



CAV CONTROLLER  
VARIANT VFC, WITH  
ROTARY KNOB



TESTED TO VDI 6022



ACTUATOR WITH  
POTENTIOMETERS



ACTUATOR WITH  
MECHANICAL STOPS



VARIANT WITH ROTARY  
KNOB

VFC



FOR LOW AIRFLOW VELOCITIES

Circular mechanical self-powered volume flow controllers for the control of supply air or extract air in constant air volume systems with low airflow velocities

- Suitable for airflow velocities from 0.8 m/s
- Very simple commissioning
- Volume flow rate can be set using a rotary knob and a scale on the outside of the casing
- Simple retrofit of an actuator for variable volume flows
- Any installation orientation; maintenance-free
- Casing air leakage to EN 1751, class C

Optional equipment and accessories

- Circular silencer Type CA or CF for the reduction of air-regenerated noise
- Hot water heat exchanger Type WL and electric air heater Type EL for reheating the airflow
- Actuator for variable volume flows or for  $q_{V_{min}}$  -  $q_{V_{max}}$  switching

## Application

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### Application

- Circular CAV controllers of Type VFC for the precise supply air or extract air flow control in constant air volume systems
- Mechanical self-powered volume flow control without external power supply
- For low airflow velocities
- Simplified project handling with orders based on nominal size

### Special features

- Volume flow rate can be set using an external scale; no tools required
- Simple retrofit of an actuator is possible
- Correct operation even under unfavourable upstream or downstream conditions (1.5 D straight section required upstream)
- Any installation orientation
- Aerodynamic function testing of each unit on a special test rig prior to shipping

### Nominal sizes

- 80, 100, 125, 160, 200, 250

## Description

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### Parts and characteristics

- Ready-to-commission controller
- Damper blade with low-friction bearings
- Bellows that acts as an oscillation damper
- Leaf spring
- Rotary knob with pointer for setting the volume flow rate
- Lip seal

### Attachments

- Min/Max actuators: Actuators for switching between minimum and maximum volume flow rate setpoint values
- Modulating actuators: Actuators for the stepless adjustment of volume flow rates

### Useful additions

- Secondary silencer Type CA or CF
- Heat exchanger Type WL
- Electric air heater Type EL

### Construction features

- Circular casing
- Spigot with lip seal, for circular connecting ducts to EN 1506 or EN 13180
- Damper blade with low-friction bearings and special bellows

### Materials and surfaces

- Casing made of galvanised sheet steel
- Damper blade and other parts made of high-quality plastic, to UL 94, V1; to DIN 4102, material classification B2
- Leaf spring made of stainless steel
- Polyurethane bellows

### Standards and guidelines

- Hygiene conforms to VDI 6022
- Casing air leakage to EN 1751, class C

### Maintenance

- Maintenance-free as construction and materials are not subject to wear

## TECHNICAL INFORMATION

Function, TECHNICAL DATA, QUICK SIZING, SPECIFICATION TEXT, ORDER CODE, Produktbeziehungen

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### Functional description

The volume flow controllers work without an external power supply.

A damper blade with low-friction bearings is adjusted by aerodynamic forces such that a set volume flow rate is maintained within the differential pressure range.

The aerodynamic forces of the airflow create a closing torque on the damper blade.

The bellows extends and increases this force while at the same time acting as an oscillation damper.

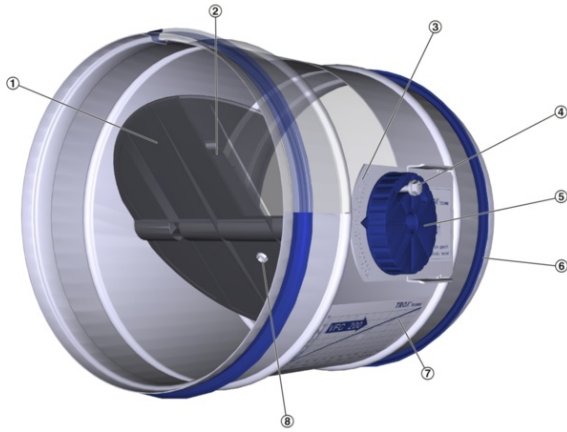
The closing force is countered by a leaf spring. As the differential pressure changes, the leaf spring adjusts the position of the damper blade such that the volume flow rate is maintained almost exactly.

### Efficient commissioning

The volume flow rate setpoint value can be set quickly and easily using the pointer on the external scale; no measurements are required.

The advantage over flow adjustment dampers is that there is no need for repeat measurements or adjustments by an air conditioning engineer. Should the system pressure change, e.g. by opening or closing of duct sections, the flow rates in the entire system will also change if flow adjustment dampers are used; however, this is not the case with mechanical self-powered volume flow controllers. A mechanical self-powered controller reacts immediately and adjusts the damper blade such that the set constant volume flow rate is maintained.

### Schematic illustration of the VFC



- ① Damper blade
- ② Leaf spring
- ③ Volume flow rate scale
- ④ Rotary knob locking screw
- ⑤ Rotary knob
- ⑥ Lip seal
- ⑦ Diagram with setting values
- ⑧ Bellows inlet

<b>Nominal sizes</b>	80 – 250 mm
<b>Volume flow rate range</b>	6 – 370 l/s or 22 – 1332 m³/h
<b>Volume flow rate control range</b>	Approx. 10 – 100 % of the nominal volume flow rate
<b>Volume flow rate accuracy</b>	Approx. ± 10 % of the nominal volume flow rate
<b>Minimum differential pressure</b>	30 Pa
<b>Maximum differential pressure</b>	500 Pa
<b>Operating temperature</b>	10 – 50 °C

Quick sizing tables provide a good overview of the room sound pressure levels that can be expected. Approximate intermediate values can be interpolated. Precise intermediate values and spectral data can be calculated with our Easy Product Finder design programme.

The first selection criteria for the nominal size are the actual volume flow rates  $V_{\min}$  and  $V_{\max}$ . The quick sizing tables are based on generally accepted attenuation levels. If the sound pressure level exceeds the required level, a larger air terminal unit and/or a silencer is required.

**VFC, Sound pressure level at differential pressure 50 Pa**

Nominal size	V		Air-regenerated noise				Case-radiated noise
			①	②	③	④	①
Nominal size	V		LPA		LPA1		LPA2
	l/s	m³/h	dB(A)				
80	6	22	25	<15	<15	<15	<15
	10	36	28	16	<15	<15	<15
80	20	72	33	21	<15	<15	<15
	42	151	39	27	18	16	17
100	6	22	29	15	<15	<15	<15
	15	54	33	20	<15	<15	15
100	30	108	37	26	18	17	18
	65	234	41	33	26	25	21
125	10	36	22	<15	<15	<15	<15
	20	72	27	16	<15	<15	<15
125	45	162	34	25	18	16	<15
	100	360	41	34	29	27	16
160	18	65	25	16	<15	<15	<15
	45	162	32	24	18	16	18
160	85	306	36	29	24	22	22
	185	666	41	35	30	28	27
200	25	90	27	16	<15	<15	<15
	60	216	31	22	16	<15	18
200	120	432	35	27	21	19	22
	250	900	37	30	25	24	26
250	37	133	31	21	<15	<15	18
	100	360	35	25	18	16	22
250	185	666	36	28	21	19	25
	370	1332	37	29	23	22	29

① VFC

② VFC with secondary silencer CF, insulation thickness 50 mm, length 500 mm

③ VFC with secondary silencer CF, insulation thickness 50 mm, length 1000 mm

④ VFC with secondary silencer CF, insulation thickness 50 mm, length 1500 mm

Circular volume flow controllers for constant and variable air volume systems with low airflow velocities, mechanical self-powered, without external power supply, suitable for supply or extract air, available in 6 nominal sizes.

Ready-to-commission unit consists of the casing containing a damper blade with low-friction bearings, bellows, leaf spring, and a rotary knob to set the volume flow rate setpoint.

Differential pressure: 30 – 500 Pa

Volume flow rate: max. 10 : 1

Spigot with lip seal, for circular connecting ducts to EN 1506 or EN 13180.

Casing air leakage to EN 1751, class C.

#### Special features

- The Volume flow rate can be set using an external scale; no tools required
- Simple retrofitting of an actuator is possible
- Correct operation even under unfavourable upstream or downstream conditions (1.5 D straight section required upstream)
- Any installation orientation
- Aerodynamic functional testing of each unit on a special test rig before prior to shipping

#### Materials and surfaces

- Casing made of galvanised sheet steel
- Damper blade and other parts made of high-quality plastic, to UL 94, V1; to DIN 4102, fire rating class B2
- Leaf spring made of stainless steel
- Polyurethane bellows

#### Technical data

- Nominal sizes: 80 to 250 mm
- Volume flow rate range: 6 to 370 l/s or 22 to 1332 m<sup>3</sup>/h
- Volume flow rate control range: approx. 10 – 100 % of the nominal volume flow rate
- Volume flow rate accuracy: approx. ± 10 % of the nominal volume flow rate
- Minimum differential pressure: 30 Pa
- Maximum differential pressure: 500 Pa

#### Sizing data

- $q_v$  [m<sup>3</sup>/h]
- $\Delta p_{st}$  [Pa]

Air-regenerated noise

- $L_{PA}$  [dB(A)]

Case-radiated noise

- $L_{PA}$  [dB(A)]

This specification text describes the general properties of the product. Texts for variants can be generated with our Easy Product Finder design programme.

Order example: VFC/100/E03

Nominal size [mm]	100
Actuator	Variable volume flow, 24 V AC/DC, potentiometer, control signal 0 to 10 V DC

# VFC / 100 / E01



## 1 Type

VFC Volume flow controller

## 2 Nominal size [mm]

80, 100, 125, 160, 200, 250

## 3 Actuator

No entry: manual adjustment

- E01 24 V AC/DC, 3-point (min/max), potentiometer
- E03 24 V AC/DC, modulating 0 – 10 V DC, potentiometer
- M01 24 V AC/DC, 3-point (min/max), mechanical stops

Variants, Attachments, Dimensions and weight, Product details



CAV controller variant VFC, with rotary knob



VFC, actuators

Order code detail	Actuator	Supply voltage	Auxiliary switch
<b>Min/Max actuators</b>			
E01	Actuator with potentiometers TROX/Gruner	24 V AC/DC	–
E02	Actuator with potentiometers TROX/Gruner	230 V AC	–
M01	Actuator with mechanical stops TROX/Belimo	24 V AC/DC	–
M02	Actuator with mechanical stops TROX/Belimo	230 V AC	–
<b>Modulating actuators</b>			
E03	Actuator with potentiometers TROX/Gruner	24 V AC/DC	–

#### Anbauteile: VARYCONTROL Regelkomponenten

☒	Regel- größe	Schnittstelle	V <sub>min</sub> -/ V <sub>max</sub> - Verstellung	Differenzdruck- transmitter	Stellantrieb	Fabrikat	LVC	TVR	TVJ	TVT	TZ- S	TA- S	TVZ	TVA	TVM	TVRK	TVLK
	Easyregler		Dynamisch														
Easy	V			Integriert	Integriert	①	●	●	●	●	●	●	●	●			
	Compactregler		Dynamisch														
BC0	V	MP-Bus		Integriert	Integriert	②	●	●	●	●	●	●	●	●			
BF0	V	MP-Bus		Integriert	Integriert	②										●	
BL0	V	LonWorks		Integriert	Integriert	②		●	●	●	●	●	●	●			
BM0	V	Modbus		Integriert	Integriert	②											
BM0- J6	V	Modbus und steckerfertiger Anschlussleitung		Integriert	Integriert	②											
XG0	V			Integriert	Integriert	③										●	
XB0	V			Integriert	Integriert	③		●	●	●	●	●	●	●			
LN0	V			Integriert	Integriert	⑤		●	●	●	●	●	●	●			
LK0	V	KNX				⑤											
LY0	V			Integriert	Integriert	⑤										●	
	Compactregler		Statisch														
SA0	V			Integriert	Integriert	④											
SC0	Δp			Integriert	Schnelllaufender Stellantrieb integriert	④											
	Universalregler		Dynamisch														
B11	V			Integriert	Stellantrieb, Drehmoment für TVT	②				●							
B13	V			Integriert	Stellantrieb	②		●	●		●	●	●	●			
B27	V			Integriert	Stellantrieb	②										●	
B1B	V			Integriert	Federrücklaufantrieb	②		●	●	●	●	●	●	●			



XC3	V			Integriert	Federrücklaufantrieb	③	●	●	●	●	●	●	●						
		<b>Universalregler</b>		<b>Statisch</b>															
BP1	V	MP-Bus		Separates Bauteil	Stellantrieb, Drehmoment für TVT	②				●									
BP3	V	MP-Bus		Separates Bauteil	Stellantrieb	②	●	●		●	●	●	●				●	●	
BPB	V	MP-Bus		Separates Bauteil	Federrücklaufantrieb	②	●	●	●	●	●	●	●				●		
BPG	V	MP-Bus		Separates Bauteil	Schnelllaufender Stellantrieb	②	●	●	●	●	●	●	●				●	●	
BB1	V			Separates Bauteil	Stellantrieb, Drehmoment für TVT	②				●									
BB3	V			Separates Bauteil	Stellantrieb	②	●	●		●	●	●	●				●	●	
BBB	V			Separates Bauteil	Federrücklaufantrieb	②			●	●	●	●	●	●			●		
XD1	V			Integriert	Stellantrieb	③	●	●	●	●	●	●	●				●		
XD3	V			Integriert	Federrücklaufantrieb	③	●	●	●	●	●	●	●				●		
BR1	Δp	MP-Bus		100 Pa	Stellantrieb, Drehmoment für TVT	②				●									
BR3	Δp	MP-Bus		100 Pa	Stellantrieb	②	●	●		●	●	●	●				●		
BRB	Δp	MP-Bus		100 Pa	Federrücklaufantrieb	②	●	●	●	●	●	●	●				●		
BRG	Δp	MP-Bus		100 Pa	Schnelllaufender Stellantrieb	②	●			●	●	●	●				●		
BS1	Δp	MP-Bus		600 Pa	Stellantrieb, Drehmoment für TVT	②				●									
BS3	Δp	MP-Bus		600 Pa	Stellantrieb	②	●	●								●	●		
BSB	Δp	MP-Bus		600 Pa	Federrücklaufantrieb	②	●	●	●								●		
BSG	Δp	MP-Bus		600 Pa	Schnelllaufender Stellantrieb	②	●	●	●								●		
BG1	Δp			100 Pa	Stellantrieb, Drehmoment für TVT	②				●									
BG3	Δp			100 Pa	Stellantrieb	②	●	●		●	●	●	●				●		
BGB	Δp			100 Pa	Federrücklaufantrieb	②	●	●	●	●	●	●	●				●		
BH1	Δp			600 Pa	Stellantrieb, Drehmoment für TVT	②				●									
BH3	Δp			600 Pa	Stellantrieb	②	●	●									●		
BHB	Δp			600 Pa	Federrücklaufantrieb	②	●	●	●								●		
XE1	Δp			Integriert, 100 Pa	Stellantrieb	③	●	●	●	●	●	●	●				●		

XE3	$\Delta p$			Integriert, 100 Pa	Federrücklaufantrieb	③		●	●	●	●	●	●	●	●	●	●	●
XF1	$\Delta p$			Integriert, 600 Pa	Stellantrieb	③		●	●	●								●
XF3	$\Delta p$			Integriert, 600 Pa	Federrücklaufantrieb	③		●	●	●								●

① TROX, ② TROX/Belimo, ③ TROX/Gruner, ④ Sauter, ⑤ Siemens

☒ Bestellschlüsseldetail, V Volumenstrom,  $\Delta p$  Differenzdruck

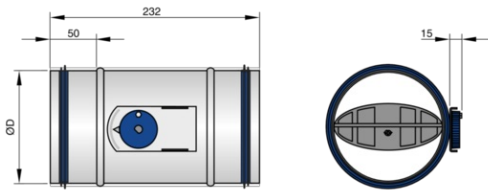
**Anbauteile: VARYCONTROL Regelkomponenten**

☒	Regel-größe	Schnittstelle	V <sub>min</sub> -/ V <sub>max</sub> - Verstellung	Differenzdruck- transmitter	Stellantrieb	Fabrikat
		Easylabregler		Statisch		
Elab	RS, RE, PC, C	TCU3		Integriert	Schnelllaufender Stellantrieb	
	RS, PC, C	TCU3		Integriert	Schnelllaufender Stellantrieb	
Elab	RE, PC, C	TCU3		Integriert	Schnelllaufender Stellantrieb	
	RS, RE, PC, FH, C	TCU3		Integriert	Schnelllaufender Stellantrieb	
		Elektronischer Regler		Statisch	Elektronischer Regler	
TMA	RS, RE, PC	TCU-LON-II mit LonWorks-Schnittstelle		Integriert	Schnelllaufender Stellantrieb	
TMB	RS, RE, PC	TCU-LON-II mit LonWorks-Schnittstelle		Integriert	Schnelllaufender Stellantrieb (bürstenloser Motor)	
TMA	RS, RE,	TCU-LON-II mit LonWorks-Schnittstelle		Integriert	Schnelllaufender Stellantrieb	
TMB	RS, RE,	TCU-LON-II mit LonWorks-Schnittstelle		Integriert	Schnelllaufender Stellantrieb (bürstenloser Motor)	
TMA	RE ,PC	TCU-LON-II mit LonWorks-Schnittstelle		Integriert	Schnelllaufender Stellantrieb	
TMB	RE ,PC	TCU-LON-II mit LonWorks-Schnittstelle		Integriert	Schnelllaufender Stellantrieb (bürstenloser Motor)	
TMA	RS, RE ,PC, FH	TCU-LON-II mit LonWorks-Schnittstelle		Integriert	Schnelllaufender Stellantrieb	
TMB	RS, RE ,PC, FH	TCU-LON-II mit LonWorks-Schnittstelle		Integriert	Schnelllaufender Stellantrieb (bürstenloser Motor)	
XF3	$\Delta p$			Integriert, 600 Pa	Federrücklaufantrieb	③
BB3	V			Separates Bauteil	Stellantrieb	②

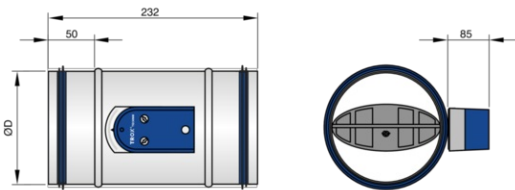
① TROX, ② TROX/Belimo, ③ TROX/Gruner, ④ Sauter, ⑤ Siemens

☒ Bestellschlüsseldetail, V Volumenstrom,  $\Delta p$  Differenzdruck

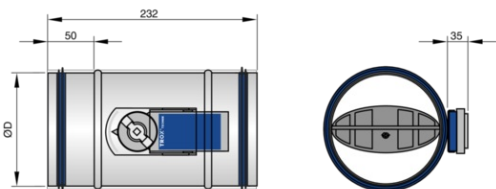
### VFC



### VFC/.../E0\*



### VFC/.../M0\*



## VFC system



- ① CAV controller with rotary knob
- ② Actuator E0\* with potentiometers
- ③ Actuator M0\* with mechanical stops

## Installation details, Basic information and nomenclature



### Installation and commissioning

- Any installation orientation
- Take the adjustment value from the characteristic on the sticker (on each volume flow controller)
- Volume flow rate setpoint can be set on external scale

### Upstream conditions

The volume flow rate accuracy  $\Delta V$  applies to a straight upstream section of the duct. Bends, junctions or a narrowing or widening of the duct cause turbulence that may affect measurement. Duct connections, e.g. branches off the main duct, must comply with EN 1505. Some installation situations require straight duct sections upstream.

Free air intake only with a straight duct section of 1D upstream.

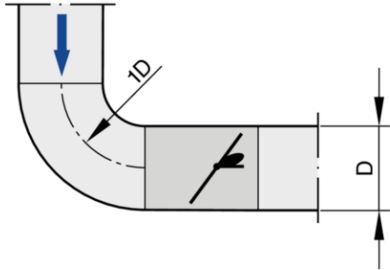
### Space required for commissioning and maintenance

Sufficient space must be kept clear near any attachments to allow for commissioning and maintenance. It may be necessary to provide sufficiently sized inspection access openings.

### Space required

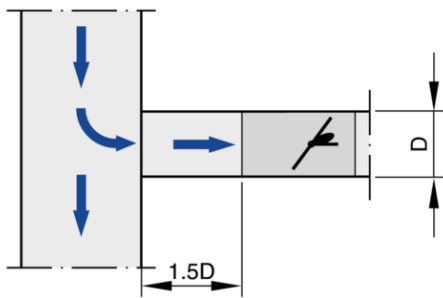
Attachments	①	②	③
	mm		
Without actuator	200	200	200
With actuator E0*	200	200	300
With actuator M0*	200	200	230

### Bend



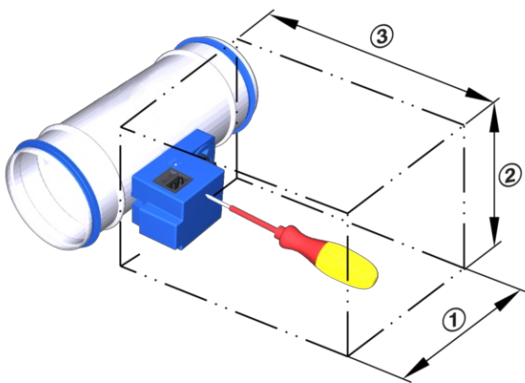
A bend with a curvature radius of at least  $1D$  – without an additional straight duct section upstream of the CAV controller – has only a negligible effect on the volume flow rate accuracy.

### Junction



A junction causes strong turbulence. The stated volume flow rate accuracy  $\Delta V$  can only be achieved with a straight duct section of at least  $1.5D$  upstream. Shorter upstream sections require a perforated plate in the branch and before the CAV controller. If there is no straight upstream section at all, the control will not be stable, even with a perforated plate.

### Access to attachments, mounted on one side



Schematic illustration of required installation space

## Prinipal dimensions

### ØD [mm]

Outer diameter of the spigot

### L [mm]

Length of unit including connecting spigot

### L<sub>1</sub> [mm]

Length of casing or acoustic cladding

### m [kg]

Weight

## Acoustic data

### f<sub>m</sub> [Hz]

Octave band centre frequency

### L<sub>PA</sub> [dB(A)]

A-weighted sound pressure level of air-regenerated noise of the CAV controller, system attenuation taken into account

### L<sub>PA1</sub> [dB(A)]

A-weighted sound pressure level of air-regenerated noise of the VAV terminal unit with secondary silencer, system attenuation taken into account

### L<sub>PA2</sub> [dB(A)]

A-weighted sound pressure level of case-regenerated noise of the VAV terminal unit, system attenuation taken into account

### q<sub>Vnom</sub> [m<sup>3</sup>/h] and [l/s]

Nominal volume flow rate (100 %)

- The value depends on product type and nominal size
- Values are published on the internet and in technical leaflets, and stored in the Easy Product Finder design software.
- Upper limit of the setting range and maximum volume flow rate setpoint value for the CAV controller

### q<sub>v</sub> [m<sup>3</sup>/h] and [l/s]

Volume flow rate

### ΔV [± %]

Volume flow rate accuracy in relation to setpoint (tolerance)

### Δp<sub>st</sub> [Pa]

Static differential pressure

### Δp<sub>st min</sub> [Pa]

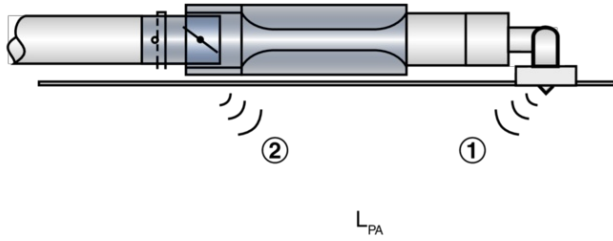
Static differential pressure, minimum

- The static minimum differential pressure is equal to the pressure loss of the CAV controller when the damper blade is open, caused by flow resistance (bellows, crossbar)
- If the pressure on the CAV controller is too low, the setpoint volume flow rate may not be achieved, not even when the damper blade is open
- Important factor in designing the ductwork and in rating the fan including speed control
- Sufficient duct pressure must be ensured for all operating conditions and for all controllers, and the measurement point or points for speed control must have been selected accordingly to achieve this

## Galvanised sheet steel

- Casing made of galvanised sheet steel
- Parts in contact with the airflow as described for the product type
- External parts, e.g. mounting brackets or covers, are usually made of galvanised sheet steel

## Definition of noise



- ① Air-regenerated noise
- ② Case-radiated noise

**Static differential pressure**

