

Multileaf dampers

Type JZ-HL



For low-leakage shut-off in air conditioning systems

Rectangular multileaf dampers for volume flow and pressure control as well as for low-leakage shut-off of ducts and openings in walls and ceiling slabs

- Maximum dimensions 2000 × 1995 mm
- Closed blade air leakage to EN 1751, classes 1 – 2, depending on size
- Casing air leakage to EN 1751, class C
- Aerofoil opposed action blades
- Blades interconnected by external linkage
- Available in standard sizes and many intermediate sizes

Optional equipment and accessories

- Actuators: Open/Close actuators, modulating actuators
- Explosion-proof construction with pneumatic actuator or spring return actuator
- Powder-coated construction



Opposed blades

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Application

Application

- Multileaf dampers of Type JZ-HL are used as an acting element in the volume flow and pressure control in air conditioning systems
- For low-leakage shut-off of ducts and openings in walls and ceiling slabs
- Powder-coated construction
- Steel and stainless steel variants with brass or stainless steel bearings are suitable for use in potentially explosive atmospheres (ATEX)

Special characteristics

- Aerofoil blades
- Low-maintenance, robust construction
- No parts with silicone
- Available in standard sizes and many intermediate sizes

Classification

Closed blade air leakage to EN 1751

Test pressure up to 2000 Pa

- Up to B = 599 mm, class 1
- From B = 600 mm, class 2

Nominal sizes

- B: 200 – 2000 mm, in increments of 1 mm
- Width subdivided (BM): 2001 – 4150 mm, in increments of 1 mm
- H: 180, 345, 510, 675, 840, 1005, 1170, 1335, 1500, 1665, 1830, 1995 mm (intermediate sizes 183 – 1993 in increments of 1 mm, except for standard size H – 1 mm, H + 1 mm, H + 2 mm)
- Height subdivided (HM): 1998 – 4066 mm, in increments of 1 mm
- Any combination of B × H

Description

Construction

Duct connection

- Corner holes on both sides
- G: Flange holes on both sides

Bearings

- Plastic bearings, operating temperature 0 – 100 °C
- M: Brass bearings, operating temperature 0 – 100 °C
- E: Stainless steel bearings, operating temperature 0 – 100 °C

Blades

Only for steel or stainless steel multileaf dampers with brass or stainless steel bearings (JZ-...-M, JZ-...-E)

- V: reinforced blades available from width 800 mm

Parts and characteristics

- Ready-to-install shut-off damper
- Blades with external linkage
- Drive arm

Attachments

- Quadrant stays and limit switches: Quadrant

stays to adjust the damper blades (stepless adjustment) and for capturing the end positions

- Open/Close actuators: Actuators for opening and closing multileaf dampers
- Modulating actuators: Actuators for stepless blade adjustment
- Pneumatic actuators: Pneumatic actuators for opening and closing multileaf dampers
- Explosion-proof actuators: Actuators for opening and closing multileaf dampers installed in potentially explosive atmospheres

Accessories

- Installation subframe: Installation subframe for the fast and simple installation of multileaf dampers

Construction features

- Rectangular casing, welded (P1: casing with screws), material thickness 1.25 mm
- Blades, material thickness 1 mm
- Flanges on both sides, suitable for duct connection, either flange holes or corner holes
- External linkage, robust and durable, consisting of the coupling rod and horizontal arms
- Blade shafts, Ø12 mm, with notch to indicate

- the blade position (not for attachment ZS99)
- With drive shaft as an attachment: For the position of the drive shaft see 'Dimensions and weight'
- With actuator as an attachment: The actuator is attached to the second blade from the top
- Travel stop (angle section) ensures tight closure of the top and bottom blades
- Blade tip seals
- Construction and materials comply with the EU directive and guidelines for use in potentially explosive atmospheres (ATEX) for variants with brass or stainless steel bearings (-M, -E)

Materials and surfaces

- Casing and blades made of galvanised sheet steel
- Blade shafts, drive arm and external linkage made of galvanised steel

- Blade tip seals made of PP/PTV plastic
- P1: Powder-coated, RAL CLASSIC colour
- PS: Powder-coated, DB colour

Standards and guidelines

- Casing air leakage to EN 1751, class C
- Meets the general requirements of DIN 1946, part 4, with regard to the acceptable closed blade air leakage (from B = 600 mm)

Maintenance

- Maintenance-free as construction and materials are not subject to wear
- Contamination should be removed as it may lead to corrosion and to increased closed blade air leakage

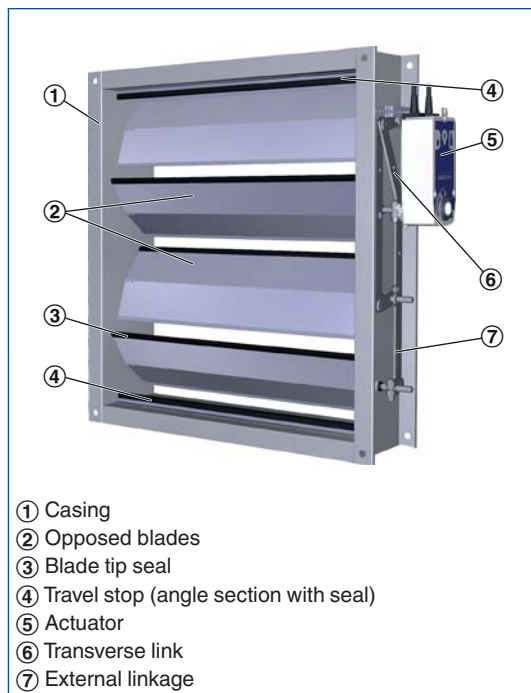
Functional description

Multileaf dampers with external linkage can have parallel action blades or opposed action blades. An external linkage transfers the synchronous rotational movement from the drive arm to the individual blades. Even very large multileaf

dampers can be safely opened and closed with this type of linkage.

Opposed action blades close at different speeds since the linkage includes a transverse link. This facilitates the closing process and reduces the closed blade air leakage.

Schematic illustration of JZ-HL



The torque for closing a multileaf damper must be such that the damper can be safely opened and closed.

For closure, the torque must suffice to ensure complete shut-off by the blades.

Opening is initiated without aerodynamic forces. When air flows through the damper, the

aerodynamic forces of the airflow create a closing force (torque) on the blades; this happens independent of the direction of the airflow. This closing force must be countered, or overcome. The blade position, or blade angle α , for which there is the largest torque depends, among other factors, on the fan characteristics.

Nominal sizes	200 × 180 mm – 2000 × 1995 mm
Operating temperature	0 – 100 °C

JZ-HL, minimum torque

H	B [mm]									
	200	400	600	800	1000	1200	1400	1600	1800	2000
mm	Nm									
180 – 1995	10	10	10	10	10	10	10	10	10	10

Steel and stainless steel multileaf dampers, free area

H	B [mm]									
	200	400	600	800	1000	1200	1400	1600	1800	2000
mm	m ²									
180 – 344	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.27	0.30
345 – 509	0.06	0.11	0.17	0.23	0.28	0.34	0.40	0.45	0.51	0.57
510 – 674	0.08	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.83
675 – 839	0.11	0.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99	1.10
840 – 1004	0.14	0.27	0.41	0.55	0.69	0.82	0.96	1.10	1.23	1.37
1005 – 1169	0.16	0.33	0.49	0.66	0.82	0.98	1.15	1.31	1.47	1.64
1170 – 1334	0.19	0.38	0.57	0.76	0.95	1.14	1.33	1.52	1.72	1.91
1335 – 1499	0.22	0.43	0.65	0.87	1.09	1.30	1.52	1.74	1.96	2.17
1500 – 1664	0.24	0.49	0.73	0.98	1.22	1.47	1.71	1.95	2.20	2.44
1665 – 1829	0.27	0.54	0.81	1.08	1.36	1.63	1.90	2.17	2.44	2.71
1830 – 1994	0.30	0.60	0.89	1.19	1.49	1.79	2.08	2.38	2.68	2.98
1995	0.32	0.65	0.97	1.30	1.62	1.95	2.27	2.60	2.92	3.25

Intermediate sizes: Intermediate widths can be interpolated

Maximum static differential pressure for a closed multileaf damper

Construction	B [mm]						
	800	1000	1200	1400	1600	1800	2000
	$\Delta p_{st \max}$ Pa						
Standard construction	2500	2000	1650	1400	1250	1100	1000
Brass bearings (-M)	3000	2500	2200	1950	1750	1600	1500
Stainless steel bearings (-E)	3000	2500	2200	1950	1750	1600	1500
Reinforced blades (-M-V, -E-V)	3500	3000	2700	2500	2300	2100	2000

JZ-HL, sound power level for a closed multileaf damper

Δp_{st}	Area [m ²]							
	0.14	0.2	0.4	0.6	0.8	1.2	2	4
Pa	L_{WA} dB(A)							
100	43	45	48	50	51	53	55	58
200	51	53	56	58	59	61	63	66
500	62	63	66	68	69	>70	>70	>70
1000	69	>70	>70	>70	>70	>70	>70	>70
1500	>70	>70	>70	>70	>70	>70	>70	>70
2000	>70	>70	>70	>70	>70	>70	>70	>70

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

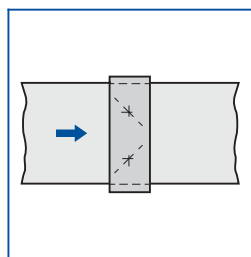
The sound power levels L_{WA} apply to multileaf dampers with a cross-sectional area ($B \times H$) of 1 m^2 .

The differential pressures apply to multileaf dampers installed in ducts (installation type A).

JZ-LL, JZ-LL-A2, JZ-HL, differential pressure and sound power level

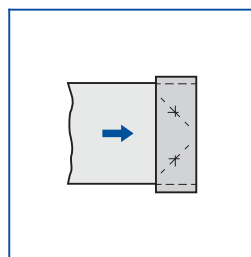
v	Damper blade position α									
	OPEN		20°		40°		60°		80°	
	Δp_{st} Pa	L_{WA} dB(A)	Δp_{st} Pa	L_{WA} dB(A)	Δp_{st} Pa	L_{WA} dB(A)	Δp_{st} Pa	L_{WA} dB(A)	Δp_{st} Pa	L_{WA} dB(A)
0.5	<5	<30	<5	<30	<5	7.5	22	34	250	63
1	<5	<30	<5	<30	8	26	85	53	1000	83
2	<5	<30	<5	<30	30	46	345	73	>2000	>90
4	<5	41	10	44	120	65	1385	>90	>2000	>90
6	<5	52	24	56	270	77	>2000	>90	>2000	>90
8	10	60	42	64	480	85	>2000	>90	>2000	>90

Installation type A



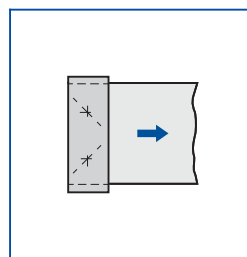
Ducts on both sides

Installation type B



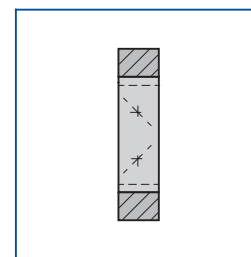
Air discharge

Installation type C



Air intake

Installation type D



Air transfer

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

Rectangular multileaf dampers for volume flow and pressure control as well as for low-leakage shut-off of ducts and openings in walls and ceiling slabs.

Ready-to-operate unit which consists of the casing, aerofoil blades and the blade mechanism. Flanges on both sides, suitable for duct connection.

The blade position is indicated externally by a notch in the blade shaft extension.

Closed blade air leakage to EN 1751, classes 1 – 2. Casing air leakage to EN 1751, class C.

Special characteristics

- Aerofoil blades
- Low-maintenance, robust construction
- No parts with silicone
- Available in standard sizes and many intermediate sizes

Materials and surfaces

- Casing and blades made of galvanised sheet steel
- Blade shafts, drive arm and external linkage made of galvanised steel
- Blade tip seals made of PP/PTV plastic
- P1: Powder-coated, RAL CLASSIC colour
- PS: Powder-coated, DB colour

Construction

Duct connection

- Corner holes on both sides
- G: Flange holes on both sides

Bearings

- Plastic bearings, operating temperature 0 – 100 °C
- M: Brass bearings, operating temperature 0 – 100 °C
- E: Stainless steel bearings, operating temperature 0 – 100 °C

Blades

Only for steel or stainless steel multileaf dampers with brass or stainless steel bearings (JZ-...-M, JZ-...-E)

- V: reinforced blades available from width 800 mm

Technical data

- Nominal sizes:
200 × 180 mm – 2000 × 1995 mm
- Operating temperature: 0 to 100 °C

Sizing data

- \dot{V} _____
[m³/h]
- Δp_{st} _____
[Pa]

Air-regenerated noise

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

JZ-HL

JZ - HL - G - E - V - L / 1000x1005 / ER / Z64 / NC / P1 - RAL ...									
1	2	3	4	5	6	7	8	9	10

1 Type

JZ-HL Low-leakage multileaf damper, closed blade air leakage to EN 1751, class 1 – 2

2 Duct connection

No entry: corner holes on both sides
G Flange holes on both sides (no corner holes)

3 Bearings

No entry: plastic bearings
M Brass bearings
E Stainless steel bearings

4 Construction of blades

Only for steel or stainless steel multileaf dampers with brass or stainless steel bearings
V reinforced blades available from width 800 mm

5 Operating side

No entry: on the right
L Left side

6 Nominal size [mm]

B × H

B > 2000 = width subdivided
H > 1998 = height subdivided

7 Installation subframe

No entry: none
ER With (only for construction G)

8 Attachments

No entry: none
Z04 – Z07 Quadrant stay
Z12 – Z51 Actuators
ZF01 – ZF15 Spring return actuators
Z60 – Z77 Pneumatic actuators

Explosion-proof actuators
Z1EX, Z3EX Electric
Z60EX – Z77EX Pneumatic

9 Damper blade safety function

Only for spring return actuators or pneumatic actuators
NO Pressure off/power off to OPEN
NC Pressure off/power off to CLOSE

10 Surface

No entry: standard construction
P1 Powder-coated, specify RAL CLASSIC colour
PS Powder-coated, specify DB colour

Gloss level
RAL 9010 50 %
RAL 9006 30 %
All other RAL colours 70 %

Order example: JZ-HL-G-M-V-L/1200x675/ER/ZF06/NC

Duct connection	Flange holes on both sides
Bearings	Brass bearings
Construction of blades	Reinforced blades
Operating side	Left side
Nominal size	1200 × 675 mm
Installation subframe	With
Attachments	Spring return actuator, 20 Nm, 24 V AC/DC
Damper blade position	Power off to CLOSE
Surface	Standard construction

Quadrant stays and limit switches

Order code detail	Meaning	Limit switch	Function
Z04	Quadrant stay	–	
Z05	Quadrant stay	1	Damper blade position CLOSED
Z06	Quadrant stay	1	Damper blade position OPEN
Z07	Quadrant stay	2	Damper blade positions CLOSED nad OPEN

Open/Close actuators

Order code detail	Meaning	Function	Supply voltage	Torque	Auxiliary switch
Z12	SM230A	–1-wire-control –2-wire-control (3-point)	100 – 240 V AC	20 Nm	–
Z13	GM230A	–1-wire-control –2-wire-control (Open/Close)	100 – 240 V AC	40 Nm	–
Z14	SM24A	–1-wire-control –2-wire-control (3-point)	24 V AC/DC	20 Nm	–
Z15	GM24A	–1-wire-control –2-wire-control (Open/Close)	24 V AC/DC	40 Nm	–
Z16	SM230A	–1-wire-control –2-wire-control (3-point)	100 – 240 V AC	20 Nm	S2A
Z17	GM230A	–1-wire-control –2-wire-control (3-point)	100 – 240 V AC	40 Nm	S2A
Z18	SM24A	–1-wire-control –2-wire-control (3-point)	24 V AC/DC	20 Nm	S2A
Z19	GM24A	–1-wire-control –2-wire-control (3-point)	24 V AC/DC	40 Nm	S2A
Z43	NM230A	–1-wire-control –2-wire-control (3-point)	100 – 240 V AC	10 Nm	–
Z45	NM24A	–1-wire-control –2-wire-control (3-point)	24 V AC/DC	10 Nm	–
Z47	NM230A	–1-wire-control –2-wire-control (3-point)	100 – 240 V AC	10 Nm	S2A
Z49	NM24A	–1-wire-control –2-wire-control (3-point)	24 V AC/DC	10 Nm	S2A

Open/Close actuators, fast-running

Order code detail	Meaning	Function	Supply voltage	Torque	Auxiliary switch
ZS21	SMQ24A	–1-wire-control	24 V AC/DC	16 Nm	–
ZS22	SMQ24A	–1-wire-control	24 V AC/DC	16 Nm	S2A

Open/Close actuators, spring return

Order code detail	Meaning	Function	Supply voltage	Torque	Auxiliary switch
ZF01	NF24A	Supply voltage on/off	24 V AC/DC	10 Nm	–
ZF02	NFA	Supply voltage on/off	24 – 240 V AC 24 – 125 V DC	10 Nm	–
ZF03	NF24A-S2	Supply voltage on/off	24 V AC/DC	10 Nm	integrated
ZF04	NFA-S2	Supply voltage on/off	24 – 240 V AC 24 – 125 V DC	10 Nm	integrated
ZF06	SF24A	Supply voltage on/off	24 V AC/DC	20 Nm	–
ZF07	SFA	Supply voltage on/off	24 – 240 V AC 24 – 125 V DC	20 Nm	–
ZF08	SF24A-S2	Supply voltage on/off	24 V AC/DC	20 Nm	integrated
ZF09	SFA-S2	Supply voltage on/off	24 – 240 V AC 24 – 125 V DC	20 Nm	integrated
ZF11	EF24A	Supply voltage on/off	24 V AC/DC	30 Nm	–
ZF12	EF230A	Supply voltage on/off	100 – 240 V AC	30 Nm	–
ZF13	EF24A-S2	Supply voltage on/off	24 V AC/DC	30 Nm	integrated
ZF14	EF230A-S2	Supply voltage on/off	100 – 240 V AC	30 Nm	integrated

Modulating actuators

Order code detail	Meaning	Function	Supply voltage	Torque	Auxiliary switch
Z20	SM24A-SR	2 – 10 V DC	24 V AC/DC	20 Nm	–
Z21	GM24A-SR	2 – 10 V DC	24 V AC/DC	40 Nm	–
Z51	NM24A-SR	2 – 10 V DC	24 V AC/DC	10 Nm	–

Modulating actuators, spring return

Order code detail	Meaning	Function	Supply voltage	Torque	Auxiliary switch
ZF05	NF24A-SR	2 – 10 V DC	24 V AC/DC	10 Nm	–
ZF10	SF24A-SR	2 – 10 V DC	24 V AC/DC	20 Nm	–
ZF15	EF24A-SR	2 – 10 V DC	24 V AC/DC	30 Nm	–

Double acting pneumatic actuators, including explosion-proof actuators

Order code detail		Meaning	Damper blade safety function	Operating pressure	Torque at 6 bar	Limit switch	Solenoid valve
①	②						
Z60	Z60 EX	DR030	–	1.2 – 6 bar	35 Nm	–	–
Z61	Z61 EX	DR030	Power off to close/open	1.2 – 6 bar	35 Nm	–	24 V DC
Z62	Z62 EX	DR030	Power off to close/open	1.2 – 6 bar	35 Nm	–	230 V AC
Z63	Z63 EX	DR030	–	1.2 – 6 bar	35 Nm	2	–
Z64	Z64 EX	DR030	Power off to close/open	1.2 – 6 bar	35 Nm	2	24 V DC
Z65	Z65 EX	DR030	Power off to close/open	1.2 – 6 bar	35 Nm	2	230 V AC
Z66	Z66 EX	DR060	–	1.2 – 6 bar	70 Nm	–	–
Z67	Z67 EX	DR060	Power off to close/open	1.2 – 6 bar	70 Nm	–	24 V DC
Z68	Z68 EX	DR060	Power off to close/open	1.2 – 6 bar	70 Nm	–	230 V AC
Z69	Z69 EX	DR060	–	1.2 – 6 bar	70 Nm	2	–
Z70	Z70 EX	DR060	Power off to close/open	1.2 – 6 bar	70 Nm	2	24 V DC
Z71	Z71 EX	DR060	Power off to close/open	1.2 – 6 bar	70 Nm	2	230 V AC

① Standard

② Explosion-proof (only with brass or stainless steel bearings)

Z60 – Z65, Z60EX – Z65EX: At 1.2 bar operating pressure only up to height H < 1665 mm

Single acting pneumatic actuators, including explosion-proof actuators

Order code detail		Meaning	Damper blade safety function	Operating pressure	Torque at 6 bar	Limit switch	Solenoid valve
①	②						
Z72	Z72 EX	SC06 0 SO06 0	Pressure off to close/open	6 bar	30 Nm		
Z73	Z73 EX	SC06 0 SO06 0	Power off and pressure off to close/open	6 bar	30 Nm		24 V DC
Z74	Z74 EX	SC06 0 SO06 0	Power off and pressure off to close/open	6 bar	30 Nm		230 V AC
Z75	Z75 EX	SC06 0 SO06 0	Pressure off to close/open	6 bar	30 Nm	2	
Z76	Z76 EX	SC06 0 SO06 0	Power off and pressure off to close/open	6 bar	30 Nm	2	24 V DC
Z77	Z77 EX	SC06 0 SO06 0	Power off and pressure off to close/open	6 bar	30 Nm	2	230 V AC

① Standard

② Explosion-proof (only with brass or stainless steel bearings)

Explosion-proof Open/Close actuators, spring return actuators

Order code detail	Meaning	Function	Supply voltage	Torque	Auxiliary switch
Z1EX	ExMax15-SF	2-wire-control (3-point)	24 – 240 V AC/DC	15 Nm	integrated
Z3EX	ExMax30-SF	2-wire-control (3-point)	24 – 240 V AC/DC	30 Nm	integrated

Only with brass or stainless steel bearings

JZ-HL, standard sizes

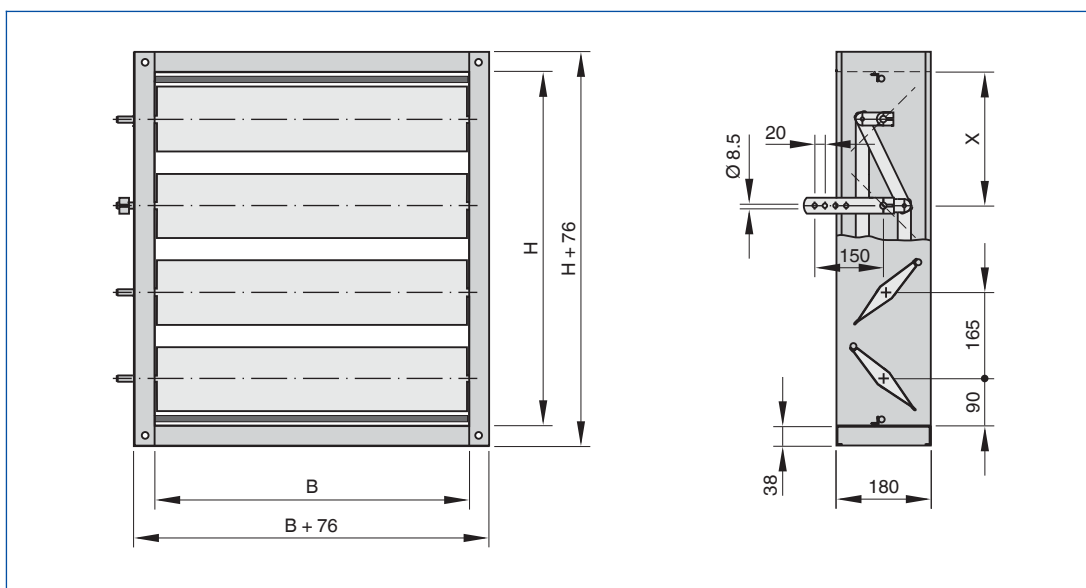


Illustration shows operating side on the right

JZ, JZ-HL, standard sizes

H	No. of blades	Position of drive shaft	
		X	Blade
mm	-	mm	-
180	1	90	1
345	2	90	1
510	3	90	1
675	4	255	2
840	5	420	3
1005	6	420	3
1170	7	585	4
1335	8	585	4
1500	9	750	5
1665	10	750	5
1830	11	915	6
1995	12	915	6

JZ-HL, intermediate sizes

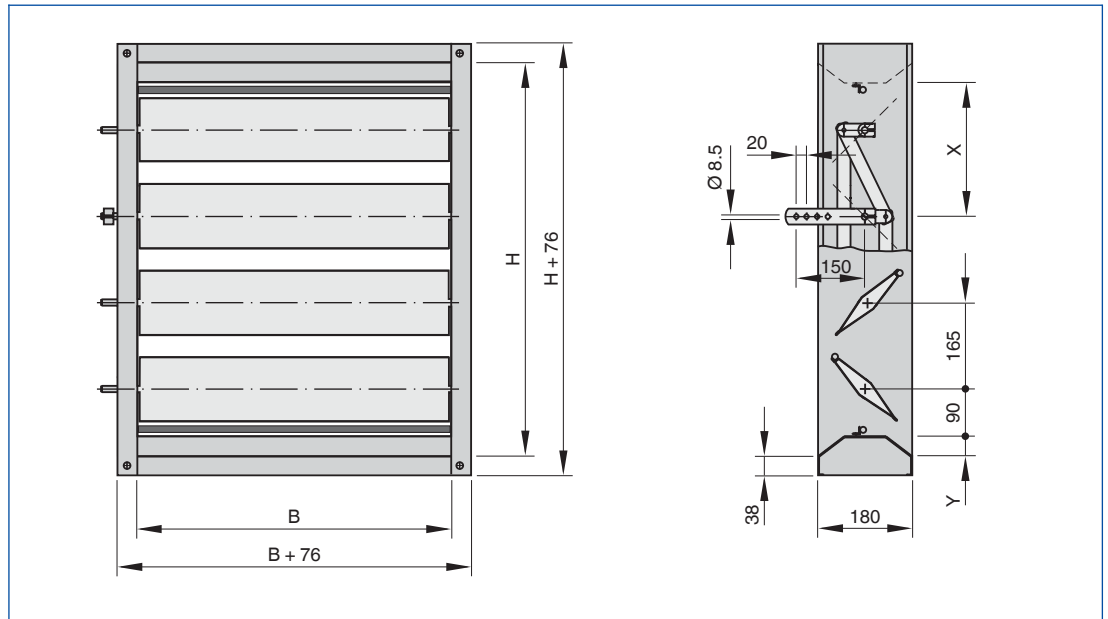


Illustration shows operating side on the right

JZ, JZ-HL, intermediate sizes

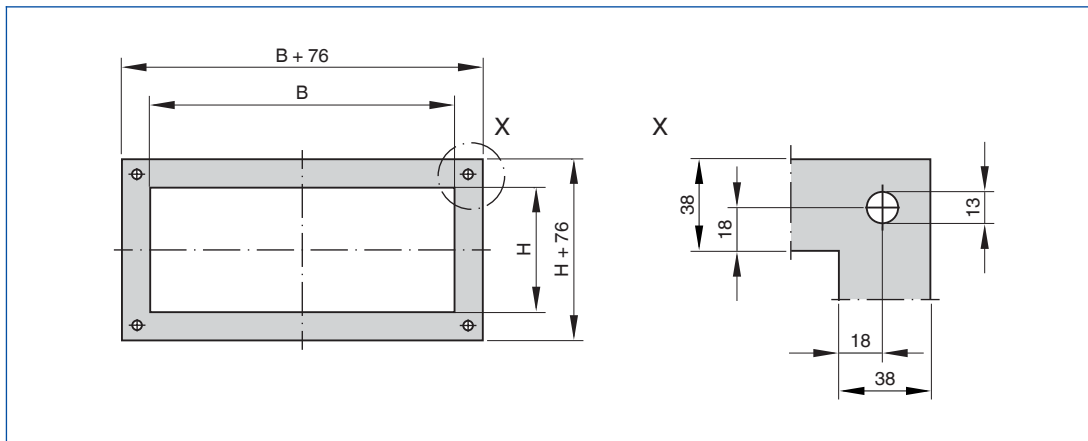
H	No. of blades	Position of drive shaft		Y
		X	Blade	
mm	-	mm	-	mm
183 – 343	1	90	1	1.5 – 81.5
348 – 508	2	90	1	1.5 – 81.5
513 – 673	3	90	1	1.5 – 81.5
678 – 838	4	255	2	1.5 – 81.5
843 – 1003	5	420	3	1.5 – 81.5
1008 – 1168	6	420	3	1.5 – 81.5
1173 – 1333	7	585	4	1.5 – 81.5
1338 – 1498	8	585	4	1.5 – 81.5
1503 – 1663	9	750	5	1.5 – 81.5
1668 – 1828	10	750	5	1.5 – 81.5
1833 – 1993	11	915	6	1.5 – 81.5

JZ, JZ-LL, JZ-HL, weight

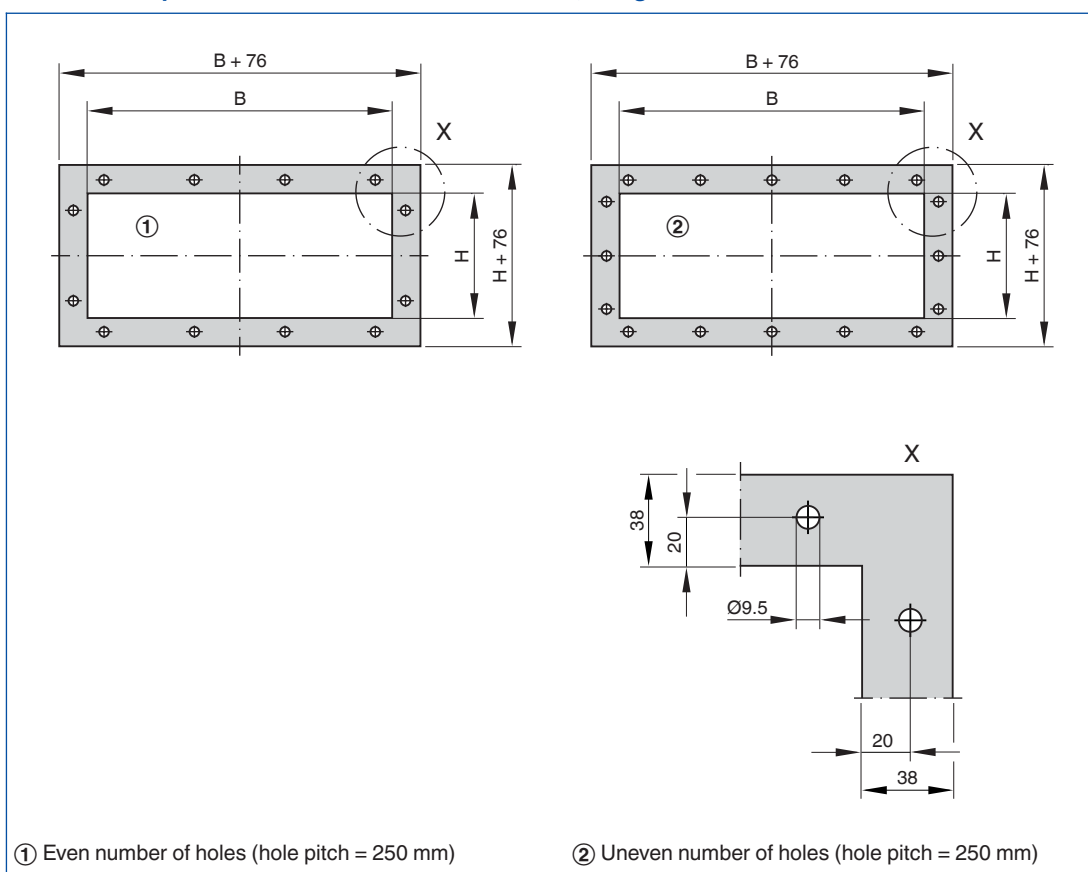
H	B [mm]									
	200	400	600	800	1000	1200	1400	1600	1800	2000
mm	kg									
180	4	6	8	9	11	13	14	16	18	19
345	6	8	10	12	15	17	19	21	24	26
510	7	10	13	16	19	22	25	27	30	33
675	10	13	16	20	23	27	30	33	37	40
840	11	15	19	23	28	32	37	41	46	50
1005	11	17	22	27	32	38	43	48	53	59
1170	13	19	25	31	37	43	49	55	61	67
1335	15	22	28	35	41	48	55	61	68	74
1500	16	23	30	37	44	51	59	66	73	80
1665	17	25	33	41	49	57	65	72	80	88
1830	18	27	35	44	52	61	69	78	86	95
1995	19	29	38	47	56	66	75	84	94	103

- Constructions with flange holes (-G) do not have corner holes
- Flange holes on casing sizes from width 288 mm and height 212 mm
- Drive shafts (special accessory) upon request

Multileaf dampers made of steel or stainless steel, ccorner holes



Multileaf dampers made of steel or stainless steel, flange holes



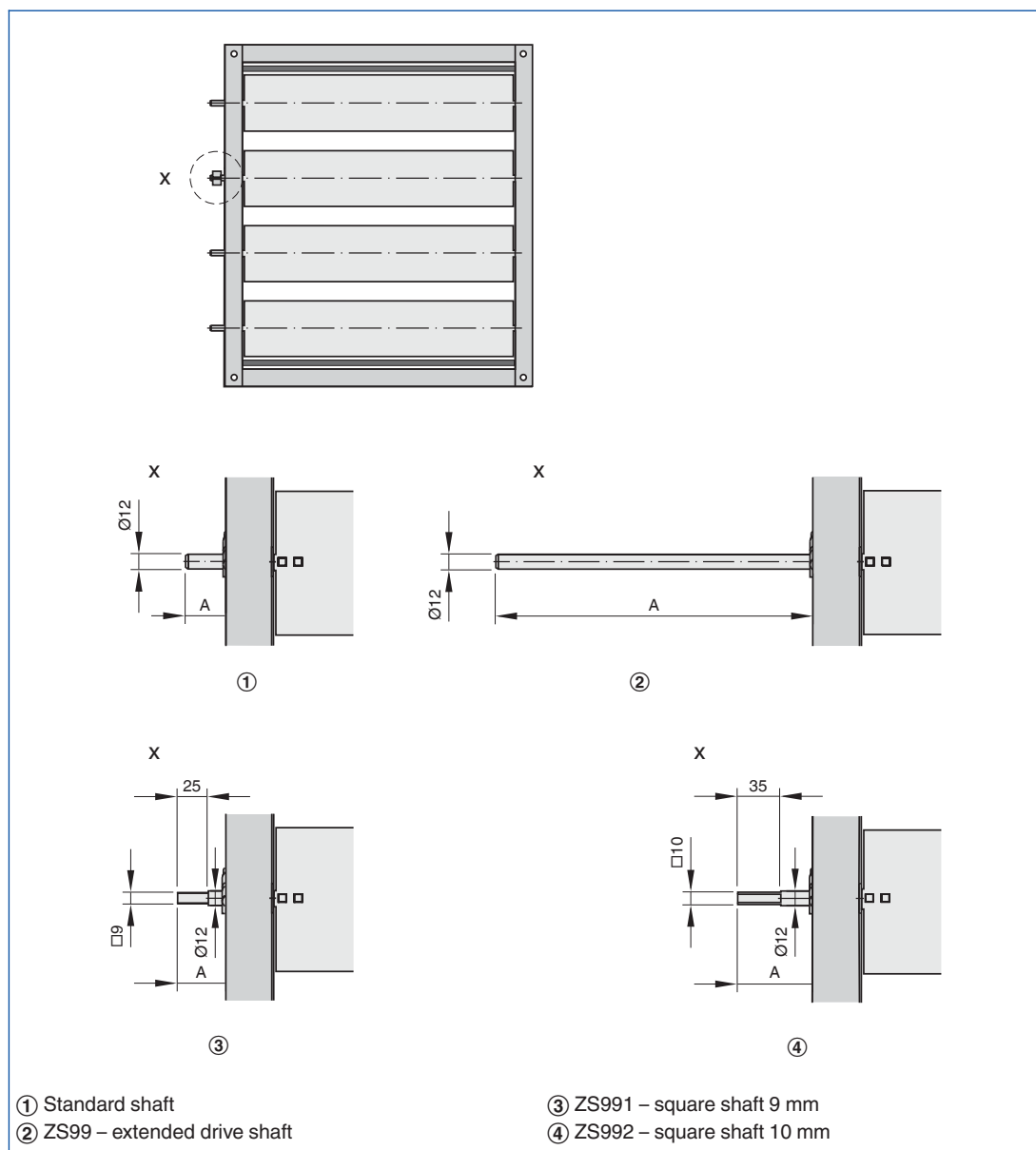
Steel or stainless steel multileaf dampers, width, no. of flange holes per side

B	No. of holes	
	n	
mm	-	
200 – 287		1
288 – 537		2
538 – 787		3
788 – 1037		4
1038 – 1287		5
1288 – 1537		6
1538 – 1787		7
1788 – 2000		8

Steel or stainless steel multileaf dampers, height, no. of flange holes per side

H	No. of holes	
	n	
mm	-	
180 – 211		1
212 – 461		2
462 – 711		3
712 – 961		4
962 – 1211		5
1212 – 1461		6
1462 – 1711		7
1712 – 1961		8
1962 – 1995		9

JZ-LL, JZ-HL, JZ-LL-A2, drive shafts



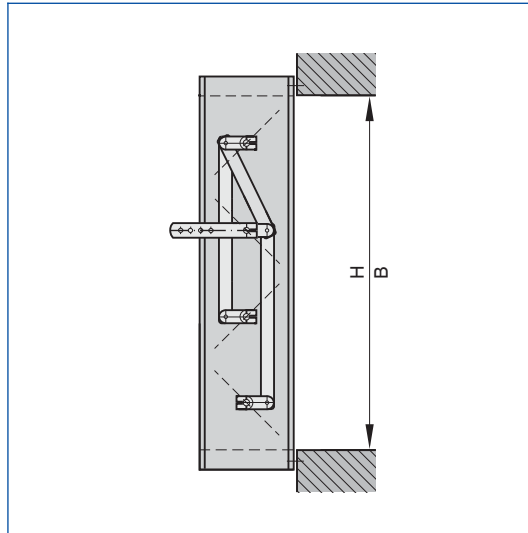
Shaft end projection

Drive shaft	Multileaf damper		
	JZ-LL	JZ-LL-A2	JZ-HL
	A		
	mm		
① Standard	30	26	30
② extended	250	180	250
③ Square 9 mm	37	37	37
④ Square 10 mm	70	–	60

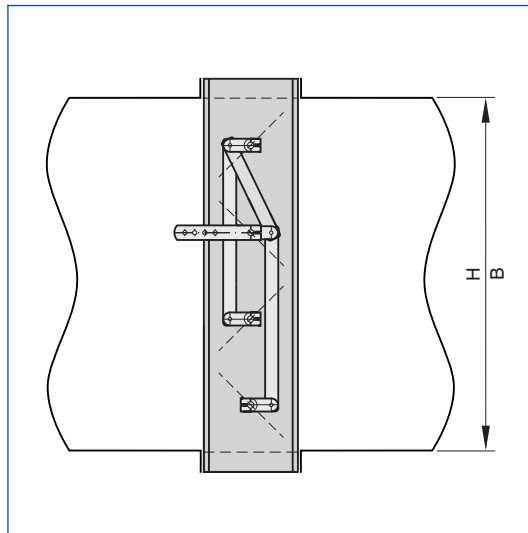
Installation and commissioning

- Only with horizontal blades
- With or without installation subframe
- Torsion-free installation
- For widths exceeding 2000 mm or heights exceeding 1995 mm install two multileaf dampers side by side or one above the other
- Only for installation in internal spaces

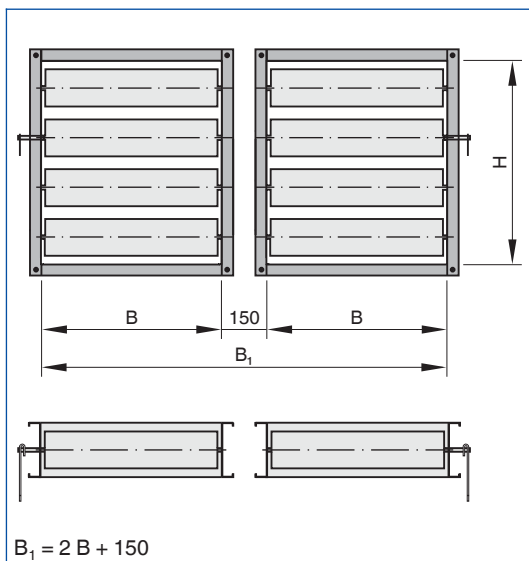
Wall installation without installation subframe



Duct installation



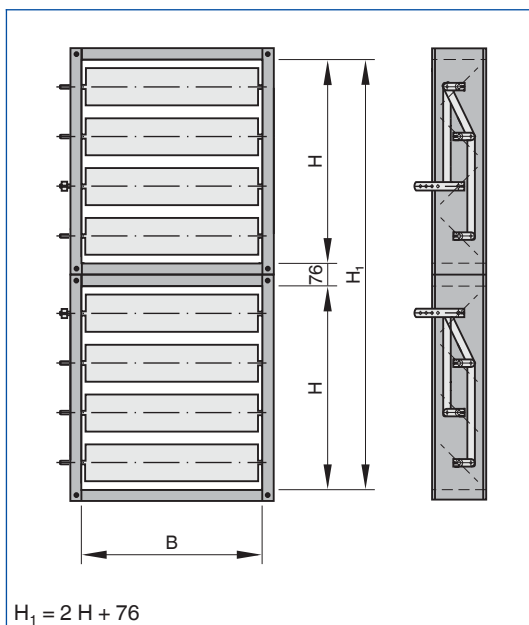
Width subdivided



Width subdivided, width

B_1 mm	B mm
2550	1200
2950	1400
3350	1600
3750	1800
4150	2000

Height subdivided



Principal dimensions

B [mm]
Duct width

H [mm]
Duct height

n []
Number of flange screw holes

M [kg]
Weight

Nomenclature

L_{WA} [dB(A)]
A-weighted sound power level of air-regenerated noise for the multileaf damper

α [°]
Damper blade position, 0°: OPEN, 90°: CLOSED

A [m²]
Upstream cross section

v [m/s]
Airflow velocity based on the upstream cross

section (B × H)

\dot{V} [m³/h] and [l/s]
Volume flow rate

Δp_{st} [Pa]
Static differential pressure

$\Delta p_{st,max}$ [Pa]
Maximum static differential pressure

All sound power levels are based on 1 pW.