USER MANUAL

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Volume flow controller
VR1-N

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Table of content

Product portfolio:

Areas of application for round volume flow controllers and limiters

Description	VR1-N	VR1	VRL1	VRE1	VRup / VRpro
Functional principle	Mechanical controller	Mechanical controller	Mechanical limiter	Electronic controller	Electronic controller
Pressure difference	30 ... 600 Pa	50 .. 1000 Pa	30 ... 300 Pa	20 ... 1000 Pa	5 ... 1000 Pa
Flow rate range	30 ... 2300 m³/h	50 ... 3100 m³/h	13 ... 1060 m³/h	34 ... 5430 m³/h	42 ... 5430 m³/h
Nominal diameter	DN 80 ... DN 315	DN 80 ... DN 315	DN 80 ... DN 250	DN 100 ... DN400	DN 100 ... DN400
Flow velocity	1.1 ... 12.2 m/s	2.1 ... 15.5 m/s	0.8 ... 6 m/s	1.2 ... 12 m/s	1.5 ... 12 m/s
Control accuracy	Approx. ±5 % from nominal flow rate*	±5 ... ±10 % from set point flow rate	±5 ... ±10 % from nominal flow rate	±5 ... ±15 % from set point flow rate	±5 ... ±20 % from set point flow rate
Operating temperature	-20 ... +70 °C, short-term 90 °C	-20 ... +70 °C, short-term 90 °C	+10 ... +50 °C	+5 ... +60 °C	0 ... +50 °C
Further information	In this document	LINK	LINK	LINK	LINK

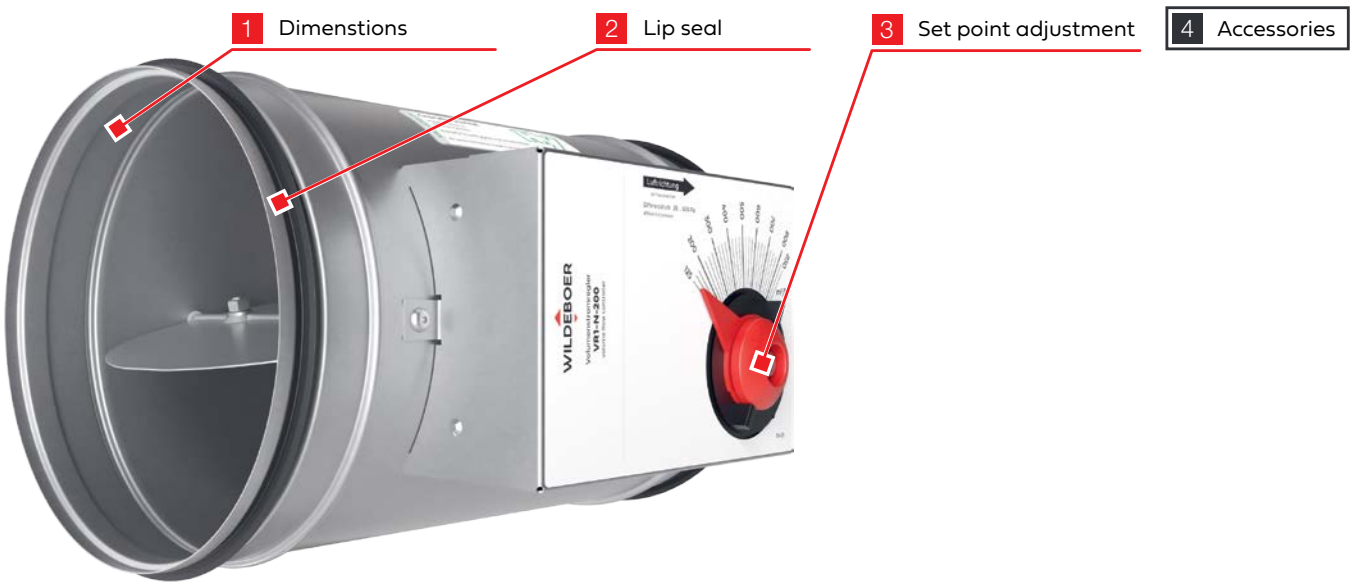
* or ±10 % from set point flow rate (depending on which deviation is greater)

1 Product overview

VR1-N volume flow controllers are maintenance-free, self-acting mechanical controllers for supply air and extract air ducts with constant flow rates that operate without auxiliary energy. They are used especially at low flow velocities and variable pressures to keep the flow rate constant according to the set point value. The setting is made using a manual setting device with setting pointer, scale and locking option. As an option, the VR1-N can be fitted with a 24 V AC/DC or 230 V AC actuator for motorised set point adjustment for applications with variable flow rates.

- Highest control accuracy at low variable pressures
- Factory presets for set point flow rates
- Adjustable locally
- Position-independent installation
- Maintenance-free design
- Sizes DN 80 to DN 315
- Casing tightness: Class C according to DIN EN 1751
- Volume flow range: 30 ... 2300 m³/h
- Pressure range: 30 ... 600 Pa
- Flow velocities: 1.1 ... 12.2 m/s
- Temperature range: -20 ... +70 °C, short-term 90 °C
- Hygiene certificate:
  VDI 6022-1, VDI 3803-1, DIN 1946-4, DIN EN 16798-3, SWKI VA104-01, SWKI VA105-01, ÖNORM H6020, ÖNORM H6021
- Environment product declaration: EPD-WIL-20150036-ICA-DE
- Options
  - Reversing actuator with 2-point and 3-point control for setting to two flow rate set points, 230 V AC or 24 V AC/DC
  - Continuously adjustable reversing actuator for setting to any flow rate set point, 24 V AC/DC
  - Acoustic insulation with sheet metal jacket
  - SRC duct silencer in lengths: 600 mm and 900 mm
  - Lip seals on both sides

2 Product features



1 Dimensions

Nominal diameter [DN]						
80	100	125	160	200	250	315

2 Lip seal

For airtight connection to ventilation ducts
Optional accessories pre-assembled at the factory or for on-site installation

3 Set point adjustment

Manual (basic version)

Manual setting device with setting pointer, scale and locking mechanism:
The flow rate set point values are set manually using the setting pointer within the ranges $\dot{V}_{min}$ to $\dot{V}_{max}$. The controllers are adjusted at the factory for the entire volume flow range.
The VR1-N can be preset at the factory when delivered For this purpose, the flow rate set point values must be specified when ordering. Subsequent adjustment on site is possible.
Pre-assembled at the factory in the scope of delivery

Motorised (optional version)

M1:
Reversing actuator 230 V AC with 2-point and 3-point control.
The corresponding motor limit are positioned in order to adjust the flow rates.
Optional accessories pre-assembled at the factory or for on-site installation

M2:
Reversing actuator 24 V AC/ DC with 2-point and 3-point control.
The corresponding motor limit are positioned in order to adjust the flow rates.
Optional accessories pre-assembled at the factory or for on-site installation

M3:
Continuously adjustable reversing actuator 24 V AC/DC
To set the flow rates, use a reference signal from 0 ... 10 V.
Optional accessories pre-assembled at the factory or for on-site installation

For details, see ▸ Page 16.

4 Accessories

Acoustic insulation with sheet metal casing to reduce the external sound radiation of the volume flow controller (radiated noise)
Optional accessories pre-assembled at the factory or for on-site installation

For details, see ▸ Page 7.

SRC duct silencer for reduction of flow noise in the closed ventilation duct. Pack thickness: 50 mm mineral wool
lengths:
- 600 millimetres
- 900 millimetres

Optional accessories for on-site installation

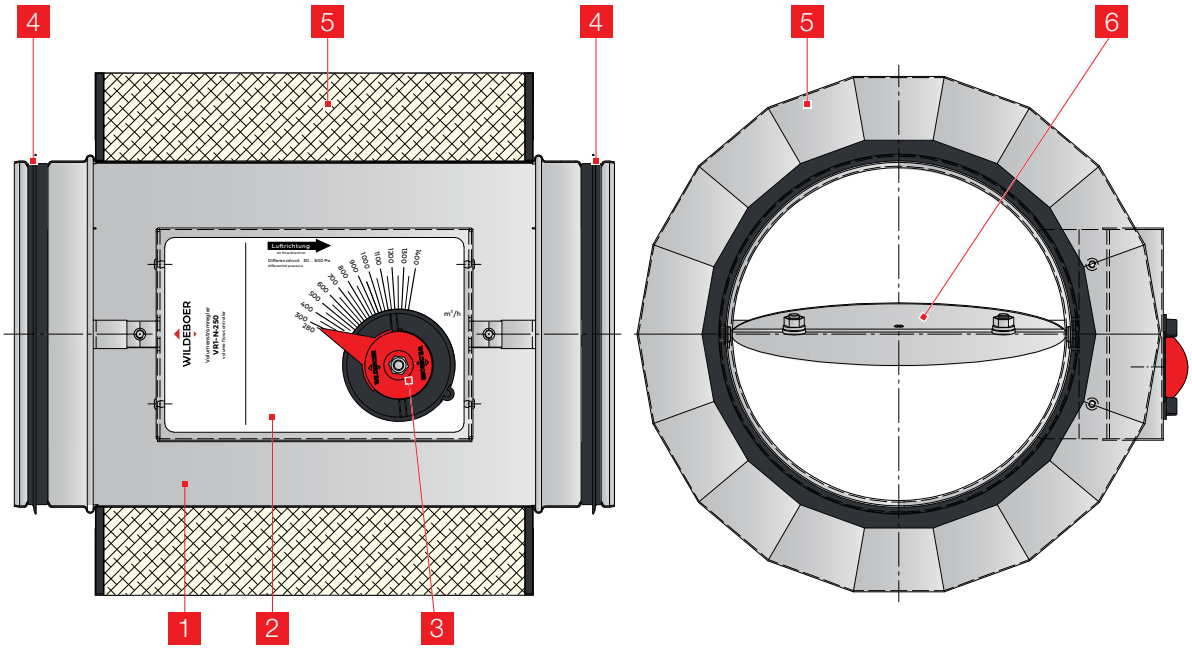
For details, see ▸ Page 7.

3 Product description

The VR1-N volume flow controller is made of galvanised steel. The centrally supported damper blade which controls the flow rate has a stainless steel bearing axis in special bushings. The manual setting device is fitted with a setting pointer, scale and locking mechanism. Flow rate set points can be adjusted manually or by actuator within the flow rate ranges $\dot{V}_{min}$ to $\dot{V}_{max}$.

The special control mechanism ensures high control accuracy so that the flow rate can be kept constant over the entire pressure range with variable pressures.

The adjustable volume flow set points depend on the nominal diameter of the VR1-N.



Position	Description
1	Duct casing
2	Label with scale and air direction indicator
3	Manual setting device with setting pointer, scale and locking mechanism
4	Lip seal (optional)
5	Acoustic insulation with sheet metal jacket (optional)
6	Damper blade

Size [DN]	$\dot{V}_{min}$ [m³/h]	$\dot{V}_{max}$ [m³/h]
80	30	220
100	40	300
125	70	440
160	100	625
200	125	850
250	280	1400
315	400	2300

3.1 Area of application

The VR1-N volume flow controller is used in supply air and extract air ducts of ventilation and air conditioning systems.

Notes

- VR1-N volume flow controllers are adjusted for the entire scaled application area.
- The flow rate set point is set during installation by turning the setting pointer to the desired set point on the scale and locking this setting. This does not affect the control accuracy.
- Factory preset volume flow controllers can be installed directly. The flow rate set point can be changed at a later date by releasing the catch.
- The VR1-N volume flow controllers and the optionally available SRC duct silencers are supplied separately. Assembly is carried out on site.
- Installation and operating instructions for the VR1-N are available on the Internet at www.wildeboer.de.

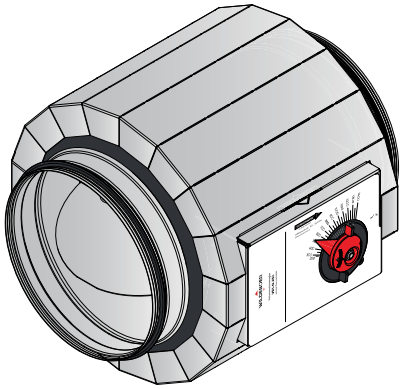
3.2 Function

The VR1-N volume flow controller operates without auxiliary energy. The air flow in the ventilation duct generates a torque in the closing direction when it hits the damper blade. This torque is equalised by the restoring torque of a blade spring so that the flow rate can be kept constant within the tolerances, even if the pressure differences change. Additional damping bellows ensures vibration-free movement of the damper blade.

3.3 Accessories

3.3.1 Acoustic insulation with sheet metal jacket

Acoustic insulation with a sheet metal jacket is supplied as factory-mounted or for on-site installation.

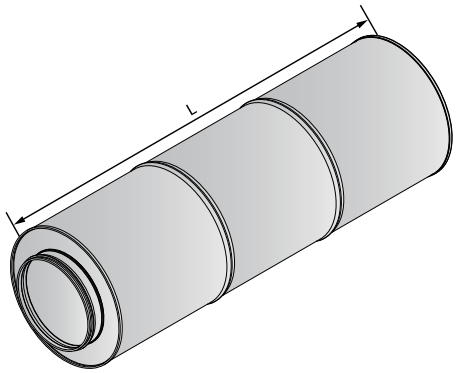


Maximum possible reduction in radiated noise as a function of the nominal diameter:

DN	Reduction
80	-18 dB
100	
125	
160	
200	
250	
315	

3.3.2 SRC duct silencer

The SRC duct silencer is supplied separately. Assembly is carried out on site along with the volume flow controller.



Maximum possible reduction in flow noise as a function of the silencer length:

DN	Outer diameter [mm]	L [mm]	
		600	900
80	200	-22 dB	-
100	200	-22 dB	-25 dB
125	225	-22 dB	-25 dB
160	260	-21 dB	-24 dB
200	300	-19 dB	-24 dB
250	355	-18 dB	-22 dB
315	415	-15 dB	-19 dB

Pack thickness: 50 mm mineral wool

4 Quick layout

The quick layout displays the expected sound power level of the VR1-N. Intermediate values can be interpolated for a rough estimate. The exact values for different differential pressures can be taken from the Wildeboer dimensioning software WiDim. ▸ WiDim

Sound level

Size	Flow rate	Flow velocity	Differential pressure	Flow noise	Radiated noise
[DN]	$\dot{V}$ [m³/h]	v [m/s]	Δp [Pa]	Sound power level L_{WA} [dB(A)]	Sound power level L_{WA} [dB(A)]
80	30	1.7	50	32	< 20
80	125	6.9		43	29
80	220	12.2	100	48	40
100	40	1.4	50	32	< 20
100	170	6.0		44	25
100	300	10.6	100	49	37
125	70	1.6	50	34	< 20
125	255	5.8		45	30
125	440	10.0	100	50	38
160	100	1.4	50	35	22
160	360	5.0		45	32
160	625	8.6	100	50	35
200	125	1.1	50	35	27
200	500	4.4		46	34
200	850	7.5	100	51	37
250	280	1.6	50	40	22
250	840	4.8		48	33
250	1400	7.9	125	52	37
315	400	1.4	50	41	24
315	1350	4.8		50	37
315	2300	8.2	125	54	42

The sound power level of the **radiated noise** can be further reduced by using acoustic insulation.

The **mean sound power level in the room** for the following equipment is:

- **26 dB** less with acoustic insulation
- **8 dB** less without acoustic insulation

than the sound power levels specified in the nomograms L_{WA}.

The sound pressure level can be further reduced by carrying out additional sound attenuation measures on site (suspended ceilings, high degree of room attenuation).

However, the acoustic insulation can only achieve the stated values if the connected circular ventilation ducts are soundproofed (insulated) accordingly.

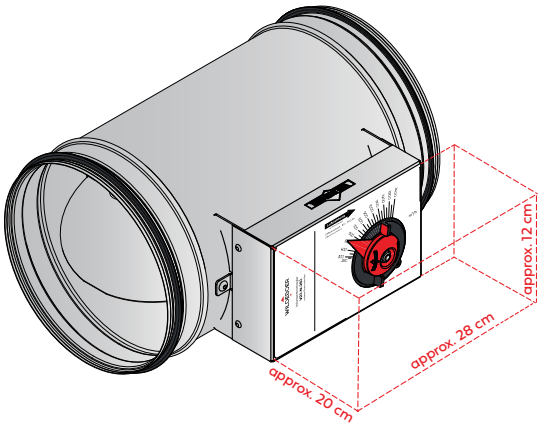
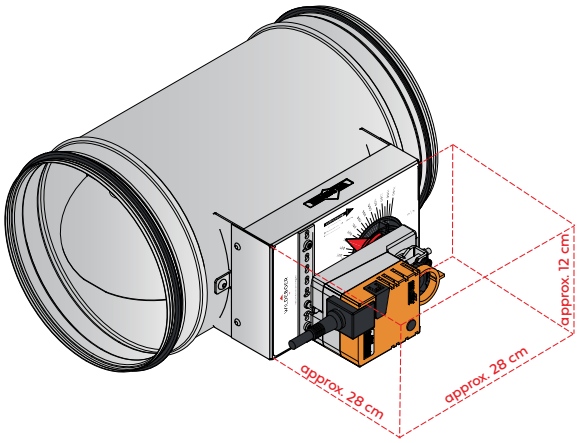
The sound power level of the **flow noise** can be reduced by up to **25 dB** by using an SRC duct silencer. ▸ Page 7.

5 Installation

The VR1-N volume flow controller is installed regardless of the position and in the air direction indicated on the label. To ensure lasting functionality and leak tightness, stress-free installation in ventilation ducts is a prerequisite.

Observe available space

In order to enable the scale to be read and the commissioning and servicing work to be carried out, sufficient space should be kept free in the attachment area. If necessary, inspection openings of sufficient size are required so that the attachments are easily accessible.

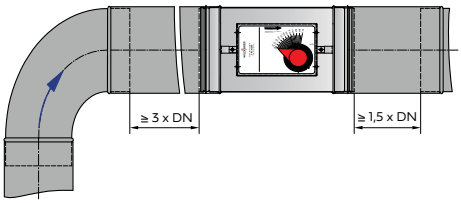
Set point adjustment: manual	Set point adjustment: motorised
	

5.1 Distances to disruption points

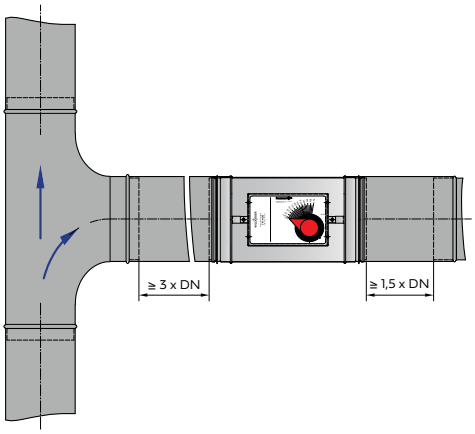
The specified control accuracy of $\Delta\dot{V}$ applies to a straight and disruption-free inflow. Fittings such as bends, branches or changes in cross-section cause fluctuations that can influence the flow rate measurement.

For the VR1-N volume flow controller to work efficiently, the flows must be extensively undisrupted. After flow disturbance points (e.g. bends or branches), the straight inlet and outlet sections shown as examples must be observed; longer inlet sections may be required where several disruption points occur consecutively. Otherwise significant nonconformities must be anticipated.

Bend connection



Branch-off from main duct



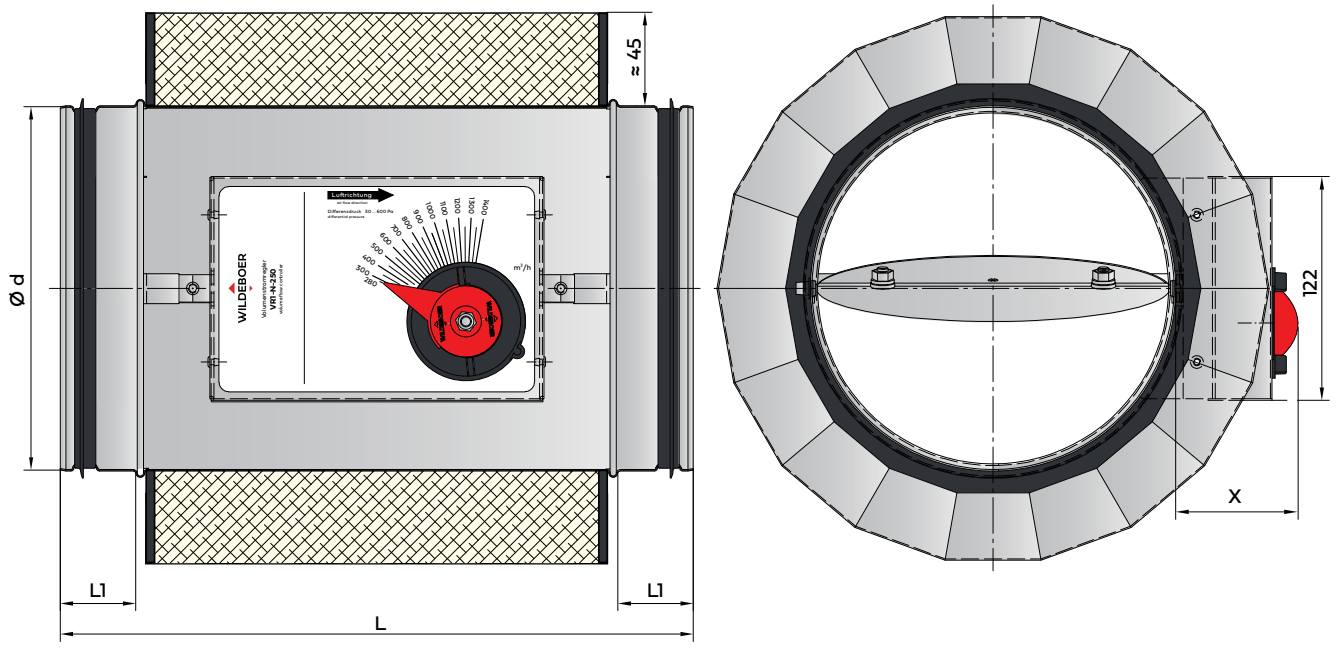
The specified control accuracy of $\Delta\dot{V}$ can only be achieved with at least 3 x DN straight flow path.

Note:
EN 1506 must be observed for the design of ventilation duct connections.

6 Technical data

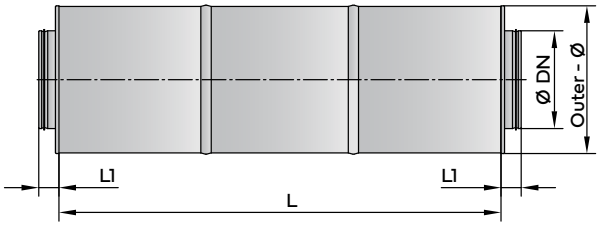
General data	
Nominal diameter	DN 80, DN 100, DN 125, DN 160, DN 200, DN 250, DN 315
Flow rate range	30 ... 2300 m³/h
Control range	Approx. 13 ... 100 % from nominal flow rate
Control accuracy	Approx. ±5 % from the nominal flow rate or ±10 % from the set point flow rate (depending on which deviation is greater)
Differential pressure range	30 ... 600 Pa
Flow velocity	1.1 ... 12.2 m/s
Operating temperature	-20 ... +70 °C, short-term +90 °C
Relative humidity	≤ 95 %, non-condensing
Casing tightness according to DIN EN 1751	Class C
Maintenance-free design	Yes
Materials	
Casing + damper blade	Galvanised steel
Bearing axles	Stainless steel

6.1 Dimensions



Nominal diameter [DN]	Ød [mm]	L [mm]	L1 [mm]	X	A_A [m²]
80	79	329	40	Manual: 65 millimetres Motorised: 130 millimetres	0.005
100	99	329	40		0.008
125	124	329	40		0.012
160	159	329	40		0.020
200	199	329	40		0.031
250	249	407	60		0.049
315	314	457	60		0.078

6.1.1 SRC duct silencer



Size [DN]	Outer Ø [mm]	L [mm]		L1 [mm]
80	200	600	-	40
100	200		900	
125	225			
160	260			
200	300			
250	355			
315	415			

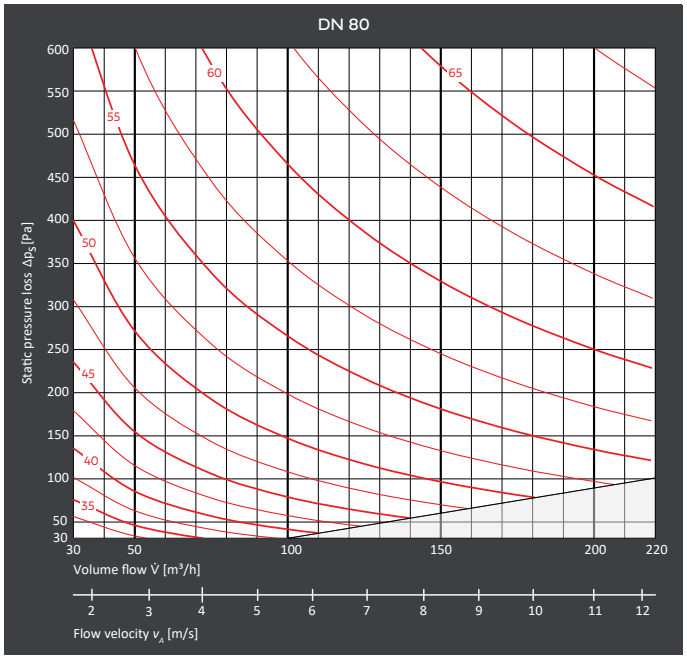
6.2 Weight

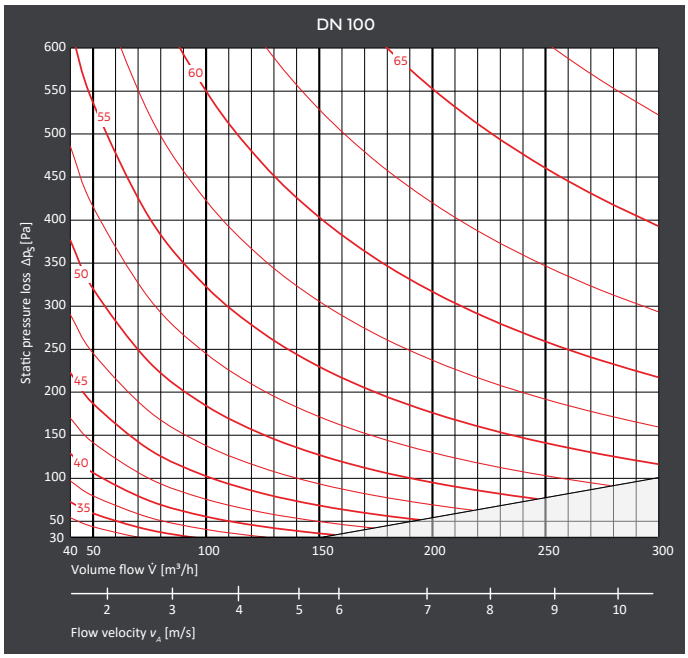
Nominal diameter [DN]	VR1-N [kg]	Acoustic insulation [kg]	Lip seal [g]	SRC duct silencer [kg]	
				600 millimetres	900 mm
80	1.13	0.73	20	3.00	-
100	1.24	0.88	26	3.80	5.70
125	1.39	1.07	32	4.50	6.30
160	1.60	1.33	40	5.10	7.80
200	1.88	1.84	52	6.20	10.00
250	3.26	2.45	64	7.80	11.50
315	4.37	3.60	88	9.10	13.10

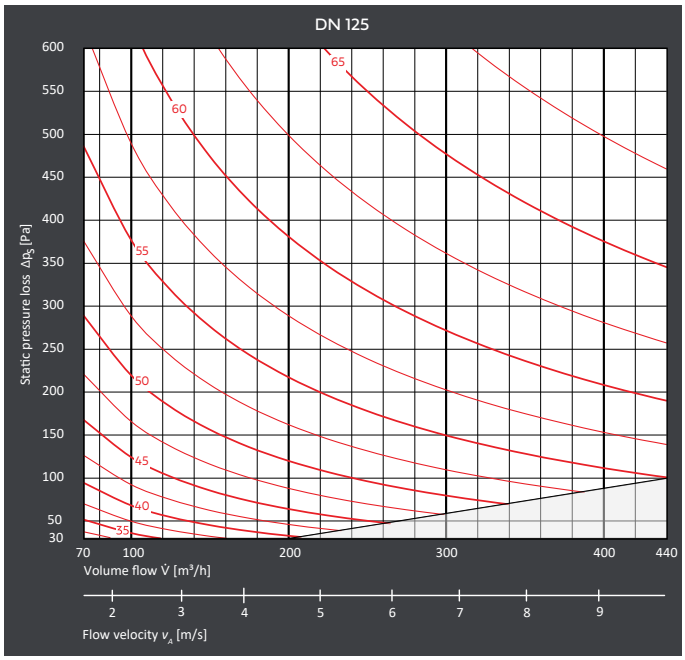
Actuator	Weight [g]
M1	660
M2	660
M3	630

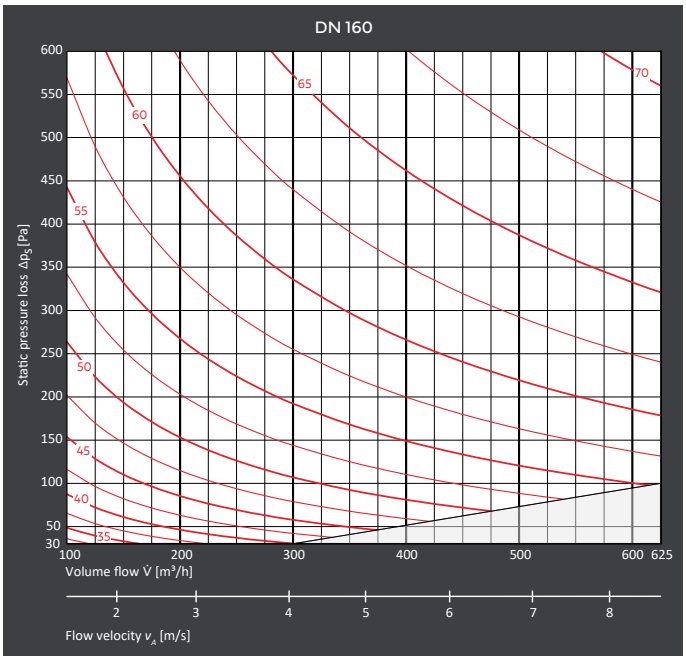
6.3 Sound power level (flow noise)

Sound power level L_{WA} [dB(A)]

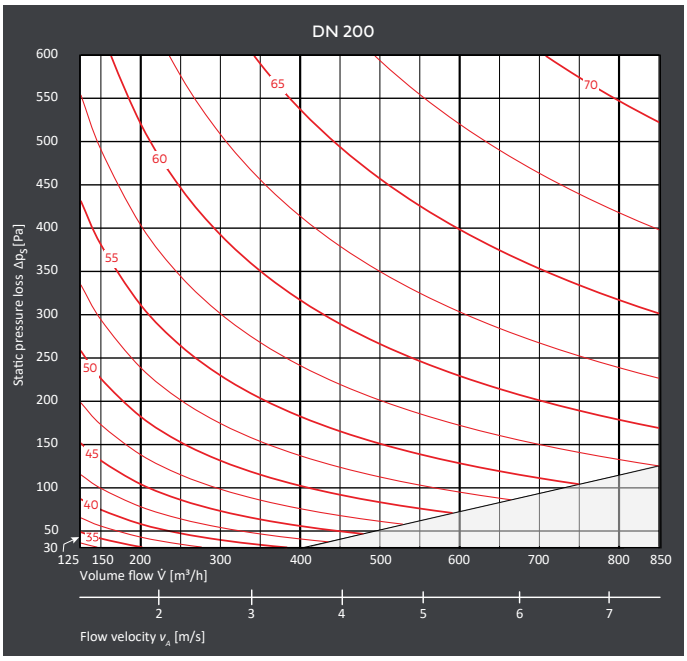


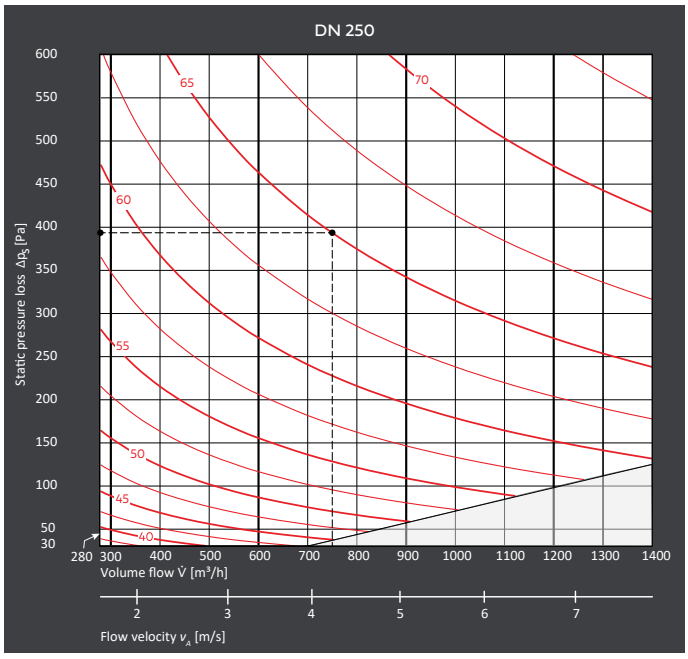


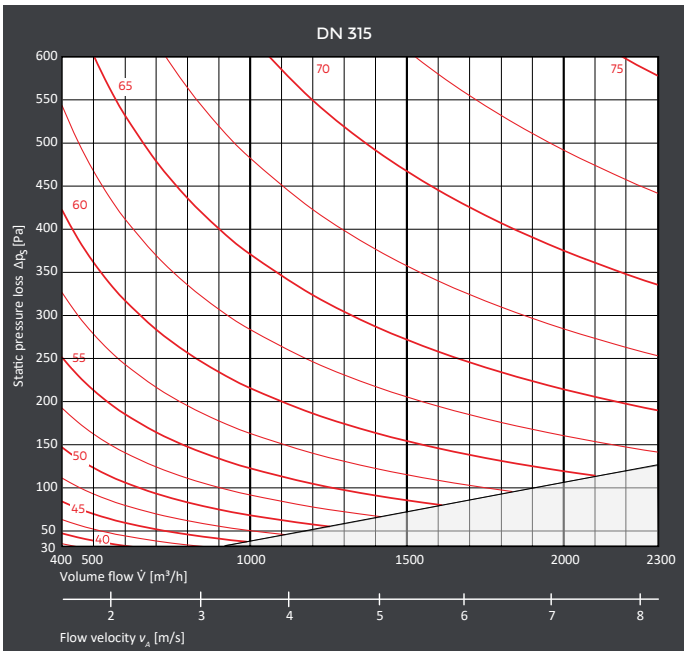




Sound power level L_{WA} [dB(A)]







Example:

Specified:	Size	DN 250	
	Flow rate	$\dot{V}$ = 750	m³/h
	Flow velocity	v_A = 4.25	m/s
	Static pressure drop	Δp_S = 395	Pa
Result:	Flow noise		
	Sound power level	L_{WA} = 65	dB(A)

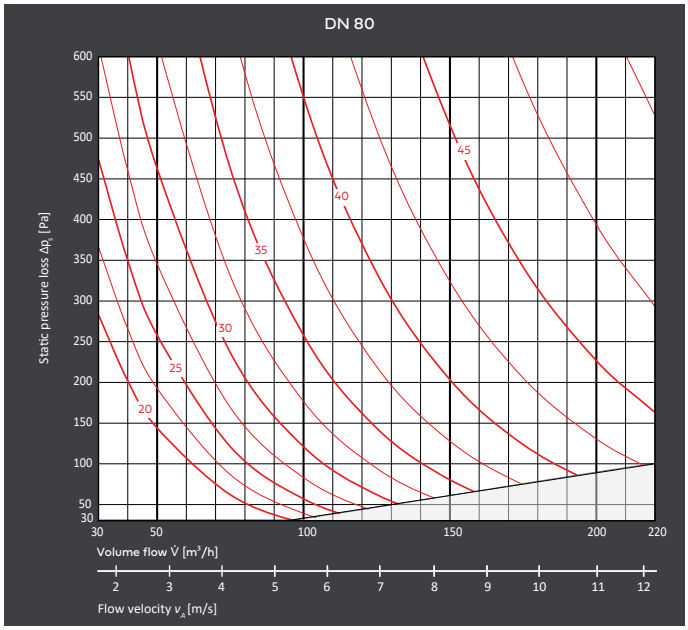
- The sound power level of the flow noise can be further reduced by using the SRC duct silencer. Further information ▸ Page 7
- The sound power level inside the connecting duct is calculated in the nomograms as an A-weighted overall level L_{WA}.
- Corresponding octave sound power levels $L_{W\text{-}Okt}$ result for each size and for all operating points from the Wildeboer dimensioning software ▸ WiDim; including the dimensioning with additional SRC duct silencer.
- Important: The sound levels indicated in the nomograms are sound power levels! The values represent the sound energy introduced into the duct system. They should be applied for acoustic calculations, e.g. when adding sound attenuators.
- Please note: The sound power levels L_p or L_{pA} are specified more than once to generally indicate attenuations of up to 16 dB. When comparing numerical values, always bear in mind the difference between the sound power level and sound pressure level. Furthermore, the degree of attenuation only becomes apparent once the specific ducts, deflections, branches and rooms have actually been connected.

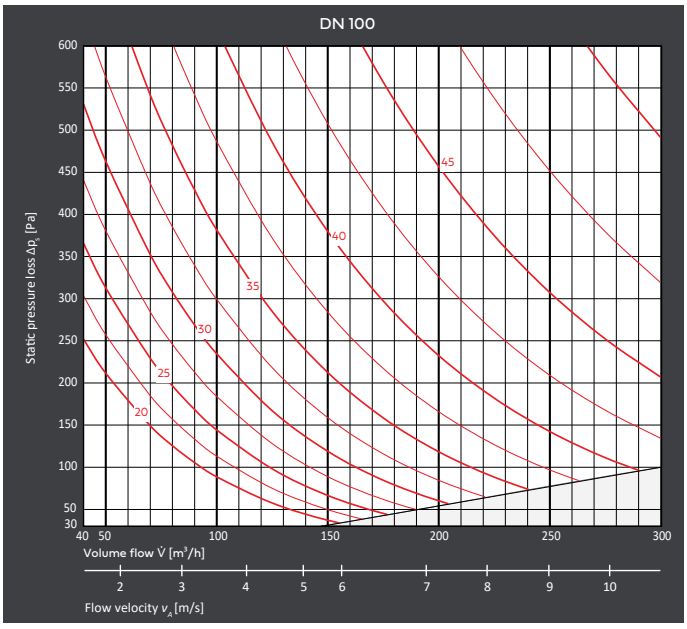
Nomenclature

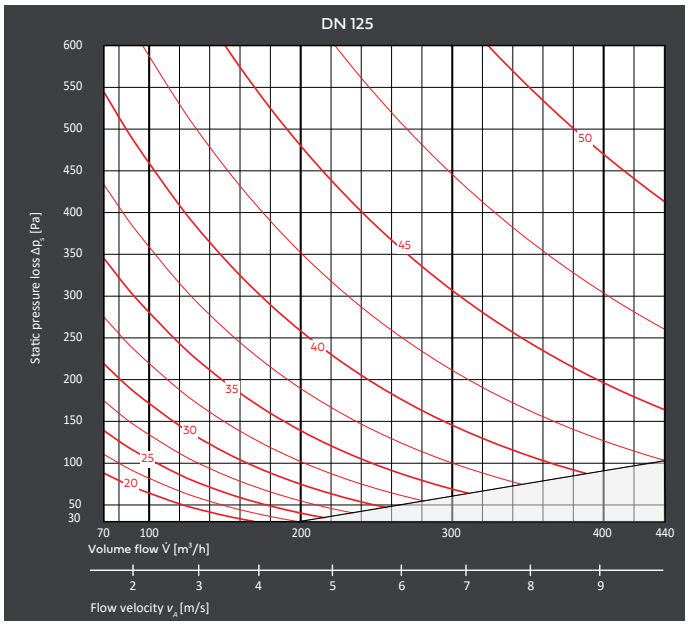
$\dot{V}$	[m³/h]	flow rate
A_A	[m²]	Incoming flow cross-section
v_A	[m/s]	Flow velocity in A_A
Δp_S	[Pa]	Static pressure drop
Δp	[Pa]	Differential pressure
L_{WA}	[dB(A)]	A-weighted sound power level
$L_{W\text{-}Okt}$	[dB]	Octave sound power level $L_{W\text{-}Okt} = L_{WA} + \Delta L$
ΔL	[dB]	Relative sound power level to L_{WA}
f	[Hz]	Octave mid-frequency
L_p	[dB]	Sound pressure level
L_{pA}	[dB(A)]	A-weighted sound pressure level

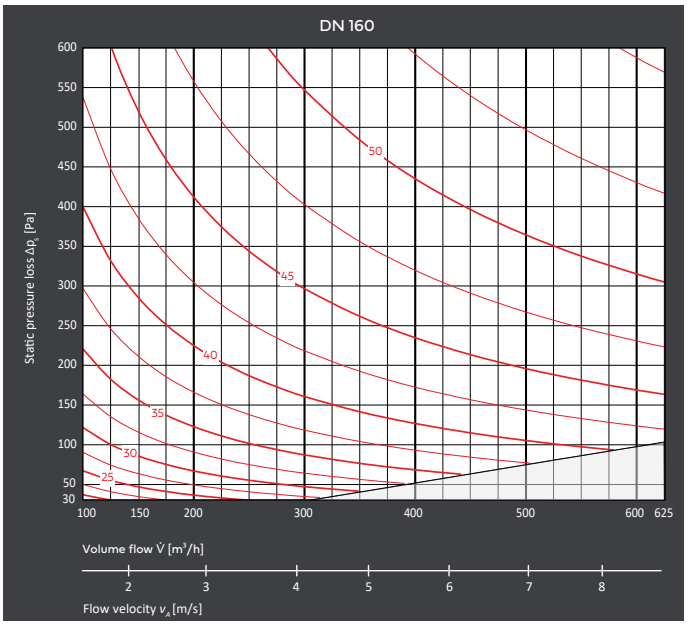
6.4 Sound power level (radiated noise)

Sound power level L_{WA} [dB(A)]

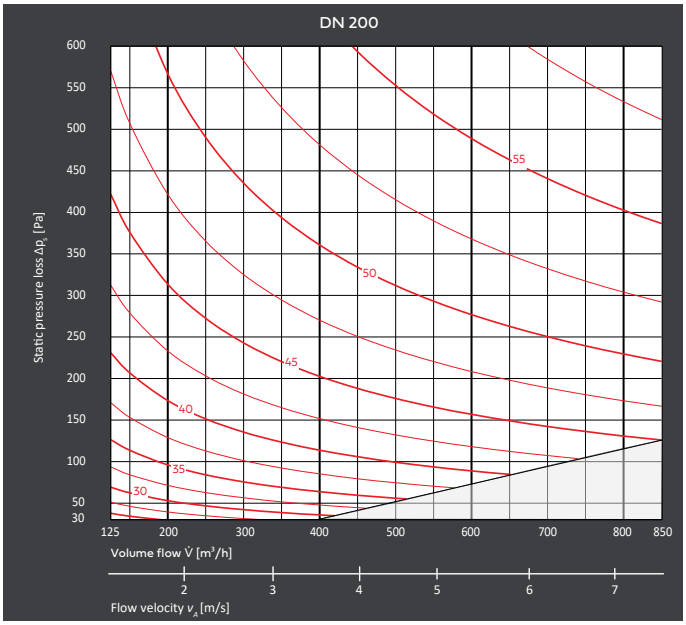


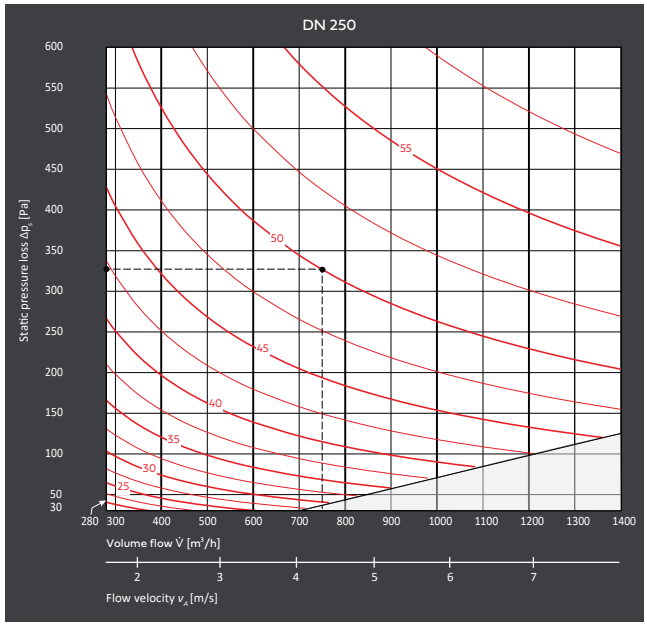


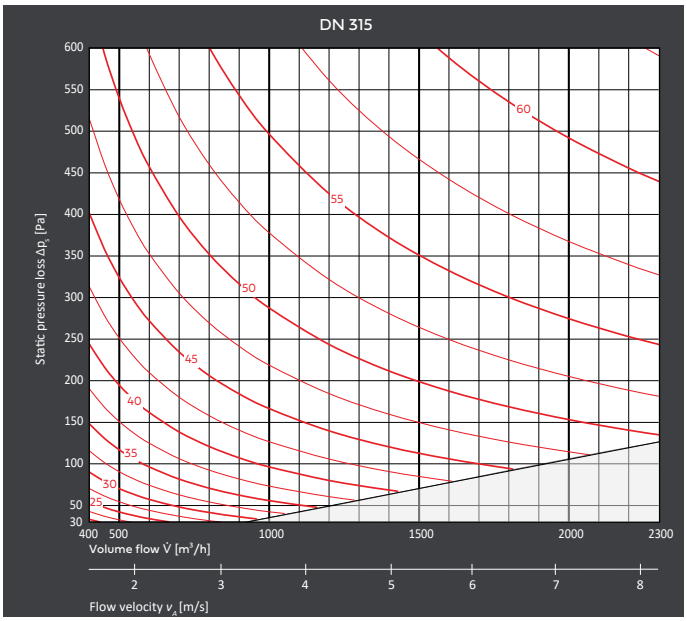




Sound power level L_{WA} [dB(A)]







Example:

Specified:	Size	DN 250	
	Flow rate	$\dot{V}$ = 750	m³/h
	Flow velocity	v_A = 4.25	m/s
	Static pressure drop	Δp_S = 340	Pa
Result:	Radiated noise		
	Sound power level	L_{WA} = 50	dB(A)

- The sound power level of the radiated noise can be further reduced by using acoustic insulation. Further information ▸ Page 7
- The sound pressure level can be further reduced by carrying out additional sound attenuation measures on site (suspended ceilings, high degree of room attenuation).

Nomenclature

$\dot{V}$	[m³/h]	flow rate
A_A	[m²]	Incoming flow cross-section
v_A	[m/s]	Flow velocity in A_A
Δp_S	[Pa]	Static pressure drop
Δp	[Pa]	Differential pressure
L_{WA}	[dB(A)]	A-weighted sound power level
$L_{W\text{-}Okt}$	[dB]	Octave sound power level $L_{W\text{-}Okt} = L_{WA} + \Delta L$
ΔL	[dB]	Relative sound power level to L_{WA}
f	[Hz]	Octave mid-frequency
L_p	[dB]	Sound pressure level
L_{pA}	[dB(A)]	A-weighted sound pressure level

6.5 Set point adjustment

6.5.1 Manual

VR1-N volume flow controllers are designed in the basic version for manual adjustment of the flow rate set point and operate without auxiliary energy. The volume flow set point is preselected at an adjusting device with high and kept constant at variable pressures to a high degree of accuracy. The volume flow controllers are adjusted at the factory for the entire volume flow range.

6.5.2 Motorised

As an option, the set point adjustment can be motorised via factory-mounted electric actuators. Reversing actuators and continuously controllable reversing actuators are available for this.

Actuator and actuator size		Electrical connection					Power	Runtime for 90°	Manual Adjustment
		Voltage	AC tolerance	DC tolerance	Connected load	Wires	Run	Actuator	
M1	5 Nm	230 V AC	85 ... 265 V	-	3.5 VA	3 x 0.75 mm², 1 m long	1.5 W	< 150 s	Push button, lockable
M2		24V AC/DC	19.2 ... 28.8 V		1.5 VA		1 W		
M3		24V AC/DC	19.2 ... 28.8 V		2 VA	4 x 0.75 mm², 1 m long			

Reversing actuators (M1, M2) open and close the volumetric flow controllers with 230 V AC voltage or 24 V DC or AC voltage.

The **M1** (230 V AC) and **M2** (24 V AC/DC) actuators enable 2-point and 3-point control. The corresponding motor limit stops are positioned in order to adjust the two flow rates. In the delivery condition, the two limit stops of the actuators are set at the 0 direction of travel and the largest possible angle of rotation. The maximum angle of rotation corresponds to the largest possible flow rate set point, and the minimum is equivalent to a "cutoff" at a residual leakage that is significantly lower than the minimum flow rate. This can be extended to 3-point control systems an additional 0 circuit arrangement. When actuated in this way, the actuator remains in its current position and the VR1-N volume flow controller adjusts the corresponding set point.

Continuously adjustable reversing actuator (M3) with 24 V AC/DC sets the volume flow controllers to any desired position. The position is specified by means of a command signal of 0 or 2 to 10 V, position feedback via an output signal of 2 to 10 V.

The **M3** (24 V AC/DC) actuator enables continuous set point adjustment. The actuator is controlled with a setting voltage of Y = 0 ... 10 V DC and moves to the position specified by the control signal; however, the operating range of the motor only starts at 2 V. The flow rate set point changes almost in line with the setting voltage. In the delivery condition, the actuator is set to 0 direction of travel and the adjustable mechanical limit stops are set for the largest possible angle of rotation, which means that when Y = 10 V the maximum angle of rotation corresponding to the maximum volume flow set point is approached, and at 0 2 V... The minimum angle of rotation is approached; this corresponds to a "cutoff" at a residual leakage that is significantly lower than the minimum volume flow set point. The purpose of the checkback voltage U = 2 ... 10 V DC is to provide an electric display of the volume flow set point setting and serve as a subsequent actuating signal for other actuators.

Notes

- All adjusting actuators are overload-proof, do not require a limit switch and stop automatically at the limit stop.
- In the event of a power failure or interruption, the current actuator position is retained.
- The direction of travel of all adjusting actuators can be reversed via a push button on the motor.

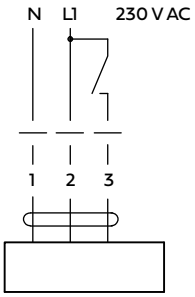
Presetting

Depending on the nominal diameter, the flow rate set point can be preset at the factory in the following increments.

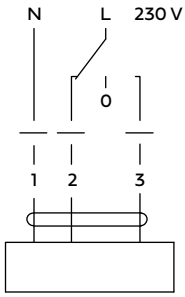
Nominal diameter [DN]	Flow rate set point$_{min}$	Flow rate set point$_{max}$	Increments
80	30	220	10
100	40	300	10
125	75	425	25
160	100	625	25
200	125	850	25
250	300	1400	50
315	400	2300	100

Electrical connection

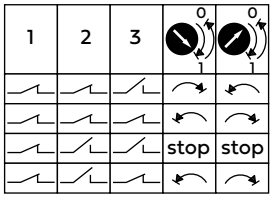
M1: 2- point control



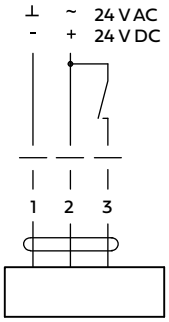
M1: 3- point control



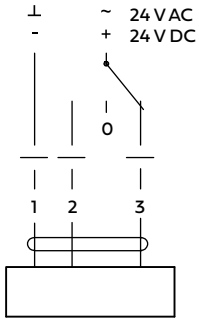
M1: Direction of travel



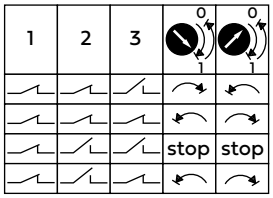
M2: 2- point control



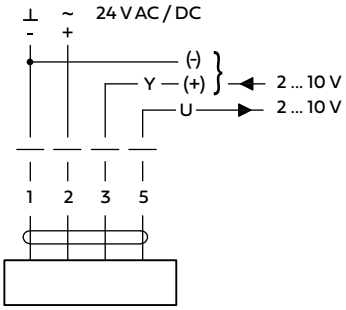
M2: 3- point control



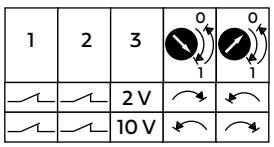
M2: Direction of travel



M3: Continuous control



M3: Direction of travel



7 Specification text

Maintenance-free, circular volume flow controller for position-independent installation in circular ventilation ducts for supply and exhaust air ventilation and air conditioning systems with low flow velocities and variable pressures. Casing and control mechanism made of galvanized sheet steel, with acoustic insulation, with lip seals. **With centrally supported damper blade for volume flow control, with stainless steel bearing axis in special bushings. Adjustment device with rotary pointer, scale and locking device for the volume flow set point,** can be adjusted manually or by actuator. **Volume flow controller designed as mechanical controller for constant volume flows without auxiliary power supply. With special control mechanism for a high degree of control accuracy throughout the entire control range. The volume flow set point must be infinitely adjustable throughout the control range. The flow rate is kept constant at variable pressures between 30 and 600 Pa with a deviation of around ±5 % of the nominal flow rate or ±10 % of the set point flow rate (depending on which deviation is greater). Casing tightness class C according to DIN EN 1751. Certificate as proof of compliance with the hygiene requirements according to VDI 6022-1, VDI 3803-1, DIN 1946-4, DIN EN 16798-3, SWKI VA104-01, SWKI VA105-01, ÖNORM H6020 and ÖNORM H6021. Environmental Product Declaration according to ISO 14025 and EN 15804.**

.....	**Pc.**			
	Volume flow:	.....	**m³/h**	
	Pressure drop:	.....	**Pa**	
	Maximum sound power level			
	Flow noise	.....	**dB(A)**	
	including SRC duct silencer			
	Radiated noise	.....	**dB(A)**	
	Manufacturer:	**WILDEBOER**		
	Type: VR1-N			
	Size:			
	Supplied complete with fixings:		.....	
		install:	.....	.....
.....	**pc. SRC duct silencer 600 / 900**			
		deliver:	.....	
		install:	.....	.....

Delete text not printed in bold as required!

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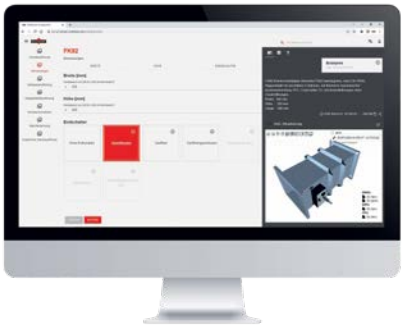
Or you can use the tender text customised for your product selection in the Wildeboer Configurator ▸ Wildeboer Configurator.

8 Wildeboer makes it simple

8.1 Wildeboer Configurator



- Quick, intuitive configuration of Wildeboer products
- Easy calculation of the operating point data for the configured product
- 3D display of the product and download in various formats
- Download of data sheets, tender texts and variant keys
- Login area with individual price display option

8.2 WiDim dimensioning software

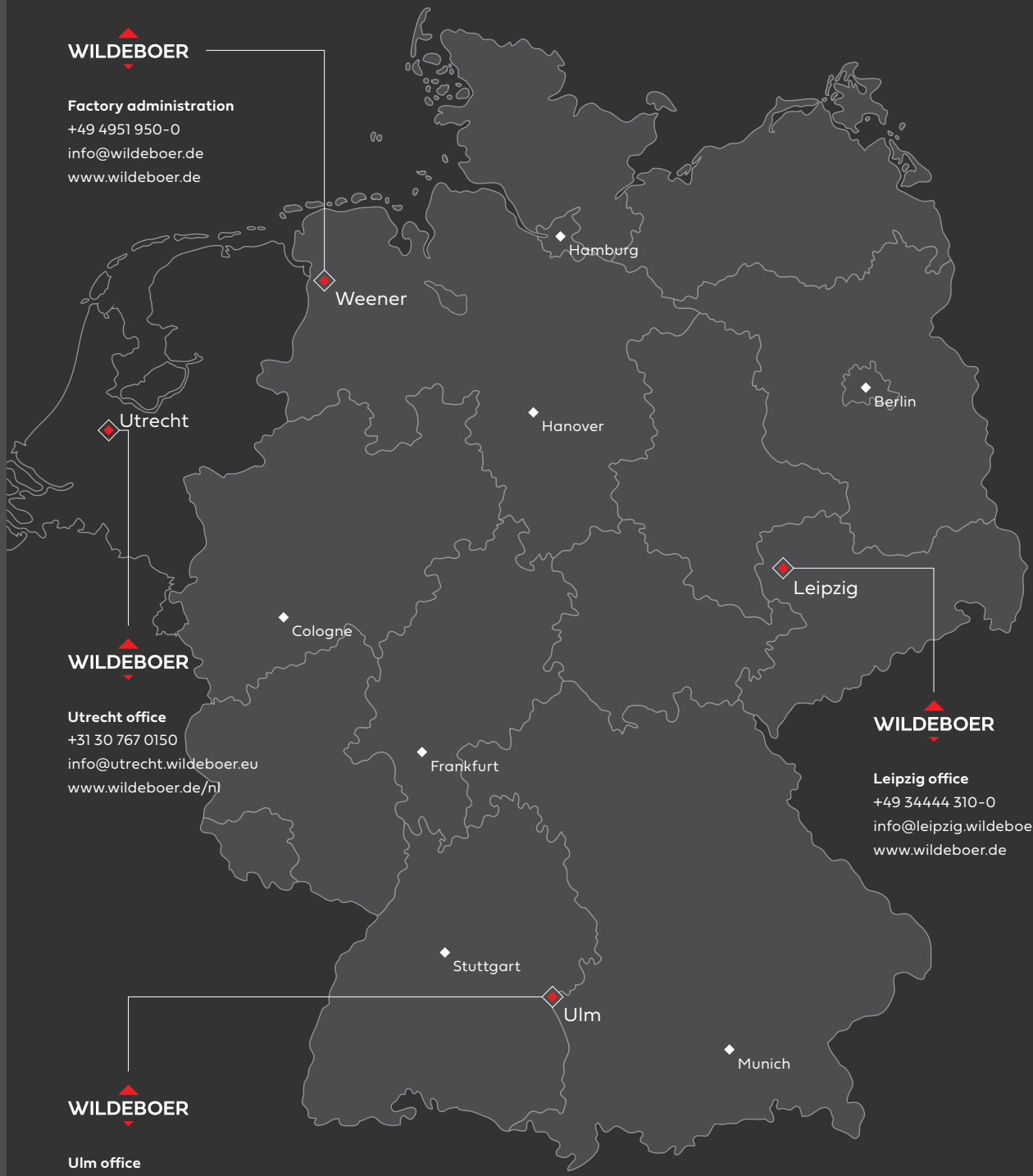
- Functional, modern and intuitive dimensioning of Wildeboer products
- Collect operating point data, 3D product views, matching accessories and current revision documents in a single project in a user-friendly manner
- Project can be output in various formats
- A GAEB interface and an interface based on VDI 3805 facilitate a continuous planning process

8.3 Documents online

- Paperless and environmentally friendly online access to Wildeboer documents
- All documents in one central location and always up to date
- Supporting interactive formats and content

Always there for you

Locations & contact



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