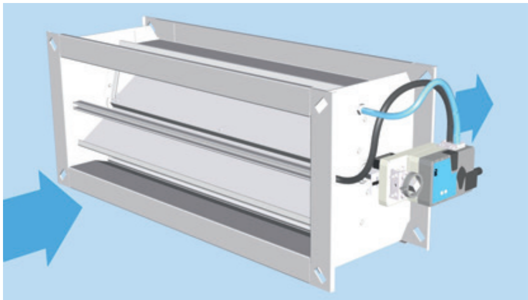
AIR TECH SYSTEMS

Technical Brochure

LTG Air Distribution

Variable flow rate controllers VRF*active*

active control



Square, with LTG map control
For comfort ventilation applications (e.g. office rooms)

LTG Comfort Air

Air-Water-Systems

Air Diffusers

Air Distribution

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Notes

Dimensions stated in this brochure are subject to General Tolerances according to DIN ISO 2768-vL.

The actual specifications are available as a word document at your local distributor or at www.LTG.net.

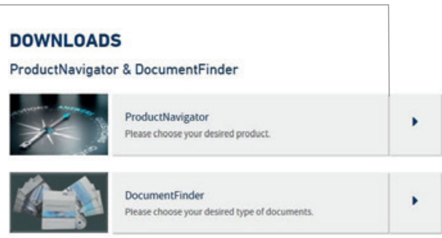
The flow rate controllers VRE, VRF, VRE*active* and VRF*active* are designed to be installed in air-conditioning systems in accordance with VDI 2066 Sheets 1+2 and DIN 1946 Sheet 2.

The aforementioned standards, in particular DIN 1946-2 which has been superseded by DIN EN 13779, relate to DIN EN 13779, which in turn refer to the standards DIN EN 12237 and DIN EN 1507. The tightness classes quoted in the standards must be enquired depending on the product design.

LTG planning tools – we support you!

Visit the download area on our website www.LTG.net with helpful tools, such as dimensioning programs, streaming videos and product information!

Also available: Our product overviews about air diffusers, air-water systems, decentralised ventilation units and air distribution products.



Flow Rate Control Basics – Which Product for which Application?

Plant types

Variable Flow Rate

Units with variable flow rates (VVS) use electronic flow rate controllers providing the room with exactly the required air volume – according to function and energy efficency.

Constant Flow Rate

Units with constant flow rates (KVS) use flow rate controllers maintaining a constant flow rate mechanically system-powered. Working with no wiring or external power supply, they provide convenient and cost-saving solutions.

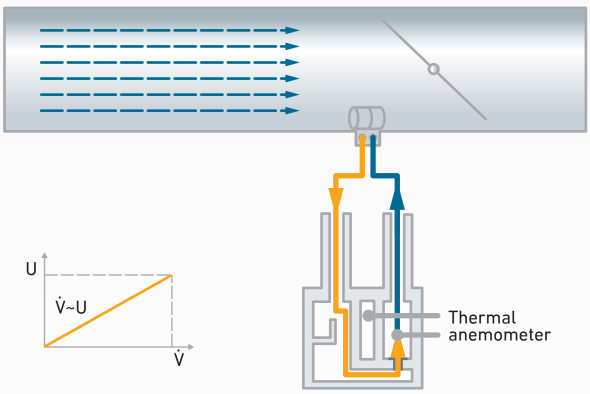
Measuring Methods

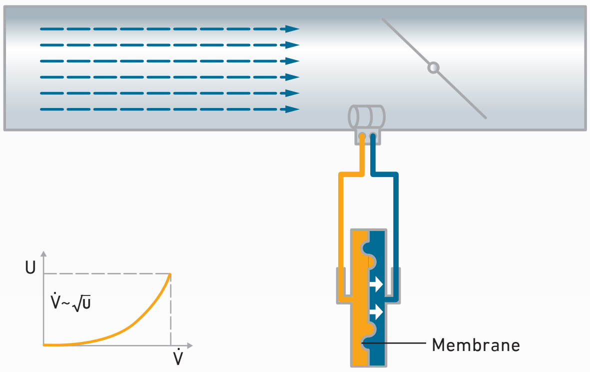
Dynamic Differential Pressure Management

Dynamic methods measure part of the air that is guided through the differential pressure transducer. Dynamic differential pressure measuring makes economical sense in plants where no dust and/or chemical pollution of the air is expected, potentially leading to the contamination of sensors (e. g. administration and office buildings, museums, etc.).

Static Differential Pressure Management

Static differential pressure measurement uses a diaphragm pressure transducer. With this method, no air is guided through the sensor, so no dust or chemical pollution by the air is possible and hence, may well be used in such environments.

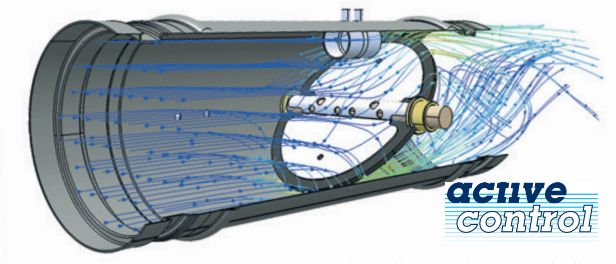




Both principles are applied in our products of VR... series: VR*active* (dynamic) and VR*active-s* (static).

LTG map control.
Differential pressure + Damper setting = Flow rate

Contrary to common measuring techniques, the differential pressure is not measured using an upstream element such as orifice plate or differential pressure sensor. Flow rate controllers VR.*active* measure the differential pressure directly in the damper blade area (stronger signal due to locally accelerated air flow).



Locally accelerated air flow at the measuring point

View of unit

Application

The flow rate controller VRF*active* has been designed for use in rectangular air ducts to electronically control flow rate based on constant or variable set values, independent of the pressure in the air duct. The damper has a very short installation case depth.

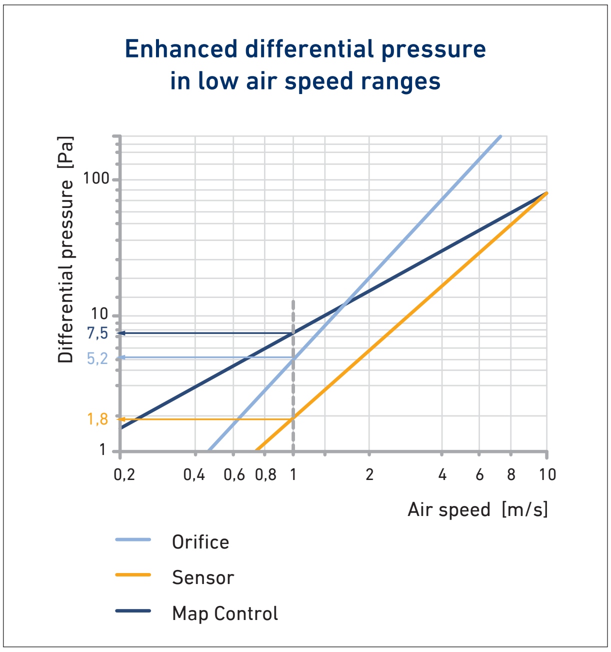
Casing sections match the recommended sizes for rec tangular air ducts according to DIN EN 1505. Thus, the largest possible air flow section may be selected even in case of limited installation conditions.

Flow rate control has been designed for air speeds of 1...10 m/s. The flange is provided with oblong holes in the corners taking flat-flange air connections (DIN 24192) as well as Meinig, MEZ/SBM duct connections with a 30 mm resp. 40 mm section height.

Casing leakage meets DIN EN 1751 Class C and damper leakage Class 4 requirements (size 200 x 100: Class 3). All flow rate controllers are suitable for use with limit differential pressures of up to -750 Pa and +1000 Pa based on ambient pressure conditions.

Measuring principle

The flow rate is determined using two pressure-integrating measuring probes inside the duct casing. The measuring front probe determines the total pressure and the rear probe measures static pressure inside the jet-like damper-accele rated air flow. Thus, the resulting differential pressure is hydraulically amplified.



Output comparison of different measuring principles

Benefits

- Precision flow rate control at low air speeds (up to 1 m/s) compared to other hydraulic measuring techniques that rely on low pressure gauge/measurements.
- Improved differential pressure averaging of velocity profiles based by duct fittings
- Very short installation length thanks to measuring probe in the damper blade area
- Short entry flow duct requirement
- Excellent control accuracy of ±5 % based on nominal flow rate
- Extended control range from 1...10 m/s
- Low loss of minimum pressure, leading to energy savings in operation and lower acoustic figures
- Low casing air leakage rate
- Damper offering complete shut-off facility
- Reduced pollution sensitivity due to 3 mm diameter pressure bores
- Damper position reading from outside

Materials, finishes

- Casing, damper and axle of galvanised steel
- Measuring probes of aluminium
- Damper bearings of POM plastic
- Sealings of EPDM

Accessories, special versions

- 40 mm thick insulating case of mineral wool with a 1 mm sheet steel jacket
- Sound absorbers, matched to the cross-section
- Compact controller compatible with MP-Bus, Modbus or BACnet
- Integrated NFC interface for diagnostic and parametrization via smartphone/app
- Service tool ZTH for diagnostic and parametrization

Additional accessories and special versions on request.

Recommendation for selection

- Air speed up to 7 m/s
- Damper pressure loss up to 500 Pa
- If sound emission via air duct surfaces is critical, all ducts including the controller must be sound insulated up to the sound absorber
- For sound absorbers, the flow noise downstream of the splitters and the noise created by the increased outflow air speed in the connected fittings must be considered

Application ranges and limits

- Minimum air speed 1 m/s
- Nominal air speed 10 m/s
- Maximum air speed in the free case section 12 m/s with specific factory-set adjustment
- Static over-pressure in the air duct up to 1000 Pa (Pressure Class 2, DIN EN 1507)
- Static under-pressure in the air duct based on ambient pressure -750 Pa max. (tightness Class C DIN EN 1507)
- Leakage flow rate via shut damper blade (standard ver sion) Class 4 (size 200 x 100 Class 3) acc. to DIN EN 1751
- Leakage flow rate via casing Class C, acc. to DIN EN 1751
- Media temperature range 0 ... +50 °C, 5 ... 95 % rH, non condensing (acc. to EN 60730-1)
- Suitable for low-pollution air flows (e.g. ETA1, ETA2, acc. to DIN EN 13779), non-corrosive, aggressive air, without solvents that may affect the EPDM damper sealing
- Installation with horizontal damper axle only
- Free suction with upstream air duct or via fitting only

Connection

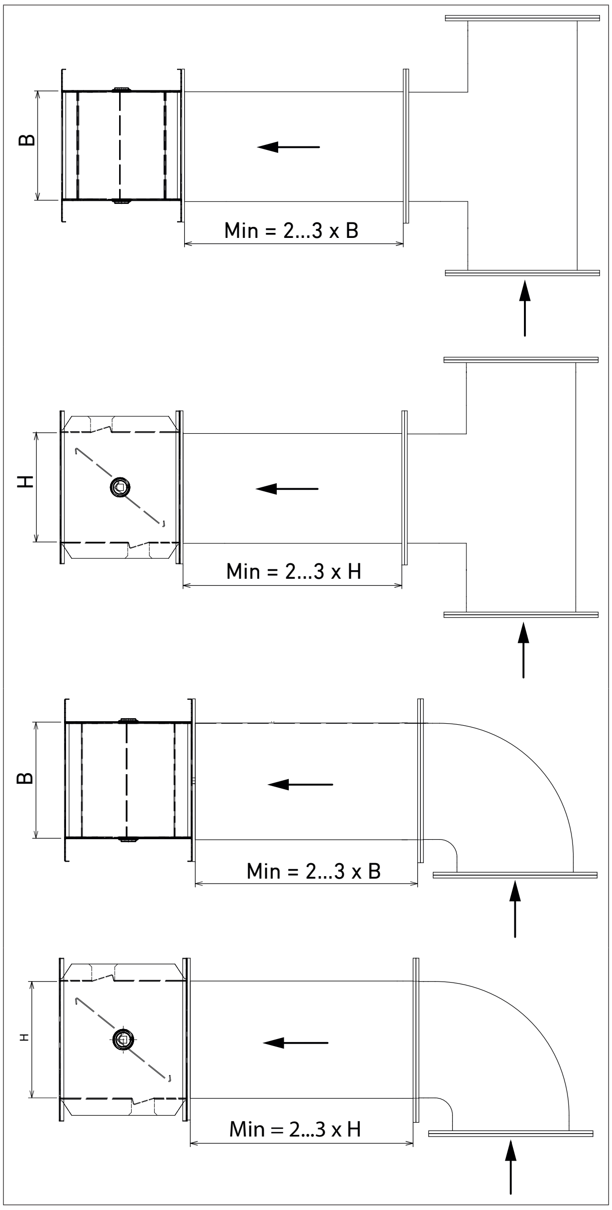
Notes and circuit diagrams for regulating the flow rate can be found in the operating and maintenance instructions.

Control accuracy, installation recommendations

Control accuracy is ± 5 % based on nominal flow rate. Due to measurement by the accelerated damper blade air flow the controller is virtually insensitive to entry duct conditions

Straight entry ducts are to be designed as follows: Length Min > 2...3 H or > 2...3 B, depending on whether the disturbance is produced via the duct height H or width B.

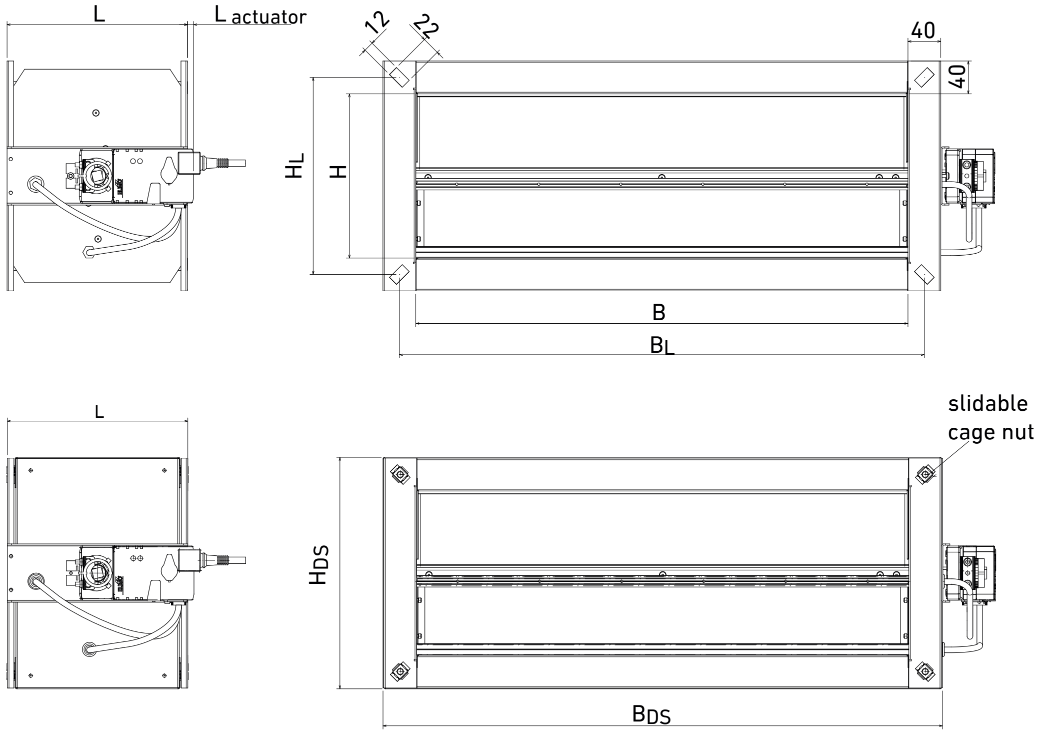
If a combination of fittings that is unfavourable with view to the air flow is unavoidable, the minimum distance is several times the given Min.



Dimensions, weights

Without insulating case

With insulating case



Width B [mm]	Height H [mm]	Length L [mm]	Distance between holes B_L [mm]	Distance between holes H_L [mm]	Excess length $L_{actuator}$ [mm]	Width with insulation B_{DS} [mm]	Height with insulation H_{DS} [mm]	Max. torque [Nm]	Weight without insulation [kg]	Weight with insulation [kg]
200	100	135	240	140	60	282	182	5	3.0	4.3
300			340	140		382			3.7	5.5
400			440	140		482			4.4	6.5
500			540	140		582			5.1	7.5
600			640	140		682			5.8	8.3
300	150	170	340	190	60	382	232	5	4.4	6.5
400			440	190		482			5.2	7.6
500			540	190		582			6.0	8.8
600			640	190		682			6.8	10.2
200	200	220	240	240	30	282	282	5	4.3	6.7
300			340	240		382			5.3	8.3
400			440	240		482			6.3	9.5
500			540	240		582			7.3	11.2
600			640	240		682			8.3	12.4
800			840	240		882			10.2	15.2
300	250	270	340	290	30	382	332	5	6.3	11.3
400			440	290		482			7.4	12.3
500			540	290		582			8.5	15.4
600			640	290		682			9.6	17.5
800			840	290		882			11.6	21.8
300	300	325	340	340	0	382	382	10	7.8	13.0
400			440	340		482			9.2	15.5
500			540	340		582			10.2	17.5
600			640	340		682			12.8	20.0
800			840	340		882			15.7	23.5
1000			1040	340		1082			18.7	27.5
400	400	430	440	440	0	482	482	10	12.7	20.0
500			540	440		582			14.5	22.5
600			640	440		682			16.3	26.0
800			840	440		882			19.9	30.5
1000			1040	440		1082			23.5	35.0
1200			1240	440		1282			27.1	40.0

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Flow rates, minimum pressure differences

Width B [mm]	Height H [mm]	at 1 m/s V_{min} [m³/h]	at 2 m/s V [m³/h]	at 2 m/s Δp_{min} [Pa]	at 4 m/s V [m³/h]	at 4 m/s Δp_{min} [Pa]	at 7 m/s V [m³/h]	at 7 m/s Δp_{min} [Pa]	at 10 m/s V_{nom} [m³/h]	at 10 m/s Δp_{min} [Pa]
200	100	72	144	10	288	20	504	40	720	80
300		108	216		432	15	756	35	1080	70
400		144	288		576		1008	30	1440	60
500		180	360		720		1260		1800	
600		216	432		864		1512		2160	
300	150	162	324	10	648	15	1134	20	1620	40
400		216	432		864		1512		2160	
500		270	540		1080		1890		2700	
600		324	648		1296		2268		3240	
200	200	144	288	10	576	15	1008	20	1440	40
300		216	432		864		1512		2160	
400		288	576		1152		2016		2880	
500		360	720		1440		2520		3600	
600		432	864		1728		3024		4320	
800		576	1152		2304		4032		5760	
300	250	270	540	10	1080	15	1890	20	2700	30
400		360	720		1440		2520		3600	
500		450	900		1800		3150		4500	
600		540	1080		2160		3780		5400	
800		720	1440		2880		5040		7200	
300	300	324	648	10	1296	15	2268	20	3240	30
400		432	864		1728		3024		4320	
500		540	1080		2160		3780		5400	
600		648	1296		2592		4536		6480	
800		864	1728		3456		6048		8640	
1000		1080	2160		4320		7560		10 800	
400	400	576	1152	10	2304	15	4032	20	5760	30
500		720	1440		2880		5040		7200	
600		864	1728		3456		6048		8640	
800		1152	2304		4608		8064		11 520	
1000		1440	2880		5760		10 080		14 400	
1200		1728	3456		6912		12 096		17 280	

V - Flow rate

V_{min} - Minimum flow rate = lower limit of control

V_{nom} - Nominal flow rate

Δp_{min} - Minimum pressure loss

Airborne sound transmission without sound absorber

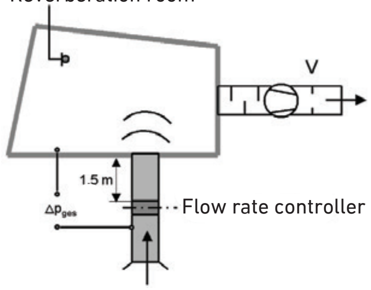
Width B [mm]	Height H [mm]	Air speed [m/s]	Δp_{tot} = 100 Pa										Δp_{tot} = 200 Pa										Δp_{tot} = 500 Pa									
			f_m [Hz]								Sum		f_m [Hz]								Sum		f_m [Hz]								Sum	
			63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]	63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]	63	125	250	500	1 k	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]
			L_W [dB/Okt]										L_W [dB/Okt]										L_W [dB/Okt]									
300	**100**	1	31	31	40	43	40	33	31	29	**44**	**37**	36	34	42	47	46	42	38	37	**50**	**42**	39	46	45	49	51	50	48	47	**56**	**48**
		2	37	38	45	41	42	39	34	31	**46**	**38**	39	39	49	50	48	46	43	40	**53**	**45**	43	43	49	55	55	54	52	52	**61**	**53**
		4	41	45	46	42	43	40	38	33	**47**	**40**	42	45	51	49	49	49	46	42	**55**	**47**	44	45	53	57	60	56	56	54	**64**	**56**
		7	56	58	55	50	48	45	43	38	**54**	**45**	52	55	59	54	53	51	52	52	**59**	**51**	51	53	60	60	61	59	60	59	**67**	**58**
		10	59	60	59	55	55	53	47	41	**60**	**49**	61	63	62	61	60	57	53	51	**65**	**54**	56	59	66	62	63	60	61	60	**68**	**58**
400	**150**	1	42	43	46	48	45	43	36	38	**50**	**42**	47	46	50	52	51	50	44	42	**56**	**48**	48	49	55	59	58	58	60	56	**65**	**58**
		2	46	50	50	47	45	47	39	39	**52**	**44**	49	51	57	56	52	53	58	49	**62**	**54**	54	55	59	62	61	61	67	60	**70**	**62**
		4	54	56	54	51	49	48	43	40	**55**	**45**	57	61	63	58	54	54	59	52	**63**	**54**	62	63	67	70	63	61	63	68	**72**	**63**
		7	60	60	58	54	52	49	45	42	**57**	**46**	64	66	66	61	58	56	58	53	**65**	**53**	69	70	74	72	66	64	64	70	**75**	**63**
		10	65	64	62	58	57	52	48	45	**61**	**48**	72	70	69	64	61	58	56	54	**67**	**53**	74	76	78	75	68	66	66	72	**77**	**64**
600	**200**	1	48	47	51	49	53	53	40	39	**57**	**49**	52	48	57	55	54	65	48	44	**67**	**59**	56	52	61	63	61	69	55	55	**71**	**63**
		2	55	47	50	54	53	57	46	41	**60**	**50**	55	50	57	56	56	60	56	47	**64**	**54**	60	51	59	65	63	67	68	59	**72**	**63**
		4	60	51	52	53	54	55	47	40	**59**	**46**	64	58	59	61	59	60	57	52	**65**	**53**	70	61	64	66	66	67	68	63	**73**	**61**
		7	61	60	57	56	54	55	48	44	**60**	**45**	70	62	61	63	60	61	60	58	**67**	**53**	78	71	71	71	71	69	69	66	**76**	**62**
		10	63	59	57	58	54	51	48	45	**60**	**43**	77	66	64	64	61	62	58	55	**68**	**51**	80	75	74	73	71	69	68	69	**77**	**60**
600	**250**	1	49	48	51	50	55	53	40	39	**58**	**50**	52	50	57	56	56	65	49	45	**67**	**59**	57	53	62	64	62	69	58	56	**72**	**64**
		2	55	49	52	55	55	56	45	41	**60**	**49**	56	52	57	58	58	61	55	47	**65**	**54**	61	54	62	67	65	69	67	59	**74**	**63**
		4	59	52	54	55	55	55	47	44	**60**	**46**	64	59	61	63	61	60	57	52	**66**	**53**	70	63	65	67	68	69	68	62	**75**	**61**
		7	63	61	58	57	55	55	49	45	**61**	**45**	71	64	63	64	62	62	60	59	**68**	**53**	79	72	72	72	72	70	69	67	**77**	**61**
		10	65	62	59	59	56	53	51	49	**61**	**44**	77	68	66	65	63	62	58	57	**69**	**51**	82	77	75	73	73	70	69	69	**78**	**60**
600	**300**	1	51	48	52	52	57	53	40	39	**59**	**51**	53	51	58	57	59	65	50	45	**67**	**58**	58	55	63	66	64	70	60	57	**73**	**64**
		2	55	50	54	57	56	55	44	41	**61**	**49**	57	53	57	60	61	61	54	48	**66**	**54**	62	57	64	68	67	71	66	59	**75**	**63**
		4	58	53	57	57	56	55	47	47	**61**	**46**	65	60	62	64	62	61	56	51	**67**	**52**	70	64	65	68	71	71	68	62	**76**	**61**
		7	64	62	60	59	57	56	50	46	**62**	**46**	71	65	64	65	63	62	60	59	**69**	**52**	79	73	72	73	74	71	69	67	**78**	**61**
		10	68	65	61	60	57	54	53	52	**63**	**44**	77	70	67	67	64	63	59	58	**70**	**51**	83	78	75	74	74	71	70	69	**79**	**60**
800	**400**	1	55	50	53	56	61	53	42	40	**62**	**52**	54	55	60	59	65	65	52	47	**69**	**58**	60	59	66	70	68	72	66	61	**76**	**67**
		2	57	53	59	60	59	55	43	42	**63**	**49**	60	57	59	65	67	64	53	49	**70**	**56**	65	63	69	72	72	77	64	60	**80**	**68**
		4	57	57	62	61	58	56	48	55	**64**	**47**	67	63	65	69	67	62	55	52	**71**	**54**	72	68	67	71	76	76	69	62	**81**	**65**
		7	67	65	64	63	61	59	54	49	**66**	**46**	73	69	67	68	67	65	61	60	**72**	**52**	82	76	74	76	78	74	70	69	**81**	**65**
		10	73	72	66	63	61	58	58	60	**67**	**47**	78	74	70	70	69	65	61	61	**73**	**53**	86	81	77	75	77	74	72	70	**81**	**62**

Conversion to other model sizes is realised at the same throttle point of air speed and pressure loss using the ΔL values from the following chart. The values are applicable to the associated unit height H.

$L_{W\,Okt} = L_{W\,Chart} + \Delta L$ $L_{WA} = L_{WA\,Chart} + \Delta L$

Δp_{tot} - Total pressure diff.
f_m - Octave mid-band frequency
L_W - Sound power level
L_{WA} - Sound power level, A-weighted
L_{pA} - Sound pressure level, A-weighted

Width B [mm]	**Height H** [mm]					
	100	**150**	**200**	**250**	**300**	**400**
200	-2		-5			
300	0	-1	-3	-3	-3	
400	1	0	-2	-2	-2	-3
500	2	1	-1	-1	-1	-2
600	3	2	0	0	0	-1
800			1	1	1	0
1000				2	2	1
1200					3	2



Airborne sound transmission with sound absorber

Δp_{tot} = 100 Pa

Width B [mm]	Height H [mm]	Air speed [m/s]	63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]
			f_m [Hz], L_W [dB/Okt]								Sum	Sum
300	100	1	29	27	32	26	7	1	13	15	**27**	**19**
		2	35	34	37	24	9	7	16	17	**30**	**22**
		4	39	41	38	25	10	8	20	19	**32**	**24**
		7	54	54	47	33	15	13	25	24	**42**	**32**
		10	57	56	51	38	22	21	29	27	**45**	**34**
400	150	1	40	39	38	31	12	11	18	24	**33**	**25**
		2	44	46	42	30	12	15	21	25	**36**	**28**
		4	52	52	46	34	16	16	25	26	**41**	**30**
		7	58	56	50	37	19	17	27	28	**45**	**32**
		10	63	60	54	41	24	20	30	31	**49**	**34**
600	200	1	46	43	43	32	20	21	22	25	**37**	**29**
		2	53	43	42	37	20	25	28	27	**39**	**29**
		4	58	47	44	36	21	23	29	26	**40**	**26**
		7	59	56	49	39	21	23	30	30	**45**	**29**
		10	61	55	49	41	21	19	30	31	**45**	**27**
600	250	1	47	44	43	33	22	21	22	25	**37**	**29**
		2	53	45	44	38	22	24	27	27	**40**	**29**
		4	57	48	46	38	22	23	29	30	**41**	**27**
		7	61	57	50	40	22	23	31	31	**46**	**29**
		10	63	58	51	42	23	21	33	35	**47**	**28**
600	300	1	49	44	44	35	24	21	22	25	**38**	**29**
		2	53	46	46	40	23	23	26	27	**41**	**29**
		4	56	49	49	40	23	23	29	33	**43**	**28**
		7	62	58	52	42	24	24	32	32	**47**	**30**
		10	66	61	53	43	24	22	35	38	**49**	**29**
800	400	1	53	46	45	39	28	21	24	26	**40**	**30**
		2	55	49	51	43	26	23	25	28	**45**	**31**
		4	55	53	54	44	25	24	30	41	**48**	**31**
		7	65	61	56	46	28	27	36	35	**51**	**30**
		10	71	68	58	46	28	26	40	46	**55**	**33**

Δp_{tot} = 200 Pa

Width B [mm]	Height H [mm]	Air speed [m/s]	63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]
			f_m [Hz], L_W [dB/Okt]								Sum	Sum
300	100	1	34	30	34	30	13	10	20	23	**31**	**23**
		2	37	35	41	33	15	14	25	26	**36**	**28**
		4	40	41	43	32	16	17	28	28	**37**	**29**
		7	50	51	51	37	20	19	34	38	**45**	**36**
		10	59	59	54	44	27	25	35	37	**49**	**38**
400	150	1	45	42	42	35	18	18	26	28	**37**	**29**
		2	47	47	49	39	19	21	40	35	**45**	**37**
		4	55	57	55	41	21	22	41	38	**49**	**39**
		7	62	62	58	44	25	24	40	39	**52**	**40**
		10	70	66	61	47	28	26	38	40	**55**	**41**
600	200	1	50	44	49	38	21	33	30	30	**43**	**35**
		2	53	46	49	39	23	28	38	33	**44**	**34**
		4	62	54	51	44	26	28	39	38	**47**	**34**
		7	68	58	53	46	27	29	42	44	**51**	**35**
		10	75	62	56	47	28	30	40	41	**53**	**35**
600	250	1	50	46	49	39	23	33	31	31	**43**	**35**
		2	54	48	49	41	25	29	37	33	**45**	**34**
		4	62	55	53	46	28	28	39	38	**49**	**35**
		7	69	60	55	47	29	30	42	45	**52**	**35**
		10	75	64	58	48	30	30	40	43	**55**	**35**
600	300	1	51	47	50	40	26	33	32	31	**44**	**35**
		2	55	49	49	43	28	29	36	34	**45**	**33**
		4	63	56	54	47	29	29	38	37	**49**	**34**
		7	69	61	56	48	30	30	42	45	**53**	**35**
		10	75	66	59	50	31	31	41	44	**56**	**36**
800	400	1	52	51	52	42	32	33	34	33	**46**	**35**
		2	58	53	51	48	34	32	35	35	**48**	**34**
		4	65	59	57	52	34	30	37	38	**53**	**36**
		7	71	65	59	51	34	33	43	46	**55**	**35**
		10	76	70	62	53	36	33	43	47	**59**	**37**

Δp_{tot} = 500 Pa

Width B [mm]	Height H [mm]	Air speed [m/s]	63	125	250	500	1 k	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]
			f_m [Hz], L_W [dB/Okt]								Sum	Sum
300	100	1	37	42	37	32	18	18	30	33	**37**	**29**
		2	41	39	41	38	22	22	34	38	**41**	**33**
		4	42	41	45	40	27	24	38	40	**44**	**36**
		7	49	49	52	43	28	27	42	45	**49**	**40**
		10	54	55	58	45	30	28	43	46	**52**	**41**
400	150	1	46	45	47	42	25	26	42	42	**47**	**39**
		2	52	51	51	45	28	29	49	46	**52**	**44**
		4	60	59	59	53	30	29	45	54	**57**	**47**
		7	67	66	66	55	33	32	46	56	**61**	**49**
		10	72	72	70	58	35	34	48	58	**64**	**50**
600	200	1	54	48	53	46	28	37	37	41	**49**	**41**
		2	58	47	51	48	30	35	50	45	**53**	**43**
		4	68	57	56	49	33	35	50	49	**55**	**42**
		7	76	67	63	54	38	37	51	52	**60**	**44**
		10	78	71	66	56	38	37	50	55	**62**	**44**
600	250	1	55	49	54	47	29	37	40	42	**50**	**42**
		2	59	50	54	50	32	37	49	45	**53**	**43**
		4	68	59	57	50	35	37	50	48	**55**	**41**
		7	77	68	64	55	39	38	51	53	**60**	**44**
		10	80	73	67	56	40	38	51	55	**63**	**44**
600	300	1	56	51	55	49	31	38	42	43	**51**	**42**
		2	60	53	56	51	34	39	48	45	**54**	**42**
		4	68	60	57	51	38	39	50	48	**56**	**41**
		7	77	69	64	56	41	39	51	53	**61**	**43**
		10	81	74	67	57	41	39	52	55	**64**	**44**
800	400	1	58	55	58	53	35	40	48	47	**55**	**44**
		2	63	59	61	55	39	45	46	46	**57**	**43**
		4	70	64	59	54	43	44	51	48	**58**	**41**
		7	80	72	66	59	45	42	52	55	**63**	**43**
		10	84	77	69	58	44	42	54	56	**66**	**44**

The values on which the attenuation is based are applicable to an active sound absorber length of 1000 mm. Conversion to other model sizes is realised at the same throttle point of air speed and pressure loss using the ΔL values from the following chart. The values are applicable to the associated unit height H.

$L_{W\,Okt} = L_{W\,Chart} + \Delta L$ $L_{WA} = L_{WA\,Chart} + \Delta L$

Δp_{tot} - Total pressure difference

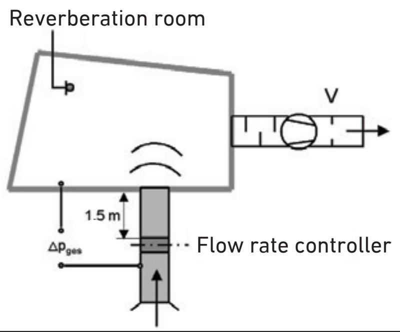
f_m - Octave mid-band frequency

L_W - Sound power level

L_{WA} - Sound power level, A-weighted

L_{pA} - Sound pressure level, A-weighted

Width B [mm]	Height H [mm] 100	150	200	250	300	400
200	-2		-5			
300	0	-1	-3	-3	-3	
400	1	0	-2	-2	-2	-3
500	2	1	-1	-1	-1	-2
600	3	2	0	0	0	-1
800			1	1	1	0
1000				2	2	1
1200					3	2



Casing radiation <u>without</u> insulating case

Width B [mm]	Height H [mm]	Air speed [m/s]	Δp_tot = 100 Pa: 63	125	250	500	1 K	2 K	4 K	8 K	Sum L_{WA} [dB(A)]	Sum L_{pA} [dB(A)]	Δp_tot = 200 Pa: 63	125	250	500	1 K	2 K	4 K	8 K	Sum L_{WA} [dB(A)]	Sum L_{pA} [dB(A)]	Δp_tot = 500 Pa: 63	125	250	500	1 k	2 K	4 K	8 K	Sum L_{WA} [dB(A)]	Sum L_{pA} [dB(A)]
			f_m [Hz], L_W [dB/Okt]										f_m [Hz], L_W [dB/Okt]										f_m [Hz], L_W [dB/Okt]									
300	100	1	41	38	39	34	31	23	21	22	**36**	**27**	46	41	41	38	37	32	28	30	**41**	**32**	49	53	44	40	42	40	38	40	**48**	**39**
		2	46	45	44	32	33	28	24	24	**39**	**30**	48	46	48	41	39	36	33	33	**45**	**36**	52	51	48	46	46	44	42	45	**52**	**43**
		4	51	52	45	33	33	30	28	26	**42**	**32**	52	52	50	40	40	38	36	36	**47**	**38**	53	52	52	48	50	46	46	47	**55**	**46**
		7	65	65	54	41	39	35	33	31	**52**	**43**	61	62	57	45	44	41	42	45	**53**	**44**	60	60	59	51	52	49	50	52	**58**	**50**
		10	69	67	58	46	46	43	37	34	**55**	**46**	71	70	61	52	51	47	43	44	**59**	**50**	65	67	64	53	54	50	51	53	**61**	**52**
400	150	1	47	46	42	38	35	32	26	31	**41**	**32**	52	49	46	42	41	40	34	35	**47**	**38**	53	53	50	49	48	47	50	49	**56**	**47**
		2	51	54	46	37	35	37	29	32	**44**	**35**	54	55	53	46	42	43	48	42	**53**	**44**	59	59	55	52	52	51	57	53	**61**	**52**
		4	59	60	50	41	39	37	33	33	**48**	**39**	62	65	59	48	45	44	49	45	**56**	**47**	67	66	63	59	53	51	53	61	**64**	**55**
		7	65	64	54	44	43	38	34	35	**52**	**43**	69	69	62	51	48	46	48	46	**59**	**50**	74	74	70	62	56	54	54	63	**67**	**58**
		10	70	68	58	48	47	42	38	38	**56**	**47**	77	73	65	54	51	48	46	47	**62**	**53**	79	79	74	65	59	56	56	65	**71**	**62**
600	200	1	51	49	46	38	44	43	30	32	**48**	**39**	56	51	52	45	44	55	38	37	**57**	**48**	60	54	56	52	51	59	45	48	**61**	**52**
		2	59	50	46	43	44	47	36	34	**50**	**42**	59	52	52	45	46	50	46	40	**54**	**45**	64	54	55	55	53	56	57	52	**63**	**53**
		4	64	53	48	43	44	45	37	33	**50**	**41**	67	60	55	50	49	49	47	45	**56**	**47**	74	64	59	56	56	56	57	56	**64**	**55**
		7	65	63	52	45	44	44	38	37	**52**	**43**	74	65	57	52	51	50	50	51	**59**	**50**	82	73	67	61	61	59	58	59	**68**	**59**
		10	67	62	52	47	45	41	38	38	**52**	**43**	81	69	60	54	51	51	47	48	**61**	**52**	84	78	69	63	62	59	58	62	**69**	**60**
600	250	1	52	49	46	40	46	43	30	32	**49**	**40**	55	51	52	45	47	55	39	38	**57**	**48**	60	55	57	54	53	59	48	50	**62**	**53**
		2	58	50	47	45	45	46	35	34	**51**	**42**	59	53	52	47	49	51	45	41	**55**	**46**	64	56	57	56	55	59	57	52	**64**	**55**
		4	62	54	50	45	45	45	37	37	**51**	**42**	67	61	56	52	51	50	47	45	**57**	**48**	73	65	60	57	59	59	58	55	**65**	**56**
		7	66	63	53	47	46	45	39	38	**53**	**44**	74	66	58	53	52	51	50	52	**60**	**51**	82	73	67	62	63	60	59	60	**68**	**60**
		10	68	64	54	48	46	43	41	42	**54**	**45**	80	70	61	55	53	52	48	50	**61**	**52**	85	78	70	63	63	60	59	62	**70**	**61**
600	300	1	53	49	46	41	47	42	30	32	**50**	**40**	55	52	53	46	49	54	40	38	**57**	**48**	60	56	58	55	54	60	50	51	**63**	**54**
		2	58	51	49	46	46	45	34	34	**51**	**42**	60	54	52	49	51	51	44	41	**56**	**47**	65	58	59	57	57	61	56	52	**65**	**56**
		4	60	55	51	46	46	45	37	40	**52**	**43**	67	61	56	54	53	50	46	45	**58**	**49**	73	65	60	58	61	61	58	55	**66**	**58**
		7	66	63	55	48	47	46	40	39	**54**	**45**	73	67	59	54	54	52	50	52	**60**	**51**	82	74	67	62	64	61	59	60	**69**	**60**
		10	70	67	56	49	48	44	43	45	**56**	**47**	79	71	62	56	55	53	49	51	**62**	**53**	85	79	70	63	64	61	60	62	**71**	**62**
800	400	1	55	50	47	45	51	43	32	33	**53**	**44**	54	54	54	48	56	55	42	40	**59**	**51**	60	58	60	69	58	61	56	54	**68**	**59**
		2	57	53	53	49	50	44	33	35	**53**	**44**	60	57	53	54	57	53	43	42	**60**	**51**	66	62	64	61	63	67	54	53	**70**	**61**
		4	57	57	56	50	49	46	38	48	**55**	**46**	67	63	59	58	57	52	45	45	**61**	**52**	72	67	62	60	66	66	59	55	**71**	**62**
		7	68	65	58	52	51	49	44	42	**57**	**48**	73	69	61	57	57	55	51	53	**63**	**54**	82	76	68	65	68	63	60	62	**72**	**63**
		10	73	72	61	52	51	48	48	53	**60**	**52**	78	74	65	59	59	55	51	54	**65**	**56**	86	81	71	64	67	64	62	63	**73**	**64**

Conversion to other model sizes is realised at the same throttle point of air speed and pressure loss using the ΔL values from the following chart. The values are applicable to the associated unit height H.

$L_{W\,Okt} = L_{W\,Chart} + \Delta L$ $L_{WA} = L_{WA\,Chart} + \Delta L$

Δp_{tot} - Total pressure-difference

f_m - Octave midband frequency

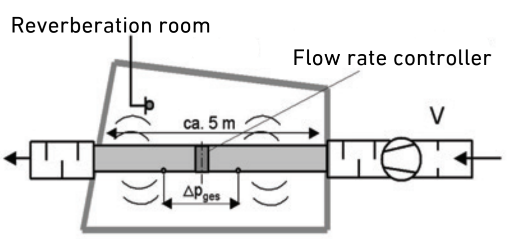
L_W - Sound power level

L_{WA} - Sound power level, A-weighted

L_{pA} - Sound power level, A-weighted

Width B [mm]	**Height H** [mm]: **100**	**150**	**200**	**250**	**300**	**400**
200	-2		-5			
300	0	-1	-3	-3	-3	
400	1	0	-2	-2	-2	-3
500	2	1	-1	-1	-1	-2
600	3	2	0	0	0	-1
800			1	1	1	0
1000				2	2	1
1200					3	2

Controller and air duct <u>without</u> insulating case



Casing radiation with insulating case

Δp_{tot} = 100 Pa (f_m [Hz], L_W [dB/Okt]; Sum: L_{WA} [dB(A)], L_{pA} [dB(A)])

Width B [mm]	Height H [mm]	Air speed [m/s]	63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]
300	100	1	33	31	32	25	19	9	5	4	**27**	**18**
		2	39	38	37	23	21	15	9	5	**30**	**22**
		4	43	45	38	24	21	17	13	7	**33**	**24**
		7	58	58	47	32	27	21	18	12	**44**	**35**
		10	62	60	51	37	34	29	22	15	**47**	**38**
400	150	1	40	39	35	29	23	19	11	12	**31**	**22**
		2	43	47	39	28	23	23	14	13	**35**	**26**
		4	51	52	43	32	27	24	18	14	**39**	**30**
		7	57	57	47	35	31	25	19	17	**44**	**35**
		10	63	60	51	38	35	28	23	19	**48**	**38**
600	200	1	44	42	39	29	32	29	15	13	**37**	**28**
		2	51	43	39	34	32	33	20	15	**39**	**30**
		4	57	46	41	34	32	31	22	14	**39**	**30**
		7	58	56	45	36	32	31	22	19	**43**	**34**
		10	59	55	45	38	32	27	23	19	**43**	**34**
600	250	1	45	42	39	31	33	29	15	14	**37**	**28**
		2	51	43	40	36	33	32	20	16	**39**	**30**
		4	55	47	43	35	33	31	22	18	**40**	**31**
		7	58	56	46	38	34	32	24	20	**44**	**35**
		10	61	57	47	39	34	29	25	23	**45**	**36**
600	300	1	46	42	39	32	35	29	15	14	**38**	**29**
		2	50	44	42	37	34	31	19	15	**40**	**31**
		4	53	47	44	37	34	31	22	22	**41**	**32**
		7	59	56	48	39	35	32	25	21	**45**	**36**
		10	62	59	49	40	35	30	28	26	**47**	**37**
800	400	1	48	43	40	36	39	29	16	14	**41**	**32**
		2	50	46	46	40	37	31	18	16	**43**	**34**
		4	50	50	49	41	37	32	23	30	**44**	**35**
		7	60	57	51	43	39	35	29	23	**47**	**38**
		10	66	65	54	43	39	34	32	34	**52**	**43**

Δp_{tot} = 200 Pa (f_m [Hz], L_W [dB/Okt]; Sum: L_{WA} [dB(A)], L_{pA} [dB(A)])

Width B [mm]	Height H [mm]	Air speed [m/s]	63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]
300	100	1	38	34	34	29	24	18	13	11	**31**	**22**
		2	41	39	41	31	27	22	18	14	**35**	**26**
		4	44	45	43	31	28	25	21	17	**37**	**28**
		7	54	55	50	36	32	27	26	26	**45**	**35**
		10	63	63	54	43	39	33	28	26	**50**	**41**
400	150	1	45	42	39	33	29	26	19	16	**36**	**27**
		2	47	48	46	37	30	29	33	23	**41**	**33**
		4	55	58	52	38	32	30	34	26	**47**	**38**
		7	61	62	55	42	36	32	33	28	**50**	**41**
		10	69	66	58	44	39	34	31	28	**54**	**45**
600	200	1	48	44	45	36	32	41	23	18	**44**	**35**
		2	52	45	45	36	34	36	31	21	**42**	**33**
		4	60	53	48	41	37	36	32	26	**45**	**36**
		7	66	58	50	43	39	37	35	33	**48**	**39**
		10	73	62	53	44	39	38	32	30	**52**	**43**
600	250	1	48	44	45	36	35	41	24	19	**44**	**35**
		2	52	46	45	38	37	37	30	22	**43**	**34**
		4	60	54	49	43	39	36	32	26	**46**	**37**
		7	66	59	51	44	40	38	35	33	**49**	**40**
		10	73	63	54	46	41	39	33	31	**52**	**43**
600	300	1	47	45	46	37	37	41	25	19	**45**	**36**
		2	52	47	45	40	39	38	29	22	**44**	**35**
		4	60	54	49	45	41	37	31	26	**47**	**38**
		7	66	59	52	45	42	39	35	33	**50**	**41**
		10	72	64	55	47	42	39	34	33	**53**	**44**
800	400	1	47	47	47	39	43	41	27	21	**47**	**38**
		2	53	50	46	45	45	40	28	24	**48**	**39**
		4	59	56	52	49	45	39	30	26	**50**	**42**
		7	66	62	54	48	45	41	36	35	**52**	**43**
		10	71	67	58	50	47	41	36	36	**55**	**47**

Δp_{tot} = 500 Pa (f_m [Hz], L_W [dB/Okt]; Sum: L_{WA} [dB(A)], L_{pA} [dB(A)])

Width B [mm]	Height H [mm]	Air speed [m/s]	63	125	250	500	1 k	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]
300	100	1	41	46	37	31	30	26	23	21	**36**	**27**
		2	45	43	41	37	34	30	27	26	**40**	**31**
		4	46	45	45	39	38	33	31	29	**43**	**34**
		7	53	53	52	42	39	35	35	33	**47**	**38**
		10	58	60	57	44	41	37	36	35	**51**	**42**
400	150	1	45	46	43	40	36	34	35	30	**43**	**34**
		2	52	52	48	43	40	37	41	34	**48**	**39**
		4	60	59	56	50	41	38	38	42	**52**	**43**
		7	66	67	63	53	44	40	39	45	**57**	**49**
		10	72	72	67	56	47	42	41	46	**61**	**53**
600	200	1	53	47	49	43	39	45	30	30	**49**	**40**
		2	56	47	48	46	41	43	42	33	**49**	**41**
		4	66	57	52	47	44	43	42	37	**52**	**43**
		7	74	66	60	52	49	45	43	40	**57**	**48**
		10	77	71	62	53	50	46	43	43	**60**	**51**
600	250	1	53	48	50	45	41	45	33	31	**50**	**40**
		2	57	49	50	47	43	45	42	34	**51**	**42**
		4	66	57	53	48	47	45	43	37	**53**	**44**
		7	74	66	60	53	50	46	44	41	**58**	**49**
		10	77	71	63	54	51	47	44	44	**60**	**51**
600	300	1	53	49	51	46	42	46	35	32	**50**	**42**
		2	57	51	52	48	45	48	40	33	**53**	**44**
		4	65	58	53	49	49	47	43	36	**54**	**45**
		7	74	67	60	53	52	47	44	41	**58**	**49**
		10	78	72	63	54	52	47	44	43	**61**	**52**
800	400	1	53	51	53	50	46	48	41	35	**53**	**44**
		2	58	55	57	52	50	53	39	34	**57**	**48**
		4	65	60	55	51	54	52	44	36	**58**	**49**
		7	75	68	61	56	56	50	45	43	**61**	**52**
		10	79	74	64	55	55	50	46	44	**62**	**54**

Conversion to other model sizes is realised at the same throttle point of air speed and pressure loss using the ΔL values from the following chart. The values are applicable to the associated unit height H.

$L_{W\ Okt} = L_{W\ Chart} + \Delta L$ $\qquad$ $L_{WA} = L_{WA\ Chart} + \Delta L$

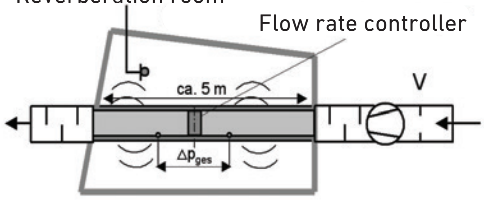
- **Δp_{tot}** - Total pressure difference
- **f_m** - Octave mid band frequency
- **L_W** - Sound power level
- **L_{WA}** - Sound power level, A-weighted
- **L_{pA}** - Sound pressure level, A-weighted

Width B [mm]	Height H [mm] 100	150	200	250	300	400
200	-2		-5			
300	0	-1	-3	-3	-3	
400	1	0	-2	-2	-2	-3
500	2	1	-1	-1	-1	-2
600	3	2	0	0	0	-1
800			1	1	1	0
1000				2	2	1
1200					3	2

Controller and air duct with insulating case

Reverberation room

Flow rate controller



Room sound pressure level calculation from controller sound transmission (excluding flow noise from the air diffusers)

Insertion sound attenuation for the splitter attenuator type SDF-SM (optional, included in chart on page 8)

f_m	[Hz]	63	125	250	500	1000	2000	4000	8000
$\Delta_{LW\ Okt}$	[dB/Okt]	2	4	8	17	33	32	18	14

System attenuation according to VDI 2081

f_m		[Hz]	63	125	250	500	1000	2000	4000	8000
Deflection	$\Delta L_{W\ Okt}$	[dB/Okt]	0	0	1	2	3	3	3	3
Room attenuation	$\Delta L_{W\ Okt}$	[dB/Okt]	5	5	5	5	5	5	5	5
Outlet reflection	$\Delta L_{W\ Okt}$	[dB/Okt]	10	5	2	0	0	0	0	0

Branching attenuation for distributing the sound power over multiple rooms, V_{room} = 540 m³/h

f_m	[m³/h]	540	1080	2160	5400	10800	16200	21600
$\Delta L_{W\ Okt} = 10 \times Lg \dfrac{V}{540\ m^3/h}$	[dB/Okt]	0	3	6	10	13	14	16

Sample calculation sound transmission

Given: VRF*active* 500 x 200 with sound absorber type SDF-SM

V_{max} = 1440 m³/h, equates to 4 m/s

Δp_{tot} = 200 Pa

Required: Room sound pressure level L_{pA} from controller sound transmission

Solution:	f_m		[Hz]	63	125	250	500	1000	2000	4000	8000	Source
	Sound power level size 600 x 200	$L_{W\ Okt}$	[dB/Okt]	62	54	51	44	26	28	39	38	page 8
	Converted to size 500 x 200	$\Delta_{LW\ Okt}$	[dB/Okt]	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	page 8
	Deflection	$\Delta_{LW\ Okt}$	[dB/Okt]	0	0	- 1	- 2	- 3	- 3	- 3	- 3	page 11
	Room attenuation	$\Delta_{LW\ Okt}$	[dB/Okt]	- 5	- 5	- 5	- 5	- 5	- 5	- 5	- 5	page 11
	Outlet reflection		ΔLW Okt	- 10	- 5	- 2	0	0	0	0	0	page 11
	Branching attenuation $\Delta L_{W\ Okt} = 10 \times Lg$	$\dfrac{1440\ m^3/h}{540\ m^3/h}$	[dB/Okt]	- 4	- 4	- 4	- 4	- 4	- 4	- 4	- 4	page 11
	A-weighted	$\Delta_{LW\ Okt}$	[dB/Okt]	- 26	- 16	- 9	- 3	0	1	1	- 1	
	A-weighted sound pressure level	$L_{pA\ Okt}$	[dB(A)/Okt]	16	23	29	29	13	16	27	24	
	A-weighted sum sound pressure level L_{pA} = 34 dB(A)											

Room sound pressure level calculation from controller radiation

f_m	[Hz]	63	125	250	500	1000	2000	4000	8000
Ceiling attenuation $\Delta L_{W\,Okt}$	[dB/Okt]	4	4	4	4	4	4	4	4
Room attenuation $\Delta L_{W\,Okt}$	[dB/Okt]	5	5	5	5	5	5	5	5

Sample calculation radiation

Given: VRF*active* 500 x 200 with insulation case

V_{max} = 1440 m^3/h, equates to 4 m/s

Δp_{tot} = 200 Pa

Required: Room sound pressure level L_{pA} from controller radiation

Solution: f_m	[Hz]	63	125	250	500	1000	2000	4000	8000	Source
Sound pressure level size 600 x 200 $L_{W\,Okt}$	[dB/Okt]	60	53	48	41	37	36	32	26	page 10
Converted to size 500 x 200 $\Delta L_{W\,Okt}$	[dB/Okt]	- 1	- 1	- 1	- 1	- 1	- 1	- 1	- 1	page 10
Ceiling attenuation $\Delta L_{W\,Okt}$	[dB/Okt]	- 4	- 4	- 4	- 4	- 4	- 4	- 4	- 4	page 12
Room attenuation $\Delta L_{W\,Okt}$	[dB/Okt]	- 5	- 5	- 5	- 5	- 5	- 5	- 5	- 5	page 12
A-weighted $\Delta L_{W\,Okt}$	[dB/Okt]	- 26	- 16	- 9	- 3	- 0	1	1	- 1	
A-weighted sound pressure level $L_{pA\,Okt}$	[dB(A)/Okt]	16	23	29	29	13	16	27	24	
A-weighted sum sound pressure level L_{pA} = 35 dB(A)										

Nomenclature, ordering code

VRF*active* / ... x ... / S / D / B 681
(1) (2) (3) (4) (5) (6) (7)

(1)	**Type**	**VRF*active***	=	Flow rate controller, rectangular, short, with map control
(2)	**Measuring principle**		=	dynamic
		S	=	static
(3)	**Dimensions**	**... x ...**	=	width x height [mm] (see page 6)
(4)	**Version**	**S**	=	galvanised steel
		K	=	coated
(5)	**Insulating case**	**D**	=	with insulating case
		–	=	without insulating case
(6)	**Compact controller (make)**	**B**	=	Belimo
		G	=	Gruner
(7)	**Compact controller (type)**	**681**	=	Belimo LMV-D3W-E-MF (standard up to nominal height 250 mm)
		680	=	Belimo LMV-D3W-E-MP (compatible with MP-Bus, up to nominal height 250 mm)
		690	=	Belimo NMV-D3W-E-MP (compatible with MP-Bus, standard from nominal height 300 mm)
		672	=	Belimo LMV-D3W-MOD-F (compatible with Modbus and BACnet, up to nominal height 250 mm)
		692	=	Belimo NMV-D3W-E-MOD (compatible with Modbus and BACnet, from nominal height 300 mm)
		227-05	=	Gruner 227VM-05 (static, up to nominal height 250 mm)
		227-10	=	Gruner 227VM-10 (static, from nominal height 300 mm)

Additional order informations

Please specify when ordering

- V_{min} [m³/h]
- V_{max} [m³/h]
- Mode: 0...10 V or 2...10 V

Please notice:

- V_{nom} see page 7
- $V_{min} \geq 0$ m³/h
- $V_{min} \leq V_{max}$
- $V_{max} \leq V_{nom}$
- $V_{max} \geq 0{,}2\ V_{nom}$

In the absence of such specifications the unit will be delivered with the following factory settings:

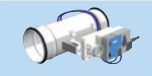
- $V_{min} = 0$ m³/h
- $V_{max} = V_{nom}$
- Mode = 0...10 V

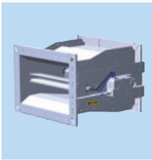
Ordering example

VRF*active* 600x200/S/D/B681, V_{min} = 1000 m³/h, V_{max} = 3000 m³/h, Mode 2...10 V

Product Overview • **LTG Air Distribution**

Flow rate controllers

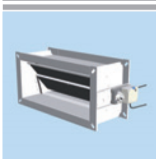
Round			
Variable		VRE*active*	LTG Map Control System *ActiveControl*; highest precision, short installation length
		VRD*active*	
		VRE	To combine with customized drives; VRE also available in PPs
		VRD	
Constant		VRW	Without external power supply, pollution-insentitive
		VRZ	

Square			
Variable		VRF*active*	LTG Map Control System *ActiveControl*; highest precision, short installation length
		VRF*vent*	LTG control principle-*VenturiControl*; high pecision with low pressure loss, to combine with customized drives
Constant		VRX	Without external power supply, pollution-insentitive

All variable controllers are available with dynamic or static measuring principle

Pressure controllers

Round		
	DRE DRE*active*	To balance extreme pressure level differences; optionally with flow rate measuring

Square		
	DRF DRF*active*	To balance extreme pressure level differences; optionally with flow rate measuring

Shut-off units

Round		
	KLB	Ultra-tight shut-off damper
	ARE	Air-tight shut-off damper

Square		
	ARF	Air-tight shut-off damper

Air-tight shut-off acc. to DIN EN 175: up to Class 4

Engineering Services

LTG Engineering Services Comfort Air Technology

Portfolio

For our complete portfolio of air distribution products with suitable accessories see
https://www.ltg.de/en/products-services/ltg-comfort-air-technology/air-distribution/

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Air-Water Systems
Air Diffusers
Air Distribution

Process Air Technology

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Filtration Technology
HumidificationTechnology

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Simulation & Expertise
R&D & Start-up

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