



OPTIMASS 9000

Technical Datasheet

Sensor for mass flow

- Rugged design for high-temperature applications up to 350°C
- Compensation for high temperatures and pressures
- Modular electronics concept
- For liquids and gases



KROHNE

The solution for high-temperature applications

The OPTIMASS 9000 series reliably measures the mass flow of gases and liquids in high-temperature and high-pressure applications.



- ① Comprehensive diagnosis capabilities
- ② All standard process connections available, including hygienic type connections
- ③ Same electronics for all sensors with redundant storage of calibration and sensor data

Highlights

- Rugged design
- Regardless of type of installation and external factors
- Optional heating jacket
- Modular electronics concept: electronics and sensor easy to replace
- Data redundancy: accurate plug & play replacement of electronics

Industries

- Chemical
- Oil & Gas
- Petrochemistry
- Pharmaceutical

Applications

- Crystallizing and cryogenic products
- High temperatures up to 350°C / 660°F
- Tanker loading

Mass flowmeter product family

All meters consist of a sensor and a converter, which may be mounted integral to the sensor, or remotely, either with a field mount kit, a wall mount housing or a 19" rack mount module.

A sensor mount converter (MFC 010) with a Modbus[®] output only is also possible for OEM manufacturers or where the user does not require a converter with analogue outputs.

Converter: Common hardware for all converters makes spares holding simpler



- ❶ MFC 300 C: Compact or integrally mounted on sensor
- ❷ MFC 300 F: Field mount up to 300 m / 1000 ft from sensor
- ❸ MFC 300 W: Wall mount for non-hazardous areas
- ❹ MFC 300 R: 19" Rack mount module for control room installation
- ❺ MFC 010: Sensor electronics with Modbus[®] output

Sensor: Sensors for any applications



- ❶ OPTIMASS 1000: The general purpose solution for the process industry
- ❷ OPTIMASS 3000: The meter for low flow applications
- ❸ OPTIMASS 7000: The optimum solution for the chemical, food & beverage and pharmaceutical industry
- ❹ OPTIMASS 8000: The meter for high pressure and elevated temperatures
- ❺ OPTIMASS 9000: The high temperature solution up to 350°C / 660°F

Technical Data

Hastelloy® (H) and stainless steel (S) versions

Operating data

Size	S / H15	S / H25	S / H40	S / H80	S100
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Flow rate

Nominal flow rate [kg/h]	2700	9000	32000	85000	250000
Nominal flow rate [lbs/min]	100	300	1200	3000	9300
Maximum flow rate	130% of the nominal flow rate for the corresponding sensor size; depending on the application.				
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	±0.008% 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 - safe area (remote version only)	0 ...+350°C / +32 ...+660°F
Measuring range - ATEX / FM / CSA (remote version only)	0 ...+350°C / +32 ...+660°F
Accuracy	±1°C ±0.5% of the value / ±1.8°F ±0.5% of the value

Device specifications

Size	S / H15	S / H25	S / H40	S / H80	S100
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Materials

Measuring tube	Stainless steel 1.4435 / AISI 316L or Hastelloy® C-22
Flanges	Stainless steel 1.4435 / AISI 316L or stainless steel 1.4435 / AISI 316L, backing with Hastelloy® C-22 flange raised face
Sensor electronics housing	Stainless steel 1.4435 / AISI 316L

Pressure

Measuring tube	See pressure-temperature table
Outer housing	Rupture pressure typically in excess of 50 bar _{rel.} / 725 psig at 20°C / 68°F. Burst disc option recommended for gas measurement > 50 bar _{rel.} / 725 psig at 20°C / 68°F. Max. temperature for burst disc is 150°C / 300°F.

Temperature

Process temperature - safe area (remote version only)	0...+350°C / +32...+660°F
Process temperature - ATEX / FM / CSA (remote version only)	0...+350°C / +32...+660°F
Ambient temperature (remote version only)	-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

Measuring tube pressure range

Size	Process temperature					
	150°C / 300°F maximum		230°C / 440°F maximum		350°C / 660°F maximum	
	bar _{rel.}	psig	bar _{rel.}	psig	bar _{rel.}	psig
DN 15	210	3045	185	2680	160	2320
DN 25	165	2390	145	2100	125	1810
DN 40	140	2030	120	1740	105	1520
DN 80	125	1810	110	1595	95	1375
DN 100	85	1230	75	1085	65	940

Approvals

Size	S / H15	S / H25	S / H40	S / H80	S100
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Mechanical

Protection category (acc. to EN 60529)	IP 67; NEMA 4X
European Pressure Equipment directive	PED 97-23 EC (acc. to AD 2000 Regelwerk)

ATEX (acc. to 94/9/EC)

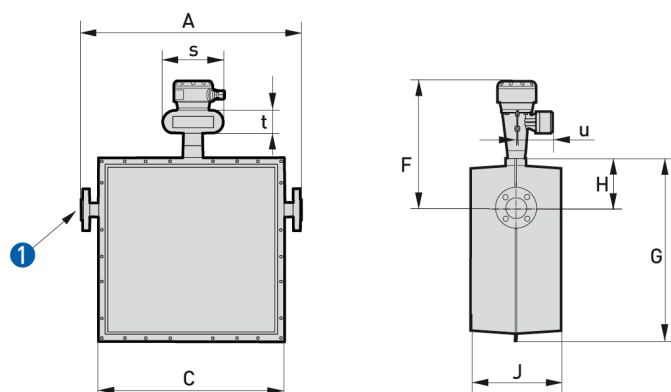
OPTIMASS 9000 and 9010 C	II 2 G EEx ib IIC T4...T1
	II 2 D Ex ibD 21 T385°C
MFC 300 F- With "flameproof" terminal compartment	II 2(1) G EEx d [ia] IIC T6
	II 2(1) D Ex tD [iaD] A21 IP6x T85°C
MFC 300 F- With "increased safety" terminal compartment	II 2(1) G EEx de [ia] IIC T6
	II 2(1) D Ex tD [iaD] A21 IP6x T85°C
Factory Mutual / CSA (pending)	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	Namur NE 21/5.95;
	89/336/EEC (EMC);
	72/73/EEC (Low Voltage Directive)

Dimensions

Version with insulating jacket



① Process connection

Dimensions in mm

Size	Dimensions [mm]								
	A	C	F	G	H	J	s	t	u
15	①	310	271	411	138	240	160	60	98.5
25	①	439	271	464	138	260	160	60	98.5
40	①	530	281	524	148	260	160	60	98.5
80	①	884	298	684	165	304	160	60	98.5
100	①	932	331	730	200	343	160	60	98.5

① depending on the process connection; see tables for dimension A

Dimensions in inches

Size	Dimensions [inches]								
	A	C	F	G	H	J	s	t	u
15	①	12.2	10.7	16.2	5.4	9.4	6.3	2.4	3.9
25	①	17.3	10.7	18.3	5.4	10.2	6.3	2.4	3.9
40	①	20.9	11.1	20.6	5.8	10.2	6.3	2.4	3.9
80	①	34.8	11.7	26.9	6.5	12.0	6.3	2.4	3.9
100	①	36.7	13.0	28.7	7.9	13.5	6.3	2.4	3.9

① depending on the process connection; see tables for dimension A

Dimensions in mm for A with flanged connections

Flange		Material	Size 15		Size 25		Size 40			Size 80		Size 100		
			DN15	DN25	DN25	DN40	DN40	DN50	DN80	DN80	DN 100	DN 100	DN 150	
			½"	1"	1"	1½"	1½"	2"	3"	3"	4"	4"	6"	
Dimensions [mm]														
EN 1092-1	PN40	Stainless steel	370	370	500	500	600	600	610	1000	1000	1100	1100	
		Hastelloy®	-	390	500	520	-	620	620	1000	1000	-	-	
	PN 63	Stainless steel	-	-	-	-	-	620	620	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
	PN100	Stainless steel	380	390	520	560	620	660	730	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
ASME B16.5	150 lb	Stainless steel	370	370	500	500	600	600	610	1000	1000	1100	1100	
		Hastelloy®	-	390	500	520	-	620	620	1000	1000	-	-	
	300 lb	Stainless steel	-	370	-	510	-	600	620	-	-	-	-	
		Hastelloy®	-	390	-	520	-	620	620	-	-	-	-	
	600 lb	Stainless steel	380	390	520	560	620	630	640	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
	900 lb	Stainless steel	-	-	-	-	640	720	760	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
	1,500 lb	Stainless steel	400	450	540	600	-	-	-	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
	JIS B 2220	10K	Stainless steel	370	370	500	500	600	600	600	1000	1000	1100	1100
		20K	Stainless steel	370	370	500	500	600	600	600	1000	1000	1100	1100

Dimensions in mm for A with hygienic type connections

Connection type	Material	Size 15	Size 25	Size 40		Size 80
		DN25	DN40	DN50	DN65	DN100
		1"	1½"	2"	3"	4"
Dimensions [mm]						
Triclamp DIN32676 & ISO2852	Stainless steel	370	500	600	600	1020
Triclover Triclamp	Stainless steel	370	500	600	600	1020
DIN 11851 male thread	Stainless steel	380	510	600	-	1050

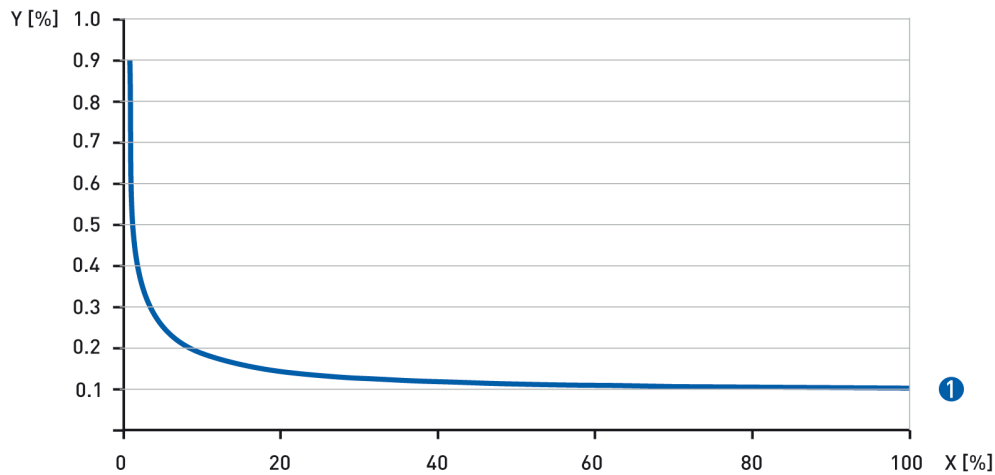
Dimensions in mm for A with flanged connections

Flange		Material	Size 15		Size 25		Size 40			Size 80		Size 100		
			DN15	DN25	DN25	DN40	DN40	DN50	DN80	DN80	DN 100	DN 100	DN 150	
			½"	1"	1"	1½"	1½"	2"	3"	3"	4"	4"	6"	
Dimensions [inches]														
EN 1092-1	PN40	Stainless steel	14.6	14.6	19.7	19.7	23.6	23.6	24.0	39.4	39.4	43.3	43.3	
		Hastelloy®	-	15.4	19.7	20.5	-	24.4	24.4	39.4	39.4	-	-	
	PN 63	Stainless steel	-	-	-	-	-	24.4	24.4	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
	PN100	Stainless steel	15.0	15.4	20.5	22.0	24.4	26.0	28.7	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
ASME B16.5	150 lb	Stainless steel	14.6	14.6	19.7	19.7	23.6	23.6	24.0	39.4	39.4	43.3	43.3	
		Hastelloy®	-	15.4	19.7	20.5	-	24.4	24.4	39.4	39.4	-	-	
	300 lb	Stainless steel	-	14.6	-	20.1	-	23.6	24.4	-	-	-	-	
		Hastelloy®	-	15.4	-	20.5	-	24.4	24.4	-	-	-	-	
	600 lb	Stainless steel	15.0	15.4	20.5	22.0	24.4	24.8	25.2	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
	900 lb	Stainless steel	-	-	-	-	25.2	28.3	29.9	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
	1.500 lb	Stainless steel	15.7	17.7	21.3	23.6	-	-	-	-	-	-	-	
		Hastelloy®	-	-	-	-	-	-	-	-	-	-	-	
	JIS B 2220	10K	Stainless steel	14.6	14.6	19.7	19.7	23.6	23.6	23.6	39.4	39.4	43.3	43.3
		20K	Stainless steel	14.6	14.6	19.7	19.7	23.6	23.6	23.6	39.4	39.4	43.3	43.3

Dimensions in inches for A with hygienic type connections

Connection type	Material	Size 15	Size 25	Size 40		Size 80
		DN25	DN40	DN50	DN65	DN100
		1"	1½"	2"	3"	4"
Dimensions [inches]						
Triclamp DIN32676 & ISO2852	Stainless steel	14.6	19.5	23.6	23.6	40.2
Triclover Triclamp	Stainless steel	14.6	19.5	23.6	23.6	40.2
DIN 11851 male thread	Stainless steel	15.0	20.1	23.6	-	41.3

Measuring accuracy



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

① All tube materials

Measuring error

The measuring error is obtained from the combined effects of accuracy and zero stability; measured at various points over the nominal flow range of each sensor size. The values are applicable both for the 8000 and 9000 series with a stainless steel or Hastelloy® C-22 measuring tube.

Full-scale ranges and measuring errors

Full-scale ranges	100 : 1	20 : 1	10 : 1	5 : 1	2 : 1	1 : 1
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Hastelloy® C-22, stainless steel 316L

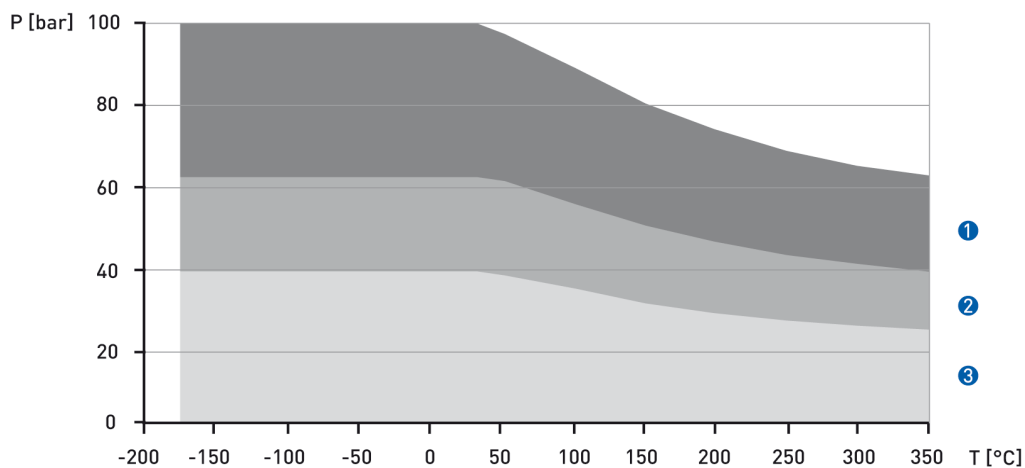
Typical measuring error %	0.90	0.26	0.18	0.14	0.12	0.11
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Guidelines for maximum operating pressure

Note:

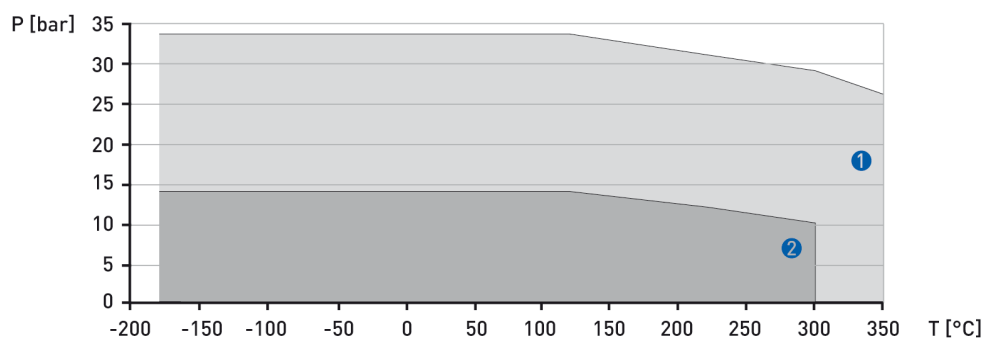
Ensure that the meters are used within their operating limits. Observe the following illustrations.

DIN flanged connections as per EN 1092-1



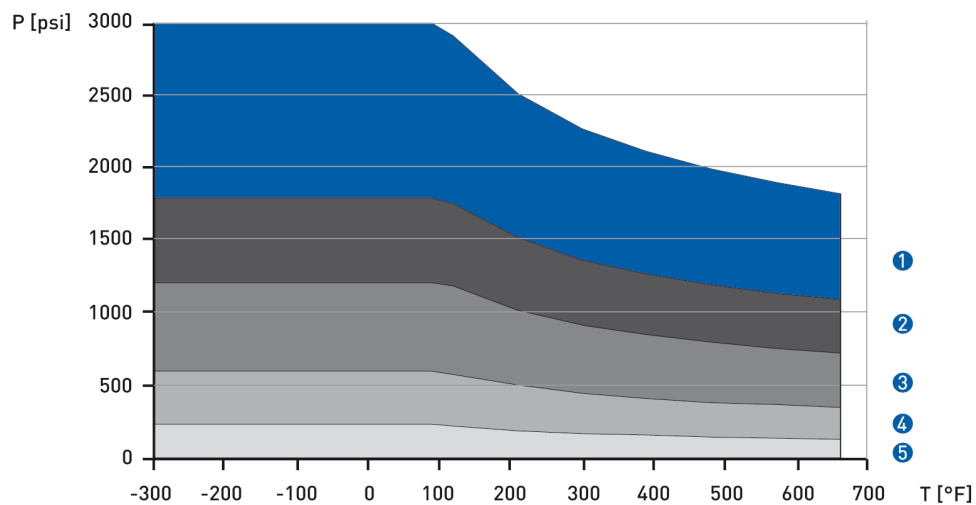
- ① PN100 flanges
- ② PN63 flanges
- ③ PN40 flanges

Flanged connections as per JIS 2220 B



- ① 20K flanges
- ② 10K flanges

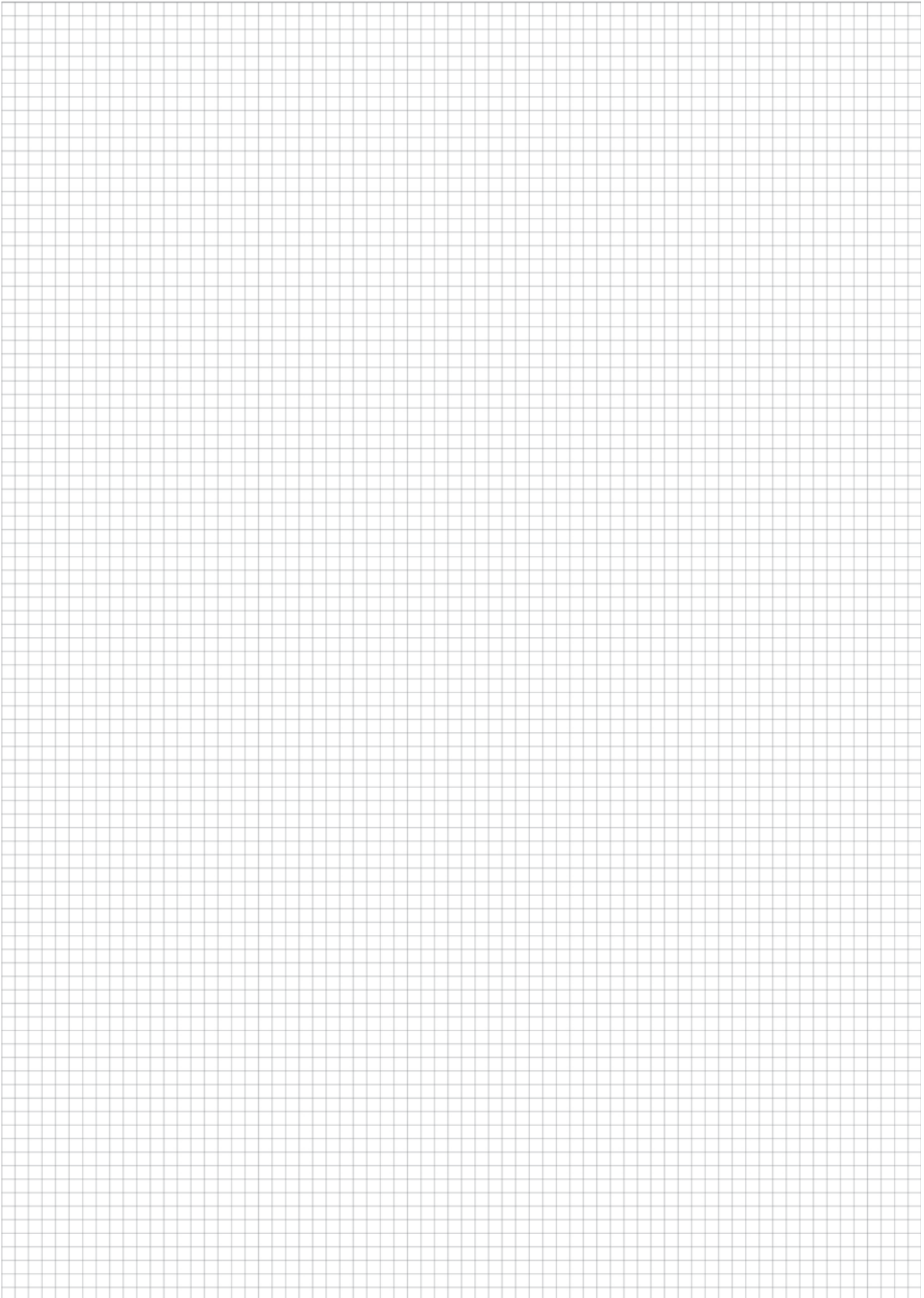
Flanged connections as per ASME B16.5



- ① ASME 1500 lbs
- ② ASME 900 lbs
- ③ ASME 600 lbs
- ④ ASME 300 lbs
- ⑤ ASME 150 lbs







KROHNE Product Overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Mass flowmeters
- Ultrasonic flowmeters
- Vortex flowmeters
- Flow controllers
- Level measuring instruments
- Pressure gauges
- Temperature measuring instruments
- Water solutions & analysis
- Oil and gas turnkey solutions

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