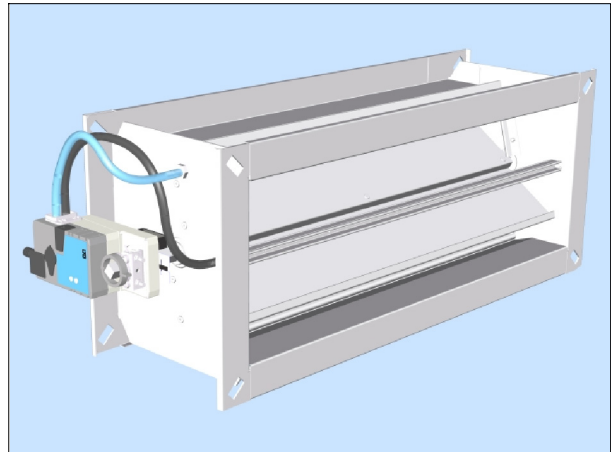


Technical Documentation

Flow rate controllers type VRF-W (short)



LTG Aktiengesellschaft

70435 Stuttgart, Grenzstraße 7, Germany
Tel. +49 711 8201-0, Fax +49 711 8201-720
info@LTG-AG.com
www.LTG-AG.com

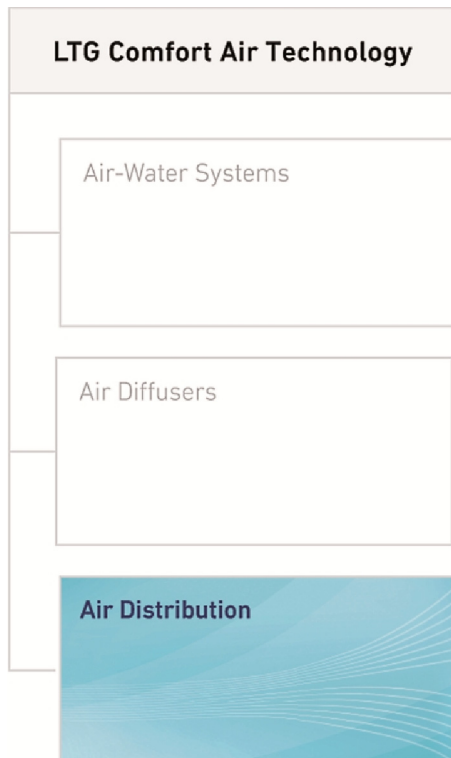
LTG Incorporated

105 Corporate Drive, Suite E
Spartanburg S.C. 29303, USA
Tel. +1 864 599-6340, Fax +1 864 599-6344
info@LTG-INC.net
www.LTG-INC.net

LTG S.r.l. con socio unico

Via Matilde Serao 5, 20144 Milano (MI), Italia
Tel. +39 02 9550535, Fax +39 02 9550828
info@LTG-SRL.it
www.LTG-SRL.com

Flow rate controllers type VRF-W (short)



Content	Page
View of unit, application, measuring principle, advantages	3
Materials, finishes, accessories, special versions, connection, selection, application ranges, control accuracy, installation	4
Dimensions, weights	5
Flow rates, minimum pressure differences	6
Airborne sound transmission without sound absorber	7
Airborne sound transmission with sound absorber	8
Casing radiation without insulating case	9
Casing radiation with insulating case	10
Sample calculation sound transmission	11
Sample calculation radiation	12
Nomenclature, ordering key	12
Specification and schedule of prices	

Notes

Dimensions stated in this brochure are in mm.

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

The actual specifications are at the end of this document. They are available as a word document at your local distributor or at www.LTG-AG.de.

Flow rate controllers type VRF-W (short)

View of unit



Application

The LTG Flow Rate Controller VRF-W 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 (over a specified range). The damper has a very short installation case depth.

Casing sections match the recommended sizes for rectangular 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 to 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/40 mm section height.

Casing leakage meets DIN EN 1751 Class C and damper leakage Class 3 requirements (optional Class 4). 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

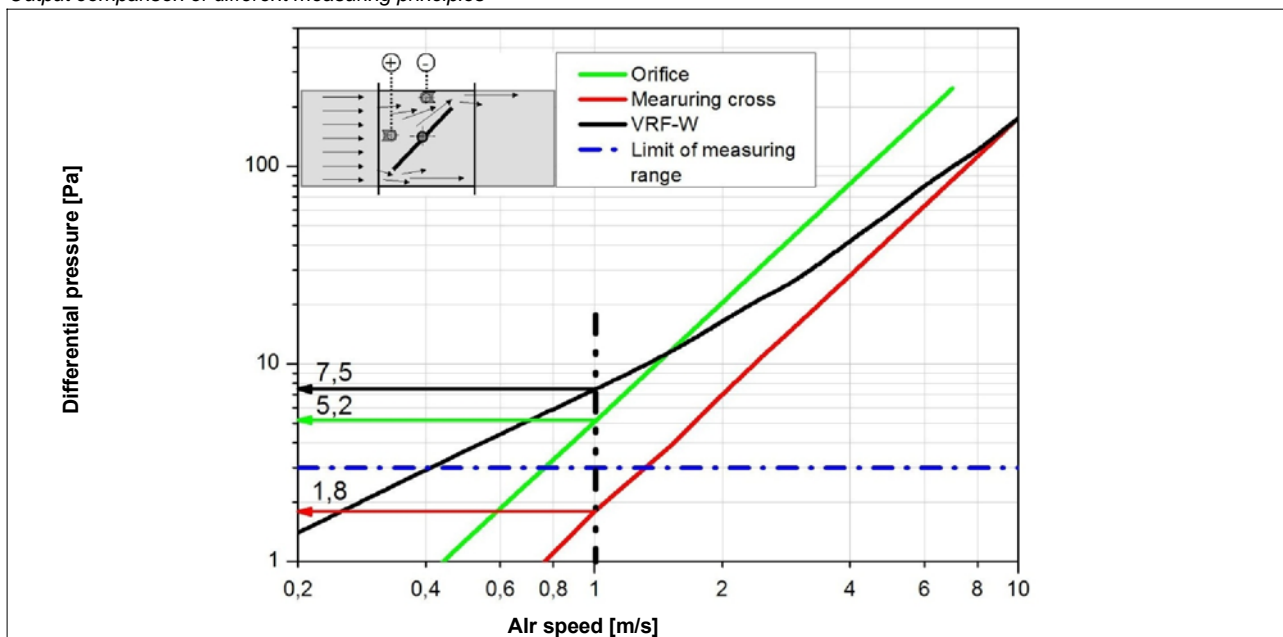
The flow rate is determined using two pressure-integrating measuring probes inside the duct casing.

The measuring front probe determines the total pressure and the rear probe measures static pressure inside the jet-like damper-accelerated air flow. Thus, the resulting differential pressure is hydraulically amplified.

Advantages

- Precision flow rate control at low air speeds (around 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 $\pm 5\%$ 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

Output comparison of different measuring principles



Flow rate controllers type VRF-W (short)

Materials, finishes

- Casing, damper and axle of galvanized steel
- Measuring probes of aluminum
- 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 configured to suit the range are available as accessories.
- Compact controller compatible with MP-Bus or LON

Connection

Notes and circuit diagrams for regulating the rate of flow can be found in the operating and servicing instructions

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

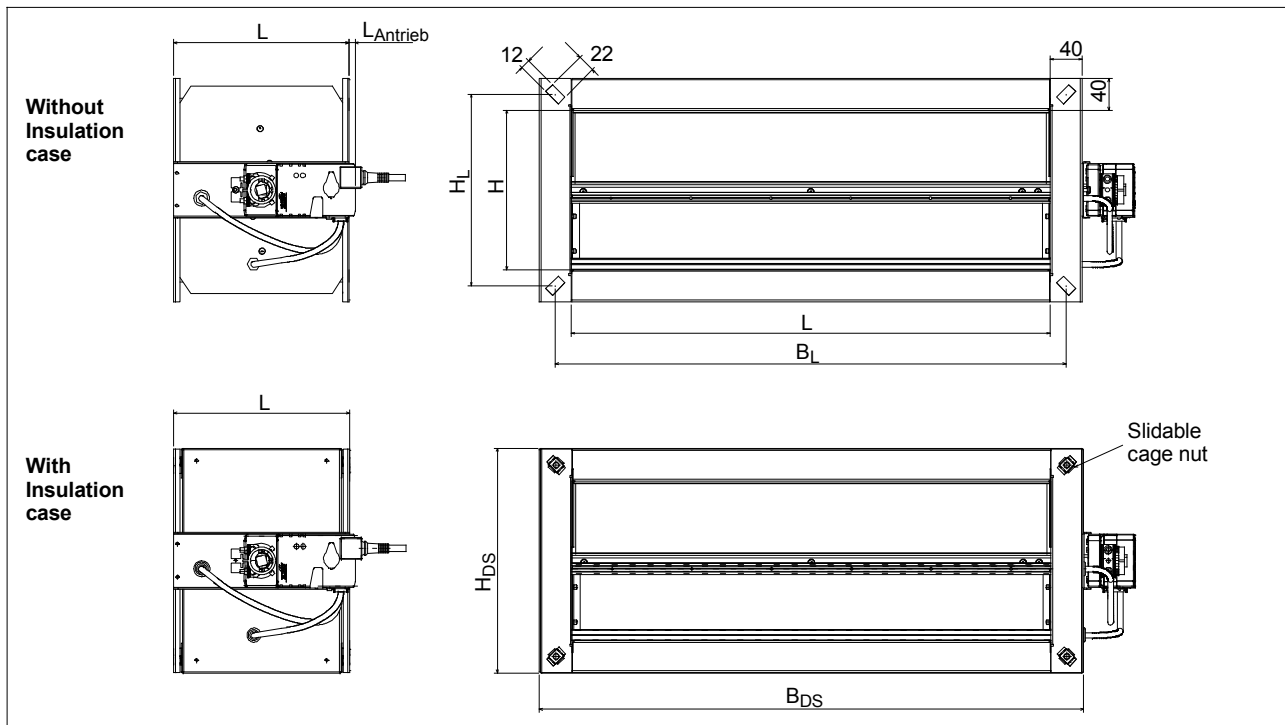
- Minimum air speed 1 m/s
- Nominal air speed 10 m/s
- Maximum air speed in the free case section 12 m/s with specific factory-set adjustment
- Static over-pressure in the air duct up to 1000 Pa (Pressure Class 2, DIN EN 1507)
- Static under-pressure in the air duct based on ambient pressure -750 Pa max. (tightness Class C, DIN/BS EN 1507)
- Leakage flow rate via shut damper blade (standard version) Class 3 (optional Class 4) acc. to DIN/BS EN 1751
- Leakage flow rate via casing Class C, DIN/BS EN 1751
- Operating temperature range 0 ... +50 °C, 5 ... 95 % rH non condensing (EN 60730-1)
- Suitable for low-pollution air flows (e.g. ETA1, ETA2 - DIN/BS 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

Control accuracy, installation

- Control accuracy is $\pm 5\%$ based on nominal flow rate. Due to measurement by the accelerated damper blade airflow the controller is virtually insensitive to entry duct conditions.
- Straight entry ducts are to be designed as follows:
 $L_{Anstr} > 2 - 3 H$ or $> 2 - 3 W$,
 depending on whether the disturbance is produced via the duct height H or width W.

Flow rate controllers type VRF-W (short)

Dimensions, weights



Width B [mm]	Height H [mm]	Length L [mm]	Distance between holes B _L [mm]	Distance between holes H _L [mm]	Excess length L _{Antrieb} [mm]	Width with insu- lation B _{DS} [mm]	Height with insu- lation H _{DS} [mm]	Max. Torque [Nm]	Weight without insulat. [kg]	Weight with insulat [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

Flow rate controllers type VRF-W (short)

Flow rates, minimum pressure differences

Width B [mm]	Height H [mm]	At 1 m/s			At 2 m/s		At 4 m/s		At 7 m/s		At 10 m/s	
		V _{min} [m ³ /h]	V [m ³ /h]	Δp _{min} [Pa]	V [m ³ /h]	Δp _{min} [Pa]	V [m ³ /h]	Δp _{min} [Pa]	V _{nenn} [m ³ /h]	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					
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		10800			
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		11520			
1000		1440	2880		5760		10080		14400			
1200		1728	3456		6912		12096		17280			

Legend

- V - Flow rate
- V_{min} - Minimum flow rate = lower limit of control
- V_{nenn} - Nominal flow rate
- Δp_{min} - Minimum pressure loss

Flow rate controllers type VRF-W (short)

Airborne sound transmission without sound absorber

Width W [mm]	Height H [mm]	Air speed [m/s]	$\Delta p_{ges} = 100 \text{ Pa}$										$\Delta p_{ges} = 200 \text{ Pa}$										$\Delta p_{ges} = 500 \text{ Pa}$									
			f_m [Hz]								Sum		f_m [Hz]								Sum		f_m [Hz]								Sum	
			63	125	250	500	1 K	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]	63	125	250	500	1 K	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]	63	125	250	500	1 k	2 K	4 K	8 K	LWA [dB(A)]	LpA [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 realized 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.

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

$$L_{WA} = L_{WA \text{ Chart}} + \Delta L$$

Legend

Δp_{ges} - Total pressure diff.

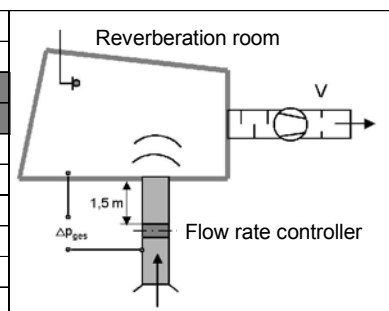
f_m - Octave mid-band frequency

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



Flow rate controllers type VRF-W (short)

Airborne sound transmission with sound absorber

Width W [mm]	Height H [mm]	Air speed [m/s]	$\Delta p_{ges} = 100 \text{ Pa}$										$\Delta p_{ges} = 200 \text{ Pa}$										$\Delta p_{ges} = 500 \text{ Pa}$									
			f_m [Hz]								Sum		f_m [Hz]								Sum		f_m [Hz]								Sum	
			63	125	250	500	1 K	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]	63	125	250	500	1 K	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]	63	125	250	500	1 k	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]
			L _W [dB/Okt]										L _W [dB/Okt]										L _W [dB/Okt]									
300	100	1	29	27	32	26	7	1	13	15	27	19	34	30	34	30	13	10	20	23	31	23	37	42	37	32	18	18	30	33	37	29
		2	35	34	37	24	9	7	16	17	30	22	37	35	41	33	15	14	25	26	36	28	41	39	41	38	22	22	34	38	41	33
		4	39	41	38	25	10	8	20	19	32	24	40	41	43	32	16	17	28	28	37	29	42	41	45	40	27	24	38	40	44	36
		7	54	54	47	33	15	13	25	24	42	32	50	51	51	37	20	19	34	38	45	36	49	49	52	43	28	27	42	45	49	40
		10	57	56	51	38	22	21	29	27	45	34	59	59	54	44	27	25	35	37	49	38	54	55	58	45	30	28	43	46	52	41
400	150	1	40	39	38	31	12	11	18	24	33	25	45	42	42	35	18	18	26	28	37	29	46	45	47	42	25	26	42	42	47	39
		2	44	46	42	30	12	15	21	25	36	28	47	47	49	39	19	21	40	35	45	37	52	51	51	45	28	29	49	46	52	44
		4	52	52	46	34	16	16	25	26	41	30	55	57	55	41	21	22	41	38	49	39	60	59	59	53	30	29	45	54	57	47
		7	58	56	50	37	19	17	27	28	45	32	62	62	58	44	25	24	40	39	52	40	67	66	66	55	33	32	46	56	61	49
		10	63	60	54	41	24	20	30	31	49	34	70	66	61	47	28	26	38	40	55	41	72	72	70	58	35	34	48	58	64	50
600	200	1	46	43	43	32	20	21	22	25	37	29	50	44	49	38	21	33	30	30	43	35	54	48	53	46	28	37	37	41	49	41
		2	53	43	42	37	20	25	28	27	39	29	53	46	49	39	23	28	38	33	44	34	58	47	51	48	30	35	50	45	53	43
		4	58	47	44	36	21	23	29	26	40	26	62	54	51	44	26	28	39	38	47	34	68	57	56	49	33	35	50	49	55	42
		7	59	56	49	39	21	23	30	30	45	29	68	58	53	46	27	29	42	44	51	35	76	67	63	54	38	37	51	52	60	44
		10	61	55	49	41	21	19	30	31	45	27	75	62	56	47	28	30	40	41	53	35	78	71	66	56	38	37	50	55	62	44
600	250	1	47	44	43	33	22	21	22	25	37	29	50	46	49	39	23	33	31	31	43	35	55	49	54	47	29	37	40	42	50	42
		2	53	45	44	38	22	24	27	27	40	29	54	48	49	41	25	29	37	33	45	34	59	50	54	50	32	37	49	45	53	43
		4	57	48	46	38	22	23	29	30	41	27	62	55	53	46	28	28	39	38	49	35	68	59	57	50	35	37	50	48	55	41
		7	61	57	50	40	22	23	31	31	46	29	69	60	55	47	29	30	42	45	52	35	77	68	64	55	39	38	51	53	60	44
		10	63	58	51	42	23	21	33	35	47	28	75	64	58	48	30	30	40	43	55	35	80	73	67	56	40	38	51	55	63	44
600	300	1	49	44	44	35	24	21	22	25	38	29	51	47	50	40	26	33	32	31	44	35	56	51	55	49	31	38	42	43	51	42
		2	53	46	46	40	23	23	26	27	41	29	55	49	49	43	28	29	36	34	45	33	60	53	56	51	34	39	48	45	54	42
		4	56	49	49	40	23	23	29	33	43	28	63	56	54	47	29	29	38	37	49	34	68	60	57	51	38	39	50	48	56	41
		7	62	58	52	42	24	24	32	32	47	30	69	61	56	48	30	30	42	45	53	35	77	69	64	56	41	39	51	53	61	43
		10	66	61	53	43	24	22	35	38	49	29	75	66	59	50	31	31	41	44	56	36	81	74	67	57	41	39	52	55	64	44
800	400	1	53	46	45	39	28	21	24	26	40	30	52	51	52	42	32	33	34	33	46	35	58	55	58	53	35	40	48	47	55	44
		2	55	49	51	43	26	23	25	28	45	31	58	53	51	48	34	32	35	35	48	34	63	59	61	55	39	45	46	46	57	43
		4	55	53	54	44	25	24	30	41	48	31	65	59	57	52	34	30	37	38	53	36	70	64	59	54	43	44	51	48	58	41
		7	65	61	56	46	28	27	36	35	51	30	71	65	59	51	34	33	43	46	55	35	80	72	66	59	45	42	52	55	63	43
		10	71	68	58	46	28	26	40	46	55	33	76	70	62	53	36	33	43	47	59	37	84	77	69	58	44	42	54	56	66	44

The values on which the attenuation is based are applicable to an active silencer length of 1000 mm. Conversion to other model sizes is realized 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.

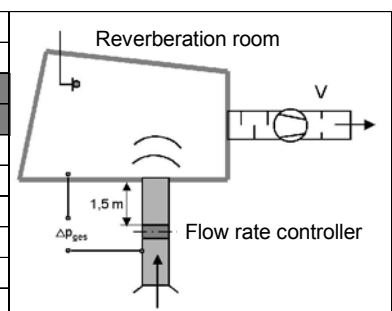
$$L_{W \text{ Okt}} = L_{W \text{ Chart}} + \Delta L$$

$$L_{WA} = L_{WA \text{ Chart}} + \Delta L$$

Legend

- Δp_{ges} - 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



Flow rate controllers type VRF-W (short)

Casing radiation without insulating case

Width W [mm]	Height H [mm]	Air speed [m/s]	$\Delta p_{ges} = 100 \text{ Pa}$										$\Delta p_{ges} = 200 \text{ Pa}$										$\Delta p_{ges} = 500 \text{ Pa}$									
			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	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

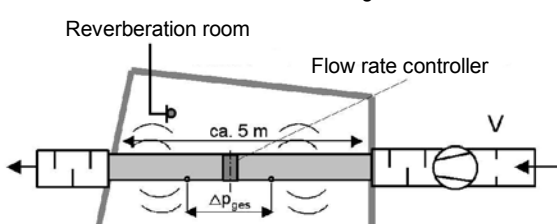
Conversion to other model sizes is realized at the same throttle point of air speed and pressure loss using the ΔL values from the following chart. The values are applicable to the associated unit height H.

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

$$L_{WA} = L_{WA \text{ Chart}} + \Delta L$$

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 without insulating case



Legend

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

Flow rate controllers type VRF-W (short)

Casing radiation with insulating case

Width W [mm]	Height H [mm]	Air speed [m/s]	$\Delta p_{ges} = 100 \text{ Pa}$								$\Delta p_{ges} = 200 \text{ Pa}$								$\Delta p_{ges} = 500 \text{ Pa}$																			
			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_W [dB(A)]		L_{WA} [dB(A)]	L_{pA} [dB(A)]	63	125	250	500	1 K	2 K	4 K	8 K	L_W [dB(A)]		L_{WA} [dB(A)]	L_{pA} [dB(A)]	63	125	250	500	1 k	2 K	4 K	8 K	L_W [dB(A)]		L_{WA} [dB(A)]	L_{pA} [dB(A)]
			L_W [dB/Okt]										L_W [dB/Okt]										L_W [dB/Okt]															
300	100	1	33	31	32	25	19	9	5	4	27	18	38	34	34	29	24	18	13	11	31	22	41	46	37	31	30	26	23	21	36	27						
		2	39	38	37	23	21	15	9	5	30	22	41	39	41	31	27	22	18	14	35	26	45	43	41	37	34	30	27	26	40	31						
		4	43	45	38	24	21	17	13	7	33	24	44	45	43	31	28	25	21	17	37	28	46	45	45	39	38	33	31	29	43	34						
		7	58	58	47	32	27	21	18	12	44	35	54	55	50	36	32	27	26	26	45	35	53	53	52	42	39	35	35	33	47	38						
		10	62	60	51	37	34	29	22	15	47	38	63	63	54	43	39	33	28	26	50	41	58	60	57	44	41	37	36	35	51	42						
400	150	1	40	39	35	29	23	19	11	12	31	22	45	42	39	33	29	26	19	16	36	27	45	46	43	40	36	34	35	30	43	34						
		2	43	47	39	28	23	23	14	13	35	26	47	48	46	37	30	29	33	23	41	33	52	52	48	43	40	37	41	34	48	39						
		4	51	52	43	32	27	24	18	14	39	30	55	58	52	38	32	30	34	26	47	38	60	59	56	50	41	38	38	42	52	43						
		7	57	57	47	35	31	25	19	17	44	35	61	62	55	42	36	32	33	28	50	41	66	67	63	53	44	40	39	45	57	49						
		10	63	60	51	38	35	28	23	19	48	38	69	66	58	44	39	34	31	28	54	45	72	72	67	56	47	42	41	46	61	53						
600	200	1	44	42	39	29	32	29	15	13	37	28	48	44	45	36	32	41	23	18	44	35	53	47	49	43	39	45	30	30	49	40						
		2	51	43	39	34	32	33	20	15	39	30	52	45	45	36	34	36	31	21	42	33	56	47	48	46	41	43	42	33	49	41						
		4	57	46	41	34	32	31	22	14	39	30	60	53	48	41	37	36	32	26	45	36	66	57	52	47	44	43	42	37	52	43						
		7	58	56	45	36	32	31	22	19	43	34	66	58	50	43	39	37	35	33	48	39	74	66	60	52	49	45	43	40	57	48						
		10	59	55	45	38	32	27	23	19	43	34	73	62	53	44	39	38	32	30	52	43	77	71	62	53	50	46	43	43	60	51						
600	250	1	45	42	39	31	33	29	15	14	37	28	48	44	45	36	35	41	24	19	44	35	53	48	50	45	41	45	33	31	50	40						
		2	51	43	40	36	33	32	20	16	39	30	52	46	45	38	37	37	30	22	43	34	57	49	50	47	43	45	42	34	51	42						
		4	55	47	43	35	33	31	22	18	40	31	60	54	49	43	39	36	32	26	46	37	66	57	53	48	47	45	43	37	53	44						
		7	58	56	46	38	34	32	24	20	44	35	66	59	51	44	40	38	35	33	49	40	74	66	60	53	50	46	44	41	58	49						
		10	61	57	47	39	34	29	25	23	45	36	73	63	54	46	41	39	33	31	52	43	77	71	63	54	51	47	44	44	60	51						
600	300	1	46	42	39	32	35	29	15	14	38	29	47	45	46	37	37	41	25	19	45	36	53	49	51	46	42	46	35	32	50	42						
		2	50	44	42	37	34	31	19	15	40	31	52	47	45	40	39	38	29	22	44	35	57	51	52	48	45	48	40	33	53	44						
		4	53	47	44	37	34	31	22	22	41	32	60	54	49	45	41	37	31	26	47	38	65	58	53	49	49	47	43	36	54	45						
		7	59	56	48	39	35	32	25	21	45	36	66	59	52	45	42	39	35	33	50	41	74	67	60	53	52	47	44	41	58	49						
		10	62	59	49	40	35	30	28	26	47	37	72	64	55	47	42	39	34	33	53	44	78	72	63	54	52	47	44	43	61	52						
800	400	1	48	43	40	36	39	29	16	14	41	32	47	47	47	39	43	41	27	21	47	38	53	51	53	50	46	48	41	35	53	44						
		2	50	46	46	40	37	31	18	16	43	34	53	50	46	45	45	40	28	24	48	39	58	55	57	52	50	53	39	34	57	48						
		4	50	50	49	41	37	32	23	30	44	35	59	56	52	49	45	39	30	26	50	42	65	60	55	51	54	52	44	36	58	49						
		7	60	57	51	43	39	35	29	23	47	38	66	62	54	48	45	41	36	35	52	43	75	68	61	56	56	50	45	43	61	52						
		10	66	65	54	43	39	34	32	34	52	43	71	67	58	50	47	41	36	36	55	47	79	74	64	55	55	50	46	44	62	54						

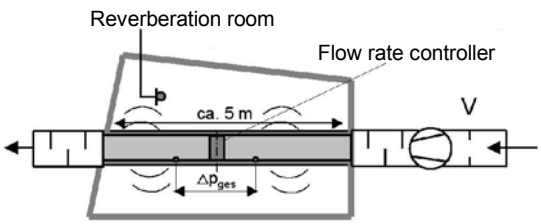
Conversion to other model sizes is realized at the same throttle point of air speed and pressure loss using the ΔL values from the following chart. The values are applicable to the associated unit height H.

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

$$L_{WA} = L_{WA \text{ Chart}} + \Delta L$$

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



Legend

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

Flow rate controllers type VRF-W (short)

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
$\Delta L_{W \text{ Okt}}$	[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	$\Delta L_{W \text{ Okt}}$ [dB/Okt]	0	0	1	2	3	3	3	3
Room attenuation	$\Delta L_{W \text{ Okt}}$ [dB/Okt]	5	5	5	5	5	5	5	5
Outlet reflection	$\Delta L_{W \text{ Okt}}$ [dB/Okt]	10	5	2	0	0	0	0	0

Branching attenuation for distributing the sound power over multiple rooms, $V_{\text{room}} = 540 \text{ m}^3/\text{h}$

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

Sample calculation sound transmission

Given: VRF-W 500 x 200 with silencer type SDF-SM
 $V_{\text{max}} = 1440 \text{ m}^3/\text{h}$, equates to 4 m/s
 $\Delta p_{\text{ges}} = 200 \text{ Pa}$

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	$L_{W \text{ Okt}}$ [dB/Okt]	62	54	51	44	26	28	39	38	page 8
Converted to size of 500 x 200	[dB/Okt]	-1	-1	-1	-1	-1	-1	-1	-1	page 8
$\Delta L_{W \text{ Okt}}$										
Deflection	$\Delta L_{W \text{ Okt}}$ [dB/Okt]	0	0	-1	-2	-3	-3	-3	-3	page 11
Room attenuation	$\Delta L_{W \text{ Okt}}$ [dB/Okt]	-5	-5	-5	-5	-5	-5	-5	-5	page 11
Outlet reflection	$\Delta L_{W \text{ Okt}}$ [dB/Okt]	-10	-5	-2	0	0	0	0	0	page 11
Branching attenuation	[dB/Okt]	-4	-4	-4	-4	-4	-4	-4	-4	page 11
$\Delta L_{W \text{ okt}} = 10 \times L_g \frac{1440 \text{ m}^3/\text{h}}{540 \text{ m}^3/\text{h}}$										
A-weighted	$\Delta L_{W \text{ Okt}}$ [dB/Okt]	-26	-16	-9	-3	-0	1	1	-1	
A-weighted sound pressure level	$L_{pA \text{ Okt}}$ [dB(A)/Okt]	16	23	29	29	13	16	27	24	
A-weighted sum sound pressure level $L_{pA} = 34 \text{ dB(A)}$										

Flow rate controllers type VRF-W (short)

Room sound pressure level 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-W 500 x 200 with insulation case
 $V_{max} = 1440 \text{ m}^3/\text{h}$, equates to 4 m/s
 $\Delta p_{ges} = 200 \text{ Pa}$

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 $L_{W Okt}$ size 600 x 200	[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]	23	26	29	28	25	26	22	16	
A-weighted sum sound pressure level $L_{pA} = 35 \text{ dB(A)}$										

Nomenclature, ordering key

VRF-W 600 x 200 / S / D / 3 / BI 681

(1) (2) (3) (4) (5) (6)

(1) **Flow rate controller, rectangular, short**

(2) **Dimensions** x ... = width x height in mm (refer to page 5)

(3) **Version** S = steel 1 mm, galvanized

(4) **Insulating case** – = without
D = with (sheet steel 1 mm, galvanized, 40 mm mineral wool)

(5) **Leakage** 3 = Class 3 acc. to DIN EN 1751
4 = Class 4 acc. to DIN EN 1751

(6) **Control type** BI 681 = Belimo LMV-D3W-E-MF (standard up to height 250 mm)
BI 690 = Belimo NMV-D3W-E-MP (standard from height 300 mm)
BI 680 = Belimo LMV-D3W-E-MP (special equipment up to height 250 mm)
BI 816 = Belimo LMV-D3W-E-LON (special equipment up to height 250 mm)
BI 817 = Belimo NMV-D3W-E-LON (special equipment from height 300 mm)

Additional order informations

- V_{min} [m³/h], at which $0 \leq V_{min} < V_{max}$; lower limit of control refer to page 6
- V_{max} [m³/h], at which $V_{min} < V_{max} \leq V_{nenn}$ und $V_{max} \geq 0,2 V_{nenn}$; V_{nenn} refer to page 6
- Mode: 0 ... 10 V or 2 ... 10 V

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

- $V_{min} = 0 \text{ m}^3/\text{h}$
- $V_{max} = V_{nenn}$
- Mode = 0 ... 10 V

Specification and schedule of prices

Flow rate controller type VRF-W (short)

October 2012, page 1 of 2

Quantity	Description of services	Unit price in €	Total price in €
	<p>Flow rate controller, rectangular, to control a constant or variable flow rate, initial pressure independent. Flow rates are factory set according to customer's specifications. The customer can easily change the volume rate of flow using the ZTH-GEN service tool. Control range 1 ... 10 m/s with damper pressure losses of 5 ... 1000 Pa. Admissible differential pressures based on ambient pressure +1000 Pa and -750 Pa, according to Class C, Pressure Class 2 (DIN EN 1507). Casing leakage acc. to Class C, damper leakage acc. to Class 3 (DIN EN 1751). Grading of duct widths and heights acc. to DIN EN 1505. Minimum casing lengths and low entry flow sensitivity for easy mounting in case of limited space installation conditions. Withstands temperatures up to +50 °C. Voltage range for the control and measured signal 0 ... 10 VDC. External floating switches can be used to give control override for SHUT, OPEN, V_{min} and V_{max}.</p> <p><u>Consisting of:</u></p> <ul style="list-style-type: none"> - Very short, shape-retaining <u>casing</u> of 1 mm galvanized sheet steel. - Reinforced, single-membered, pressure-resistant <u>damper blade</u> of galvanized sheet steel, with surrounding flap seal of EPDM integrated into the housing. The position of the damper blade can be seen from the axle on the outside. - Maintenance-free <u>damper bearing</u> of plastic (POM, Hostaform C 9021). - An averaging <u>differential pressure sensor</u> of aluminium, with 3 mm measuring holes is integrated into the device, and therefore only has low susceptibility to soiling. - A Belimo VAV Compact D3 electronic <u>volume flow controller</u> is fitted at the factory. It has two LEDs for display and monitoring of the function. <p>Actuator, control</p> <ul style="list-style-type: none"> o Belimo LMV-D3W-E-MF (dynamic measuring principle) o Belimo NMV-D3W-E-MP (dynamic measuring principle, compatible with MP-Bus9) o Working range 0 ... 10V o Working range 2 ... 10V <p>Sizes/dimensions W x H x L</p> <ul style="list-style-type: none"> o _____ x 100 x 135 mm o _____ x 150 x 160 mm o _____ x 200 x 220 mm o _____ x 250 x 270 mm o _____ x 300 x 320 mm o _____ x 400 x 420 mm <p>Manufacturer: LTG Aktiengesellschaft Series: Flow rate controller Type: VRF-W</p>		

Specification and schedule of prices

Flow rate controller type VRF-W (short)

October 2012, page 2 of 2

Quantity	Description of services	Unit price in €	Total price in €
	<p>Accessories, special equipment (optional, additional charge)</p> <ul style="list-style-type: none"> o Insulating case (1 mm sheet steel, 40 mm mineral wool) o Sound absorber type SDF-SM with individual casing, baffles of mineral wool, lined with glass scrim o Damper leakage acc. to Class 4 (DIN EN 1751) o Compact controller compatible with MP-Bus Belimo LMV-D3W-E-MP (up to height 250 mm) o Compact controller compatible with LON Belimo LMV-D3W-E-LON (up to height 250 mm) o Compact controller compatible with LON Belimo NMV-D3W-E-LON (from height 300 mm) 		

Flow rate controllers type VRF-W (short)

Germany

Office East 2

Sales area: **postcode 01 - 09, 98 - 99**
 Johannes-Ebert-Straße 20 · D-09128 Chemnitz
 Herr Schenfeld ☎ +49 371 77118-01, Fax -02
 E-mail: Schenfeld@LTG-AG.de

Office East 1

Sales area: **postcode 10 - 25, 39**
 Eisenhutweg 51a · D-12487 Berlin
 Herr Linke ☎ +49 30 632287-74, Fax -75
 E-mail: Linke@LTG-AG.de

Office North

Sales area: **postcode 20 - 31, 38**
 An den Auewiesen 24 · D-31515 Wunstorf
 Herr Krockner ☎ +49 5031 5150234, Fax 9623334
 E-Mail: Krockner@LTG-AG.de

Office West

Sales area: **postcode 32 - 33, 40 - 53, 58 - 59**
 Baststraße 30 · D-46119 Oberhausen/Rheinl.
 Herr Perenz ☎ +49 208 30431-55, Fax -56
 E-mail: Perenz@LTG-AG.de

Central Office 2

Sales area: **postcode 34 - 37, 56 - 57, 61 - 62, 65**
 Sperberweg 16 · D-35745 Herborn
 Herr Hartmann ☎ +49 2772 570-725, Fax -727
 E-mail: M.Hartmann@LTG-AG.de

Central Office 1

Sales area: **postcode 54 - 55, 60, 63 - 64, 66 - 69, 97**
 Wingertstraße 3a · 64390 Erzhausen
 Herr Lohr · Tel. +49 6150 542-1868, Fax -1892
 Lohr@LTG-AG.de

Office Southwest

Sales area: **postcode 70 - 79, 88 - 89**
 Grenzstraße 7 · D-70435 Stuttgart
 Frau Schanbacher · Tel. +49 711 8201-181, Fax -210
 E-Mail: Schanbacher@LTG-AG.de

Office South

Sales area: **postcode 80 - 87, 90 - 96**
 Grenzstraße 7 · D-70435 Stuttgart
 Frau Schanbacher · Tel. +49 711 8201-181, Fax -210
 E-Mail: Schanbacher@LTG-AG.de

Austria

KTG Klimatechnische Gesellschaft mbH

Schubertstraße 13 · A-2126 Ladendorf
 ☎ +43 2575 210-89, Fax -22 · E-Mail: office@ktg-wien.com

Great Britain

MAP Motorised Air Products Ltd.

Unit 5A · Sopwith Crescent
 Wickford Business Park · Wickford · GB-Essex SS11 8YU
 ☎ +44 1268 5744-42, Fax -43 · E-Mail: info@mapuk.com

Netherlands

Opticlina Systems b.v.

Leeuwerikstraat 110 · NL-3853 AG Ermelo
 ☎ +31 341 4939-69, Fax -31 · E-Mail: info@opticlina.nl

Poland

HTK Went Sp.z.o.o.

ul. Chopina 13/3 · PL-30047 Krakow
 ☎ +48 12 632-3132, Fax -8193 · E-Mail: info@htk-went.pl

Portugal

ArGelo S. A.

R. Luis Pastor de Macedo · Lote 28 B, P-1750-158 Lisboa
 ☎ +351 21 75201-20, Fax -29 · E-Mail: info@argelo.pt

Switzerland

Laminair AG

Kirchbergstrasse 105 · CH-3400 Burgdorf
 ☎ +41 34 42002-10, Fax -11 · E-Mail: info@laminair.ch

Turkey

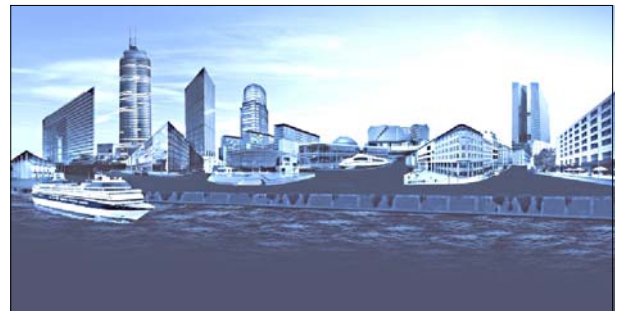
Step Müh. Yapi Ltd.

Barbaros Mah. · Kayacan Sokak No. 10
 TR-34746 Yenisahra-Atasehir-Istanbul
 ☎ +90 216 4700-070, Fax -525 · E-Mail:
 info@stepyapi.com.tr

The Program for Comfort Air Technology

Key components

Air diffusers for ceilings, walls and floors: LTG System clean[®], linear diffusers, displacement air diffusers, swirl diffusers Coandavent[®] · LTG chilled beam cool wave[®] · Induction units Klimavent[®] · Induction unit Coandatrol[®] · Fan coil units Raumluf[®] · Ceiling fan coil units Ventotel[®] · Decentralized facade ventilation units Univent[®] · Airflow control units · labair[®] system: components for lab ventilation



LTG Engineering Services

Technical services for investors, architects, engineers and plant builders during design, construction and operation of buildings. Reliable and precise data relating to the ventilation of air conditioning system are given already before realization of the project, determined by measurements, calculations, building simulations and experiments.

The Program for Process Air Technology

Key components

Axial, radial and tangential fans · Fahrtwind Simulators · LTG Filtration Technology: fans, suction nozzles, dampers, filters, separators, compactors · LTG Humidification Technology: air humidifiers, product humidifiers

LTG Engineering Services

Technical services during development and operation of assembly groups, machines and plants · Analysis, simulation, optimization · Customized solutions · Mobile filtration lab/ filter engineering on site