

CONTOIL®

Fuel oil meters



Applications

- Flow measurement of mineral oils such as heating or propellant fuels
- In burners, on board ships, land vehicles and fixed installations
- Marine and metrological type approvals (optional)



Features

- The complete range of products offering the best solutions for the measurement of oil consumption
- State-of-the-art design with electronic counter, flow indication, analogue and digital output signals and limiting value switch
- Mounting on the pressure or suction side of a pump, with no straight inlets or outlets required
- Independent of viscosity and temperature
- High vibration resistance
- Classical version with mechanical display

Your benefits

- Solutions for all of your measuring applications from a single supplier
- Reliable monitoring and flexible control of the system. Simplifies burner settings and optimizing consumption
- Highly flexible mounting with very small space requirements
- Accurate measurements
- Maximum safety in the shipbuilding and automobile industries
- Cost-effective metering

The right product for every application

CONTOIL® Electronic Oil Meters with multifunctional display and selectable outputs
9218 (1/2") ... 9252 (2")



Electronic display of

- totalizer, total and resettable volume
- actual flow rate
- other flow parameters

Output signals for

- volume pulses
- actual flow rate
- limiting values (Q_{min} , Q_{max})

Simple to operate
 Interactive parameter input
 External power supply

Housing with threaded or flanged connections

Main characteristic data:

- flow range 0.25 ... 8000 g/h
- temperature ranges 140 and 260 °F
- nominal pressure 150, 225 and 350 PSI



CONTOIL® Mechanical Oil Meters with total volume display and pulse output (optional) 9204 (1/8") ... 9251 (2")



Total volume display on roller counter

Option: Reed pulser for remote totalisation

Housing with threaded or flanged connections



Main characteristic data:

- flow range 0.12 ... 8,000 g/h
- temperature ranges 140, 266, 345 °F
- nominal pressure 232, 362, 580 PSI



ISTEC CORPORATION
 5 Park Lake Road, Sparta, NJ 07871
 973 383 9888 (Phone)
 973 383 9088 (Fax)
 Email: sales@istec-corp.com
 Web: www.istec-corp.com

CONTOIL® offers special order solution for special applications

- differential measurement (VZFA / VZOA 15...50)
- certification/official verification for commercial transactions (VZOA 4...50)
- engine test benches (VZFA / VZOA 15...50)



VZFA

Electronic display of

- totalizer, total and resettable volume
- actual flow rate
- other flow parameters

Output signals for

- volume pulses
- actual flow rate
- limiting values (Q_{min} , Q_{max})

Simple to operate

Interactive parameter input

External power supply

VZOA 4 and 8

- Volume display on roller counter



VZOA 15...50

- Volume display on roller counter

Option: IN inductive pulser for control purposes

Option: RV Reed pulser for remote totalisation, integrated into the roller counter

Housing with threaded or flanged connections

Main characteristic data:

- flow range 10 ... 30,000 l/h
- temperature ranges 130 and 180° C
- nominal pressure PN 16 and PN 25 bar (PN 40 on request)

with special pairing for minimum measurement variance.



ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

CONTOIL[®], the world's most frequently used oil consumption meter

Leading manufacturers of oil burners and operators of heating systems, ships or diesel engines rely on CONTOIL[®] fuel oil meters - and with good reasons.

The advantages of CONTOIL[®] fuel oil meters – your benefits

You can decide which of these many benefits are the most important for you:

- the optimal solution for every application
- simple burner setting with flow rate display
- simple consumption monitoring with limiting value switch Q_{\min}/Q_{\max}
- manual dosing feature, with a resettable counter
- can be mounted on the pressure or suction side of a pump
- space-saving installation, because no straight inlet/outlet sections are needed
- flexible mounting of the meter in horizontal, vertical or inclined positions
- accurate measurement result, since the reading is independent of the temperature and viscosity of the fluid
- minimum failure costs due to simple function monitoring, rapid fault analysis and the possibility of simple repairs on site

Areas of application

- to measure heating fuel consumption by oil burners (for example, in heating boilers, industrial furnaces, tar processing plants, ships boilers)
- to measure propellant fuel consumption by motors and engines (such as diesel locomotives, construction machinery and ships, or in emergency power units, combined heating and power stations)
- consumption monitoring and optimisation
- flow measurement for mineral oils
- optional remote processing and integration into systems
- manual dosing / batching
- flow measurement for machine and motor/engine oils
- engine test benches

Fuel types

- heating fuel extra light / light, medium, heavy
- naphtha
- diesel
- petrol
- and other lubricating liquids

ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

ISTEC's CONTOIL ® Series Oil Meter in ½” through 2” sizes

Technical data 1)



- display of total volume, resettable volume, and flow rate in m³, litres or US gallons 2)
- user-friendly, interactive parameter input
- fuel oil meter with threaded or flanged connections
- for mounting in horizontal or vertical positions

Versions available on request:

- different flange drillings, such as ANSI, JIS

		9218	9223	9228	9242	9252
Nominal diameter	inch (mm)	1/2 (15)	3/4 (20)	1 (25)	1 1/2 (40)	2 (50)
Installation length inch (mm)	inch (mm)	6.5" (165)	6.5" (165)	7.5" (190)	11.8" (300)	13.8" (350)
Nominal pressure with threaded ends (PSI)	PSI	232	232	232	232	232
Nominal pressure with flanges (PSI)	PSI	362	362	362	362	362
Maximum temperature Tmax,	° F	266, 356	266, 356	266, 356	266, 356	266, 356
Maximum flow rate Qmax 3)	gph (l/h)	160 (600)	400 (1500)	800 (3000)	2400 (9000)	8000 (30000)
Nominal flow rate Qcont 3)	gph (l/h)	105 (400)	265 (1000)	530 (2000)	1600 (6000)	5300 (20000)
Minimal flow rate Qmin	gph (l/h)	4 (15)	8 (30)	20 (75)	60 (225)	200 (750)
Approx. starting flow rate	gph (l/h)	1	3	8	24	80
Max. permissible error		± 1% of				
Repeatability		± 0.2%				
Safety filter mesh size	mm	0.400	0.400	0.400	0.800	0.800
Dirt filter mesh size	mm	0.250	0.400	0.400	0.600	0.800
Housing finish		enameled red				
Weight with threaded ends 4)	lbs (kg)	4.9 (2.2)	5.5 (2.5)	9.3 (4.2)	38.2 (17.3)	-
Weight with flanges PN 25	lbs (kg)	8.4 (3.8)	9.9 (4.5)	16.5 (7.5)	44.7 (20.3)	90.2 (41)
Smallest readable amount:						
Total volume	g	No decimal places				
Resettable volume	g	1 decimal place				
Digital flow rate display	g/h	1 decimal place				
Registration capacity	g	100000000				
Registration time at Qcont until roll over	h	128000	100000	50000	16667	5000
Outputs 5)						
Pulse value for totalizer	Vol./pulse	pulse value and width programmable				
Current 4..20 mA for flowrate	I4 /Q1, I20 Q2	flow rates to 4 and 20 mA programmable				
Frequency for flow	f1/Q1, f2/Q2	frequency and flowrate programmable				
Limiting switch	Qmin, Qmax	minimum, maximum and hysteresis programmable				

1) Manufacturer's specification, valid for the reference conditions as specified under "APPENDIX: 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 be taken into consideration.

4) Weight without couplings.

5) Two freely selectable outputs are available, totally independent of each other.

Pressure drop curves

See "APPENDIX: Meter data"

ISTEC CORPORATION

5 Park Lake Road, Sparta, NJ 07871

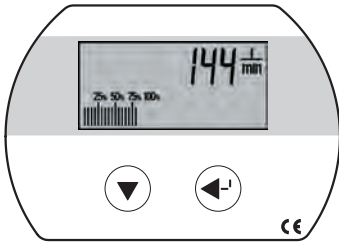
973 383 9888 (Phone)

973 383 9088 (Fax)

Email: sales@istec-corp.com

Web: www.istec-corp.com

Electronic display



- Display values:
- total volume, resettable volume, flow rate
 - In the information menu, hours of operation and other information can be obtained
- Display:
- 8-character LCD with identification of the parameter, height of numbers: 8 mm, flow rate (meter load) using bar indicator
- Temperature:
- ambient temperature -25 ... +70° C, storage temperature -25 ... +85° C
- Safety:
- CE, vibration and shock test to DIN IEC 68
- Power supply:
- 24 V DC (6...30 V DC)
- Data preservation:
- by non-volatile memory (EEPROM)
- Protection class:
- IP66 (IEC 60529) against water jets and dust

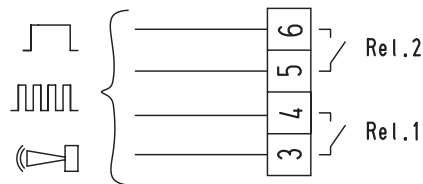
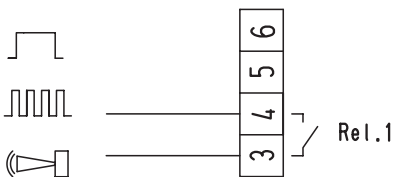
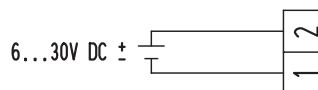
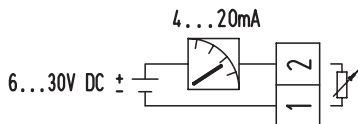
Outputs

Four different output functions are available:

- Pulser for volume pulses with programmable pulse value (for external totaliser)
- Analogue current output 4...20 mA corresponding to flow rate
- Frequency output 0...100 Hz corresponding to flow rate
- Switching function (limiting value switch) specified by programmable upper and lower flow rates

Except for the current output function, any two of the remaining three functions can always be used simultaneously. This results in two types of connection:

- 1 potential-free digital output (Rel. 1), programmable to one of the three functions described below.
- 1 passive analogue 4...20 mA output also used for powering the meter.
- 2 potential-free digital outputs (Rel. 1 + Rel. 2), each programmable to one of the three functions described below.
- the analogue output is not available in this case. The power, however, is supplied over these terminals.



ISTEC CORPORATION
 5 Park Lake Road, Sparta, NJ 07871
 973 383 9888 (Phone)
 973 383 9088 (Fax)
 Email: sales@istec-corp.com
 Web: www.istec-corp.com

Specification of the outputs

Passive analogue output (1-2)

- Voltage range U: 6...30V DC
- Maximum load R_L : (U-5) V / 0.0215A [Ω]
- Resolution: 16 Bit
- Max. error: ± 0.2 mA
- Update interval: < 1s

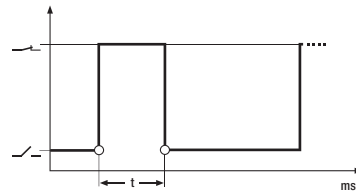
Digital outputs (3-4, 5-6)

- Max. voltage U_{max} : 48V AC/DC
- Max. current I_{max} : 50 mA
- Max. output frequency f_{max} : 100 Hz
- Update interval: < 1s
- ON-resistance R_0 : $\leq 100\Omega$
- OFF-resistance R_∞ : $\geq 10M\Omega$
- Insulation voltage: > 100V AC/DC

Adjustable functions:

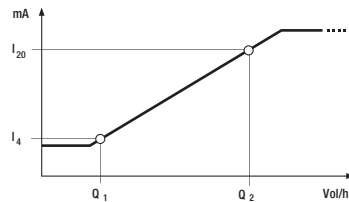
Volume pulses

- Pulse width t: 5, 50, 250, 500 ms
Pulse value: programmable



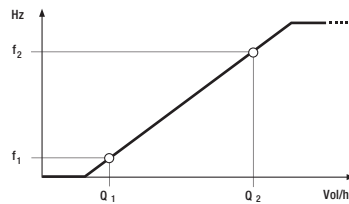
Current signal

- Flow rate at 4 mA Q_1 : programmable
- Flow rate 20 mA Q_2 : programmable
- Attenuation: programmable



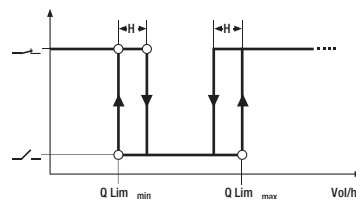
Frequency signal

- Output frequency f_{max} : 100Hz
Pulse ratio: 1:1
Frequency / Flowrate f_1/Q_1 : programmable
Frequency / Flowrate f_2/Q_2 : programmable



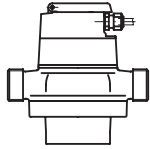
Limiting value switch

- Limit Q_{min} : programmable
Limit Q_{max} : programmable
Hysteresis H: programmable



ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

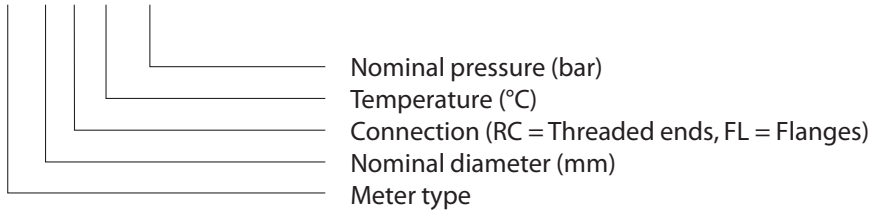
Dimensions

Type	inch	9218	9223	9228	9242	9252
	Length	6.5	6.5	7.5	11.8	13.8
	Width	4.1	4.1	5.1	8.8	11
	Height	6.1	6.5	7.5	9.5	11.7

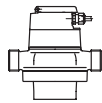
Detailed dimensional diagrams in "APPENDIX: Meter data"

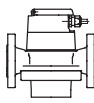
Factory Key

VZF 25 FL 130/25



Ordering specifications

Threaded ends, PN16	Type 130 °C	Order No.
	VZF 15 RC 130/16	9218
	VZF 20 RC 130/16	9223
	VZF 25 RC 130/16	9228
	VZF 40 RC 130/16	9242

Flanges, PN25	Type 130 °C	Order No.	Type 180 °C	Order No.
	VZF 15 FL 130/25	93706		
	VZF 20 FL 130/25	93709	VZF 20 FL 180/25	93710
	VZF 25 FL 130/25	93726	VZF 25 FL 180/25	93727
	VZF 40 FL 130/25	93731	VZF 40 FL 180/25	93732
	VZF 50 FL 130/25	9252	VZF 50 FL 180/25	93736

Modification VZF	For marine type approval (e.g. GL, LRS, DNM)	96295
------------------	--	-------

ISTEC CORPORATION
 5 Park Lake Road, Sparta, NJ 07871
 973 383 9888 (Phone)
 973 383 9088 (Fax)
 Email: sales@istec-corp.com
 Web: www.istec-corp.com

CONTOIL® Classic Mechanical Oil Meters 9204...9250

9204 and 9208

Technical data 1)



- oil meter with internal threaded connections located on the bottom plate
- with mechanical roller counter, volume display in litres
- meters in US-Gallons ²⁾
- for mounting in horizontal, vertical and inclined positions
- VZO 4 and 8 with EEC legal verification

Option: Reed pulser 48 V

		9204	9208
Nominal diameter	inch (mm)	1/8 (4)	1/4 (8)
Connection threads of meter	inch	1/8	1/4
Nominal pressure with threaded ends (PSI)	PSI	363	363
Maximum temperature Tmax,	° F	140	140
Maximum flow rate Qmax 3)	gph (l/h)	21 (80)	52 (200)
Nominal flow rate Qcont 3)	gph (l/h)	13 (50)	35 (135)
Minimal flow rate Qmin	gph (l/h)	.26 (1)	1 (4)
Approx. starting flow rate	gph (l/h)	.1 (.4)	.42 (1.6)
Max. permissible error		± 1% of actual value	
Repeatability			
Safety filter mesh size	mm	0.125	0.125
Dirt filter mesh size	mm	0.080	0.080
Housing finish		enameled red RAL 3013	
Weight without couplings	lbs (kg)	1.4 (.65)	1.6 (.75)
Smallest readable amount:	g	0.001	0.001
Registration capacity	g	10000	100000
Registration time at Qcont until roll over	h	7140	28570
Outputs 5)			
Reed pulsers	10 ppg	9205	9209
Optional High Speed Pulser	1216 ppg	-	Special Order

1) Manufacturer's specification, valid for the reference conditions as specified under "APPENDIX: Meter data".

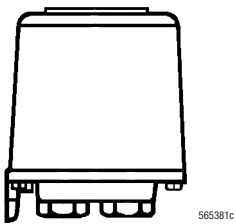
2) 1 US gallon corresponds to 3.785 litres

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) Max. permissible error: VZO 4 Q_{min} 0.5: 0.5 l/h ... 2 l/h = + 1%/- 2%. VZO 4: 1 l/h ... 2 l/h = + 1%/- 2%.

5) Note: pulses of short duration!

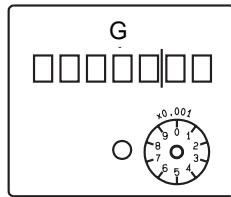
Dimensions



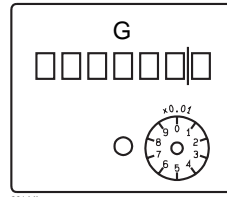
height = 3"
width = 2.5"
depth = 2.5"

Dial

9204

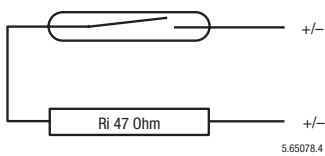


9208



Detailed dimensional drawings in "APPENDIX: Meter data"

Pulsers



Switching element:
Switching voltage:
Switching current:
Quiescent current:
Switching power:
Temperature:
Protection class:

- Reed switch with dry contact (inert gas)
- Max. 48 V AC/DC
- Max. 50 mA
- Open Contact
- Max. 3 VA
- Ambient -10 ... +60° C

Meters without pulser:

- IP 65 (IEC 60529) against water-jets and dust

Meters with pulser RE:

- IP 50 (IEC 60529) against dust deposits

Connections:

- On plug supplied with product for cable, 2 × 0.35 mm²

ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

9215 ... 9250

Technical data ¹⁾



- Volume display on roller counter in gallons
- Fuel oil meter with threaded or flanged ends
- Mounting in horizontal, vertical or inclined positions
- Option: Reed pulser or RV / IN pulser
- Versions available on request:
 - different flange drillings, such as ANSI, JIS
 - meters in liters ²⁾ (option)

		9215	9220	9225	9240	9250
Nominal diameter	inch (mm)	1/2 (15)	3/4 (20)	1 (25)	1 1/2 (40)	2 (50)
Installation length inch (mm)	inch (mm)	6.5" (165)	6.5" (165)	7.5" (190)	11.8" (300)	13.8" (350)
Nominal pressure with threaded ends (PSI)	PSI	232	232	232	232	232
Nominal pressure with flanges (PSI)	PSI	362 / 580	362 / 580	362 / 580	362 / 580	362 / 580
Maximum temperature Tmax,	° F	266, 356	266, 356	266, 356	266, 356	266, 356
Maximum flow rate Qmax 3)	gph (l/h)	160 (600)	400 (1500)	800 (3000)	2400 (9000)	8000 (30000)
Nominal flow rate Qcont 3)	gph (l/h)	105 (400)	265 (1000)	530 (2000)	1600 (6000)	5300 (20000)
Minimal flow rate Qmin	gph (l/h)	4 (15)	8 (30)	20 (75)	60 (225)	200 (750)
Approx. starting flow rate	gph (l/h)	1	3	8	24	80
Max. permissible error		± 1% of actual value				
Repeatability		± 0.2%				
Safety filter mesh size	mm	0.400	0.400	0.400	0.800	0.800
Dirt filter mesh size	mm	0.250	0.400	0.400	0.600	0.800
Housing finish		enameled red RAL 3013				
Weight with threaded ends 4)	lbs (kg)	4.9 (2.2)	5.5 (2.5)	9.3 (4.2)	38.2 (17.3)	-
Weight with flanges PN 25	lbs (kg)	8.4 (3.8)	9.9 (4.5)	16.5 (7.5)	44.7 (20.3)	90.2 (41)
Smallest readable amount:						
Total volume	g	0.01	0.01	0.01	0.1	0.1
Registration capacity	g	999,999	999,999	999,999	9,999,999	9,999,999
Registration time at Qcont until roll over	h	9520	3770	1880	6250	1880
Outputs 5)	P/N	9216	9221	9226	9241	9251
Pulse value for totalizer	Vol./pulse	0.1	0.1	1	10	10

1) Manufacturer's specification, valid for the reference conditions as specified under "APPENDIX: 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.

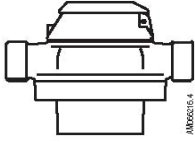
4) Weight without couplings.

Pressure drop curves

See "APPENDIX: Meter data"

ISTEC CORPORATION
 5 Park Lake Road, Sparta, NJ 07871
 973 383 9888 (Phone)
 973 383 9088 (Fax)
 Email: sales@istec-corp.com
 Web: www.istec-corp.com

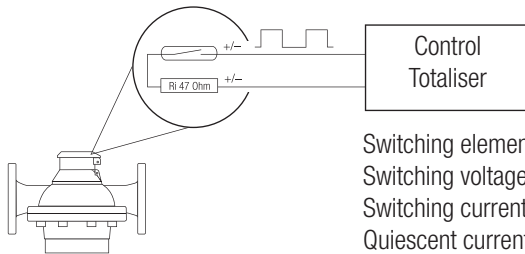
Dimensions

Type	inch	9215	9220	9225	9240	9250
	Length	6.5	6.5	7.5	11.8	13.8
	Width	4.1	4.1	5.1	8.3	11
type 266F						
	Height Mechanical	4.2	4.5	5.6	9.2	11.5
	Height Pulser	5.1	5.4	6.5	10.2	12.4
type 356F (optional)						
	Height Mechanical	5.8	6.1	7.2	9.2	11.5
	Height Pulser	6.7	7	8.1	10.1	12.4

Detailed dimensional diagrams in "APPENDIX: Meter data".

RV Pulsers

This type of pulser is integrated into the roller counter and thus is especially appropriate for remote totalisation. For other applications the IN inductive pulser is preferable.



Switching element:	• Reed switch with dry contact (inert gas)
Switching voltage:	• max. 48 V AC/DC
Switching current:	• max. 50 mA (Ri = 47 Ω/0.5 W)
Quiescent current:	• Open Contact
Switching power:	• max. 2 W
ON-time:	• 50% ± 10%
Temperature:	• Ambient -10 ... +70° C
Protection class:	• IP 65 (IEC 60529) against water-jets and dust
Connections:	• Cast-in cable, length 3 m
Cable cross section:	• 2 x 0.14 mm ²

ISTEC CORPORATION
 5 Park Lake Road, Sparta, NJ 07871
 973 383 9888 (Phone)
 973 383 9088 (Fax)
 Email: sales@istec-corp.com
 Web: www.istec-corp.com

CONTOIL® VZFA/VZOA ½" ... 2", SPECIAL ORDER ONLY versions for special requirements / applications

For applications requiring an increased accuracy of $\pm 0.5\%$ or better, such as:

- Measurement of EL heating fuel or diesel in testing facilities
- Differential measurement
- Commercial transactions for which the meters are legally required to have type approval or official verification.

These products require dirt filters with smaller mesh size.

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 diesel engines in an emergency power system
- 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 official verification

CONTOIL® fuel oil meters are used almost exclusively for the measurement of the consumption of fuel oil. The metrological standards (such as MID or EC guideline 71/319/EEC), however, regulate the requirements for meters and systems used for commercial transactions as well as the procedures for design approval and official verification. Measuring installations where a fluid is sold are regarded as transfer points that require official verification. These include petrol pumps at petrol stations, measuring devices for road tankers and measuring stations for loading and unloading all types of road vehicles. As a rule, a metering system must be ready for use and be checked and sealed by the local office responsible for transfer verification.

Typical of these applications is the narrow range of use with regard to liquid, flow rate and temperature. Subject to type approval restrictions, CONTOIL® oil meters are also available with metrological type approval or official verification. The differences in products relate only to the design or specifications of the meter and not to the quality of the product.

ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

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.

Electronic ½" ... 2"

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



Mechanical ½" ... 2"

With the exception of the counter with the RV Reed pulser, the roller counter can be rotated through 360° for optimum readability.



Mechanical 1/8" & 1/4"

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.

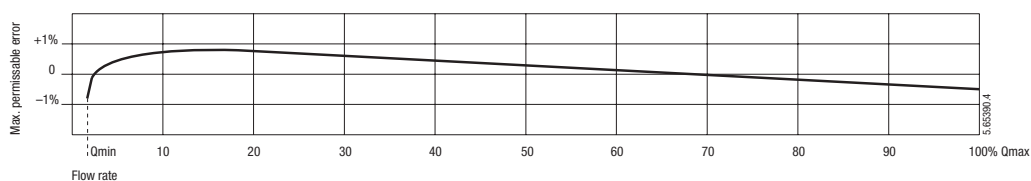
Reference conditions

Liquid: Calibration oil similar to extra light heating oil, density at 20° C = 814 kg/m³
Viscosity = 5.0 mm²/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.



ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

Pressure drop curves

Viscosity information

Kinematic viscosity
Dynamic viscosity

Stokes, Centi-Stokes, mm²/s
Pascal seconds, millipascal seconds
Poise, Centipoise (outmoded)

St, cSt, mm²/s
Pas, mPa.s
P, cP

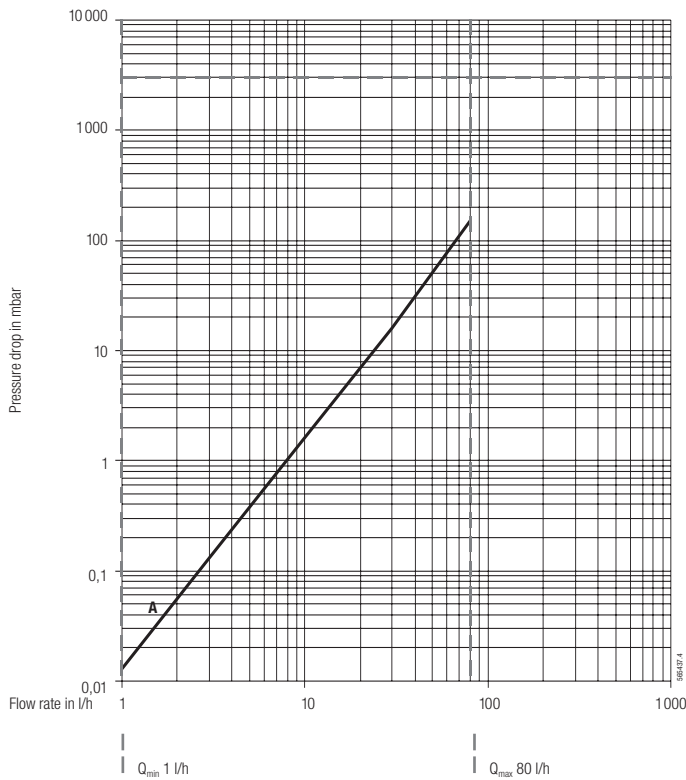
Conversion

cSt × 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

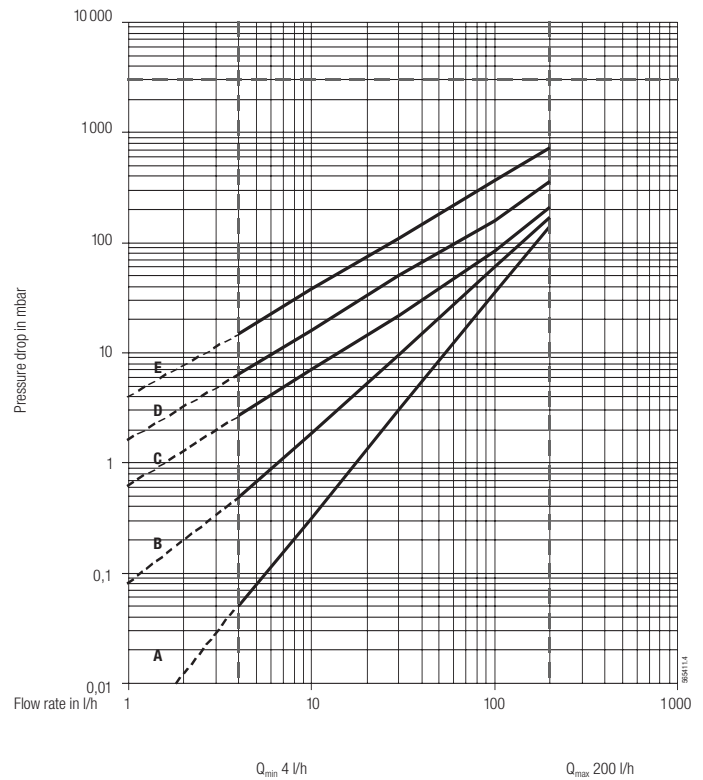
Rule of thumb

1 cSt → 1 mm²/s → 1 mPa.s

DN 4



DN 8



Viscosity diagrams:

A = 5 mPa.s
B = 50 mPa.s

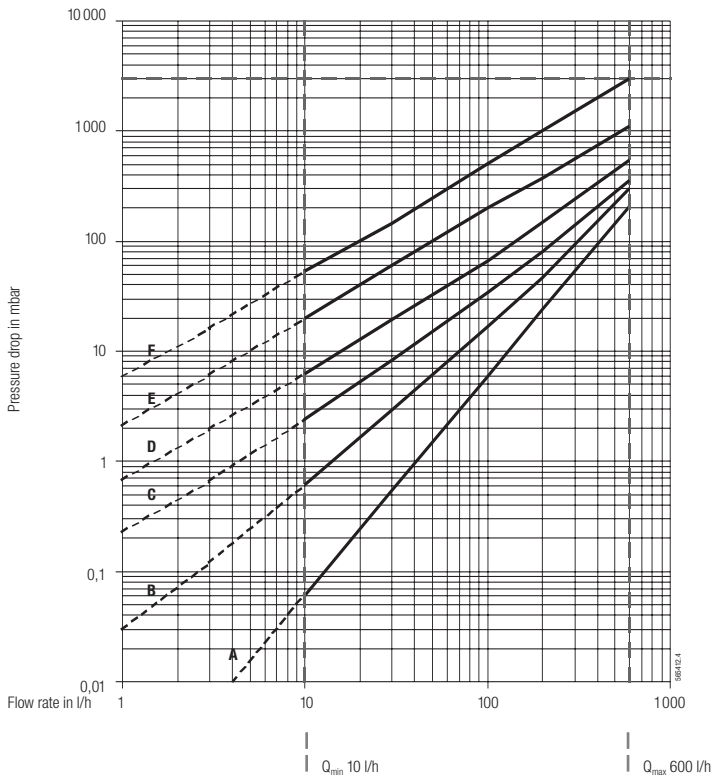
C = 100 mPa.s
D = 200 mPa.s

E = 500 mPa.s

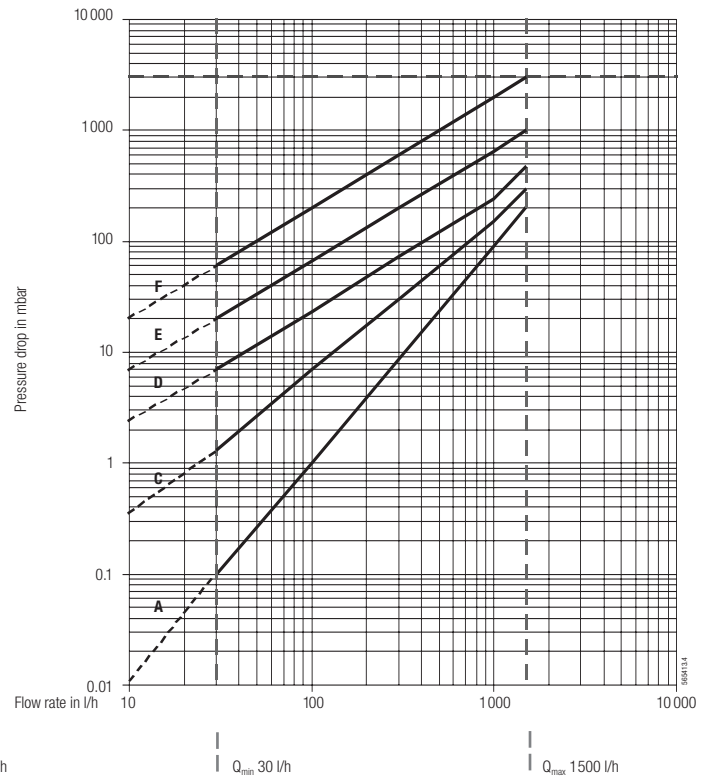
For a pressure drop of more than 1 bar, it is recommended to use the next larger meter size.
Maximum permissible pressure drop = 3 bar

ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

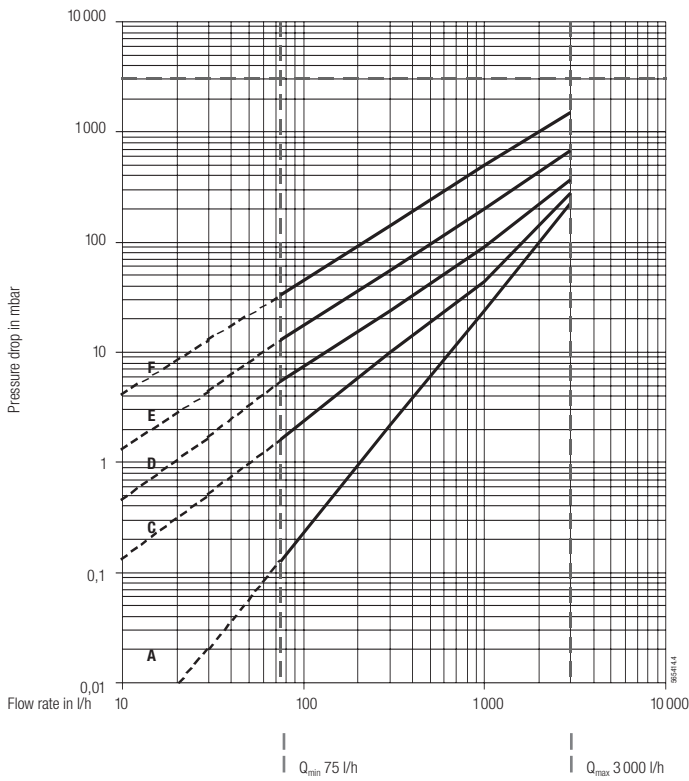
DN 15



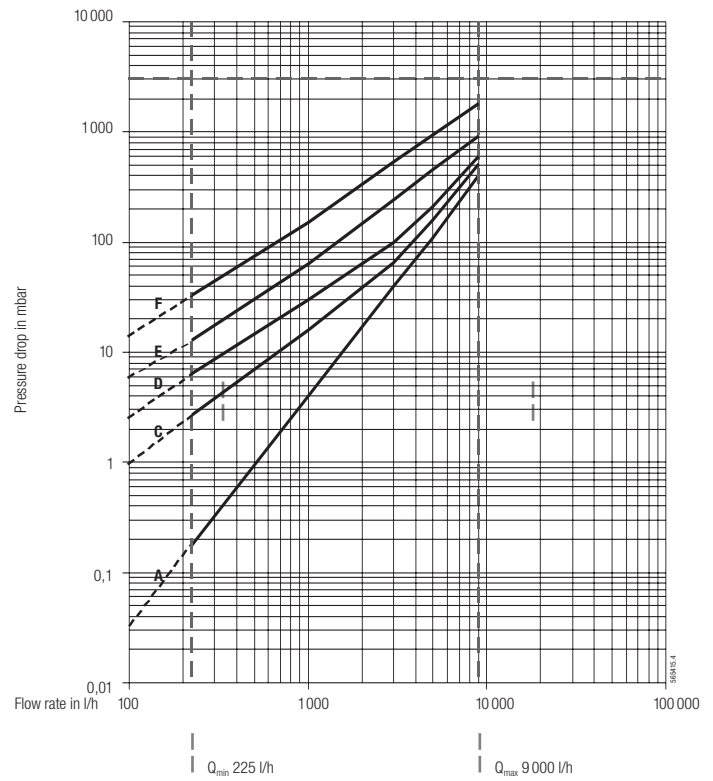
DN 20



DN 25



DN 40



Viscosity diagrams:

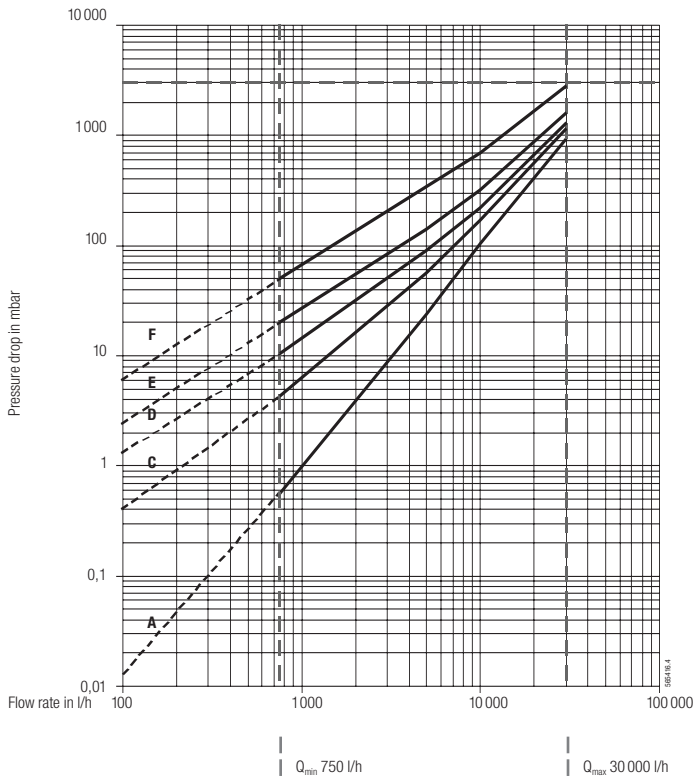
A = 5 mPa.s
B = 25 mPa.s

C = 50 mPa.s
D = 100 mPa.s

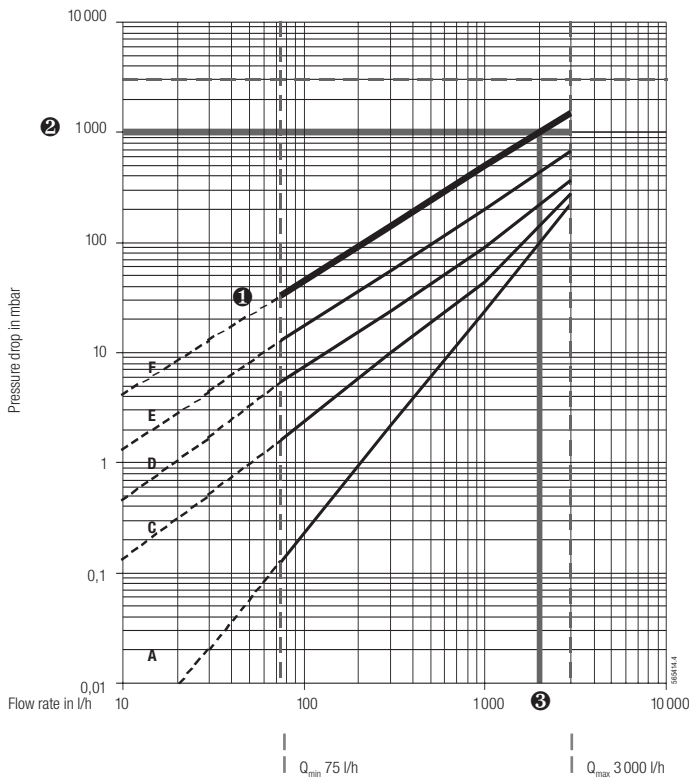
E = 200 mPa.s
F = 500 mPa.s

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

- ① Viscosity curves DN 25
select closest curve
F = 500 mPa.s
- ② Assume max. permissible pressure drop = 1 bar
- ③ The intersection of curve F with the line corresponding to 1 bar gives a flow rate of 2000 l/h.

ISTEC CORPORATION

5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

Materials		Meter				
Part	Material	9204	9208	15 20 25	9240	9250
Housing / Measuring unit	Brass	•	•			
Housing with threaded ends	Cast brass Spheroidal graphite iron GGG			• • •		•
Housing with flanges	Spheroidal graphite iron GGG			• • •	•	•
Measuring chamber						
- PN 16 / 25	Cast brass			• • •	•	
	Red brass					•
- PN 40	Stainless steel			• • •	•	•
Seals	NBR butadiene- acrylonitril FPM fluorelastomer	• S	•	• • •	•	•
Rotary piston	Anodized aluminium	•	•	• • •	•	•
Ancillaries	Plastic			• • •	•	•
Cover of meter	Plastic	•	•			

ISTEC CORPORATION
 5 Park Lake Road, Sparta, NJ 07871
 973 383 9888 (Phone)
 973 383 9088 (Fax)
 Email: sales@istec-corp.com
 Web: www.istec-corp.com

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)	●	—	●	—	●
Diesel engines	●	●	●	●	●	●
Ship motors	●	—	●	●	—	●
Petrol engines		2)			—	
Common applications						
Heating systems	●	●	●			
Ships	●		●	●		●
Diesel locomotives	●	●	●	●		●
Trucks/coaches/construction machinery		●	●			●
Fuel types						
Light heating fuel	●	●	●	●	●	●
Medium heating fuel	●	●	●	●		●
Heavy heating fuel	●	—	●	●	—	●
Diesel	●	●	●	●	●	●
Petrol 2)		2)				
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	●	●	●	—	DN 4	—
± 0,5% of actual value or smaller	—	—	—	●	DN 8	●
PTB approval	—	—	—	●	●	●
EC approval/verification	Class 1	—	—	—	DN 4	—
	Class 0.5	—	—	—	DN 8	●
Outputs 4)						
Current output	●	—	—	●	—	—
Digital outputs	4..20mA	—	—	●	—	—
	volume pulses	●	—	—	●	—
	frequency signal	●	—	—	●	—
	min/max limiting values	●	—	—	●	—
Pulsar (Option)						
Inductive, with decadic pulse value	—	—	●	—	—	●
Reed pulser for remote totalisation	—	●	●	—	●	●

● applicable
— not applicable

○ on request

Fuels and suitable	DN 4	DN 8	DN 15	DN 20	DN 25	DN 40	DN 50
Meter sizes							
Light heating fuel	●	●	●	●	●	●	●
Medium heating fuel	●	●	●	●	●	●	●
Heavy heating fuel	—	—	3)	●	●	●	●
Diesel	●	●	●	●	●	●	●
Petrol	2)	2)	—	—	—	—	—

1) Only in accordance with the maximum mesh size of the dirt filter as per technical data.

2) Determine conditions of use with supplier (other measured values!).

3) DN 15 only when the plant has a dirt filter with a max. 0.1 mm mesh size.

4) Two freely selectable independent outputs are always available.

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.

Fuel oils

Characteristics of different fuels

Fuel			extra light	light	medium	heavy	Bunker C
Density at 15° C	min.	kg/dm ³	0.82	0.82	0.82	0.82	0.90
	max.	kg/dm ³	0.86	0.95	0.96	0.99	1.01
Specific volume at average density		l/kg	1.19	1.12	1.12	1.11	1.08
Viscosity at	20° C	mPa.s	8	14	50	420	4200
	40° C	mPa.s	3	5	16	60	380
	100° C	mPa.s	–	–	3	10	35
Energy value		kWh/kg	11.8	10.6	11.4	11.2	11.0

Indicative values on power for burners and engines

Burners

Burner		Fuel oil meter		
Power up to kW	Flow rate heating fuel EL kg/h	l/h	Flow rate Q _{min} ...Q _{cont} l/h	Size DN
500	42	50	1 ... 50	4
1 300	113	135	4 ... 135	8
4 000	336	400	10 ... 400	15
10 000	840	1 000	30 ... 1 000	20
20 000	1 680	2 000	75 ... 2 000	25
60 000	5 040	6 000	225 ... 6 000	40
200 000	16 800	20 000	750 ... 20 000	50

Formula for consumption in litres/hour:

Example:

$$\frac{\text{Burner power in kW}}{\text{Energy value of fuel in kWh/kg} \times \text{density in kg/dm}^3} = \frac{600 \text{ kW}}{11.8 \text{ kWh/kg} \times 0.82 \text{ kg/dm}^3} = 62 \text{ l/h}$$

Engines

Engine		Fuel oil meter ¹⁾		
Power up to approx. PS	Diesel fuel consumption ca. kW	l/h	Flow rate Q _{min} ...Q _{cont} l/h	Size DN
250	184	50	1 ... 50	4
680	500	135	4 ... 135	8
2 000	1 470	400	10 ... 400	15
5 000	3 680	1 000	30 ... 1 000	20
10 000	7 360	2 000	75 ... 2 000	25
30 000	22 000	6 000	225 ... 6 000	40
100 000	73 600	20 000	750 ... 20 000	50

1) For differential measurement the flow meter has to be selected according to the pump flow rate and the flow in the return pipe.

Formula:

$$1 \text{ HP} = 0.736 \text{ kW} \quad 1 \text{ kg Diesel at } 0.84 \text{ kg/dm}^3 = 1.19 \text{ l}$$

$$1 \text{ kW} = 1.36 \text{ HP}$$

Rule of thumb:

approx. 190 g/kWh correspond to 0.226 l/kWh
approx. 140 g/HP correspond to 0.167 l/HP/h

ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

How to obtain an optimal measurement

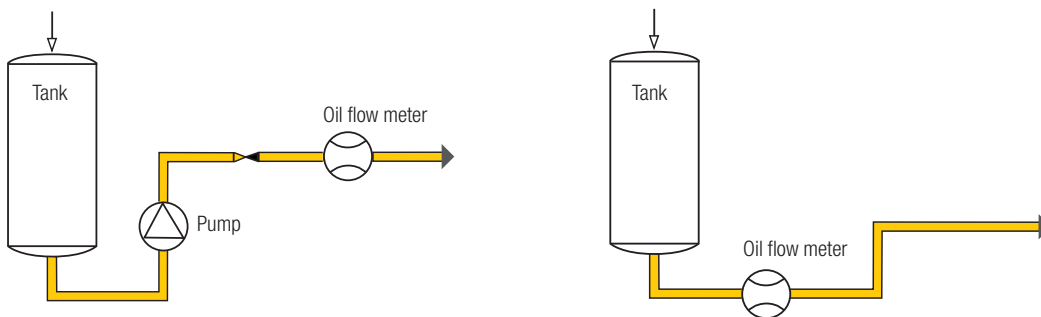
Planning

Flow meters are precision measuring instruments. They achieve optimal results if

- a few important rules are observed during plant design,
- mounting and commissioning are carried out with care,
- the meters are used for their defined purpose only.

Layout of Pipework

- The quantities consumed by all consumers must be registered by the meter.
- Rotary piston meters do not require flow conditioners or inlet runs (after bends, T-pieces or fittings). They may be mounted in horizontal, vertical or inclined position, except with the head pointing downwards.
- The layout of piping must ensure that the meter is at all times filled with liquid and that no inclusions of air or gas may occur. Do not install the instrument at the highest point of the installation.
- Meter and accessory equipment must be easily accessible.



Selection of the Meter and Ancillaries

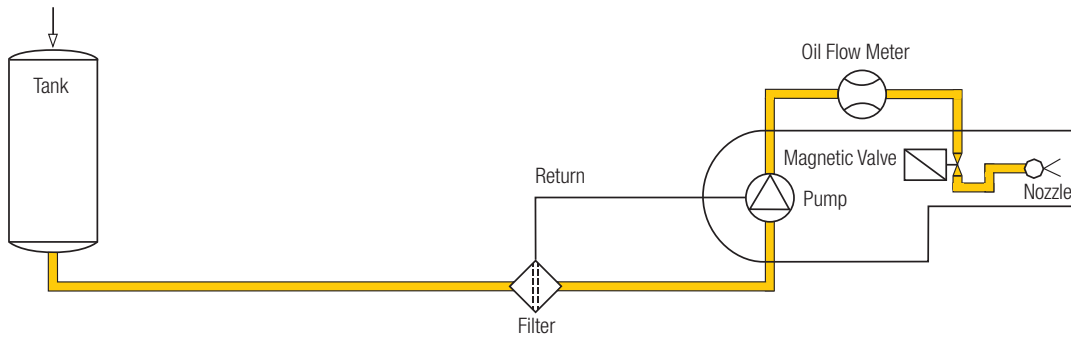
To be considered when selecting the meter:

- Operating temperature
- Viscosity of the medium
- Operating pressure
- Flow rate
- Resistance of the material against fuel to be metered and working conditions

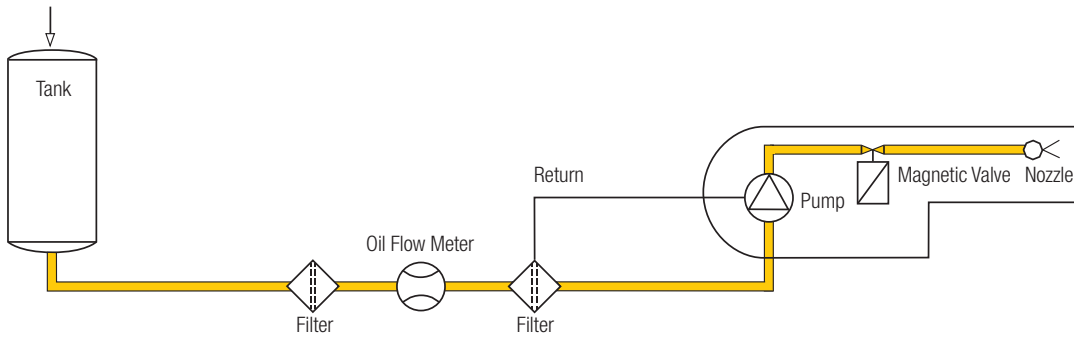
The technical data are valid for the following reference conditions: EL heating fuel / diesel at 20° C. For higher viscosities or if the meter is mounted on the suction side of a pump, it is necessary to determine the pressure drop and the flow rate that can still be attained by using the pressure loss curves (page 25ff). If the pressure drop is more than 1 bar, it is advised to use the next larger meter size. Maximum permissible pressure drop = 3 bar.

ISTEC CORPORATION
5 Park Lake Road, Sparta, NJ 07871
973 383 9888 (Phone)
973 383 9088 (Fax)
Email: sales@istec-corp.com
Web: www.istec-corp.com

Mounting on pressure side of pump (burners)



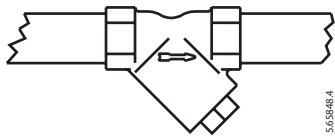
Mounting on suction side of pump (burners)



Impurities in plant or fuel

Should impurities occur in the plant or in the fuel, a dirt filter has to be installed before the meter. The filter mounted in the meter inlet is only a safety filter and is too small to act as a dirt filter.

Maximum mesh size of dirt filter for meter accuracy of:	1%	1%	1/2%
1/8"		0,080 mm	0.080 mm
1/4"		0.100 mm	0.100 mm
1/2"	0.250 mm	0.250 mm	0.100 mm
3/4"	0.400 mm	0.400 mm	0.100 mm
1"	0.400 mm	0.400 mm	0.250 mm
1 1/2"	0.600 mm	0.600 mm	0.250 mm
2"	0.600 mm	0.600 mm	0.250 mm

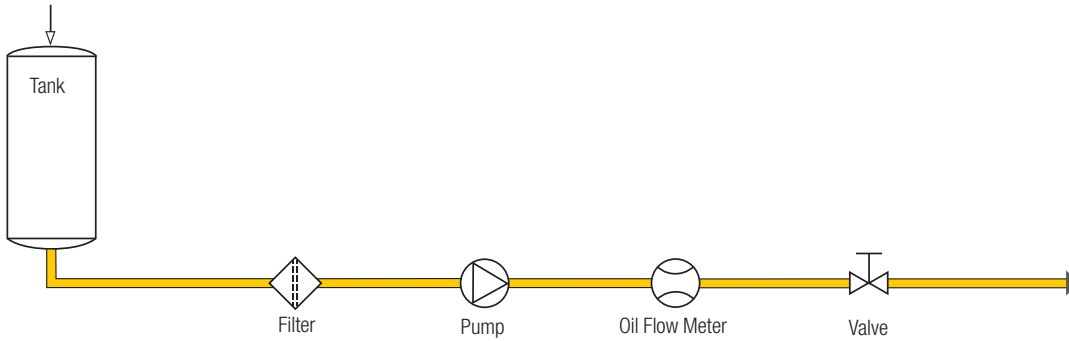


5.65846.4

ISTEC CORPORATION
 5 Park Lake Road, Sparta, NJ 07871
 973 383 9888 (Phone)
 973 383 9088 (Fax)
 Email: sales@istec-corp.com
 Web: www.istec-corp.com

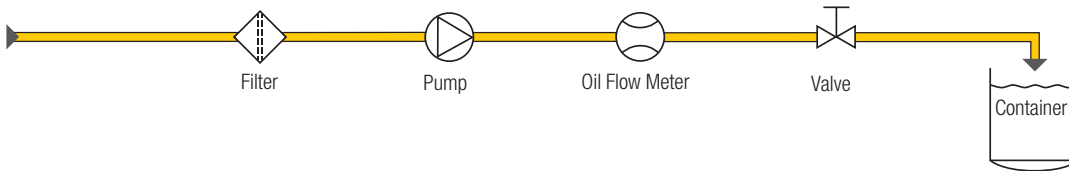
Stop valves or cocks

In order to avoid backflow and draining, stop valves have to be mounted after the meter. Backflow and draining cause measuring errors and can damage the meter.



Filling/Dosing

For filling and dosing the valve has to be mounted between meter and outlet. The shorter the pipe section between meter and outlet, the higher the accuracy. Fast opening and shutting of the valve should be avoided (pressure hammer!).



Remote Processing/Ancillaries

Any backflow must be avoided on meters equipped with pulsers for remote processing. If this cannot be achieved by appropriate plant design, a non-return valve should be fitted.

Electrical wiring and installations

Electrical wiring and installations are subject to statutory regulations which must be taken into account when planning the system. For installations in zones subject to explosion hazards, consult an appropriate expert.

The following factors should be taken into account during plant design:

- ancillaries connected to the meter
- environmental interference
- maximum permissible cable lengths (with or without amplifier)
- junction boxes, cable guides

Cable lengths on the VZF meter outputs

A cable with wire diameter of 0.5mm is generally suitable up to 25 m and such of 0.8mm will go up to 100m. In all other cases the limiting factors should be considered.

- for the analogue current output: (4..20mA)

Limiting factors are supply voltage (U) and resistance of the load (RL). To ensure the maximum current signal of 21.5 mA with sufficient operating voltage for the meter the following formula is used to calculate the maximum permissible resistance (RL) which consists of the resistance of the cable plus the resistance of other components within the circuit. Knowing the resistance of the other components, the maximum permissible length for the cable can then be calculated.

$$R_L = \frac{(U - 5)V}{0.0215A} \quad [\Omega]$$

Example: Supply voltage U = 24 V

$$R_L = \frac{(24 - 5)V}{0.0215A} = \frac{19V}{0.0215A} = 883\Omega$$

- for the semi conductor relay output: (volume pulses, frequency signal, limit switch)

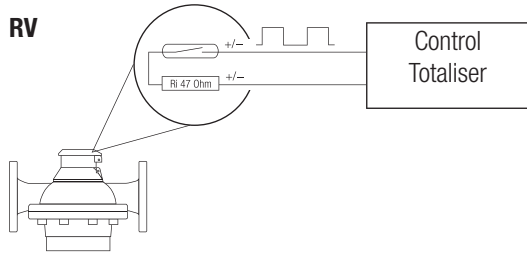
Limiting factors depend on the input specification of the higher system or the totalizer. The ability of the input to detect the actual state of the switch is specified by the system manufacturer.

For the relay switch a maximum of 100Ω at ON-state has to be considered together with the cable's resistance. A minimum of 10MΩ at OFF-state has to be considered together with the cable's capacity. The maximum permissible length of the cable depends on the individual properties for resistance and capacity.

Pulsers IN and RV

Power supply

Our range of products includes passive pulsers for the remote processing of flow data. The pulser generates one pulse per unit of volume and is to be supplied with power from the pulse processing device.



Power supply 5 ... 48 V AC/DC

Selection of the appropriate pulser

The selection of the most appropriate pulser and pulse value depends on the application. As a rule, remote totalisation demands rather large pulse values, whereas analogue signals, dosing control or indication of actual flow rate tend to need small values. Battery supplied devices can only be used together with Reed pulsers.

Selection of the processing device

The pulse length depends on the flow rate. Continuous contact may occur at zero flow. The device connected must therefore be able to accept continuous load; otherwise, protective measures have to be taken. For remote totalisation, it is recommended to use an electronic pulse counter with a low power consumption and bounce filter.

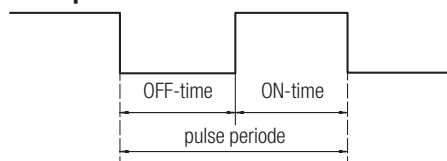
Correct pulse processing

Interrupted flow may cause hydraulic oscillation of the liquid in certain plants (hydraulic vibration with minimal backward/forward flow). The pulses which can occur in such cases may be interpreted as forward flow by the connected device. Such faulty pulses do not affect the indication of the actual value since they can only occur at almost zero flow. However, if the pulser controls a counting device, hydraulic vibration must be avoided by an appropriate modification or layout of the plant.

Pulse values

Pulse values depend on type and nominal size of the meter. They are listed in the technical information of the meter concerned.

Pulse period



Pulse period as well as on- and off-times can be calculated with the following formula:

$$\text{Pulse period in s} = \frac{\text{pulse value in litres} \times 3600}{\text{flow } Q \text{ in l/h}}$$

$$\text{On-time} = \frac{\text{pulse period in s} \times \text{on-time in \% of pulse period}}{100}$$

$$\text{Off-time} = \text{pulse period in s} \text{ minus on-time}$$

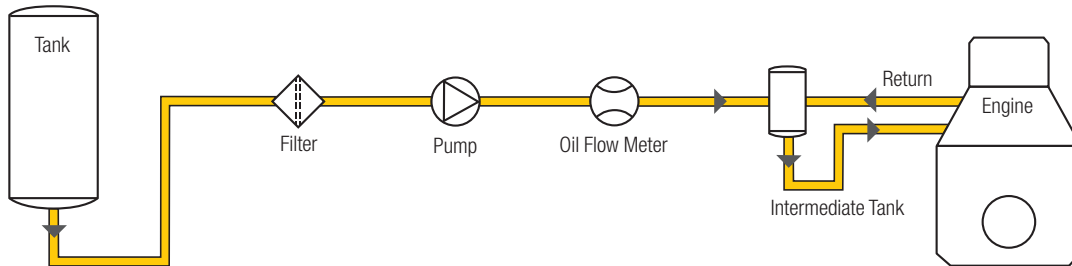
We recommend that this calculation be carried out for the highest and lowest expected flow rates.

Application examples

Diesel engine

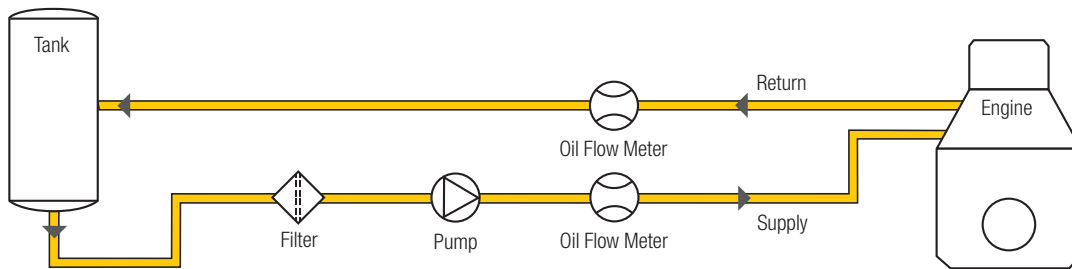
Direct consumption measurement

Instead of returning the fuel back into the main tank, an intermediate tank equipped with a heat exchanger should be installed on the supply side of the system. The flow measurement is taken in the supply pipe to the intermediate tank. The load on the meter and the measuring result correspond precisely to the consumption.



Differential measurements

For differential measurements, the piping remains unchanged, with circulation back into the tank. A flowmeter is installed in both supply and return pipes. The consumption is determined as the difference between the amount in the supply section and the amount in the return section. The meter loads therefore correspond to the supply and return flow rates.



Reasons for using special meters for differential measurements

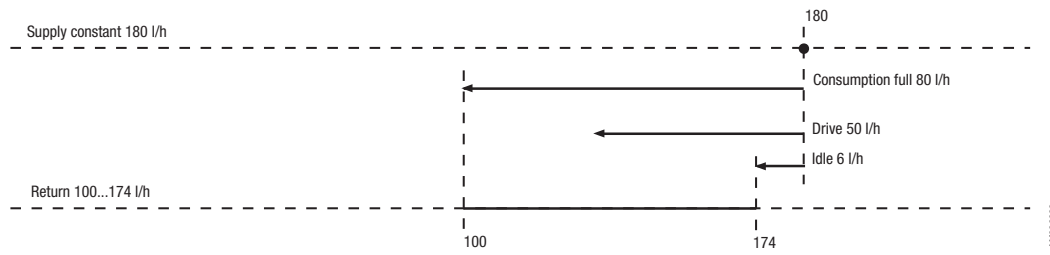
Standard meters feature a large measuring range and a max. permissible error of $\pm 1\%$. This makes them unsuitable for differential measurements, as the following example shows:

Full load	Supply	400 l/h	Error $\pm 1\%$	= nominal ± 4.0 l
	Return	150 l/h	Error $\pm 1\%$	= nominal ± 1.5 l
	Consumed	250 l/h	Divergence	nominal ± 5.5 l
	Maximum divergence	Consumed = $5.5 \times 100 : 250 = \pm 2.2\%$		
Min. load	Supply	400 l/h	Error $\pm 1\%$	= nominal ± 4.0 l
	Return	360 l/h	Error $\pm 1\%$	= nominal ± 3.6 l
	Consumed	40 l/h	Divergence	nominal ± 7.6 l
	Maximum divergence	Consumed = $7.6 \times 100 : 40 = \pm 19\%$		

For an optimal result, special meters are therefore used for differential measurements. These are precisely matched to the operating conditions and are calibrated in pairs. This means that the measurement error can be significantly reduced (for example: $\pm 0.1\%$ at constant flow rates on the supply side and $\pm 0.3\%$ with slightly variable flow rates on the return side).

Loads on meters

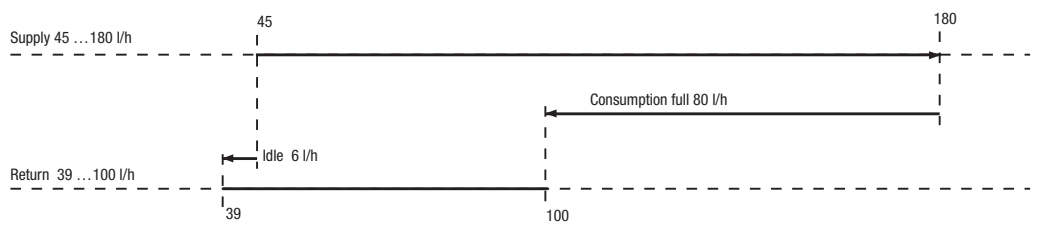
Example: Engine power 500 hp, vehicle with electric pump



Effective loads on meters

Supply	constant 180 l/h
Return	100 ... 174 l/h

Example: Engine power 500 hp, vehicle with revolution speed dependent pump 1:4

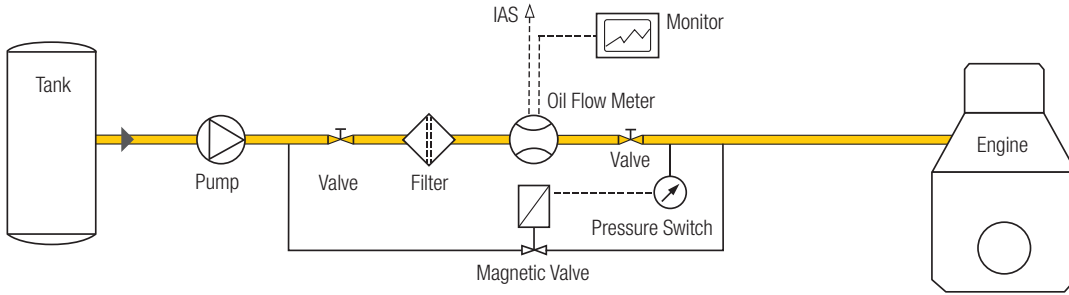


Effective loads on meters

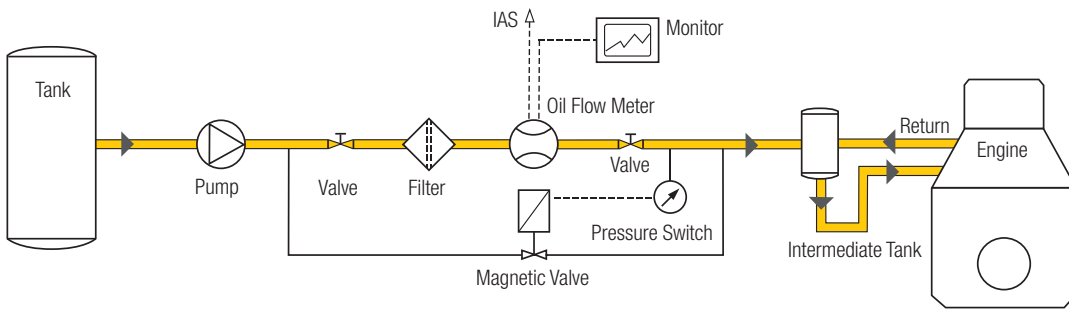
Supply	45 ... 180 l/h
Return	39 ... 100 l/h

Consumption measurement on ships

On ships, care is usually taken to ensure that the engine can still be operated at full power even if the filter is heavily contaminated or if the meter is damaged. When switching over to the bypass, attention may be drawn to the necessary maintenance via an alarm output, and the engine can be temporarily operated without measuring the consumption.

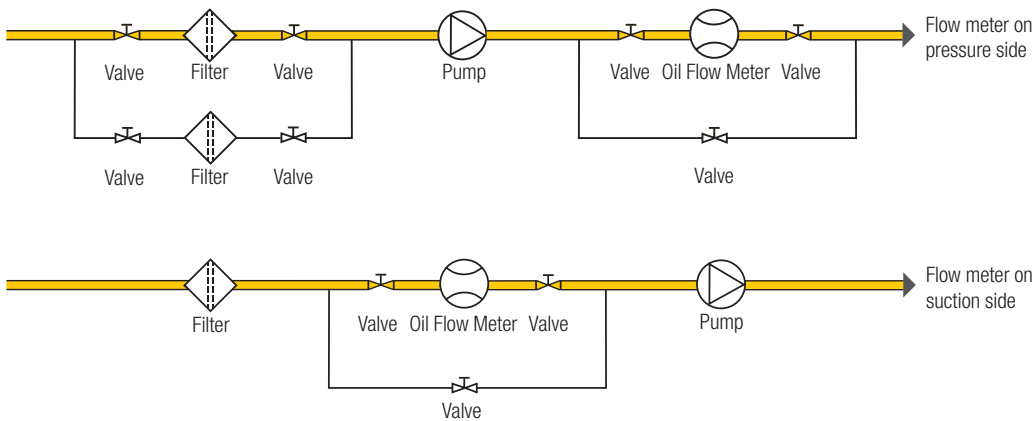


The magnetic valve opens as soon as the pressure drops below a defined level.



Float or valve control in the intermediate tank is required. Formation of gas is to be avoided. The magnetic valve opens as soon as the pressure drops below a defined level. For measuring the consumption of more than one engine, each will require a separate installation similar to the one above.

Installation of meter on suction side of pump



If the flow meter is installed on the suction side of the pump, the pressure drop at the max. allowed flow rate and highest possible viscosity must be taken into account. Also to be considered are installed filters.