

OVAL WHEEL METER

SERIES OaP

1. IDENTIFICATION

Manufacturer	Bopp & Reuther Messtechnik Am Neuen Rheinhafen 4 67346 Speyer Telefon: +49 6232 657-0 Telefax: +49 6232 657-505
Product type	Direct volumetric meter (positive displacement meter, version: double-case)
Product name	Oval Wheel Meter Series OaP

2. RANGE OF APPLICATION

The range of application of all oval wheel meters of the series OaP comprises measuring of volumes and flowrates in the process, custody transfer, dosage and controlling of liquids. They are used for the measurement of intermediate and final liquid products such as liquefied gases, acids, alkaline solutions, fats, alcohol, solvents, dispersions, polymers, polycondensates, paints, colors, adhesives and other media. Please note the oval wheel meters capability to measure liquids with very high viscosities with nearly no pressure loss.

The high accuracy provided by the oval wheel meters series OaP ensure a maximum quality of products being manufactured.

Oval wheel meters of the series OaP are manufactured with nominal widths of 25 to 400 mm. Depending on the nominal width they can be used up to PN100 with a maximum operating temperature of up to 290°C.

3. MEASURING PRINCIPLE AND SYSTEM CONFIGURATION

3.1 Measuring principle

Oval wheel meters belong to the group of direct volumetric meters for liquids with movable partition walls (displacement flow meters). The oval wheel meter consists of a measuring chamber housing with two pivoted oval wheels, which are toothed and roll off in counter-rotations around each other.

Each revolution of the oval wheels displaces four discrete volumes of liquid (defined by the space between oval wheel and measuring chamber) through the counter. The number of the rotations is a measure for the volume.



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3.2 System configuration

Sensor :

Measuring of the volumetric flow and the volume of liquids is performed by the oval wheel meter either by.

- a magnetic coupling that transmits the rotary motion of the oval wheels to mechanical roller counters with the decisive advantage of having to work without auxiliary power, if necessary as an option with an encoder (e.g. AG19, AG01-08) for connection to flow computers, controls or control systems

or

- via direct electronic scanning of the rotation of the oval wheels by means of a pulse generator (e.g. AG44), without additional mechanical parts, on-site display series F if required, combined with the advantages of modern electronic solutions and direct integration into control systems via 4 ... 20mA / HART

A comprehensive range of additional devices is available for these oval gear meters, e.g. mechanical, electrical and electronic transducers, whose signals can be used for remote metering, flow measurement and control, as well as for integration into higher-level automation systems. Suitable volume preselection devices with matching valves of various designs and operating modes can also be used for dosing.

Pulse pick-up

The AG19 (single-channel, Exi) and AG20 (custody transfer, dual-channel, Exi) pulse pick-up and the high-resolution AG44 pulse pick-up (Wiegand principle, Exi) are designed for connection to devices in accordance with EN 50227 NAMUR. The high-resolution AG01-08 pulse pick-up (custody transfer, Exd) is also part of the range.

Mechanical on-site display

We also offer mechanical solutions such as a single pointer indicator E, a double pointer indicator D and resettable roller counters M5 and M5V with quantity setting mechanism and step switches (sp2, sp22, se2).

On-site display F series

The F series local display is a user-friendly display with numerous functions. It offers various options for displaying the current flow rate as well as resettable and non-resettable volume values. The large display enables simple configuration and ensures intuitive operation.

The F series local display can be operated via various power sources, including a battery-powered version. It is also suitable for use in potentially explosive atmospheres. A white backlight ensures good readability day and night, while a red flashing indicator is activated in the event of an alarm.

The device also has analogue and digital outputs for transmitting flow data, volume pulses and alarm messages. It can optionally be equipped with HART-communication, flow controller and a linearisation function. It can be mounted directly on the oval gear meter or installed remotely in a more accessible area.

On-site display E series

The E series transmitter records the volume flow of the oval gear meter. When the housing is closed, operation is made possible by optical buttons behind the glass pane. The E series transmitter can be used in explosion-proof areas (flameproof enclosure). A 4 ... 20mA output and digital outputs, which can be used as a pulse output or alarm signal, are available as outputs. The 15-point linearisation is used to optimise the output signal. HART-communication is also available as an option.

The transmitter can be mounted directly on the oval gear meter or installed remotely in a more accessible area.

4. INPUT

4.1 Measured value

Volume and Volume flow rate

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4.2 Flow range

Typ	DN	Flowrate $Q_{\max}$ [l/min]	Load with viscosity	< 0.3 mPa·s		0.3 ... 1.5 mPa·s		1.5 ... 150 mPa·s		... 350 mPa·s		... 1000 mPa·s		... 3000 mPa·s	
				[l/min]	[m³/h]	[l/min]	[m³/h]	[l/min]	[m³/h]	[l/min]	[m³/h]	[l/min]	[m³/h]	[l/min]	[m³/h]
OaP5	25	60 (3.6 m³/h)	Min	8	0.5	5	0.3	5	0.3	2.5	0.15	1.25	0.075	0.45	0.027
			Max	48	3.0	60	3.6	60	3.6	30	1.8	15	0.9	5.4	0.32
			Continuous	18	1.1	36	2.2	50	3	28	1.7	14	0.83	5	0.3
OaP10	25	120 (7.2 m³/h)	Min	16	1.0	10	0.6	10	0.6	7	0.42	3.5	0.20	1.2	0.072
			Max	96	6.0	120	7.2	120	7.2	84	5	42	2.4	14.4	0.86
			Continuous	36	2.2	73	4.4	99	5.9	77	4.6	39	2.2	13.2	0.79
OaP50	50	360 (21.6 m³/h)	Min	50	3.0	30	1.8	30	1.8	18	1.08	9.0	0.54	3	0.18
			Max	300	18	360	21.6	360	21.6	216	13	108	6.5	36	2.2
			Continuous	110	6.6	220	13	297	18	198	12	99	5.9	33	2
OaP125	65	840 (50.4 m³/h)	Min	100	6	70	4.2	70	4.2	60	3.6	40	2.4	15	0.9
			Max	600	36	840	50.4	840	50.4	720	43	480	29	180	11
			Continuous	220	13	460	28	578	35	660	40	440	26	165	10
OaP250	80	1440 (86.4 m³/h)	Min	200	12	120	7.2	120	7.2	100	6	60	3.6	30	1.8
			Max	1200	72	1440	86.4	1440	86.4	1200	72	720	43	360	22
			Continuous	440	26	790	48	1100	66	1100	66	660	40	330	20
OaP600	100	3600 (216 m³/h)	Min	400	24	250	15	250	15	200	12	150	9	75	4.5
			Max	2400	140	3600	216	3600	216	3000	180	1800	110	900	54
			Continuous	880	53	1800	110	2750	165	2750	165	1650	100	830	50
OaP 1200	150 6"	6000 (360 m³/h)	Min	800	48	500	30	500	30	400	24	250	15	120	7.2
			Max	4800	290	6000	360	6000	360	4800	290	3000	180	1400	86
			Continuous	1800	110	2800	170	3900	220	4400	260	2800	170	1300	79
OaP 2000	200 8"	9600 (576 m³/h)	Min	1300	80	800	48	800	48	660	40	400	24	200	12
			Max	7800	480	9600	576	9600	576	7900	480	4800	290	2400	140
			Continuous	2900	180	4400	260	6100	350	7300	440	4400	260	2200	130
OaP 3200	300 12"	14400 (864 m³/h)	Min	2000	120	1200	72	1200	72	1000	60	600	36	300	18
			Max	12000	720	14400	864	14400	864	12000	720	7200	430	3600	220
			Continuous	4400	260	6600	400	8800	530	11000	660	6600	400	3300	200
OaP 4000	400 16"	24000 (1,440 m³/h)	Min	3200	200	2000	120	2000	120	1500	90	1000	60	400	42
			Max	19000	1200	24000	1440	24000	1440	18000	1100	12000	720	4800	290
			Continuous	7300	440	11000	660	15000	880	17000	1000	11000	660	4400	260

with viscosity > 150 mPa·s

Special toothed oval wheels from OaP10, generally for material version "D2"

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5. CHARACTERISTIC PARAMETER

5.1 Reference conditions

Bopp & Reuther Messtechnik calibration equipment is approved by the PTB and traceable to national standards.

Pressure: 2 to 7 bar. Temp: 20°C to 30°C

5.2 Accuracy

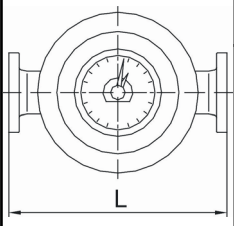
Lin. $\pm 0.05\%$ to $\pm 0.3\%$ of measured value (depending on product characteristics and measuring range)

5.3 Repeatability

$< 0.02\%$

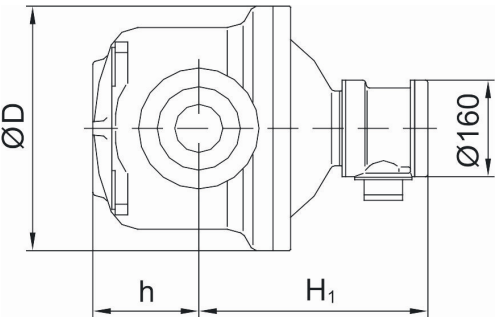
6. CONSTRUCTION DETAILS

6.1 Design / Dimensions / Weights

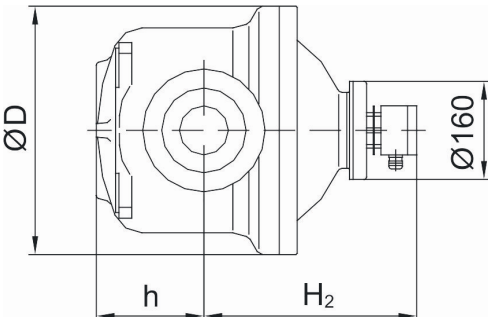
	Typ		OaP5	OaP10	OaP50	OaP125	OaP250	OAP600	OaP1200	OaP2000	OaP3200	OaP4000
	Nominal diameter		DN25	DN25	DN50	DN65	DN80	DN100	DN150	DN200	DN300	DN400
	Length L (mm)	DIN PN16/25/ PN40 ANSI150/ ANSI300	220	220	325	450	550	650	800	900	900	1200
		DIN PN100 ANSI600	250	310	400	500	600	700				

The following dimensions apply to oval wheel meters of the OaP series with AG19, AG20 or AG44 pulse generator only

AG19 / AG 20



AG 44





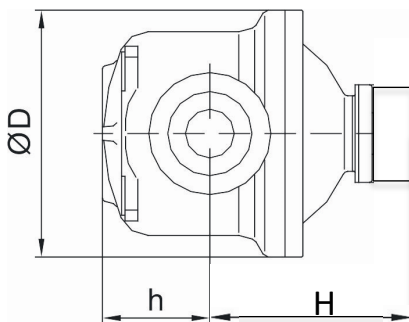
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Typ		OaP5	OaP10	OaP50	OaP125	OaP250	OaP600	OaP1200	OaP2000	OaP3200	OaP4000
Nominal diameter		DN25	DN25	DN50	DN65	DN80	DN100	DN150	DN200	DN300	DN400
Dimensions (mm) DIN PN16,25,40 ANSI150,300	D	144	165	260	320	400	480	614	665	665	665
	h	142	82	104	150	176	258	280	400	658	748
	H ₁	217	296	314	342	382	428,5	482	588	824	914
	H ₂	185	264	282	309	349	396	449	556	792	882
Weight approx. (kg)		20	28	62	81	156	261	510	895	1225	1925

Typ		OaP5	OaP10	OaP50	OaP125	OaP250	OaP600
Nominal diameter		DN25	DN25	DN50	DN65	DN80	DN100
Dimensions (mm) DIN PN100 ANSI600	D	150	223	292	345	440	505
	H	70	81	121	166	202	278
	H ₁	356	363	381	409	448	495
	H ₂	303	331	349	377	412	463
Weight approx. (kg)		29	54	99	141	261	441

OaP 5 - OaP 4000 with on-site display Series F



Typ		OaP5	OaP10	OaP50	OaP125	OaP250	OaP600	OaP 1200	OaP2000	OaP3200	OaP4000
Nominal diameter		DN25	DN25	DN50	DN65	DN80	DN100	DN150	DN200	DN300	DN400
Dimension (mm) DIN PN16, 25,40 ANSI 150,300	D	144	165	260	320	405	480	614	665	665	665
	h	142	82	104	150	176	258	280	400	658	748
	H F Exi	198	273	295	322	362	409	462	569	805	895
	H E Exd	on request									
Weight approx. (kg)		19	27	61	80	155	260	509	894	1224	1924

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Type		OaP5	OaP10	OaP50	OaP125	OaP250	OaP600
Nominal diameter		DN25	DN25	DN50	DN65	DN80	DN100
Dimension (mm)	D	150	223	292	345	440	505
	h	70	81	121	166	202	278
	H F Exi	175	177	195	242	259	292
	H E Exd	auf Anfrage					
Weight approx. (kg)		28	53	98	140	260	440

OaP5 - OaP400 with mechanical pointer totalizer E,D or roller counter M5 and optional pulse pick-up AG19, AG20
Versions with single-pointer totalizer E and double-pointer totalizer D

OaP ... E / OaP ... D	OaP ... Es / OaP ... Ds	OaP ... wE / OaP ... wD

Versions with roller counter M5

OaP ... M5	OaP ... M5s

Versions with roller counter M5V

OaP ... M5V (with pneumatic switch or electric switch e2)	OaP ... M5sV

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Typ		OaP5	OaP10	OaP50	OaP125	OaP250	OaP600	OaP 1200	OaP2000	OaP3200	OaP4000
Nominal diameter		DN25	DN25	DN50	DN65	DN80	DN100	DN150	DN200	DN300	DN400
D (mm)		144	165	260	320	405	480	614	665	665	665
Dimension (mm)	h	142	82	104	150	176	258	280	400	658	748
	H1	235	314	332	358	399	446	499	606	842	932
	H2	315	394	412	438	479	526	579	686	922	1012
	H3	360	439	457	483	524	571	624	731	967	1057
	H4	365	444	462	488	529	576	629	736	972	1062
	H5	395	474	492	518	559	606	659	766	1002	1092
	H6	370	449	467	493	534	581	657	741	977	1067
	H7	440	519	537	563	604	651	727	811	1047	1137
Weight approx. (kg)	E,D	19	27	61	80	155	260	509	894	1224	1924
	M5	25	33	67	86	161	266	515	900	1230	1930
	M5V	32	40	74	93	168	273	522	907	1237	1937

Typ		OaP5	OaP10	OaP50	OaP125	OaP250	OaP600
Nominal diameter		DN25	DN25	DN50	DN65	DN80	DN100
D (mm)		150	223	292	345	440	505
Dimension (mm)	h	70	81	121	166	202	278
	H1	374	381	398	427	466	513
	H2	454	461	478	507	546	593
	H3	499	506	523	552	591	638
	H4	504	511	528	557	596	643
	H5	534	541	558	587	626	673
	H6	509	516	533	562	601	648
	H7	579	586	603	632	671	718
Weight approx. (kg)	E,D	28	53	98	140	260	440
	M5	34	59	104	146	266	446
	M5V	41	66	111	153	273	453

Regardless of the pressure rating of the flanges, the dimensions H1 to H7 change as follows for meters with external adjustment, pulse generator AG19 / AG20 or extension:

External adjustment
+ 42 mm

Pulse pick-up AG19
+ 115 mm

Pulse pick-up AG20
+115 mm

Pulse pick-up AG01-08
+190 mm

Extension
+300 mm

When using a 300 mm temperature extension, the weight increases by approx. 2 kg

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6.2 Material

	Material code		
	L2	D2	G2
Housing	Cast steel	Cast steel	Cast steel
Measuring chamber	Aluminum	Cast iron	Cast iron
Oval wheels	Aluminum	Cast iron	Cast iron
Bearing	Hard carbon	Cast iron	Hard carbon

Available materials

	L2	D2	G2
OaP 5	in planning	•	on request
OaP 10	in planning	•	on request
OaP 50	in planning	•	on request
OaP 125	•	•	on request
OaP 250	•	•	on request
OaP 600	•	•	•
OaP1200	•	•	on request
OaP 2000	in planning	•	on request
OaP 3200	in planning	•	on request
OaP 4000	in planning	•	on request

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7. OPERATING CONDITIONS

7.1 Degree of protection

OaP:	Ambient temperature	Housing	Explosion protection
			Mech. Ex. Protection see manufacturer's declaration
AG19, AG20:	-25°C ... +90°C	IP54	II 2G Ex ia IIC T6
AG44 :	-50°C ... +60°C/+75°C/+85°C	IP65	II 2G Ex ib IIC T6/5/4
AG01-08	-30°C ... +70°C	IP68	II 2G Ex d II BT6Gb
Indicator E, D:	-20°C ... +110°C	IP54	
M5:	-20°C ... +60°C	IP54	
M5 Accessories :			see D-DE-17205-00
Fxxx Exi :	-40°C ... +70°C	IP65	Gas: II 1 G Ex ia IIC T4 Ga Dust: II 1 D Ex ia IIIC T 200 100 °C Da
Exxx Exd:	-40°C ... +70°C	IP65	Gas: II 2 G Ex db IIC T6 Gb Dust: II 2 D Ex tb IIIC T85°C Db

Protection class for housing IP according to IEC 60529 / EN 60529, Ex approval Directive 2014/34/EU

7.2 Process pressure - Process connection

Druckstufe*	PN25 DIN2544	PN40 DIN2545	PN100 DIN2547	ANSI150 ⁽¹⁾	ANSI300 ⁽²⁾	ANSI600 ⁽³⁾
OaP 5		L2**-D2	L2**-D2	L2**-D2	L2**-D2	D2
OaP 10		L2**-D2	L2**-D2	L2**-D2	L2**-D2	D2
OaP 50		L2**-D2	L2**-D2	L2**-D2	L2**-D2	D2
OaP 125		L2--D2	L2-D2	L2-D2	L2-D2	L2-D2
OaP 250		L2-D2	L2-D2	L2-D2	L2-D2	L2-D2
OaP 600		L2-D2-G2	L2-D2-G2	L2-D2-G2	L2-D2-G2	L2-D2-G2
OaP 1200		L2-D2		L2-D2	L2-D2	
OaP 2000	L2**-D2	L2**-D2		L2**-D2	L2-D2	
OaP 3200	L2**-D2	D2		L2**-D2	L2**-D2	
OaP 4000	L2**-D2			L2**-D2	L2**-D2	

*Observe pressure reduction for medium temperatures below -10°C and above 50°C

** in planning

- (1) Flanges drilled to ANSI150 but body to DIN PN25, 40 depending on material
- (2) Flanges drilled to ANSI300 but body to DIN PN25, 40 depending on material
- (3) Flanges drilled to ANSI600 but body to DIN PN100

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7.3 Operating temperature limit

See available materials chapter 6.2

OaP L2	-10°C ... 60°C
OaP mech. display	Standard
OaP AG19/AG20/AG01-08	
OaP AG44	
OaP AG44 Local display Fxxx series Exxx series	

OaP D2	< 90°C	>90°C ... 110°C	>110°C ... 170°C	>110°C ... 290°C
OaP mech. display from -20°C	-20°C		Extension + high-temp. magnetic coupling	
OaP AG19/AG20/AG01-08 -30°C	Standard	Extension		
OaP AG44 from -50°C			Extension+High temp. pulse generator	
OaP AG44 On-site display Fxxx series Exxx series	-40°C +70°C			
	-30°C +70°C			

Special toothed oval wheels as standard for material version D2 from OaP10

OaP D2	< 90°C	>90°C ... 110°C	>110°C ... 170°C	>110°C ...230°C
OaP mech. display from -20°C		Special tolerances	Extension + special tolerances High-temperature magnetic coupling	
OaP AG19/AG20/AG01-08 from -30°C	Standard	Extension+ Special tolerances		
OaP AG44 from -50°C		Special tolerances	Extension+Special tolerances+High temp. pulse generator	
OaP AG44 On-site display Fxxx series Exxx series	-40°C +70°C			
	-30°C +70°C			

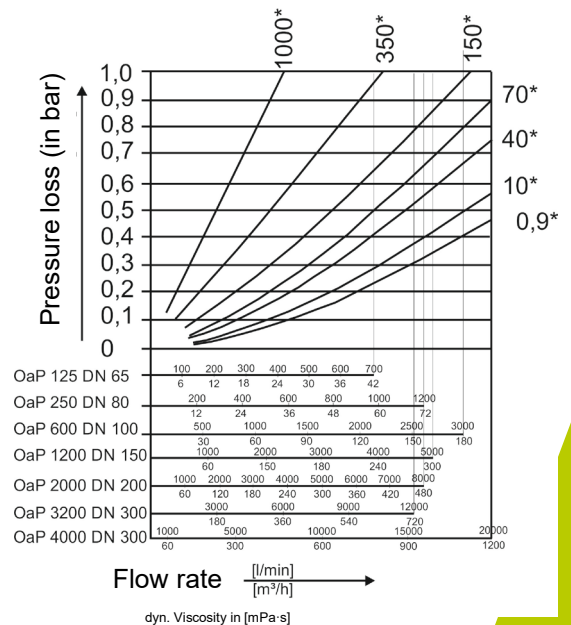
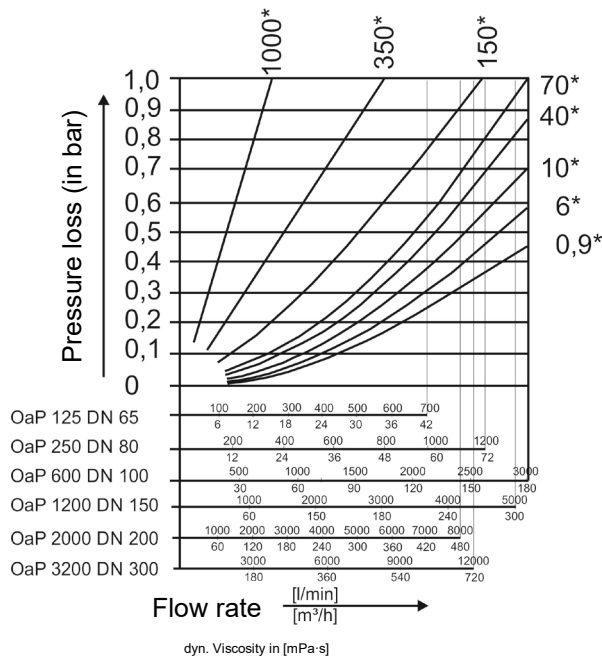
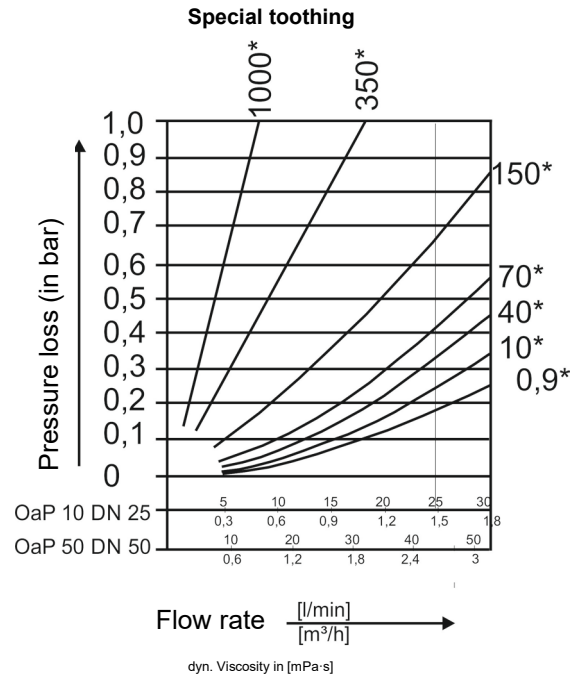
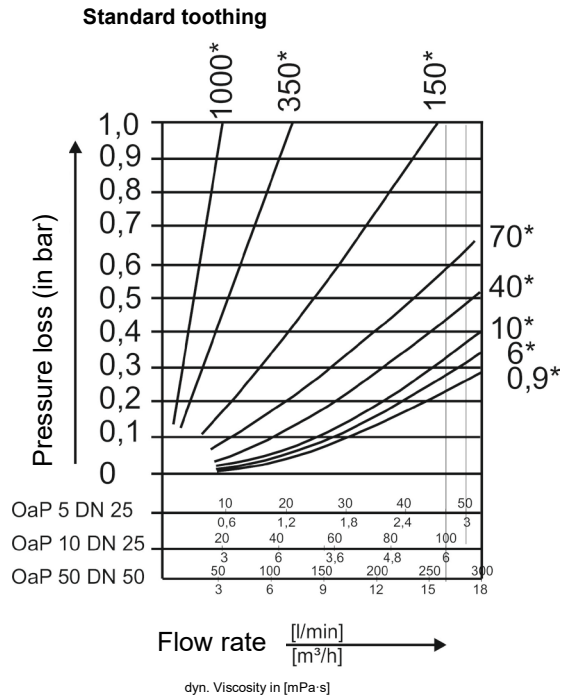
Low-temperature version

- For liquefied gases with special tolerances (versions D2 not suitable for this) max. 20°C.
For OaP with mech. display or AG19/AG20/AG01-08 with 400 mm extension and . Magnetic coupling low temperature down to -60°C (note pressure reduction).
- For OaP AG44 with or without local display with special screws and nuts Low temperature down to -40°C (note pressure reduction).

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7.4 Pressure loss



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8. CERTIFICATE AND APPROVALS

EC Certificate of Conformity,
Bopp & Reuther Messtechnik GmbH

EC TYPE EXAMINATION CERTIFICATE

Directive 2014/34/EU (Ex Directive),

DIN EN ISO80079-36: Non-electrical equipment for use in potentially explosive atmospheres

EN 1127-1: Explosion protection, principles and methodology

EN 60079-0: Electrical apparatus for potentially explosive gas atmospheres areas - General requirements

EN 60079-11: Intrinsic safety "i"

EN 60079-1: Flameproof enclosure "d"

- Pulse pick-up AG19, AG20 (slotted proximity switches types SJ 3.5N)
PTB 99 ATEX 2219 X
- Pulse pick-up AG44 (Wiegand sensor with preamplifier type PV11)
DMT 00 ATEX E 063 X
- Pulse pick-up AG01-08 TÜV 15 ATEX 131621X

Directive 2014/30/EU (EMC Directive)

- EN 61000-6-2: Generic standards - Immunity for industrial areas
- EN 61000-6-3: Generic standards - Emission for residential, commercial and light-industrial environments

Directive 2014/68/EU (Pressure Equipment Directive)

- DIN EN 10213
- AD 2000 regulations
- EC type examination module B + C1

OIML R117 test reports (PTB, NMI)
NMI evaluation certificate TC8253

Other standards taken into account and authorisations

EN 55011: Industrial, scientific and medical radio frequency equipment (ISM equipment) Radio disturbance - Limits and methods of measurement

NAMUR NE 21: Electromagnetic compatibility (EMC) of process and laboratory control technology equipment

EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use - General requirements

EN 60947-5-6: Low-voltage switchgear Control units and switching elements; DC interface for proximity sensors and switching amplifiers (NAMUR)

SIL2: OaP AG19x, OaP AG20x acc. to IEC 61508:1999

Lloyds Register, Rostechnadzor

CE mark:

The measuring system fulfils the legal requirements of EC Directives 2014/30/EU, 2014/34/EU, 2014/68/EU and 2011/65/EU, including the amendments and addenda published to date. Bopp & Reuther Messtechnik GmbH confirms the successful testing of the device by affixing the CE mark.

9. DOCUMENTATION

WEIGHTS AND MEASURES APPROVALS ACCORDING TO NATIONAL AND EUROPEAN DIRECTIVE

Measuring Instrument Directive MID 2014/32/EU

OPERATING INSTRUCTIONS

A-EN-01221-00 Operating manual OaP with pulse pick-up and/or mechanical counters

ACCESSORIES

D-EN-01653-00 Pulse pick-up AG19 and AG20
D-EN-01651-00 Pulse pick-up AG01-08
D-EN-01654-00 Pulse pick-up AG4x
D-EN-01663-00 Single-pointer totalizer E
D-EN-01662-00 Double-pointer totalizer D
D-EN-01665-00 Mechanical counters, M5 series

Edition March 2025
Subject to change without notice