Honeywell

VersaFlow Coriolis 1000 Mass Flow Sensor
Technical Datasheet

34-VF-03-03
June 1, 2007

Specification

The superior solution

The VersaFlow mass flow sensor is the only mass flow sensor with a straight measuring tube that is available in Hastelloy®, titanium or stainless steel. VersaFlow reliably measures mass flow, density, volume, temperature, mass or volume concentration and solids content.

Highlights

- Single straight measuring tube
- Secondary pressure containment
- Low pressure loss
- Easily drained and easy to clean
- Choice of three different tube materials
- Excellent zero stability
- Low operating and installation costs
- Rapid signal processing even with varying conditions
- Modular/Plug & play electronics

Industries

- Water and Wastewater
- Mining & Building Materials
- Chemical
- Iron, Steel & Metal
- Food & Beverage
- Oil & Gas
- Pulp & Paper
- Petrochemical
- Pharmaceutical

Applications

- Viscous or shear-sensitive products
- Products requiring low flow velocities
- Inhomogeneous mixtures
- Products with entrained solids or gas

Figure 1 – VersaFlow Mass Flow Sensor

VersaFlow converter configuration options:

1. TWC 9000 C: Compact or integrally mounted on sensor
2. TWC 9000 F: Field mount up to 300 m / 1000 ft from sensor
3. TWC 9000 W: Wall mount for non-hazardous areas

Mass flowmeter product family

All meters consist of a sensor and a converter. The converter may be mounted integral to the sensor, or remotely, either with a field mounting kit or a wall-mounted housing. See specification 34-VF-03-04 for converter details.

Technical Data

Titanium versions:

Operating data

Size	T06	T10	T15	T25	T40	T50	T80

Flow Rate

Nominal flow rate [kg/h]	950	2700	11250	34500	91500	180000	430000
Nominal flow rate [lbs/min]	35	100	400	1250	3300	6600	15800
Maximum flow rate	130% of nominal flow rate						
Minimum flow rate	Accuracy dependant						

Accuracy

Accuracy, liquid	±0.1% of actual measured flow rate
Accuracy, gas	±0.5% of actual measured flow rate
Repeatability	Better than 0.05% plus zero stability (includes the combined effects of repeatability, linearity and hysteresis)
Zero stability	±0.008% of nominal flow rate with respective sensor size

Reference conditions

Product	Water
Temperature	20°C / 68°F
Operating pressure	1 $bar_{rel.}$ / 14.5 psig

Density

Measuring range	500…2000 kg/m^3 / 30…125 lbs/ft^3
Accuracy	±2 kg/m^3 / ±0.13 lbs/ft^3
Accuracy (on-site calibration)	±0.5 kg/m^3 / ±0.033 lbs/ft^3

Temperature

Measuring range	-40…+150°C / -40…+302°F
Accuracy	±1°C / ±1.8°F

Device Specification

Size	T06	T10	T15	T25	T40	T50	T80

Materials

Measuring tube	Titanium
Flange raised face	Titanium
Flanges	Stainless steel 1.4435 / AISI 316L
Outer cylinder (secondary pressure containment)	Stainless steel 1.4301 /AISI 304 (optional: stainless steel 1.4435 /AISI 316L)
Sensor electronics housing	Stainless steel 1.4435/AISI 316L

Nominal pressure at 20°C or 68°F

Measuring tube	-1...100 $bar_{rel.}$ / -14.5...1450 psig
Outer cylinder (secondary pressure containment)	Standard: -1...63 $bar_{rel.}$ / -14.5...910 psig; Optional: -1...100 $bar_{rel.}$ /-14.5...1450 psig

Temperature

Process temperature - flanged connections	-40...+150°C/ -40...+302°F
Process temperature - hygienic type connections	-20...+150°C/ -4...+302°F
Ambient temperature - compact version	-40...+55°C/ -40...+130°F
Ambient temperature - remote version	-40...+60°C/ -40...+140°F

Process effects on the sensor

Temperature	0.002% of the nominal flow rate per 1°C / 0.001% of the nominal flow rate per 1°F
Pressure	0.015% of the nominal flow rate per 1 $bar_{rel.}$ / 0.001% of the nominal flow rate per 1 psig

Hastelloy® Versions:

Operating data

Size	H10	H15	H25	H40	H50	H80

Flow rate

Nominal flow rate [kg/h]	2700	11250	34500	91500	180000	430000
Nominal flow rate [lbs/min]	100	400	1250	3300	6600	15800
Maximum flow rate	130% of nominal flow rate					
Minimum flow rate	Depending on measuring error required					

Accuracy

Accuracy, liquid	±0.1% of actual measured flow rate
Accuracy, gas	±0.5% of actual measured flow rate
Repeatability	Better than 0.05% plus zero stability (includes the combined effects of repeatability, linearity and hysteresis)
Zero stability	±0.05% of nominal flow rate with respective sensor size

Reference conditions

Product	Water
Temperature	20°C / 68°F
Operating pressure	1 $bar_{rel.}$ / 14.5 psig

Density

Measuring range	500...2000 kg/m^3 / 30...125 lbs/ft^3
Accuracy	±2 kg/m^3/ ±0.13 lbs/ft^3
Accuracy (on-site calibration)	±0.5 kg/m^3 / ±0.033 lbs/ft^3

Temperature

Measuring range	0...+100°C /+32...+210°F
Accuracy	±1°C /±1.8°F

Device specifications

Size	H10	H15	H25	H40	H50	H80

Materials

Measuring tube	Hastelloy® C-22
Flange raised face	Hastelloy® C-22
Flanges	Stainless steel 1.4435 / AISI 316L (optional: HC-22)
Outer cylinder (secondary pressure containment)	Stainless steel 1.4301 /AISI 304 (optional: stainless steel 1.4435 /AISI 316L)
Sensor electronics housing	Stainless steel 1.4435 / AISI 316L

Nominal pressure at 20°C or 68°F

Measuring tube	-1...40 $bar_{rel.}$ / -14.5...580 psig
Outer cylinder (secondary pressure containment)	-1...63 $bar_{rel.}$ / -14.5...910 psig

Temperature

Process temperature - flanged connections	0...+100°C/ +32...+210°F
Ambient temperature - compact version	-40...+55°C/ -40...+130°F
Ambient temperature - remote version	-40...+60°C/ -40...+140°F

Process effects on the sensors

Temperature	0.0075% of the nominal flow rate per 1°C / 0.0042% of the nominal flow rate per 1°F
Pressure	0.015% of the nominal flow rate per 1 $bar_{rel.}$ / 0.001% of the nominal flow rate per 1 psig

Stainless steel versions:

Operating data

Size	S06	S10	S15	S25	S40	S50	S80

Flow rate

Nominal flow rate [kg/h]	950	2700	11250	34500	91500	180000	430000
Nominal flow rate [lbs/min]	35	100	400	1250	3300	6600	15800
Maximum flow rate	130% of nominal flow rate						
Minimum flow rate	Depending on measuring error required						

Accuracy

Accuracy, Liquid	±0.1% of actual measured flow rate
Accuracy, gas	±0.5% of actual measured flow rate
Repeatability	Better than 0.05% plus zero stability (includes the combined effects of repeatability, linearity and hysteresis)
Zero stability	±0.05% of nominal flow rate with respective sensor size

Reference conditions

Product	Water
Temperature	20°C / 68°F
Operating pressure	1 $bar_{rel.}$ / 14.5 psig

Density

Measuring range	500...2000 kg/m^3 / 30...125 lbs/ft^3
Accuracy	±2 kg/m^3 / ±0.13 lbs/ft^3
Accuracy (on-site calibration)	±0.5 kg/m^3 / ±0.033 lbs/ft^3

Temperature

Measuring range - flanged connections	0...+100°C / +32...+210°F	
Measuring range - hygienic type connections	0...+100°C / +32...+210°F	0...+130°C / +32...+265°F
Accuracy	± 1°C / ±1.8°F	

Device Specifications

Size	S06	S10	S15	S25	S40	S50	S80

Materials

Measuring tube	Stainless steel 1.4462 /AISI 318L
Flange raised face	Stainless steel 1.4462 / AISI 318L
Flanges	Stainless steel 1.4435 / AISI 316L
Outer cylinder (secondary pressure containment)	Stainless steel 1.4301 /AISI 304 (optional: stainless steel 1.4435 / AISI 316L)
Sensor electronics housing	Stainless steel 1.4435/AISI 316L

Nominal pressure at 20°C or 68°F

Measuring tube	-1...40 $bar_{rel.}$ / -14.5...580 psig
Outer cylinder (secondary pressure containment)	-1...63 $bar_{rel.}$ / -14.5...910 psig

Temperature

Process temperature	0...+100°C / +32...+210°F	0...+130°C / +32...+265°F (with hygienic type connections)
Ambient temperature - compact version	-40...+55°C / -40...+130°F	
Ambient temperature - remote version	-40...+60°C / -40...+140°F	

Process effects of the sensor

Temperature	0.0075% of the nominal flow rate per 1°C / 0.0042% of the nominal flow rate per 1°F
Pressure	0.015% of the nominal flow rate per 1 $bar_{rel.}$ / 0.001% of the nominal flow rate per 1 psig

Approvals

Size	S / H / T06	S / H / T10	S / H / T15	S / H / T25	S / H / T40	S / H / T80

Mechanical

Protection category (ace. to EN 60529)	IP 67; NEMA4X
European Pressure Equipment directive	PED 97-23 EC (ace. to AD 2000 Regelwerk)

ATEX (acc. to 94/9/EC)

VERSAFLOW Mass flow Sensor - With "flameproof" terminal compartment	II 2 G EEx d ib IIC T6...T1
	II 2 D Ex tD A21 IP6x T175°C
	II 2(1) G EEx d ib[ia] IIC T6...T1
	II 2(1) D Ex tD [iaD] A21 IP6x T175°C
VERSAFLOW Mass flow Sensor - With "increased safety" terminal compartment	II 2 G EEx de ib IIC T6...T1
	II 2 D Ex tD A21 IP6x T175°C
	II 2(1) G EEx de ib [ia] IIC T6...T1
	II 2(1) D Ex tD [iaD] A21 IP6x T175°C
Versaflow Mass flow Sensor	II 2 G EEx ib IIC T6...T1
	II 2 D Ex ibD 21 T165°C
MFC 300 F-With "flameproof" terminal compartment	II 2(1) G EEx d [ia] IICT6
	112(1) D Ex tD [iaD] A21 IP6x T85°C
MFC 300 F-With "increased safety" terminal compartment	II 2(1) G EEx de [ia] IICT6
	112(1) D Ex tD [iaD] A21 IP6x T85°C
Factory Mutual / CSA	Class I, Div 1 groups A, B, C, D
	Class II, Div 1 groups E, F, G
	Class III, Div 1 hazardous areas
	Class I, Div 2 groups A, B, C, D
	Class II, Div 2 groups F, G
	Class III, Div 2 hazardous areas

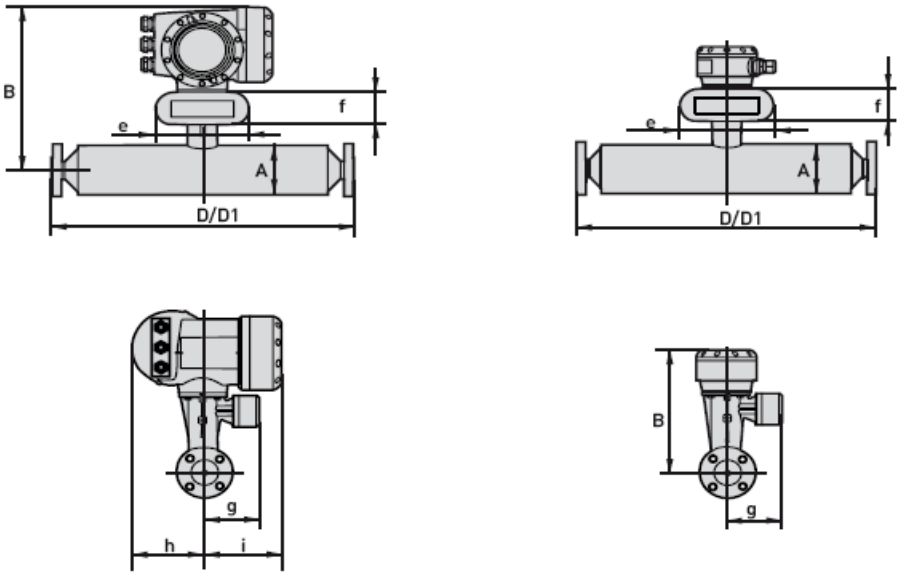
Electromagnetic compatibility [EMC]

to CE	EN 50081-1 (1992); EN 50082-2 (1994);
	Namur NE 21/5.95;
	89/336/EEC (EMC);
	72/73/EEC (Low Voltage Directive)

Dimensions

Flanged version

1) **Compact Version**
2) **Remote Version**



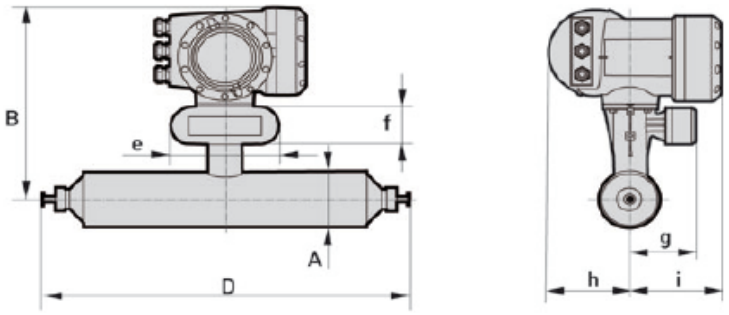
Dimensions in mm

Dimensions [mm]	Size						
	T06 / S06	T10 / H10 / S10	T15 / H15 / S15	T25 / H25 / S25	T40 / H40 / S40	T50 / H50 / S50	T80 / H80 / S80
A	102			115	170	220	274
B (compact)	311			318	345	370	397
B (remote)	231 ±2			237±2	265±2	290±2	317±4
D (standard flange)	420±2	510±2	548±2	700±2	925±2	1101±2	1460±4
D1 (ASME flange 600 lbs)	428±2	518±2	556±2	708±2	933±2	1109±2	1468±4
e	160						
f	60						
g	98.5						
h	123.5						
i	137						

Dimensions in inches

Dimensions [inches]	Size						
	T06 / S06	T10 / H10 / S10	T15 / H15 / S15	T25 / H25 / S25	T40 / H40 / S40	T50 / H50 / S50	T80 / H80 / S80
A	4			4,5	6,7	8,7	10,8
B (compact)	12.2			12,5	13,6	14,6	15,6
B (remote)	9.1±0.08			9.3±0.08	10.4±0.08	11.4±0.08	12.5±0.16
D (standard flange)	16.5±0.08	20.1±0.08	21.6±0.08	27.6±0.08	36.4±0.08	43.3±0.08	57.5±0.16
D1 (ASME flange 600 lbs)	16.9±0.08	20.4±0.08	21.9±0.08	27.9±0.08	36.7±0.08	43.7±0.08	57.8±0.16
e	6.3						
f	2.4						
g	3.9						
h	4.9						
i	5.4						

Hygienic version



Dimensions in mm

Dimensions [mm]	Size						
	T06 / S06	T10 / H10 / S10	T15 / H15 / S15	T25 / H25 / S25	T40 / H40 / S40	T50 / H50 / S50	T80 / H80 / S80
A	102			115	170	220	274
B	311			318	345	370	397
e	160						
f	60						
g	98.5						
h	123.5						
i	137						

Dimensions in inches

Dimensions [inches]	Size						
	T06 / S06	T10 / H10 / S10	T15 / H15 / S15	T25 / H25 / S25	T40 / H40 / S40	T50 / H50 / S50	T80 / H80 / S80
A	4			4.5	6.7	8.7	10.8
B	12.2			12.5	13.6	14.6	15.6
e	6.3						
f	2.4						
g	3.9						
h	4.9						
i	5.4						

Hygienic type connections: all-welded versions

Size	Tri-Clover	D [mm]	TriClamp DIN 32676	D [mm]	TriClamp ISO 2852	D [mm]	Tongue and groove flange DIN 11864	D [mm]
6	½"	480±2	DN10	484±2	-	-	-	-
10	½"	558±2	DN10	564±2	-	-	DN10	528±2
15	¾"	596±2	DN15	602±2	-	-	DN15	566±2
25	1½"	816±2	DN25	761 ±2	1½"	816±2	DN25	718±2
40	2"	1043±2	DN40	986±2	2"	1043±2	DN40	948±2
50	3"	1305±2	DN50	1168+2	3"	1305±2	DN50	1124+2
80	4"	1527±2	DN80	1584±2	4"	1527±2	DN80	1538±2

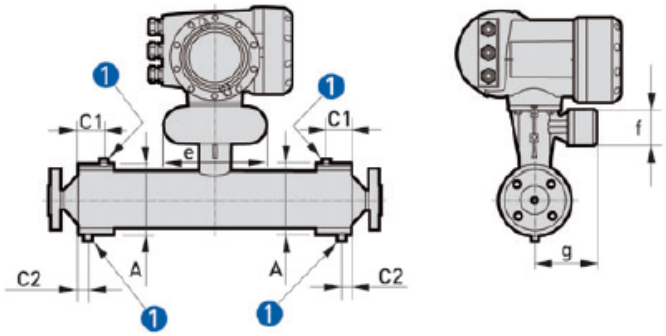
Hygienic type connections: adapter versions

Size	Tri-Clover	D [mm]	TriClamp DIN 32676	D [mm]	TriClamp ISO 2852	D [mm]
6	-	-	-	-	-	-
10	½"	597±2	DN10	590±2	-	-
15	¾"	635±2	DN15	628±2	-	-
15	1	665±2	-		1	665±2
25	1½"	855±2	DN25	787±2	1½"	855±2
40	2"	1077±2	DN40	1017+2	2"	1077±2
50	3"	1355±2	DN50	1193+2	3"	1355±2
80	-	-	-	-	-	-

Hygienic type connections: adapter versions

Size	Male thread DIN 11851	D [mm]	Male thread SMS	D [mm]	Male thread IDF/ISS	D [mm]	Male thread RJT	D [mm]
6	-	-	-	-	-	-	-	-
10	DN10	596±2	-	-	-	-	-	-
15	DN15	634±2	-	-	-	-	-	-
25	-	-	1"	665±2	1"	664±2	1"	676±2
40	DN25	802±2	1½"	852±2	1½"	854±2	1½"	866±2
50	DN40	1040±2	2"	1074±2	2"	1076±2	2"	1088±2
80	DN50	1220±2	3"	1360±2	3"	1354±2	3"	1366±2
	DN80	1658±2	-	-	-	-	-	-

Version with heating jacket



1) Connection

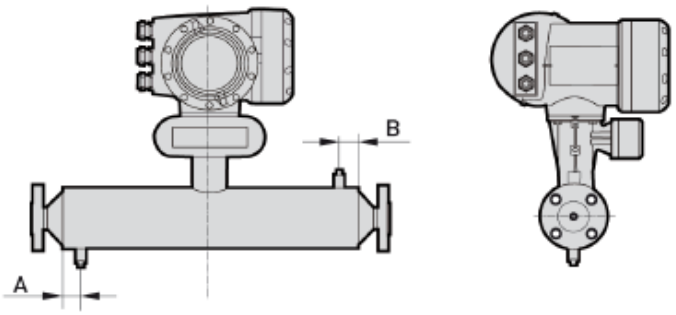
Dimensions in mm

Dimensions [mm]	Size						
	T10 / H10 / S10	T15 / H15 / S15	T25 / H25 / S25	T40 / H40 / S40	T50 / H50 / S50		T80 / H80 / S80
Connection Size	12					25	
A	115±1		142±1	206±1	254±1		305±1
B	311		318	345	370		397
C1 (T)	36±1	51±1	100±1	130±1	180±1	175±2	385±2
C2 (T)	20					26±1	
C1 (H & S)	-	51±1	55 ±1	130±1	105±1	100±2	200±2
C2 (H & S)	-	20				26±1	
e	160						
f	60						
g	98.5						

Dimensions in inches

Dimensions [inches]	Size						
	T10 / H10 / S10	T15 / H15 / S15	T25 / H25 / S25	T40 / H40 / S40	T50 / H50 / S50		T80 / H80 / S80
Connection Size	½					1	
A	4.5±1		5.6±1	8.1±1	10±1		12±1
B	12.2		12.5	13.6	14.6		15.6
C1 (T)	1.4±0.08	2±0.08	3.9±0.08	5.1±0.08	7.1±0.08	6.9±0.16	15.2±0.16
C2 (T)	0.8					1±0.08	
C1 (H & S)	-	2±0.08	2.2±0.08	5.1±0.08	4.1±0.08	3.9±0.16	7.9±0.16
C2 (H & S)	-	0.8				1±0.08	
e	6.3						
f	2.4						
g	3.9						

Version with purge ports

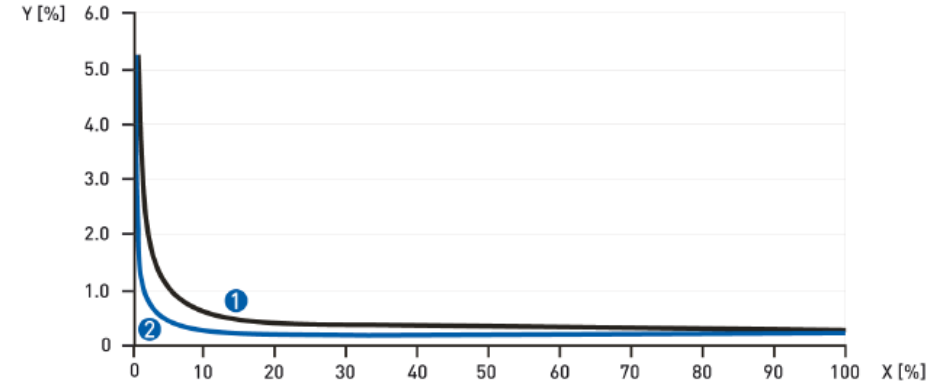


Dimensions [mm]	Size						
	T06 / S06	T10 / H10 / S10	T15 / H15 / S15	T25 / H25 / S25	T40 / H40 / S40	T50 / H50 / S50	T80 / H80 / S80
A	65	30			65		
B	30				65		

Dimensions in inches

Dimensions [inches]	Size						
	T06 / S06	T10 / H10 / S10	T15 / H15 / S15	T25 / H25 / S25	T40 / H40 / S40	T50 / H50 / S50	T80 / H80 / S80
A	2.6	1.2			2.6		
B	1.2				2.6		

Measuring accuracy



Y[%]: measuring error; X[%] nominal flow rate

1) **Hastelloy ® C-22 and stainless steel 318L**
2) **Titanium**

Measuring error: (The measuring error is obtained from the combined effects of accuracy and zero stability).

Full-scale ranges and measuring errors

Full-Scale ranges	100 : 1	20 : 1	10 : 1	5 : 1	2 : 1	1 : 1

Titanium

Typical measuring error %	0.90	0.26	0.18	0.14	0.12	0.11

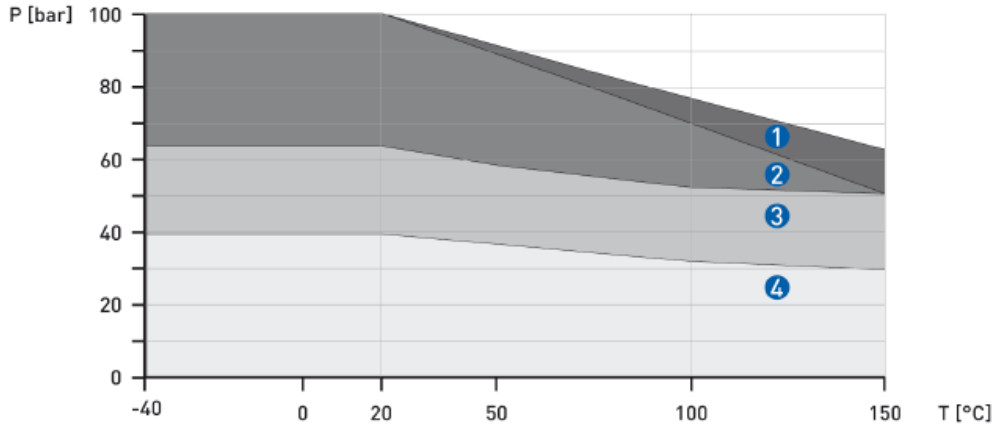
Hastelloy ® C-22 & stainless steel 318L

Typical measuring error %	5.10	1.10	0.60	0.35	0.20	0.15

Guidelines for maximum operating pressure

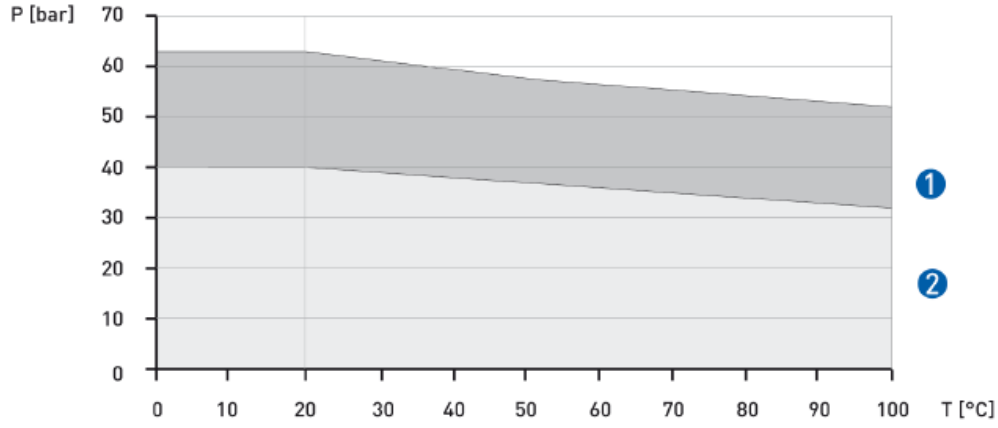
Note:
Ensure that the meters are used within their operating limits. Observe the following illustrations.

Flanged connections as per DIN 2501:
Pressure / temperature de-rating for titanium Gr 9 meters



1) **PN100 flanges for sizes T06...T25 and secondary pressure containment PN100**
2) **PN100 flanges for sizes T40...T80 and secondary pressure containment PN100**
3) **PN63 flanges for secondary pressure containment PN63**
4) **PN40 flanges**

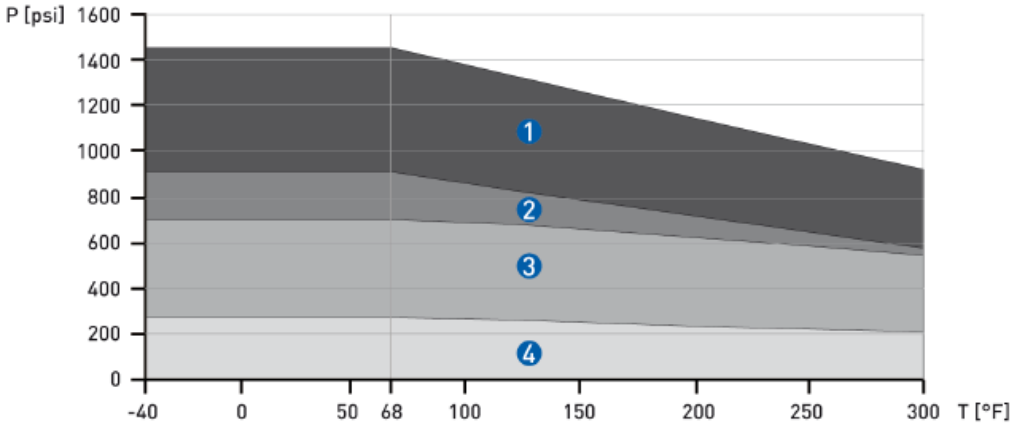
Pressure / temperature de-rating for stainless steel and Hastelloy® C22 meters



1) **Secondary pressure containment for all sizes**
2) **PN40 flanges**

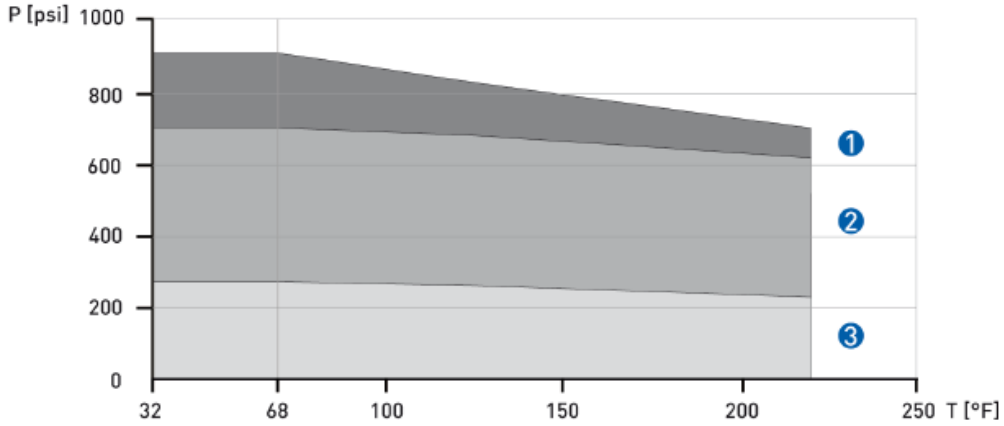
Note:
All hygienic type process connections rated to 10 barg / 145 psig at 20°C/68°F.

Flanged connections as per ASME:
Pressure / temperature de-rating for titanium Gr 9 meters



1) **ASME 600 lbs and secondary pressure containment 1450 psi**
2) **Secondary pressure containment 910 psi**
3) **ASME 300 lbs**
4) **ASME 150 lbs**

Pressure / temperature de-rating for stainless steel and Hastelloy® C22 meters



1) **Secondary pressure containment for all sizes**
2) **ASME 300 lbs**
3) **ASME 150 lbs**

Note:
All hygienic type process connections rated to 10 barg / 145 psig at 20°C / 68°F.

Ordering Information

Contact your nearest Honeywell sales office, or

In the U.S.:

Honeywell Process Solutions
Honeywell International Inc
2500 West Union Hills Drive
Phoenix, AZ 85027 1-800-343-0228

In Canada:

The Honeywell Centre
155 Gordon Baker Rd.
North York, Ontario M2H 3N7
1-800-461-0013

In Latin America:

Honeywell Inc.
480 Sawgrass Corporate Parkway,
Suite 200 Sunrise, FL 33325
(954) 845-2600

In Europe and Africa:

Honeywell S. A.
Avenue du Bourget 1
1140 Brussels, Belgium

In Eastern Europe:

Honeywell Praha,
s.r.o. Budejovicka 1
140 21 Prague 4,
Czech Republic

In the Middle East:

Honeywell Middle East Ltd.
Khalifa Street,
Sheikh Faisal Building
Abu Dhabi, U. A. E.

In Asia:

Honeywell Asia Pacific Inc.
Honeywell Building,
17 Changi Business Park Central 1
Singapore 486073
Republic of Singapore

In the Pacific:

Honeywell Pty Ltd.
5 Thomas Holt Drive
North Ryde NSW Australia 2113
(61 2) 9353 7000

In Japan:

Honeywell K.K.
14-6 Shibaura 1-chrome
Minato-ku, Tokyo, Japan 105-0023

Or, visit Honeywell on the World Wide Web at: **http://www.honeywell.com**
Specifications are subject to change without notice.