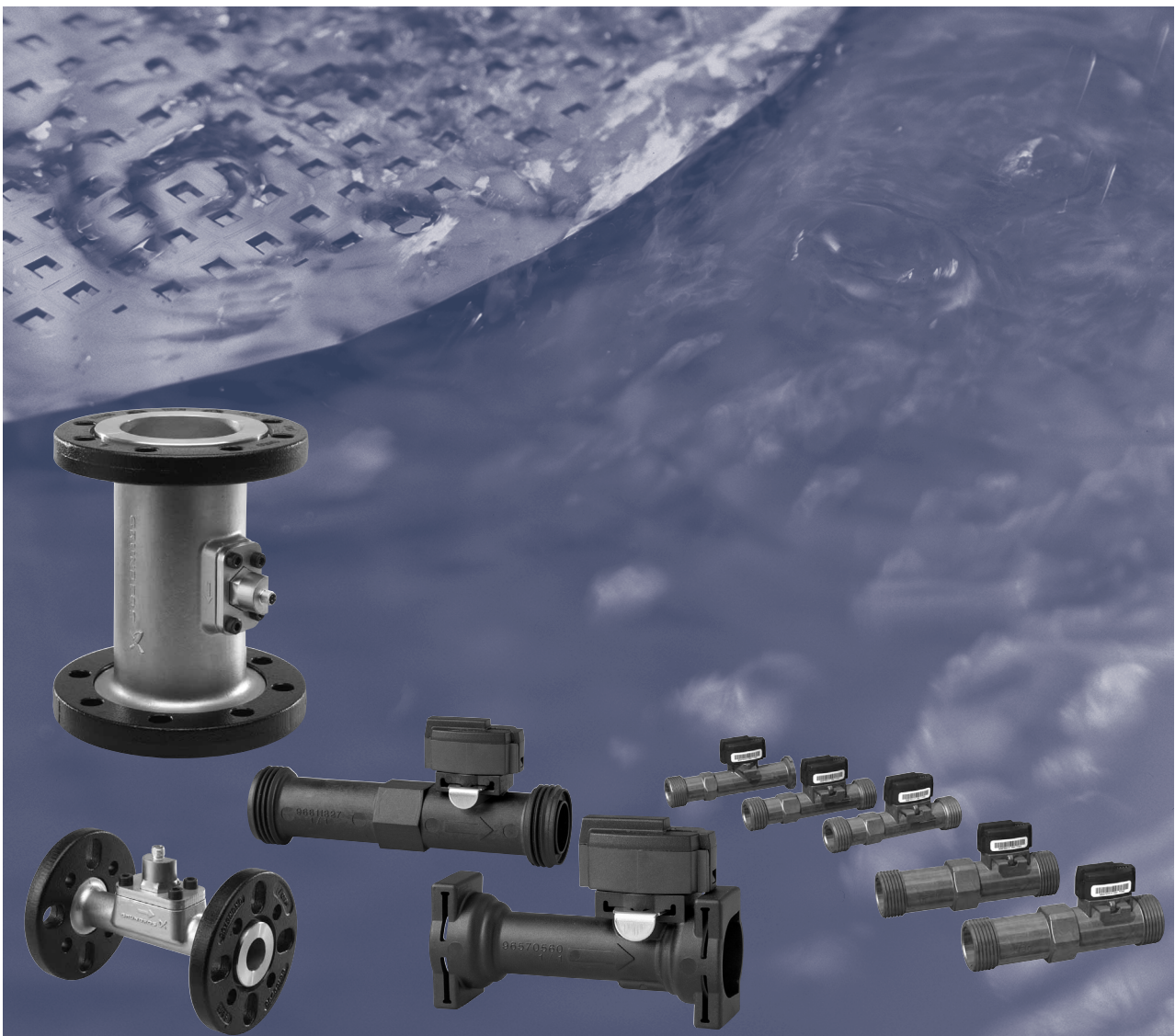


# Grundfos Direct Sensor™

Vortex flow



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# 1. Vortex Flow Sensors

## Introduction

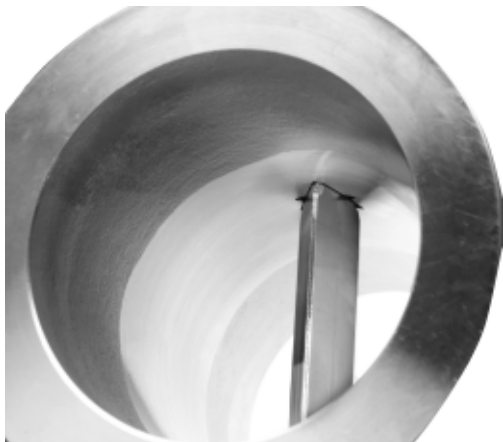
This Product guide comprises Grundfos Vortex flow sensors.



**Fig. 1** Grundfos Vortex Flow Sensors

By combining the established vortex principle with the unique metal-glass coating, Silicoat® from Grundfos, an affordable, accurate vortex flow sensor is made. Inside the vortex flow sensor a bluff body is located in the middle of the pipe, within the path of the fluid. As fluid passes this bluff body, disturbances in the flow called vortices are generated.

Downstream from the bluff body is a Grundfos Direct Sensor that can detect the pressure pulses in the flowing fluid.



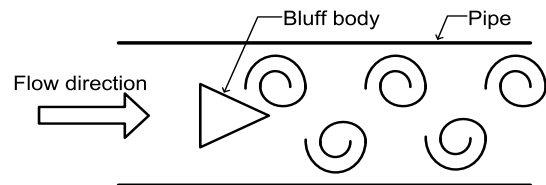
**Fig. 2** Bluff body inside a Vortex flow sensor

If the fluid is not flowing no vortices form, but as soon as the fluid starts flowing and reaches a certain flow rate vortices are created at the back of the bluff body. The vortices detach periodically from either side of the body and are carried down stream. Zones of high or low pressure are now created down the stream and this phenomenon is known as the Von Karman Vortex Street.

The pressure differences match the frequency of the vortices and the length between two vortices corresponds to a defined volume of fluid.

Therefore a total flow can be calculated by counting the vortices as they pass.

With increased flow the frequency of the vortices will increase and the frequency increases directly proportional to the flow in a full pipe.



**Fig. 3** Karman Vortex Street

The sensor detects the pressure pulsation generated by the vortices, and converts the calculated flow volume into an electrical output signal.

Note: The trademark Grundfos Direct Sensors™ is owned and controlled by the Grundfos group.

## 2. Vortex Flow Sensor Industry

### VFI General data

#### Vortex Flow\_sensor Industry



Fig. 4 VFI Sensor

TM04 7362 2210

### Technical overview

The VFI is the industrial version of the Grundfos vortex flow sensor range. The VFI is based on the principle of vortex shedding behind a bluff body. The VFI has no moving parts and is built into a stainless steel pipe. The rugged design allows the VFI to be used in a wide range of applications as a cost-effective and accurate flow sensor.

The Flow sensor is delivered with flanges or with threaded ends for use with union nuts.

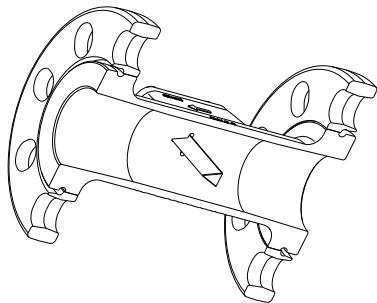


Fig. 5 Bluff body in a VFI Sensor

TM04 9228 3710

### Applications

- water treatment and distribution
- light chemical industry
- water management
- pool and water resort
- heating
- air conditioning
- cooling towers
- condensing units
- solar system

### Features

- flow range from 1.32 to 1056 GPM
- based on vortex principle
- compact and well-proven design
- approved for potable water
- wide temperature range.

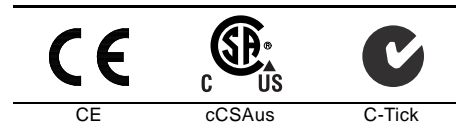
### Benefits

- no moving parts
- compatible with wet, aggressive media
- cost-effective and robust construction
- system solution with Grundfos pumps.

### Approvals

- WRAS
- KTW
- ACS
- NSF 61

### Markings



### Type key

The sensor is labelled with a type designation.

VFI 0.3-6 DN18 020 E ,Set GG	
Type	
Flow range [m3/h]	0.3-6
Pipe size [mm]	DN18
Output signal:	020 = 4-20mA, 2-wire supply 11-30V
O-ring material:	E = EPDM F = FKM
Set = Complete flow sensor	
Connection type:	GG = cast iron flange, SS = stainless steel flange G1 1/4" = thread connection

### Electrical connections

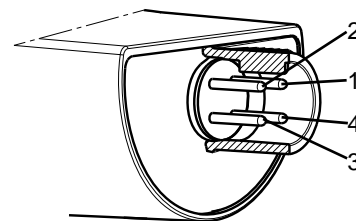


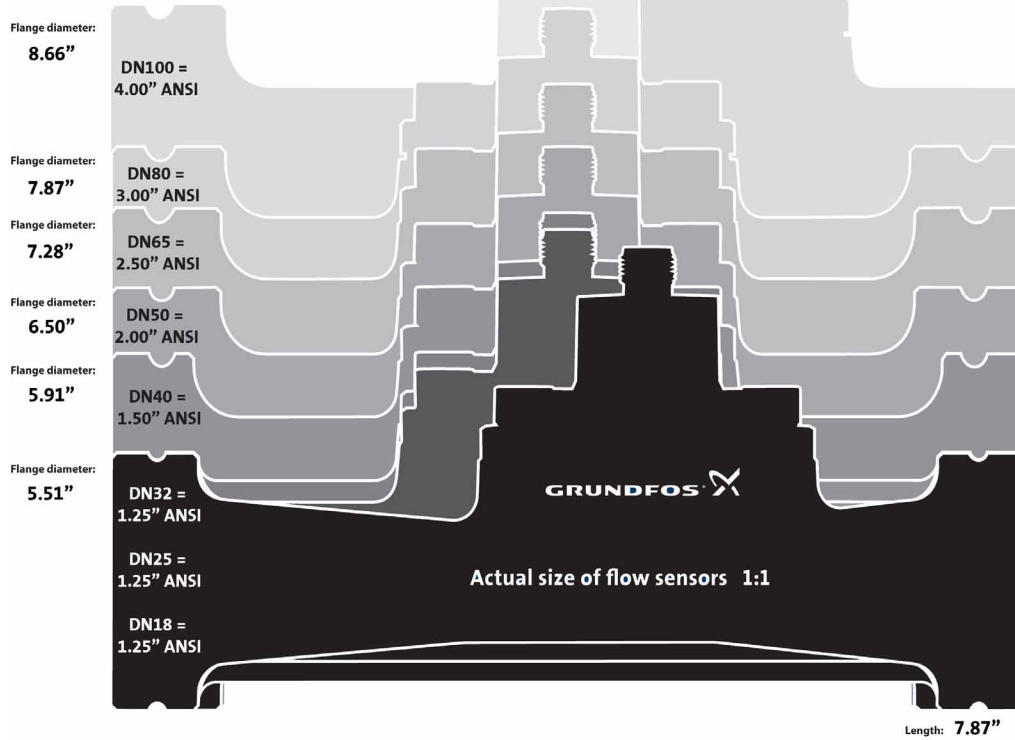
Fig. 6 Electrical connections

PIN	1	2	3	4
Wire color	Brown	White	Blue	Black
Output 4 - 20 mA	+		-	

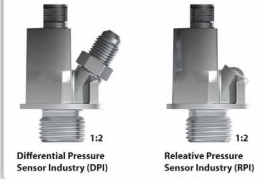
TM04 7156 1610

# Flow Sensors Chart

The product name of the flow sensor equals its inner diameter.  
e.g. DN100 = 4.00" ANSI



### Pressure sensors



### Coding for M12 connection

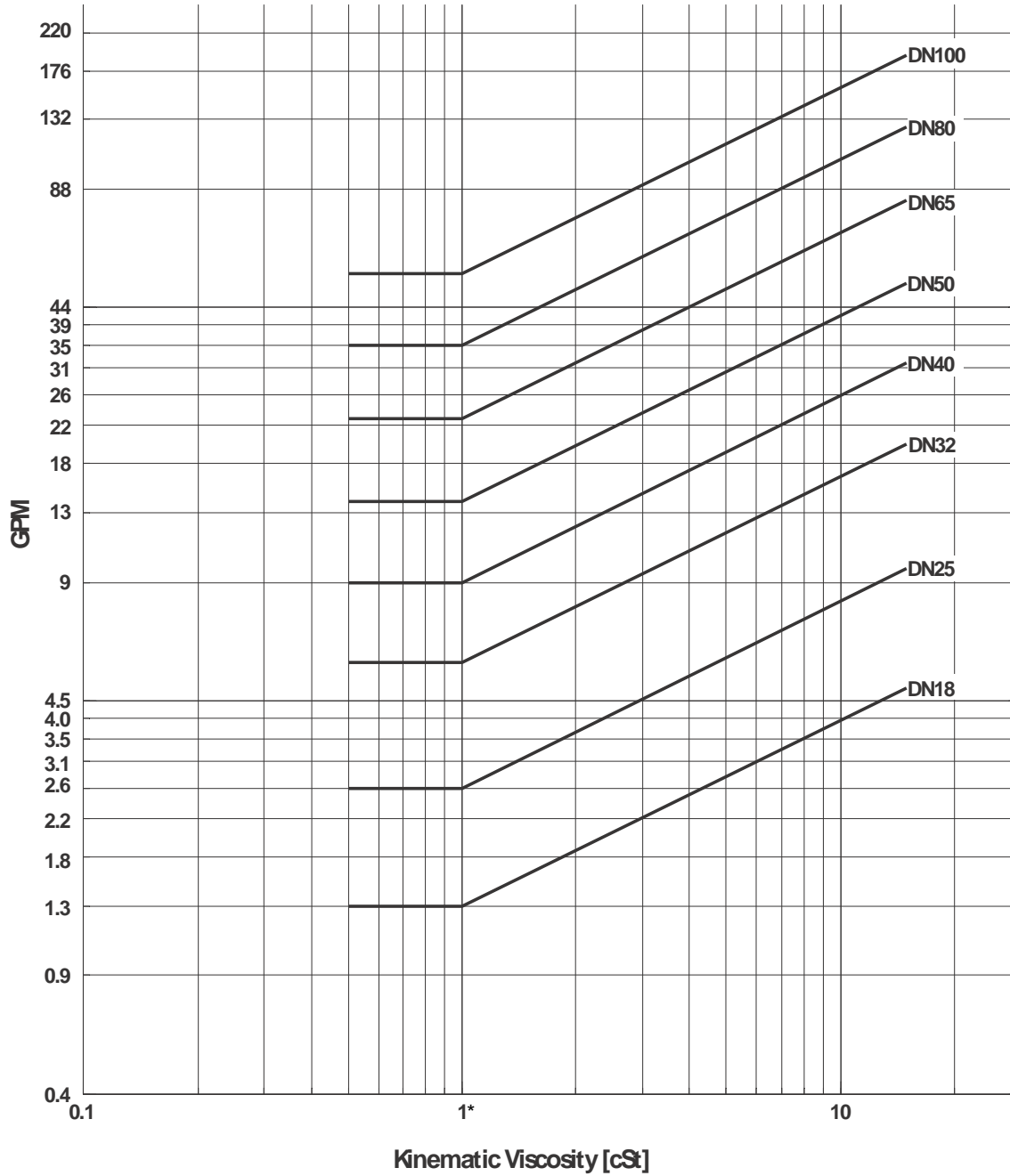


Pin	4 - 20 mA	0 - 10 V (2 x 0 - 10 V)
1	+ Supply	+ Supply
2		Pressure signal
3	- Common	- Common*
4		Temperature signal

\* Common ground for both pressure and temperature signal.

### Min. Flowrate as a function of the Kinematic Viscosity

The minimum detectable flowrate ( $Q_{min}$ ) for the VFI sensors is dependent of the Kinematic Viscosity of the liquid. The graph below shows  $Q_{min}$  as function of the Kinematic Viscosity.

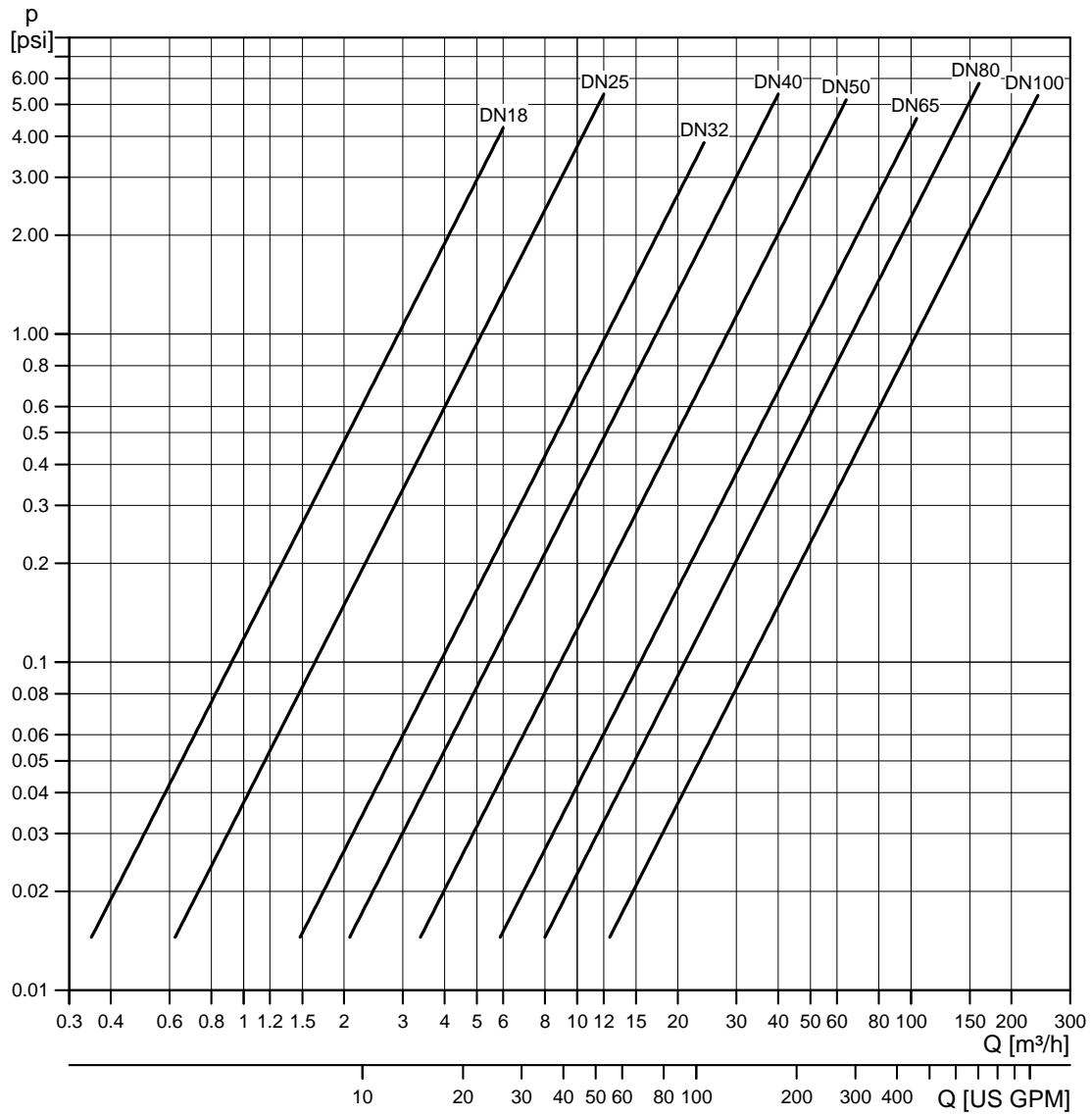


TM04 8001 2710

\*Reference condition:

- Liquids at 68°F (20°C), 1 atmosphere (1013 mbar),
- Density = 62.3 lbs./ft.<sup>3</sup> ( $\rho = 998 \text{ kg/m}^3$ ),  $\nu = 1 \text{ cSt}$

### Pressure drop curves



TM04 9390 4310

Reference condition:

- Liquids at 68°F (20°C), 1 atmosphere (1013 mbar),
- Density = 62.3 lbs./ft.<sup>3</sup> (ρ = 998 kg/m<sup>3</sup>), ν = 1 cSt

### VFI 0.3-6 DN18

Vortex Flow Industry 1.32 to 26.42 GPM (0.3 to 6 m³/h)

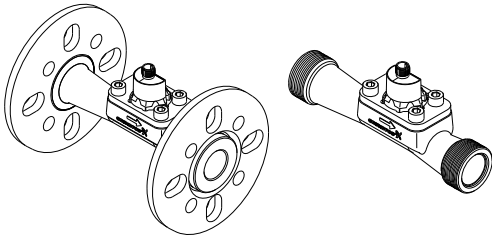


Fig. 7 VFI 0.3-6 sensor

TM047142 1710 / TM04 4250 1710

### Dimensions

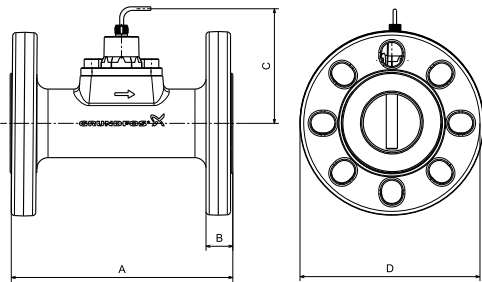


Fig. 8 Dimensions VFI sensor with flanges

TM04 7154 1610

Flange material type	Flange	A [In]	B [In]	C [In]	D [In]	Wt. [lbs.]
Cast iron	1.25"					9.66
Stainless steel	ANSI (DN25/32) [PN40]	7.88 (200mm)	0.71 (18mm)	4.72 (119mm)	5.51 (140mm)	9.70

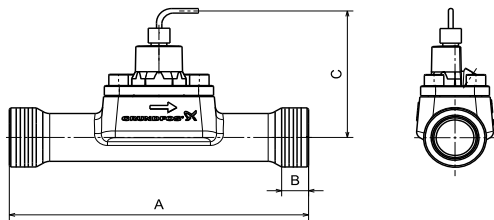


Fig. 9 Dimensions VFI sensor with thread

TM04 7153 1610

Material type	Thread size	A [In]	B [In]	C [In]	Wt. [lbs.]
Stainless steel	G1 1/4"	7.88 (200mm)	0.71 (18mm)	4.72 (119mm)	3.06

The VFI sensor with threaded ends must be mounted with union nuts.

### Specifications

Flow	
Measuring range	1.32 to 26.42 GPM (0.3 to 6 m³/h)
Accuracy ( $\pm 1\sigma$ ), 32 to 210°F (0 to 100 °C)	1.5% FS
Response time	< 1 s
Resolution	0.07 GPM (0.02 m³/h)
Media and environment	
Media types	See appendix A
Media max. pressure	360 psi (24.82 bar)
Media temperature (operation)	- 27 to 250°F (-32 to 121°C)
Media temperature (peak)	- 27 to 250°F (-32 to 121°C)
Ambient air temp. (operation)	- 13 to 140°F (-25 to 60°C)
Ambient air temp. (peak)	- 65 to 160°F (-53 to 71°C)
Storage temperature	- 65 to 160°F (-53 to 71°C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	870 psi (60 bar)
Electrical data	
Power supply	11 - 30 VDC ( $\pm 5\%$ )
Output signals	4 - 20 mA
Max. signal cable length without amplification	100 Ft. (30m)
Power consumption	max 66 mW
Load impedance	Max 60 $\Omega$ at 11 VDC Max 700 $\Omega$ at 24 VDC Max 1000 $\Omega$ at 30 VDC
Sensor materials	
Measurement element	silicon-based MEMS sensor
Packing material	EPDM or FKM rubber
Sensor housing	stainless steel 316L
Flow pipe	stainless steel 316
Bluff body	stainless steel 316
Wetted materials	corrosion-resistant coating EPDM or FKM rubber stainless steel 316L/316
ANSI Flange Class	250 lb.
Environmental standards	
Enclosure class	IP67
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1

\*See appendix page 30

### Sensor output signal

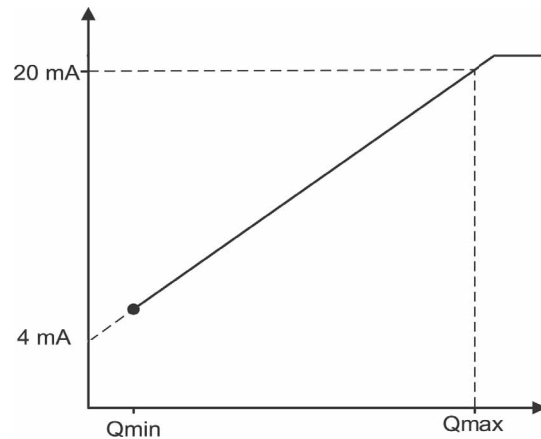


Fig. 10 Flow response

TM04 7534 1210

## VFI 0.6-12 DN25

Vortex Flow Industry 2.6 to 52.8 GPM (0.6 to 12 m³/h)

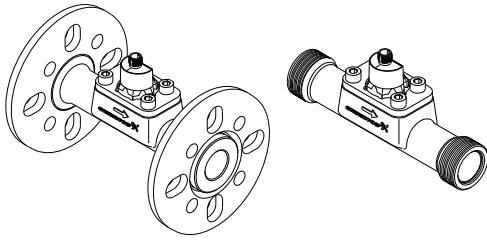


Fig. 11 VFI 0.6-12 sensor

TM047143 1710 / TM04 4251 1710

### Dimensions

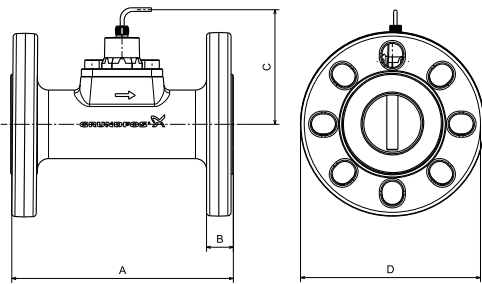


Fig. 12 Dimensions VFI sensor with flanges

TM04 7154 1610

Flange material type	Flange size	A [In]	B [In]	C [In]	D [In]	Wt. [lbs.]
Cast iron	1.25"					9.96
Stainless steel	ANSI (DN25/32) [PN40]	7.88 (200mm)	0.71 (18mm)	4.88 (123mm)	5.51 (140mm)	10.10

Flanges are compatible with DN25/32 flange size

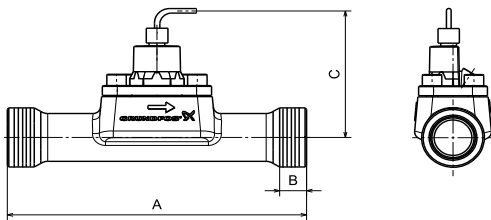


Fig. 13 Dimensions VFI sensor with thread

TM04 7153 1610

Material type	Thread size	A [In]	B [In]	C [In]	Wt. [lbs.]
Stainless steel	G1 1/4"	7.88 (200mm)	0.71 (18mm)	4.72 (119mm)	3.37

The VFI sensor with threaded ends must be mounted with union nuts.

### Specifications

Flow	
Measuring range	2.6 to 52.8 GPM (0.6 to 12 m³/h)
Accuracy ( $\pm 1\sigma$ ), 32 to 210°F (0 to 100 °C)	1.5% FS
Response time	< 1 s
Resolution	0.07 GPM (0.02 m³/h)
Media and environment	
Media types	See appendix A
Media max. pressure	360 psi (24.82 bar)
Media temperature (operation)	- 27 to 250°F (-32 to 121°C)
Media temperature (peak)	- 27 to 250°F (-32 to 121°C)
Ambient air temp. (operation)	- 13 to 140°F (-25 to 60°C)
Ambient air temp. (peak)	- 65 to 160°F (-53 to 71°C)
Storage temperature	- 65 to 160°F (-53 to 71°C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	870 psi (60 bar)
Electrical data	
Power supply	11 - 30 VDC ( $\pm 5\%$ )
Output signals	4 - 20 mA
Max. signal cable length without amplification	100 Ft. (30m)
Power consumption	max 66 mW
Load impedance	Max 60 $\Omega$ at 11 VDC
	Max 700 $\Omega$ at 24 VDC
	Max 1000 $\Omega$ at 30 VDC
Sensor materials	
Measurement element	silicon-based MEMS sensor
Packing material	EPDM or FKM rubber
Sensor housing	stainless steel 316L
Flow pipe	stainless steel 316
Bluff body	stainless steel 316
Wetted materials	corrosion-resistant coating
	EPDM or FKM rubber stainless steel 316L/316
ANSI Flange Class	250 lb.
Environmental standards	
Enclosure class	IP67
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1

\*See appendix page 30

### Sensor output signal

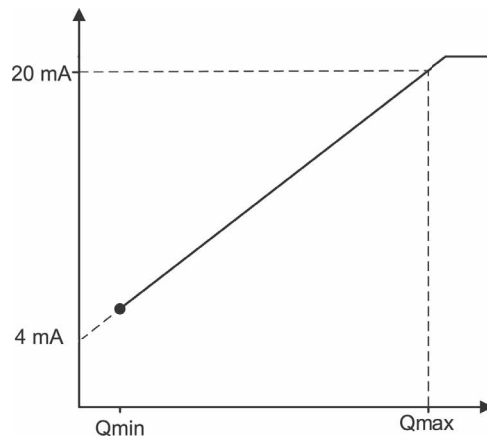


Fig. 14 Flow response

TM04 7534 1210

### VFI 1.3-25 DN32

Vortex Flow Industry 5.7 to 110 GPM (1.3 to 25 m³/h)

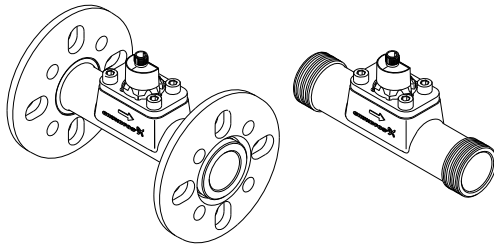


Fig. 15 VFI 1.3-25 sensor

TM047144 1710 / TM04 4252 1710

### Dimensions

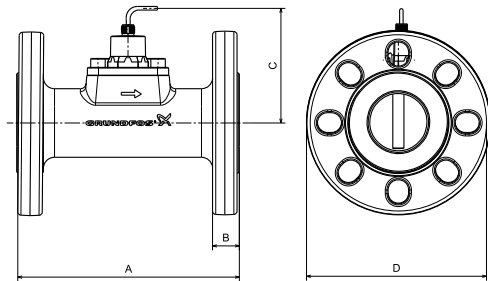


Fig. 16 Dimensions VFI sensor with flanges

TM04 7154 1610

Flange material type	Flange size	A [In]	B [In]	C [In]	D [In]	Wt. [lbs.]
Cast iron	1.25" ANSI	7.88	0.71	5.04	5.51	9.85
Stainless steel	(DN25/32) [PN40]	(200mm)	(18mm)	(128mm)	(140mm)	9.99

Flanges are compatible with DN25/32 flange size

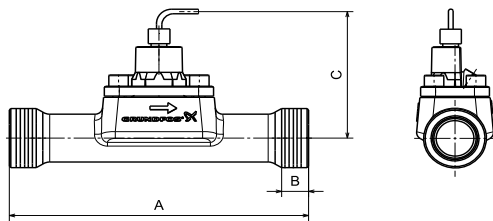


Fig. 17 Dimensions VFI sensor with thread

TM04 7153 1610

Material type	Thread size	A [In]	B [In]	C [In]	Wt. [lbs.]
Stainless steel	G 1 1/2"	7.88 (200mm)	0.75 (19mm)	5.04 (128mm)	2.89

The VFI sensor with threaded ends must be mounted with union nuts.

### Specifications

Flow	
Measuring range	5.7 to 110 GPM (1.3 to 25 m³/h)
Accuracy ( $\pm 1\sigma$ ), 32 to 210°F (0 to 100 °C)	1.5% FS
Response time	< 1 s
Resolution	0.14 GPM (0.03 m³/h)
Media and environment	
Media types	See appendix A
Media max. pressure	360 psi (24.82 bar)
Media temperature (operation)	- 27 to 250°F (-32 to 121°C)
Media temperature (peak)	- 27 to 250°F (-32 to 121°C)
Ambient air temp. (operation)	- 13 to 140°F (-25 to 60°C)
Ambient air temp. (peak)	- 65 to 160°F (-53 to 71°C)
Storage temperature	- 65 to 160°F (-53 to 71°C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	870 psi (60 bar)
Electrical data	
Power supply	11 - 30 VDC ( $\pm 5\%$ )
Output signals	4 - 20 mA
Max. signal cable length without amplification	100 Ft. (30m)
Power consumption	max 66 mW
Load impedance	Max 60 $\Omega$ at 11 VDC Max 700 $\Omega$ at 24 VDC Max 1000 $\Omega$ at 30 VDC
Sensor materials	
Measurement element	silicon-based MEMS sensor
Packing material	EPDM or FKM rubber
Sensor housing	stainless steel 316L
Flow pipe	stainless steel 316
Bluff body	stainless steel 316
Wetted materials	corrosion-resistant coating EPDM or FKM rubber stainless steel 316L/316
ANSI Flange Class	250 lb.
Environmental standards	
Enclosure class	IP67
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1

\*See appendix page 30

### Sensor output signal

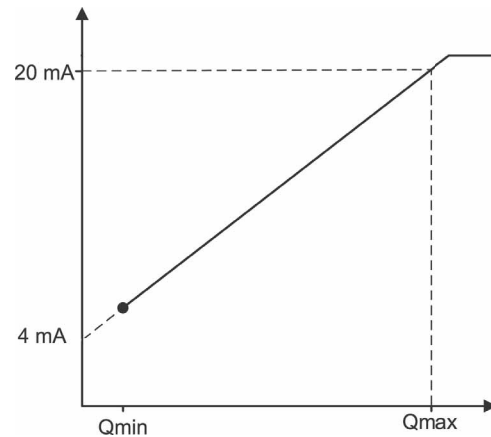


Fig. 18 Flow response

TM04 7534 1210

## VFI 2-40 DN40

Vortex Flow Industry 8.8 to 176 GPM (2 to 40 m³/h)

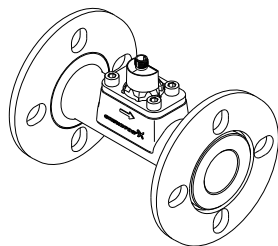
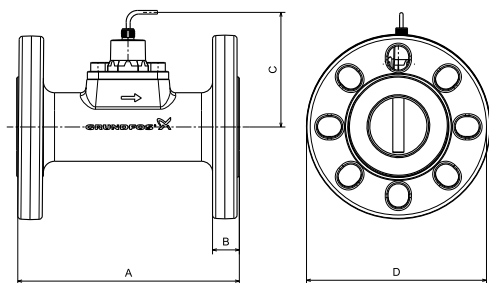


Fig. 19 VFI 2 - 40 sensor

TM047145 1710

## Dimensions



TM04 7154 1610

Fig. 20 Dimensions VFI sensor with flanges

Flange material type	Flange size	A [In]	B [In]	C [In]	D [In]	Wt. [lbs.]
Cast iron	1.50"					12.30
Stainless steel	ANSI (DN40) (PN40)	7.88 (200mm)	0.71 (18mm)	5.16 (131mm)	5.91 (150mm)	14.22

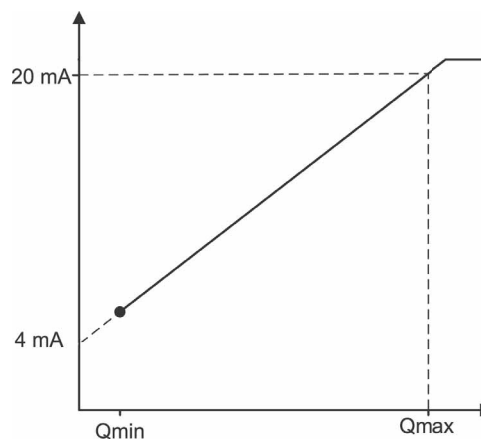
Flanges are compatible with DN40 flange size

## Specifications

Flow	
Measuring range	8.8 to 176 GPM (2 to 40 m³/h)
Accuracy ( $\pm 1\sigma$ ), 32 to 210°F (0 to 100 °C)	1.5% FS
Response time	< 1 s
Resolution	0.22 GPM (0.05 m³/h)
Media and environment	
Media types	See appendix A
Media max. pressure	360 psi (24.82 bar)
Media temperature (operation)	- 27 to 250°F (-32 to 121°C)
Media temperature (peak)	- 27 to 250°F (-32 to 121°C)
Ambient air temp. (operation)	- 13 to 140°F (-25 to 60°C)
Ambient air temp. (peak)	- 65 to 160°F (-53 to 71°C)
Storage temperature	- 65 to 160°F (-53 to 71°C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	870 psi (60 bar)
Electrical data	
Power supply	11 - 30 VDC ( $\pm 5\%$ )
Output signals	4 - 20 mA
Max. signal cable length without amplification	100 Ft. (30m)
Power consumption	max 66 mW
Load impedance	Max 60 $\Omega$ at 11 VDC Max 700 $\Omega$ at 24 VDC Max 1000 $\Omega$ at 30 VDC
Sensor materials	
Measurement element	silicon-based MEMS sensor
Packing material	EPDM or FKM rubber
Sensor housing	stainless steel 316L
Flow pipe	stainless steel 316
Bluff body	stainless steel 316
Wetted materials	corrosion-resistant coating EPDM or FKM rubber stainless steel 316L/316
ANSI Flange Class	250 lb.
Environmental standards	
Enclosure class	IP67
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1

\*See appendix page 30

## Sensor output signal



TM04 7534 1210

Fig. 21 Flow response

### VFI 3.2-64 DN50

Vortex Flow Industry 14 to 282 GPM (3.2 to 64 m³/h)

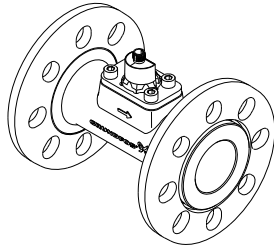


Fig. 22 VFI 2 - 64 sensor

TM047146 1710

### Dimensions

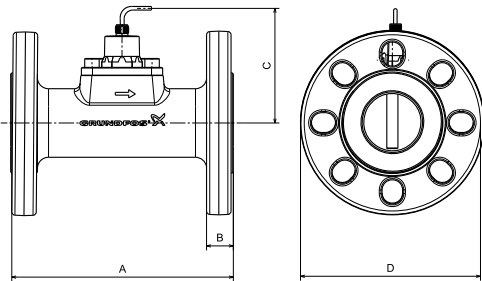


Fig. 23 Dimensions VFI sensor with flanges

TM04 7154 1610

Flange material type	Flange size	A [In]	B [In]	C [In]	D [In]	Wt. [lbs.]
Cast iron	2.00"	7.88	0.87	5.43	6.50	15.30
Stainless steel	ANSI DN50 (PN40)	(200mm)	(22mm)	(137mm)	(165mm)	13.10

Flanges are compatible with DN50 flange size

### Specifications

Flow	
Measuring range	14 to 282 GPM (3.2 to 64 m³/h)
Accuracy ( $\pm 1\sigma$ ), 32 to 210°F (0 to 100 °C)	1.5% FS
Response time	< 1 s
Resolution	0.35 GPM (0.07 m³/h)
Media and environment	
Media types	See appendix A
Media max. pressure	360 psi (24.82 bar)
Media temperature (operation)	- 27 to 250°F (-32 to 121°C)
Media temperature (peak)	- 27 to 250°F (-32 to 121°C)
Ambient air temp. (operation)	- 13 to 140°F (-25 to 60°C)
Ambient air temp. (peak)	- 65 to 160°F (-53 to 71°C)
Storage temperature	- 65 to 160°F (-53 to 71°C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	870 psi (60 bar)
Electrical data	
Power supply	11 - 30 VDC ( $\pm 5\%$ )
Output signals	4 - 20 mA
Max. signal cable length without amplification	100 Ft. (30m)
Power consumption	max 66 mW
Load impedance	Max 60 $\Omega$ at 11 VDC Max 700 $\Omega$ at 24 VDC Max 1000 $\Omega$ at 30 VDC
Sensor materials	
Measurement element	silicon-based MEMS sensor
Packing material	EPDM or FKM rubber
Sensor housing	stainless steel 316L
Flow pipe	stainless steel 316
Bluff body	stainless steel 316
Wetted materials	corrosion-resistant coating EPDM or FKM rubber stainless steel 316L/316
ANSI Flange Class	250 lb.
Environmental standards	
Enclosure class	IP67
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1

\*See appendix page 30

### Sensor output signal

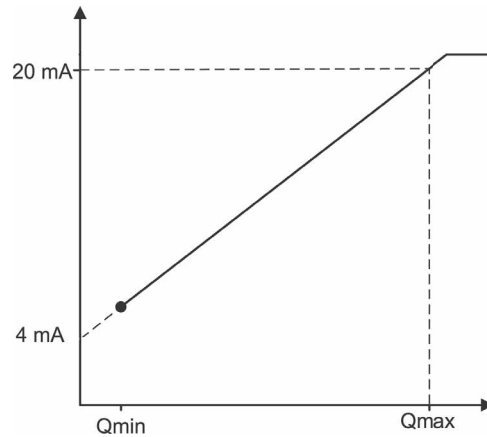


Fig. 24 Flow response

TM04 7534 1210

## VFI 5.2-104 DN65

Vortex Flow Industry 22.9 to 458 GPM (5.2 to 104 m³/h)

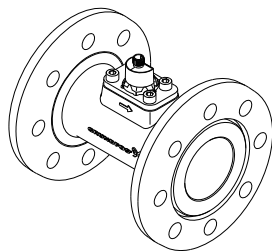


Fig. 25 VFI 5.2 - 104 sensor

### Dimensions

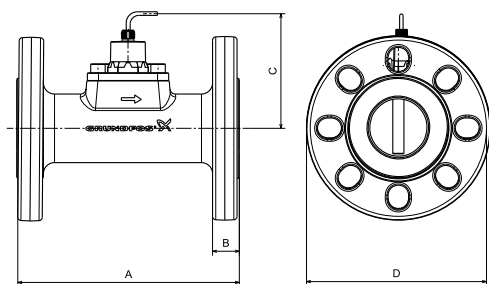


Fig. 26 Dimensions VFI sensor with flanges

Flange material type	Flange size	A [In]	B [In]	C [In]	D [In]	Wt. [lbs.]
Cast iron	2.50"					20.53
Stainless steel	ANSI DN65 (PN40)	7.88 (200mm)	0.98 (25mm)	5.71 (145mm)	7.28 (185mm)	21.83

Flanges are compatible with DN65 flange size

### Specifications

Flow	
Measuring range	22.9 to 458 GPM (5.2 to 104 m³/h)
Accuracy ( $\pm 1\sigma$ ), 32 to 210°F (0 to 100 °C)	1.5% FS
Response time	< 1 s
Resolution	0.57 GPM (0.12 m³/h)
Media and environment	
Media types	See appendix A
Media max. pressure	360 psi (24.82 bar)
Media temperature (operation)	- 27 to 250°F (-32 to 121°C)
Media temperature (peak)	- 27 to 250°F (-32 to 121°C)
Ambient air temp. (operation)	- 13 to 140°F (-25 to 60°C)
Ambient air temp. (peak)	- 65 to 160°F (-53 to 71°C)
Storage temperature	- 65 to 160°F (-53 to 71°C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	870 psi (60 bar)
Electrical data	
Power supply	11 - 30 VDC ( $\pm 5\%$ )
Output signals	4 - 20 mA
Max. signal cable length without amplification	100 Ft. (30m)
Power consumption	max 66 mW
Load impedance	Max 60 $\Omega$ at 11 VDC
	Max 700 $\Omega$ at 24 VDC
	Max 1000 $\Omega$ at 30 VDC
Sensor materials	
Measurement element	silicon-based MEMS sensor
Packing material	EPDM or FKM rubber
Sensor housing	stainless steel 316L
Flow pipe	stainless steel 316
Bluff body	stainless steel 316
Wetted materials	corrosion-resistant coating
	EPDM or FKM rubber
	stainless steel 316L/316
ANSI Flange Class	250 lb.
Environmental standards	
Enclosure class	IP67
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1

\*See appendix page 30

### Sensor output signal

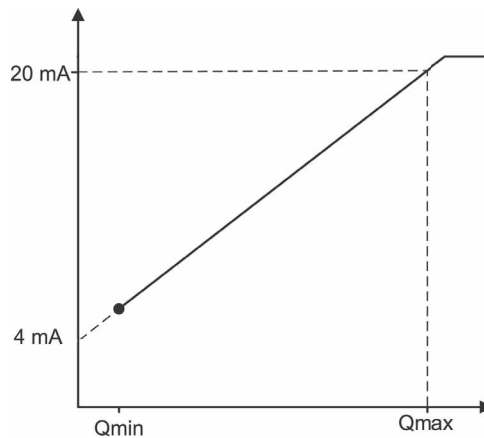


Fig. 27 Flow response

### VFI 8-160 DN80

Vortex Flow Industry 35 to 704 GPM (3 to 160 m³/h)

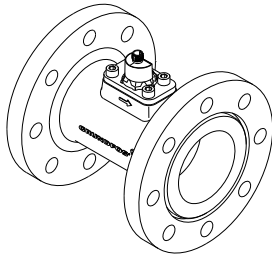


Fig. 28 VFI 8 - 160 sensor

TM047148 1710

### Dimensions

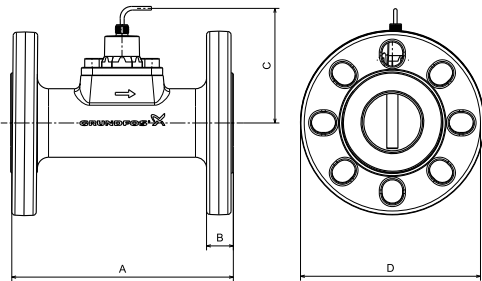


Fig. 29 Dimensions VFI sensor with flanges

TM04 7154 1610

Flange material type	Flange size	A [In]	B [In]	C [In]	D [In]	Wt. [lbs.]
Cast iron	3.50"					25.38
Stainless steel	ANSI DN80 (PN40)	7.88 (200mm)	0.98 (24.89mm)	5.98 (151mm)	9.25 (235mm)	35.27

Flanges are compatible with DN80 flange size

### Specifications

Flow	
Measuring range	35 to 704 GPM (3 to 160 m³/h)
Accuracy ( $\pm 1\sigma$ ), 32 to 210°F (0 to 100 °C)	1.5% FS
Response time	< 1 s
Resolution	0.88 GPM (0.19 m³/h)
Media and environment	
Media types	See appendix A
Media max. pressure	360 psi (24.82 bar)
Media temperature (operation)	- 27 to 250°F (-32 to 121°C)
Media temperature (peak)	- 27 to 250°F (-32 to 121°C)
Ambient air temp. (operation)	- 13 to 140°F (-25 to 60°C)
Ambient air temp. (peak)	- 65 to 160°F (-53 to 71°C)
Storage temperature	- 65 to 160°F (-53 to 71°C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	870 psi (60 bar)
Electrical data	
Power supply	11 - 30 VDC ( $\pm 5\%$ )
Output signals	4 - 20 mA
Max. signal cable length without amplification	100 Ft. (30m)
Power consumption	max 66 mW
Load impedance	Max 60 $\Omega$ at 11 VDC Max 700 $\Omega$ at 24 VDC Max 1000 $\Omega$ at 30 VDC
Sensor materials	
Measurement element	silicon-based MEMS sensor
Packing material	EPDM or FKM rubber
Sensor housing	stainless steel 316L
Flow pipe	stainless steel 316
Bluff body	stainless steel 316
Wetted materials	corrosion-resistant coating EPDM or FKM rubber stainless steel 316L/316
ANSI Flange Class	250 lb.
Environmental standards	
Enclosure class	IP67
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1

\*See appendix page 30

### Sensor output signal

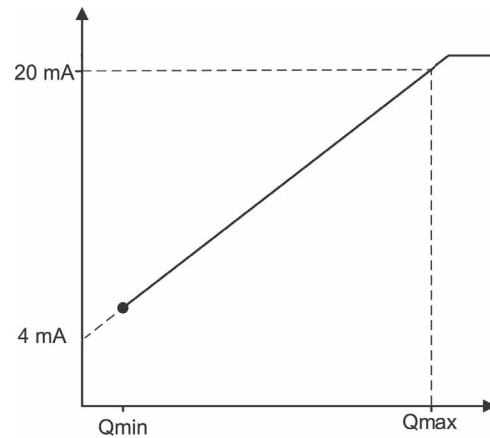


Fig. 30 Flow response

TM04 7534 1210

# VFI 12-240 DN100

Vortex Flow Industry, 52.8 to 1056 (12 to 240 m³/h)

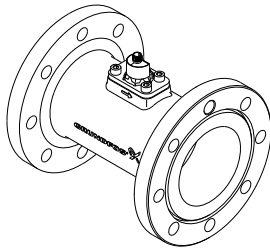
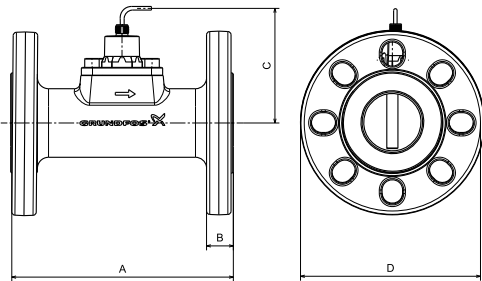


Fig. 31 VFI 12 - 240 sensor

TM047149 1710

## Dimensions



TM04 7154 1610

Fig. 32 Dimensions VFI sensor with flanges

Flange material type	Flange size	A [In]	B [In]	C [In]	D [In]	Wt. [lbs.]
Cast iron	4.00" ANSI	9.84	0.98	6.42	8.66	29.89
Stainless steel	DN100 (PN16)	(250mm)	(25mm)	(163mm)	(220mm)	30.86

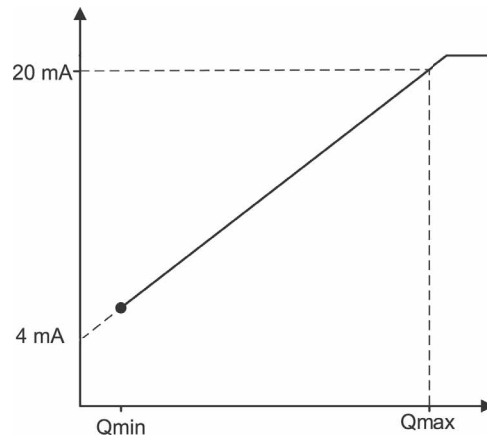
Flanges are compatible with DN100 flange size

## Specifications

Flow	
Measuring range	52.8 to 1056 GPM (12 to 240 m³/h)
Accuracy ( $\pm 1\sigma$ ), 32 to 210°F (0 to 100 °C)	1.5% FS
Response time	< 1 s
Resolution	1.32 GPM (0.29 m³/h)
Media and environment	
Media types	See appendix A
Media max. pressure	360 psi (24.82 bar)
Media temperature (operation)	- 27 to 250°F (-32 to 121°C)
Media temperature (peak)	- 27 to 250°F (-32 to 121°C)
Ambient air temp. (operation)	- 13 to 140°F (-25 to 60°C)
Ambient air temp. (peak)	- 65 to 160°F (-53 to 71°C)
Storage temperature	- 65 to 160°F (-53 to 71°C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	870 psi (60 bar)
Electrical data	
Power supply	11 - 30 VDC ( $\pm 5\%$ )
Output signals	4 - 20 mA
Max. signal cable length without amplification	100 Ft. (30m)
Power consumption	max 66 mW
Load impedance	Max 60 $\Omega$ at 11 VDC Max 700 $\Omega$ at 24 VDC Max 1000 $\Omega$ at 30 VDC
Sensor materials	
Measurement element	silicon-based MEMS sensor
Packing material	EPDM or FKM rubber
Sensor housing	stainless steel 316L
Flow pipe	stainless steel 316
Bluff body	stainless steel 316
Wetted materials	corrosion-resistant coating EPDM or FKM rubber stainless steel 316L/316
ANSI Flange Class	250 lb.
Environmental standards	
Enclosure class	IP67
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1

\*See appendix page 30

## Sensor output signal



TM04 7534 1210

Fig. 33 Flow response

## 3. Vortex Flow Sensor Standard

### VFS General data

#### Vortex Flow sensor Standard



Fig. 34 VFS and VFS QT Sensors

### Technical overview

Grundfos Direct Sensors™, type VFS, is a series of combined flow- and temperature sensors (two-in-one) based on the principle of vortex shedding behind a bluff body. The VFS sensors are designed for high-volume production and are fully compatible with wet, aggressive media. The VFS sensor utilizes MEMS sensing technology in combination with a novel packaging concept using corrosion-resistant coating on the MEMS sensor element. This makes the VFS sensor very robust and ideal for high-volume OEM applications.

### Applications

- thermal management in solar heating systems
- industrial process flow control
- flow rate detection for pump controls
- monitoring of pumps, valves and filters
- cooling and temperature control
- domestic hot-water systems
- heat metering indication (solar - heat pumps).

### Features

- flow ranges: 0.2 - 5.2 GPM, 0.4 - 10.7 GPM, 1.5 - 26.5 GPM, 2.6 - 53 GPM, 5.2 - 105 GPM
- based on vortex shedding
- voltage output (ratiometric, ideal for use with microprocessor and PLC)
- compact and robust design
- approved for potable water: WRAS, KTW, W270, ACS.

### Benefits

- no moving parts
- flow and temperature sensor in one package (two-in-one sensor)
- quick temperature response (direct media contact)
- compatible with wet, aggressive media
- cost-effective and robust construction.

### Type key

The sensor is labeled with a type designation.

96xxxxxx - XX - XXX XXXXX			
Product number			
Revision			
Production year and week			
Consecutive number			

### Electrical connections

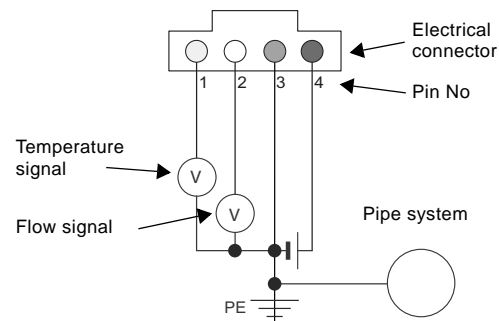


Fig. 35 Electrical connections

Pin configuration	Color
1 Temperature signal (0.5 to 3.5 V relative to pin 3)	Yellow
2 Flow signal (0.5 to 3.5 V relative to pin 3)	White
3 GND (0 V), PELV	Green
4 Power supply (+ 5 V DC)	Brown

### Power supply requirements

- 5 Vdc
- separated from hazardous live circuitry by double or reinforced insulation
- power limitation: 150 VA; current limitation: 8 A.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

### VFS 1 - 20

Vortex Flow sensor standard, 0.2 to 5.2 gpm (1 to 20 l/min)



Fig. 36 VFS 1 - 20 sensor

### Dimensions [inch (mm)]

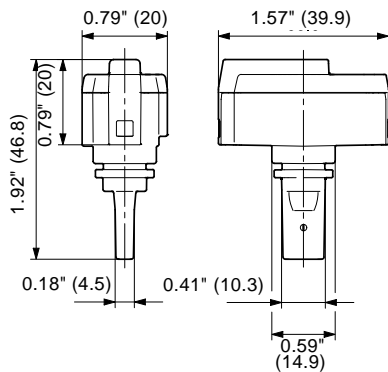


Fig. 37 Dimensional sketches of sensing element

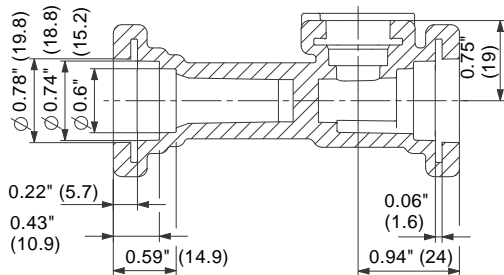


Fig. 38 Dimensional sketch of flow pipe

### Sensor output signals

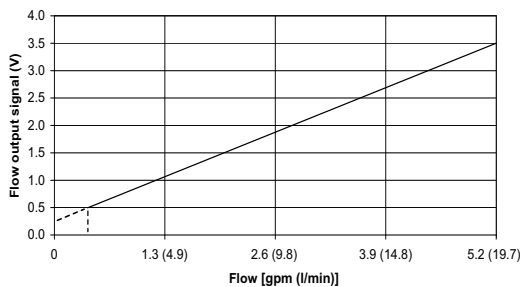


Fig. 39 Flow response

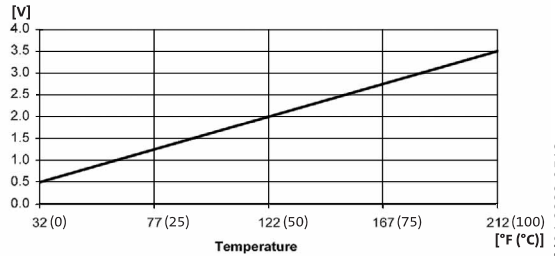


Fig. 40 Temperature response

### Specifications

Flow	
Measuring range	0.2 to 5.2 gpm (1 to 20 l/min)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 1.5\%$ FS
Response time (63.2 %)	< 1s
Resolution	0.03 gpm (0.11 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8$ °F ( $\pm 1.0$ °C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6$ °F ( $\pm 2.0$ °C)
Response time (63.2 % at 50 % FS flow)	< 1s
Resolution	0.9 °F (0.5 °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 2$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F (-25 to 120 °C),
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 to 95 % (relative), non-condensing
System burst pressure	140 psi (9.65 bars)
Electrical data	
Power supply	5 V DC ( $\pm 5\%$ ). Grounding of the sensor supply is recommended (PELV)
Output signals	Ratiometric linear
Flow signal	0.35 to 3.5 V (Zero at 0.35 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 k $\Omega$
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
Housing	Composites (PPS, PA66)
Flow pipe	PPA 40-GF
Wetted materials	Corrosion-resistant coating, EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.84"x1.57"x0.79" (47x40x20mm), see drawing
Flow pipe	3.23"x1.54"x0.98" (88x39x25mm)

\*See appendix page 30

### VFS 2 - 40

Vortex Flow sensor Standard, 0.4 to 10.7 gpm (2 to 40 l/min)



Fig. 41 VFS 2 - 40 sensor

### Dimensions [inch (mm)]

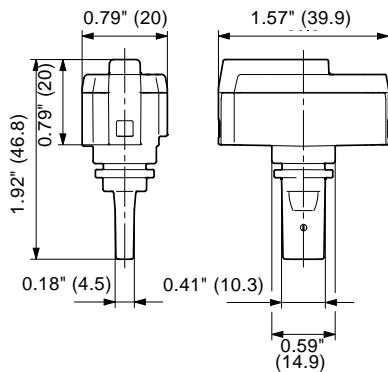


Fig. 42 Dimensional sketches of sensing element

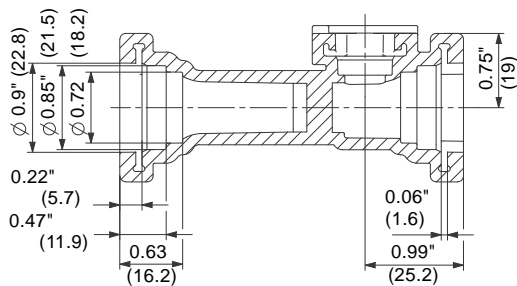


Fig. 43 Dimensional sketch of flow pipe

### Sensor output signals

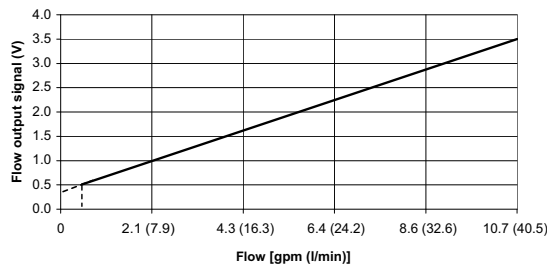


Fig. 44 Flow response

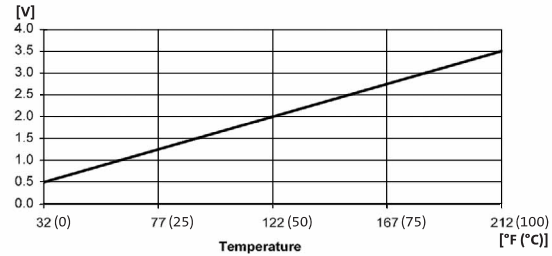


Fig. 45 Temperature response

### Specifications

Flow	
Measuring range	0.4 to 10.7 gpm (2 to 40 l/min)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 1.5\%$ FS
Response time (63.2 %)	< 1 s
Resolution	0.05 gpm (0.19 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8$ °F ( $\pm 1.0$ °C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6$ °F ( $\pm 2.0$ °C)
Response time (63.2 % at 50 %FS flow)	< 1 s
Resolution	0.9 °F (0.5 °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 2$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F (-25 to 120 °C)
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 - 95 % (relative), non-condensing
System burst pressure	240 psi (16.54 bars)
Electrical data	
Power supply	5 V DC ( $\pm 5\%$ ). Grounding of the sensor supply is required (PELV)
Output signals	Ratiometric linear
Flow signal	0.5 - 3.5 V (Zero at 0.35 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 k $\Omega$
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
Housing	Composites (PPS, PA66)
Flow pipe	PPA 40-GF
Wetted materials	Corrosion-resistant coating, EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.84"x1.57"x0.79" (47x40x20mm), see drawing
Flow pipe	3.47"x1.54"x0.98" (88x39x25mm)

TM03 8210 0807

TM03 8136 0607

TM03 8204 0807

TM04 8866 0211

TM04 9828 0512

### VFS 5-100

Vortex Flow sensor Standard, 1.5 to 26.5 gpm (5 to 100 l/min)



Fig. 46 VFS 5-100 sensor

### Dimensions [inch (mm)]

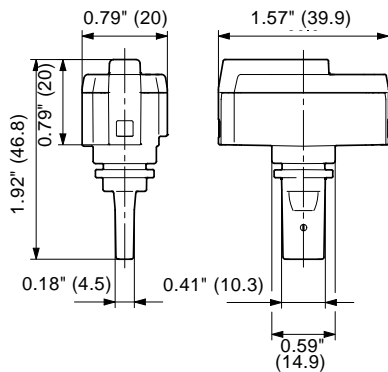


Fig. 47 Dimensional sketches of sensing element

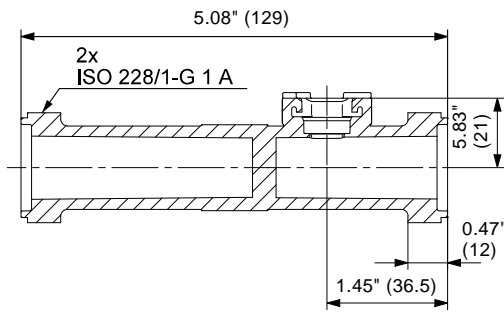


Fig. 48 Dimensional sketch of flow pipe

### Sensor output signals

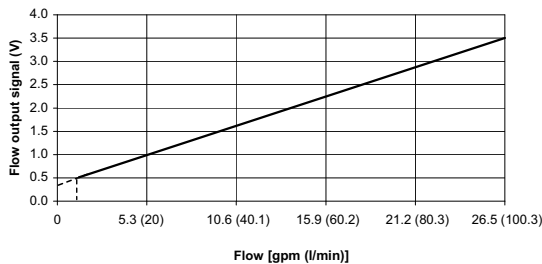


Fig. 49 Flow response

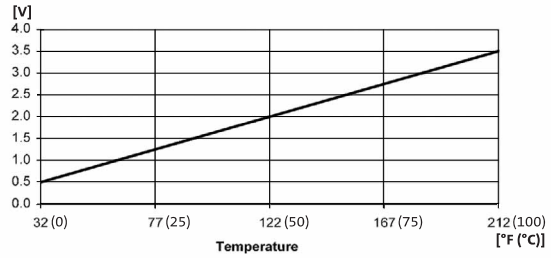


Fig. 50 Temperature response

### Specifications

Flow	
Measuring range	1.5 to 26.5 gpm (5 to 100 l/min)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 1.5\%$ FS
Response time (63.2 %)	< 1 s
Resolution	0.13 gpm (0.49 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8\%$ ( $\pm 1.0\%$ °C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6\%$ ( $\pm 2.0\%$ °C)
Response time (63.2 % at 50 % FS flow)	< 1 s
Resolution	0.9 °F ( $\pm 0.5\%$ °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 2$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F, (-25 to 120 °C), non freezing
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 - 95 % (relative), non-condensing
System burst pressure	240 psi (16.54 bars)
Electrical data	
Power supply	5 V DC ( $\pm 5\%$ ). Grounding of the sensor supply is required (PELV)
Output signals	Ratiometric
Flow signal	0.5 - 3.5 V (Zero at 0.35 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 k $\Omega$
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
Housing	Composites (PPS, PA66)
Flow pipe	PPA 40-GF
Wetted materials	Corrosion-resistant coating, EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.84"x1.57"x0.79" (46.73x39.87x20.06mm), see drawing
Flow pipe	5.08"x1.46"x1.26" (129.03x37.08x32mm)

TM03 8211 0807

TM03 8136 0607

TM03 8219 0807

TM04 8867 0211

TM04 9828 0512

### VFS 10-200

Vortex Flow sensor Standard, 2.6 to 53 gpm (10 to 200 l/min)



Fig. 51 VFS 10-200 sensor

### Dimensions [inch (mm)]

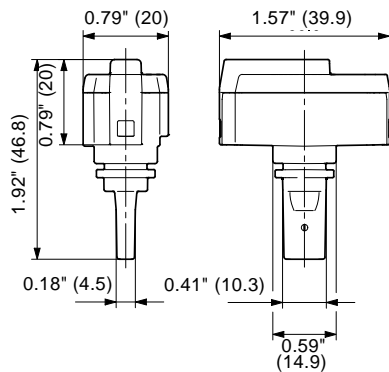


Fig. 52 Dimensional sketches of sensing element

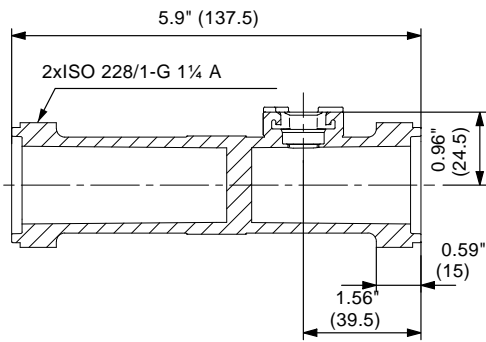


Fig. 53 Dimensional sketch of flow pipe

### Sensor output signals

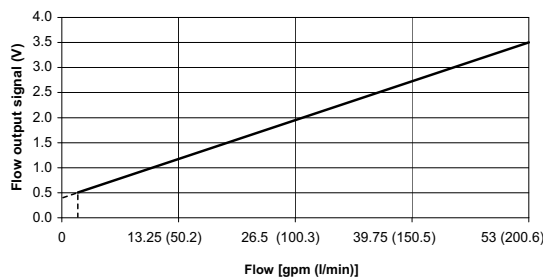


Fig. 54 Flow response

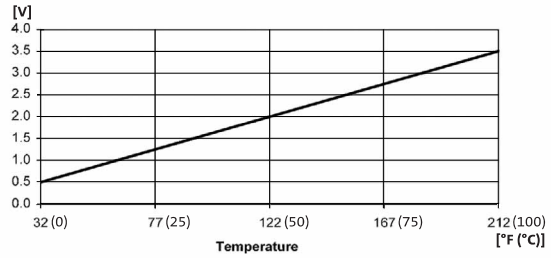


Fig. 55 Temperature response

### Specifications

Flow	
Measuring range	2.6 to 53 gpm (10 to 200 l/min)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 1.5\%$ FS
Response time start-up flow / no flow (90 %)	< 1 s
Resolution	0.2 gpm (0.76 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8\%$ F ( $\pm 1.0\%$ °C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6\%$ F ( $\pm 2.0\%$ °C)
Response time (63.2 % at 50 % FS flow)	< 1 s
Resolution	0.9 °F (0.5 °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 2$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F (-25 to 120 °C)
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	240 psi (16.54 bars)
Electrical data	
Power supply	5 VDC ( $\pm 5\%$ ). Grounding of the sensor supply is required (PELV)
Output signals	Ratiometric linear
Flow signal	0.5 - 3.5 V (Zero at 0.35 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 k $\Omega$
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
Housing	Composites (PPS, PA66)
Flow pipe	PPA 40-GF
Wetted materials	Corrosion-resistant coating, EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.84"x1.57"x0.79" (47x40x20mm), see drawing
Flow pipe	5.9"x1.77"x1.61" (137x45x41mm)

TM03 8209 0807

TM03 8136 0607

TM03 8220 0807

TM04 9894 0211

TM04 9828 0512

### VFS 20-400

Vortex Flow sensor Standard, 5.2 to 105 gpm (20 to 400 l/min)



Fig. 56 VFS 20-400 sensor

### Dimensions [inch (mm)]

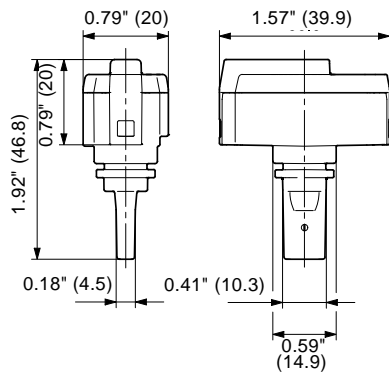


Fig. 57 Dimensional sketches of sensing element

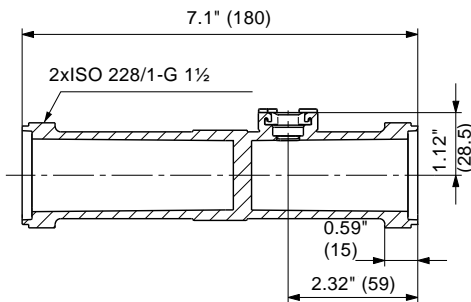


Fig. 58 Dimensional sketch of flow pipe

### Sensor output signals

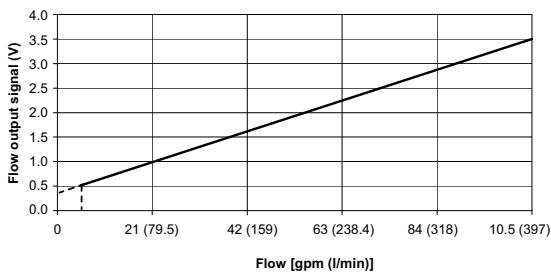


Fig. 59 Flow response

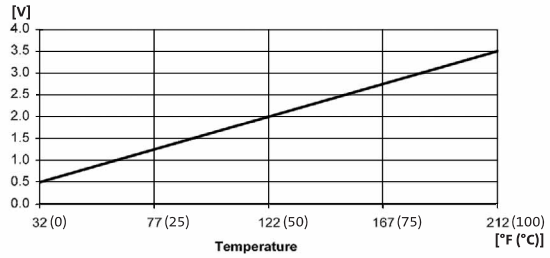


Fig. 60 Temperature response

### Specifications

Flow	
Measuring range	5.2 to 105 gpm (20 to 400 l/min)
Accuracy ( $\pm 1\sigma$ ), 32 to 212°F (0 to 100 °C)	$\pm 1.5\%$ FS
Response time start-up flow / no flow (90 %)	< 1.0 s
Resolution	0.4 gpm (1.51 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8\%$ F ( $\pm 1.0\%$ °C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6\%$ F ( $\pm 2.0\%$ °C)
Response time (63.2 % at 50 % FS flow)	< 1 s
Resolution	0.9 °F (0.5 °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 2$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F (-25 to 120 °C),
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	240 psi (16.54 bars)
Electrical data	
Power supply	5 VDC ( $\pm 5\%$ ). Grounding of the sensor supply is required (PELV)
Output signals	Ratiometric linear
Flow signal	0.5 - 3.5 V (Zero at 0.35 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 kΩ
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
Housing	Composites (PPS, PA66)
Flow pipe	PPA 40-GF
Wetted materials	Corrosion-resistant coating, EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.84"x1.57"x0.79" (47x40x20mm), see drawing
Flow pipe	7.9"x2.1"x1.89" (180x54x48mm)

TM03 8209 0807

TM03 8136 0607

TM04 2954 3308

TM04 9895 0211

TM04 9828 0512

### VFS 1-12 QT

Vortex Flow sensor Standard, 0.2 to 3.2 gpm (1 to 12 l/min)



Fig. 61 VFS 1-12 sensor

### Dimensions [inch (mm)]

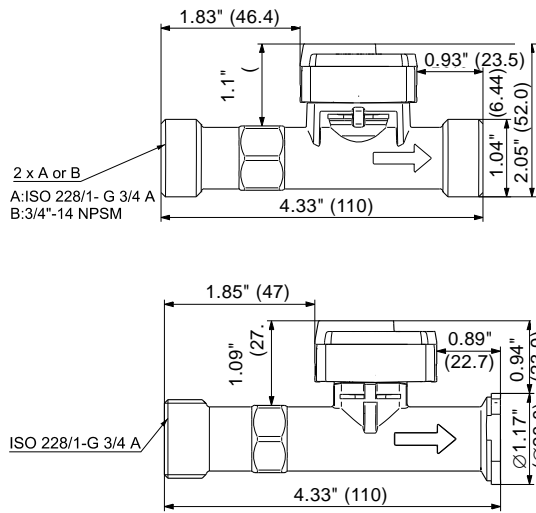


Fig. 62 Dimensional sketches of VFS QT

### Sensor output signals

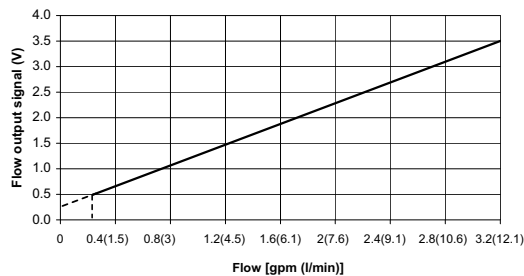


Fig. 63 Flow response

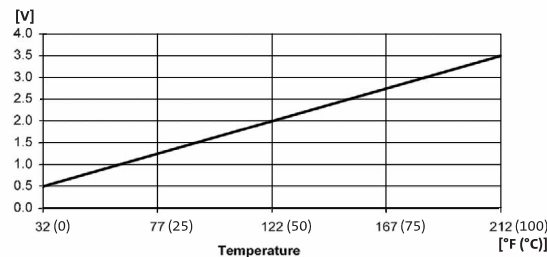


Fig. 64 Temperature response

### Specifications

Flow	
In water, 32 to 212 °F, (0 to 100 °C)	
[42% glycol], 86 to 212 °F, (30 to 100 °C)	0.2 to 3.2 gpm (1 to 12 l/min)
Measuring range	
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	1.5 % / 5 % FS (typical 3 %)
Response time (63.2 %)	< 3 sec.
Resolution	0.02 gpm (0.08 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8$ °F ( $\pm 1.0$ °C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6$ °F ( $\pm 2.0$ °C)
Response time (63.2 % at 50 % FS flow)	approx. 1/4 sec.
Resolution	0.7 °F (0.4 °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 4$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F (-25 to 120 °C), non-freezing
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 - 95 % (relative), non-condensing
System burst pressure	240 psi (16.54 bars)
Electrical data	
Power supply	5 V DC ( $\pm 5$ %). Grounding of the sensor supply is required (PELV)
Output signals	Ratiometric linear
Flow signal	0.5 - 3.5 V (Zero at 0.25 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 k $\Omega$
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
Housing	Composites (PPS, PA66)
flow pipe	ASTM A 351 CF-8-M /Aisi 316 C
Insert	PPA 40 GF
Wetted materials	Corrosion-resistant coating EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.85"x1.58"x0.79" (47x40x20mm)
Flow pipe	4.33"x1.17"x1.24" (110x29.8x31.5mm)
Insert	2.52"x0.63"x0.61" (63.9x16x15.4mm)

TM04 6746 0810

TM04 7245 1810

TM04 7248 1810

TM04 9864 0211

TM04 9828 0512

## VFS 2-40 QT

Vortex Flow sensor Standard, 0.4 to 10.7 gpm (2 to 40 l/min)



Fig. 65 VFS 2-40 sensor

## Dimensions

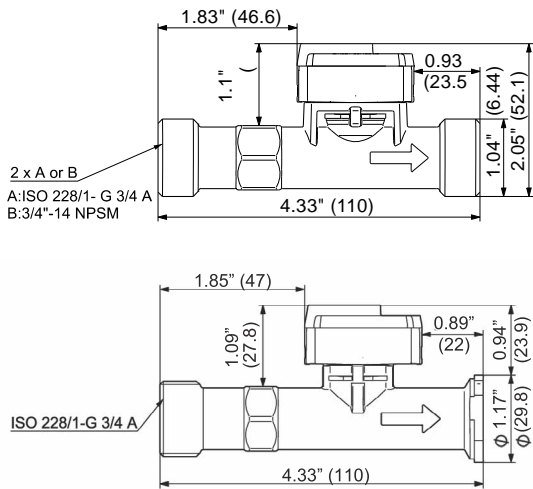


Fig. 66 Dimensional sketches of VFS QT

## Sensor output signals

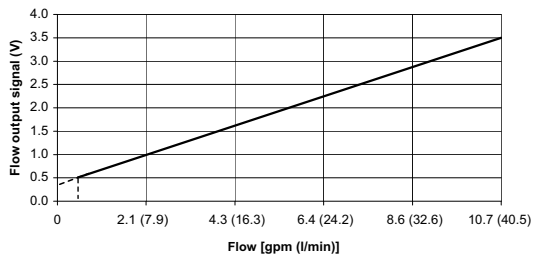


Fig. 67 Flow response

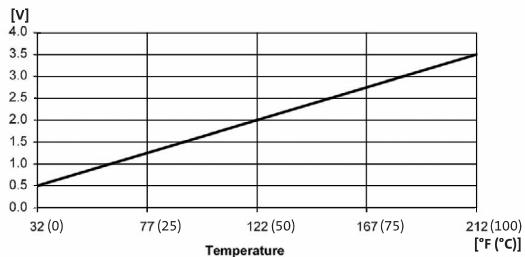


Fig. 68 Temperature response

## Specifications

Flow	
In water, 32 to 212 °F (0 to 100 °C)	
[42% glycol], 86 to 212 °F (30 to 100 °C)	0.4 to 10.7 gpm (2 to 40 l/min)
Measuring range	
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	1.5 % / 5 % FS (typical 3 %)
Response time (63.2 %)	< 1 sec.
Resolution	0.05 gpm (0.19 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8$ °F ( $\pm 1.0$ °C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6$ °F ( $\pm 2.0$ °C)
Response time (63.2 % at 50 % FS flow)	< 1 s
Resolution	0.7 °F (0.4 °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 4$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F (-25 to 120 °C), non-freezing
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 - 95 % (relative), non-condensing
System burst pressure	140 psi (9.65 bars)
Electrical data	
Power supply	5 V DC ( $\pm 5$ %). Grounding of the sensor supply is required (PELV)
Output signals	Ratiometric linear
Flow signal	0.5 - 3.5 V (zero at 0.35 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 k $\Omega$
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
Housing	Composites (PPS, PA66)
flow pipe	ASTM A 351 CF-8-M /Aisi 316 C
Insert	PPA 40 GF
Wetted materials	Corrosion-resistant coating, EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.84"x1.57"x0.79" (47x40x20mm)
Flow pipe	4.3"x1.17"x1.24" (110x29.8x31.5mm)
Insert	2.52"x0.63"x0.61" (63.9x16x15.4mm)

TM04 6746 0810

TM047245 1810

TM047248 1810

TM04 9866 0211

TM04 9828 0512

## VFS 5-100 QT

Vortex Flow sensor Standard, 1.5 to 26.5 gpm (5 to 100 l/min)



Fig. 69 VFS 5-100 sensor

## Dimensions

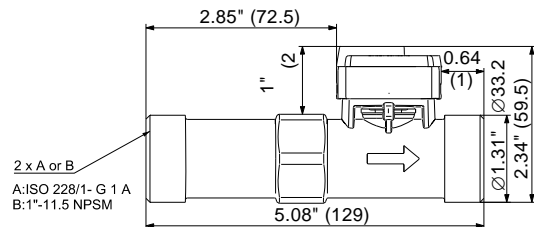


Fig. 70 Dimensional sketches of VFS QT

## Sensor output signals

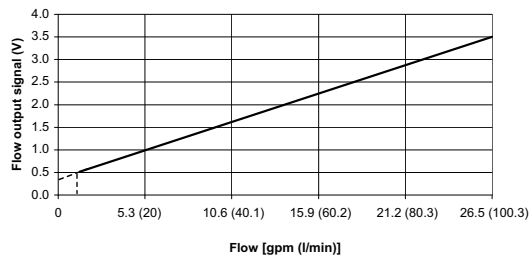


Fig. 71 Flow response

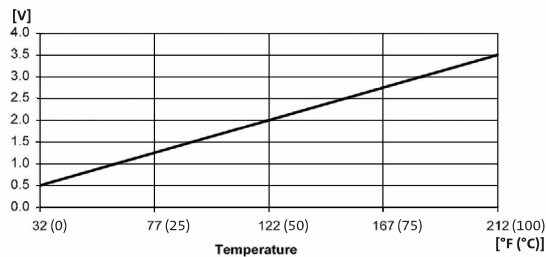


Fig. 72 Temperature response

## Specifications

Flow	
In water, 32 to 212 °F, (0 to 100 °C)	1.5 to 26.5 gpm (5 to 100 l/min)
[42% glycol], 86 to 212 °F, (30 to 100 °C)	
Measuring range	
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (30 to 100 °C)	$\pm 1.5\%$ FS
Response time (63.2 %)	< 1 s
Resolution	0.1 gpm (0.38 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8$ °F ( $\pm 1.0$ °C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6$ °F ( $\pm 2.0$ °C)
Response time (63.2 % at 50 % FS flow)	< 1 s
Resolution	0.9 °F (0.5 °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 2$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F (-25 to 120 °C), non-freezing
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 - 95 % (relative), non-condensing
System burst pressure	240 psi (16.54 bars)
Electrical data	
Power supply	5 V DC ( $\pm 5\%$ ). Grounding of the sensor supply is required (PELV)
Output signals	Ratiometric linear
Flow signal	0.5 - 3.5 V (Zero at 0.35 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 k $\Omega$
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
flow pipe	ASTM A 351 CF-8-M /Aisi 316 C
Insert	PPA 40-GF
Wetted materials	Corrosion-resistant coating, EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.84"x1.57"x0.79" (47x40x20mm)
Flow pipe	5.08"x1.46"x1.26" (129x37x32mm)
Insert	3.91x0.92"x0.86" (99.2x23.4x21.9mm)

TM04 6749 0810

TM047246 1810

TM04 9867 0211

TM04 9828 0512

### VFS 10-200 QT

Vortex Flow sensor Standard, 2.6 to 53 gpm (10 to 200 l/min)



Fig. 73 VFS 10-200 sensor

### Dimensions

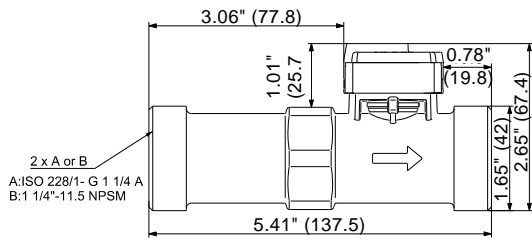


Fig. 74 Dimensional sketches of VFS QT

### Sensor output signals

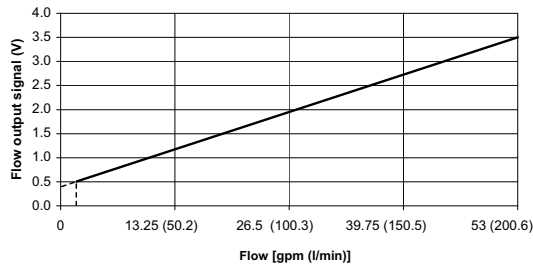


Fig. 75 Flow response

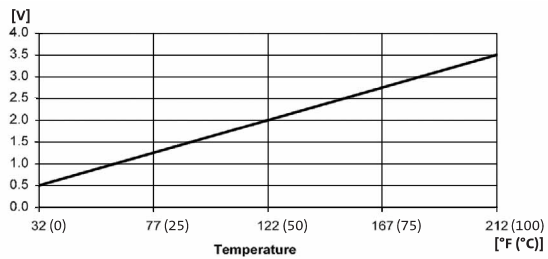


Fig. 76 Temperature response

### Specifications

Flow	
In water, 32 to 212 °F (0 - 100 °C)	2.6 to 53 gpm (10 to 200 l/min)
[42% glycol], 86 to 212 °F (30 - 100 °C)	
Measuring range	
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 1.5\%$ FS
Response time start-up flow / no flow (90 %)	< 1 s
Resolution	0.2 gpm (0.76 L/min)
Temperature	
Measuring range	32 to 212 °F (0 to 100 °C)
Accuracy ( $\pm 1\sigma$ ), 77 to 176 °F (25 to 80 °C)	$\pm 1.8\%$ F ( $\pm 1.0\%$ C)
Accuracy ( $\pm 1\sigma$ ), 32 to 212 °F (0 to 100 °C)	$\pm 3.6\%$ F ( $\pm 2.0\%$ C)
Response time (63.2 % at 50 % FS flow)	< 1 s
Resolution	0.9 °F (0.5 °C)
Media and environment	
Media types	The sensor is compatible with liquids (kinematic viscosity $\leq 2$ cSt)
Media temperature (operation)	32 to 212 °F (0 to 100 °C)
Media temperature (peak)	-13 to 248 °F (-25 to 120 °C), non-freezing
Ambient air temp. (operation)	-13 to 140 °F (-25 to 60 °C)
Ambient air temp. (peak)	-67 to 194 °F (-55 to 90 °C)
Humidity	0 - 95 % RH, non-condensing
System burst pressure	240 psi (16.54 bars)
Electrical data	
Power supply	5 VDC ( $\pm 5\%$ ). Grounding of the sensor supply is required (PELV)
Output signals	Ratiometric linear
Flow signal	0.5 - 3.5 V (Zero at 0.35 V)
Temperature signal	0.5 - 3.5 V
Power consumption	< 50 mW
Load impedance	> 10 k $\Omega$
Sensor materials	
Sensing element	Silicon-based MEMS sensor
Seal (sensor to housing)	EPDM rubber
flow pipe	ASTM A 351 CF-8-M /Aisi 316 C
Insert	PPA 40-GF
Wetted materials	Corrosion-resistant coating, EPDM, PPS, PPA 40-GF
Environmental standards	
Enclosure class	IP44
Temperature cycling	IEC 68-2-14
Vibration (non-destructive)	20 - 2000 Hz, 10G, 4h
Electromagnetic compatibility	EN 61326-1
Dimensions	
Sensing element	1.84"x1.57"x0.79" (40x40x20mm)
Flow pipe	5.9"x1.77"x1.61" (137x45x41mm)
Insert	4.09"x1.2"x1.14" (104.2x30.4x28.9mm)

TM04 6752 0810

TM047247 1810

TM04 9894 0211

TM04 9828 0512

## 4. Product range

### VFI sensor

#### Scope of delivery

- Flow pipe with sensor
- flanges (only for flange versions)
- union nuts (for threaded versions)
- 16.4 ft. [5 meter] cable with M12 connection in one end
- quick guide

Complete product	Flow range	Pipe size	O-ring		Connection type			Product number
			EPDM	FKM	Cast Iron flange	Stainless steel flange	Thread	
VFI 0.3-6 DN18 020 E, Set GG			•		•			97686127
VFI 0.3-6 DN18 020 F, Set GG				•	•			97686128
VFI 0.3-6 DN18 020 E, Set SS	1.5 - 26.5 GPM (0.3-6 m <sup>3</sup> /h)	1.25" ANSI (DN 18)	•			•		97688293
VFI 0.3-6 DN18 020 F, Set SS				•		•		97688294
VFI 0.3-6 DN18 020 E, Set G1 1/4"			•				•	97688334
VFI 0.3-6 DN18 020 F, Set G1 1/4"				•			•	97688342
VFI 0.6-12 DN25 020 E, Set GG			•		•			97686129
VFI 0.6-12 DN25 020 F, Set GG				•	•			97686130
VFI 0.6-12 DN25 020 E, Set SS	2.6 - 53 GPM (0.6 - 12 m <sup>3</sup> /h)	1.25" ANSI (DN 25)	•			•		97688295
VFI 0.6-12 DN25 020 F, Set SS				•		•		97688296
VFI 0.6-12 DN25 020 E, Set G1 1/4"			•				•	97688335
VFI 0.6-12 DN25 020 F, Set G1 1/4"				•			•	97688343
VFI 1.3-25 DN32 020 E, Set GG			•		•			97686141
VFI 1.3-25 DN32 020 F, Set GG				•	•			97686142
VFI 1.3-25 DN32 020 E, Set SS	5.2 - 105 GPM (1.3 - 25 m <sup>3</sup> /h)	1.25" ANSI (DN 32)	•			•		97688297
VFI 1.3-25 DN32 020 F, Set SS				•		•		97688298
VFI 1.3-25 DN32 020 E, Set G1 1/2"			•				•	97688336
VFI 1.3-25 DN32 020 F, Set G1 1/2"				•			•	97688344
VFI 2-40 DN40 020 E, Set GG			•		•			97686143
VFI 2-40 DN40 020 F, Set GG	8.8 - 176 GPM (2 - 40 m <sup>3</sup> /h)	1.50" ANSI (DN 40)		•	•			97686144
VFI 2-40 DN40 020 E, Set SS				•		•		97688299
VFI 2-40 DN40 020 F, Set SS				•		•		97688300
VFI 3.2-64 DN50 020 E, Set GG			•		•			97686145
VFI 3.2-64 DN50 020 F, Set GG	14 - 282 GPM (3.2 - 64 m <sup>3</sup> /h)	2.00" ANSI (DN 50)		•	•			97686146
VFI 3.2-64 DN50 020 E, Set SS				•			•	
VFI 3.2-64 DN50 020 F, Set SS				•		•		97688302
VFI 5.2-104 DN65 020 E, Set GG			•		•			97686147
VFI 5.2-104 DN65 020 F, Set GG	22.9 - 458 GPM (5.2 - 104 m <sup>3</sup> /h)	2.50" ANSI (DN 65)		•	•			97686148
VFI 5.2-104 DN65 020 E, Set SS				•			•	
VFI 5.2-104 DN65 020 F, Set SS				•		•		97688304
VFI 8-160 DN80 020 E, Set GG			•		•			97686149
VFI 8-160 DN80 020 F, Set GG	35 - 704 GPM (8 - 160 m <sup>3</sup> /h)	3.00" ANSI (DN 80)		•	•			97686150
VFI 8-160 DN80 020 E, Set SS				•			•	
VFI 8-160 DN80 020 F, Set SS				•		•		97688306
VFI 12-240 DN100 020 E, Set GG			•		•			97686151
VFI 12-240 DN100 020 F, Set GG	52.8 - 1056 GPM (12 - 240 m <sup>3</sup> /h)	4.00" ANSI (DN 100)		•	•			97686152
VFI 12-240 DN100 020 E, Set SS				•			•	
VFI 12-240 DN100 020 F, Set SS				•		•		97688309

## VFS sensor

### Sensor selection

Grundfos offers a wide range of variants of the VFS sensor, and can be customized to meet individual requirements.

Because of the large variation of VFS sensors, it will be unreadable to make only one table which include all VFS sensors. Therefore the table below gives a point of selection. Be aware that not all combinations are possible, therefore in any questions regarding selection, please contact Grundfos Sensors

Example of a type key:

#### VFS - 20-400L-C-1.2mE-G4-CS-P-25

1	2	3	4	5	6	7	8	9
VFS	20 - 400 L	C	1.2mE	G4	CS	09	G	10

1. Product name

2. Product range and Units:

Product Range	Range of unit
1-12 l/min	0.2-3.2 gpm (0.06-0.72 m <sup>3</sup> /hr)
1-20 l/min	0.2-5.2 gpm (0.08-1.20 m <sup>3</sup> /hr)
2-40 l/min	0.4-10.7 gpm (0.12-2.40 m <sup>3</sup> /hr)
5-100 l/min	1.5-26.5 gpm (0.30-6.00 m <sup>3</sup> /hr)
10-200 l/min	2.6-53 gpm (0.60-12.00 m <sup>3</sup> /hr)
20-400 l/min	5.2-105 gpm (1.20-24.00 m <sup>3</sup> /hr)

3. Sensor connector or cable connector in sensor end:

Code	Connector description
A	Grundfos cover, 4-pin male
C	MPE-Gerry BL12-700, over moulded
S	TE snap-on cover, 4-pin male

4. Cable length and connector opposite sensor:

It is possible to order cable in any length

Standard cable length	
[Ft.]	[m]
0	0
1.48	0,45
3.94	1,20
5.58	1,70
9.51	2,90

Code	Cable connector description
B	FCI 90312-004LF/77138-101
C	CKM 42010107/42010311, tin plated
D	AMP 103648-3/104479-9
E	Molex 51004-0400/50011-8000
F	AMP 172167-1/0-170365-1
G	Tyco Val-U-Lok 794954-4/794958-2, gold plated
J	JST XHP-4/SXH-001T-P0.6
L	Lumberg 3510-04 K02
N	Lumberg 3510-04 K03
P	Molex 43025-0400/43030-0005, 43030-001/ Cembre 1910M16
Q	Molex 43025-0400/43030-0006
R	Molex 51004-0400/50011-8000/ Cembre 1900M12
X	Open ended

5. Sealing material and Class

Code	Sealing description
E	EPDM (drinking water approved)
F	FPM (for use in oily media)
G	Gel filled

Code	Class
2	IP20
4	IP44
5	IP55
6	IP67

6. Material:

The first letter represents the flow pipe, the second represents the mechanical connection part

Code	Material description
B	Brass
C	Composite
G	Cast iron
Q	Stainless steel flow pipe w. composite insert (QT)
S	Stainless steel

7. Dimension of mechanical connection

Code	Dimension	Code	Dimension
03	G ½"	17	0.44
04	G ¾"	19	0.74
05	G 1"	21	0.85
06	6mm	24	0.13 - 27
07	G 1¼"	25	0.75 - 25
08	8mm	26	1 - 11.5
09	G 1½"	27	1.25 - 11.5
10	G 1½"	51	f1" - G ¾"
11	G 2½"	52	f1¼" - G 1"
12	G 3"	63	G ½" with ventilation opening

8. Mechanical connection type

Code	Description
B	BSPT (ISO 7/1)
C	Compression
F	Flange
G	Flange and BSPP (ISO 228/1)
K	Clips
M	NPSM
N	NPT
P	BSPP (ISO 228/1)
S	Sweat
T	Tube
U	UNF

9. Packaging

Code	Description of packaging
A	Set with preassemble components
P	Spares set
S	Set
V	Service set
W	Blister pack, std. Grundfos cardboard
N	Blister pack, white cardboard
1	1 piece
10	Bulk 10
25	Bulk 25
50	Bulk 50
100	Bulk 100
500	Bulk 500

## 5. Accessories

### Sensor Interface type SI 001 PSU

Grundfos Direct Sensors™, Type SI 001 PSU, is an external power supply for the VFI and other transmitters with 24 VDC supply voltage.

For distances longer than 98 ft.(30M) a power supply will have to be placed between transmitter and controller.



Fig. 77 Sensor Interface, SI 001 PSU

#### Specification

- Voltage range: 110 - 400 VAC
- frequency range: 50 - 60 Hz
- ambient temperature: -4 to 122°F (-20 to +50°C)
- enclosure class: IP54

Part	Product No.
Sensor Interface, SI 001 PSU	96915820

TM04 4194 0809

### Sensor Interface type SI 010 CNV

Grundfos Direct Sensors™, Type SI 010 CNV, is an external power supply, signal amplifier and signal converter for Grundfos sensors.

SI 010 CNV has built-in precision resistors enabling the transmitter to give 1-5 V and 2-10 V output signals in stead of 4-20 mA.

SI 010 CNV is used in sensor applications with controllers with 4-20 mA inputs in which the pressure and flow measurements are carried out by products from the Grundfos Direct Sensors™ standard product range.



Fig. 78 Sensor interface, SI 010 CNV

#### Specification

- Voltage range: 115 - 230 VAC± 10% or 24 VDC
- frequency range: 50 - 60 Hz
- power consumption: Max. 2.5 W
- ambient temperature: -4 to 122°F (-20 to +50°C)
- enclosure class: IP20

Part	Product No.
Sensor Interface, SI 010 CNV	96983684

TM04 4882 2209

**Counter flanges for Sensors**

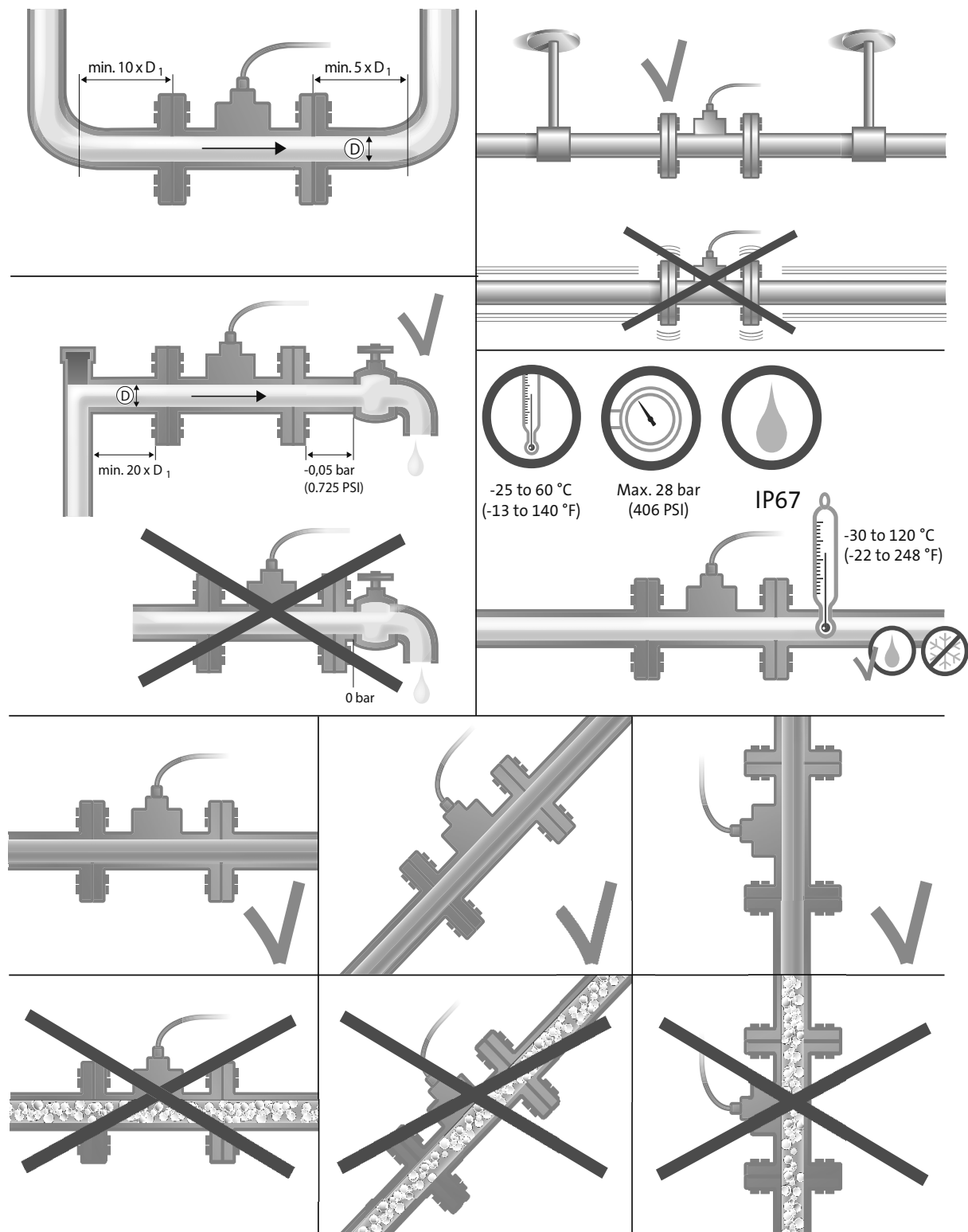
A set consists of two counter flanges, two gaskets, bolts and nuts.

Counter flange	ANSI size	Description	Pressure class	Pipe work connection	Product number
	1.25"	Threaded	ANSI 250 lb.	1 1/4" NPT	91122260
	2.00"	Threaded	ANSI 250 lb.	2" NPT	335021
<p>ANSI 300 LB.</p>	2.50"	Threaded	ANSI 250 lb.	2 1/2" NPT	345050
	3.00"	Threaded	ANSI 250 lb.	3" NPT	91121952
	4.00"	Threaded	ANSI 250 lb.	4" NPT	3600028

\*Grundfos does not offer a 1.50" Counter flange

## 6. Appendix

### Installation VFI sensor



TM05 2306 4811

# 7. Further product documentation

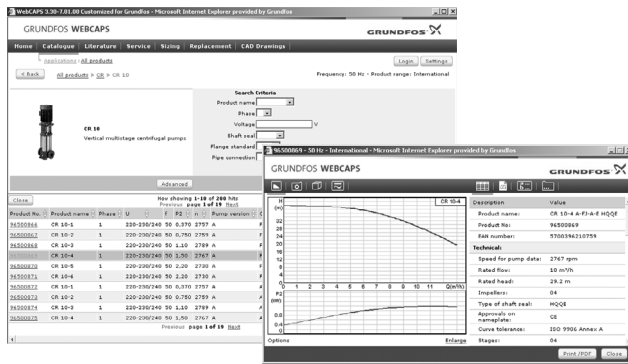
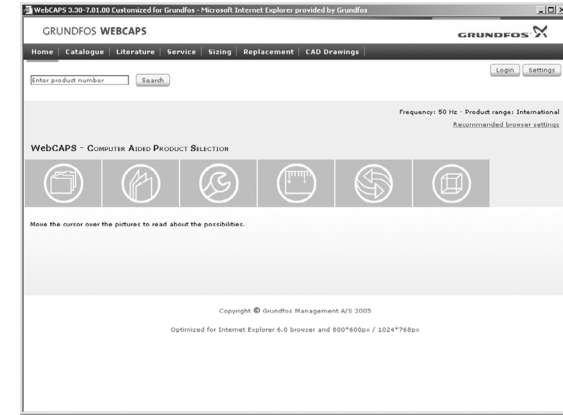
## WebCAPS

WebCAPS is a **Web-based Computer Aided Product Selection** program available on [www.grundfos.com](http://www.grundfos.com).

WebCAPS contains detailed information on more than 185,000 Grundfos products in more than 20 languages.

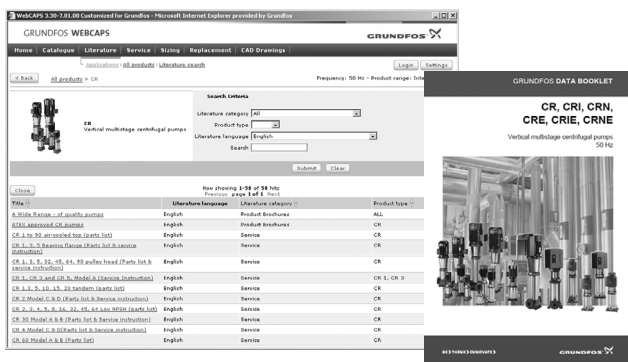
In WebCAPS, all information is divided into 6 sections:

- Catalog
- Literature
- Service
- Sizing
- Replacement
- CAD drawings.



### Catalog

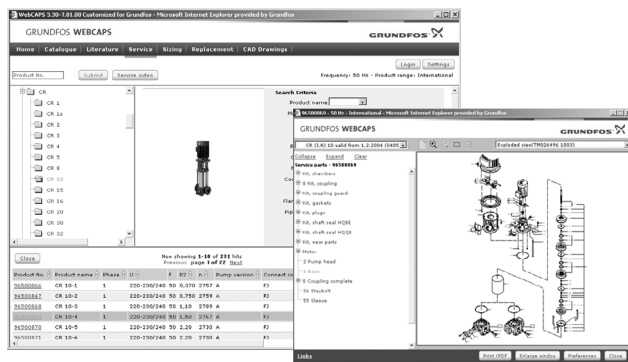
- This section is based on fields of application and pump types, and contains
- technical data
- curves (QH, Eta, P1, P2, etc.) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.



### Literature

In this section you can access all the latest documents of a given pump, such as

- data booklets
- installation and operating instructions
- service documentation, such as Service kit catalogue and Service kit instructions
- quick guides
- product brochures.



### Service

This section contains an easy-to-use interactive service catalogue. Here you can find and identify service parts of both existing and discontinued Grundfos pumps.

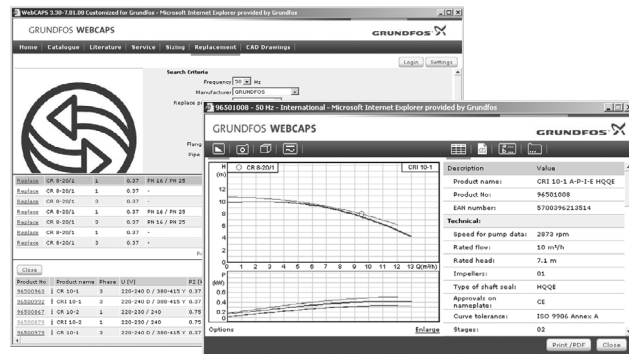
Furthermore, this section contains service videos showing you how to replace service parts.



### Sizing

This section is based on different fields of application and installation examples, and gives easy step-by-step instructions in how to

- select the most suitable and efficient pump for your installation
- carry out advanced calculations based on energy consumption, payback periods, load profiles, life cycle costs, etc.
- analyze your selected pump via the built-in life cycle cost tool
- determine the flow velocity in wastewater applications, etc.

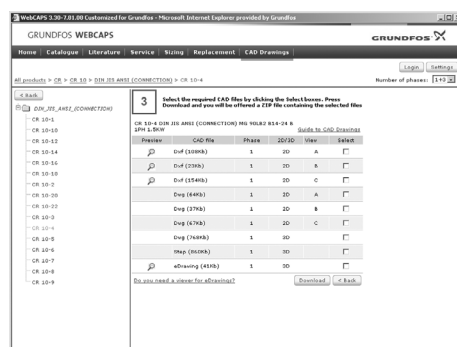


### Replacement

In this section you find a guide to selecting and comparing replacement data of an installed pump in order to replace the pump with a more efficient Grundfos pump.

The section contains replacement data of a wide range of pumps produced by other manufacturers than Grundfos.

Based on an easy step-by-step guide, you can compare Grundfos pumps with the one you have installed on your site. When you have specified the installed pump, the guide will suggest a number of Grundfos pumps which can improve both comfort and efficiency.



### CAD drawings

In this section it is possible to download 2-dimensional (2D) and 3-dimensional (3D) CAD drawings of most Grundfos pumps.

These formats are available in WebCAPS:

- 2-dimensional drawings:
  - dxf, wire frame drawings
  - dwg, wire frame drawings.
- 3-dimensional drawings:
  - dwg, wire frame drawings (without surfaces)
  - stp, solid drawings (with surfaces)
  - eprt, E-drawings.

## WinCAPS



Fig. 79 WinCAPS CD-ROM

WinCAPS is a **Windows-based Computer Aided Product Selection** program containing detailed information on more than 185,000 Grundfos products in more than 20 languages.

The program contains the same features and functions as WebCAPS, but is an ideal solution if no Internet connection is available.

WinCAPS is available on CD-ROM and updated once a year.

<b>L-DS-PG-001</b> 0512
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ECM: —
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