XAFP 100: Flow probe for ventilation ducts

XAFP100F001

Improving energy efficiency

Efficient recording of air volume flows for demand-controlled ventilation in ventilation and air conditioning systems

Features

- Flow probe for precise and inexpensive recording of effective pressure signals in ventilation and air conditioning systems
- Efficient regulation of applications for demand-controlled ventilation in offices, laboratories, fume cupboards and clean rooms, by combining an air damper and an electronic/pneumatic volume flow controller
- In combination with a square root differential pressure sensor, air volume flows can be reliably recorded and monitored
- Optimised flow profile for accurate measurement of operating pressure signals
- Can be used in atmospheres containing aggressive substances
- Length (396 mm) can be shortened on site if necessary

Technical data

Parameters		
	Measurement tolerance	< 3%
	Range (mm)	DN 80...DN 400
Admissible ambient conditions		
	Operating temperature	0...50 °C
	Admissible ambient humidity	< 85% rh, no condensation
Operation		
	Function	Flow sensor
Construction		
	Dimensions	65 × 40 × 396 mm (W × H × L)
	Bore	Ø 30...32 mm
Material	Flow probe	PA 6
	Seal	PE, physiologically safe
	Connecting tube	PU
Standards and directives		
Flow probe	Electrical	UL 7468
	Flammability	UL 94, IEC 60695-2-12, IEC 60695-2-13

Overview of types

Type	Properties
XAFP100F001	Flow probe for ventilation ducts

Description of operation

Flow probes are obstacles in the flow where deceleration and acceleration of the fluid, in this case air, convert kinetic energy into pressure and vice versa. The differential pressure signal this generates is affected by factors such as compressibility, viscosity and the flow profile of the fluid, as well as the position where the pressure is measured. Flow probes do not contain any moving parts to create differential pressure and can be installed in any position in relation to the gravitational field. The differential pressure that is generated and measured can be converted using a square root function into a signal proportional to the volume flow and represents a measure of the volume flow.

Intended use

This product is only suitable for the purpose intended by the manufacturer, as described in the “Description of operation” section.
All related product documents must also be adhered to. Changing or converting the product is not admissible.

Engineering and fitting notes

When the flow probe is installed in a duct system, suitable flow sections must be provided. If these flow sections are insufficient, a wider tolerance range must be expected. The measurements are stable in the long term. The material is resistant to normal air contamination (see table of chemical resistance). Access to the flow probe and its devices must be ensured for maintenance.

List of abbreviations

DN	Nominal diameter of a pipe
Q_v	Volume flow [m³/h], [l/s]
c	Probe factor
Δp	Differential pressure at the Pitot tube
ρ	Air density [kg/m³]
s	Pipe wall thickness
$c_{1.2}$	Probe factor at 1.2 kg/m³ air density

Fitting

Probe length L = DN - 20mm - s
Probe position = perpendicular to the last change of direction of the fluid in the duct system

Pipe type	Length A [1]	Length B[2]	Length C [3]
Straight pipe	DN 3	DN 1	DN 2
90° bend	DN 3	DN 1	DN 2
Double bend	DN 5	DN 1	DN 2
T-branch	DN 3	DN 1	DN 2
Pipe narrower at one end	DN 5	DN 1	DN 2

Q_v in m³/h: Table of values for converting the measured differential pressure into the required volume flow, $Q_v = c\sqrt{\Delta p}$, Δp [Pa]

DN [mm]	ρ = 1.2 kg/m³	ρ = 1.15 kg/m³	c-factor ρ = 1.1 kg/m³	ρ = 1.05 kg/m³	ρ = 1.0 kg/m³
80	12.6	12.9	13.2	13.5	13.8
90	16.6	16.9	17.3	17.7	18.2
100	21.1	21.6	22.1	22.6	23.2
110	26.3	26.8	27.4	28.1	28.8
125	35.0	35.8	36.6	37.4	38.4
150	52.4	53.5	54.7	56.0	57.4
160	60.3	61.6	62.9	64.4	66.0
180	77.6	79.3	81.1	83.0	85.0
200	97.1	99.2	101.4	103.8	106.4
224	123.1	125.8	128.6	131.6	134.9
250	154.6	157.9	161.4	165.2	169.3
280	194.8	199.0	203.5	208.3	213.4
300	224.0	228.8	233.9	239.4	245.3
315	247.0	252.3	258.0	264.1	270.6
355	313.2	320.0	327.2	334.9	343.1
400	395.6	404.1	413.2	422.9	433.4

Q_v in l/s: Table of values for converting the measured differential pressure into the required volume flow, $Q_v = c\sqrt{\Delta p}$, Δp [Pa]

DN [mm]	ρ = 1.2 kg/m³	ρ = 1.15 kg/m³	c-factor ρ = 1.1 kg/m³	ρ = 1.05 kg/m³	ρ = 1.0 kg/m³
80	3.5	3.6	3.7	3.7	3.8
90	4.6	4.7	4.8	4.9	5.0

[1] *Distance in front of the probe (between geometric change and probe)*
[2] *Distance behind the probe (between probe and next geometric change)*
[3] *Minimum distance between probe and damper; NOTE: The damper spindle must be perpendicular to the probe*

DN [mm]	ρ = 1.2 kg/m³	ρ = 1.15 kg/m³	c-factor ρ = 1.1 kg/m³	ρ = 1.05 kg/m³	ρ = 1.0 kg/m³
100	5.9	6.0	6.1	6.3	6.4
110	7.3	7.5	7.6	7.8	8.0
125	9.7	9.9	10.2	10.4	10.7
150	14.6	14.9	15.2	15.6	15.9
160	16.7	17.1	17.5	17.9	18.3
180	21.6	22.0	22.5	23.1	23.6
200	27.0	27.6	28.2	28.8	29.6
224	34.2	34.9	35.7	36.6	37.4
250	42.9	43.9	44.8	45.9	47.0
280	54.1	55.3	56.5	57.9	59.3
300	62.2	63.6	65.0	66.5	68.2
315	68.6	70.1	71.7	73.4	75.2
355	87.0	88.9	90.9	93.0	95.3
400	109.9	112.3	114.8	117.5	120.4

Converting the probe factor to the existing density: $C = C_{1,2} \sqrt{1{,}2/\rho}$

Table of resistance to chemicals

Chemical	Resistance	Chemical	Resistance	Chemical	Resistance	Chemical	Resistance
Acetaldehyde 40%	B	Calcium chloride, aqueous 10%	A	Ethyl ether 100%	A	Potassium nitrate 10%	A
Acetamide 50%	A	Calcium chloride, alc. 20%	D	Ethylene chloride 100%	A	Potassium permanganate 1%	C
Acetone 100%	A	Chlorobenzene 100%	A	Ethylenediamine 100%	A	Copper sulphate 10%	B
Acrylonitrile 100%	A	Chlorine gas 100%	C				
Allyl alcohol 100%	B	Chloroform 100%	B	Hydrofluoric acid 40%	D	Diluted alkaline solutions	A
Aluminium sulphate 10%	A	Chlorine water	C	Formaldehyde, aqueous 20%	A		
Aluminium chloride 10%	B	Chrome alum 10%	B	Freon 12, liquid 100%	A	Magnesium chloride, aqueous 10%	A
Formic acid 85%	D	Chromic acid 10%	C	Furfural 100%	A	Manganese sulphate 10%	A
Amonochloride 10%	A	Citric acid 10%	A			Methanol 98%	B
Ammonia 10%	A	Cyclohexanol 100%	A	Glycerine 90%	A	Methyl acetate 100%	A
Aniline 100%	B					Methyl ethyl ketone 100%	A
Cyclohexanone 100%	A	Decalin 100%	A	Urea, aqueous 10%	A	Methylene chloride 100%	B
		Diesel 100%	A	Hexane 100%	A	Lactic acid 10%	A
Benzaldehyde 100%	B	Dibutyl phthalate 100%	A	Heptane 100%	A	Mineral oil 100%	A
Petrol 100%	A	Dioctyl phthalate 100%	A				
Benzene 100%	A	Dioxane 100%	A	Isopropyl alcohol 90%	A	Sodium bisulphide 10%	A
Benzyl alcohol 100%	B			Tincture of iodine	C	Sodium carbonate 10%	A
Bleach 0.1% act. chlorine	C	Iron chloride 10%	A	Lugol’s iodine 3%	C	Sodium chloride 10%	A
Boric acid 10%	B	Acetic acid 80%	C			Sodium sulphate 10%	A
Butanol 100%	A	Acetic acid 10%	C	Caustic potash, aqueous 50%	A	Caustic soda, aqueous 50%	B
Butyl acetate 100%	A	Ethanol 96	A	Caustic potash, aqueous 10%	A	Caustic soda, aqueous 10%	A

Chemical	Resistance	Chemical	Resistance	Chemical	Resistance	Chemical	Resistance
		Ethyl acetate 100%	A	Potassium dichromate 5%	B	Nitrobenzene 100%	B
Oleic acid, conc. 40%	A	Resorcinol 100%	D	Tallow 100%	A	Hydrogen peroxide 1%	A
Oxalic acid 10%	B			Carbon tetrachloride 100%	A	Hydrogen peroxide 3%	B
Ozone	C	Nitric acid, conc. 65%	C	Tetrahydrofuran 100%	A	Hydrogen peroxide 10%	C
		Nitric acid 10%	C	Tetralin 100%	A	Hydrogen peroxide 30%	C
Petroleum 100%	A	Hydrochloric acid 10%	C	Thionyl chloride 100%	D	Wax, molten 100%	A
Phenol, molten 100%	D	Hydrochloric acid 2%	C	Toluene 100%	A	Wine	A
Phenol, aqueous 10%	C	Carbon disulphide 100%	C	Transformer oil 100%	A	Brandy	A
Phosphoric acid, conc. 80%	C	Sulphuric acid 98%	C	Trichloroethylene 100%	B		
Phosphoric acid 10%	C	Sulphuric acid 10%	A			Xylene 100%	A
Pyridine 100%	A	Hydrogen sulphide, aqueous 2%	C	Perchloric acid 10%	C		
		Seawater 100%	A			Zinc chloride 10%	B
Mercury 100%	A	Soap solution 1%	A	Water, cold 100%	A		
Mercury chloride, aqueous 5%	C	Styrene 100%	A	Hydrogen peroxide 0.5%	A		

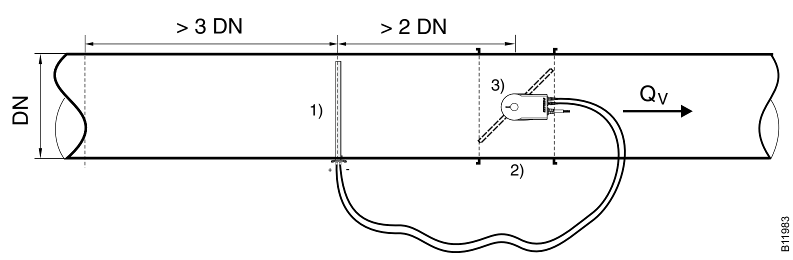
Disposal

When disposing of the product, observe the currently applicable local laws.
More information on materials can be found in the Declaration on materials and the environment for this product.

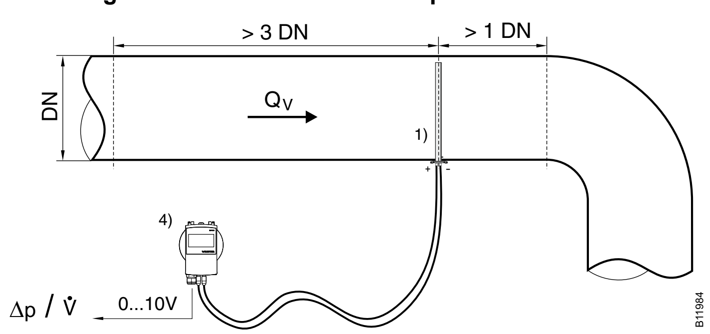
Example applications

Regulating volume flows

$v_{max} \leq 10$ m/s

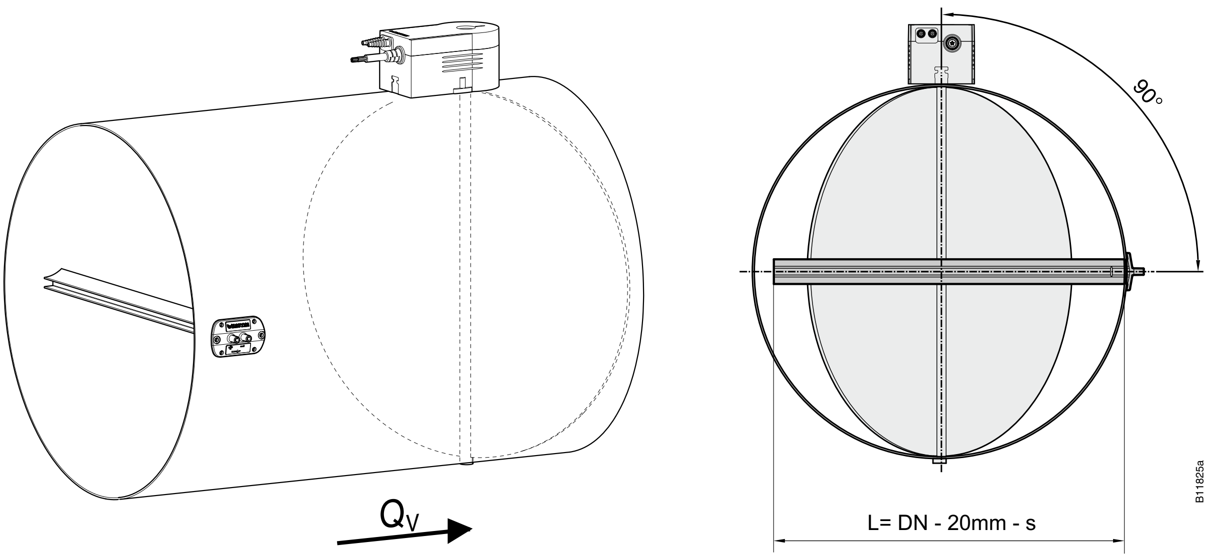


Measuring volume flow or differential pressure in ventilation ducts

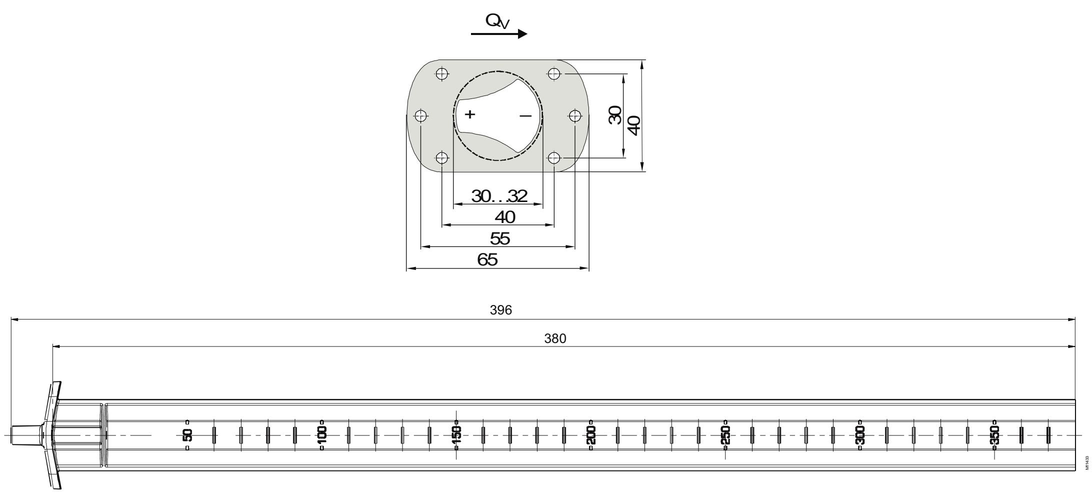


Key	
1	XAFP100 – flow probe for air ducts
2	Air damper
3	ASV115 – VAV controller
4	EGP100 – differential-pressure transmitter

Fitting position



Dimension drawing



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