mcr WIP PRO/V
mcr WIP PRO/V-M

multi-blade smoke exhaust fire dampers for multi-zone fire ventilation systems

PRODUCT CONFIGURATOR AT WWW.MERCOR.COM.PL

CE 1396-CPR-0115

FIRES

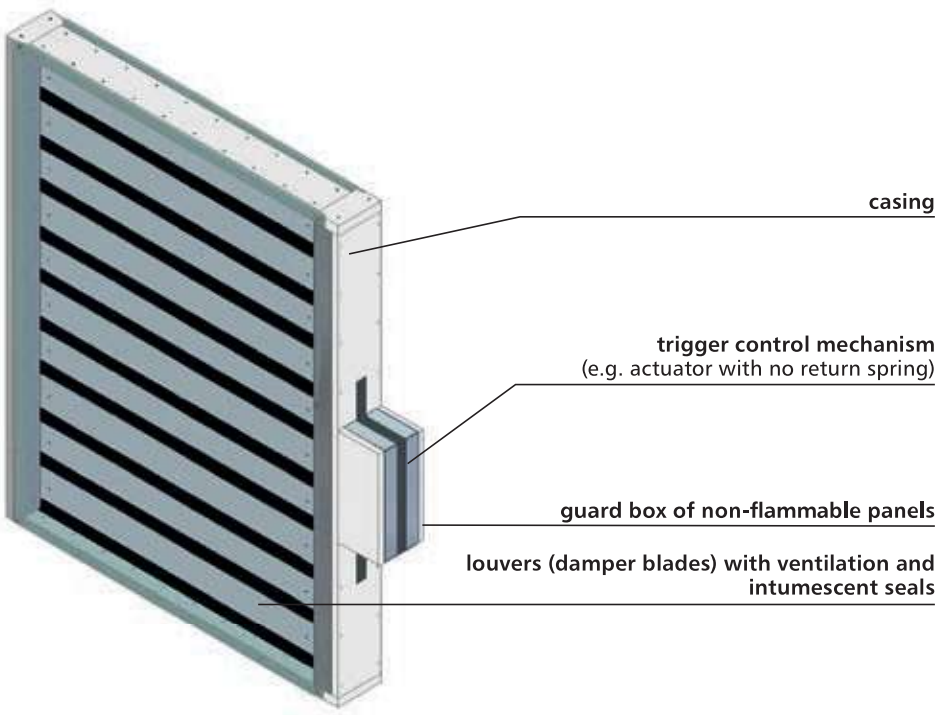
ATEST HIGIENICZNY

- **EIS120, EIS90, ES120**
- **Certificate of constancy of performance 1396-CPR-0115.**
- **Dampers certified for compliance with EN 12101-8.**
- **Dampers qualified under EN 13501-4 and tested under EN 1366-10.**
- **Narrow louvered fire dampers for fire ventilation systems.**

10.1. application

Multi-blade mcr WIP PRO/V, mcr WIP PRO/V-M fire dampers for use in automatic fire ventilation systems. mcr WIP PRO/V fire dampers are used in fire ventilation systems, mcr WIP PRO/V-M fire dampers are used in mixed systems, combining both fire and comfort ventilation systems. The devices prevent fire, smoke and fire gases propagation to the adjacent areas. During normal operation, the fire damper is in open or closed position depending on its function. In the fire-covered area, the fire damper is open, whereas it remains closed in the other areas. mcr WIP PRO/V, mcr WIP PRO/V-M fire dampers due to their design are intended for use in systems, where the components such as a silencer, bend or supply/return grille are installed downstream of the fire damper.

10.2. design



Multi-blade mcr WIP PRO/V, mcr WIP PRO/V-M dampers consist of a rectangular casing made of two steel sections joined with a non-combustible plate using rivets and galvanized steel fasteners, a set of movable blades rotating around their axis and a trigger control mechanism. The fire damper casing is made of fire resistant panels and galvanized steel „C" shape profiles. The device is reinforced on both sides with steel corners. Intumescent and ventilation seals are installed on the inside. Each fire damper blade is made of two 20 mm thick fire resistant plates. Intumescent seal and ventilation seals fixed with staples are installed at the entire blade length. The blades rotate around the axis made by two steel pins. Each pin is mounted in a brass sleeve mounted on a vertical side H of the fire damper casing.

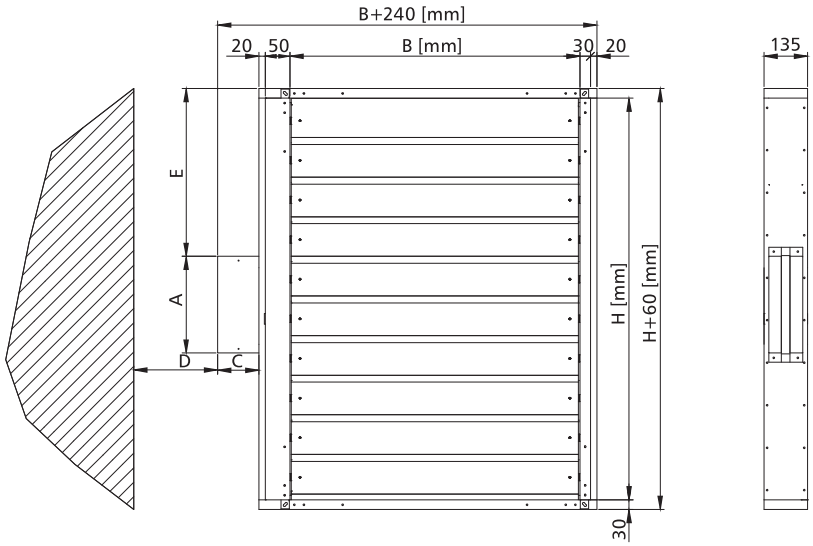
10.3. versions

10.3.1. **mcr WIP PRO/V, mcr WIP PRO/V-M** fire damper for multi-zone fire ventilation systems with actuator - damper opened/closed with an actuator.

During normal operation, the louvers are open or closed. In case of fire, the fire damper louvers are opened in the fire-covered area and closed in the other areas - the fire damper is released remotely by feeding the supply voltage to the trigger control mechanism.

mcr WIP PRO/V, mcr WIP PRO/V-M fire dampers feature a Belimo trigger control mechanisms **BLE, BE** axial actuator without the return spring (24 V AC/DC or 230 V AC). BLE, BE series actuators are equipped with limit switches used to monitor the blade position. Furthermore, the mechanical blade position indicator is placed on the actuator.

mcr WIP PRO/V, mcr WIP PRO/V-M fire dampers with Belimo BLE, BE actuators are opened or closed by supplying voltage to the actuator terminals. Furthermore, dampers with those actuators may be opened/closed manually using a key.



mechanism	A	C	D	E
BF, BFL, BFN	298	120	75	formula*

* shown in below table

for the even number of blades	for the odd number of blades
E [mm] = (H/2 - 123) + 30	E [mm] = (H/2 - 61.5) + 30

Number of blades = H/123.

10.4. dimensions

Rectangular dampers:

- nominal width B: from 110 mm to 900 mm
- nominal height H: from 263 mm to 1250 mm
- the maximum cross-section surface of one damper up to 1.125 m^2

Apart from the standard dimensions, fire dampers may be manufactured with intermediate dimensions (in 1 mm increments, in the given range).

Square fire dampers may also be fitted with round connectors for the spigot connection to the round ducts.

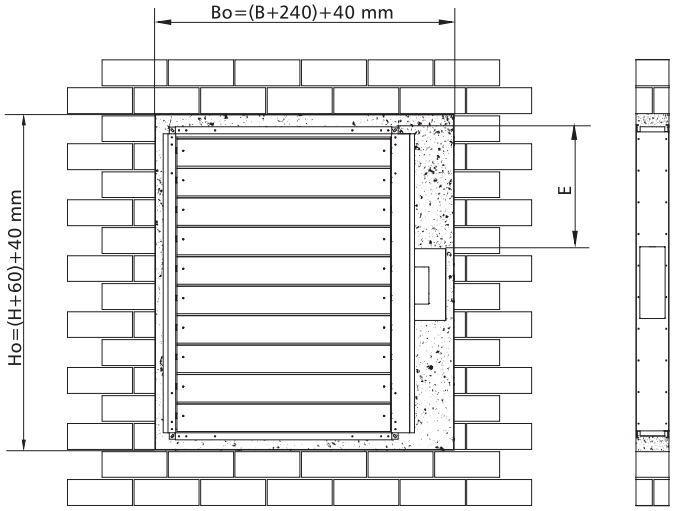
10.5. installation

Rectangular mcr WIP PRO/V, mcr WIP PRO/V-M fire dampers are class EI120(v_e i i↔ o)S-rated devices, if installed in concrete partitions, min. 110 mm thick, made of common bricks or aerated concrete blocks, min. thickness 115 mm or stud partitions with min. EI120 fire rating.

10.5.1. preparation of installation openings

The minimum dimensions of the installation opening that permits correct installation of the mcr WIP PRO/V, mcr WIP PRO/V-M damper is:

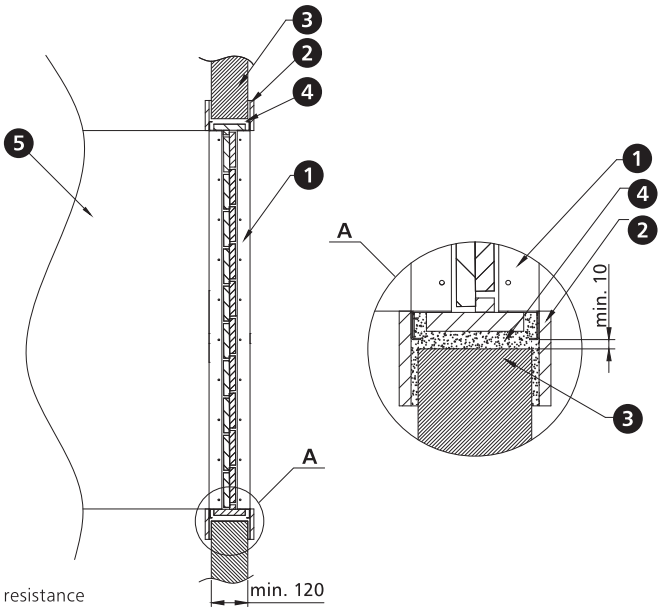
Bo = (B + 240) + 40 mm
Ho = (H + 60) + 40 mm



Dimension E (distance from the top fire damper edge to the edge of the trigger control mechanism box) - depending on the dimension H and the trigger control mechanism used:

mechanism	for the even number of blades	for the odd number of blades
BE, BLE	E [mm] = (H/2 - 123) + 30	E [mm] = (H/2 - 61.5) + 30

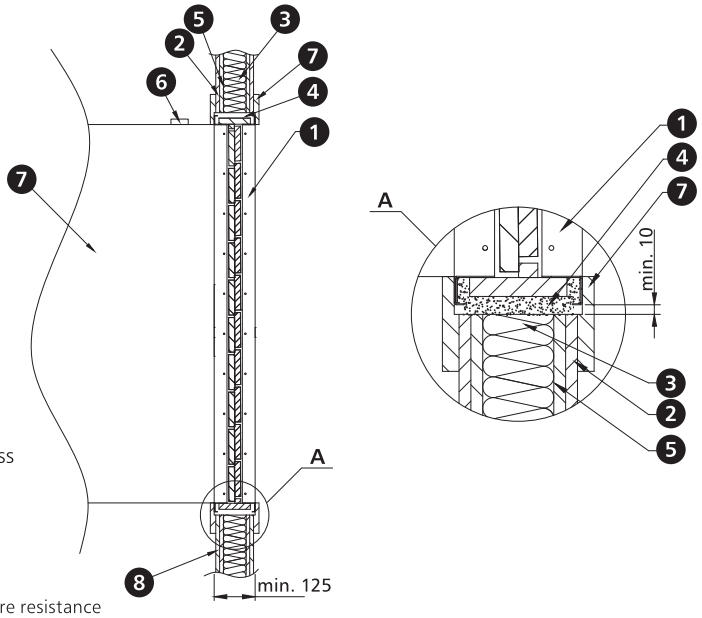
10.5.2. sample installation in concrete block or full brick walls



1. fire damper mcr WIP PRO
2. gypsum board trim 100x12.5 mm
3. brick masonry wall
4. masonry mortar (e.g. gypsum)*
5. smoke ventilation duct

*it is possible to use a different sealing which ensures the required fire resistance

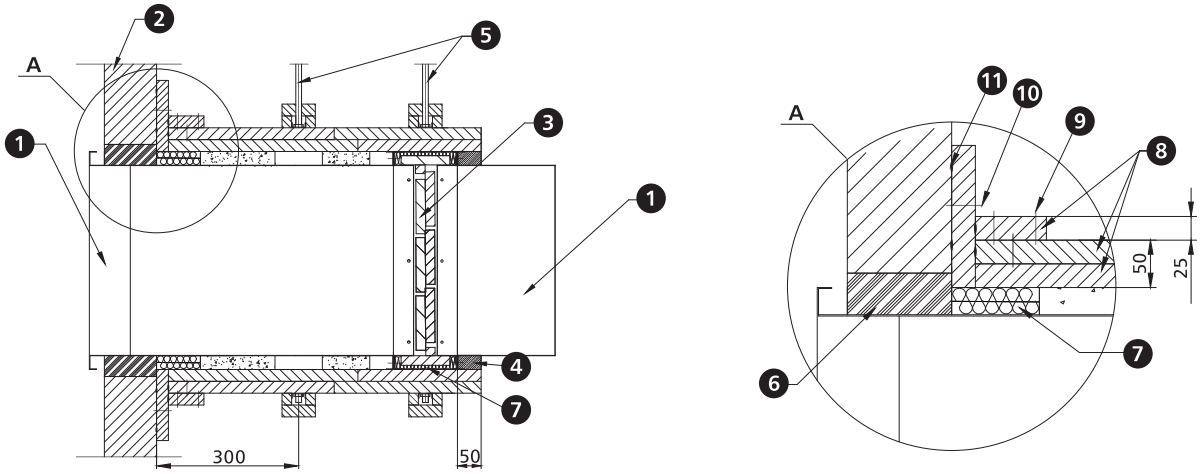
10.5.3. sample installation in lightweight walls



1. fire damper mcr WIP PRO
2. gypsum board 12.5 mm
3. mineral wool with the density of at least 80 kg/m^3, A1 class
4. mortar (e.g. gypsum)*
5. structural profile
6. gypsum board trim 100x12.5 mm
7. smoke ventilation duct
8. partition wall

*it is possible to use a different sealing which ensures the required fire resistance

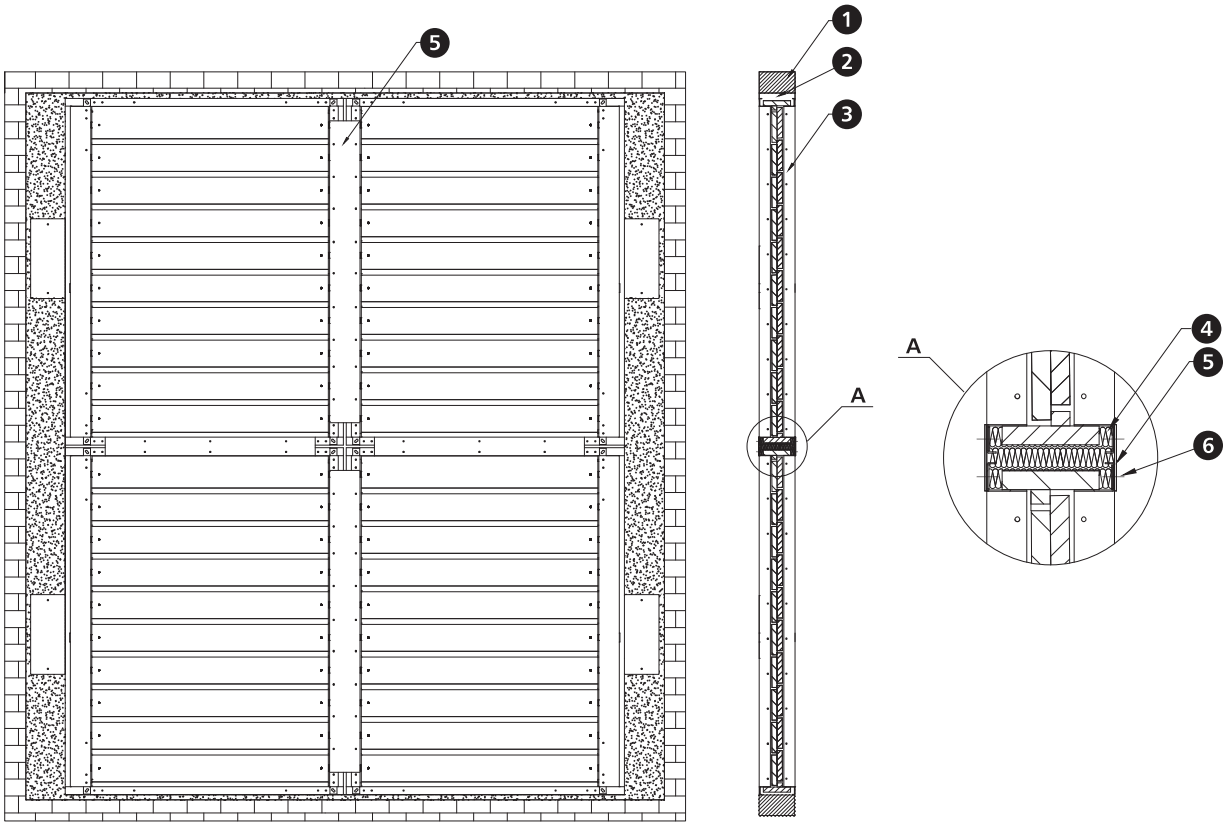
10.5.4. sample installation outside the fire partition



1. smoke ventilation duct
2. partition wall
3. fire damper mcr WIP PRO
4. gypsum infill
5. duct suspension
6. sealing (cement or cement-lime masonry mortar)*
7. mineral wool with the density of at least 80 kg/m^3, A1 class
8. Ridurit fire retardant board
9. screws 3.5 x 50 at ~150 mm centres
10. steel expansion anchor Ø8 x 80 mm
11. board joints sealed with Conlit Glue

*it is possible to use a different sealing which ensures the required fire resistance

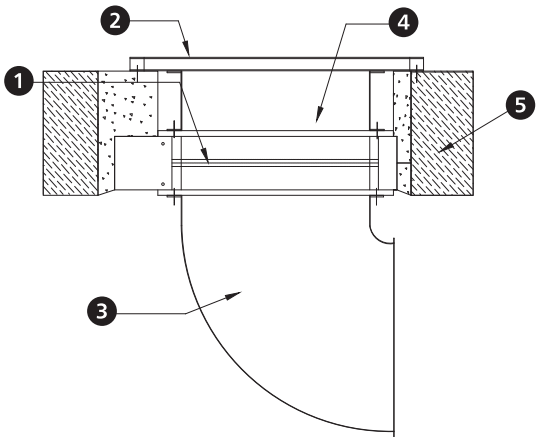
10.5.5. sample installation in a multiple set (a battery of four dampers)



1. e.g. masonry wall
2. e.g. cement mortar*
3. fire damper mcr WIP PRO
4. mineral wool with the density of at least 80 kg/m^3, A1 class
5. steel flat bar, dimensions:
   - vertical H: width 110 mm, thickness 2 mm
   - horizontal B: width 70 mm, thickness 2 mm
6. ST8x16 screw

*it is possible to use a different sealing which ensures the required fire resistance

Example applications - installation with end cap



1. fire damper mcr WIP
2. duct cover
3. ventilation duct
4. duct - ventilation straight connection pipe
5. wall, ceiling

If a mcr WIP/V, mcr WIP/V-M damper is used, thanks to the shutters (no single-plane partition) it is possible to use the space in front of and behind the damper for such system elements as a duct cover or a rectangular silencer or to route a duct along the wall using a duct bend or reduction.

10.6. technical parameters of mcr WIP PRO/V, mcr WIP PRO/V-M rectangular dampers

B – nominal width [mm]
H – nominal height [mm]

v – velocity [m/s]
Sk – duct cross-section [m^2]
Se – damper active cross-section [m^2]

Q – flow [m^3/h]
dp – pressure drop [Pa]
L_{WA} – damper noise level [dB]

		height H [mm]															
		263						300						350			
		v [m/s]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]
width B [mm]	110	4	0.029	0.019	269	13	6	0.033	0.019	269	14	10	0.039	0.019	269	16	15
		6			404	28	16			404	30	21			404	36	25
		8			539	50	24			539	54	28			539	63	33
		10			673	78	29			673	85	34			673	99	39
	150	4	0.040	0.026	367	13	7	0.045	0.026	367	14	12	0.053	0.026	367	16	16
		6			551	28	17			551	30	22			551	36	27
		8			734	50	25			734	54	30			734	63	34
		10			918	78	31			918	85	36			918	99	40
	200	4	0.053	0.034	490	13	8	0.060	0.034	490	14	13	0.070	0.034	490	16	17
		6			734	28	19			734	30	23			734	36	28
		8			979	50	26			979	54	31			979	63	35
		10			1224	78	32			1224	84	37			1224	99	41
	250	4	0.067	0.043	612	13	9	0.075	0.043	612	14	14	0.088	0.043	612	16	18
		6			918	28	20			918	30	24			918	36	29
		8			1224	50	27			1224	54	32			1224	63	36
		10			1530	78	33			1530	85	38			1530	99	42
	300	4	0.080	0.051	734	13	10	0.090	0.051	734	14	15	0.105	0.051	734	16	19
		6			1102	28	20			1102	30	25			1102	36	30
		8			1469	50	28			1469	54	33			1469	63	37
		10			1836	78	34			1836	85	39			1836	99	43
	350	4	0.093	0.060	857	13	11	0.105	0.060	857	14	15	0.123	0.060	857	16	20
		6			1285	28	21			1285	30	26			1285	36	30
		8			1714	50	29			1714	54	33			1714	63	38
		10			2142	78	34			2142	85	39			2142	99	44
	400	4	0.106	0.068	979	13	11	0.120	0.068	979	14	16	0.140	0.068	979	16	20
		6			1469	28	22			1469	30	26			1469	36	31
		8			1958	50	29			1958	54	34			1958	63	38
		10			2448	78	35			2448	84	40			2448	99	44
	450	4	0.120	0.077	1102	13	12	0.135	0.077	1102	14	16	0.158	0.077	1102	16	21
		6			1652	28	22			1652	30	27			1652	36	31
		8			2203	50	30			2203	54	34			2203	63	39
		10			2754	78	36			2754	84	40			2754	99	45
	500	4	0.133	0.085	1224	13	12	0.150	0.085	1224	14	17	0.175	0.085	1224	16	21
		6			1836	28	23			1836	30	27			1836	36	32
		8			2448	50	30			2448	54	35			2448	63	39
		10			3060	78	36			3060	85	41			3060	99	45
	550	4	0.146	0.094	1346	2	12	0.165	0.094	1346	14	17	0.193	0.094	1346	16	22
		6			2020	4	23			2020	30	28			2020	36	32
		8			2693	6	31			2693	54	35			2693	63	40
		10			3366	10	36			3366	84	41			3366	99	46
	600	4	0.160	0.102	1469	13	13	0.180	0.102	1469	14	18	0.210	0.102	1469	16	22
		6			2203	28	23			2203	30	28			2203	36	33
		8			2938	50	31			2938	54	36			2938	63	40
		10			3672	78	37			3672	85	42			3672	99	46
	650	4	0.173	0.111	1591	13	13	0.195	0.111	1591	14	18	0.228	0.111	1591	16	22
		6			2387	28	24			2387	30	29			2387	36	33
		8			3182	50	31			3182	54	36			3182	63	41
		10			3978	78	37			3978	85	42			3978	99	46
	700	4	0.186	0.119	1714	13	14	0.210	0.119	1714	14	18	0.245	0.119	1714	16	23
		6			2570	28	24			2570	30	29			2570	36	33
		8			3427	50	32			3427	54	36			3427	63	41
		10			4284	78	37			4284	85	42			4284	99	47
	750	4	0.200	0.128	1836	13	14	0.225	0.128	1836	14	19	0.263	0.128	1836	16	23
		6			2754	28	24			2754	30	29			2754	36	34
		8			3672	50	32			3672	54	37			3672	63	41
		10			4590	78	38			4590	85	43			4590	99	47
	800	4	0.213	0.136	1958	13	14	0.240	0.136	1958	14	19	0.280	0.136	1958	16	23
		6			2938	28	25			2938	30	29			2938	36	34
		8			3917	50	32			3917	54	37			3917	63	41
		10			4896	78	38			4896	84	43			4896	99	47
	850	4	0.226	0.145	2081	13	14	0.255	0.145	2081	14	19	0.298	0.145	2081	16	24
		6			3121	28	25			3121	30	30			3121	36	34
		8			4162	50	32			4162	54	37			4162	63	42
		10			5202	78	38			5202	84	43			5202	99	48
	900	4	0.239	0.153	2203	13	15	0.270	0.153	2203	14	19	0.315	0.153	2203	16	24
		6			3305	28	25			3305	30	30			3305	36	34
		8			4406	50	33			4406	54	37			4406	63	42
		10			5508	78	39			5508	84	43			5508	99	48

The mcr WIP PRO fire damper selection program is available at **www.mercor.com.pl**, in the Architect and Designer Zone.

10.6. technical parameters of mcr WIP PRO/V, mcr WIP PRO/V-M rectangular dampers

B – nominal width [mm]
H – nominal height [mm]

v – velocity [m/s]
Sk – duct cross-section [m^2]
Se – damper active cross-section [m^2]

Q – flow [m^3/h]
dp – pressure drop [Pa]
L_{WA} – damper noise level [dB]

		height H [mm]															
		400					450					500					
		v [m/s]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]
width B [mm]	110	4	0.044	0.028	401	13	8	0.050	0.028	401	14	12	0.056	0.037	532	11	15
		6			601	29	18			601	31	23			798	26	26
		8			802	52	26			802	55	30			1064	45	34
		10			1002	81	32			1002	86	36			1331	71	39
	150	4	0.060	0.038	546	13	9	0.068	0.038	546	14	14	0.077	0.050	726	11	17
		6			820	29	20			820	31	24			1089	26	27
		8			1093	52	27			1093	55	32			1452	45	35
		10			1366	81	33			1366	86	38			1814	71	41
	200	4	0.080	0.051	729	13	10	0.090	0.051	729	14	15	0.102	0.067	968	11	18
		6			1093	29	21			1093	31	25			1452	26	29
		8			1457	52	28			1457	55	33			1935	45	36
		10			1822	81	34			1822	86	39			2419	71	42
	250	4	0.100	0.063	911	13	11	0.113	0.063	911	14	16	0.128	0.084	1210	11	19
		6			1366	29	22			1366	31	26			1814	26	30
		8			1822	52	29			1822	55	34			2419	45	37
		10			2277	81	35			2277	86	40			3024	71	43
	300	4	0.120	0.076	1093	13	12	0.135	0.076	1093	14	17	0.154	0.101	1452	11	20
		6			1639	29	23			1639	31	27			2177	26	30
		8			2186	52	30			2186	55	35			2903	45	38
		10			2732	81	36			2732	86	41			3629	71	44
	350	4	0.140	0.089	1275	13	13	0.158	0.089	1275	14	17	0.179	0.118	1693	11	20
		6			1913	29	23			1913	31	28			2540	26	31
		8			2550	52	31			2550	55	35			3387	45	39
		10			3188	81	37			3188	86	41			4234	71	44
	400	4	0.160	0.101	1457	13	13	0.180	0.101	1457	14	18	0.205	0.134	1935	11	21
		6			2186	29	24			2186	31	28			2903	26	32
		8			2915	52	31			2915	55	36			3871	45	39
		10			3643	81	37			3643	86	42			4838	71	45
	450	4	0.180	0.114	1639	13	14	0.203	0.114	1639	14	18	0.230	0.151	2177	11	22
		6			2459	29	24			2459	31	29			3266	26	32
		8			3279	52	32			3279	55	36			4355	45	40
		10			4099	81	38			4099	86	42			5443	71	45
	500	4	0.200	0.127	1822	13	14	0.225	0.127	1822	14	19	0.256	0.168	2419	11	22
		6			2732	29	25			2732	31	29			3629	26	33
		8			3643	52	32			3643	55	37			4838	45	40
		10			4554	81	38			4554	86	43			6048	71	46
	550	4	0.220	0.139	2004	13	15	0.248	0.139	2004	14	19	0.282	0.185	2661	11	22
		6			3006	29	25			3006	31	30			3992	26	33
		8			4008	52	33			4008	55	37			5322	45	40
		10			5009	81	39			5009	86	43			6653	71	46
	600	4	0.240	0.152	2186	13	15	0.270	0.152	2186	14	20	0.307	0.202	2903	11	23
		6			3279	29	26			3279	31	30			4355	26	33
		8			4372	52	33			4372	55	38			5806	45	41
		10			5465	81	39			5465	86	44			7258	71	47
	650	4	0.260	0.164	2368	13	15	0.293	0.164	2368	14	20	0.333	0.218	3145	11	23
		6			3552	29	26			3552	31	31			4717	26	34
		8			4736	52	34			4736	55	38			6290	45	41
		10			5920	81	39			5920	86	44			7862	71	47
	700	4	0.280	0.177	2550	13	16	0.315	0.177	2550	14	20	0.358	0.235	3387	11	23
		6			3825	29	26			3825	31	31			5080	26	34
		8			5100	52	34			5100	55	38			6774	45	42
		10			6376	81	40			6376	86	44			8467	71	47
	750	4	0.300	0.190	2732	13	16	0.338	0.190	2732	14	21	0.384	0.252	3629	11	24
		6			4099	29	27			4099	31	31			5443	26	34
		8			5465	52	34			5465	55	39			7258	45	42
		10			6831	81	40			6831	86	45			9072	71	48
	800	4	0.320	0.202	2915	13	16	0.360	0.202	2915	14	20	0.410	0.269	3871	11	24
		6			4372	29	27			4372	31	31			5806	26	34
		8			5829	52	34			5829	55	38			7741	45	42
		10			7286	81	40			7286	86	44			9677	71	48
	850	4	0.340	0.215	3097	13	17	0.383	0.215	3097	14	20	0.435	0.286	4113	11	24
		6			4645	29	27			4645	31	31			6169	26	34
		8			6193	52	35			6193	55	38			8225	45	42
		10			7742	81	40			7742	86	44			10282	71	48
	900	4	0.360	0.228	3279	13	17	0.405	0.228	3279	14	20	0.461	0.302	4355	11	24
		6			4918	29	27			4918	31	31			6532	26	34
		8			6558	52	35			6558	55	38			8709	45	42
		10			8197	81	41			8197	86	44			10886	71	48

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10.6. technical parameters of mcr WIP PRO/V, mcr WIP PRO/V-M rectangular dampers

B – nominal width [mm]
H – nominal height [mm]

v – velocity [m/s]
Sk – duct cross-section [m^2]
Se – damper active cross-section [m^2]

Q – flow [m^3/h]
dp – pressure drop [Pa]
L_{WA} – damper noise level [dB]

		height H [mm]															
		550						630						650			
width B [mm]		v [m/s]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]
	110	4	0.061	0.037	532	13	10	0.070	0.046	664	11	14	0.072	0.046	664	12	9
		6			798	29	21			996	25	24			996	27	20
		8			1064	51	29			1327	44	32			1327	48	27
		10			1331	79	34			1659	69	38			1659	76	33
	150	4	0.083	0.050	726	13	12	0.095	0.063	905	11	15	0.098	0.063	905	12	10
		6			1089	29	22			1358	25	26			1358	27	21
		8			1452	51	30			1810	44	33			1810	48	28
		10			1814	79	36			2263	69	39			2263	76	34
	200	4	0.110	0.067	968	13	13	0.127	0.084	1207	11	16	0.130	0.084	1207	12	12
		6			1452	29	24			1810	25	27			1810	27	22
		8			1935	51	31			2413	44	34			2413	48	30
		10			2419	79	37			3017	69	40			3017	76	36
	250	4	0.138	0.084	1210	13	14	0.159	0.105	1508	11	17	0.163	0.105	1508	12	13
		6			1814	29	25			2263	25	28			2263	27	23
		8			2419	51	32			3017	44	35			3017	48	31
		10			3024	79	38			3771	69	41			3771	76	36
	300	4	0.165	0.101	1452	13	15	0.191	0.126	1810	11	18	0.195	0.126	1810	12	13
		6			2177	29	25			2715	25	29			2715	27	24
		8			2903	51	33			3620	44	36			3620	48	31
		10			3629	79	39			4525	69	42			4525	76	37
	350	4	0.193	0.118	1693	13	15	0.222	0.147	2112	11	19	0.228	0.147	2112	12	14
		6			2540	29	26			3168	25	29			3168	27	25
		8			3387	51	34			4224	44	37			4224	48	32
		10			4234	79	39			5279	69	43			5279	76	38
	400	4	0.220	0.134	1935	13	16	0.254	0.168	2413	11	19	0.260	0.168	2413	12	15
		6			2903	29	27			3620	25	30			3620	27	25
		8			3871	51	34			4827	44	37			4827	48	33
		10			4838	79	40			6034	69	43			6034	76	39
	450	4	0.248	0.151	2177	13	17	0.286	0.189	2715	11	20	0.293	0.189	2715	12	15
		6			3266	29	27			4073	25	30			4073	27	26
		8			4355	51	35			5430	44	38			5430	48	33
		10			5443	79	40			6788	69	44			6788	76	39
	500	4	0.275	0.168	2419	13	17	0.318	0.210	3017	11	20	0.325	0.210	3017	12	16
		6			3629	29	28			4525	25	31			4525	27	26
		8			4838	51	35			6034	44	38			6034	48	34
		10			6048	79	41			7542	69	44			7542	76	40
	550	4	0.303	0.185	2661	13	17	0.349	0.230	3318	11	21	0.358	0.230	3318	12	16
		6			3992	29	28			4978	25	31			4978	27	27
		8			5322	51	36			6637	44	39			6637	48	34
		10			6653	79	41			8296	69	45			8296	76	40
	600	4	0.330	0.202	2903	13	18	0.381	0.251	3620	11	21	0.390	0.251	3620	12	16
		6			4355	29	28			5430	25	32			5430	27	27
		8			5806	51	36			7240	44	39			7240	48	34
		10			7258	79	42			9050	69	45			9050	76	40
	650	4	0.358	0.218	3145	13	18	0.413	0.272	3922	11	21	0.423	0.272	3922	12	17
		6			4717	29	29			5883	25	32			5883	27	27
		8			6290	51	36			7844	44	39			7844	48	35
		10			7862	79	42			9805	69	45			9805	76	41
	700	4	0.385	0.235	3387	13	18	0.445	0.293	4224	11	22	0.455	0.293	4224	12	17
		6			5080	29	29			6335	25	32			6335	27	28
		8			6774	51	37			8447	44	40			8447	48	35
		10			8467	79	42			10559	69	46			10559	76	41
	750	4	0.413	0.252	3629	13	19	0.476	0.314	4525	11	22	0.488	0.314	4525	12	17
		6			5443	29	29			6788	25	33			6788	27	28
		8			7258	51	37			9050	44	40			9050	48	35
		10			9072	79	43			11313	69	46			11313	76	41
	800	4	0.440	0.269	3871	13	19	0.508	0.335	4827	11	22	0.520	0.335	4827	12	17
		6			5806	29	30			7240	25	33			7240	27	28
		8			7741	51	37			9654	44	40			9654	48	35
		10			9677	79	43			12067	69	46			12067	76	41
	850	4	0.468	0.286	4113	13	19	0.540	0.356	5129	11	23	0.553	0.356	5129	12	17
		6			6169	29	30			7693	25	33			7693	27	28
		8			8225	51	37			10257	44	41			10257	48	35
		10			10282	79	43			12821	69	46			12821	76	41
	900	4	0.495	0.302	4355	13	20	0.572	0.377	5430	11	23	0.585	0.377	5430	12	17
		6			6532	29	30			8145	25	32			8145	27	28
		8			8709	51	38			10860	44	39			10860	48	35
		10			10886	79	43			13576	69	44			13576	76	41

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10.6. technical parameters of mcr WIP PRO/V, mcr WIP PRO/V-M rectangular dampers

B – nominal width [mm]
H – nominal height [mm]

v – velocity [m/s]
Sk – duct cross-section [m^2]
Se – damper active cross-section [m^2]

Q – flow [m^3/h]
dp – pressure drop [Pa]
L_{WA} – damper noise level [dB]

			height H [mm]															
			700					750					800					
		v [m/s]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]
width B [mm]	110	4	0.077	0.046	664	14	12	0.083	0.060	859	9	15	0.088	0.055	795	10	11
		6			996	30	23			1288	20	25			1193	22	22
		8			1327	54	30			1717	35	33			1590	40	29
		10			1659	85	36			2146	55	39			1988	62	35
	150	4	0.105	0.063	905	14	14	0.114	0.081	1171	9	16	0.120	0.075	1084	10	12
		6			1358	30	24			1756	20	27			1626	22	23
		8			1810	54	32			2341	35	34			2169	40	30
		10			2263	85	37			2927	55	40			2711	62	36
	200	4	0.140	0.084	1207	14	15	0.152	0.108	1561	9	17	0.160	0.100	1446	10	14
		6			1810	30	25			2341	20	28			2169	22	24
		8			2413	54	33			3122	35	35			2892	40	32
		10			3017	85	39			3902	55	41			3614	62	38
	250	4	0.175	0.105	1508	14	16	0.190	0.136	1951	9	18	0.200	0.126	1807	10	15
		6			2263	30	26			2927	20	29			2711	22	25
		8			3017	54	34			3902	35	36			3614	40	33
		10			3771	85	40			4878	55	42			4518	62	39
	300	4	0.210	0.126	1810	14	17	0.227	0.163	2341	9	19	0.240	0.151	2169	10	15
		6			2715	30	27			3512	20	30			3253	22	26
		8			3620	54	35			4683	35	37			4337	40	33
		10			4525	85	40			5854	55	43			5422	62	39
	350	4	0.245	0.147	2112	14	17	0.265	0.190	2732	9	20	0.280	0.176	2530	10	16
		6			3168	30	28			4098	20	30			3795	22	27
		8			4224	54	35			5463	35	38			5060	40	34
		10			5279	85	41			6829	55	44			6325	62	40
	400	4	0.280	0.168	2413	14	18	0.303	0.217	3122	9	20	0.320	0.201	2892	10	17
		6			3620	30	28			4683	20	31			4337	22	27
		8			4827	54	36			6244	35	38			5783	40	35
		10			6034	85	42			7805	55	44			7229	62	41
	450	4	0.315	0.189	2715	14	18	0.341	0.244	3512	9	21	0.360	0.226	3253	10	17
		6			4073	30	29			5268	20	31			4879	22	28
		8			5430	54	36			7024	35	39			6506	40	35
		10			6788	85	42			8780	55	45			8132	62	41
	500	4	0.350	0.210	3017	14	19	0.379	0.271	3902	9	21	0.400	0.251	3614	10	18
		6			4525	30	29			5854	20	32			5422	22	28
		8			6034	54	37			7805	35	39			7229	40	36
		10			7542	85	43			9756	55	45			9036	62	42
	550	4	0.385	0.230	3318	14	19	0.417	0.298	4293	9	22	0.440	0.276	3976	10	18
		6			4978	30	30			6439	20	32			5964	22	29
		8			6637	54	37			8585	35	40			7952	40	36
		10			8296	85	43			10732	55	46			9940	62	42
	600	4	0.420	0.251	3620	14	20	0.455	0.325	4683	9	22	0.480	0.301	4337	10	18
		6			5430	30	30			7024	20	33			6506	22	29
		8			7240	54	38			9366	35	40			8675	40	36
		10			9050	85	43			11707	55	46			10843	62	42
	650	4	0.455	0.272	3922	14	20	0.493	0.352	5073	9	22	0.520	0.326	4699	10	19
		6			5883	30	31			7610	20	33			7048	22	29
		8			7844	54	38			10146	35	40			9397	40	37
		10			9805	85	44			12683	55	46			11747	62	43
	700	4	0.490	0.293	4224	14	20	0.531	0.379	5463	9	23	0.560	0.351	5060	10	19
		6			6335	30	31			8195	20	33			7590	22	30
		8			8447	54	38			10927	35	41			10120	40	37
		10			10559	85	44			13658	55	47			12650	62	43
	750	4	0.525	0.314	4525	14	21	0.569	0.407	5854	9	23	0.600	0.377	5422	10	19
		6			6788	30	31			8780	20	34			8132	22	30
		8			9050	54	39			11707	35	41			10843	40	37
		10			11313	85	44			14634	55	47			13554	62	43
	800	4	0.560	0.335	4827	14	19	0.606	0.434	6244	9	23	0.640	0.402	5783	10	20
		6			7240	30	29			9366	20	34			8675	22	30
		8			9654	54	37			12488	35	41			11566	40	38
		10			12067	85	42			15610	55	47			14458	62	44
	850	4	0.595	0.356	5129	14	21	0.644	0.461	6634	9	24	0.680	0.427	6144	10	20
		6			7693	30	32			9951	20	34			9217	22	31
		8			10257	54	39			13268	35	42			12289	40	38
		10			12821	85	45			16585	55	47			15361	62	44
	900	4	0.630	0.377	5430	14	21	0.682	0.488	7024	9	24	0.720	0.452	6506	10	20
		6			8145	30	32			10536	20	34			9759	22	31
		8			10860	54	39			14049	35	42			13012	40	38
		10			13576	85	45			17561	55	48			16265	62	44

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10.6. technical parameters of mcr WIP PRO/V, mcr WIP PRO/V-M rectangular dampers

B – nominal width [mm]
H – nominal height [mm]

v – velocity [m/s]
Sk – duct cross-section [m^2]
Se – damper active cross-section [m^2]

Q – flow [m^3/h]
dp – pressure drop [Pa]
L_{WA} – damper noise level [dB]

width B [mm]	height H [mm]	850						900						950					
		v [m/s]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]		
	110	4	0.097	0.064	927	12	14	0.099	0.064	927	13	10	0.105	0.064	927	14	13		
		6			1390	27	24			1390	30	21			1390	32	23		
		8			1853	49	32			1853	53	28			1853	57	31		
		10			2317	76	37			2317	83	34			2317	89	36		
	150	4	0.132	0.088	1264	12	15	0.135	0.088	1264	13	11	0.143	0.088	1264	14	14		
		6			1895	27	25			1895	30	22			1895	32	24		
		8			2527	49	33			2527	53	30			2527	57	32		
		10			3159	76	39			3159	83	35			3159	89	38		
	200	4	0.176	0.117	1685	12	16	0.180	0.117	1685	13	13	0.190	0.117	1685	14	15		
		6			2527	27	27			2527	30	23			2527	32	26		
		8			3370	49	34			3370	53	31			3370	57	33		
		10			4212	76	40			4212	83	37			4212	89	39		
	250	4	0.220	0.146	2106	12	17	0.225	0.146	2106	13	14	0.238	0.146	2106	14	16		
		6			3159	27	28			3159	30	24			3159	32	27		
		8			4212	49	35			4212	53	32			4212	57	34		
		10			5265	76	41			5265	83	38			5265	89	40		
	300	4	0.264	0.176	2527	12	18	0.270	0.176	2527	13	14	0.285	0.176	2527	14	17		
		6			3791	27	28			3791	30	25			3791	32	27		
		8			5054	49	36			5054	53	33			5054	57	35		
		10			6318	76	42			6318	83	38			6318	89	41		
	350	4	0.308	0.205	2948	12	19	0.315	0.205	2948	13	15	0.333	0.205	2948	14	18		
		6			4423	27	29			4423	30	26			4423	32	28		
		8			5897	49	37			5897	53	33			5897	57	36		
		10			7371	76	42			7371	83	39			7371	89	41		
	400	4	0.352	0.234	3370	12	19	0.360	0.234	3370	13	16	0.380	0.234	3370	14	18		
		6			5054	27	30			5054	30	26			5054	32	29		
		8			6739	49	37			6739	53	34			6739	57	36		
		10			8424	76	43			8424	83	40			8424	89	42		
	450	4	0.396	0.263	3791	12	20	0.405	0.263	3791	13	16	0.428	0.263	3791	14	19		
		6			5686	27	30			5686	30	27			5686	32	29		
		8			7582	49	38			7582	53	34			7582	57	37		
		10			9477	76	44			9477	83	40			9477	89	43		
	500	4	0.441	0.293	4212	12	20	0.450	0.293	4212	13	17	0.475	0.293	4212	14	19		
		6			6318	27	31			6318	30	27			6318	32	30		
		8			8424	49	38			8424	53	35			8424	57	37		
		10			10530	76	44			10530	83	41			10530	89	43		
	550	4	0.485	0.322	4633	12	21	0.495	0.322	4633	13	17	0.523	0.322	4633	14	20		
		6			6950	27	31			6950	30	28			6950	32	30		
		8			9266	49	39			9266	53	35			9266	57	38		
		10			11583	76	44			11583	83	41			11583	89	43		
	600	4	0.529	0.351	5054	12	21	0.540	0.351	5054	13	17	0.570	0.351	5054	14	20		
		6			7582	27	31			7582	30	28			7582	32	30		
		8			10109	49	39			10109	53	36			10109	57	38		
		10			12636	76	45			12636	83	41			12636	89	44		
	650	4	0.573	0.380	5476	12	21	0.585	0.380	5476	13	18	0.618	0.380	5476	14	20		
		6			8213	27	32			8213	30	28			8213	32	31		
		8			10951	49	39			10951	53	36			10951	57	38		
		10			13689	76	45			13689	83	42			13689	89	44		
	700	4	0.617	0.410	5897	12	22	0.630	0.410	5897	13	18	0.665	0.410	5897	14	21		
		6			8845	27	32			8845	30	29			8845	32	31		
		8			11794	49	40			11794	53	36			11794	57	39		
		10			14742	76	45			14742	83	42			14742	89	44		
	750	4	0.661	0.439	6318	12	22	0.675	0.439	6318	13	18	0.713	0.439	6318	14	21		
		6			9477	27	32			9477	30	29			9477	32	31		
		8			12636	49	40			12636	53	37			12636	57	39		
		10			15795	76	46			15795	83	42			15795	89	45		
	800	4	0.705	0.468	6739	12	22	0.720	0.468	6739	13	19	0.760	0.468	6739	14	21		
		6			10109	27	33			10109	30	29			10109	32	32		
		8			13478	49	40			13478	53	37			13478	57	39		
		10			16848	76	46			16848	83	43			16848	89	45		
	850	4	0.749	0.497	7160	12	22	0.765	0.497	7160	13	19	0.808	0.497	7160	14	21		
		6			10741	27	33			10741	30	30			10741	32	32		
		8			14321	49	40			14321	53	37			14321	57	39		
		10			17901	76	46			17901	83	43			17901	89	45		
	900	4	0.793	0.527	7582	12	23	0.810	0.527	7582	13	19	0.855	0.527	7582	14	22		
		6			11372	27	33			11372	30	30			11372	32	32		
		8			15163	49	41			15163	53	37			15163	57	40		
		10			18954	76	47			18954	83	43			18954	89	46		

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v – velocity [m/s]
Sk – duct cross-section [m^2]
Se – damper active cross-section [m^2]

Q – flow [m^3/h]
dp – pressure drop [Pa]
L_{WA} – damper noise level [dB]

width B [mm]		height H [mm]															
		1000					1050					1100					
		v [m/s]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]
110		4	0.110	0.073	1058	12	15	0.116	0.073	1058	13	12	0.124	0.083	1190	11	14
		6			1587	27	25			1587	29	22			1784	24	24
		8			2116	48	33			2116	51	30			2379	43	32
		10			2645	76	38			2645	79	36			2974	67	38
150		4	0.151	0.100	1443	12	16	0.158	0.100	1443	13	13	0.169	0.113	1622	11	15
		6			2164	27	26			2164	29	24			2433	24	26
		8			2886	48	34			2886	51	31			3244	43	33
		10			3607	76	40			3607	79	37			4055	67	39
200		4	0.201	0.134	1924	12	17	0.210	0.134	1924	13	14	0.225	0.150	2163	11	16
		6			2886	27	28			2886	29	24			3244	24	26
		8			3848	48	35			3848	51	32			4326	43	34
		10			4810	76	41			4810	79	38			5407	67	40
250		4	0.251	0.167	2405	12	18	0.263	0.167	2405	13	15	0.282	0.188	2704	11	17
		6			3607	27	29			3607	29	25			4055	24	27
		8			4810	48	36			4810	51	33			5407	43	35
		10			6012	76	42			6012	79	39			6759	67	41
300		4	0.301	0.200	2886	12	19	0.315	0.200	2886	13	15	0.338	0.225	3244	11	17
		6			4329	27	29			4329	29	26			4866	24	28
		8			5772	48	37			5772	51	34			6489	43	36
		10			7214	76	43			7214	79	39			8111	67	41
350		4	0.351	0.234	3367	12	20	0.368	0.234	3367	13	16	0.394	0.263	3785	11	18
		6			5050	27	30			5050	29	27			5678	24	29
		8			6733	48	38			6733	51	34			7570	43	36
		10			8417	76	43			8417	79	40			9463	67	42
400		4	0.402	0.267	3848	12	20	0.420	0.267	3848	13	17	0.451	0.300	4326	11	19
		6			5772	27	31			5772	29	27			6489	24	29
		8			7695	48	38			7695	51	35			8652	43	37
		10			9619	76	44			9619	79	41			10814	67	43
450		4	0.452	0.301	4329	12	21	0.473	0.301	4329	13	17	0.507	0.338	4866	11	19
		6			6493	27	31			6493	29	28			7300	24	30
		8			8657	48	39			8657	51	35			9733	43	37
		10			10822	76	45			10822	79	41			12166	67	43
500		4	0.502	0.334	4810	12	21	0.525	0.334	4810	13	18	0.564	0.376	5407	11	20
		6			7214	27	32			7214	29	28			8111	24	30
		8			9619	48	39			9619	51	36			10814	43	38
		10			12024	76	45			12024	79	42			13518	67	44
550		4	0.552	0.367	5291	12	22	0.578	0.367	5291	13	18	0.620	0.413	5948	11	20
		6			7936	27	32			7936	29	29			8922	24	31
		8			10581	48	40			10581	51	36			11896	43	38
		10			13226	76	45			13226	79	42			14870	67	44
600		4	0.602	0.401	5772	12	22	0.630	0.401	5772	13	18	0.676	0.451	6489	11	20
		6			8657	27	32			8657	29	29			9733	24	31
		8			11543	48	40			11543	51	37			12977	43	39
		10			14429	76	46			14429	79	42			16222	67	44
650		4	0.653	0.434	6252	12	22	0.683	0.434	6252	13	19	0.733	0.488	7029	11	21
		6			9379	27	33			9379	29	29			10544	24	31
		8			12505	48	40			12505	51	37			14059	43	39
		10			15631	76	46			15631	79	43			17573	67	45
700		4	0.703	0.468	6733	12	23	0.735	0.468	6733	13	19	0.789	0.526	7570	11	21
		6			10100	27	33			10100	29	30			11355	24	32
		8			13467	48	41			13467	51	37			15140	43	39
		10			16834	76	46			16834	79	43			18925	67	45
750		4	0.753	0.501	7214	12	23	0.788	0.501	7214	13	19	0.845	0.563	8111	11	21
		6			10822	27	33			10822	29	30			12166	24	32
		8			14429	48	41			14429	51	38			16222	43	40
		10			18036	76	47			18036	79	43			20277	67	45
800		4	0.803	0.534	7695	12	23	0.840	0.534	7695	13	20	0.902	0.601	8652	11	22
		6			11543	27	34			11543	29	30			12977	24	32
		8			15391	48	41			15391	51	38			17303	43	40
		10			19238	76	47			19238	79	44			21629	67	46
850		4	0.853	0.568	8176	12	23	0.893	0.568	8176	13	20	0.958	0.638	9192	11	22
		6			12264	27	34			12264	29	31			13788	24	33
		8			16353	48	41			16353	51	38			18384	43	40
		10			20441	76	47			20441	79	44			22981	67	46
900		4	0.904	0.601	8657	12	24	0.945	0.601	8657	13	20	1.014	0.676	9733	11	22
		6			12986	27	34			12986	29	31			14599	24	33
		8			17315	48	42			17315	51	38			19466	43	40
		10			21643	76	48			21643	79	44			24332	67	46

The mcr WIP PRO fire damper selection program is available at **www.mercor.com.pl**, in the Architect and Designer Zone.

10.6. technical parameters of mcr WIP PRO/V, mcr WIP PRO/V-M rectangular dampers

B – nominal width [mm]
H – nominal height [mm]

v – velocity [m/s]
Sk – duct cross-section [m^2]
Se – damper active cross-section [m^2]

Q – flow [m^3/h]
dp – pressure drop [Pa]
L_{WA} – damper noise level [dB]

		height H [mm]															
		1150						1200						1250			
		v [m/s]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]	Sk [m^2]	Se [m^2]	Q [m^3/h]	dp [Pa]	L_{WA} [dB]
width B [mm]	110	4	0.127	0.083	1190	13	11	0.132	0.083	1190	2	13	0.138	0.092	1321	11	10
		6			1784	29	22			1784	4	23			1982	24	21
		8			2379	52	29			2379	7	31			2642	43	28
		10			2974	81	35			2974	11	37			3303	66	34
	150	4	0.173	0.113	1622	13	12	0.180	0.113	1622	2	14	0.188	0.125	1801	11	12
		6			2433	29	23			2433	4	25			2702	24	22
		8			3244	52	30			3244	7	32			3603	43	30
		10			4055	81	36			4055	11	38			4504	66	36
	200	4	0.230	0.150	2163	13	12	0.240	0.150	2163	2	14	0.250	0.167	2402	11	11
		6			3244	29	23			3244	4	25			3603	24	22
		8			4326	52	31			4326	7	33			4804	43	29
		10			5407	81	36			5407	11	38			6005	66	35
	250	4	0.288	0.188	2704	13	13	0.300	0.188	2704	2	15	0.313	0.209	3002	11	12
		6			4055	29	24			4055	4	26			4504	24	23
		8			5407	52	32			5407	7	33			6005	43	30
		10			6759	81	37			6759	11	39			7506	66	36
	300	4	0.345	0.225	3244	13	14	0.360	0.225	3244	2	16	0.375	0.250	3603	11	13
		6			4866	29	25			4866	4	27			5404	24	24
		8			6489	52	32			6489	7	34			7206	43	31
		10			8111	81	38			8111	11	40			9007	66	37
	350	4	0.403	0.263	3785	13	15	0.420	0.263	3785	2	17	0.438	0.292	4203	11	14
		6			5678	29	25			5678	4	27			6305	24	24
		8			7570	52	33			7570	7	35			8407	43	32
		10			9463	81	39			9463	11	41			10508	66	38
	400	4	0.460	0.300	4326	13	15	0.480	0.300	4326	2	17	0.500	0.334	4804	11	14
		6			6489	29	26			6489	4	28			7206	24	25
		8			8652	52	34			8652	7	36			9608	43	32
		10			10814	81	39			10814	11	41			12010	66	38
	450	4	0.518	0.338	4866	13	16	0.540	0.338	4866	2	18	0.563	0.375	5404	11	15
		6			7300	29	27			7300	4	29			8106	24	25
		8			9733	52	34			9733	7	36			10809	43	33
		10			12166	81	40			12166	11	42			13511	66	39
	500	4	0.575	0.376	5407	13	16	0.600	0.376	5407	2	18	0.625	0.417	6005	11	15
		6			8111	29	27			8111	4	29			9007	24	26
		8			10814	52	35			10814	7	36			12010	43	33
		10			13518	81	40			13518	11	42			15012	66	39
	550	4	0.633	0.413	5948	13	17	0.660	0.413	5948	2	19	0.688	0.459	6605	11	16
		6			8922	29	27			8922	4	29			9908	24	26
		8			11896	52	35			11896	7	37			13211	43	34
		10			14870	81	41			14870	11	43			16513	66	40
	600	4	0.690	0.451	6489	13	17	0.720	0.451	6489	2	19	0.750	0.500	7206	11	16
		6			9733	29	28			9733	4	30			10809	24	27
		8			12977	52	35			12977	7	37			14412	43	34
		10			16222	81	41			16222	11	43			18014	66	40
	650	4	0.748	0.488	7029	13	18	0.780	0.488	7029	2	20	0.813	0.542	7806	11	17
		6			10544	29	28			10544	4	30			11709	24	27
		8			14059	52	36			14059	7	38			15612	43	35
		10			17573	81	41			17573	11	43			19516	66	40
	700	4	0.805	0.526	7570	13	18	0.840	0.526	7570	2	20	0.875	0.584	8407	11	17
		6			11355	29	28			11355	4	30			12610	24	27
		8			15140	52	36			15140	7	38			16813	43	35
		10			18925	81	42			18925	11	44			21017	66	41
	750	4	0.863	0.563	8111	13	18	0.900	0.563	8111	2	20	0.938	0.626	9007	11	17
		6			12166	29	29			12166	4	31			13511	24	28
		8			16222	52	36			16222	7	38			18014	43	35
		10			20277	81	42			20277	11	44			22518	66	41
	800	4	0.920	0.601	8652	13	18	0.960	0.601	8652	2	20	1.000	0.667	9608	11	17
		6			12977	29	29			12977	4	31			14412	24	28
		8			17303	52	37			17303	7	39			19215	43	35
		10			21629	81	42			21629	11	44			24019	66	41
	850	4	0.978	0.638	9192	13	19	1.020	0.638	9192	2	21	1.063	0.709	10208	11	18
		6			13788	29	29			13788	4	31			15312	24	28
		8			18384	52	37			18384	7	39			20416	43	36
		10			22981	81	43			22981	11	45			25520	66	42
	900	4	1.035	0.676	9733	13	19	1.080	0.676	9733	2	21	1.125	0.751	10809	11	18
		6			14599	29	30			14599	4	32			16213	24	28
		8			19466	52	37			19466	7	39			21617	43	36
		10			24332	81	43			24332	11	45			27022	66	42

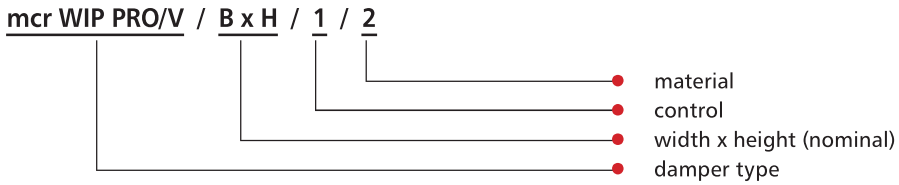
The mcr WIP PRO fire damper selection program is available at **www.mercor.com.pl**, in the Architect and Designer Zone.

10.7. estimated weights of mcr WIP PRO/V, mcr WIP PRO/V-M dampers [kg]

width B [mm]	height H [mm]										
	263	300	400	500	600	700	800	900	1000	1100	1250
110	3	3	4	5	7	8	9	10	11	13	14
150	4	4	6	8	9	11	12	14	16	17	20
200	5	6	8	10	12	15	17	19	21	23	27
250	7	8	12	13	16	18	21	24	27	29	33
300	8	9	12	16	19	22	25	29	32	35	40
350	9	11	15	18	22	26	30	34	37	41	47
400	11	12	17	21	25	30	34	38	43	47	54
500	14	16	21	27	32	37	43	48	54	59	67
600	16	19	25	32	38	45	51	58	64	71	81
700	19	22	30	37	45	52	60	68	75	83	94
800	22	25	34	43	51	60	69	77	86	95	108
900	25	29	38	48	58	68	77	87	97	106	128

The table shows the weights of dampers with RST-KW1 type trigger control mechanisms or actuators.

10.8. marking



1 – control:

– Belimo trigger control mechanism
BE24 – actuator with no return spring, U = 24 V AC/DC
BE24-ST (with the BKNE230-24 option) – actuator with no return spring, U = 24 V AC/DC, with a SBS Control system
BE230 – actuator with no return spring, U = 230 V AC/DC
BLE24 – actuator with no return spring, U = 24 V AC/DC
BLE24-ST (with the BKNE230-24 option) – actuator with no return spring, U = 24 V AC/DC, with a SBS Control system
BLE230 – actuator with no return spring, U = 230 V AC/DC

2 – material:

[no symbol] – galvanised steel, Zn 275 g/m^2 coating
KN – 1.4404 acid-proof stainless steel

example marking:

mcr WIP PRO/V 400 x 400 BLE24
Louvered fire damper EIS120 with a compact 24 V Belimo actuator with limit switches.

Chapter 12 - power supply and control (p. 141) contains:
- technical specifications and connection diagrams for the trigger control mechanisms supporting the damper,
- location of trigger control mechanisms in relation to the damper - manufacture standards.