



# OVAL WHEEL METER SERIES OI



## 1. IDENTIFICATION

Manufacturer Bopp & Reuther Messtechnik  
Am Neuen Rheinhafen 4  
67346 Speyer  
Phone : +49 (63) 657-0  
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Product type Direct volumetric meter  
(positive displacement meter)

Product name Oval wheel meter series OI

## 2. RANGE OF APPLICATION

The range of application of all Oval wheel meters of the OI series comprises measuring of volumes and flowrates in the process, custody transfer, dosage, and controlling of liquids. Oval Wheel Meters of the OI series meet all of these requirements. They are used for the measurement of intermediate and final liquid products such as liquified gases, acids, alkaline solutions, fats, alcohol, solvents, dispersions, polymers, polycondensates, paints, colors,

adhesives and other media. Please note the Oval Wheel Meter's capability to measure liquids with very high viscosities with nearly no pressure loss. The high accuracy provided by the oval wheel meters series OI ensure a maximum quality of the products being manufactured. Oval wheel meters of the OI series are manufactured with nominal widths of 25 to 100 mm. Depending on the nominal width they can be used for up to PN 40 with a maximum operating temperature of up to 180 °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 fluid (defined by the space between oval wheel and measuring chamber) through the counter. The number of the rotations is a Measure for the volume.

### 3.2 SYSTEM CONFIGURATION

**Sensor element:** Measuring of the volumetric flow and the volume of liquids is performed by the oval wheel meter.

There is an extensive program for accessories available for the oval wheel meters. This includes mechanical, electrical and electronic instrument transmitters, whose signals can be used for remote metering, flow measurements and control and supply of data processing systems. In addition, we also offer quantity preselection devices for dosing with appropriate valves of the most varied construction and functions.

**Pulse pick-up AG19 / AG20** see D-EN-17202-00 Rev.A  
(attached devices acc. EN507 NAMUR)

**Pulse pick-up AG42, AG43 Wiegand-Principle** see D-EN-17201-00 Rev.A  
(attached devices acc. EN507 NAMUR)

**Single indicator E and double indicator D** see D-EN-17205-00 Rev.A

**Mechanical resettable Roller counter M5** see D-EN-17205-00-Rev.A

M5, with printer M5B, with pre-setting device M5V or M5BV

KS (electrical switch) and KSP (pneumatical switch)

step switches sp2, sp22, se2

**Electronical counter EZ, EZD** see D-EN-1706-00-Rev.A

**Universal Smart Transmitter UST** see D-EN-1707-00-Rev.A

The UST comes by default with a local display, a 4-20mA current output for the flowrate signal and HART-communication (driver acc. FDT available), as well as a pulse output acc. NAMUR for counting (original or scalable).

The oval wheel meter series OI is also available with a heating jacket, type OUI.

## 4. INPUT

### 4.1 MEASURED VALUE

Volume and volumetric flow

# OUR EXPERIENCE COUNTS

## LIQUIDS

### 4.2 MEASURING RANGE

Measuring ranges of oval wheel meters with graphite sleeve bearings for liquids with Newtonian flow elasticity.

OI 5, OI 10, OI 50, OI 100, OI 00, OI 400: 0,3 - 3000 mPa.s (OI 10, OI 50, OI 100, OI 00, OI 400 with special toothing: >150mPa.s)

Type	DN	Flowrate Qmax [l/min]		< 0,3 mPa.s		0,3 - 1,5 mPa.s		1,5 - 150 mPa.s		up to 350 mPa.s		up to 1000 mPa.s		up to 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]
OI 5	25	50	Min	8	0,5	5	0,3	5	0,3	2,5	0,15	1,25	0,075	0,45	0,027
			Max	40	2,4	50	3	50	3	25	1,5	12,5	0,75	4,5	0,27
			Continuous	16	1	33	2	33	2	25	1,5	12,5	0,75	4,5	0,27
OI 10	25	100	Min	16	1	10	0,6	10	0,6	7	0,42	3,5	0,20	1,2	0,072
			Max	80	5	100	6	100	6	70	4,2	35	2	12	0,72
			Continuous	33	2	66	4	80	4,8	70	4,2	35	2	12	0,72
OI 50	50	300	Min	50	3	30	1,8	30	1,8	18	1,08	9,5	0,54	3	0,18
			Max	250	15	300	18	300	18	180	10,8	90	5,4	30	1,8
			Continuous	100	6	200	12	200	14,4	180	10,8	90	5,4	30	1,8
OI 100	50	660	Min	110	6,6	66	3,9	66	3,9	48	2,9	24	1,45	10	0,6
			Max	550	33	660	39,6	660	39,6	480	29	240	14,5	100	6
			Continuous	230	13,2	440	26,4	530	31,8	480	29	240	14,5	100	6
OI 200	80	700	Min	110	6,6	70	4,2	70	4,2	50	3	25	1,5	12	0,72
			Max	560	34	700	42	700	42	500	30	250	15	120	7,2
			Continuous	230	14	420	25,2	525	31,5	500	30	250	15	120	7,2
OI 400	100	100	Min	200	12	120	7,2	120	7,2	100	6	60	3,6	30	1,8
			Max	1000	60	1200	7,2	1200	7,2	1000	60	600	36	300	18
			Continuous	400	24	960	57,6	1100	66	1000	60	600	36	300	18

#### Measuring range for water

Measuring for cold water:

Use in column 0,3 – 1,5 mPa.s for continuous operation 50% and for max. operation 70% of line 2 (max.).

Measuring range for hot water:

Use in column <0,3 mPa.s only min. up to continuous

Measuring range for sulfuric acid: upon request

### Measuring ranges of oval wheel meters with ball bearings for liquids with low or high viscosity and Newtonian flow elasticity

Meter with ball bearings (instead of graphite sleeve bearings), special toothing (OI 5 standard toothing)

Type	DN	Flowrate Qmax [l/min]		1,5 - 0 mPa.s		up to 350 mPa.s		up to 1000 mPa.s		up to 5000 mPa.s		up to 10000 mPa.s		up to 20000 mPa.s		up to 60000 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]	[l/min]	[m³/h]
OI 5	25	50	Min	15	0,9	5	0,3	2,5	0,15	1,2	0,072	0,6	0,036	0,3	0,018	0,1	0,006
			Max	50	3	50	3	25	1,5	12	0,72	6	0,36	3	0,18	1	0,06
OI 10	25	100	Min	30	1,8	10	0,6	8	0,5	4	0,24	2	0,12	1	0,06	0,3	0,018
			Max	100	6	100	6	80	5	40	2,4	20	1,2	10	0,6	3	0,18
OI 50	50	300	Min	60	3,6	30	1,8	15	0,9	7,5	0,45	4	0,24	2	0,12	1	0,06
			Max	300	18	300	18	200	12	150	9	80	5	40	2,5	12	0,72
OI 200	80	700	Min	140	8,4	70	4,2	30	1,8	15	0,9	10	0,6	4	0,25	3	0,18
			Max	700	42	700	42	700	42	350	20	180	11	80	5	25	1,5
OI 400	100	100	Min	240	14,5	120	7,2	60	3,6	35	2	17	1	10	0,6	4	0,24
			Max	1200	72	1200	72	1200	72	700	42	350	21	180	11	50	3

For liquids with Newtonian elasticity up to 100.000 mPas:

OI 50: 0,6 to 6 l/min.

OI 200: 1 to 12 l/min

OI 400: 2 to 25 l/min



## Measuring ranges of oval wheel meters with ball bearings for shear thinning liquids with non Newtonian elasticit (for example dispersions)

Type	DN	Flowrate Qmax [l/min]		1,5 - 0 mPa.s		up to 300 mPa.s		up to 3000 mPa.s		up to 6000 mPa.s		up to 100000 mPa.s	
				[l/min]	[m³/h]	[l/min]	[m³/h]	[l/min]	[m³/h]	[l/min]	[m³/h]	[l/min]	[m³/h]
OI 5	25	50	Min	15	0,9	5	0,3	3,5	0,21	2,5	0,15	1,5	0,09
			Max	50	3	50	3	35	2,1	25	1,5	15	0,9
OI 10	25	100	Min	30	1,8	10	0,6	7,5	0,45	5	0,3	3	0,18
			Max	100	6	100	6	75	4,5	50	3	30	1,8
OI 50	50	300	Min	60	3,6	30	1,8	12	0,72	7,5	0,45	4,5	0,27
			Max	300	18	300	18	240	14,5	150	9	90	5,4
OI 200	80	700	Min	140	8,4	70	4,2	25	1,5	15	0,9	10	0,6
			Max	700	42	700	42	500	30	300	18	200	12
OI 400	100	100	Min	240	14,5	120	7,2	45	2,7	30	1,8	18	1,1
			Max	1200	72	1200	72	900	54	600	36	360	22

## 5. CHARACTERISTIC PARAMETER

### 5.1 REFERENCE CONDITIONS

The calibration facilities of Bopp & Reuther Messtechnik are accepted by PTB and are traceable to international laboratory standards.

Pressure: up to 7 bar, temperature: 0 to 30°C

### 5.2 ACCURACY

± 0,1% up to ± 0,3% of measured value

### 5.3 REPEATABILITY

< 0,1%

## 6. CONSTRUCTIONS DETAILS

### 6.1 DESIGN / DIMENSIONS / WEIGHTS

Type	OI 5		OI 10		OI 50		OI 100		OI 200		OI 400	
	DN 25		DN 25		DN 50		DN 50		DN 80		DN 100	
Nominal width	D		D		D		D		D		D	
D (mm)	135		150		245		290		365		445	
Length L (mm)	DIN		220		220		300		370		550	
	ANSI150		220		220		330		370		550	
	ANSI300		220		220		330		390		560	

For oval wheel meters series OI only with pulse pick-up AG19, AG20 or AG42, AG43 the following dimensions apply:

Type	OI 5		OI 10		OI 50		OI 100		OI 200		OI 400		
Nominal width		DN 25		DN 25		DN 50		DN 50		DN 80		DN 100	
Dimensions (mm)	h	52		65-72*		104		146		145		183	
	H <sub>with pulse pick-up AG19, Ag20</sub>	214		217		235		282		299		335	
	H <sub>with pulse pick-up AG42</sub>	180		183		-		-		-		-	
	H <sub>with pulse pick-up AG43</sub>	-		-		201		248		265		301	
Weight ca. (kg)		12		15		34		65		74		119	

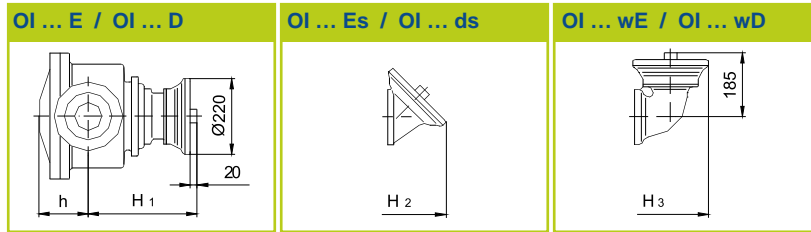
If a temperature extension is used, increase the dimension H about 300 mm, as well as the weight about ca. 2 kg.

\*depends on type of material

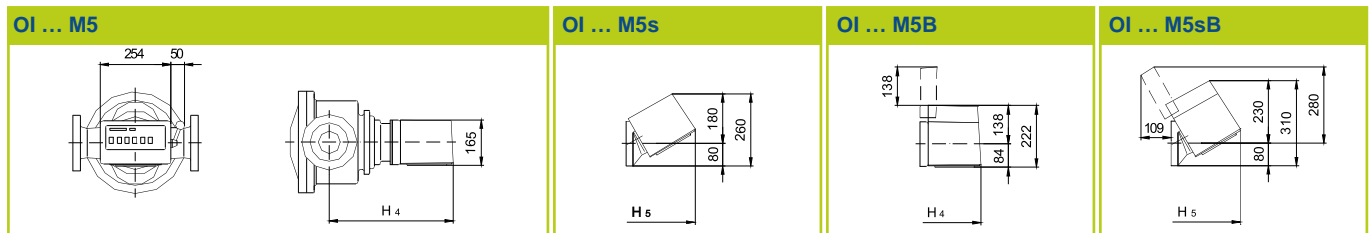
# OUR EXPERIENCE COUNTS

## LIQUIDS

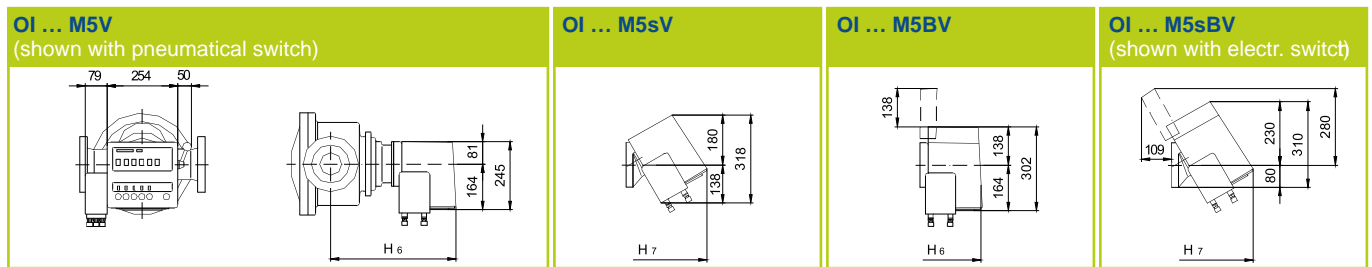
**OI 5 – OI 400 with mechanical indicator E, D or Roller counter M5 and optional pulse pick-ups AG19, AG20**  
Version with single indicator E and double indicator D



Version with roller counter M5 und M5B (roller counter M5 combined with printer B)



Version with roller counter M5V und M5BV (roller counter M5 combined with printer B and preset counter V)



Type		OI 5	OI 10	OI 50	OI 100	OI 200	OI 400	
Nominal width		DN 25	DN 25	DN 50	DN 50	DN 80	DN 100	
Dimensions (mm)	h	52	71	106	147	144	183	For meter with external regulation, pulse pick-up AG19 / Ag20 or extension the dimensions H1 to H7 increase by about:  <b>External regulation</b> + 42 mm  <b>Pulse pick-up AG19</b> + 115 mm  <b>Pulse pick-up AG20</b> + 115 mm  <b>Extension</b> + 300 mm
	H1	229	231	249	296	313	349	
	H	312	314	332	379	396	432	
	H3	357	359	377	424	441	477	
	H4	362	364	382	429	446	482	
	H5	392	394	412	459	476	512	
	H6	367	369	387	434	451	487	
Weight ca. (kg)	E,D	13	16	35	66	75	120	If a temperature extension is used, increase the dimension H about 300 mm, as well as the weight about ca. 2 kg
	M5	17	22	36	72	81	126	
	M5B	20	25	39	75	84	129	
	M5V	24	29	43	79	88	133	
	M5BV	27	32	46	82	91	136	

**OI 5 – OI 400 with EZ, EZD**

Type		OI 5	OI 10	OI 50	OI 100	OI 200	OI 400
Nominal width		DN 25	DN 25	DN 50	DN 50	DN 80	DN 100
Dimensions (mm)	h	52	71	106	147	144	183
	H	199	202	220	267	284	320
Weight ca. (kg)		13	16	35	66	75	120



## OI 5 – OI 400 with UST

	Type	<b>OI 5</b>	<b>OI 10</b>	<b>OI 50</b>	<b>OI 100</b>	<b>OI 200</b>	<b>OI 400</b>	
	Nominal width	DN 25	DN 25	DN 50	DN 50	DN 80	DN 100	
	Dimensions (mm)	h	52	71	106	147	144	183
		H USTI/USTX	337	339	357	404	421	457
		H USTD	325	327	345	392	409	445
Weight ca. (kg)	13	16	35	66	75	120		

## 6.2 MATERIAL

	<b>A4</b>	<b>G1</b>	<b>G2</b>	<b>F5</b>	<b>F57</b>
<b>Housing</b>	Brass	Cast iron	Cast steel	Stainless steel	Stainless steel
<b>Oval wheels</b>	Brass	Cast iron	Cast iron	Stainless steel	Stainless steel
<b>Cover of measuring chamberl</b>	Brass (*) + Hard carbon ring	Grauguss (*) + Hard carbon ring	Grauguss (*) + Hard carbon ring	Hard carbon	Stainless steel
<b>Sleeve</b>	---	---	Hard carbon	Hard carbon	---
<b>Bearing</b>	Hard carbon	Hard carbon	Hard carbon	Hard carbon	Ball bearing

(\*) Measuring chamber coverl of carbon for meters < DN50

**F528** same as **F5** however with encapsulated magnet resp. magnet carrier in the wet side and acid-resistant carbon bearings.

Available material groups

	Mech. counters with/witout AG19/AG20	AG42/AG43 with/witout UST or EZD	<b>A4</b>	<b>G1</b>	<b>G2</b>	<b>F5</b>	<b>F57</b>	<b>F528</b>
<b>OI5</b>	•	•	•	•	•	•	•	•
<b>OI10</b>	•	•	•	•	•	•	•	•
<b>OI50</b>	•	•	•	•	•	•	•	•
<b>OI100</b>	•	•	•	•	•	•	•	•
<b>OI200</b>	•	•	•	•	•	•	•	•
<b>OI400</b>	•	•	•	•	•	•	•	•

## 7. OPERATING CONDITIONS

### 7.1 DEGREE OF PROTECTION

	Ambient temperature	Housing	EX-protection
<b>OI:</b>			
<b>AG19, AG20:</b>	-5 up to +90°C	IP54	Mech. EX-protection, see cert. of conformity
<b>AG42, AG43:</b>	-50 up to +60/+75/+85°C	IP65	II 2G EEx ia IIC T6
<b>Indicator E, D:</b>	-20 up to +110°C	IP54	II 2G EEx ib IIC T6/5/4
<b>M5:</b>	-20 up to +60°C	IP54	
<b>M5 accessories:</b>			see D-DE-1705-00 Rev. A
<b>EZD:</b>	-20 up to +70°C	IP65	II 2G EEx ib IIC T4
<b>USTI:</b>	-20 up to +70°C	IP65	II 1/2G EEx ia IIC T4
<b>USTX:</b>	-40 up to +60°C	IP65	II 2G EEx d [ib] IIC T4
<b>USTD:</b>	-40 up to +70°C	IP65	II 2G EEx d [ia] IIC/IIB T6

Degree of protection (housing) IP acc. IEC 529 / EN 60529, EX-approval directive 94/9/EC

Attention: The LC-displays of the electrical counters (UST, EZ, EZD) are working from -10°C up to +70°C

# OUR EXPERIENCE COUNTS

## LIQUIDS

### 7.2 PROCESS PRESSURE / PROCESS CONNECTION

Available materials see chapter 6.2

Nominal pressure*	PN10 DIN2532	PN16 DIN2533	PN25 DIN 2534 / DN2544	PN40 DIN2545	ANSI150 <sup>(1)</sup>	ANSI300 <sup>0</sup>
<b>OI5 / OI10</b>			A4 - G1	G2 - F5 - F57 - F528	all	all instead of G1, A4
<b>OI50</b>	A4	G1		G2 - F5 - F57 - F528	all	all instead of G1, A4
<b>OI100</b>				G - F5 - F528	all	all
<b>OI200</b>	G1		G2 - F5 - F57 - F528		all	all instead of G1
<b>OI400</b>	G1		G2 - F5 - F57 - F528		all	all instead of G1

\* at temperatures over 120°C / lower -10°C pay attention to pressure reduction!

<sup>(1)</sup> Flange drilled acc. ANSI150, (housing acc. DIN PN10, 16, 25, 40 depends on the material)

<sup>(2)</sup> Flange drilled acc. ANSI300, (housing acc. DIN PN25, 40 depends on the material)

### 7.3 OPERATING TEMPERATURE LIMIT

Available materials see chapter 6.2

<b>OI5 / OI10</b>	-10 up to 60°C	>60 up to 90°C	>90 up to 110°C	>110 up to 170°C	>110 up to 180°C
<b>OI5 / OI10 mech. indicator</b>				Extension and special tolerances	
<b>OI5 / OI10 AG19</b>	Standard		Extension		
<b>OI5 / OI10 AG42</b>				Special tolerances	
<b>OI5 / OI10 AG42 EZD</b>		Extension			
<b>OI5 / OI10 AG42 UST</b>				Special tolerances	

OI5/OI10 F57 Standard max. 60°C / with special tolerances max. 110°C, accept that with AG19/20 max. 90°C. With special tolerances and extension max. 180°C

<b>OI50 / OI100 / OI200 / OI400</b>	-10 up to 60°C	>60 up to 90°C	>90 up to 110°C	>110 up to 170°C	>110 up to 180°C
<b>OI mech. indicator</b>		Special tolerances			
<b>OI AG19</b>			Extension and special tolerances		
<b>OI AG43</b>	Standard		Special tolerances		
<b>OI AG43 EZD</b>					
<b>OI AG43 UST</b>			Special tolerances		

For liquified gases with special tolerances (version G1, F528, F57 not suitable) max. 20°C.

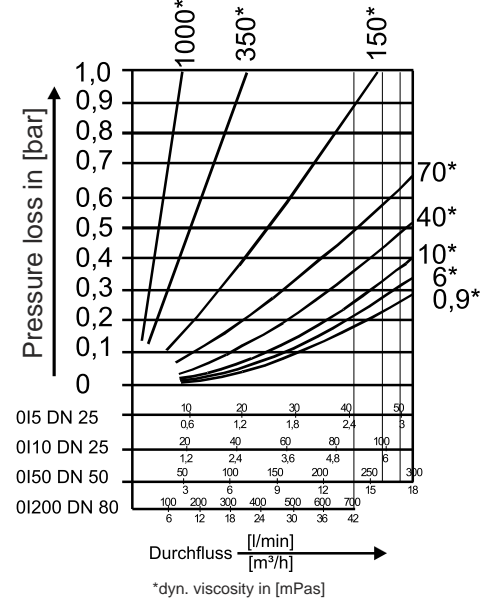
OI with mech. indicator or AG19/AG20 with extension 400 mm and 2. magnetic coupling available up to -60°C (pay attention to pressure reduction).

OI AG42/AG43 with or without UST/EZD with special tolerances and nuts of A4-70 up to -40°C (pay attention to pressure reduction).

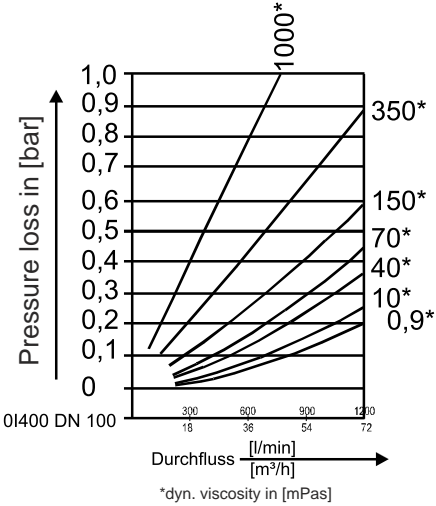
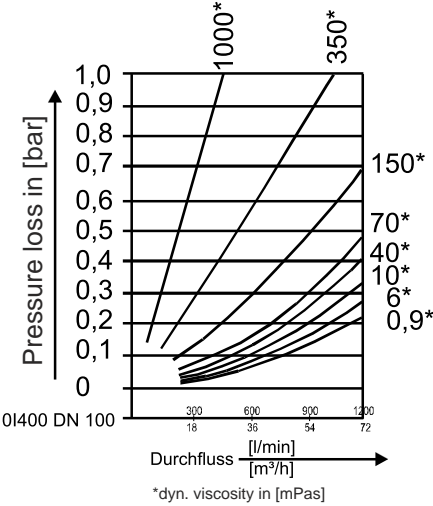
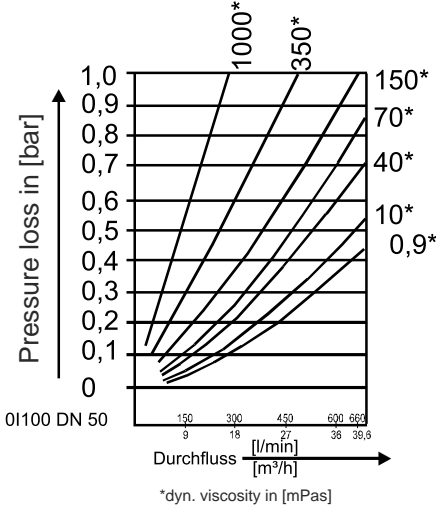
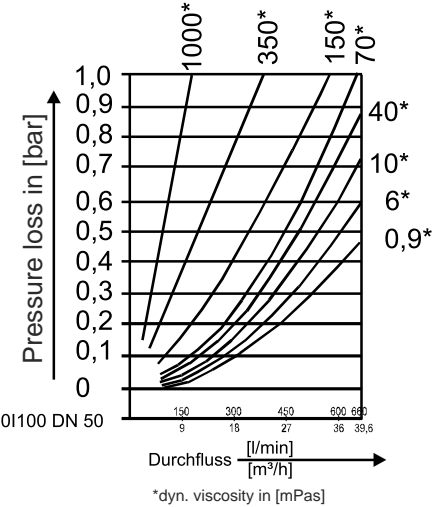
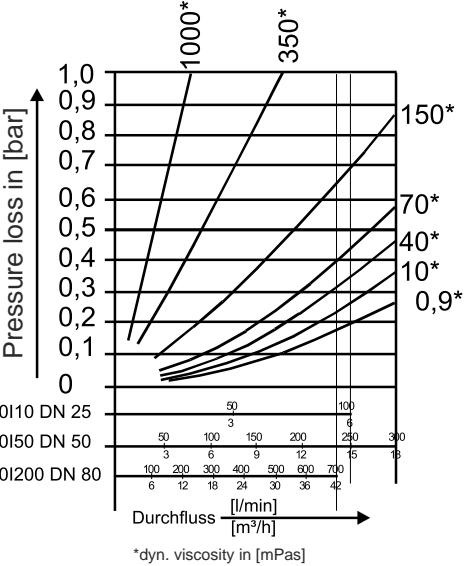


7.4. PRESSURE LOSS

Standard toothed oval wheels



Special toothed oval wheels



Pressure loss for oval wheels with ball bearings (liquids with Newtonian elasticity or shear thinning liquids with non Newtonian elasticity): upon request



## 8. CERTIFICATES AND APPROVALS

### EC-type approvals

EC-certificate of conformity CE-OI (Bopp & Reuther Messtechnik)

#### Directive 94/9/EC (Ex-protection)

- EN 13463-1: Non-electrical equipment for use in potentially explosive atmospheres
- EN 1127-1: Ex-protection, basic concepts and methodology
- EN 60079-0: Explosive atmospheres. Equipment. General requirements
- EN 60079-11: Intrinsically safety „i“
- EN 60079-1: Flameproof enclosures „d“
- EN 60079-1: Increased safety „e“

- Universal Smart Transmitter Typ UST EExia DMT 99 ATEX E 014 X
- Universal Smart Transmitter Typ UST EExd [ia] DMT 00 ATEX E 05 X
- Universal Smart Transmitter Typ UST EExd [ib] BVS 04 ATEX E 0 X
- Electronical counter EZ/EZD DMT 01 ATEX E 07 X
- Pulse pick-up AG19, AG20 (proximity switch type SJ 3,5N) PTB 99 ATEX 19 X
- Pulse pick-up AG42, AG43 (Wiegand Sensor with preamplifier Typ PV11) DMT 00 ATEX E 063 X

#### Directive 2004/108/EC (EMC - Electromagnetic Compatibility)

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

#### Directive 97/23/EC (PED - Pressure Equipment Directive)

- DIN EN 10213
- AD-Pamphlets
- EC-type approvals modul B + C1

### Type-approval certificate under german law Measuring Equipment Directive - MID

EWC-approval, Measuring Instrument Directive MID 2004/22/EC  
OIML audit report

### Other approvals and certificates

**EN 55011:** Industrial, scientific and medical (ISM) radio-frequency Equipment. Electromagnetic disturbance characteristics. Limits and methods of measurement

**NAMUR NE 21:** Electromagnetic Compatibility (EMC) of Industrial Process and Laboratory Control Equipment

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

**EN 60947-5-6:** Specification for low-voltage switchgear and controlgear. Control circuit devices and switching elements. DC interface for proximity sensors and switching amplifiers (NAMUR).

**Lloyds Register, Silicone-free, GOST- approvals (GOST R Ex-approval, GOST R Pattern approval), Gortechnadzor**

## 9. DOCUMENTATION

### MANUALS

- A-EN-01211-00 Rev. A manual OI with pulse pick-up and/or mechanical counters
- A-EN-01212-00 Rev. A manual OI with Universal Smart Transmitter UST
- A-EN-01213-00 Rev. A manual OI with electronical counter EZ/EZD

### ACCESSORIES

- D-EN-17202-00 Rev. A pulse pick-up AG19 and AG20
- D-EN-17201-00 Rev. A pulse pick-up AG4x
- D-EN-17205-00 Rev. A single indicator E and double indicator D
- D-EN-17205-00 Rev. A mechanical resettable roller counter, series M5
- D-EN-1707-00 Rev. A Universal Smart Transmitter UST

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