CONTOIL® VZFA/VZOA 4...50, versions for higher requirements / applications

For applications requiring an increased accuracy of ±0.5 % or better, such as:
- Measurement of EL heating fuel or diesel in testing facilities
- Differential measurement
- Custody transfer, where counters have statutory metrological requirements or calibration

Versions for differential measurements

For differential measurements, the flow is measured in the supply and return pipes. The difference between the two measurements is regarded as the consumption.

To obtain optimal measurement results, VZFA or VZOA CONTOIL® fuel oil meters calibrated in pairs should only be used, which are adapted precisely to the plant/system operating conditions. The flow rate occurring in each meter, the permissible pressure drop and the viscosity of the fluid must all be considered during the design phase. The load on the meter is obtained as follows: flow in supply section less consumption = flow in return section.

When the order is placed, the following information is required:

• application	e.g. differential measurement for industrial furnaces
• fuel type	e.g. diesel fuel
• temperature	e.g. 15...40° C
• operating pressure	e.g. 4 bar
• flow rate in supply section	e.g. fixed pumping rate 200 l/h
• flow rate in return section	e.g. 120...190 l/h (for a consumption of 10...80 l/h)

The meters are marked “supply” and “return” during calibration and final testing in the factory. They must then be installed in the correct pipes.

For further information on the subject of differential measurement, see the sections “How to obtain an optimal measurement” and "Application examples".

Versions with type approval or calibration

These flow meters bear the test number for the metrological type test certificate in accordance with directive 2004/22/EC and the metrological CE mark and are therefore suitable for custody transfer. For custody transfer, the meters can only be used for direct consumption measurement and have to be installed between fixed pipes.
The measurement result can be transferred to external meters by means of pulse transmitters or pulse outputs. The transferred measurement result is not in line with the directive 2004/22/ and cannot be used as a legally displayed result. Only the local display of the flow meter is valid for custody transfer.

Area of use

The CONTOIL® flow meter with MID approval is used almost exclusively where the measured liquid (heating oil, diesel) then goes directly to the consumer (heating system burner).
Other applications than the described above, must be checked and approved by the local authorities.
In accordance and compliance with the applicable norms for custody transfer, CONTOIL® flow meters with MID approval can be used.

Technical data [1]

- Versions for optimal results from differential measurement or for fiscal or commercial transactions
- VZFA with electronic display of total volume, resettable volume and flow rate; units of measurement: litres, US gallons [2]) or m^3.
- VZOA with display of total volume on roller counter; units of measurement: litres. Optional versions with counter in US gallons.
- VZOA option: with RV reed or IN inductive pulser
- threaded or flanged connections available
- mounting in horizontal or vertical positions possible (for calibrated meters horizontally only).
- VZFA: User-friendly, interactive parameter input. Easy integration into control systems.

Further Versions available on request:
- different flange drillings, such as ANSI, JIS

Type			**VZFA/VZOA**				
Nominal diameter	**DN**	**mm**	**15**	**20**	**25**	**40**	**50**
		inch	1/2	3/4	1	1 1/2	2
Installation length		mm	165	165	190	300	350
Nominal pressure with threaded ends	PN	bar	16				
with flanges	PN	bar	25				
Maximum temperature	T_{max}	° C	130, 180				
Maximum flow rate	Q_{max} [3]	l/h	600	1 500	3 000	9 000	30 000
Nominal flow rate	**Q_{cont} [3]**	**l/h**	**400**	**1 000**	**2 000**	**6 000**	**20 000**
Minimal flow rate	Q_{min}	l/h	10 [4]	30	75	225	750
Approx. starting flow rate		l/h	4	12	30	90	300
Max. permissible error			<0.5 % of actual value				
Repeatability			±0.1 %				
Safety filter mesh size		mm	0.400	0.400	0.400	0.800	0.800
Dirt filter mesh size		**mm**	**0.100**	**0.100**	**0.250**	**0.250**	**0.250**
Volume of the measuring chamber		approx. cm^3	12	36	100	330	1200
Housing finish			enamelled red RAL 3013				
Weight with threaded ends [5]		approx. kg	2.2	2.5	4.2	17.3	–
with flanges PN 25		approx. kg	3.8	4.5	7.5	20.3	41.0
VZFA							
Smallest readable amount:							
Total volume		l, m^3	No decimals				
Resettable volume		l, m^3	1 decimal place				
Digital flow rate display		l/h	1 decimal place				
Registration capacity		l, m^3	8 digits				
Registration time at Q_{cont} until overrunning to zero		h	128 000	100 000	50 000	16 667	5 000
Outputs [6]							
Pulse value for totalisor	V/Imp		pulse value and width parameterisable				
Current 4..20 mA for flow rate	I_4 / Q_1, I_{20} / Q_2		flow rates to 4 and 20 mA parameterisable				
Frequency for flow rate	f_1 / Q_1, f_2 / Q_2		frequency and flowrate parameterisable				
Limiting value switch	Q_{min}, Q_{max}		minimum, maximum and hysteresis parameterisable				
VZOA							
Smallest readable amount		l	0.01	0.1	0.1	0.1	1
Registration capacity		m^3	1 000	10 000	10 000	10 000	100 000
Registration time at Q_{cont} until overrunning to zero		h	2 500	10 000	5 000	1 667	5 000
Pulse values of pulsers:							
IN inductive according to IEC 60947-5-6		l/pulse	0.01	0.01	0.1	0.1	1
RV Reed		l/pulse	0.1	1	1	1	10
RV Reed		l/pulse	1	–	–	10	100

1) Manufacturer's specification, valid for the reference conditions as specified under Meter data.
2) 1 US gallon corresponds to 3.785 litres
3) For burners and engines or motors, the meter must be selected on the basis of the permanent flow rate. For higher viscosities, or if the meter is installed on the suction side, the pressure drop and any reduction in the measuring range must also be taken into consideration.
4) Min. flow rate VZO 15 with IN-pulser: 15 l/h
5) Weight without couplings.
6) Two freely selectable outputs are available, totally independent of each other.

Technical data for VZOA with directive 2004/22/CE (MID)

Type			VZOA 15	VZOA 20	VZOA 25	VZOA 40	VZOA 50
Temperature max.	T_{max}	° C	130	130	130	130	130
Maximum flow rate	Q_{max} 1)	l/h	400	1000	2000	6000	20000
Nominal flow rate	**Q_{cont} 1)**	**l/h**	**400**	**1000**	**2000**	**6000**	**20000**
Minimal flow rate	Q_{min}	l/h	40	100	200	600	2000
Accuracy class			0.5	0.5	0.5	0.5	0.5
Max. permissible error	±% of actual value		0.3	0.3	0.3	0.3	0.3

Technical data for VZFA with directive 2004/22/CE (MID)

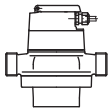
Type			VZFA 15	VZFA 20	VZFA 25	VZFA 40	VZFA 50
Temperature max.	T_{max}	° C	130	130	130	130	130
Maximum flow rate	Q_{max} 1)	l/h	400	1000	2000	6000	20000
Nominal flow rate	**Q_{cont} 1)**	**l/h**	**400**	**1000**	**2000**	**6000**	**20000**
Minimal flow rate	Q_{min}	l/h	40	100	200	600	2000
Accuracy class			0.5	0.5	0.5	0.5	0.5
Max. permissible error	±% of actual value		0.3	0.3	0.3	0.3	0.3

Two items are required when ordering: the VZOA or VZFA plus CE-Conformity declaration, Order No. 96113.
the VZOA or VZFA plus legal verification, Order No. 96026.

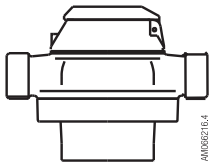
1) The meter must be selected on the basis of the permanent flow rate. For higher viscosities, or if the meter is installed on the suction side, the pressure drop and any reduction in the measuring range must also be taken into consideration.

Electronic display and Outputs VZFA: see page 6
RV Pulsers and IN Pulsers: see page 14
Pressure drop curves: see Meter data

Dimensions VZFA

Type	mm	VZFA 15	VZFA 20	VZFA 25	VZFA 40	VZFA 50
	Length	165	165	190	300	350
	Width	105	105	130	210	280
	Height	155	164	191	243	299

Dimensions VZOA

Type	mm	VZOA 15	VZOA 20	VZOA 25	VZOA 40	VZOA 50
	Length	165	165	190	300	350
	Width	105	105	130	210	280
	Typ ... 130 °C					
	Height	106	115	142	235	291
	Height -RV	130	139	166	259	315
	Height -IN	185	194	221	273	329
	Typ ... 180 °C					
	Height	147	156	183	235	291
	Height -RV	171	180	207	259	315
	Height -IN	225	234	261	313	369

Detailed dimensional diagrams in Meter data

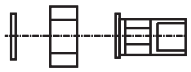
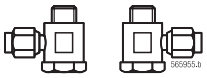
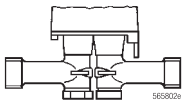
Type designation key

VZOA 25 FL 130/25-IN 0.1

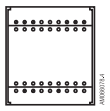
- Pulser IN or RV and pulse value
- Nominal pressure (bar)
- Temperature (°C)
- Connection (RC = Threaded ends, FL = Flanges)
- Nominal diameter (mm)
- Meter type

Accessories

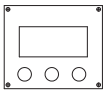
Ordering details for accessories

	Type	Description	Order No.
Threaded connections 	VSR 1/2"	for DN 15	81160
	VSR 3/4" 3 1/2"	for DN 20	81163
	VSR 3/4"	for DN 20	81166
	VSR 1"	for DN 25	81169
	VSR 1 1/2"	for DN 40	81181
Threaded connections kit 	PS-Kit VZO 4	1/8" – 8	81583
Mounting kit 	PS-Kit VZO 8	Mounting Kit	81130
	VSR 3/8"	Threaded connections to suit PS-Kit VZO 8	81156

Order details for supplementary equipment

	Type	Description	Order No.
Isolated switch amplifier 	Ex version	with relay output, max. 10 Hz	81705
	Ex version	with electronic output, max. 5 kHz	80013

Order details for supplementary equipment with mounting kits

	Type	Description	Order No.
Transducers 	Flow calculator	freely programmable, with analogue output 4...20 mA, indication of flow rate, limiting values	92439
	Differential flow calculator	freely programmable, with analogue output 4...20 mA, indication of flow rate, limiting values. Both inputs can be read out individually.	92440
	Frequency current converter	freely programmable.	92439
Mounting kit	Kit	for wall mounting or on DIN-35 mm rail	on request

Meter data

Function

CONTOIL® flow meters work on the volumetric principle of rotary piston meters (positive displacement meters).
The main features of this measuring principle are large measuring ranges, high accuracy, suitability for high viscosities and independence from power supply; flow disturbances do not influence proper operation.

Construction

Rotary piston, guide roller and drive are the only moving parts in contact with the liquid. Their movement is transmitted by a magnetic coupling through a sealing plate. The hydraulic part is completely separated from the totalising module.

VZF/VZFA 15 ... 50
Connections are made radially with two cable entries underneath the display unit which can be mounted and rotated through 90° steps.

VZO/VZOA 15 … 50
With the exception of the counter with the RV Reed pulser, the roller counter can be rotated through 360° for optimum readability.

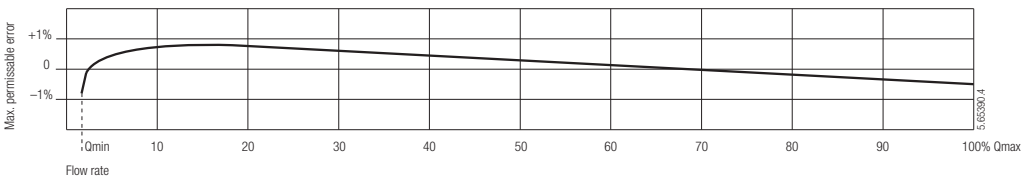
VZO/VZOA 4 and 8
The connections for the inlet and outlet are situated vertically from below in the base plate. With the OEM meter version the connections are situated on the side.

Measuring error limits: Reference conditions

Measuring error limits according to technical data of meter in % of actual value for the whole measuring range.

Reference conditions

Liquid: Calibration oil similar to extra light heating oil, density at 20 °C = 814 kg/m^3
Viscosity = 5.0 mm^2/s according to DIN 51757 / ISO 3104 (corresponds to 4.1 mPa.s)
Temperature: 18...25 °C
Horizontal mounting, readings from counter.
CONTOIL® Oil meters are never to be tested with water, otherwise they will get damaged.



Pressure drop curves

Viscosity information

Kinematic viscosity	Stokes, Centi-Stokes, mm^2/s	St, cSt, mm^2/s
Dynamic viscosity	Pascal seconds, millipascal seconds	Pas, mPa.s
	Poise, Centipoise (outmoded)	P, cP

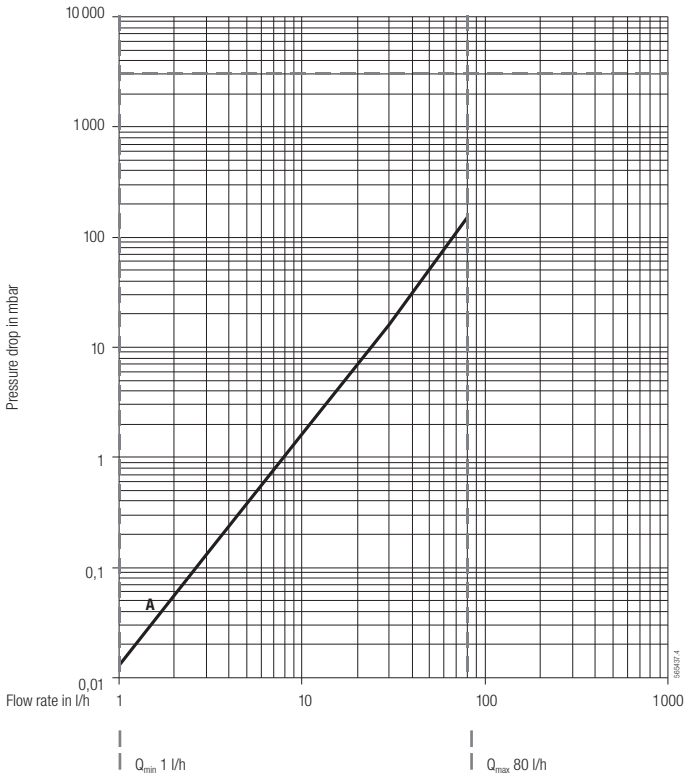
Conversion

cSt 3 density = mPa.s
Engler degrees °E to mPa.s: only use conversion table
Saybolt units to mPa.s: only use conversion table
Redwood units to mPa.s: only use conversion table

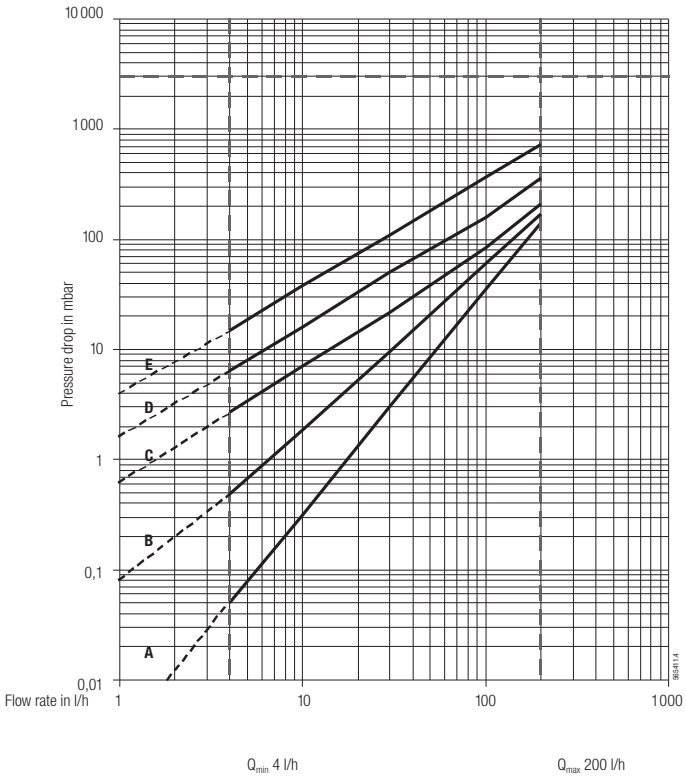
Rule of thumb

1 cSt 1 mm^2/s 1 mPa.s

DN 4



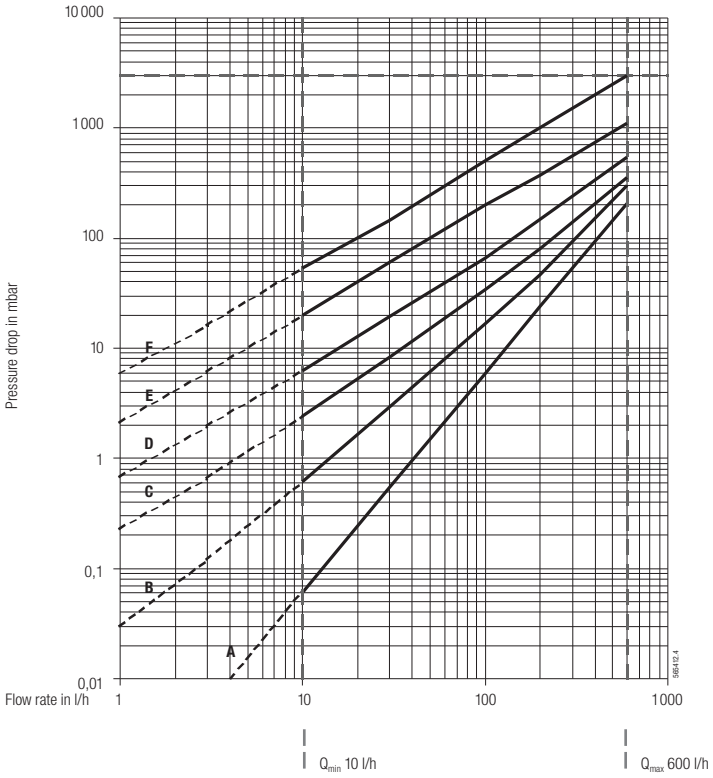
DN 8



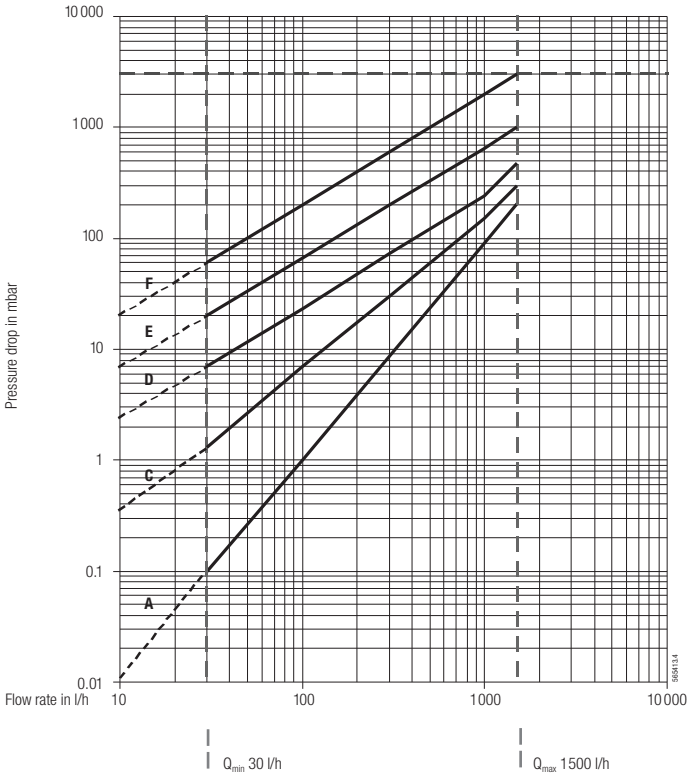
Viscosity diagrams: A = 5 mPa.s B = 50 mPa.s C = 100 mPa.s D = 200 mPa.s E = 500 mPa.s

For a pressure drop of more than 1 bar, it is recommended to use the next larger meter size.
Maximum permissible pressure drop = 3 bar

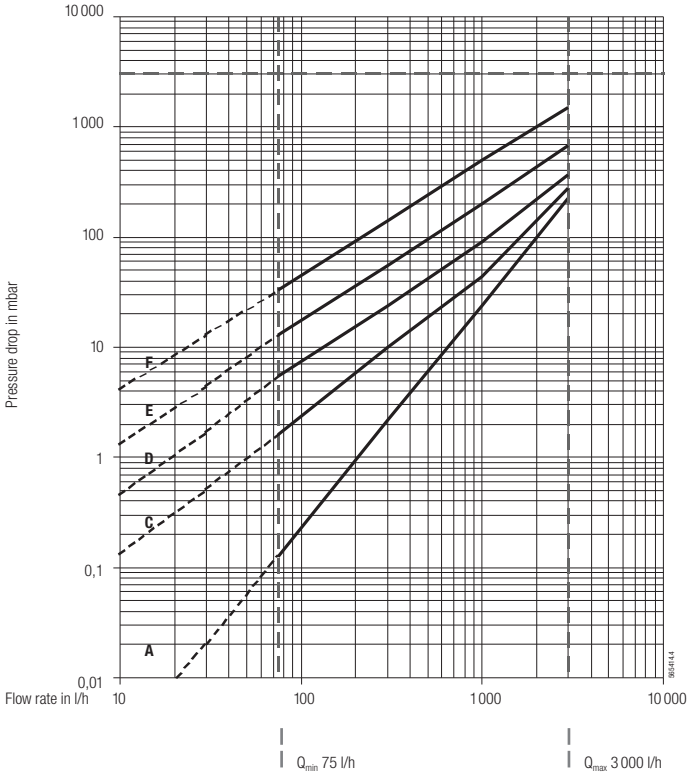
DN 15



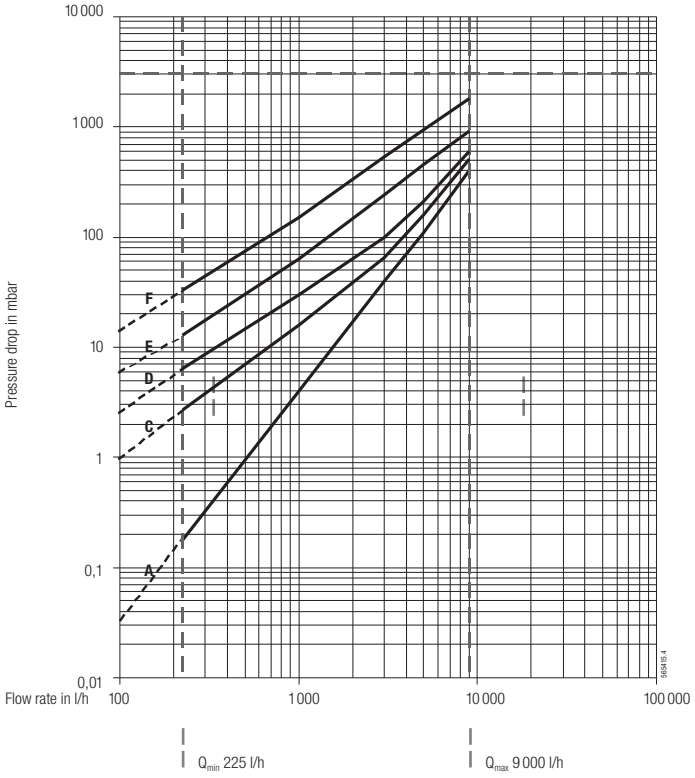
DN 20



DN 25



DN 40

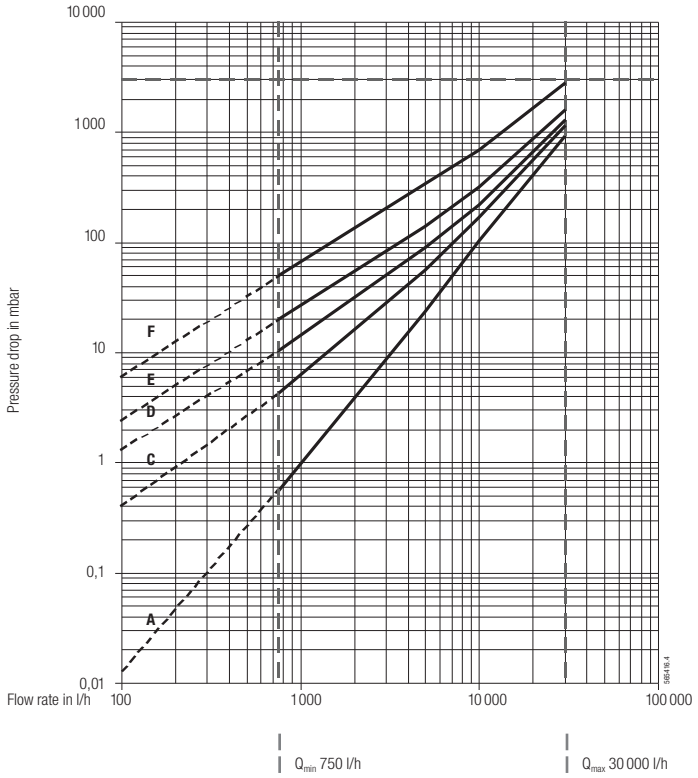


Viscosity diagrams:

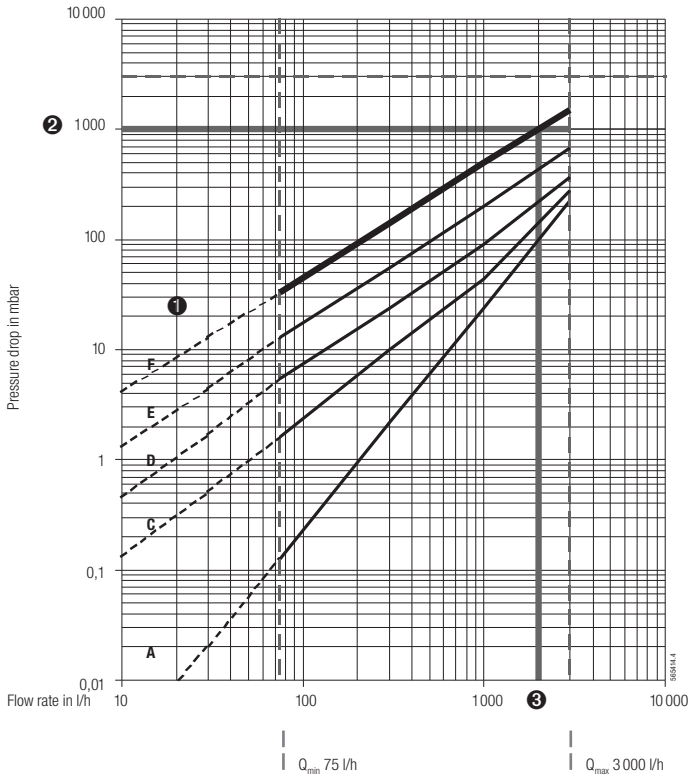
A = 5 mPa.s	C = 50 mPa.s	E = 200 mPa.s
B = 25 mPa.s	D = 100 mPa.s	F = 500 mPa.s

For a pressure drop of more than 1 bar, it is recommended to use the next larger meter size.
Maximum permissible pressure drop = 3 bar

DN 50



Example



Mineral oil, viscosity 450 mPa.s
VZO 25 mounted on pressure side of pumps

❶ Viscosity curves DN 25
select closest curve
F = 500 mPa.s

❷ Assume max. permissible pressure drop = 1 bar

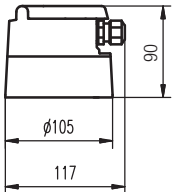
❸ The intersection of curve F with the line corresponding to 1bar gives a flow rate of 2000 l/h.

Dimensions of transducer groups / measurement transducer

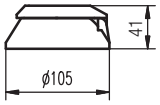
Oil flow meter	VZF / VZFA	VZO 15 - 25						VZO 40 - 50 / VZOA 15 - 50					
Max. temperature	130/180°C	130°C			180°C			130°C			180°C		
Pulsers	all	-	RV	IN	-	RV	IN	-	RV	IN	-	RV	IN
Dimensional drawing	1	2	3	6	5	4	7	5	4	6	5	4	7

VZF(A), VZO(A) Dimensional drawings 1 - 7 from table above

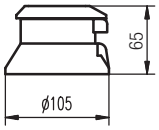
1



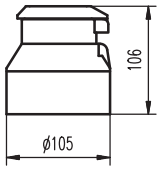
2



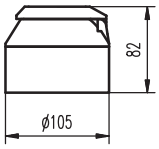
3



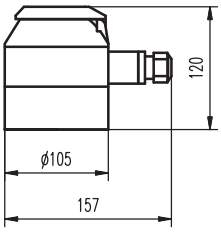
4



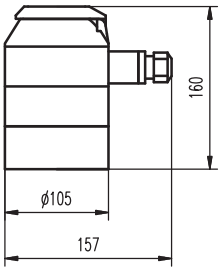
5



6

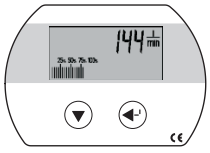


7

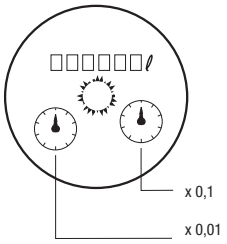


Display / Roller counter

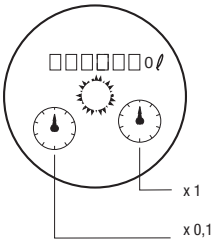
VZF / VZFA



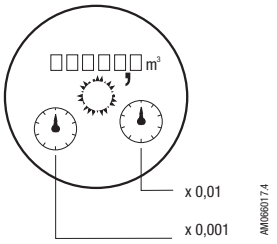
VZO / VZOA 15



VZO / VZOA 20, 25, 40



VZO / VZOA 50



Selection of the optimal meter

Type		VZF 15-50	VZO 4-8	VZO 15-50	VZFA 15-50	VZOA 4-8	VZOA 15-50
Application							
Direct consumption measurement		●	●	●	●	●	●
Differential measurement		–	–	–	●	–	●
Measuring points with metrolog. approval / calibration (optional)		–	–	–	–	●	●
Measuring points with marine type approval (optional)		●	–	●	●	–	●
Most frequent areas of use							
Domestic / industrial burner	light/medium oil	●	●	●	●	●	●
	heavy oil [1]	●	–	●	●	–	●
Common applications							
Heating systems		●	●	●			
High performance furnaces							
Fuel types							
Light heating fuel		●	●	●	●	●	●
Medium heating fuel		●	●	●	●		●
Heavy heating fuel		●	–	●	●	–	●
Display of flow data							
Total volume		●	●	●	●	●	●
Resettable volume		●	–	–	●	–	–
Instantaneous flow rate		●	–	–	●	–	–
Method of display							
LCD Electronic display		●	–	–	●	–	–
Total volume display on roller counter		–	●	●	–	●	●
Measuring error limits							
±1 % if actual value		●	●	●	–	●	–
±0,5 % of actual value or smaller		–	–	–	●	–	●
PTB approval	Class 1	–	–	–	●	●	●
EC approval/verification	Class 1	–	–	–	–	DN 4	–
	Class 0.5	–	–	–	–	DN 8	●
Outputs [2]							
Current output	4..20mA	●	–	–	●	–	–
Digital outputs	volume pulses	●	–	–	●	–	–
	frequency signal	●	–	–	●	–	–
	min/max limiting values	●	–	–	●	–	–
Pulser (Option)							
Inductive, with decadic pulse value		–	–	●	–	–	●
Reed pulser for remote totalisation		–	●	●	–	●	●

1) Only in accordance with the maximum mesh size of the dirt filter as per technical data.
2) Two freely selectable independent outputs are always available.

Fuels and suitable Meter sizes	DN 4	DN 8	DN 15	DN 20	DN 25	DN 40	DN 50
Light heating fuel	●	●	●	●	●	●	●
Medium heating fuel	●	●	●	●	●	●	●
Heavy heating fuel	–	–	●	●	●	●	●

● applicable
– not applicable

Application note
For viscosities higher than 5mPa.s or for installations on the suction side of a pump, pressure drop and possible limitation of flow range must be taken into consideration.