 10^{6}$	$1.90 \cdot 10^{7}$	$10.60 \cdot 10^{5}$
25	$12.00 \cdot 10^{-3}$	$1.90 \cdot 10^{6}$	$6.40 \cdot 10^{6}$	$4.50 \cdot 10^{5}$
40	$17.60 \cdot 10^{-3}$	$3.50 \cdot 10^{5}$	$1.30 \cdot 10^{6}$	$1.30 \cdot 10^{5}$
50	$26.00 \cdot 10^{-3}$	$7.00 \cdot 10^{4}$	$5.00 \cdot 10^{5}$	$1.40 \cdot 10^{4}$
80	$40.50 \cdot 10^{-3}$	$1.10 \cdot 10^{4}$	$7.71 \cdot 10^{4}$	$1.42 \cdot 10^{4}$
100	$51.20 \cdot 10^{-3}$	$3.54 \cdot 10^{3}$	$3.54 \cdot 10^{4}$	$5.40 \cdot 10^{3}$
150	$68.90 \cdot 10^{-3}$	$1.36 \cdot 10^{3}$	$2.04 \cdot 10^{4}$	$6.46 \cdot 10^{2}$
250	$102.26 \cdot 10^{-3}$	$3.00 \cdot 10^{2}$	$6.10 \cdot 10^{3}$	$1.33 \cdot 10^{2}$



Pressure loss diagram for water

Pressure loss coefficient for Promass M

DN	d[m]	K	K1	K2
8	$5.53 \cdot 10^{-3}$	$5.2 \cdot 10^{7}$	$8.6 \cdot 10^{7}$	$1.7 \cdot 10^{7}$
15	$8.55 \cdot 10^{-3}$	$5.3 \cdot 10^{6}$	$1.7 \cdot 10^{7}$	$9.7 \cdot 10^{5}$
25	$11.38 \cdot 10^{-3}$	$1.7 \cdot 10^{6}$	$5.8 \cdot 10^{6}$	$4.1 \cdot 10^{5}$
40	$17.07 \cdot 10^{-3}$	$3.2 \cdot 10^{5}$	$1.2 \cdot 10^{6}$	$1.2 \cdot 10^{5}$
50	$25.60 \cdot 10^{-3}$	$6.4 \cdot 10^{4}$	$4.5 \cdot 10^{5}$	$1.3 \cdot 10^{4}$
80	$38.46 \cdot 10^{-3}$	$1.4 \cdot 10^{4}$	$8.2 \cdot 10^{4}$	$3.7 \cdot 10^{4}$
High pressure version				
8	$4.93 \cdot 10^{-3}$	$6.0 \cdot 10^{7}$	$1.4 \cdot 10^{8}$	$2.8 \cdot 10^{7}$
15	$7.75 \cdot 10^{-3}$	$8.0 \cdot 10^{6}$	$2.5 \cdot 10^{7}$	$1.4 \cdot 10^{6}$
25	$10.20 \cdot 10^{-3}$	$2.7 \cdot 10^{6}$	$8.9 \cdot 10^{6}$	$6.3 \cdot 10^{5}$



Pressure loss diagram for water

1 Promass M
2 Promass M (high pressure version)

Pressure loss in US units

Pressure loss ist dependent on fluid properties nominal diameter. Consult Endress+Hauser for Applicator PC software to determine pressure loss in US units. All important instrument data is contained in the Applicator software programm in order to optimize the design of measuring system. The software is used for following calculations:

- Nominal diameter of the sensor with fluid characteristics such as viscosity, density, etc.
- Pressure loss downstream ot the measuring point.
- Converting mass flow to volume flow, etc.
- Simultaneous display of various meter size.
- Determining measuring ranges.

The Applicator runs on any IBM compatible PC with windows.

Custody transfer measurement

Promass 84 is a flowmeter suitable for custody transfer measurement for liquids (other than water) and gases.

Custody transfer variables

- Mass
- Volume
- Density

Suitability for custody transfer, metrological control, obligation to subsequent verification

Promass 84 flowmeters are usually verified on site using reference measurements. Only once it has been verified on site by the Verification Authority for legal metrology controls may the measuring device be regarded as verified and used for applications subject to legal metrology controls. The associated seal (stamp) on the measuring device ensures this status.

Caution!
Only flowmeters verified by the Verification Authorities may be used for invoicing in applications subject to legal metrology controls. For all verification processes, both the corresponding approvals and the country-specific requirements resp. regulations (e.g. such as the German Verification Act) must be observed. The owner / user of the instrument is obliged to subsequent verification.

Approval for custody transfer

The requirements of the following legal metrology authorities are taken into consideration:
- **PTB**, Germany; (www.eichamt.de)
- **NMi**, The Netherlands; (www.nmi.nl)
- **METAS**, Switzerland; (www.metas.ch)
- **BEV**, Austria; (www.bev.gv.at)

Switching on the power supply in custody transfer mode

If the device is started in custody transfer mode, for example also after a power outage, system error No. 271 "POWER BRK. DOWN" flashes on the local display. The fault message can be acknowledged or reset using the "Enter" key or by means of the status input configured accordingly.

Note!
For correct measuring operation, it is not mandatory to reset the fault message.

Verification (Example)

Type-approved measuring systems for liquids other than water are always verified at their place of deployment. For this purpose, the facility's owner-operator must make everything available when the Verification Authorities come to inspect and verify the system. This includes:

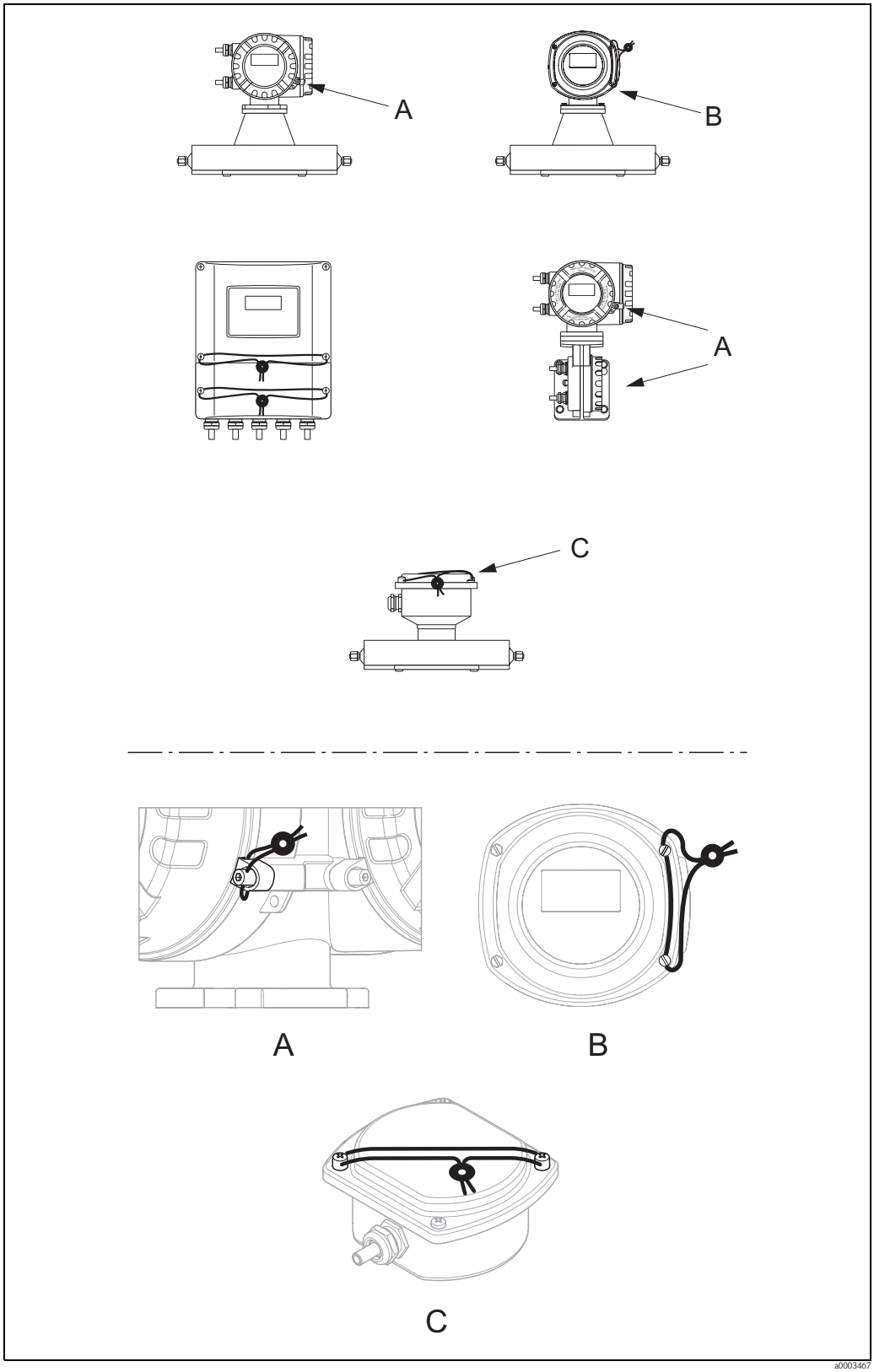
- Scales or container with a reading unit with a load or volumetric capacity that corresponds to the operation of the system at Q_{max} for one minute. The resolution of the scales display or the reading unit must be at least 0.1 % of the minimum measured quantity.
- Unit for removing the medium being measured after the totalizer to fill the scales or the container.
- Making a sufficient quantity of the medium being measured available. The quantity is derived from the operation of the system. The following rule of thumb applies - quantity at:
  3×1 minute at Q_{min},
  plus 3×1 minute at $\frac{1}{2} Q_{max}$,
  plus 3×1 minute at Q_{max},
  plus adequate quantity in reserve.
- Approval certificates

Note!
All issues should be clarified in advance with the authority responsible to ensure the successful verification of the measuring system.

Setting up custody transfer mode

A detailed description of the "setting up custody transfer mode" process is provided in the Operating Instructions supplied with the device.

Stamp points



Examples of how to seal the various device versions.

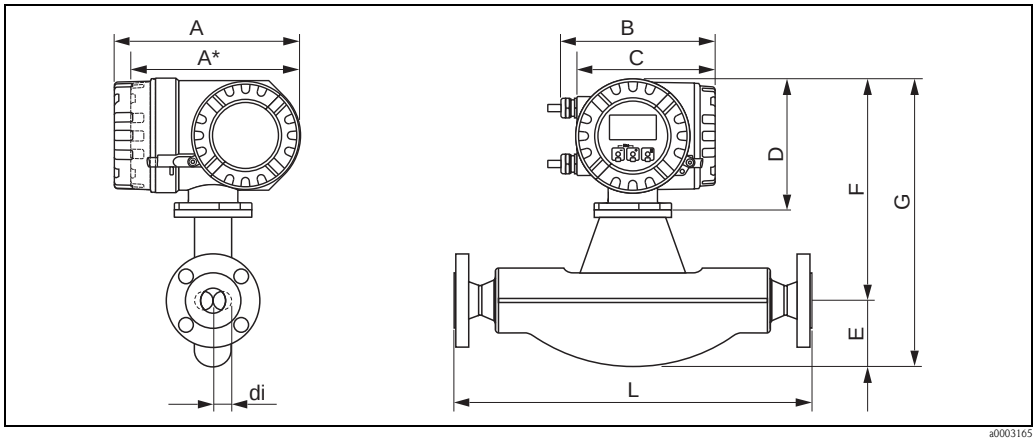
Disabling custody transfer mode

A detailed description of the "disabling custody transfer mode" process is provided in the Operating Instructions supplied with the device.

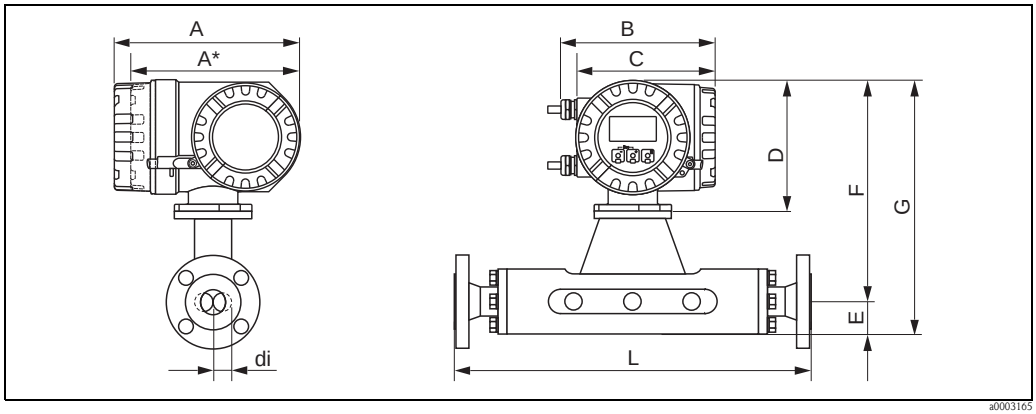
Mechanical construction

Design/dimensions in metric units

Transmitter compact version, powder coated die-cast aluminium field housing



Promass F



Promass M

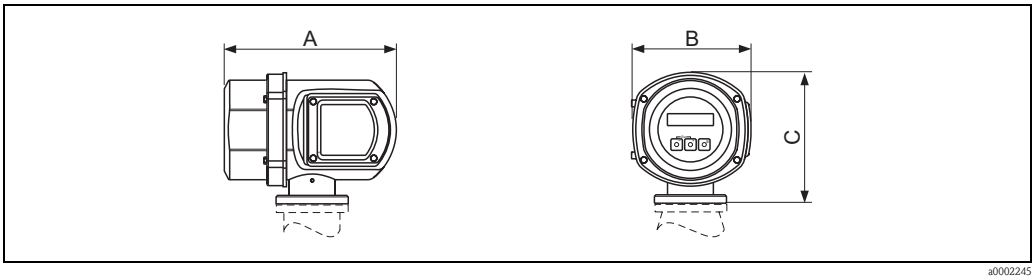
A	A*	B	C	D
227	207	187	168	160

All dimensions in [mm]
* Blind version (without display)

Promass F						Promass M					
DN	E	F	G	L	di	DN	E	F	G	L	di
8	75	266	341	1)	1)	8	35	266	301	1)	1)
15	75	266	341	1)	1)	15	37	268	305	1)	1)
25	75	266	341	1)	1)	25	40	272	312	1)	1)
40	105	271	376	1)	1)	40	49	283	332	1)	1)
50	141	283	424	1)	1)	50	58	293	351	1)	1)
80	200	305	505	1)	1)	80	76	309	385	1)	1)
100	247	324	571	1)	1)	All dimensions in [mm] 1) depends on the process connection → see tables on following pages					
150	378	362	740	1)	1)						
250	548	390	938	1)	1)						

Note!
Dimensions for transmitter II2G/zone 1 → Page 29.

Transmitter compact version, stainless steel field housing

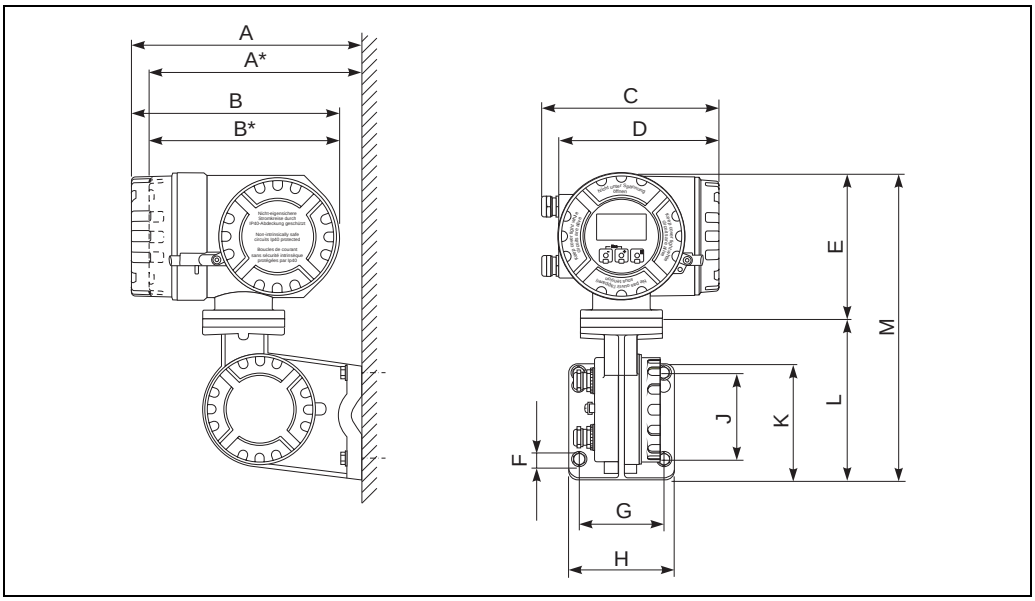


a0002245

A	B	C
225	153	168

All dimensions in [mm]

Transmitter and remote field housing (II2G/zone 1)



a0002128

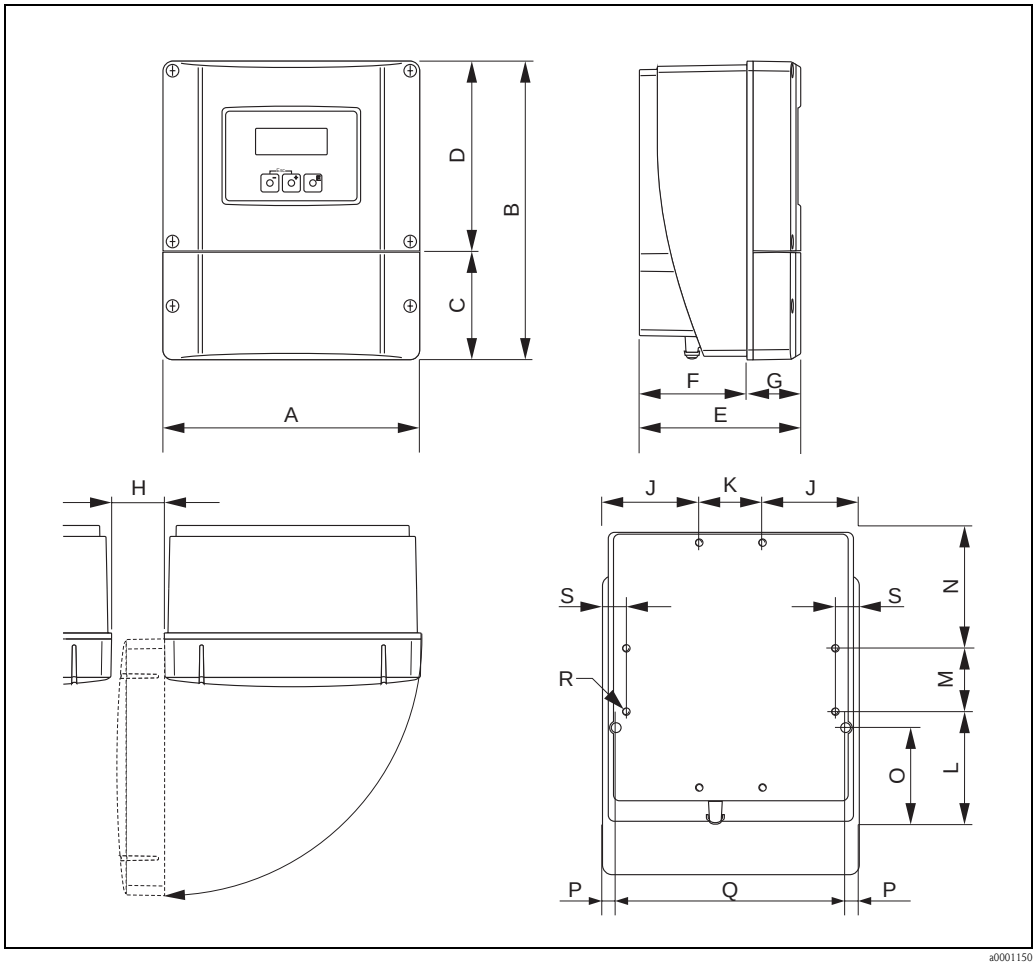
A	A*	B	B*	C	D	E
265	242	240	217	206	186	167

* Blind version (without display)

F	G	H	J	K	L	M
∅ 8.6 (M8)	100	123	100	133	188	355

All dimensions in [mm]

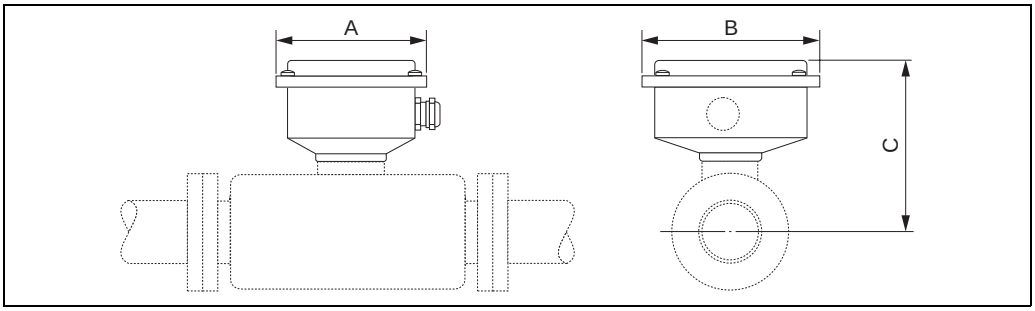
Transmitter wall-mount housing (non hazardous area and II3G/zone 2)



A	B	C	D	E	F	G	H	J
215	250	90.5	159.5	135	90	45	> 50	81
K	L	M	N	O	P	Q	R	S
53	95	53	102	81.5	11.5	192	8 × M5	20

All dimensions in [mm]

Connetion housing remote version

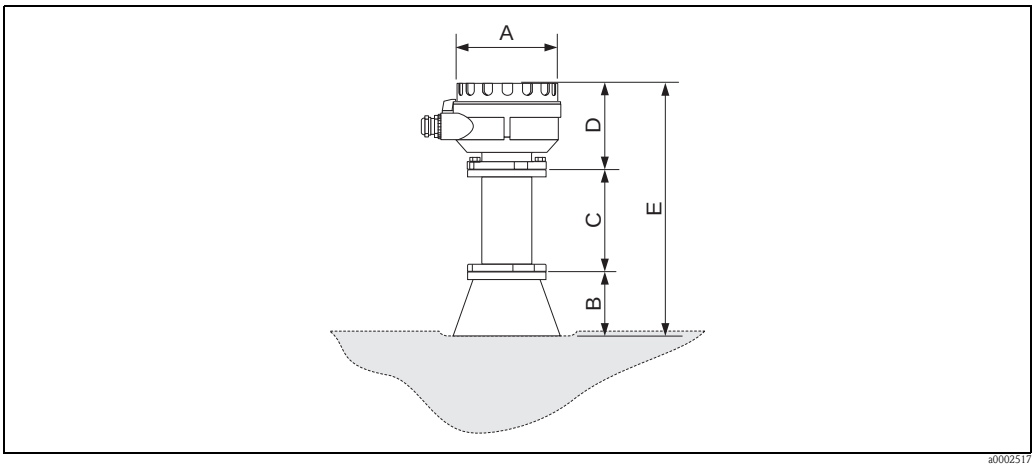


a0002516

Promass F				Promass M			
DN	A	B	C	DN	A	B	C
8	118.5	137.5	113	8	118.5	137.5	113
15	118.5	137.5	113	15	118.5	137.5	115
25	118.5	137.5	113	25	118.5	137.5	119
40	118.5	137.5	118	40	118.5	137.5	130
50	118.5	137.5	130	50	118.5	137.5	140
80	118.5	137.5	152	80	118.5	137.5	156
100	118.5	137.5	171	All dimensions in [mm]			
150	118.5	137.5	209				
250	118.5	137.5	237				

Connetion housing remote version for heating

Note!
Use this version in case of insulation or application of heating jacket.

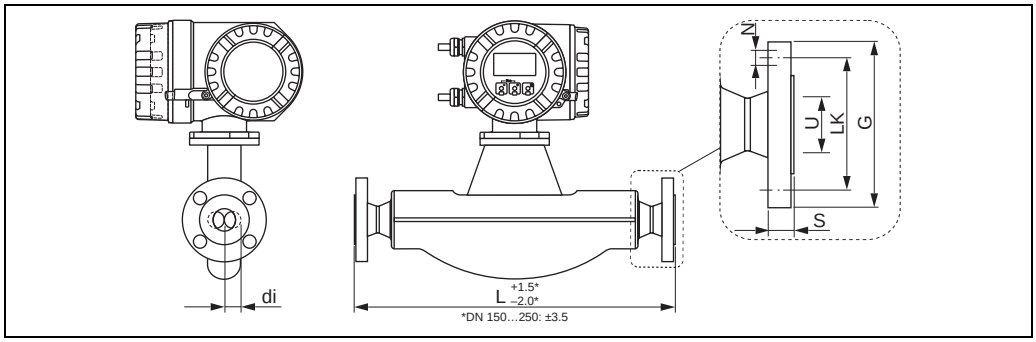


a0002517

A	B	C	D	E
129	80	110	102	292

All dimensions in [mm]

Promass F: Flange connections EN (DIN)



a0002501-en

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 16: 1.4404/316L

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

DN	G	L	N	S	LK	U	di
100	220	1128	8 × Ø 18	20	180	107.1	51.20
150	285	1330	8 × Ø 22	22	240	159.3	68.90
250 [2]	405	1780	12 × Ø 26	26	355	260.4	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] flange with groove according to EN 1092-1 Form D (DIN 2512N) available
[2] not available in Alloy

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N) extension - reduction / PN 16: 1.4404/316L
Only for nominal diameter DN 250 (on request)

Surface roughness (flange): Ra 0.8 to 3.2 µm

DN	G	L	N	S	LK	U	di
150	285	1980	8 × Ø 22	22	240	159.3	102.26
200	340	1940	12 × Ø 22	24	295	207.3	102.26
300	460	1940	12 × Ø 26	28	410	309.7	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 40: 1.4404/316L, Alloy C-22

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

DN	G	L	N	S	LK	U	di
8 [2]	95	370	4 × Ø 14	16	65	17.3	5.35
15	95	404	4 × Ø 14	16	65	17.3	8.30
25	115	440	4 × Ø 14	18	85	28.5	12.00
40	150	550	4 × Ø 18	18	110	43.1	17.60
50	165	715	4 × Ø 18	20	125	54.5	26.00
80	200	840	8 × Ø 18	24	160	82.5	40.50
100	235	1128	8 × Ø 22	24	190	107.1	51.20
150	300	1370	8 × Ø 26	28	250	159.3	68.90
250 [3]	450	1850	12 × Ø 33	38	385	258.8	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] flange with groove according to EN 1092-1 Form D (DIN 2512N) available
[2] with DN 15 flanges; [3] not available in Alloy

Flange according to EN 1092-1 (DIN 2501) / PN 40 (with DN 25-Flanges): 1.4404/316L

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

DN	G	L	N	S	LK	U	di
8	115	440	4 × Ø 14	18	85	28.5	5.35
15	115	440	4 × Ø 14	18	85	28.5	8.30

All dimensions in [mm]; Further dimensions → Page 28 ff.

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N) extension - reduction / PN 40: 1.4404/316L
Only for nominal diameter DN 250 (on request)

Surface roughness (flange): Ra 0.8 to 3.2 µm

DN	G	L	N	S	LK	U	di
150	300	1980	8 × Ø 26	28	250	159.3	102.26
200	375	1940	12 × Ø 30	34	320	206.5	102.26
300	515	1940	16 × Ø 33	42	450	307.9	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 63: 1.4404/316L, Alloy C-22

Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm

DN	G	L	N	S	LK	U	di
50	180	724	4 × Ø 22	26	135	54.5	26.00
80	215	875	8 × Ø 22	28	170	81.7	40.50
100	250	1128	8 × Ø 26	30	200	106.3	51.20
150	345	1410	8 × Ø 33	36	280	157.1	68.90
250 [2]	470	1890	12 × Ø 36	46	400	255.4	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] flange with groove according to EN 1092-1 Form D (DIN 2512N) available
[2] not available in Alloy

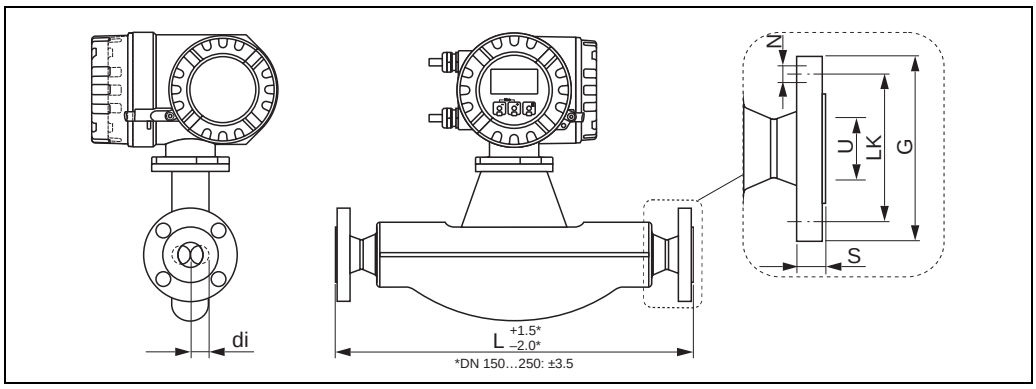
Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 100: 1.4404/316L, Alloy C-22

Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm

DN	G	L	N	S	LK	U	di
8 [2]	105	400	4 × Ø 14	20	75	17.3	5.35
15	105	420	4 × Ø 14	20	75	17.3	8.30
25	140	470	4 × Ø 18	24	100	28.5	12.00
40	170	590	4 × Ø 22	26	125	42.5	17.60
50	195	740	4 × Ø 26	28	145	53.9	26.00
80	230	885	8 × Ø 26	32	180	80.9	40.50
100	265	1128	8 × Ø 30	36	210	104.3	51.20
150	355	1450	12 × Ø 33	44	290	154.0	68.90

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] flange with groove according to EN 1092-1 Form D (DIN 2512N) available
[2] with DN 15 flanges

Promass F: Flange connections ASME B16.5



Flange according to ASME B16.5 / Cl 150: 1.4404/316L, Alloy C-22 Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
8 [1]	88.9	370	4 × Ø 15.7	11.2	60.5	15.7	5.35
15	88.9	404	4 × Ø 15.7	11.2	60.5	15.7	8.30
25	108.0	440	4 × Ø 15.7	14.2	79.2	26.7	12.00
40	127.0	550	4 × Ø 15.7	17.5	98.6	40.9	17.60
50	152.4	715	4 × Ø 19.1	19.1	120.7	52.6	26.00
80	190.5	840	4 × Ø 19.1	23.9	152.4	78.0	40.50
100	228.6	1128	8 × Ø 19.1	23.9	190.5	102.4	51.20
150	279.4	1398	8 × Ø 22.4	25.4	241.3	154.2	68.90
250 [2]	406.4	1836.8	12 × Ø 25.4	30.2	362	254.5	102.26
All dimensions in [mm]; Further dimensions → Page 28 ff. [1] with DN 15 flanges [2] not available in Alloy							

Flange according to ASME B16.5 extension - reduction / Cl 150: 1.4404/316L Only for nominal diameter DN 250 /10" (on request) Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
150	279.4	1980	8 × Ø 22.4	25.4	241.3	154.2	102.26
200	342.9	1940	8 × Ø 22.4	28.4	298.5	202.7	102.26
300	482.6	1940	12 × Ø 25.4	31.8	431.8	304.80	102.26
All dimensions in [mm]; Further dimensions → Page 28 ff.							

Flange according to ASME B16.5 / Cl 300: 1.4404/316L, Alloy C-22

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
8 [1]	95.2	370	4 × Ø 15.7	14.2	66.5	15.7	5.35
15	95.2	404	4 × Ø 15.7	14.2	66.5	15.7	8.30
25	123.9	440	4 × Ø 19.0	17.5	88.9	26.7	12.00
40	155.4	550	4 × Ø 22.3	20.6	114.3	40.9	17.60
50	165.1	715	8 × Ø 19.0	22.3	127.0	52.6	26.00
80	209.5	840	8 × Ø 22.3	28.4	168.1	78.0	40.50
100	254.0	1128	8 × Ø 22.3	31.7	200.1	102.4	51.20
150	317.5	1417	12 × Ø 22.3	36.5	269.7	154.2	68.90
250 [2]	444.5	1868.2	16 × Ø 28.4	47.4	387.3	254.5	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] with DN 15 flanges; [2] not available in Alloy

Flange according to ASME B16.5 extension - reduction / Cl 300: 1.4404/316
Only for nominal diameter DN 250 /10" (on request)

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
150	317.5	1980	12 × Ø 22.4	36.5	269.7	154.2	102.26
200	381.0	1940	12 × Ø 25.4	41.1	330.2	202.7	102.26
300	520.7	1940	16 × Ø 31.7	50.8	450.8	304.80	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.

Flange according to ASME B16.5 / Cl 600: 1.4404/316L, Alloy C-22

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
8 [1]	95.3	400	4 × Ø 15.7	20.6	66.5	13.9	5.35
15	95.3	420	4 × Ø 15.7	20.6	66.5	13.9	8.30
25	124.0	490	4 × Ø 19.1	23.9	88.9	24.3	12.00
40	155.4	600	4 × Ø 22.4	28.7	114.3	38.1	17.60
50	165.1	742	8 × Ø 19.1	31.8	127.0	49.2	26.00
80	209.6	900	8 × Ø 22.4	38.2	168.1	73.7	40.50
100	273.1	1158	8 × Ø 25.4	48.4	215.9	97.3	51.20
150	355.6	1467	12 × Ø 28.4	47.8	292.1	154.2	68.90
250 [2]	508.0	1951.2	16 × Ø 35.1	69.9	431.8	254.5	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.; [1] with DN 15 flanges; [2] not available in Alloy

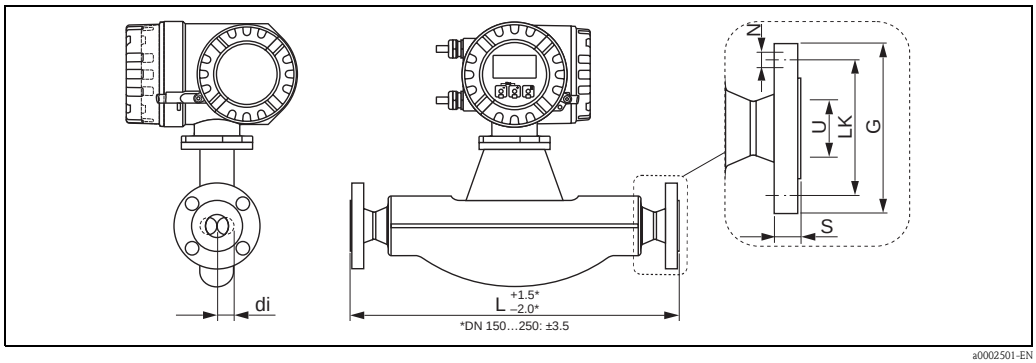
Flange according to ASME B16.5 extension - reduction / Cl 600: 1.4404/316L
Only for nominal diameter DN 250 /10" (on request)

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
150	355.6	1980	12 × Ø 28.4	54.2	292.1	154.2	102.26
200	419.1	1940	12 × Ø 31.8	62.0	349.3	202.7	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.

Promass F: Flange connections JIS



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Flange JIS B2220 / 10K: 1.4404/316L, Alloy C-22

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
50	155	715	4 × Ø 19	16	120	50	26.00
80	185	832	8 × Ø 19	18	150	80	40.50
100	210	1128	8 × Ø 19	18	175	100	51.20
150	280	1354	8 × Ø 23	22	240	150	68.90
250 [1)]	400	1780	12 × Ø 25	24	355	250	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.; [1)] not available in Alloy

Flange JIS extension - reduction / 10K: 1.4404/316L, Alloy C-22

Only for nominal diameter DN 250 (on request)
Surface roughness (flange): Ra 1.6 to 3.2 µm

DN	G	L	N	S	LK	U	di
150	280	1980	8 × Ø 23	22	240	150	102.26
200	330	1940	12 × Ø 23	22	290	200	102.26
300	445	1940	16 × Ø 25	24	400	300	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.

Flange JIS B2220 / 20K: 1.4404/316L, Alloy C-22

Surface roughness (flange): Ra 1.6 to 3.2 µm

DN	G	L	N	S	LK	U	di
8 [1]	95	370	4 × Ø 15	14	70	15	5.35
15	95	404	4 × Ø 15	14	70	15	8.30
25	125	440	4 × Ø 19	16	90	25	12.00
40	140	550	4 × Ø 19	18	105	40	17.60
50	155	715	8 × Ø 19	18	120	50	26.00
80	200	832	8 × Ø 23	22	160	80	40.50
100	225	1128	8 × Ø 23	24	185	100	51.20
150	305	1386	12 × Ø 25	28	260	150	68.90
250 [2]	430	1850	12 × Ø 27	34	380	250	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.; [1] with DN 15 flanges; [2] not available in Alloy

Flange JIS extension - reduction / 20K: 1.4404/316L, Alloy C-22

Only for nominal diameter DN 250 (on request)
Surface roughness (flange): Ra 1.6 to 3.2 µm

DN	G	L	N	S	LK	U	di
150	305	1980	12 × Ø 25	28	260	150	102.26
200	350	1940	12 × Ø 25	30	305	200	102.26
300	480	1940	16 × Ø 27	36	430	300	102.26

All dimensions in [mm]; Further dimensions → Page 28 ff.

Flange JIS B2220 / 40K: 1.4404/316L, Alloy C-22

Surface roughness (flange): Ra 1.6 to 3.2 µm

DN	G	L	N	S	LK	U	di
8 [1]	115	400	4 × Ø 19	20	80	15	5.35
15	115	425	4 × Ø 19	20	80	15	8.30
25	130	485	4 × Ø 19	22	95	25	12.00
40	160	600	4 × Ø 23	24	120	38	17.60
50	165	760	8 × Ø 19	26	130	50	26.00
80	210	890	8 × Ø 23	32	170	75	40.50
100	250	1168	8 × Ø 25	36	205	100	51.20
150	355	1498	12 × Ø 33	44	295	150	68.90

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] with DN 15 flanges

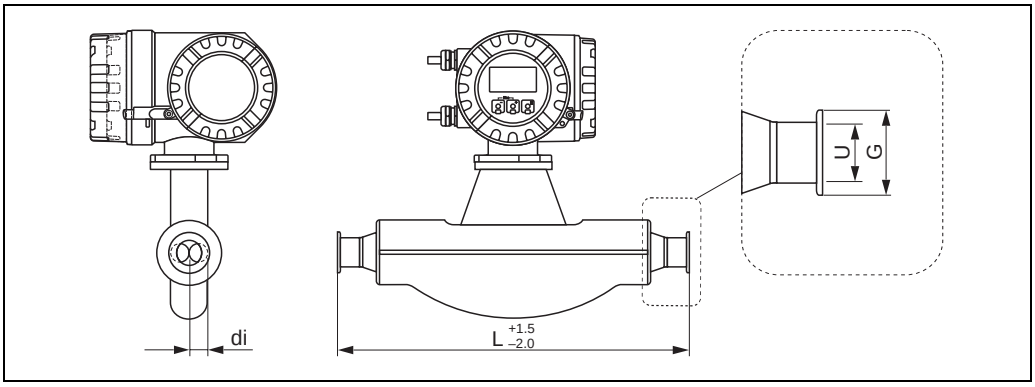
Flange JIS B2220 / 63K: 1.4404/316L, Alloy C-22

Surface roughness (flange): Ra 1.6 to 3.2 µm

DN	G	L	N	S	LK	U	di
8 [1]	120	420	4 × Ø 19	23	85	12	5.35
15	120	440	4 × Ø 19	23	85	12	8.30
25	140	494	4 × Ø 23	27	100	22	12.00
40	175	620	4 × Ø 25	32	130	35	17.60
50	185	775	8 × Ø 23	34	145	48	26.00
80	230	915	8 × Ø 25	40	185	73	40.50
100	270	1168	8 × Ø 27	44	220	98	51.20
150	365	1528	12 × Ø 33	54	305	146	68.90

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] with DN 15 flanges

Promass F: Tri-Clamp



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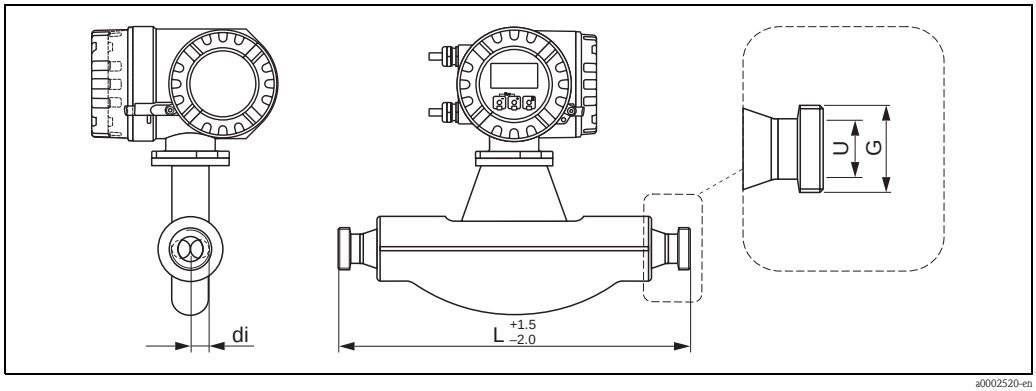
Tri-Clamp: 1.4404/316L					
DN	Clamp	G	L	U	di
8	1"	50.4	367	22.1	5.35
15	1"	50.4	398	22.1	8.30
25	1"	50.4	434	22.1	12.00
40	1 ½"	50.4	560	34.8	17.60
50	2"	63.9	720	47.5	26.00
80	3"	90.9	900	72.9	40.50
100	4"	118.9	1128	97.4	51.20
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)					

½"-Tri-Clamp: 1.4404/316L					
DN	Clamp	G	L	U	di
8	½"	25.0	367	9.5	5.35
15	½"	25.0	398	9.5	8.30
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)					

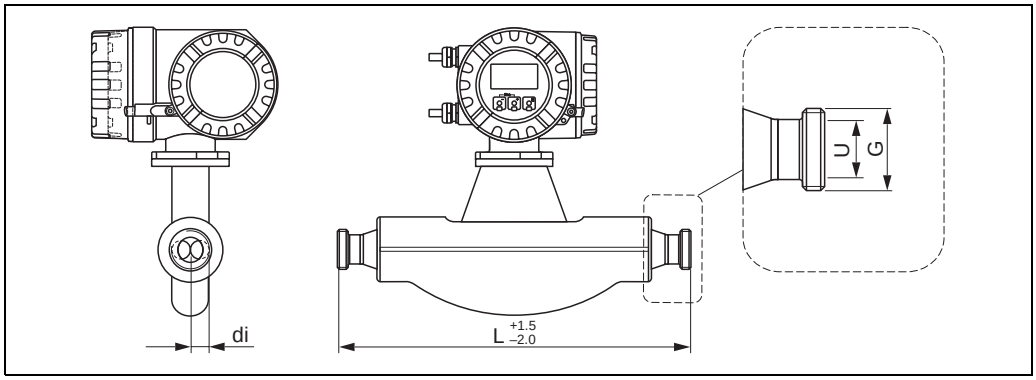
Promass F: DIN 11851 connections (threaded hygienic connection)



a0002520-en

Threaded hygienic connection DIN 11851: 1.4404/316L				
DN	G	L	U	di
8	Rd 34 × 1/8"	367	16	5.35
15	Rd 34 × 1/8"	398	16	8.30
25	Rd 52 × 1/6"	434	26	12.00
40	Rd 65 × 1/6"	560	38	17.60
50	Rd 78 × 1/6"	720	50	26.00
80	Rd 110 × 1/4"	900	81	40.50
100	Rd 130 × 1/4"	1128	100	51.20
All dimensions in [mm]; Further dimensions → Page 28 ff.; 3A version available (Ra ≤ 0.8 µm/150 grit.)				

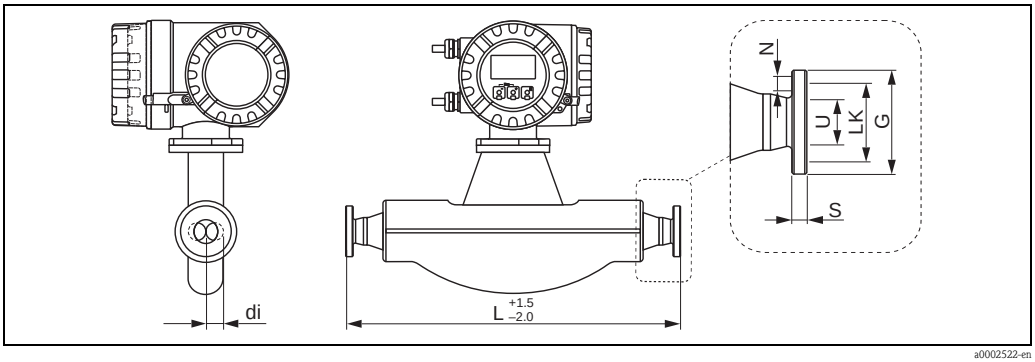
Promass F: DIN 11864-1 Form A (threaded hygienic connection)



a0002521-en

Threaded hygienic connection DIN 11864-1 Form A: 1.4404/316L				
DN	G	L	U	di
8	Rd 28 × 1/8"	367	10	5.35
15	Rd 34 × 1/8"	398	16	8.30
25	Rd 52 × 1/6"	434	26	12.00
40	Rd 65 × 1/6"	560	38	17.60
50	Rd 78 × 1/6"	720	50	26.00
80	Rd 110 × 1/4"	900	81	40.50
100	Rd 130 × 1/4"	1128	100	51.20
All dimensions in [mm]; Further dimensions → Page 28 ff.; 3A version available (Ra ≤ 0.8 µm/150 grit.)				

Promass F: DIN 11864-2 Form A (flat flange with groove)



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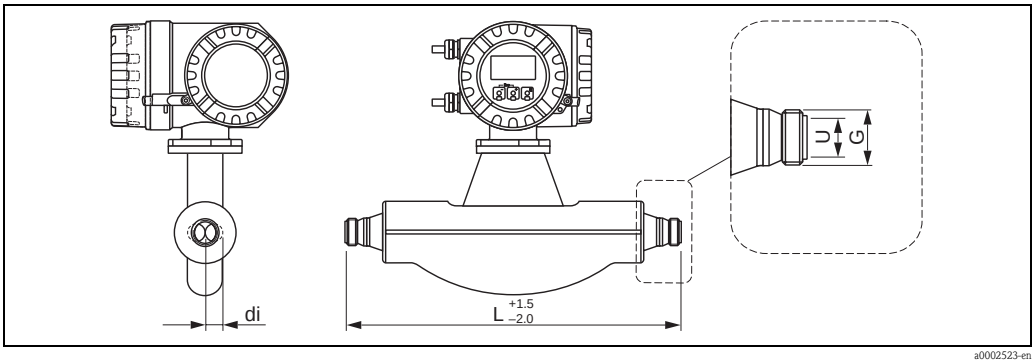
DIN 11864-2 Form A (flat fange with groove): 1.4404/316L							
DN	G	L	N	S	LK	U	di
8	54	387	4 × Ø 9	10	37	10	5.35
15	59	418	4 × Ø 9	10	42	16	8.30
25	70	454	4 × Ø 9	10	53	26	12.00
40	82	560	4 × Ø 9	10	65	38	17.60
50	94	720	4 × Ø 9	10	77	50	26.00
80	133	900	8 × Ø 11	12	112	81	40.50
100	159	1128	8 × Ø 11	14	137	100	51.20
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)							

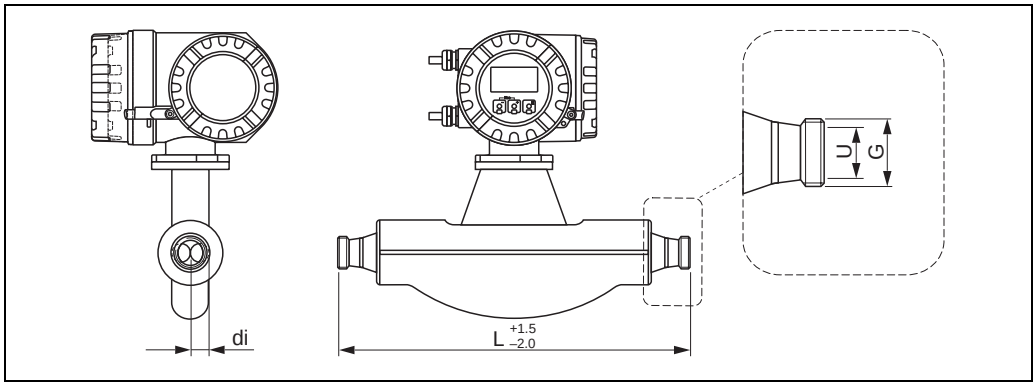
Promass F: ISO 2853 (threaded hygienic connection)



a0002523-en

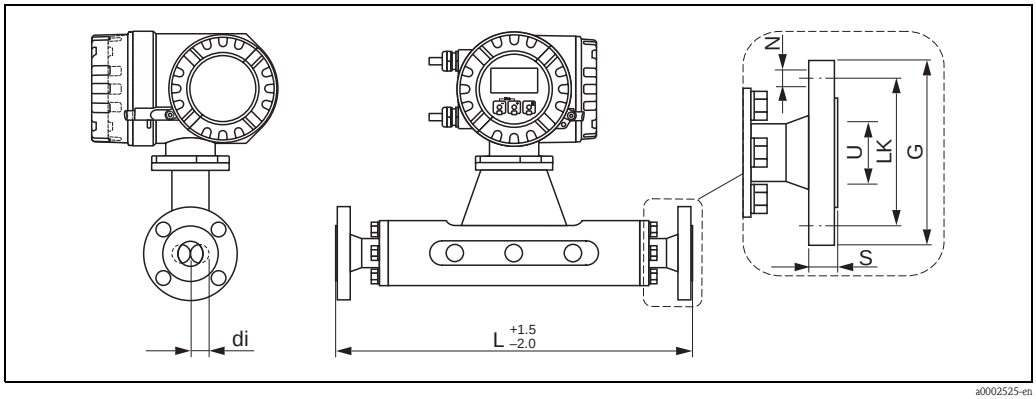
Threaded hygienic connection ISO 2853: 1.4404/316L				
DN	G [1]	L	N	di
8	37.13	367	22.6	5.35
15	37.13	398	22.6	8.30
25	37.13	434	22.6	12.00
40	52.68	560	35.6	17.60
50	64.16	720	48.6	26.00
80	91.19	900	72.9	40.50
100	118.21	1128	97.6	51.20
All dimensions in [mm]; Further dimensions → Page 28 ff.; [1] Max. thread diameter to ISO 2853 Annex A 3A version available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)				

Promass F: SMS 1145 (threaded hygienic connection)



threaded hygienic connection SMS 1145: 1.4404/316L				
DN	G	L	U	di
8	Rd 40 x 1/6"	367	22.6	5.35
15	Rd 40 x 1/6"	398	22.6	8.30
25	Rd 40 x 1/6"	434	22.6	12.00
40	Rd 60 x 1/6"	560	35.6	17.60
50	Rd 70 x 1/6"	720	48.6	26.00
80	Rd 98 x 1/6"	900	72.9	40.50
100	Rd 132 x 1/6"	1128	97.6	51.20
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit. Option: Ra ≤ 0.4 µm/240 grit)				

Promass M: Flange connections EN (DIN)



Flange according to EN 1092-1 (DIN 2501) / PN 16: PVDF							
DN	G	L	N	S	LK	U	di
8 [1]	95	370	4 × Ø 14	16	65	16.1	5.53
15	95	404	4 × Ø 14	16	65	16.1	8.55
25	115	440	4 × Ø 14	18	85	28.5	11.38
40	150	550	4 × Ø 18	18	110	43.1	17.07
50	165	715	4 × Ø 18	20	125	54.5	25.60
All dimensions in [mm]; Further dimensions → Page 28 ff. [1] with DN 15 flanges							

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 40: 1.4404/316L, Titan

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 3.2 to 12.5 µm

DN	G	L	N	S	LK	U	di
8 [2]	95	370	4 × Ø 14	16	65	17.3	5.53
15	95	404	4 × Ø 14	16	65	17.3	8.55
25	115	440	4 × Ø 14	18	85	28.5	11.38
40	150	550	4 × Ø 18	18	110	43.1	17.07
50	165	715	4 × Ø 18	20	125	54.5	25.60
80	200	840	8 × Ø 18	24	160	82.5	38.46

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] flange with groove according to EN 1092-1 Form D (DIN 2512N) available
[2] with DN 15 flanges

Flange according to EN 1092-1 (DIN 2501) / PN 40 (mit DN 25-Flanges): 1.4404/316L

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 0.8 to 12.5 µm

DN	G	L	N	S	LK	U	di
8	115	440	4 × Ø 14	18	85	28.5	5.53
15	115	440	4 × Ø 14	18	85	28.5	8.55

All dimensions in [mm]; Further dimensions → Page 28 ff.

Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 63: 1.4404/316L, Titan

Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm

DN	G	L	N	S	LK	U	di
50	180	724	4 × Ø 22	26	135	54.5	25.60
80	215	875	8 × Ø 22	28	170	81.7	38.46

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] flange with groove according to EN 1092-1 Form D (DIN 2512N) available

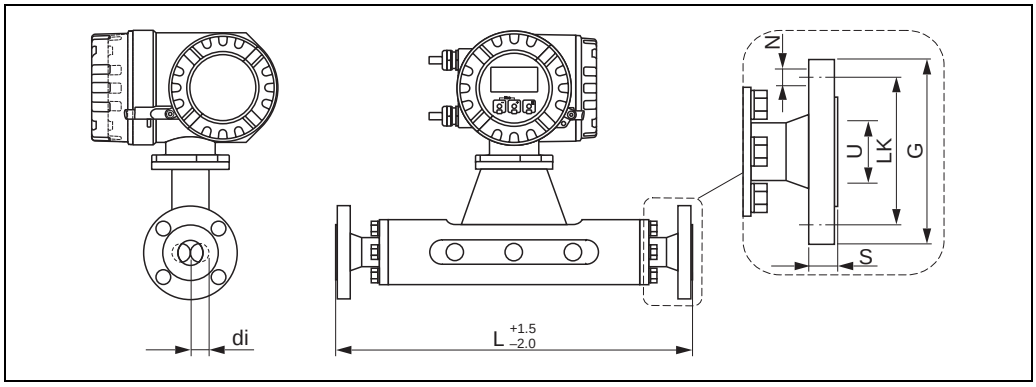
Flange according to EN 1092-1 (DIN 2501 / DIN 2512N [1]) / PN 100: 1.4404/316L, Titan

Surface roughness (flange): EN 1092-1 Form B2 (DIN 2526 Form E), Ra 0.8 to 3.2 µm

DN	G	L	N	S	LK	U	di
8 [2]	95	400	4 × Ø 14	20	65	17.3	5.53
15	95	420	4 × Ø 14	20	65	17.3	8.55
25	115	470	4 × Ø 14	24	85	28.5	11.38
40	150	590	4 × Ø 18	26	110	43.1	17.07
50	165	740	4 × Ø 18	28	125	54.5	25.60
80	230	885	8 × Ø 26	32	180	80.9	38.46

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] flange with groove according to EN 1092-1 Form D (DIN 2512N) available
[2] with DN 15 flanges

Promass M: Flange connections ASME B16.5



a0002525-en

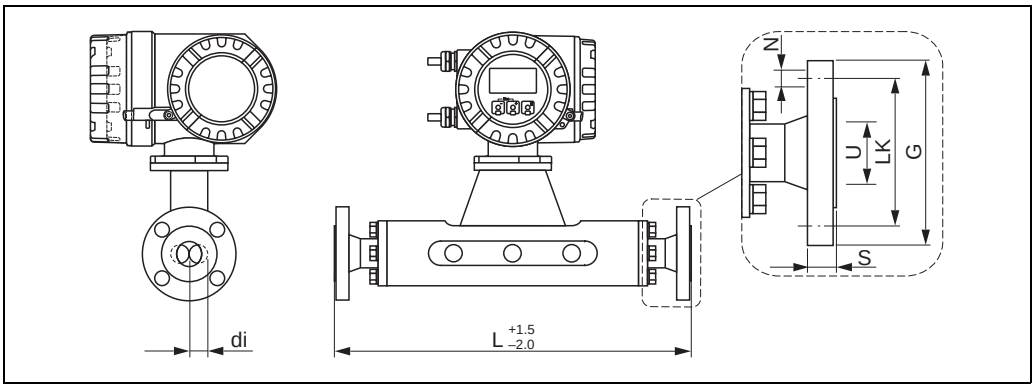
Flange according to ASME B16.5 / Cl 150: 1.4404/316L, Titan Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
8 [1]	88.9	370	4 × Ø 15.7	11.2	60.5	15.7	5.53
15	88.9	404	4 × Ø 15.7	11.2	60.5	15.7	8.55
25	108.0	440	4 × Ø 15.7	14.2	79.2	26.7	11.38
40	127.0	550	4 × Ø 15.7	17.5	98.6	40.9	17.07
50	152.4	715	4 × Ø 19.1	19.1	120.7	52.6	25.60
80	190.5	840	4 × Ø 19.1	23.9	152.4	78.0	38.46
All dimensions in [mm]; Further dimensions → Page 28 ff.; [1] with DN 15 flanges							

Flange according to ASME B16.5 / Cl 150: PVDF							
DN	G	L	N	S	LK	U	di
8 [1]	88.9	370	4 × Ø 15.7	16	60.5	15.7	5.53
15	88.9	404	4 × Ø 15.7	16	60.5	15.7	8.55
25	108.0	440	4 × Ø 15.7	18	79.2	26.7	11.38
40	127.0	550	4 × Ø 15.7	21	98.6	40.9	17.07
50	152.4	715	4 × Ø 19.1	28	120.7	52.6	25.60
All dimensions in [mm]; Further dimensions → Page 28 ff.; [1] with DN 15 flanges							

Flange according to ASME B16.5 / Cl 300: 1.4404/316L, Titan Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
8 [1]	95.2	370	4 × Ø 15.7	14.2	66.5	15.7	5.53
15	95.2	404	4 × Ø 15.7	14.2	66.5	15.7	8.55
25	123.9	440	4 × Ø 19.0	17.5	88.9	26.7	11.38
40	155.4	550	4 × Ø 22.3	20.6	114.3	40.9	17.07
50	165.1	715	8 × Ø 19.0	22.3	127.0	52.6	25.60
80	209.5	840	8 × Ø 22.3	28.4	168.1	78.0	38.46
All dimensions in [mm]; Further dimensions → Page 28 ff.; [1] with DN 15 flanges							

Flange according to ASME B16.5 / Cl 600: 1.4404/316L, Titan Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
8	95.3	400	4 × Ø 15.7	20.6	66.5	13.8	5.53
15	95.3	420	4 × Ø 15.7	20.6	66.5	13.8	8.55
25	124.0	490	4 × Ø 19.1	23.6	88.9	24.4	11.38
40	155.4	600	4 × Ø 22.4	28.7	114.3	38.1	17.07
50	165.1	742	8 × Ø 19.1	31.8	127.0	49.3	25.60
80	209.6	900	8 × Ø 22.4	38.2	168.1	73.7	38.46
All dimensions in [mm]; Further dimensions → Page 28 ff.							

Promass M: Flange connections JIS



a0002525-en

Flange JIS B2220 / 10K: 1.4404/316L, PVDF							
DN	G	L	N	S	LK	U	di
8 [1]	95	370	4 × Ø 15	16	70	15	5.53
15	95	404	4 × Ø 15	16	70	15	8.55
25	125	440	4 × Ø 19	18	90	25	11.38
40	140	550	4 × Ø 19	21	105	40	17.07
50	155	715	4 × Ø 19	22	120	50	25.60
All dimensions in [mm]; Further dimensions → Page 28 ff. [1] with DN 15 flanges							

Flange JIS B2220 / 10K: 1.4404/316L, Titan Surface roughness (flange): Ra 3.2 to 6.3 µm							
DN	G	L	N	S	LK	U	di
50	155	715	4 × Ø 19	16	120	50	25.60
80	185	832	8 × Ø 19	18	150	80	38.46
All dimensions in [mm]; Further dimensions → Page 28 ff.							

Flange JIS B2220 / 20K: 1.4404/316L, Titan

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
8 [1]	95	370	4 × Ø 15	16	70	15	5.53
15	95	404	4 × Ø 15	16	70	15	8.55
25	125	440	4 × Ø 19	18	90	25	11.38
40	140	550	4 × Ø 19	21	105	40	17.07
50	155	715	4 × Ø 19	22	120	50	25.60
80	200	832	8 × Ø 23	22	160	80	38.46

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] with DN 15 flanges

Flange JIS B2220 / 40K: 1.4404/316L, Titan

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
8 [1]	115	400	4 × Ø 19	20	80	15	5.53
15	115	425	4 × Ø 19	20	80	15	8.55
25	130	485	4 × Ø 19	22	95	25	11.38
40	160	600	4 × Ø 23	24	120	38	17.07
50	165	760	8 × Ø 19	26	130	50	25.60
80	210	890	8 × Ø 23	32	170	75	38.46

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] with DN 15 flanges

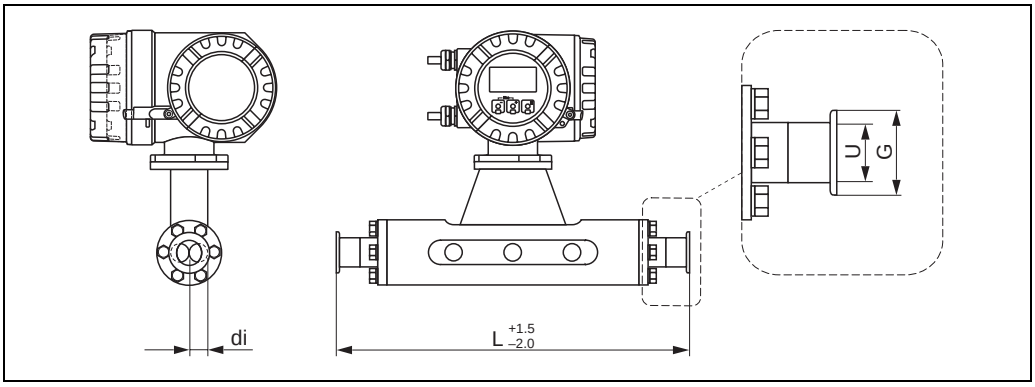
Flange JIS B2220 / 63K: 1.4404/316L, Titan

Surface roughness (flange): Ra 3.2 to 6.3 µm

DN	G	L	N	S	LK	U	di
8 [1]	120	420	4 × Ø 19	23	85	12	5.53
15	120	440	4 × Ø 19	23	85	12	8.55
25	140	494	4 × Ø 23	27	100	22	11.38
40	175	620	4 × Ø 25	32	130	35	17.07
50	185	775	8 × Ø 23	34	145	48	25.60
80	230	915	8 × Ø 25	40	185	73	38.46

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1] with DN 15 flanges

Promass M: Tri-Clamp

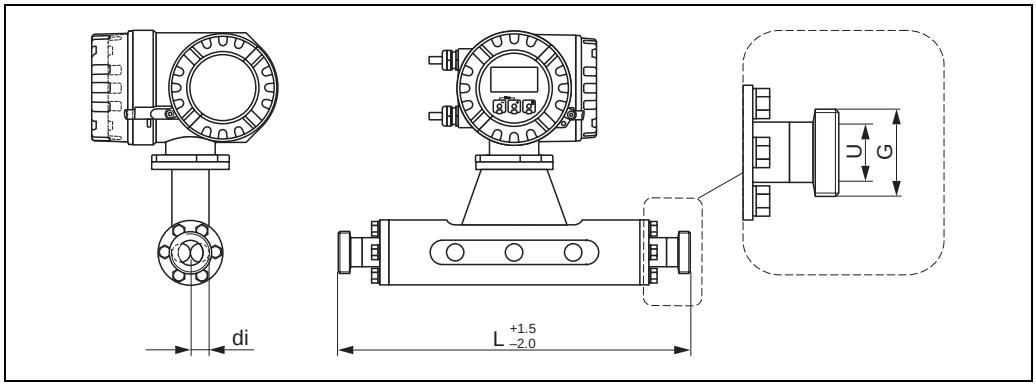


a0002526-en

Tri-Clamp: 1.4404/316L					
DN	Clamp	G	L	U	di
8	1"	50.4	367	22.1	5.53
15	1"	50.4	398	22.1	8.55
25	1"	50.4	434	22.1	11.38
40	1 ½"	50.4	560	34.8	17.07
50	2"	63.9	720	47.5	25.60
80	3"	90.9	801	72.9	38.46
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit)					

½"-Tri-Clamp: 1.4404/316L					
DN	Clamp	G	L	U	di
8	½"	25.0	367	9.5	5.53
15	½"	25.0	398	9.5	8.55
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit)					

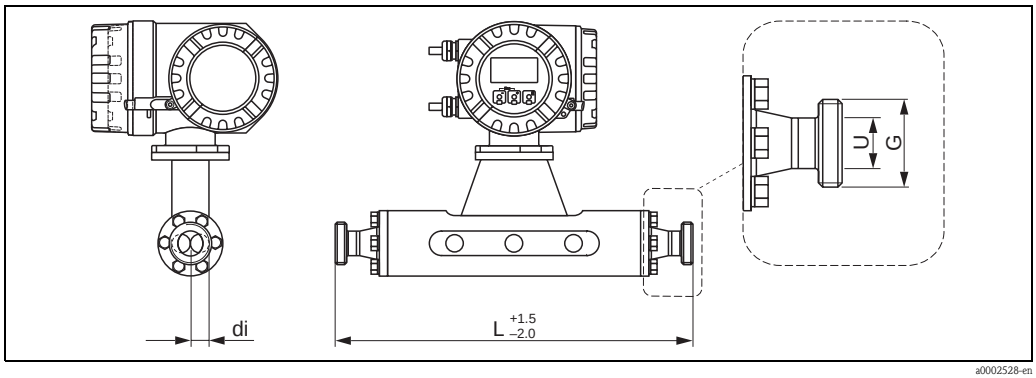
Promass M: DIN 11851 (threaded hygienic connection)



a0002527-en

Threaded hygienic connection DIN 11851: 1.4404/316L				
DN	G	L	U	di
8	Rd 34 × 1/8"	367	16	5.53
15	Rd 34 × 1/8"	398	16	8.55
25	Rd 52 × 1/6"	434	26	11.38
40	Rd 65 × 1/6"	560	38	17.07
50	Rd 78 × 1/6"	720	50	25.60
80	Rd 110 × 1/4"	815	81	38.46
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit.)				

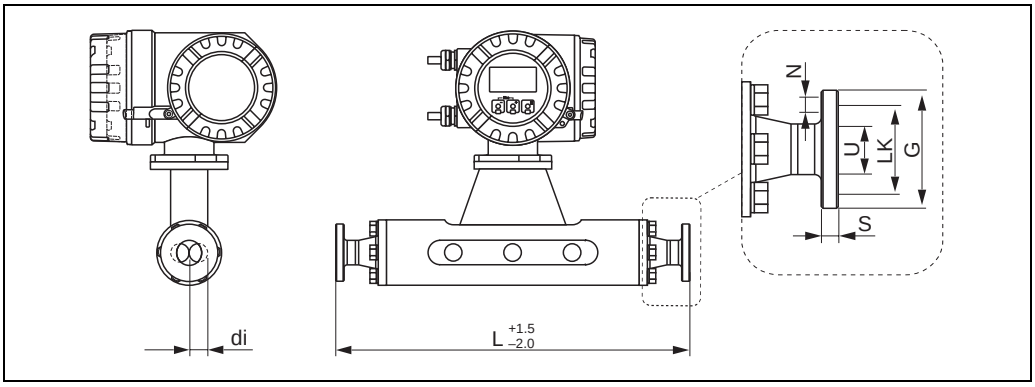
Promass M: DIN 11864-1 Form A (threaded hygienic connection)



a0002528-en

DIN 11864-1 Form A (threaded hygienic connection): 1.4404/316L				
DN	G	L	U	di
8	Rd 28x 1/8"	367	10	5.53
15	Rd 34 × 1/8"	398	16	8.55
25	Rd 52 × 1/6"	434	26	11.38
40	Rd 65 × 1/6"	560	38	17.07
50	Rd 78 × 1/6"	720	50	25.60
80	Rd 110 × 1/4"	815	81	38.46
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit.)				

Promass M: DIN 11864-2 Form A (flat flange with groove)

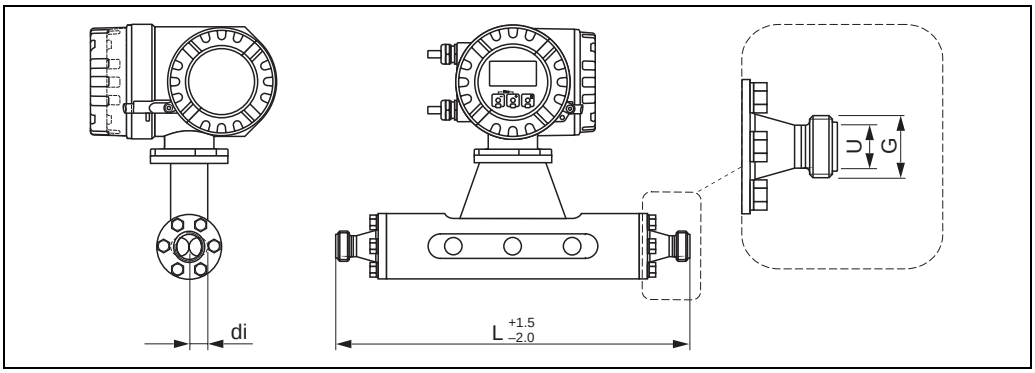


a0002529-en

DIN 11864-2 Form A (flat flange with groove): 1.4404/316L							
DN	G	L	N	S	LK	U	di
8	54	367	4 × Ø 9	10	37	10	5.53
15	59	398	4 × Ø 9	10	42	16	8.55
25	70	434	4 × Ø 9	10	53	26	11.38
40	82	560	4 × Ø 9	10	65	38	17.07
50	94	720	4 × Ø 9	10	77	50	25.60
80	133	815	8 × Ø 11	12	112	81	38.46

All dimensions in [mm]; Further dimensions → Page 28 ff.
3A version available (Ra ≤ 0.8 µm/150 grit)

Promass M: ISO 2853 (threaded hygienic connection)

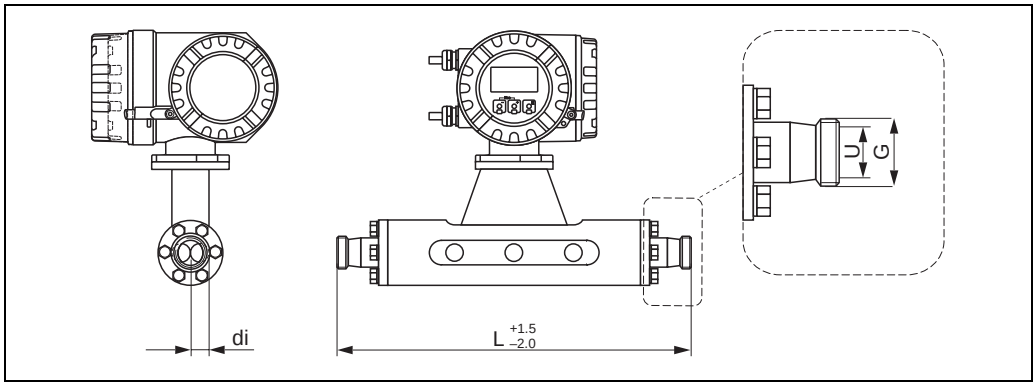


a0002530-en

Threaded hygienic connection ISO 2853: 1.4404/316L				
DN	G [1)]	L	N	di
8	37.13	367	22.6	5.53
15	37.13	398	22.6	8.55
25	37.13	434	22.6	11.38
40	52.68	560	35.6	17.07
50	64.16	720	48.6	25.60
80	91.19	815	72.9	38.46

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1)] Max. thread diameter to ISO 2853 Annex A
3A version available (Ra ≤ 0.8 µm/150 grit)

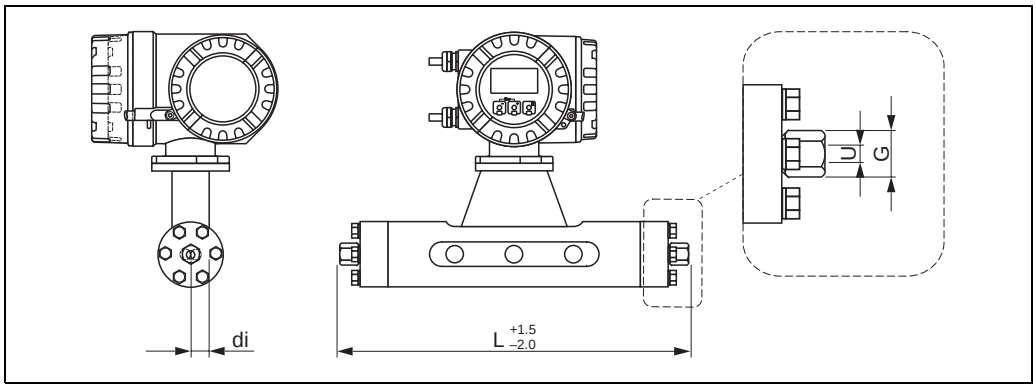
Promass M: SMS 1145 (threaded hygienic connection)



a0002531-en

Threaded hygienic connection SMS 1145: 1.4404/316L				
DN	G	L	U	di
8	Rd 40 × 1/6"	367	22.5	5.53
15	Rd 40 × 1/6"	398	22.5	8.55
25	Rd 40 × 1/6"	434	22.5	11.38
40	Rd 60 × 1/6"	560	35.5	17.07
50	Rd 70 × 1/6"	720	48.5	25.60
80	Rd 98 × 1/6"	792	72.0	38.46
All dimensions in [mm]; Further dimensions → Page 28 ff. 3A version available (Ra ≤ 0.8 µm/150 grit)				

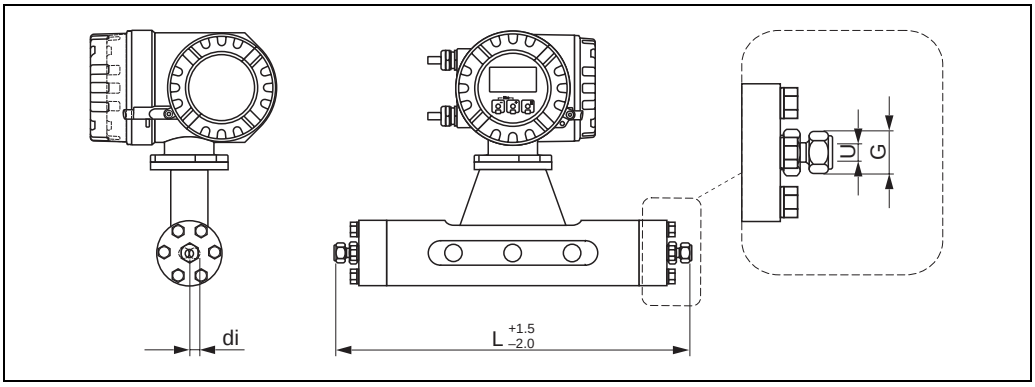
Promass M (high pressure): ½"-NPT, 3/8"-NPT and G 3/8"



a0002532-en

NPT, G 3/8": 1.4404/316L								
DN	½" NPT		3/8" NPT		G 3/8"		U	di
	G	L	G	L	G	L		
8	SW 1 1/16"	370	SW 1 5/16"	355.8	SW 24	355.8	10.2	4.93
15	SW 1 1/16"	400	SW 1 5/16"	385.8	SW 24	385.8	10.2	7.75
25	SW 1 1/16"	444	SW 1 5/16"	429.8	SW 24	429.8	10.2	10.20
All dimensions in [mm]; Further dimensions → Page 28 ff.								

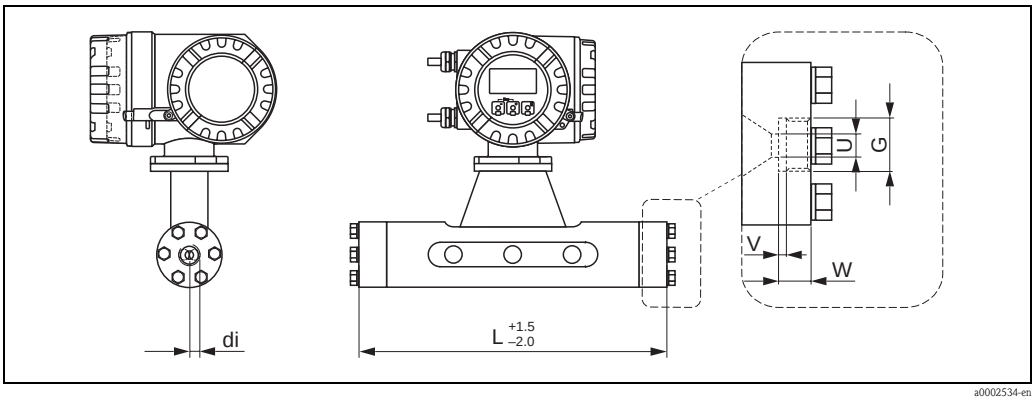
Promass M (high pressure): ½"-SWAGELOK



a0002533-en

½"-SWAGELOK: 1.4404/316L				
DN	G	L	U	di
8	7/8"	366.4	10.2	4.93
15	7/8"	396.4	10.2	7.75
25	7/8"	440.4	10.2	10.20
All dimensions in [mm]; Further dimensions → Page 28 ff.				

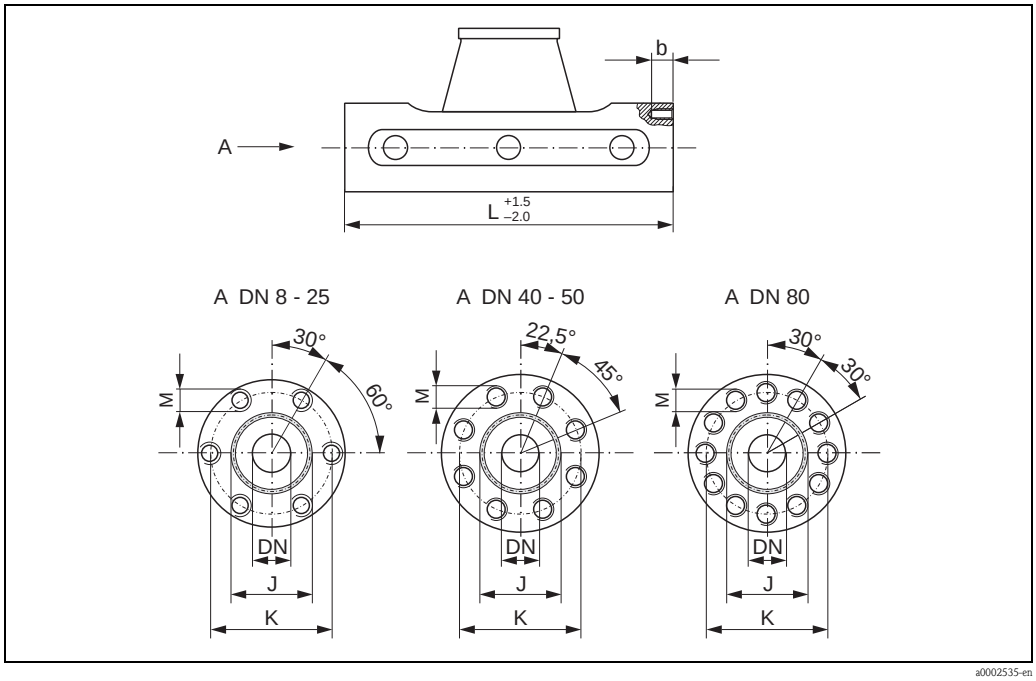
Promass M (high pressure): Connector with internal thread 7/8-14UNF



a0002534-en

Internal thread 7/8-14-UNF: 1.4404/316L						
DN	G	L	U	V	W	di
8	7/8-14UNF	304	10.2	3	14	4.93
15	7/8-14UNF	334	10.2	3	14	7.75
25	7/8-14UNF	378	10.2	3	14	10.20
All dimensions in [mm]; Further dimensions → Page 28 ff.						

Promass M: without process connections



a0002535-en

DN	L	J	K	M	$b_{max.}$	$b_{min.}$
8	256	27	54	6 × M 8	12	10
8 [1)]	256	27	54	6 × M 8	12	10
15	286	35	56	6 × M 8	12	10
15 [1)]	286	35	56	6 × M 8	12	10
25	310	40	62	6 × M 8	12	10
25 [1)]	310	40	62	6 × M 8	12	10
40	410	53	80	8 × M 10	15	13
50	544	73	94	8 × M 10	15	13
80	644	102	128	12 × M 12	18	15

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1)] High pressure version; permissible thread: A4 - 80; lubricant: Molykote P37

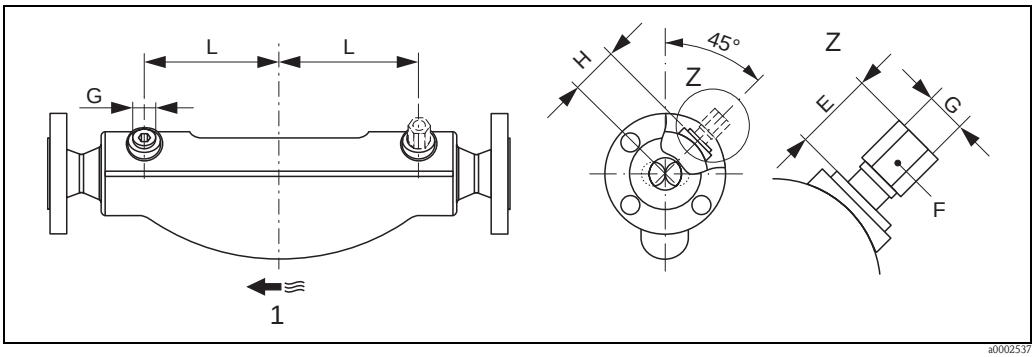
	Tightening torque	**Lubricated thread**	**O-ring**	
DN	Nm	YES/NO	Thickness	Inside Ø
8	30.0	NO	2.62	21.89
8 [1)]	19.3	YES	2.62	21.89
15	30.0	NO	2.62	29.82
15 [1)]	19.3	YES	2.62	29.82
25	30.0	NO	2.62	34.60
25 [1)]	19.3	YES	2.62	34.60
40	60.0	NO	2.62	47.30
50	60.0	YES	2.62	67.95
80	100.0	YES	3.53	94.84

All dimensions in [mm]; Further dimensions → Page 28 ff.
[1)] High pressure version; permissible thread: A4 - 80; lubricant: Molykote P37

Purge connections / secondary containment monitoring

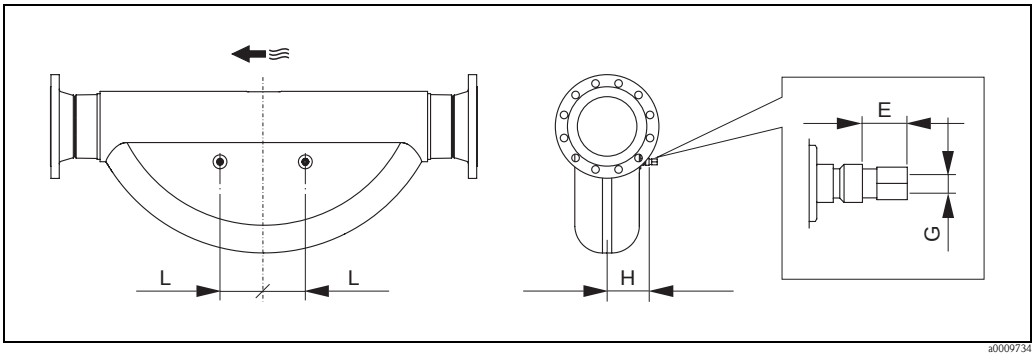
Caution!
- The secondary containment is filled with dry nitrogen (N_2). Do not open the purge connections unless the containment can be filled immediately with a dry inert gas. Use only low gauge pressure to purge. Maximum pressure: 5 bar.
- Purge connections or secondary containment monitioring can not be combined with separately available heating jacket.

Promass F: (not available for the Promass F high-temperature version)



Promass F DN 8 to DN 150

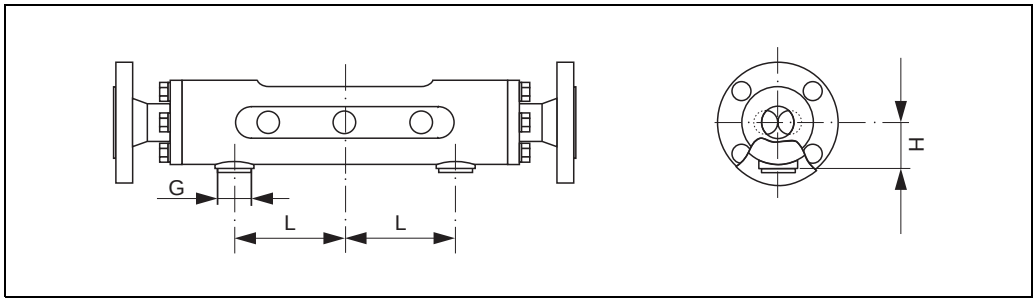
1 = Flow direction



Promass F DN 250

DN	F	G	H	L
8	AF 1"	½"-NPT	62	108
15			62	110
25			62	130
40			67	155
50			79	226
80			101	280
100			120	342
150			141	440
All dimensions in [mm]				

Promass M:



a0002536

DN	L	H	G
8	85	44.0	½"-NPT
15	100	46.5	
25	110	50.0	
40	155	59.0	
50	210	67.5	
80	210	81.5	
All dimensions in [mm]			

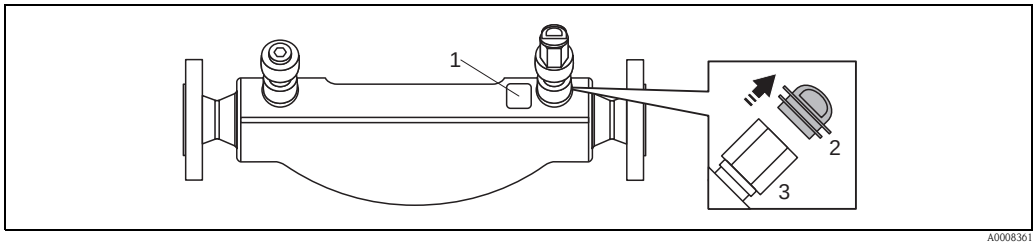
Rupture disk

Sensor housings with integrated rupture disks are optionally available.

Warning!
- Make sure that the function and operation of the rupture disk is not impeded through the installation. Triggering overpressure in the housing as stated on the indication label. Take adequate precautions to ensure that no damage occurs, and risk to human life is ruled out, if the rupture disk is triggered.
  Rupture disk: Burst pressure 10 to 15 bar.
- Please note that the housing can no longer assume a secondary containment function if a rupture disk is used.
- It is not permitted to open the connections or remove the rupture disk.

Caution!
- Rupture disks can not be combined with separately available heation jacket.
- The existing connection nozzles are not designed for a rinse or pressure monitoring function.

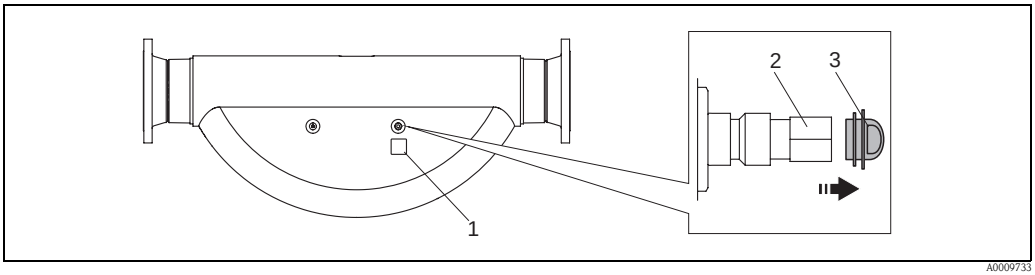
Note!
- Before commissioning, please remove the transport protection of the rupture disk.
- Please note the indication labels.



A0008361

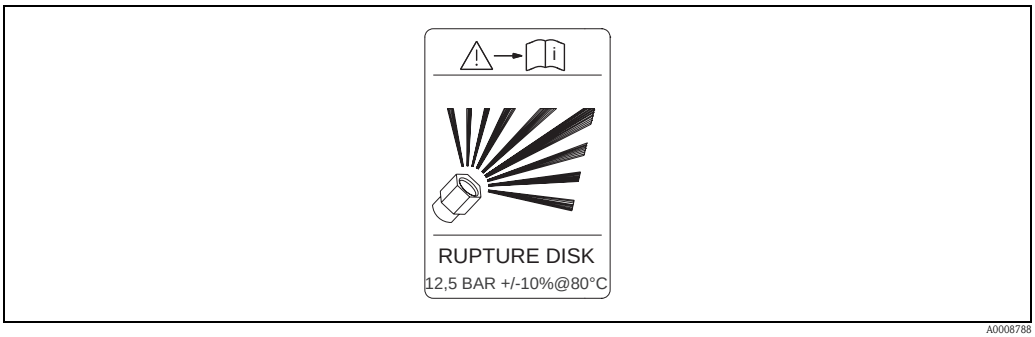
Promass F DN 8 to DN 150

1 = Indication label for the rupture disk, 2 = Transport protection, 3 = ½" NPT internal screw thread with 1" width across flats



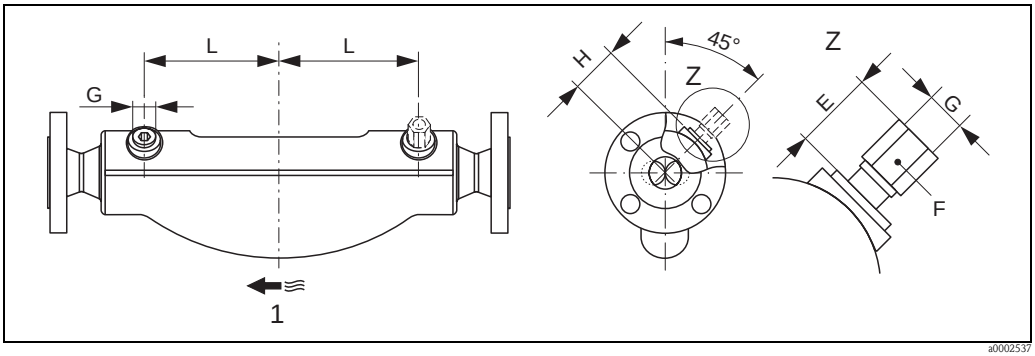
Promass F DN 250

1 = Indication label for the rupture disk, 2 = Transport protection, 3 = ½" NPT internal screw thread with 1" width across flats



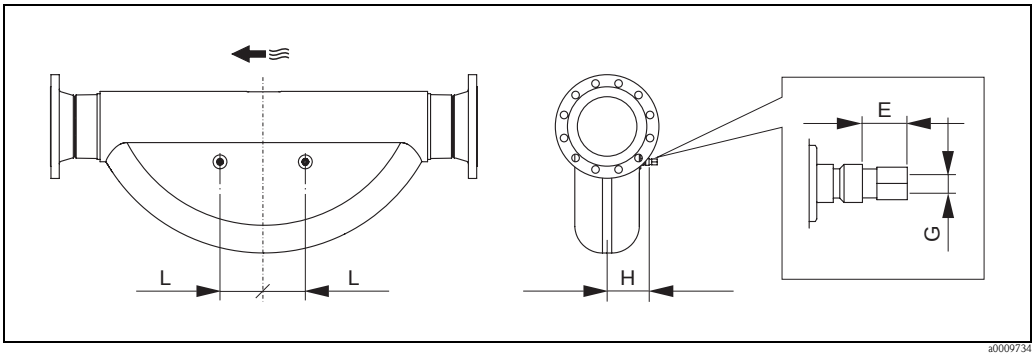
Indication label for the rupture disk

Promass F: (not available for the Promass F high-temperature version)



Promass F DN 8 to DN 150

1 = Flow direction



Promass F DN 250

DN	E	F	G	H	L
8	approx. 42	AF 1"	½"-NPT	62	108
15				62	110
25				62	130
40				67	155
50				79	226
80				101	280
100				120	342
150				141	440
All dimensions in [mm]					

Weight

- Compact version: see table below
- Remote version
  – Sensor: see table below
  – Wall-mount housing: 5 kg

Weight data in [kg].

All values (weight) refer to devices with EN/DIN PN 40 flanges.

Promass F / DN	**8**	**15**	**25**	**40**	**50**	**80**	**100**	**150**	**250 ***
Compact version	11	12	14	19	30	55	96	154	400
Compact version High temperature	–	–	14,7	–	30,7	55,7	–	–	–
Compact version Ex d	20	21	23	28	39	64	105	163	409
Remote version	9	10	12	17	28	53	94	152	398
Remote version High temperature	–	–	13,5	–	29,5	54,5	–	–	–

* With 10" according to ASME B16.5 Cl 300 flanges

Promass M / DN	**8**	**15**	**25**	**40**	**50**	**80**
Compact version	11	12	15	24	41	67
Remote version	9	10	13	22	39	65

Material

Transmitter housing:

- Compact housing:
  - stainless steel 1.4301/304
  - powder coated die-cast aluminium
  - Compact housing Ex d: stainless steel CF3M
- Compact housing:
  - Wall-mount housing: powder coated die-cast aluminium
  - Remote field housing: powder-coated die-cast aluminium

Connection housing, sensor (remote version):

- Stainless steel 1.4301/304 (standard)
- powder coated die-cast aluminium (high-temperature version and version for heating)

Sensor housing / containment:

- Promass F: Acid- and alkali-resistant outer surface
  - stainless steel 1.4301/1.4307/304L
- Promass M: Acid- and alkali-resistant outer surface
  - DN 8 to 50: steel, chemically nickel-plated
  - DN 80: stainless steel

Measuring tube(s):

- Promass F
  - DN 8 to 100: stainless steel 1.4539/904L
  - DN 150: stainless steel 1.4404/316L
  - DN 250: stainless steel 1.4404/316L; manifold: CF3M
  - DN 8 to 150: Alloy C-22 2.4602/N 06022
- Promass F (High temperature version)
  - DN 8, 50, 80: Alloy C-22 2.4602/N 06022
- Promass M
  - DN 8 to 50: titanium grade
  - DN 80: titanium grade 2
- Promass M (High pressure version)
  - Titanium grade 9

Process connections

Process connections Promass F	Material
Flange according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220	Alloy C-22 2.4602/N 06022, Stainless steel 1.4404/316L
Flange DIN 11864-2 Form A (flat flange with groove)	Stainless steel 1.4404/316L
Threaded hygienic connection DIN 11851 / SMS 1145 / ISO 2853 / DIN 11864-1	Stainless steel 1.4404/316L
Tri-Clamp (OD-Tubes)	Stainless steel 1.4404/316L

Process connections Promass M	Material
Flange according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220	Stainless steel 1.4404/316L, Titan Grade 2
Flange DIN 11864-2 Form A (flat flange with groove)	Stainless steel 1.4404/316L
PVDF-connections DIN / ASME B16.5 / JIS	PVDF
Threaded hygienic connection DIN 11851 / SMS 1145 / ISO 2853 / DIN 11864-1	Stainless steel 1.4404/316L
Connector (High pressure version)	Stainless steel 1.4404/316L
Coupling (High pressure version)	Stainless steel 1.4401/316

Seals:

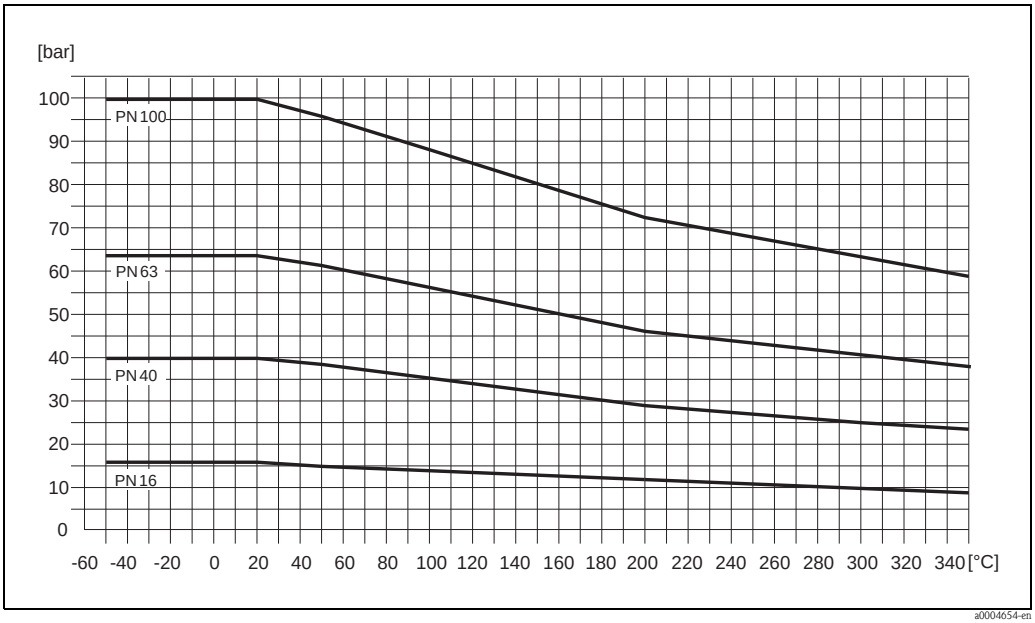
- Promass F: welded process connections without internal seals
- Promass M
  - Viton
  - EPDM
  - Silikon
  - Kalrez 6375
  - FEP sheathing (not for gas applications)

Material load curves

Warning!
The following material loade curves refer to the entire sensor and not just the process conection.

Promass F with flange connection according to EN 1092-1 (DIN 2501)

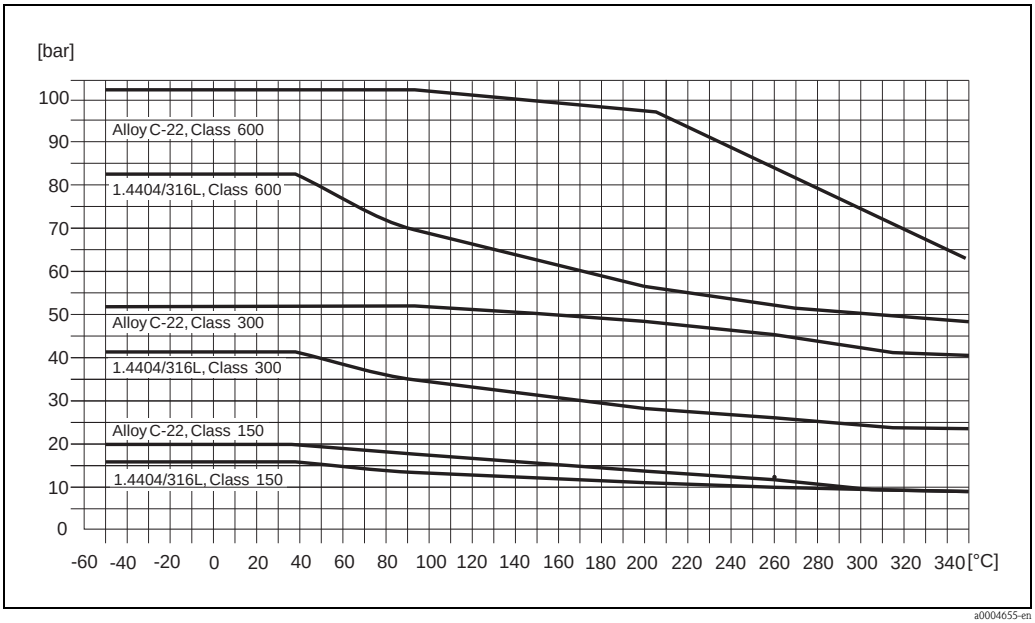
Flange material: 1.4404/316L, Alloy C-22



The values for the temperature range from 200 °C to 350 °C are exclusively valid for the high-temperature version.

Promass F with flange connection according to ASME B16.5

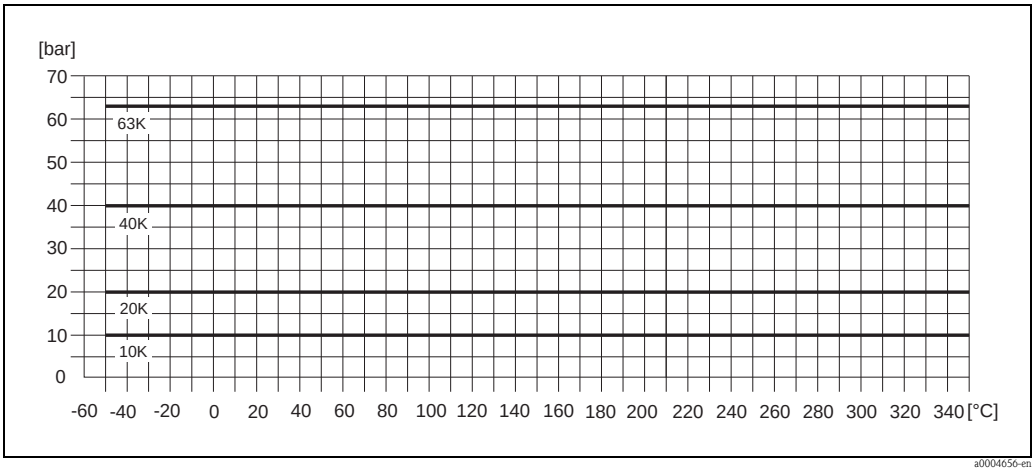
Flange material: 1.4404/316L, Alloy C-22



The values for the temperature range from 200 °C to 350 °C are exclusively valid for the high-temperature version.

Promass F with flange connection to JIS B2220

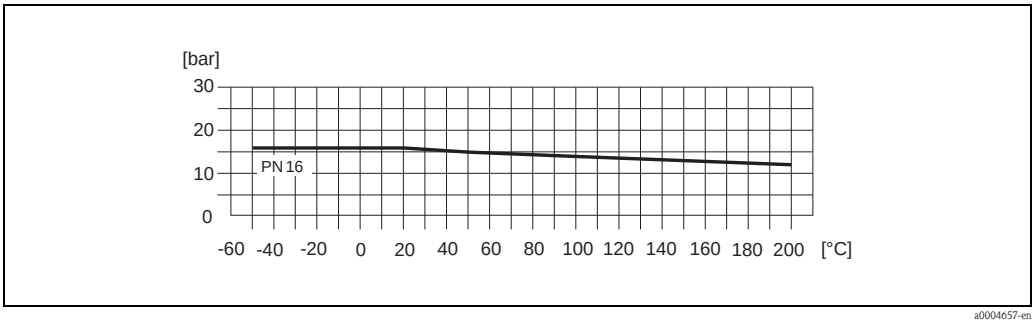
Flange material: 1.4404/316L, Alloy C-22



The values for the temperature range from 200 °C to 350 °C are exclusively valid for the high-temperature version.

Promass F with threaded hygienic connection to DIN 11851 / SMS 1145

Connection material: 1.4404/316L

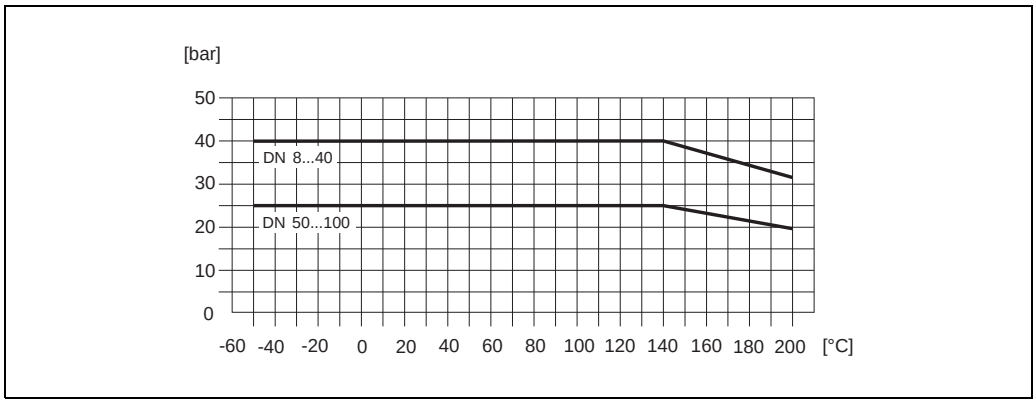


Promass F with Tri-Clamp process connection

The Clamp connections (e.g. Tri-Clamp ISO2852, DIN32676) are suited up to a maximum pressure of 16 bar. As these operating limits also depend on the clamp and the seal used, their specifications have to be observed. The clamp and the seal are not included in the scope of supply

Promass F with threaded hygienic connection to DIN 11864-1

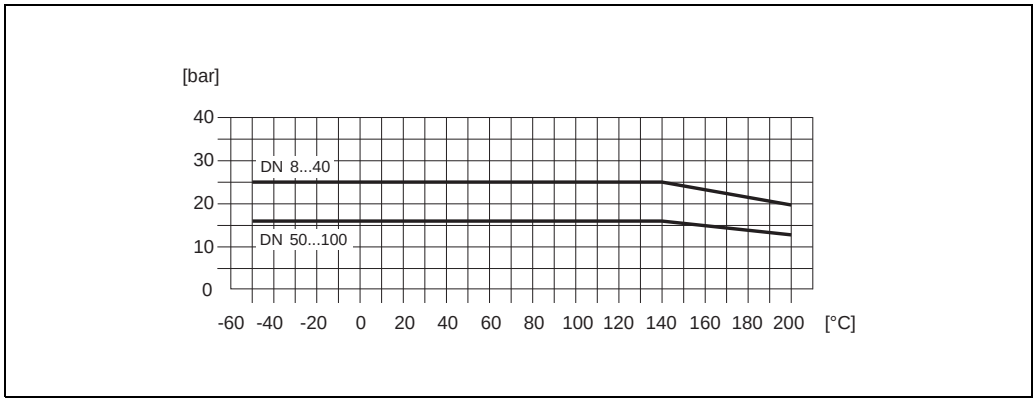
Connection material: 1.4404/316L



a0004658-en

Promass F with flange connection to DIN 11864-2 Form A (flat flange with groove)

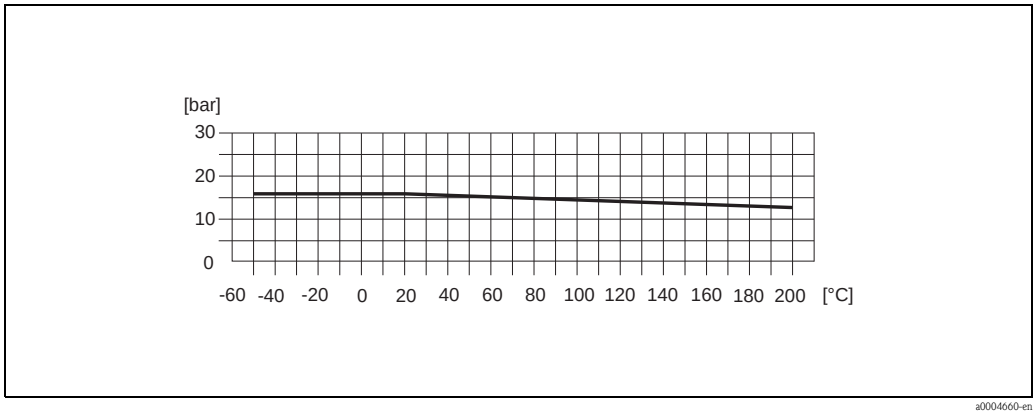
Flange material: 1.4404/316L



a0004659-en

Promass F with threaded hygienic connection to ISO 2853

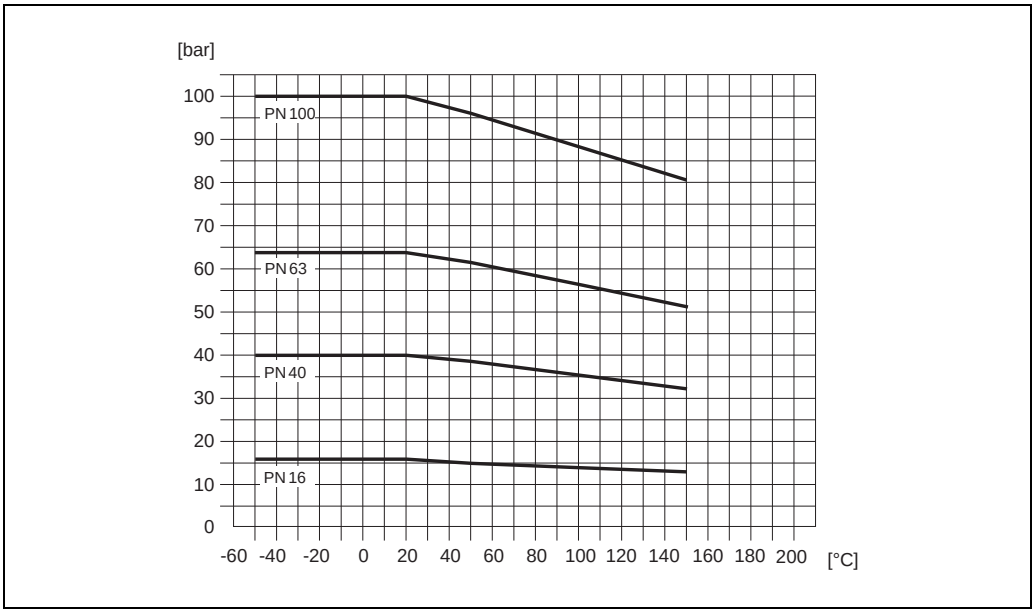
Connection material: 1.4404/316L



a0004660-en

Promass M with flange connection according to EN 1092-1 (DIN 2501)

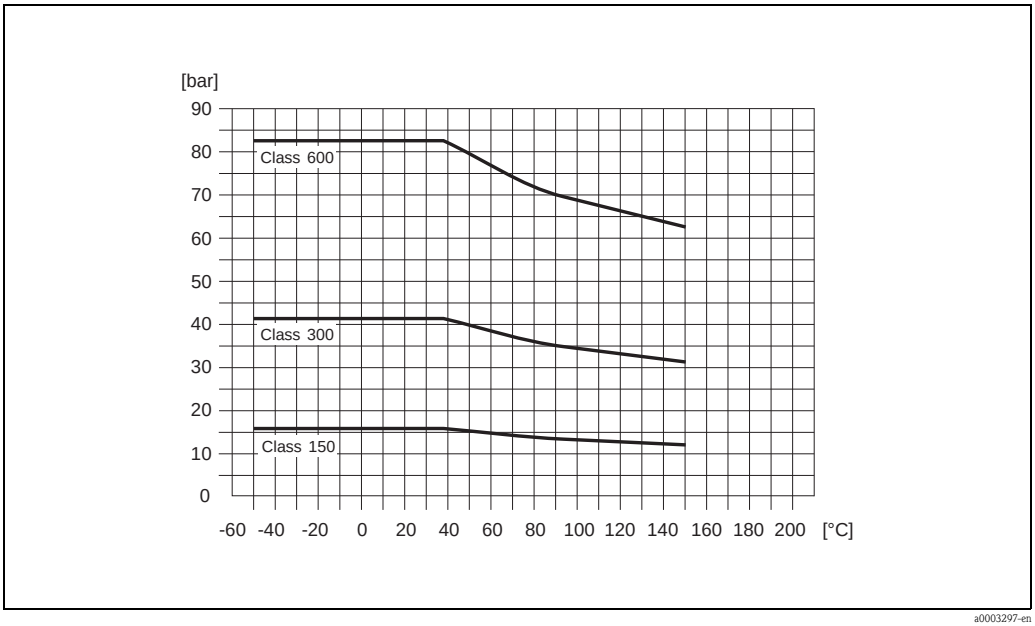
Flange material: 1.4404/316L, titanium grade 2



a0003293-en

Promass M with flange connection according to ASME B16.5

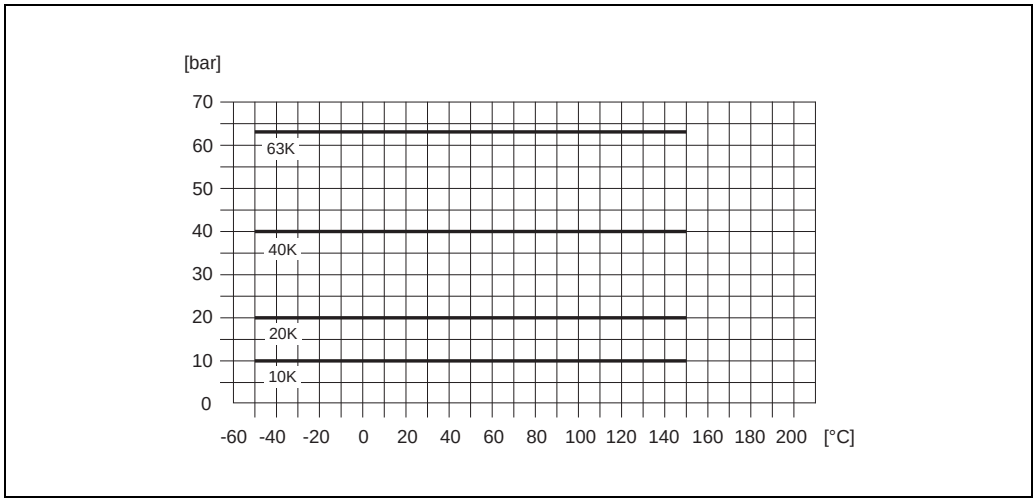
Flange material: 1.4404/316L, titanium grade 2



a0003297-en

Promass M with flange connection to JIS B2220

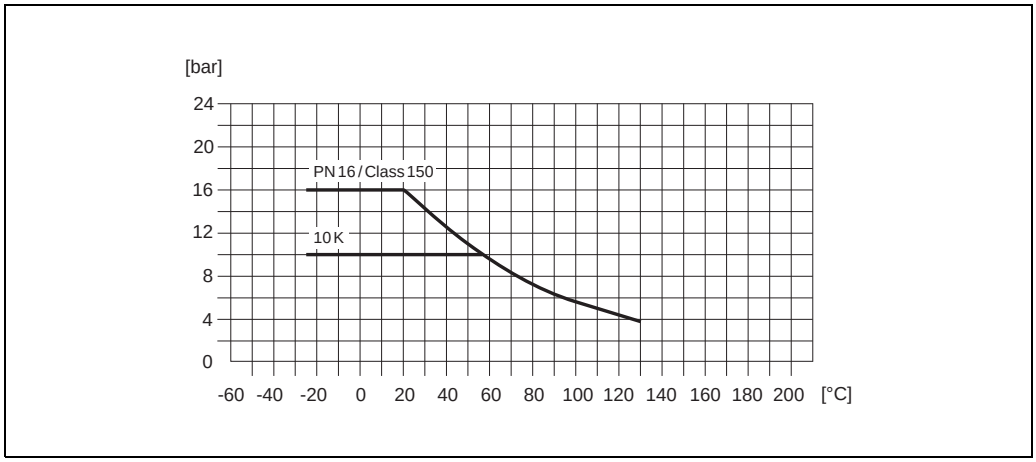
Flange material: 1.4404/316L, titanium grade 2



a0003304-en

Promass M with PVDF flange connection (to DIN 2501, according to ASME B16.5, JIS B2220)

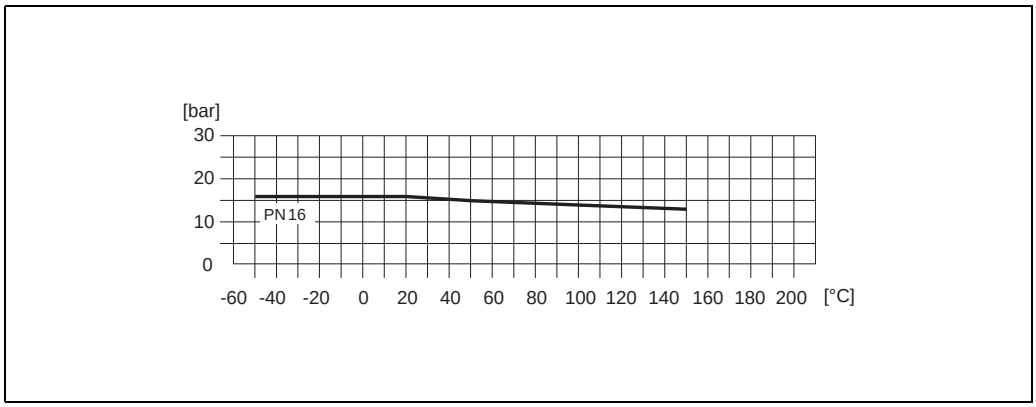
Flange material: PVDF



a0004661-en

Promass M with threaded hygienic connection to DIN 11851 / SMS 1145

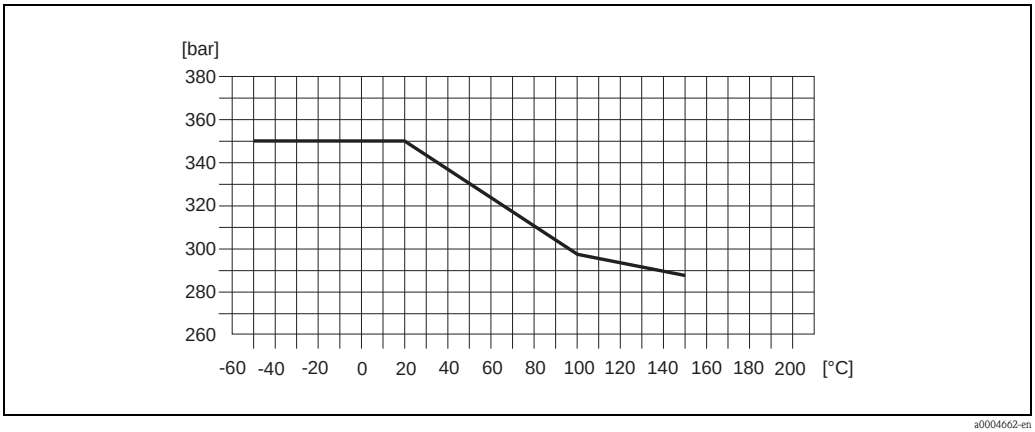
Connection material: 1.4404/316L



a0003305-en

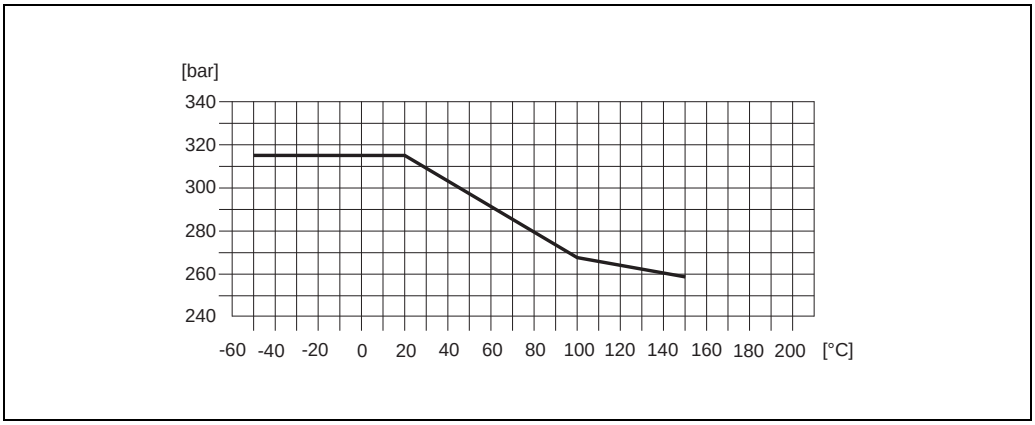
Promass M with process connections for high pressure version

Connector material: 1.4404/316L
Material of thread connections (G 3/8", VCO with ½" SWAGELOK, NPT 3/8"): 14401/316



a0004662-en

Material of thread connections (NPT ½"): 1.4401/316



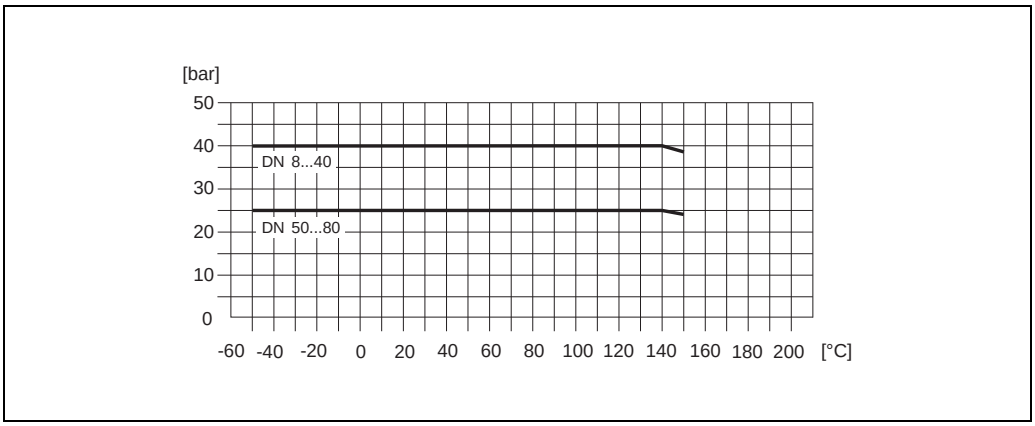
a0004663-en

Promass M with Tri-Clamp process connection

The Clamp connections (e.g. Tri-Clamp ISO 2852, DIN 32676) are suited up to a maximum pressure of 16 bar. As these operating limits also depend on the clamp and the seal used, their specifications have to be observed. The clamp and the seal are not included in the scope of supply.

Promass M with threaded hygienic connection to DIN 11864-1

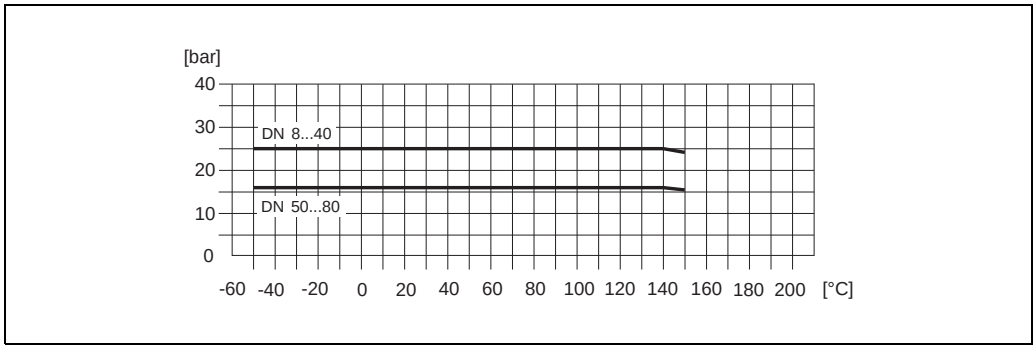
Connection material: 1.4404/316L



a0004664-en

Promass M with flange connection to DIN 11864-2 Form A (flat flange with groove)

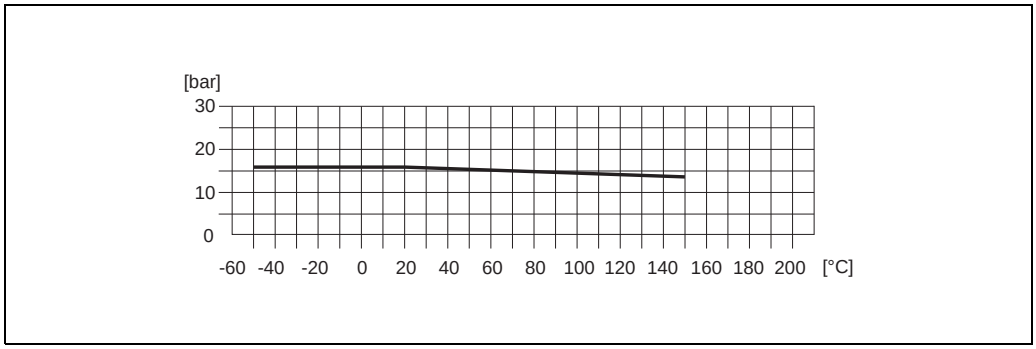
Flange material: 1.4404/316L



a0004665-en

Promass M with threaded hygienic connection to ISO 2853

Connection material: 1.4404/316L



a0003308-en

Process connections

Promass F (welded process connections)

- Flanges
  - according to EN 1092-1 (DIN 2501)
  - according to ASME B16.5
  - JIS B2220
- Sanitary connections
  - Tri-Clamp
  - threaded hygienic connections (DIN 11851, SMS 1145, ISO 2853, DIN 11864-1)
  - flange DIN 11864-2 Form A (flat flange with groove)

Promass M (threaded process connections)

- Flanges
  - according to EN 1092-1 (DIN 2501)
  - according to ASME B16.5
  - JIS B2220
- Sanitary connections
  - Tri-Clamp
  - threaded hygienic connections (DIN 11851, SMS 1145, ISO 2853, DIN 11864-1)
  - flange DIN 11864-2 Form A (flat flange with groove)

Promass M (high pressure version)

- Thread connections
  - G 3/8"-coupling
  - ½"-NPT—coupling
  - 3/8"-NPT-coupling
  - ½"-SWAGELOK-coupling
  - connector with 7/8-14UNF internal thread

Human interface

Display elements

- Liquid crystal display: illuminated, four lines with 16 characters per line
- Selectable display of different measured values and status variables
- At ambient temperatures below –20 °C the readability of the display may be impaired.

Unified control concept for both types of transmitter:

- Local operation with three optical sensors (−, +, E)
- Application specific Quick Setup menus for straightforward commissioning

Language groups

Language groups available for operation in different countries:

- Western Europe and America (WEA):
  English, German, Spanish, Italian, French, Dutch and Portuguese
- Eastern Europe and Scandinavia (EES):
  English, Russian, Polish, Norwegian, Finnish, Swedish and Czech
- South and east Asia (SEA):
  English, Japanese, Indonesian
- China (CIN):
  English, Chinese

You can change the language group via the operating program "FieldCare"

Remote operation

Operation via HART

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA, IECEx, NEPSI) can be supplied by your Endress+Hauser Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.

C-tick mark

The measuring system meets the EMC requirements of the Australian Communication and Media Authority (ACMA).

Sanitary compatibility

- 3A approval
- EHEDG tested

MODBUS RS485

The measuring device meets all the requirements of the MODBUS/TCP conformity and integration test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out and is certified by the "MODBUS/TCP Conformance Test Laboratory" of the University of Michigan.

Other standards and guidelines

- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures)
- ICE/EN 61326
  "Emission in accordance with requirements for Class A" Electromagnetic compatibility (EMC- requirements)
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 43
  Standardisation of the signal level for the breakdown information of digital transmitters with analogue output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics

Pressure device approval

Flowmeters with a nominal diameter smaller or equal DN 25 are covered by Art. 3 (3) of the European directive 97/23/EC (Pressure Equipment Directive) and are designed according to sound engineer practice. For larger nominal diameters, optional approvals according to Cat. II/III are available when required (depends on fluid and process pressure).

Optionally flowmeters in accordance to the guidelines AD 2000 are available on request.

Measuring instrument approval

This flowmeter which is a suitable component in measuring systems subject to legal metrology controls in accordance with Annex MI-005 of the European Measuring Instruments Directive 2004/22/EC (MID). This flowmeter is qualified to OIML R117-1 and has an MID Evaluation Certificate [1] which confirms compliance with the essiential requirements of the Measuring Instruments Directive.

Note!
According to the Measuring Instruments Directive, however, only the complete measuring system is licensable, covered by an EC type-examination certificate and bears conformity marking.

[1] The Evaluation Certificate results from the WELMEC (cooperation between the legal metrology services of the member states of the European Union and EFTA) towards voluntary modular approval for measuring systems in accordance with Annex MI-005 (measuring systems for the continuous and dynamic measurement of quantities of liquids other than water) of the Measuring Instruments Directive 2004/22/EC.

Approval for custody transfer

Promass 84 is a flowmeter suitable for custody transfer measurement for liquids (other than water) and for fuel gases under high pressure (> 100 bar). The requirements of the following test centres are taken into consideration:

- PTB, Germany
- NMi, The Netherlands
- METAS, Switzerland
- BEV, Austria
- NTEP, USA
- MC, Canada

Information on custody transfer measurement see Page 25 ("Custody transfer measurement" Section)

Suitability for custody transfer measurement

PTB / NMi / METAS / BEV approval

PTB / NMi / METAS / BEV approval for determining the mass and volume of liquids, other than water, and of fuel gases. The device is qualified to OIML R117-1.

Promass	DN		OIML R117-1/MID Evaluation Certificate (Europe)		
	[mm]	[inch]	Mass	Volume	Density
F	8 to 250	3/8" to 10"	YES	YES	YES
M	8 to 80	3/8" to 3"	NO	NO	NO

Promass	DN	PTB / METAS /BEV approval for			
		For liquids other than water			High-pressure gas
	[mm]	Mass	Volume	Density	(CNG) Mass
F	8 to 250	YES	YES	YES	NO
M	8 to 50	YES	NO	NO	NO
M	80	YES	YES	YES	NO
M	8 to 40	NO	NO	NO	YES
M (high pressure)	8 to 25	NO	NO	NO	YES

Promass	DN	NMi approval for			
		For liquids other than water			High-pressure gas
	[mm]	Mass	Volume	Density	(CNG) Mass
F	8 to 250	YES	YES	YES	NO
M	8 to 80	YES	NO	NO	NO
M	8 to 40	NO	NO	NO	YES
M (high pressure)	8 to 25	NO	NO	NO	YES

NTEP approval

The measuring instrument is qualified in accordance with the National Type Evaluation Program (NTEP) Handbook 44 ("Specifications and Tolerances and other Technical Requirements for Weighing and Measuring Devices").

Promass	DN	NTEP approval for		
		For liquids other than water		High-pressure gas
	[mm]	Mass	Volume	(CNG) Mass
F	15 to 150	YES	YES	NO
M	15 to 80	YES	YES	NO
M (high pressure)	15 to 25	NO	NO	YES

MC approval

The measuring instrument is qualified in accordance with "The Draft Ministerial Specifications - Mass Flow Meters" (1993-09-21).

Promass	DN	MC approval for	
		For liquids other than water	
	[mm]	Mass	Volume
F	8 to 150	YES	YES
M	8 to 80	YES	NO

Ordering information

The Endress+Hauser service organisation can provide detailed ordering information and information on the order codes on request.

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. The Endress+Hauser service organisation can provide detailed information on the order codes of your choice.

Documentation

- Flow measuring technology (FA005D/06/en)
- Technical Information Promass 84A (TI068D/06/en)
- Operating Instructions Promass 84 (BA109D/06/en)
- Description of Device Functions Promass 84 (BA110D/06/en)
- Operating Instructions Promass 84 MODBUS RS485 (BA129D/06/en)
- Description of Device Functions Promass 84 MODBUS RS485 (BA130D/06/en)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, IECEx, NEPSI

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Endress+Hauser

People for Process Automation

TI067D/06/en/07.08
71076893
FM+SGML6.0 ProMoD