



## AIRFLOWREGULATION





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# VARIABLE AIR VOLUME REGULATORS

## VARIABLE AIR VOLUME REGULATORS VSR-E / VSR-R

### APPLICATION

Variable Air Volume devices are applied in air handling installations for smooth regulation of the volume of supply air to the room within the range between the preset lower and upper limit, depending on the temporary level of the control signal (air volume regulation in the room). This, in turn, can depend e.g. on the current temperature in the room.

While regulating the air stream, we create an individual climate in the room, thus providing better comfort, better working conditions and cost savings owing to:

- cost-efficient air supply to individual rooms, appropriate to the needs,
- use of non-simultaneous occurrence of peak loads in particular zones,
- energy and operational optimisation of the ventilation unit,
- reliable compensation of external factors.

VSR-R regulators can be applied in air handling installations with variable air volume for:

- parallel control of supply and exhaust air,
- control of supply air with the regulation of exhaust air,
- compartment regulation of supply and exhaust air,
- two-duct installation,
- local temperature regulation in a particular room,
- pressure regulation in rooms.

### OPERATING METHOD

The operating principle of flow regulators manufactured by Frapol is based on air velocity measurement. The measurement is done using a measurement control terminal, which allows for pressure measurement on its both sides, which leads to very precise specification of pressure difference. It is measured using a dynamic pressure sensor, where the precise ratiometric hot-wire measurement method has been applied. Values measured according to this method are compared in the electronic regulator with the pre-set value. If the value measured is different than the pre-set one, the servo of regulatory damper sets it in such a position that there is no difference between the pre-set and measured values.



## CONSTRUCTION

The body and baffle of the VSR-R round regulator are made of galvanised steel. The baffle is sealed with a rubber seal. Pins placed on the steel measurement control terminal serve for measurement of the difference in the dynamic pressure. The control element is the Belimo servo, depending on the unit version.

## VERSIONS

- STANDARD VERSION:

In the standard version, the VSR-R regulator is furnished with VAV Compact actuator that allows for efficient regulation of the atmosphere in the room using just one unit. The kit comprises the actuator, the regulator and the dynamic pressure sensor (as one coherent LMV-D3-MP unit).

**Controlling of the regulator equipped with VAV Compact actuator:**

a) Analogue continuous control – the actuator regulates air flow within the range between the pre-set values  $V_{MIN}$  ...  $V_{MAX}$  according to the proportionate dependence of continuous control signal (2... 10V – standard, 0... 10V option) for the programmed operating range; it is also possible to have some forced settings.

b) Analogue forced control (available positions):

- damper in the „ZAM“ (CLOSED) position - closure of the dampers at air supply and exhaust to unused rooms allows for energy savings. For technical reasons, forced control to the “ZAM” (CLOSED) position is only possible within the operating range of 2 ... 10V, but generally exclusively with the setting of 0%  $V_{MIN}$ . If in the operating range of 2... 10V – input “w” and connection 1 are shorted, the actuator moves the dampers to the “ZAM” (CLOSED) position.
- damper in the „OTW“ (OPEN) position – support of smoke extraction from the rooms, or as secure position. In this case, the damper is completely opened.
- $V_{MIN}$  – minimum volume flow, depending on the needs, particular compartments or rooms can be switched in the stand-by mode. In such operation, there is only minimum airing of the rooms, and significant energy reduction.
- $V_{MAX}$  – maximum volume flow, single rooms or a group of rooms must be supplied with maximum air volume for a short time. In this way, it is possible to air the room, cool it down in the evening or quickly heat it in the morning.
- VS – medium position, both in the case of manual and automatic multi-level regulation of air volume, it is possible to achieve a more delicate grading of the flow with average value between the minimum and maximum flow volume, e.g.: with the control depending on air quality.

c) digital control using the Belimo MP-Bus,

**VAV regulators by Frapol can also be used for maintaining a constant air volume (operation as CAV).**

All VAV regulators are furnished with a bus to allow for digital communication using the MP-Bus protocol. It is possible to link regulators into groups of up to eight units. There are regulators dedicated (or gates for standard regulators) for communication with the following using the protocols:

- DDC regulator with MP-Bus interface
- LonWorks systems
- EIB /Konnex systems
- Modbus RTU systems
- BACnet MS/TP systems



- SPECIAL VERSION:

VSR-R regulators in the special version require the application of a VAV Universal control system – solution adjusted to the task the regulator is to do. The most frequently applied regulators in the special version allow for:

1) quick flow control (change of Open - Closed position within 2.5 s); regulator applied in places with special requirements related to strongly contaminated atmosphere (e.g. fumehoods, laboratories); such a system includes:

- VRP-M regulator (allowing for control analogically to VAV - Compact),
- dynamic pressure sensor VFD3,
- LMQ24A-SRV-ST actuator

2) pressure difference control; the regulator is applied e.g. for maintenance of constant overpressure as compared to the environment, in the protected rooms; such a system includes:

- VRP STP regulator
- static pressure sensor VFp-100 or VFP-300 or VFP-600. The maximum pressure difference we want to control is 100 Pa or 300 Pa or 600 Pa);
- NM24AV-ST actuator

Furthermore, we also offer other special versions, e.g. the regulator joining both above functions (version available exclusively after prior consultation with the Technological Department of Frapol).

## OPTIONAL EQUIPMENT

Each VAV regulator can be powder-painted in any colour from RAL range. It is also possible to apply the epoxy or polyester paint (standard).

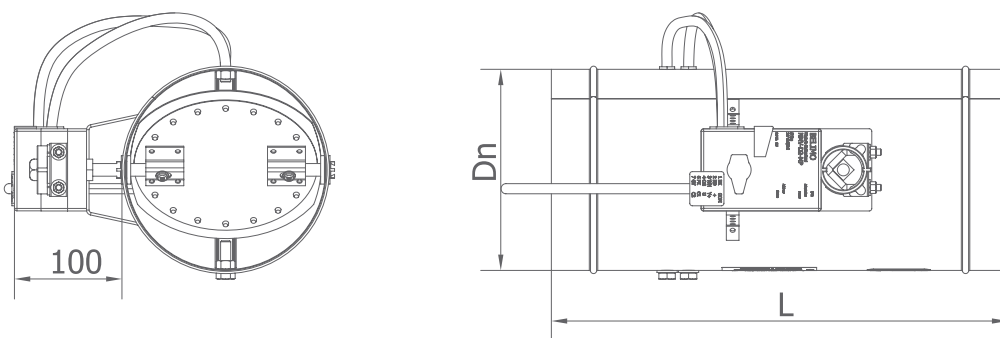
VAV regulators can be made in the version insulated.

It is also possible to order any acoustic silencer offered by Frapol, adjusted with dimensions to the VAV regulator ordered.

## AVAILABLE MAXIMUM DIMENSIONS AND AIR FLOW RANGE OF VSR-R REGULATORS.

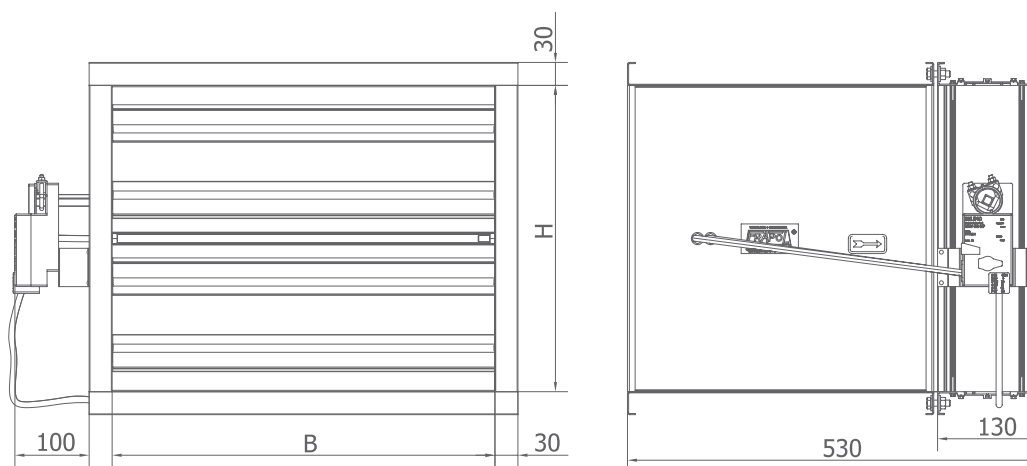
VSR-R regulators are available in the following diameters (Dn [mm] – nominal diameter; L [mm] – overall regulator length):

Dn [mm]	L [mm]	Air flow range [m <sup>3</sup> /h]
100	365	0 - 339
125	365	0 - 530
160	365	0 - 869
200	435	0 - 1357
250	435	0 - 2121
315	465	0 - 3367
400	570	0 - 5429
500	620	0 - 8482



VSR-E REGULATORS ARE AVAILABLE IN ANY CONFIGURATION OF DIMENSIONS:

H [mm]	100	230	345	460	575
B [mm]	200-1000				



## OPERATING RANGE

When selecting a VAV regulator, the following must be specified:

- $V_{NOM}$  nominal air volume [ $m^3/h$ ] resulting from the parameters of the installation; it is the standard air volume in the installation with the regulator entirely open;
- $V_{MAX}$  maximum air volume [ $m^3/h$ ], namely upper limit of air volume control
- $V_{MIN}$  minimum air volume [ $m^3/h$ ], namely lower limit of air volume control.

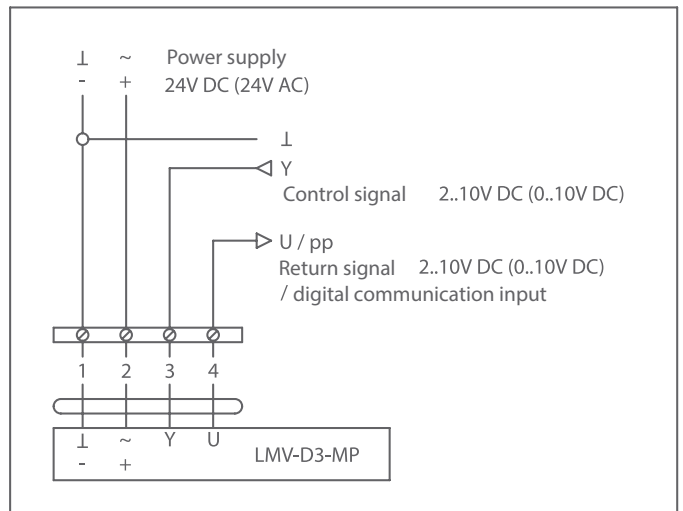
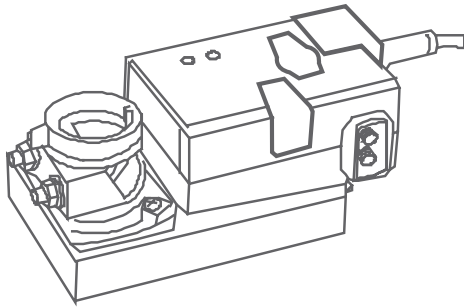
When selecting a VAV regulator, one must remember the range of air flow rates where a particular regulator size can operate. It results from the range of permissible air flow velocity values via the regulator, amounting from 0 to 12 [ $m/s$ ]. It is recommended that the  $V_{NOM}$  [ $m^3/h$ ] specified should correspond to the air flow velocity via the regulator amounting to at least 6 [ $m/s$ ].

Each electronically controlled air volume regulator manufactured by us is calibrated at the VAV measurement station for nominal flow value determined by the Ordering Party. Also, the values stated in the order are introduced.

VAV regulators manufactured by Frapol are characterised with:

- high accuracy of air volume regulation (below 3%)
- very good manufacturing quality
- opportunity of using the regulator as a cut-off element,
- easy application of noise-attenuation casing,
- maintenance-free - all parts have anti-corrosive protection and are characterised with long lifecycle.

## CONTROL ELEMENT FOR VAV-COMPACT



VAV-Compact kit with LMV-D3-MP servo is applied for regulation of VAV boxes independent on pressure. In the case of continuous setting, the kit is controlled with signals from position switch (positioner), master regulator, or from the DDC system. Through simple change of cabling for alternative current signals, it is also possible to have various operational modes in the forced control system.

The LMV-D3-MP kit has a dynamic pressure differential sensor and the measurement-regulatory part with a microchip.

## OPERATION AND SETTING

By pressing the button on the unit casing, it is possible to clutch the gear and manually change the damper position. Programming of the operational range and operating parameters VMIN and VMAX is carried out with one of additional instruments in the PP communication systems:

- ZTH -VAV (ZTH -GEN) (for testing and setting directly on the installation)
- ZIP-RS 232(for setting via OEM)

Advantages of the PP communication system include:

- opportunity of testing the current value and remote parameter change,
- almost absolute elimination of the possibility of incorrect manipulations by unauthorised personnel without relevant qualifications.

## IMPORTANT TIP

The manufacturer of VAV regulators is responsible for correct assembly, and proper settings of the LMV-D3-MP kit, as well as for the accuracy of the VAV regulator as a whole.

For this reason, LMV-D3-MP kits are distributed to manufacturers of VAV regulators.



TECHNICAL DATA LMV-D3-MP	
<b>RATED VOLTAGE</b>	24V AC, 50/60 Hz 24V DC
<b>OPERATING RANGE</b>	19,2...28,8V AC 21,6...28,8V DC
<b>POWER CONSUMPTION</b>	2W
<b>RATED POWER</b>	5,5VA
<b>THRESHOLD</b>	0...10V (within the range $V_{MIN}$ to $V_{MAX}$ )
<b>INPUT RESISTANCE</b>	min. 100k $\Omega$
<b>MANUAL CONTROL TYPES</b>	Forced control <ZAM> (OFF), $V_{MIN}$ , $V_{ZS}$ , $V_{MAX}$ and <OTW> (ON) selective cabling from supply power
<b>MODE</b>	„2...10 V“=2...10V in the range $V_{MIN}$ ... $V_{MAX}$ „0...10 V“=0...10V in the range $V_{MIN}$ ... $V_{MAX}$
<b>U-SIGNAL</b>	DC 2...10 V@ 0,5 mA (Mode 2...10) DC 0...10 V @ 0,5 mA (Mode 0...10) Linear signals, respectively 0...100% $V_{MIN}$
<b>SENSOR MEASUREMENT RANGE</b>	0...600 Pa
<b>CONNECTION</b>	Cable 4x0,75 mm <sup>2</sup>
<b>DIRECTION OF ROTATIONS</b>	selectable L/R (set via OEM)
<b>PROTECTION CLASS</b>	III (safe voltage-low)
<b>PROTECTION LEVEL</b>	IP54
<b>ROTATION ANGLE</b>	max. 95°, (mechanic bouncers to be shifted)
<b>TORQUE</b>	5Nm
<b>POSITION INDICATOR</b>	mechanical
<b>AMBIENT TEMPERATURE</b>	0...+50 °C
<b>STORAGE TEMPERATURE</b>	-20...+80 °C
<b>HUMIDITY TEST</b>	Acc. to: 60335-1
<b>ELECTROMAGNETIC INTERFERENCE EMISSIONS</b>	CE acc. to 89/336/EEC
<b>NOISE INTENSITY</b>	max. 35dB (A)
<b>MAINTENANCE</b>	Maintenance-free
<b>WEIGHT</b>	500g

## TAILORED TO THE USER – CONTINUOUS OPERATION AND FORCED CONTROL USING LMV-D3-MP

For correct operation of the air-handling systems in rooms that would correspond to user requirements, it is not only necessary to provide continuous regulation of air volume stream using the DC signals, but also to operate with gradually regulated continuous flows.

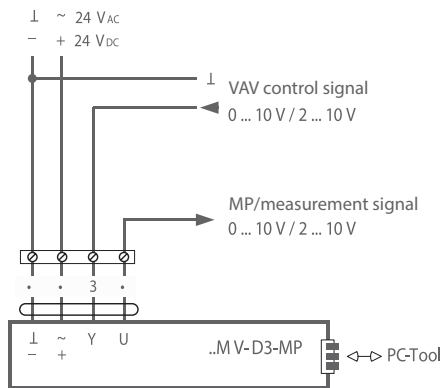
Such a combined operating mode is readily possible using the VAV-Compact regulator. Input “w” (3), for master parameters, responds both to control signals from continuous settings, and to forced control signals from AC voltage. It is also possible to switch several units in parallel, also in combination with VRD2 regulators.

For technical reasons, forced control to “ZAM”(OFF) position is only possible within operating range 2...10V, or generally only at the setting of 0% for  $V_{MIN}$ .

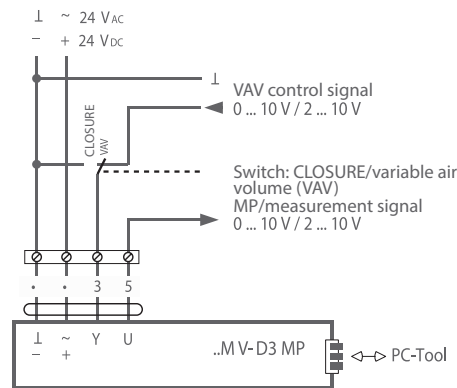
## ELECTRICAL CONNECTIONS

Electrical connection of an electronic LMV-D3-MP regulator must be performed according to the diagram indicated in the actuator Catalogue Chart by a person holding relevant qualifications.

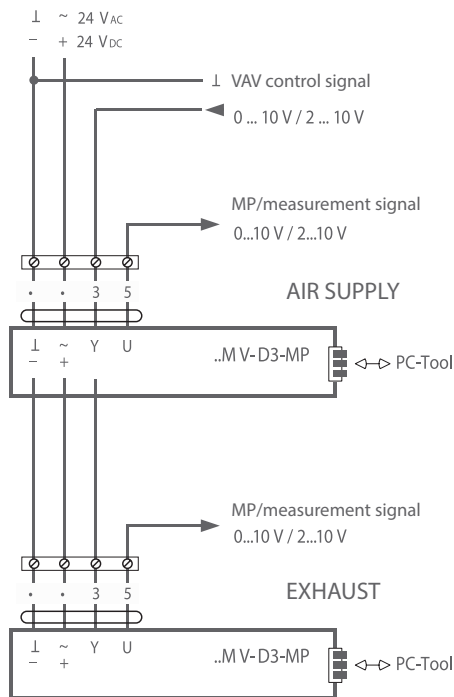
**EXAMPLE 1:**  
VAV with analogue control signal



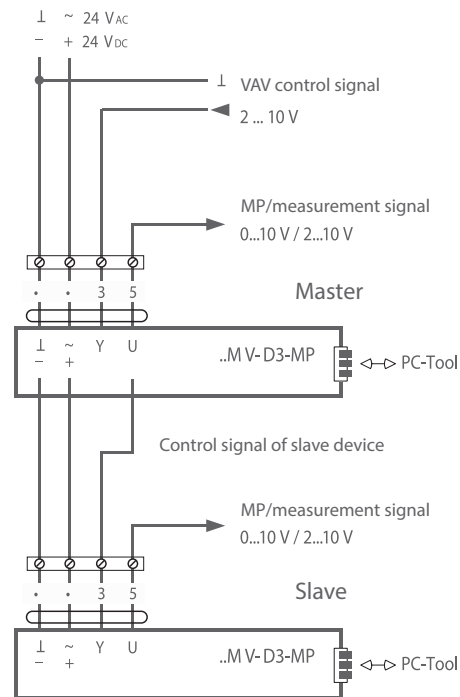
**EXAMPLE 2:**  
VAV with closing function, mode 2...10 V



**EXAMPLE 3:**  
AV with analogue control signal  
AIR SUPPLY/EXHAUST  
in the parallel system



**EXAMPLE 4:**  
VAV with analogue control signal in the master/slave system



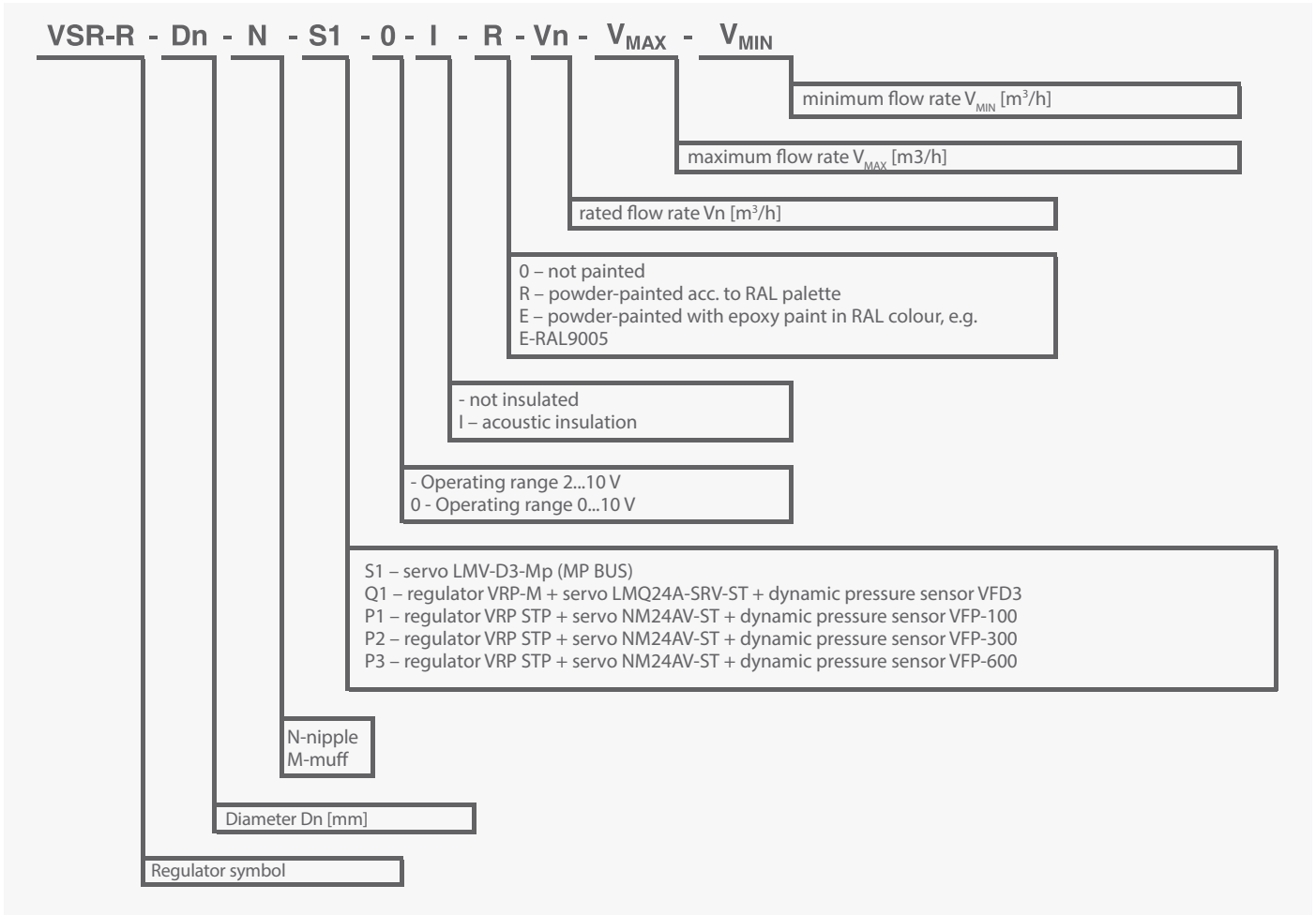
Diagrams of possible control systems are available in the Catalogue Chart for IMV-D3-MP actuator.

## INSTALLATION OFFLOW REGULATORS

The volume regulator is one of the elements of the air handling system, and must be installed according to the principles for air handling system assembly. Supply air direction to the measurement terminal is indicated by the arrows placed on the regulator casing. After installing the regulator, check whether the damper is not entirely closed. The regulator must not be installed directly downstream elbows, T-pipe branches, and diffusers or confusers with the apex angle greater than 15°. Minimum distances should be as follows (D- hydraulic diameter):

- 1D – from arches and elbows,
- 2D – 3D from T-pipes,
- 1D – 2D from diffusers and confusers.

## EXEMPLARY ORDER



# CONSTANT AIR VOLUME REGULATORS

## Constant air volume regulator CAV-N / CAV-W

### APPLICATION

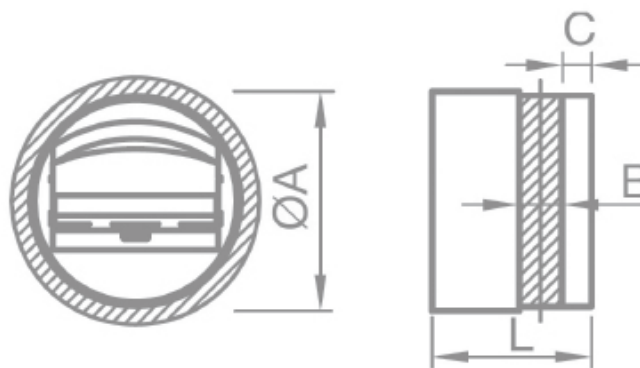
CAV regulator of constant volumetric air flow rate is offered in two pressure versions. CAV-N dedicated for low-pressure ventilation installations regulates airflow within operating pressure range 50 - 200 Pa, while CAV-W dedicated for medium-pressure installations regulates air flow within pressure range 150 - 600 Pa. The element can be applied both in the air supply and exhaust part of the ventilation installation.



### CONSTRUCTION

Built of PVC that does not spread flame, with fire resistance class M1, contains a regulatory spring made of stainless steel; the element includes a rubber seal to eliminate air flow between the regulator body and the wall of the ventilation duct.

### DIMENSIONS OF CAV-N, CAV-W REGULATOR

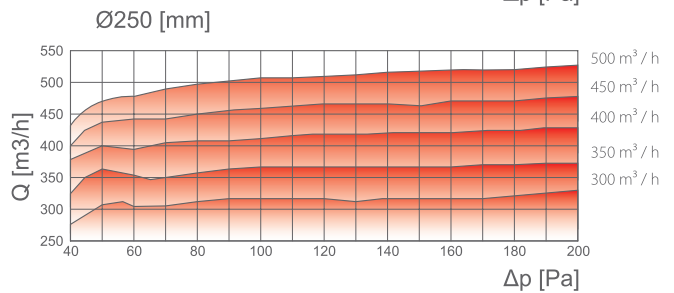
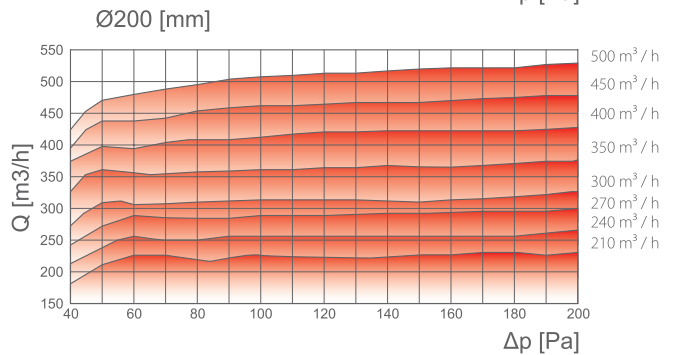
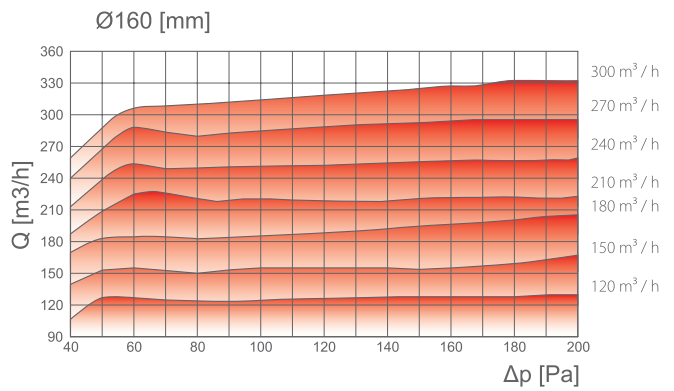
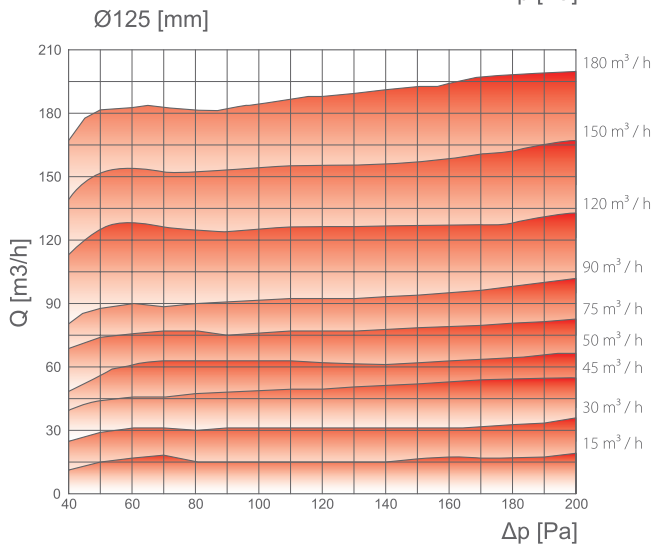
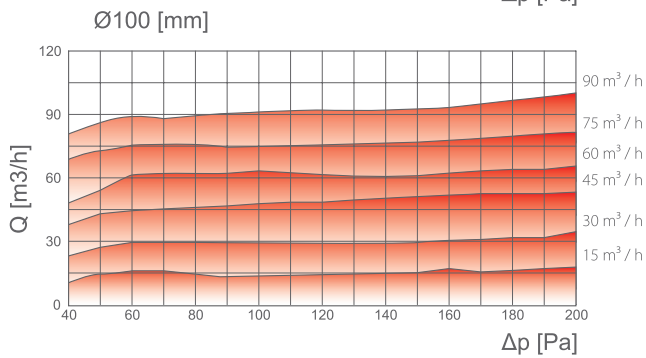
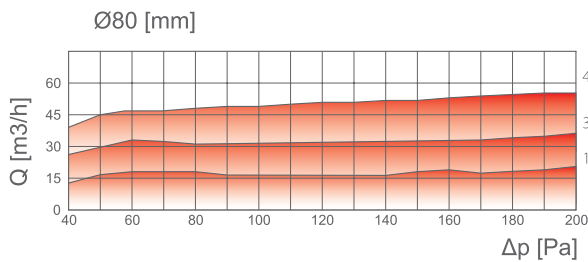


Ø [mm]	A	D	L	B	C
80	76	73	55	15	13
100	96	93	60	15	13
125	120	117	90	15	13
160	156	147	97	15	18
200	196	192	90	15	18
250	244	244	93	15	20

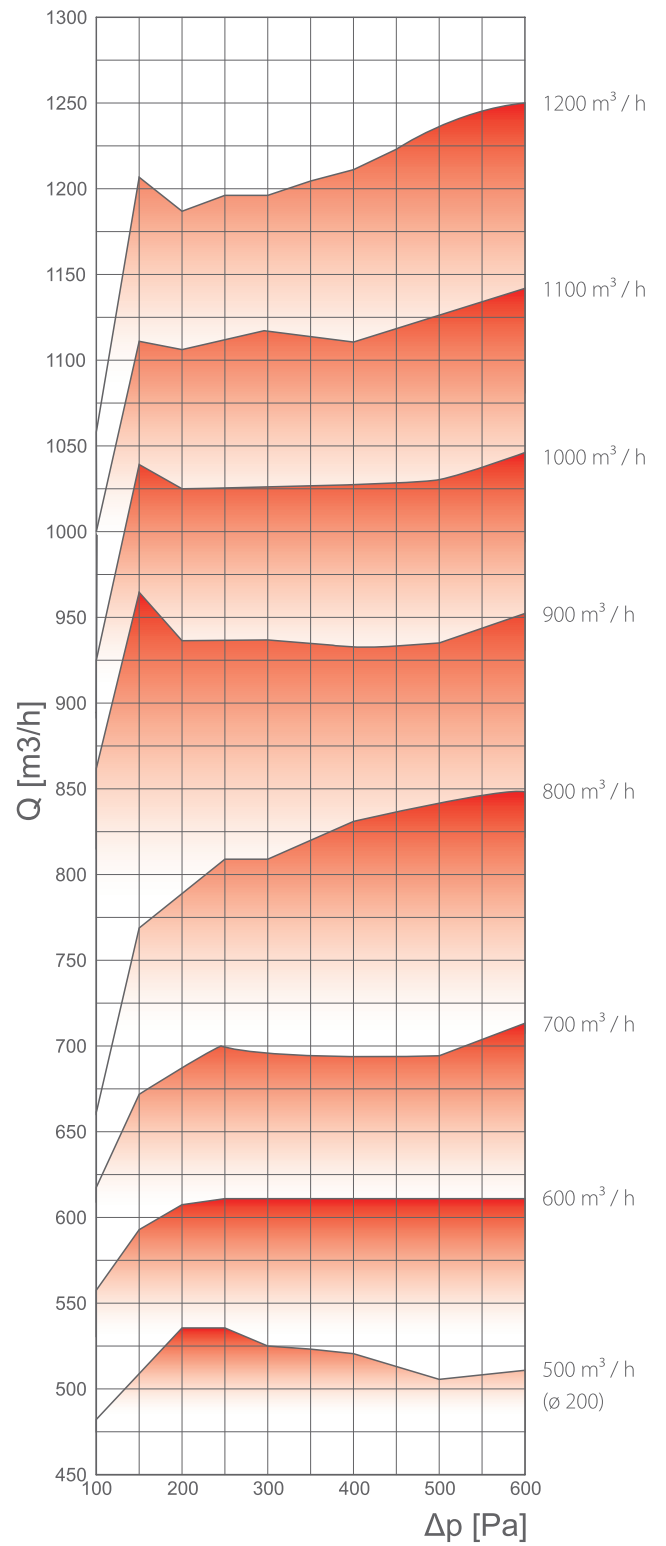
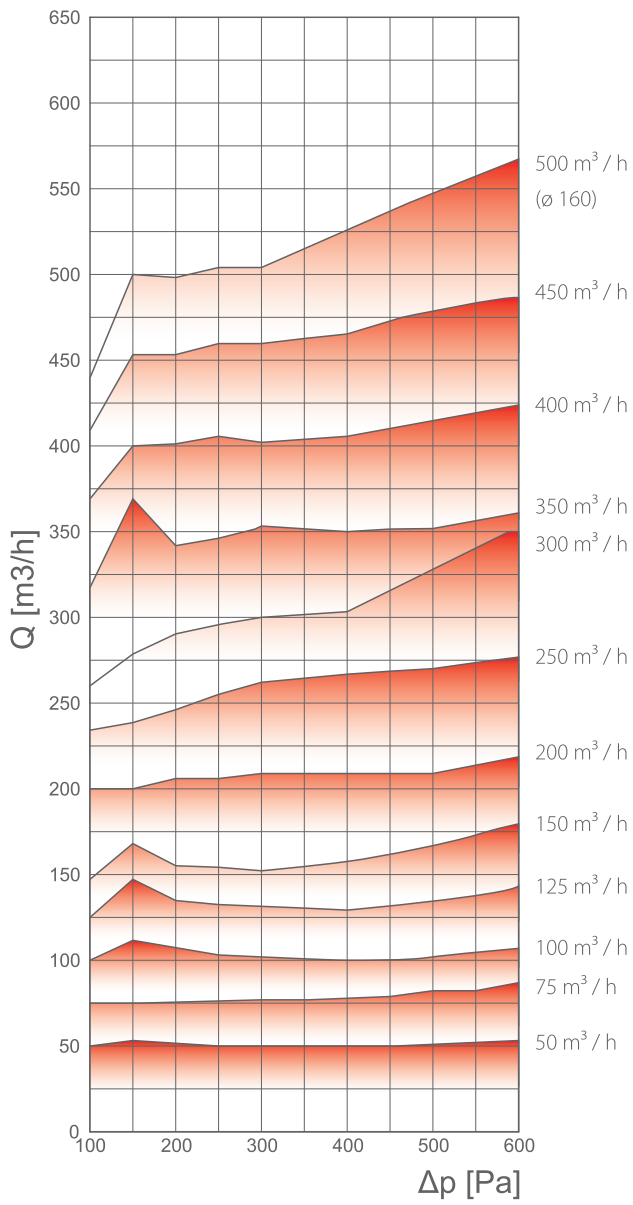
## AIR FLOW SETTINGS

Dn [mm]	Q [m³/h] CAV-N											Q [m³/h] CAV-W								
	15	25	30	45	50	60						50	75							
80	15	25	30	45	50	60						50	75							
100	15	25	30	45	50	60	75	90	100			50	75	100	125	150				
125	15	25	30	45	50	60	75	90	100	120	150	180	100	125	150	250	300			
160	120	150	180	210	240	270	300						150	200	250	300	350	400	450	500
200	210	240	270	300	350	400	450	500					350	400	450	500	600	700	800	
250	300	350	400	450	500	550	600	650	700				500	600	700	800	900	1000	1100	1200

## PRESSURE LOSS CAV-N



## PRESSURE LOSS CAV-W



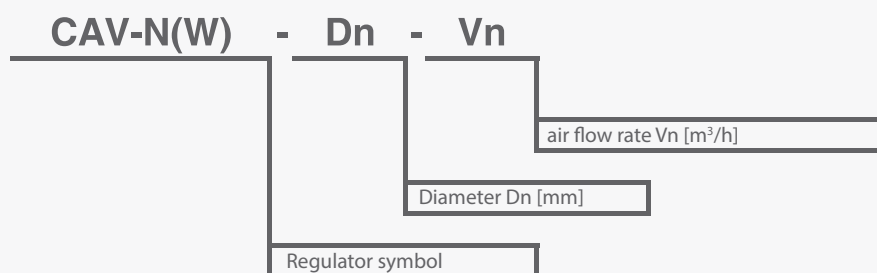
## THE LEVEL OF ACOUSTIC POWER IN DB(A) DEPENDING ON THE PRESSURE IN THE DUCT

Q[m <sup>3</sup> /h]	50 Pa	100 Pa	150 Pa	200 Pa
15	25	29	32	35
30	26	31	35	38
45	27	33	36	39
60	32	37	39	42
75	32	37	40	42
90	32	38	41	44
120	30	34	37	42
150	33	37	41	45
180	34	40	44	47
210	34	40	42	44
240	35	41	44	47
270	37	43	45	49
300	33	37	42	45
350	35	40	44	47
400	37	42	45	50
450	38	44	46	51
500	39	46	48	53

## ASSEMBLY

1. The regulator must be installed by insertion in the ventilation duct so that the "BAS" level is in the horizontal position (horizontal duct).
2. The assembly can be made in a vertical or horizontal duct (air flow must be according to the marking).
3. Distance from the air supply grill cannot be smaller than three times hydraulic diameter of the duct (distance from exhaust grill cannot be smaller than the duct diameter).

## EXEMPLARY ORDER



# Constant air volume regulator CAV-R

## APPLICATION

CAV-R constant volumetric air flow rate regulator is dedicated to low-, medium-, and high-pressure ventilation installations. The element can be applied both in the air supply and exhaust part of the ventilation installation. The regulator operates at pressure difference within the range of 20-1000 [Pa].

## CONSTRUCTION

The body is made of laser-welded galvanised steel with standard diameters of round ventilation ducts. Leak-proof assembly is ensured by rubber seals at the edges of the element. Regulatory partition is made of aluminium, placed on bearings made of PTFE. The regulator is furnished with a regulatory spring made of galvanised steel, and a piston to prevent oscillations.

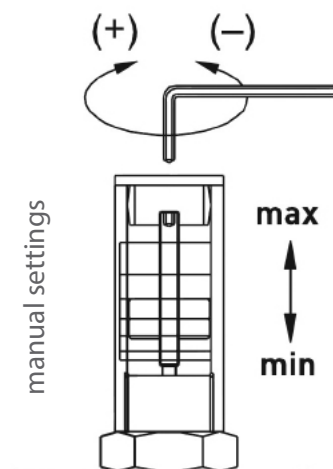
## OPTIONAL EQUIPMENT

The regulator can be optionally furnished with casing insulation and acoustic attenuator.



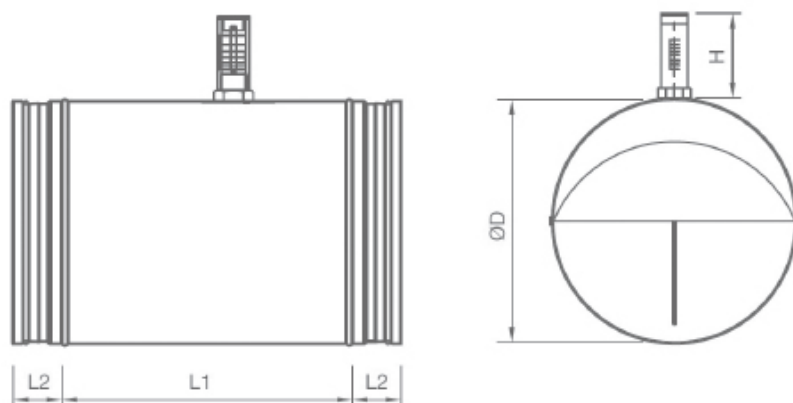
## AVAILABLE RANGES OF AIR FLOW SETTINGS AND DIAMETERS

- CAV- R 80 – from 40 to 125 m<sup>3</sup>/h
- CAV- R 100 – from 70 to 220 m<sup>3</sup>/h
- CAV- R 125 – from 100 to 280 m<sup>3</sup>/h
- CAV- R 150 – from 170 to 450 m<sup>3</sup>/h
- CAV- R 160 – from 180 to 500 m<sup>3</sup>/h
- CAV- R 200 – from 250 to 900 m<sup>3</sup>/h
- CAV- R 250 – from 500 to 1500 m<sup>3</sup>/h
- CAV- R 315 – from 800 to 3000 m<sup>3</sup>/h
- CAV- R 355 – from 900 to 3200 m<sup>3</sup>/h
- CAV- R 400 – from 1000 to 4500 m<sup>3</sup>/h





## DIMENSIONS DIAGRAM

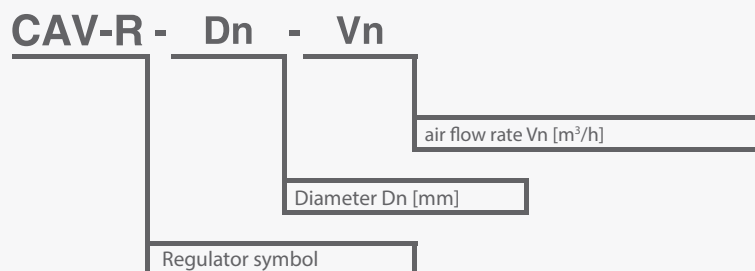


Dn [mm]	D	L <sub>1</sub>	L <sub>2</sub>	H
80	79	120	40	70
100	88	170	40	70
125	124	170	40	70
150	149	240	40	70
160	159	240	40	70
200	199	240	40	70
250	249	240	40	70
315	314	220	60	110
355	354	295	60	110
400	398	295	60	110

## ASSEMBLY

1. For assembly in a round ventilation duct.
2. The assembly can be made in a vertical or horizontal duct (air flow must be according to the marking).

## EXEMPLARY ORDER



# Constant air volume regulator CAV-E

## APPLICATION

CAV-E constant volumetric air flow rate regulator is dedicated to low-, medium-, and high-pressure ventilation installations, and regulates air flow within the operating pressure range of 20 – 1000 Pa. The element can be applied both in the air supply and exhaust part of the ventilation installation.

## CONSTRUCTION

The body is made of laser-welded galvanised steel with dimensions from 150 mm to 600 mm. Connection with ventilation ducts is made using a frame of 30 mm width. Regulatory partition is made of aluminium, placed on bearings made of PTFE. The regulator is furnished with a regulatory spring made of galvanised steel, and a piston to prevent oscillations.

## OPTIONAL EQUIPMENT

The regulator can be optionally furnished with casing insulation and acoustic attenuator.



## AVAILABLE RANGES OF AIR FLOW SETTINGS

CAV-E constant volumetric air flow regulator is selected on the basis of dimensions B (width) and H (height). Permissible minimum air flow velocity at the regulator amounts to 3m/s, while the maximum velocity is 10m/s in a particular area.

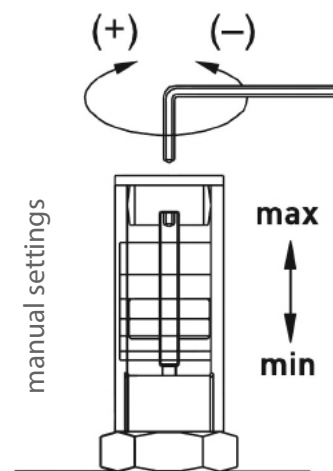
Hence:

$$P_p = B \cdot H \text{ [m}^2\text{]}$$

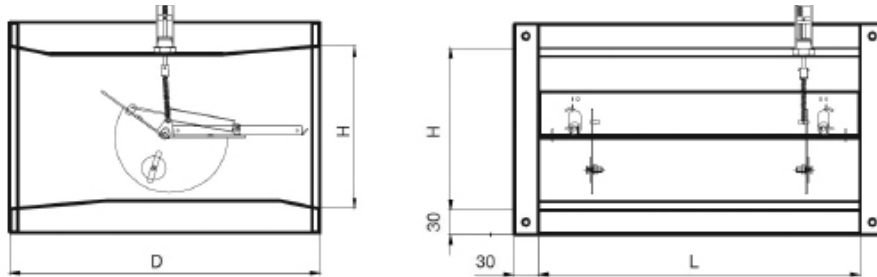
$$Q_{\text{max/min}} = V_{\text{max/min}} \cdot P_p$$

$$Q_{\text{min}} = 3 \cdot 3600 \cdot P_p \text{ [m}^3\text{/h]}$$

$$Q_{\text{max}} = 10 \cdot 3600 \cdot P_p \text{ [m}^3\text{/h]}$$



## DIMENSIONS DIAGRAM

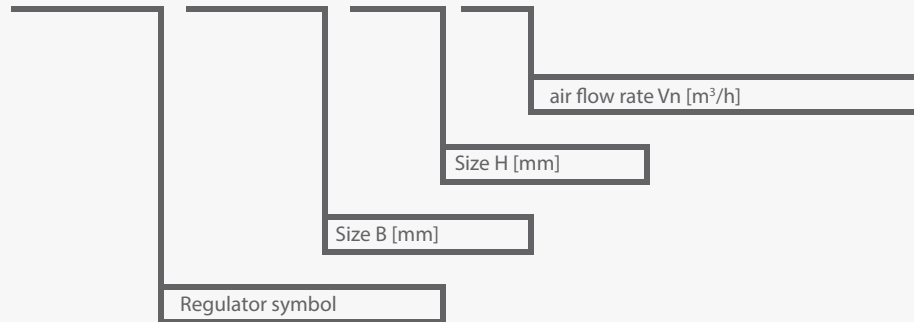


## ASSEMBLY

1. For assembly in a rectangular ventilation duct.
2. The assembly can be made in a vertical or horizontal duct (air flow must be according to the marking).

## EXEMPLARY ORDER

**CAV-E - B - H - Vn**



# SINGLE-PLANE DAMPERS

## Type DR single-plane damper

### APPLICATION

DR single-plane dampers serve for regulation or cutting off air flow in ventilation ducts.

### CONSTRUCTION

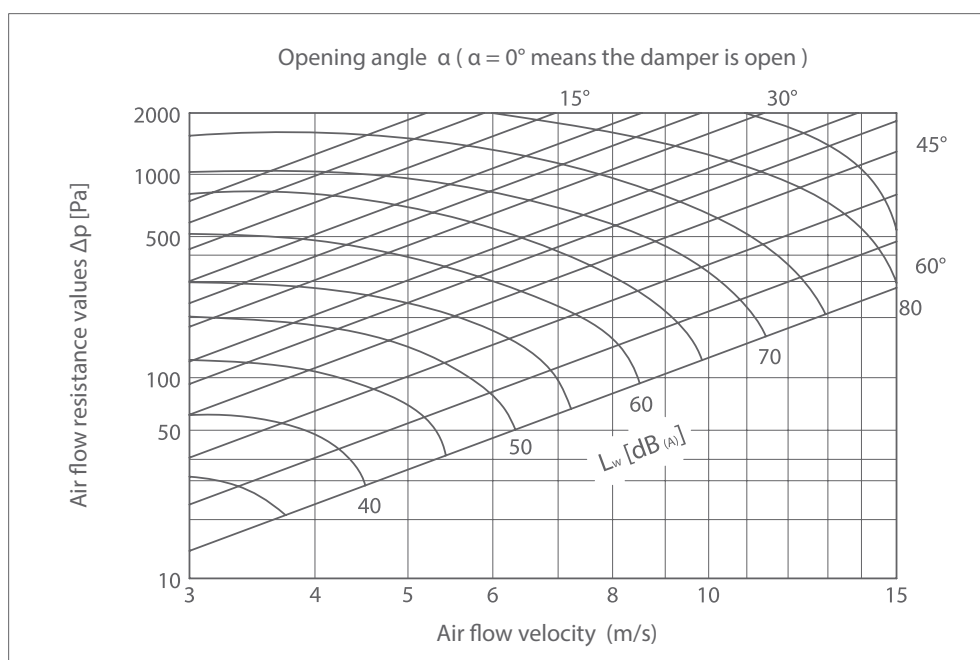
Round DR single-plane dampers are made of galvanised steel plate. Manual control or via a Belimo servo. Adjusted for assembly in "SPIRO" type ducts or furnished with flanges.



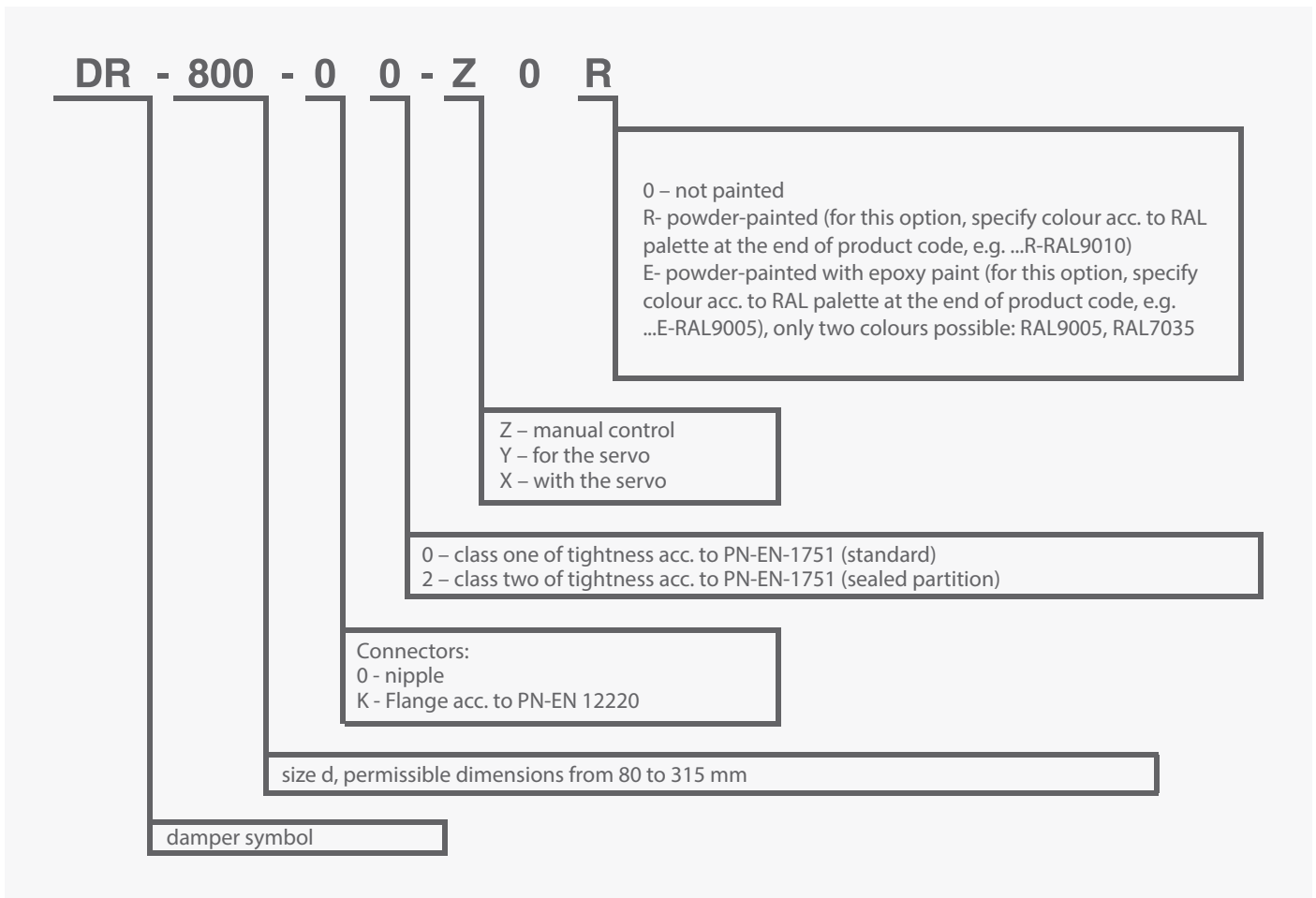
### TYPICAL SIZES

Diameter d [mm]	80	100	125	150	160	180	200	224	250	280	315
Weight [kg]	0,45	0,51	0,60	0,69	0,72	0,84	0,92	1,23	1,38	1,56	1,78

### ACOUSTIC POWER LEVEL AND PRESSURE LOSS FOR $\alpha = 5^\circ$ TO $60^\circ$



## EXEMPLARY ORDER



## Type A single-plane damper

### APPLICATION

A type single-plane dampers serve for regulation or cutting off air flow in ventilation ducts.



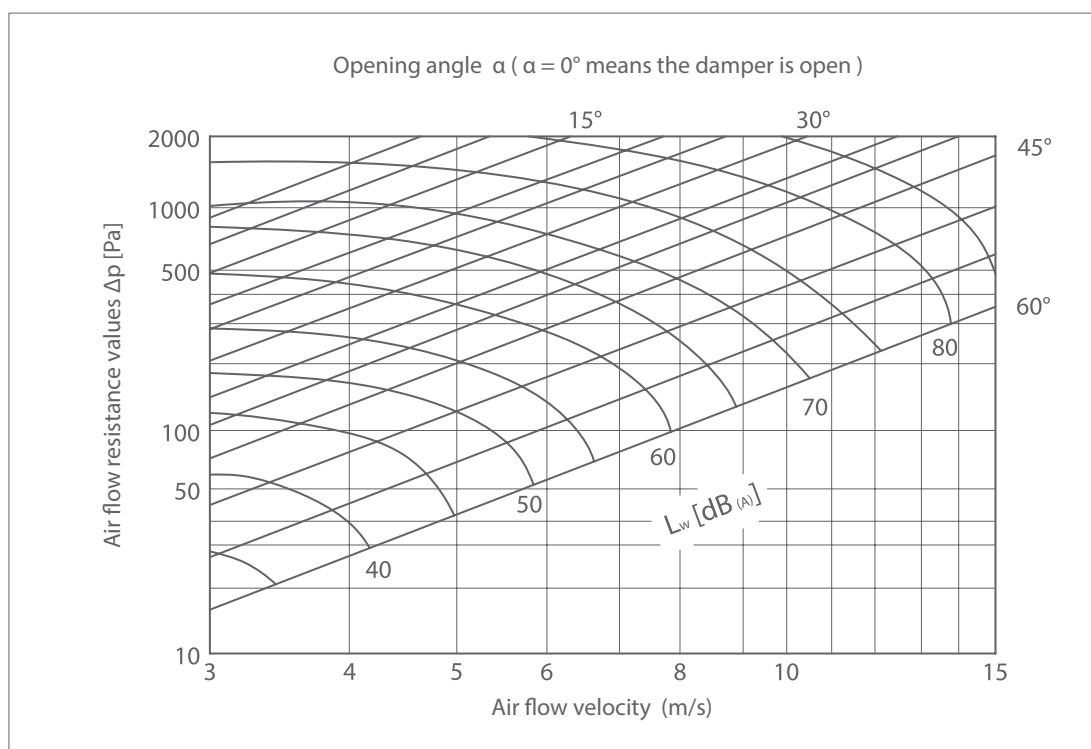
### CONSTRUCTION

Rectangular single-plane dampers are made of galvanised steel plate. Profile flanges acc. to METU system. The length of installation equals to the damper height; manual control or via a Belimo servo.

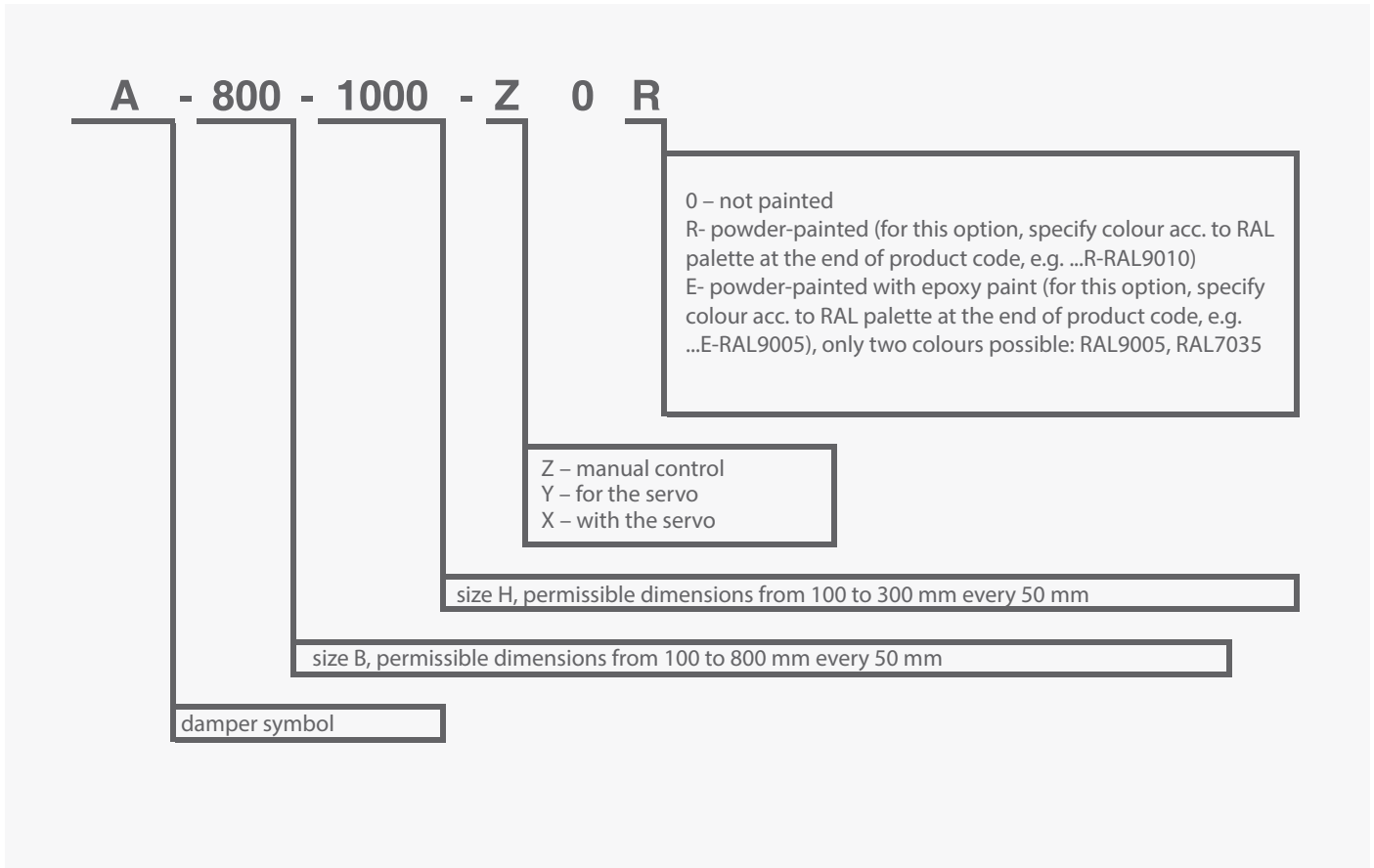
### TYPICAL SIZES

Width B [mm]	100	150	200	250	300
	400	450	500	600	800
Height H [mm]	100	150	200	250	300

### ACOUSTIC POWER LEVEL AND PRESSURE LOSS FOR $\alpha = 5^\circ$ TO $60^\circ$



## EXEMPLARY ORDER



# MULTI-PLANE DAMPERS

## ST-JHZ multi-plane damper

### APPLICATION

Multi-plane ST-JHG dampers are applied to cut off the air flow or to reduce it in the part of the ventilation system.

### CONSTRUCTION

Rectangular multi-plane damper of ST-JHG type:

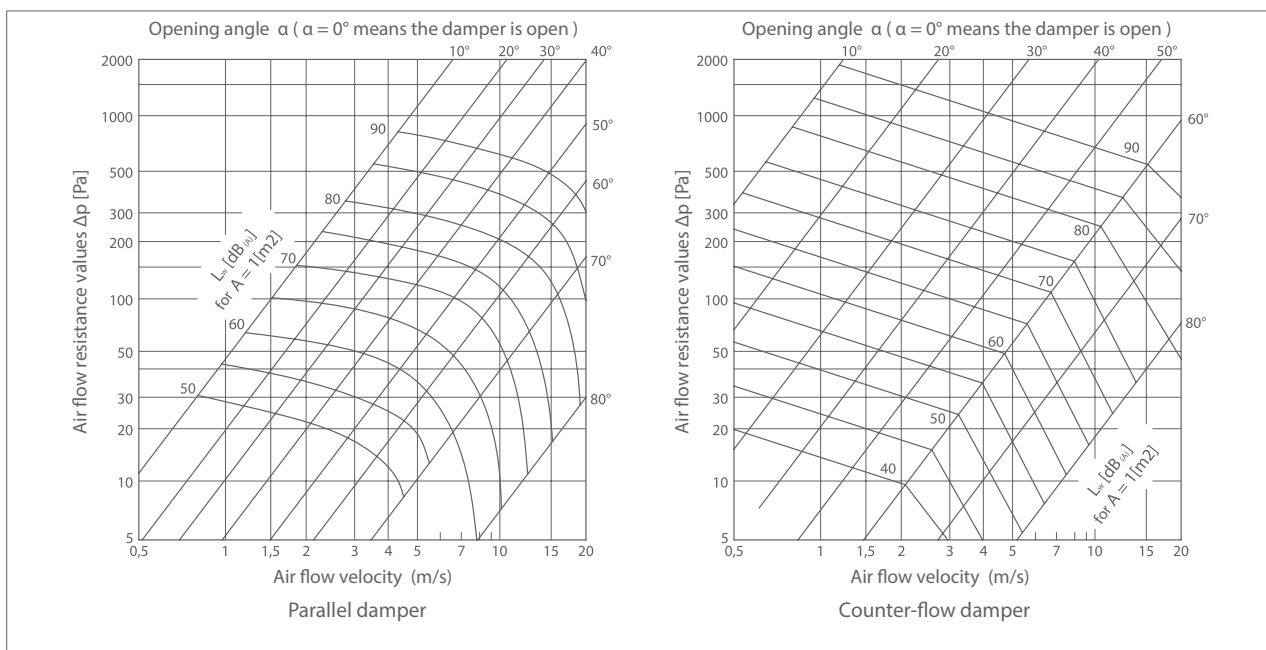
- ST-JHG-p - counter-current version
- ST-JHG-v - concurrent version
- Made of galvanised steel plate
- Length L - 140 mm
- Made of parts where dimension B > 1200 mm
- Manually controlled or with a 'BELIMO' servo



### TYPICAL SIZES

Width B [mm]	200	400	500	600	800	1000	1200
Height H [mm]	250	400	500	650	750	850	1000
	1100	1250	1400				

### ACOUSTIC POWER LEVEL AND PRESSURE LOSS FOR $\alpha = 10^\circ$ TO $80^\circ$





## EXEMPLARY ORDER

**ST-JHG-p - 800 - 1000 - Z 0 R**

0 – not painted  
 R- powder-painted (for this option, specify colour acc. to RAL palette at the end of product code, e.g. ...R-RAL9010)  
 E- powder-painted with epoxy paint (for this option, specify colour acc. to RAL palette at the end of product code, e.g. ...E-RAL9005), only two colours possible: RAL9005, RAL7035

Z – manual control  
 Y – for the servo  
 X – with the servo

size H, permissible dimensions from 250 to 1400 mm every 50 mm

size B, permissible dimensions from 200 to 1200 mm every 50 mm

damper symbol  
 ST-JHG-p – counter-current version  
 ST-JHG-v – concurrent version



# AL-JHZ multi-plane damper

## APPLICATION

Multi-plane AL-JHZ dampers are applied to cut off the air flow or to reduce it in the part of the ventilation system.

## CONSTRUCTION

Rectangular multi-plane dampers up to the size 1200x1000 inclusive are made of aluminium and steel profiles, and of galvanised steel plate with counter-flow gear wheels. Dampers with dimensions above 1200x1000 are made of aluminium profiles with counter-flow gear wheels. Fin spacing: 100 mm, installation length for dampers up to the size 1200x1000 amounts to 165 mm, while for other dampers: 130 mm. Manual control or via an actuator.

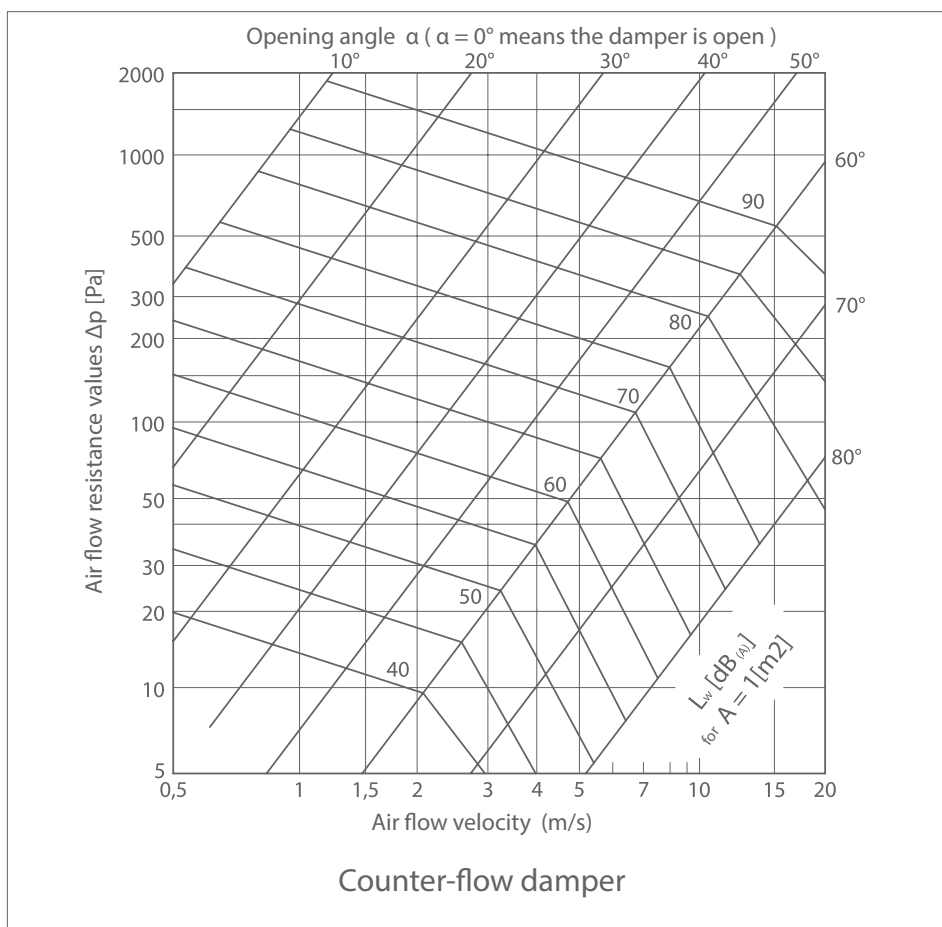


## TYPICAL SIZES

		Weight [kg]										
		Size B [mm]										
		300	500	700	900	1100	1300	1500	1700	1900	2100	2400
Size H [mm]	200	3,0	4,0	5,0	6,0	9,4	7,3	8,1	9,0	9,8	10,7	11,9
	400	4,4	5,8	7,1	8,4	12,5	11,0	12,3	13,5	14,8	16,0	17,9
	600	5,9	7,5	9,2	10,9	15,5	14,8	16,4	18,1	19,7	21,3	23,8
	800	7,3	9,3	11,3	13,3	18,6	18,6	20,6	22,6	24,6	26,6	29,7
	1000	10,7	13,3	15,9	18,5	21,6	22,3	24,7	27,1	29,6	32,0	35,6
	1200	10,1	12,9	15,7	18,5	21,3	26,1	28,9	31,7	34,5	37,3	41,5
	1400	12,0	15,2	18,4	21,6	24,8	30,4	33,5	36,7	39,9	43,1	47,9
	1600	13,5	17,1	20,6	24,2	27,8	34,1	37,7	41,3	44,9	48,5	53,8
	1800	15,0	19,0	22,9	26,9	30,9	37,9	41,9	45,8	49,8	53,8	59,7
	2000	16,5	20,8	25,2	29,6	33,9	41,6	46,0	50,4	54,7	59,1	65,6

WEIGHTS SPECIFIED MUST BE TREATED AS INFORMATIVE ONLY

## ACOUSTIC POWER LEVEL AND PRESSURE LOSS FOR $\alpha = 10^\circ$ TO $80^\circ$



## EXEMPLARY ORDER

**AL - JHZ - 800 - 1000 - 2 - Z A 0**

0 – not painted  
 R- powder-painted  
 (for this option, specify colour acc. to RAL palette at the end of product code, e.g. ...R-RAL9010)  
 E- powder-painted with epoxy paint  
 (for this option, specify colour acc. to RAL palette at the end of product code, e.g. ...E-RAL9005),  
 only two colours possible: RAL9005, RAL7035

A – aluminium } versions available for sizes above  
 D – anodized aluminium } 1200x1000 or for class two of tightness  
 S – steel body, aluminium fins – version available for sizes up to  
 1200x1000 and class one of tightness

Z – manual control  
 Y – for the servo  
 X – with the servo

0 – class one of tightness acc. to PN-EN-1751 (standard)  
 2 – class two of tightness acc. to PN-EN-1751

Size H, permissible dimensions from 200 to 2000 mm every 50 mm

Size B, permissible dimensions from 300 to 2400 mm every 50 mm

Damper symbol



# ADAPTERS

## ADAPTERS

### SIZES

Adapters are manufactured within the dimension range adjusted to the frame/vent strip where they can be installed. In the case of application of the adapter to the frame with length greater or equal to 525 [mm] furnished with invisible fixing elements; depth of each adapter amounts to at least 75 [mm]. SS type adapters are only made in typical sizes, at maximum to the size 1225x325 [mm]. SS type adapters cannot be applied in frames with invisible fixing elements.



### CONSTRUCTION

Adapters are made from steel sheet profiles.

### FIXING

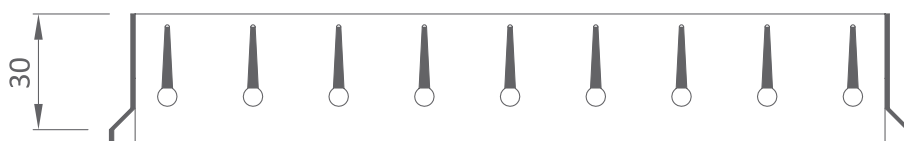
Adapters are fixed to the frame using blind rivets. Specific types of adapters are only installed in appropriate frames. Special ST-E-G adapters can be installed individually. G, SG, WG adapters can be manufactured in oblique version for assembly exclusively on STR-S and STR-W frame. In such a case, in the order form, after adapter symbol add (S).

## TYPES OF ADAPTER

Adapters are made in the following variants:

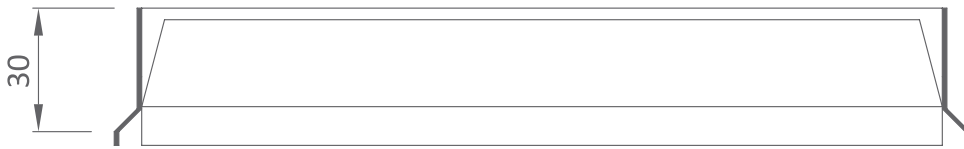
### S ADAPTER

single set vertical guides



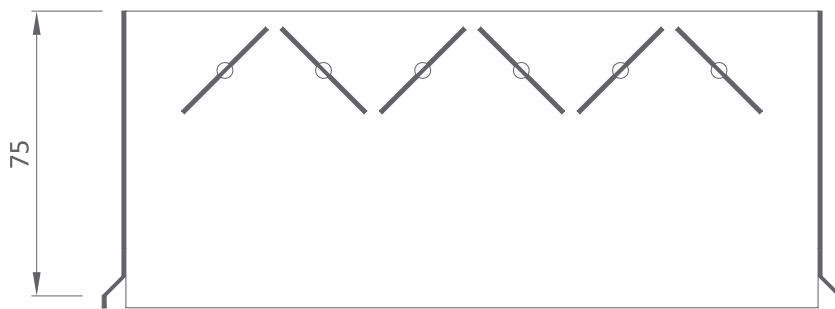
## W ADAPTER

single set horizontal guides



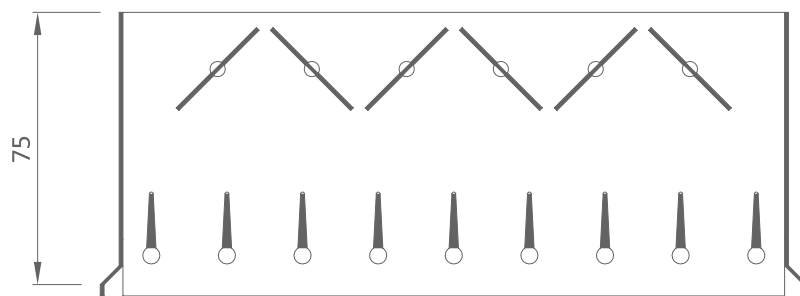
## G ADAPTER

counter-current air flow regulation with coupled blades, possible G(s) version



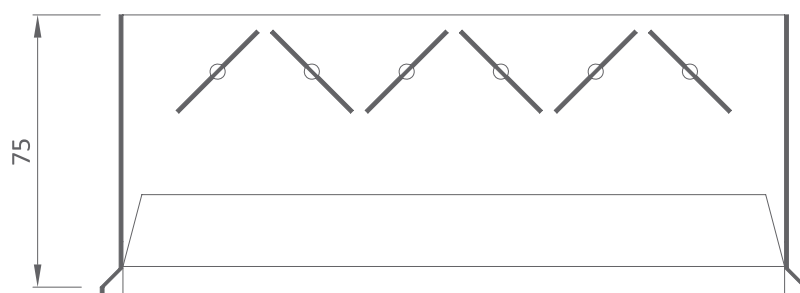
## SG ADAPTER

single set vertical guides, counter-current air flow regulation with coupled blades, possible SG(S) version



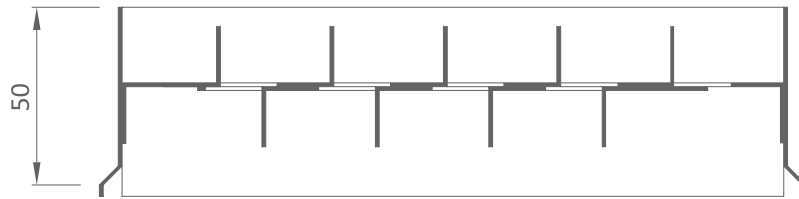
## WG ADAPTER

single set vertical guides, counter-current air flow regulation with coupled blades, possible WG(S) version



## SS ADAPTER

slot damper, maximum 50% free cross-section area.

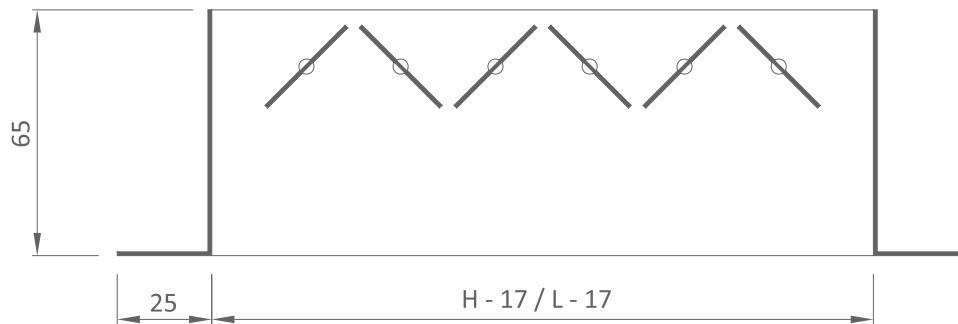


## SPECIAL ADAPTERS (FOR ST-Z-STR OR INDIVIDUAL ASSEMBLY)

L – nominal length of the frame, H – nominal height of the frame

## ST-E-G G ADAPTER

counter-current air flow regulation with coupled blades



## EXEMPLARY ORDER

**NAS/S - 75 x 325 - 0 0 0**

Size H x L

Adapter type

## EXPANSION BOXES

### Expansion Box

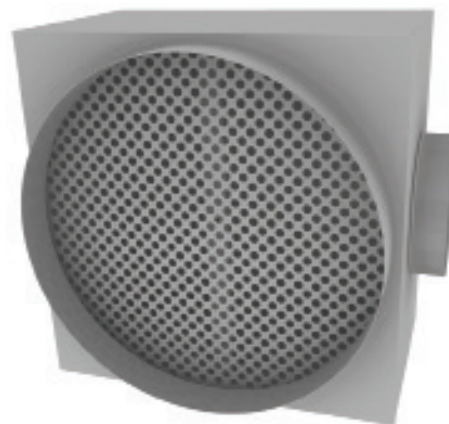
#### SIZES

When ordering an expansion box, specify the type and dimension of the product to be installed in it. Dimensions of the box will be selected appropriately.

#### CONSTRUCTION

Expansion boxes are made of galvanised plate. Expansion boxes for ceiling air inlet valve, vent strips, and ST-DVL/R inlet valve are manufactured with bent bottom edge to allow for installation. Expansion boxes for ST-DVW and ST-DRW rotational air inlet valves are manufactured without such bend, while the bottom edge is furnished with a seal. Furthermore, boxes for ST-DRW air inlet valves have an element adjusting to round air inlet vent.

Inside the boxes for rotational air inlet valves in the inlet version, there is a plate of perforated plate to break air stream. Inside the boxes for slot air inlet valves, there are bars to allow for air inlet valve assembly and straightening bars. Air is supplied to such boxes horizontally.



#### OPTIONAL EQUIPMENT

Expansion boxes can be ordered with a traverse installed inside, which is necessary for affixing the air inlet using a central screw.

It is also possible to install a plate of perforated plate at any box to break the air stream.

Expansion boxes can be furnished with a damper of perforated plate to regulate air flow intensity. Damper opening is regulated manually, using a handle (it is necessary to disassemble the inlet) or with a pull-rod (it is possible to lead it out via slots outside the inlet).

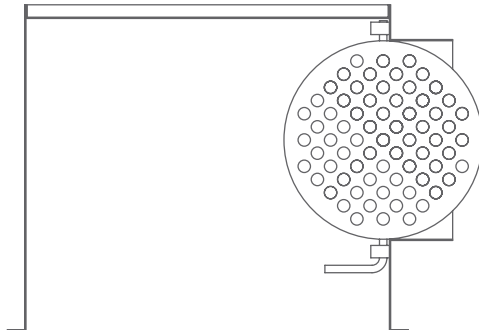
Inside the expansion box, it is possible to apply acoustic insulation of wool with cleantec of 20 [mm] thickness, or of armaxflex AF with the thickness of 9 [mm]. When ordering, optionally specify insulation symbol.

It is also possible to manufacture the box in the telescopic version (with an assembly frame riveted from inside to the box without bends). This allows for frame assembly, eliminates differences in ceiling thickness and inaccurate location. The height of the telescope (assembly frame) must be specified when ordering (standard 80 [mm]). Due to the method of air supply, expansion boxes are made in two variants: with horizontal or vertical air supply.

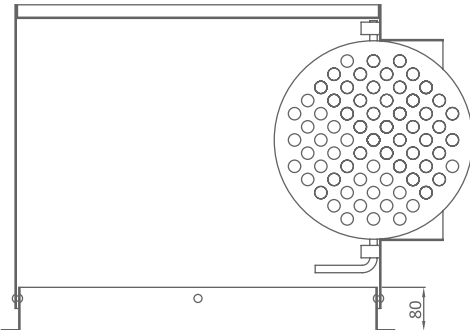


## EXPANSION BOX

STANDARD

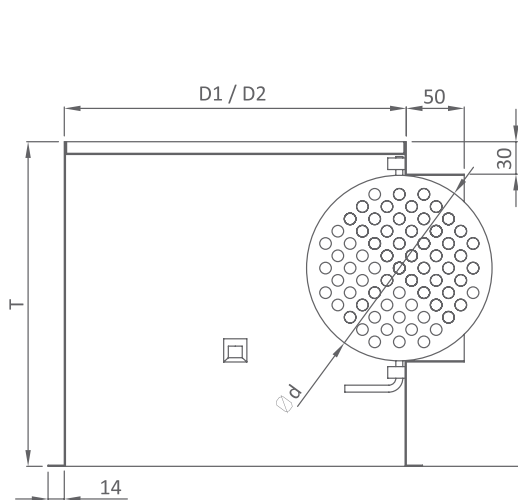


TELESCOPIC

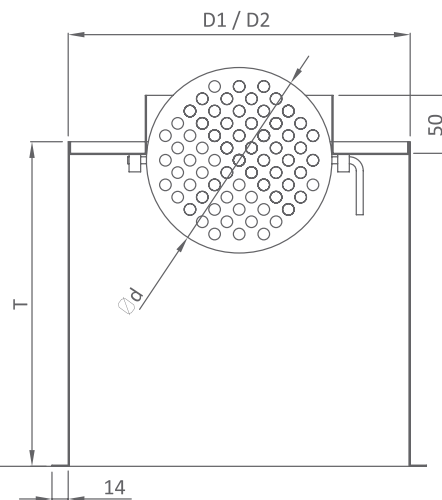


## VERSIONS OF AIR SUPPLY

WITH HORIZONTAL AIR SUPPLY



WITH VERTICAL AIR SUPPLY



## SIZES OF EXPANSION BOXES

FOR AL-DV , ST-DV , ST-DVA

SIZE	D1	D2	T	ø d
	[mm]			
1	204	204	270	158
2	260	260	270	158
3	316	316	330	198
4	372	372	330	198
5	428	428	380	248
6	457	457	380	248
7	557	557	430	313
8	582	582	430	313



## FOR ST-DVS , AL-DVS

SIZE H/L		D1	D2	T	ø d
[mm]					
<b>208</b>	371	206	369	270	158
	471	206	469	270	158
	571	206	569	270	158
	671	206	669	270	158
	871	206	869	270	2x158
	1071	206	1069	270	2x158
	1271	206	1269	270	2x158
<b>264</b>	471	262	469	330	198
	571	262	569	330	198
	671	262	669	330	198
	871	262	869	330	2x198
	1071	262	1069	330	2x198
	1271	262	1269	330	2x198
<b>320</b>	571	318	569	330	198
	671	318	669	330	198
	871	318	869	330	2x198
	1071	318	1069	330	2x198
	1271	318	1269	330	2x198
<b>376</b>	671	374	669	380	248
	871	374	869	380	248
	1071	374	1069	380	248
	1271	374	1269	380	2x248
<b>432</b>	871	430	869	380	248
	1071	430	1069	380	2x248
	1271	430	1269	380	2x248
<b>462</b>	462	460	460	380	248
	962	460	960	380	2x248
<b>562</b>	562	560	560	430	313
	1162	560	1160	430	2x313
<b>587</b>	587	585	585	430	313
	1212	585	1210	430	2x313



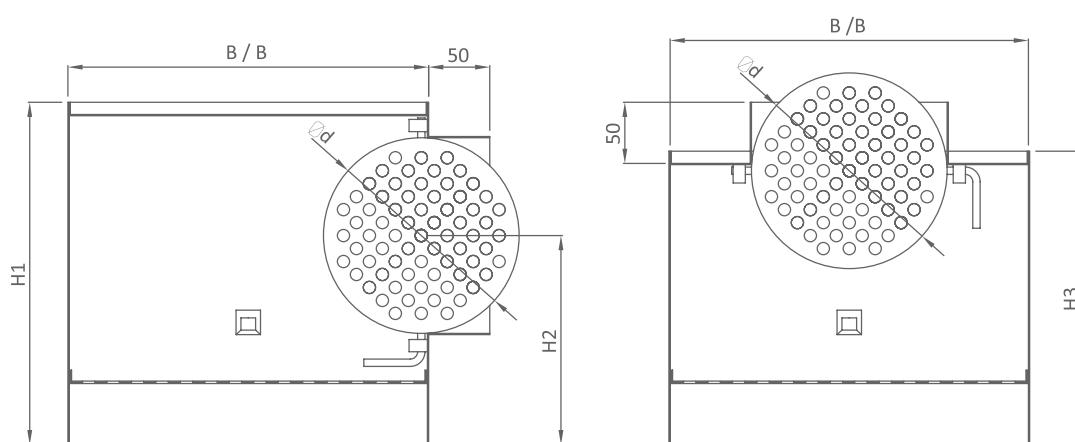
FOR VENT STRIPS AND ST-DVL

SIZE H/L	D1	D2	T	ø d	
[mm]					
<b>125</b>	225	120	220	270	158
	325	120	320	270	158
	425	120	420	270	158
	525	120	520	270	158
	625	120	620	270	158
	825	120	820	270	2x158
	1025	120	1020	270	2x158
	1225	120	1220	270	2x158
<b>225</b>	225	220	220	270	158
	325	220	320	270	158
	425	220	420	270	158
	525	220	520	270	158
	625	220	620	270	158
	825	220	820	270	2x158
	1025	220	1020	270	2x158
	1225	220	1220	270	2x158
<b>325</b>	325	320	320	330	198
	425	320	420	330	198
	525	320	520	330	198
	625	320	620	330	198
	825	320	820	330	2x198
	1025	320	1020	330	2x198
	1225	320	1220	330	2x198
<b>425</b>	425	420	420	380	248
	525	420	520	380	248
	625	420	620	380	248
	825	420	820	380	2x248
	1025	420	1020	380	2x248
	1225	420	1220	380	2x248
<b>525</b>	525	520	520	430	313
	625	520	620	430	313
	825	520	820	430	2x313
	1025	520	1020	430	2x313
	1225	520	1220	430	2x313

FOR ST-DR (ROUND EXPANSION BOX IS MANUFACTURED)

SIZE	$\varnothing D$	T	$\varnothing d$
	[mm]		
1	204	270	158
2	261	270	158
3	314	330	198
4	371	330	198
5	427	380	248

FOR ST-DVL/R



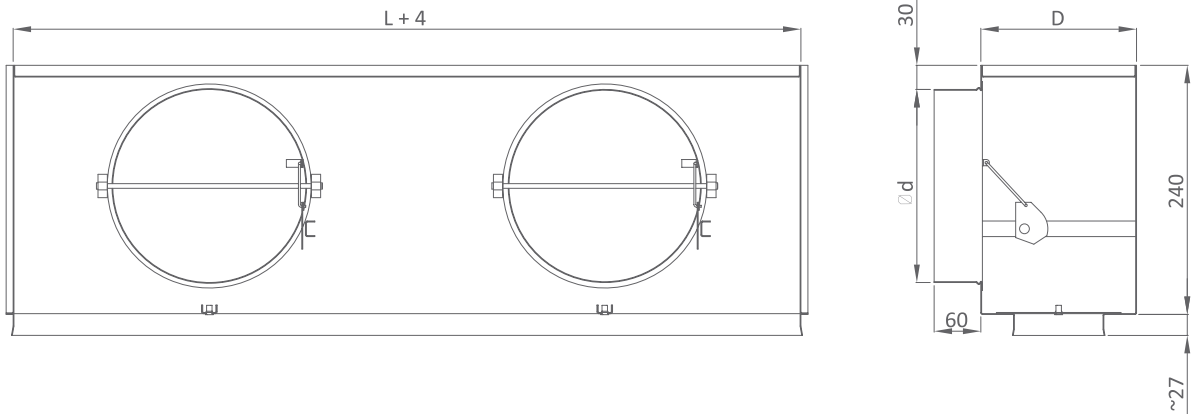
SIZE	B	H1	H2	H3	$\varnothing d$
[mm]					
377	369	500	325	300	250
505	497	560	358	350	315
569	561	600	375	370	355
633	628	650	400	390	400
761	753	700	425	420	450
1017	1009	810	480	470	560

FOR ST-DVW AND ST-DRW

SIZE	B	H1	H2	H3	$\varnothing d$
[mm]					
300	295	280	170	240	160
400	395	320	190	280	200
500	495	320	190	280	200
600	595	370	215	330	250
625	620	370	215	330	250



## FOR AL-SN



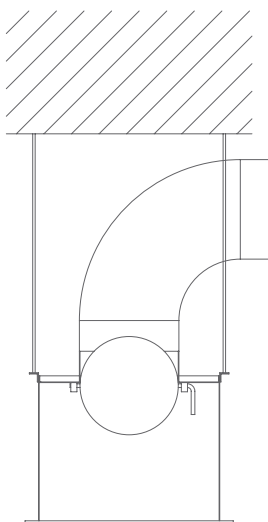
AIR INLET VENT	h [mm]	H [mm]
AL-SN-4	133	223
AL-SN-3	100	190
AL-SN-2	67	157
AL-SN-1	34	124

LENGTH[MM]	AL-SN-1	AL-SN-2	AL-SN-3	AL-SN-4
900	1-100	1-100	2-125	2-160
1200	1-125	2-125	3-125	2-160
1500	2-125	3-125	3-125	3-160

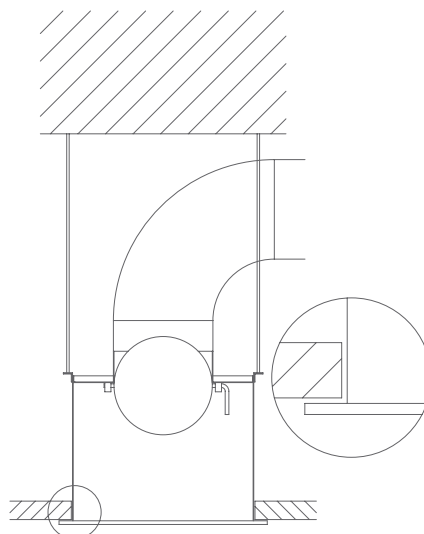
## ANCHORAGE

Expansion boxes can be installed:

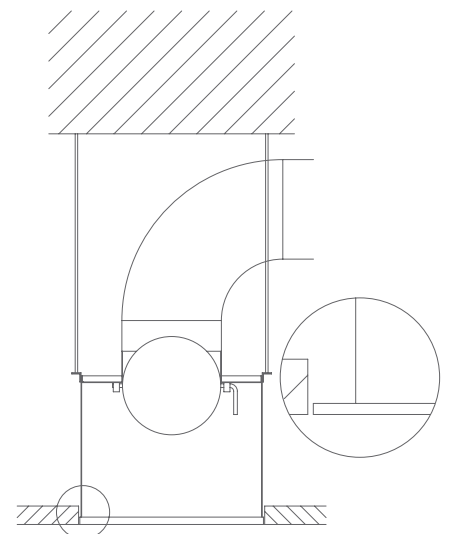
FREE-STANDING



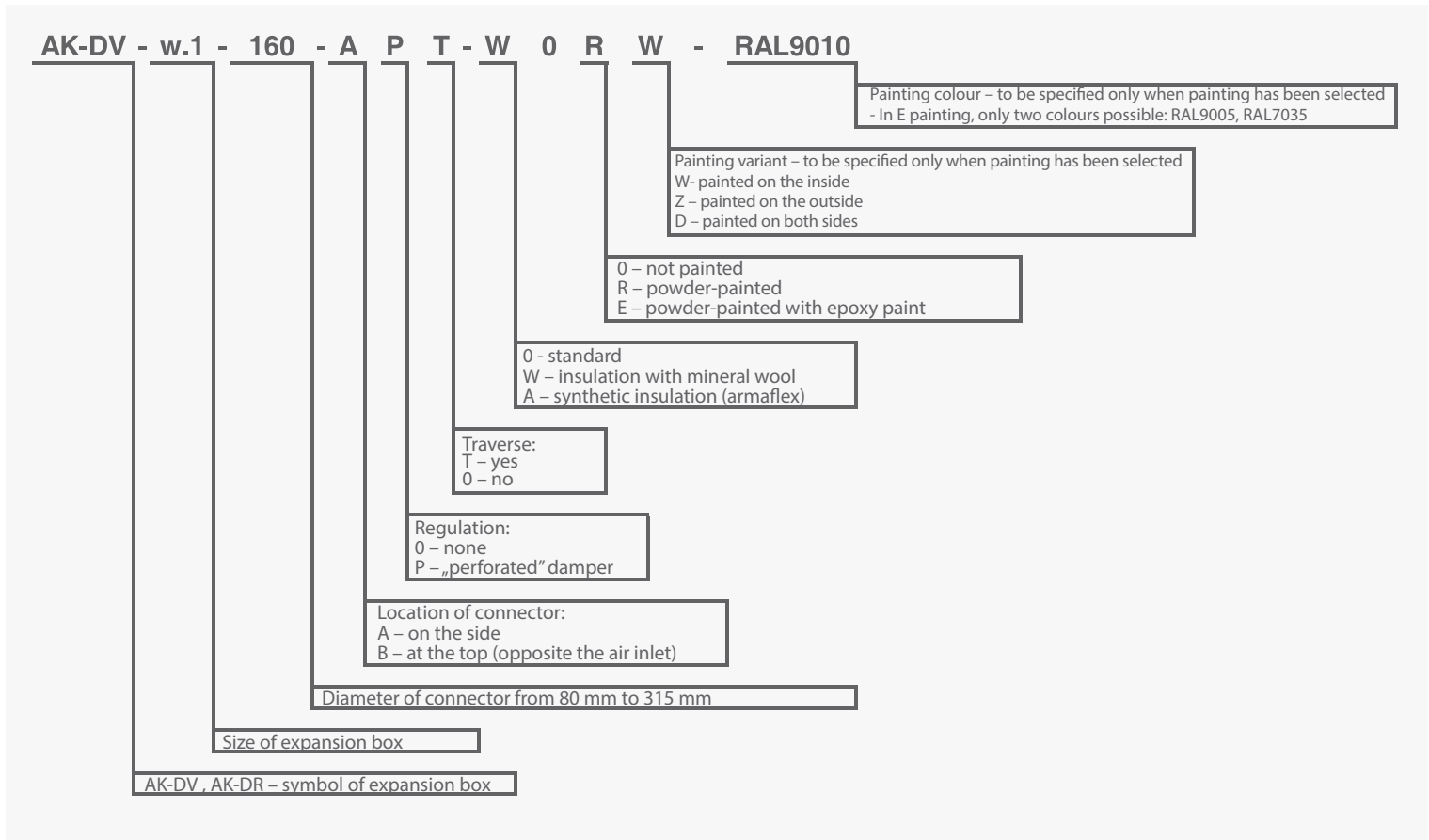
TO THE CEILING SURFACE



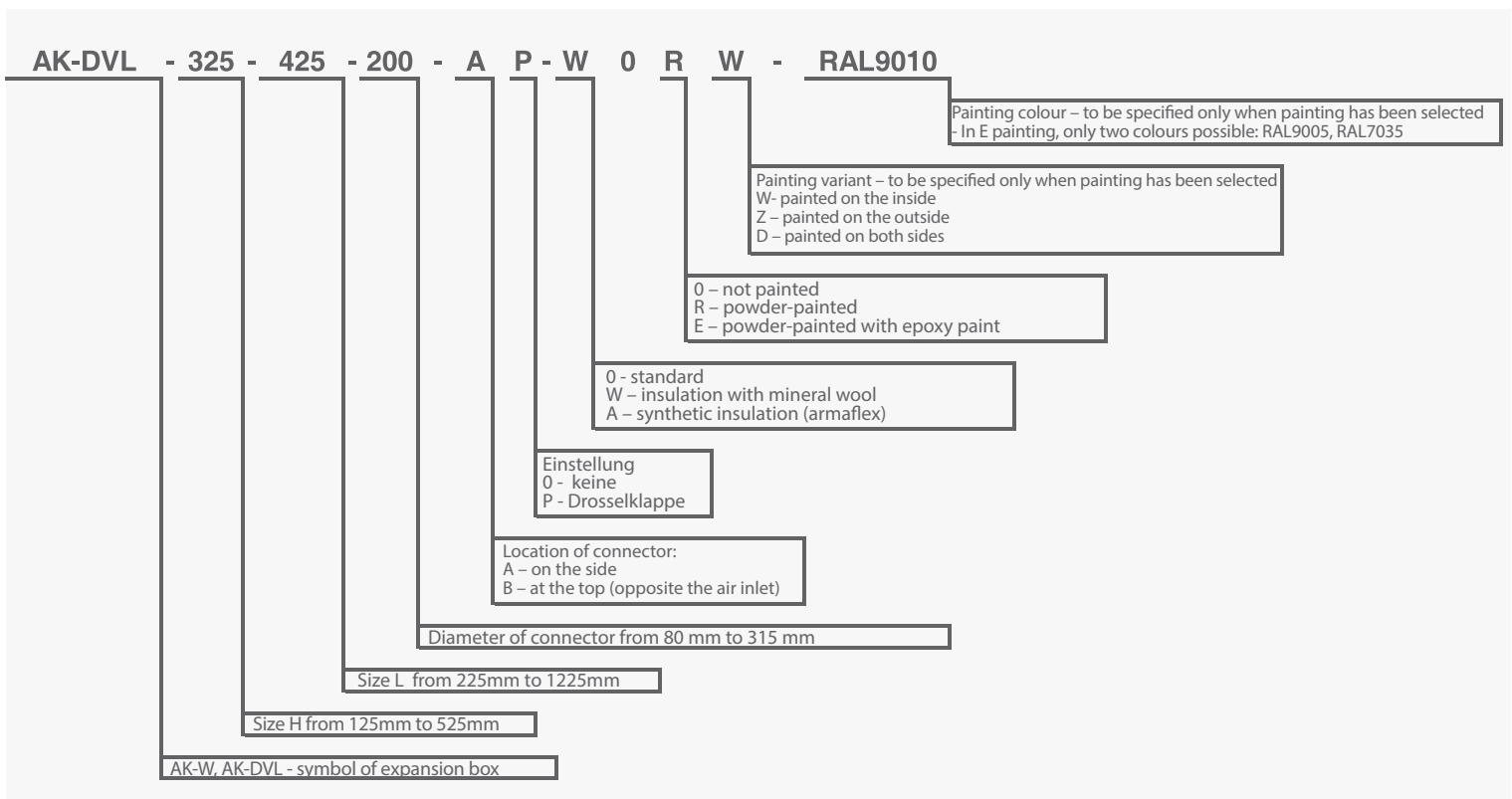
WITHIN THE CEILING



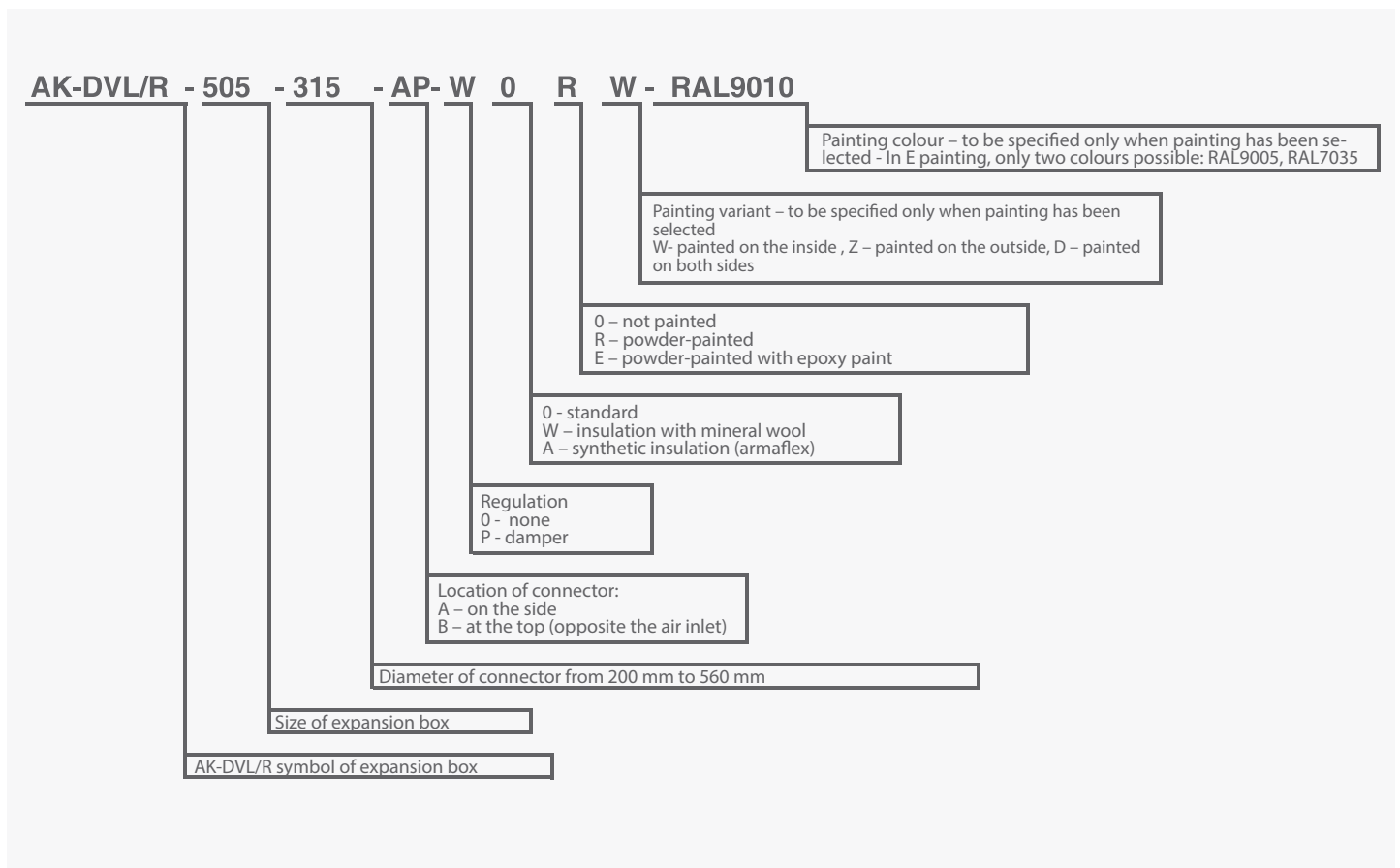
## EXEMPLARY ORDER FOR EXPANSION BOX TYPE AK-DV, AK-DR



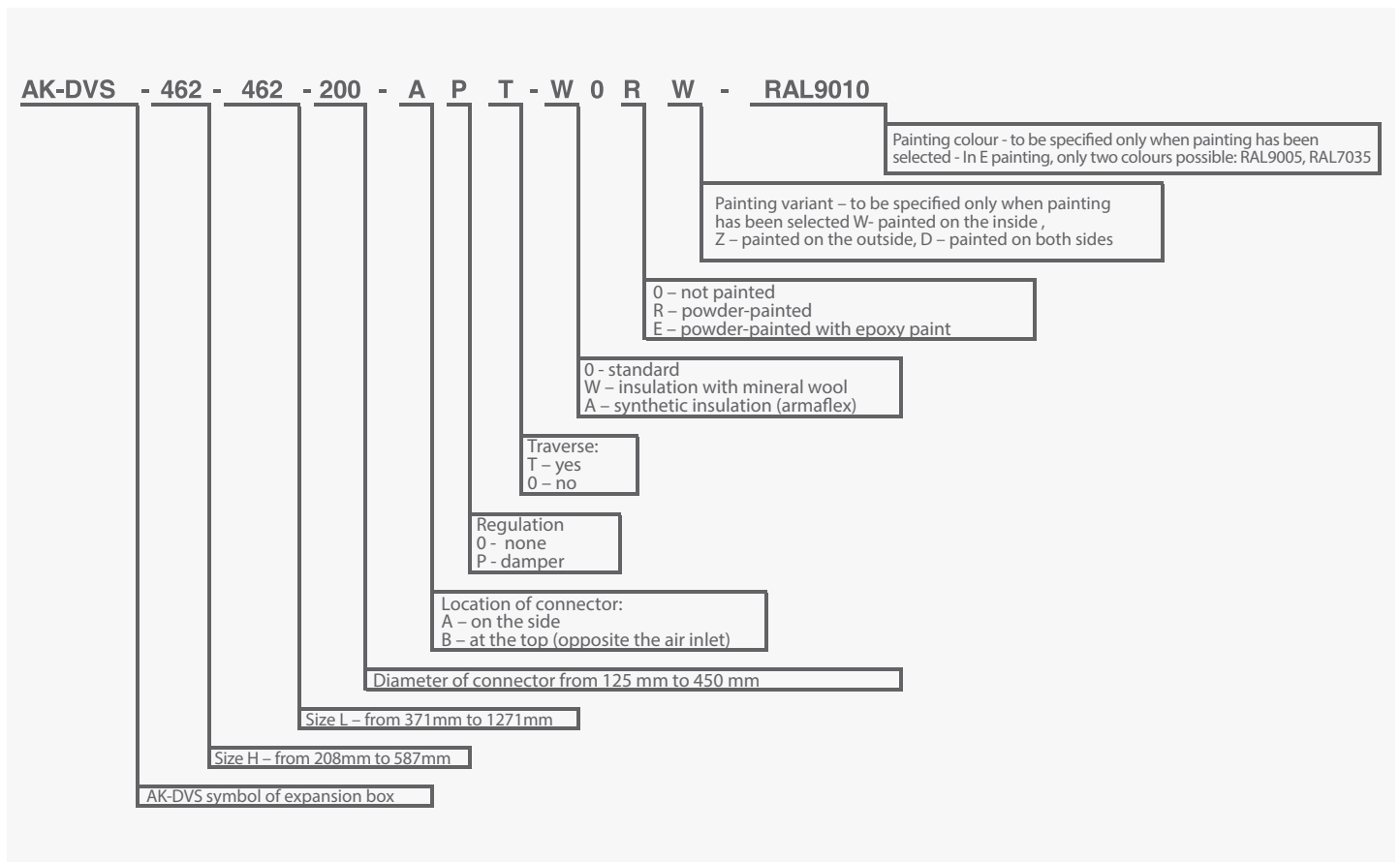
## EXEMPLARY ORDER FOR EXPANSION BOX TYPE AK-DVL, AK-W



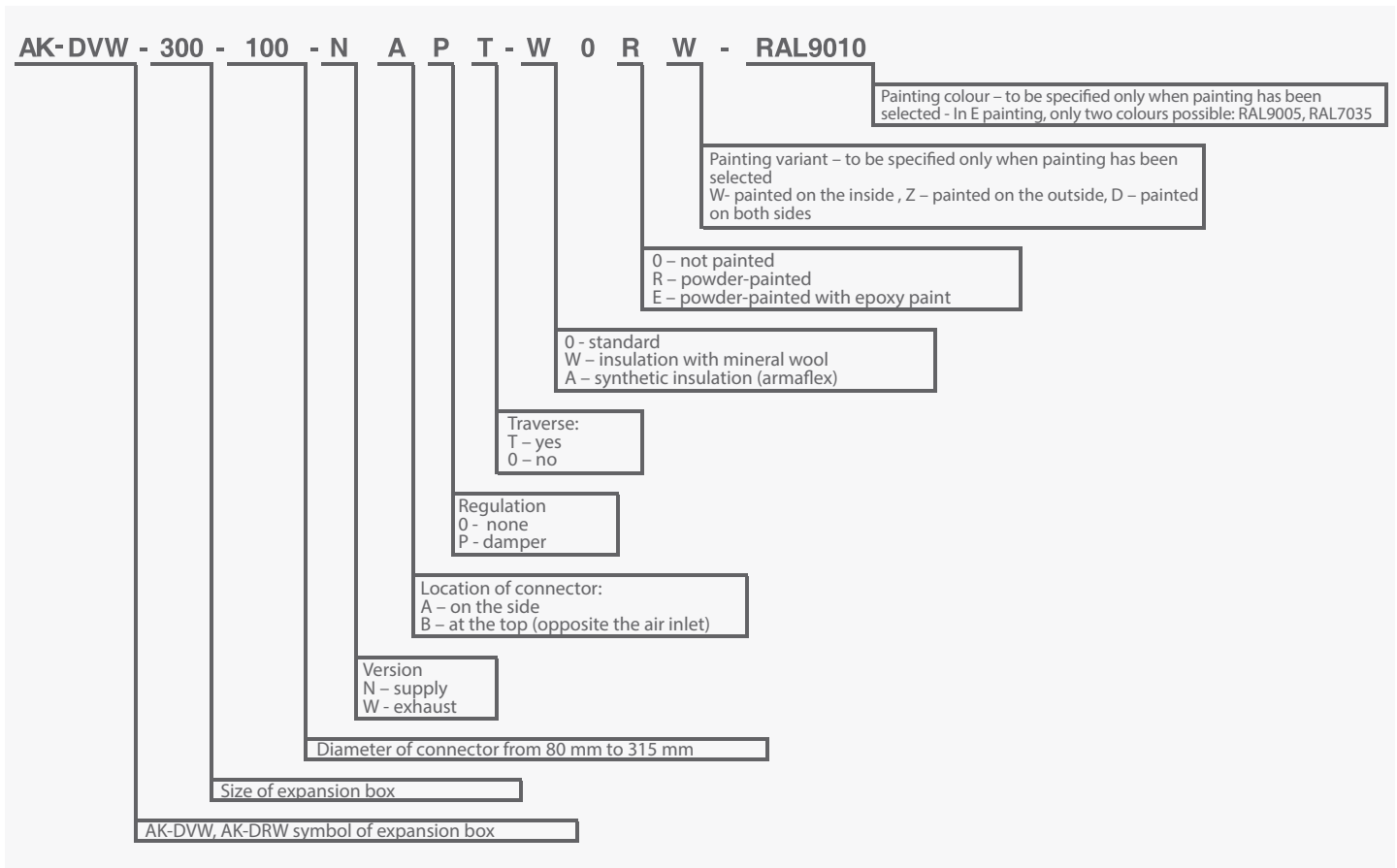
## EXEMPLARY ORDER FOR EXPANSION BOX TYPE AK-DVL/R



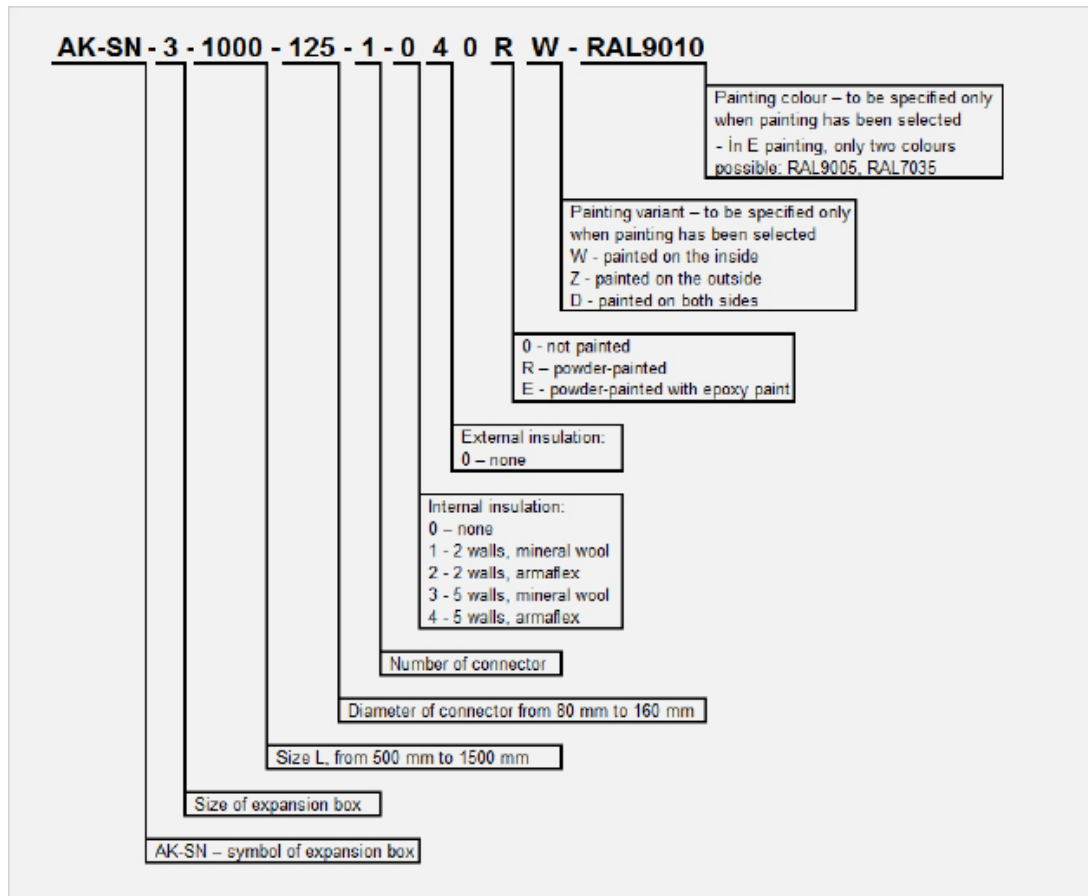
## EXEMPLARY ORDER FOR EXPANSION BOX TYPE AK-DVS

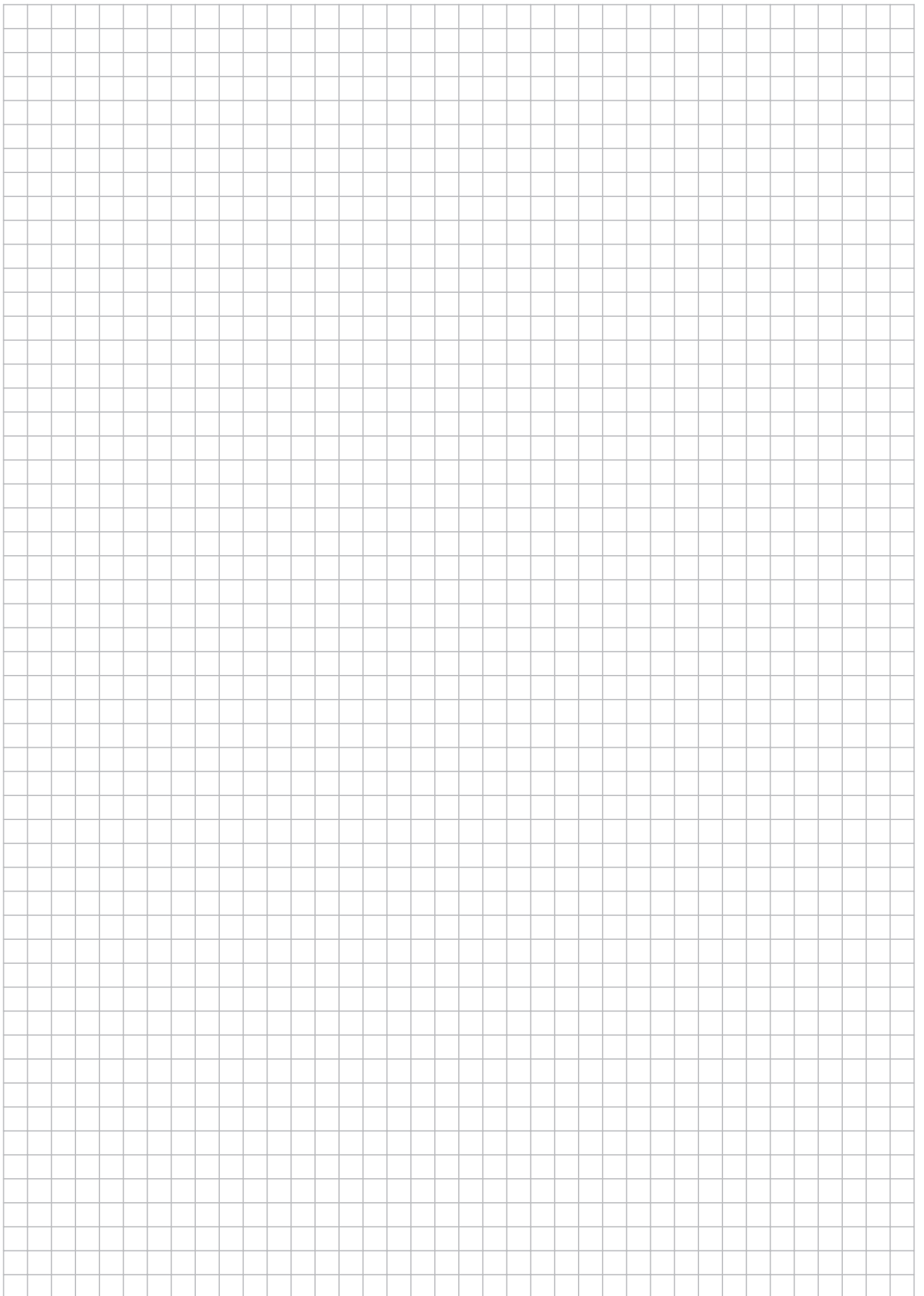


## EXEMPLARY ORDER FOR EXPANSION BOX TYPE AK-DVW , AK-DRW

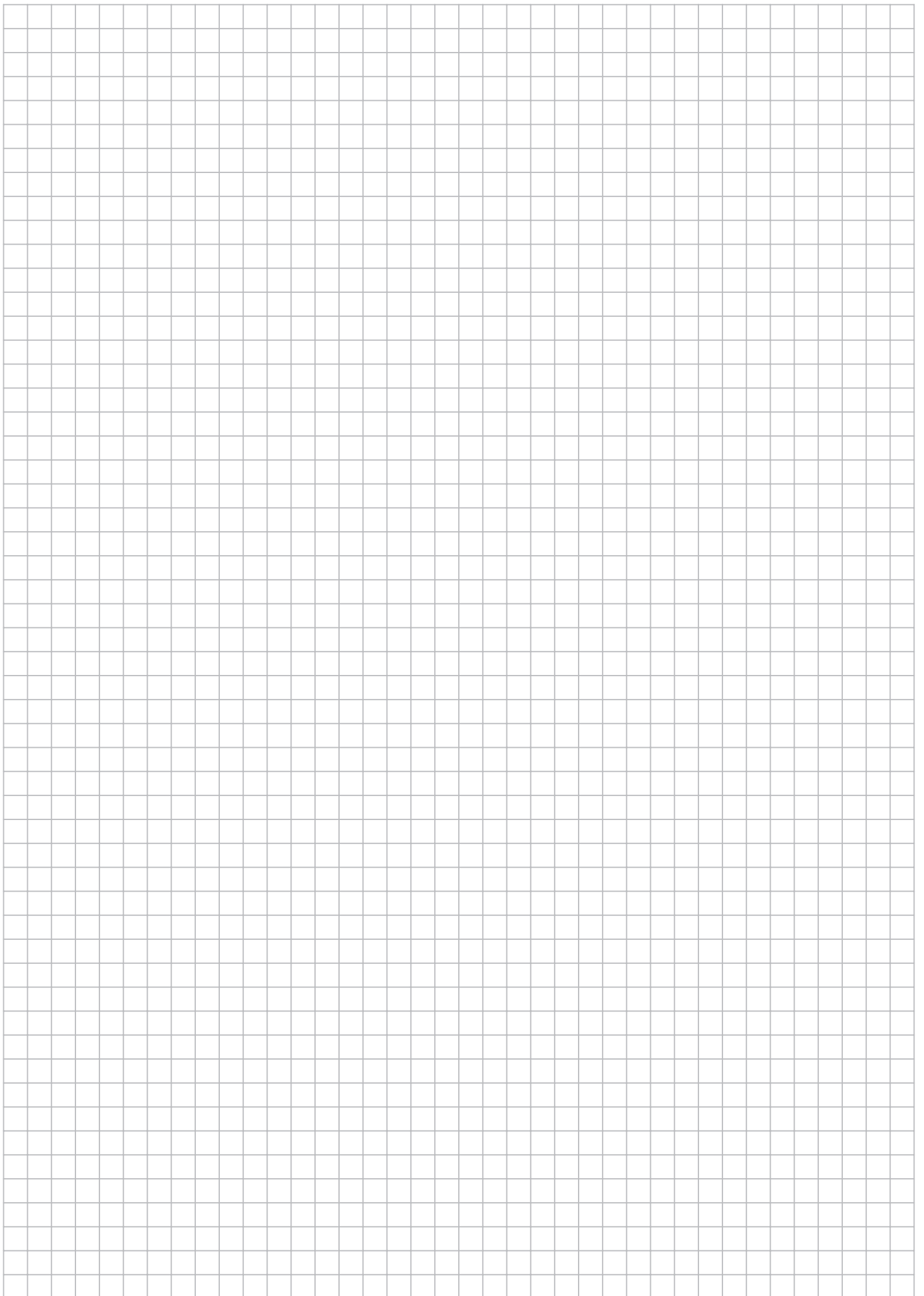


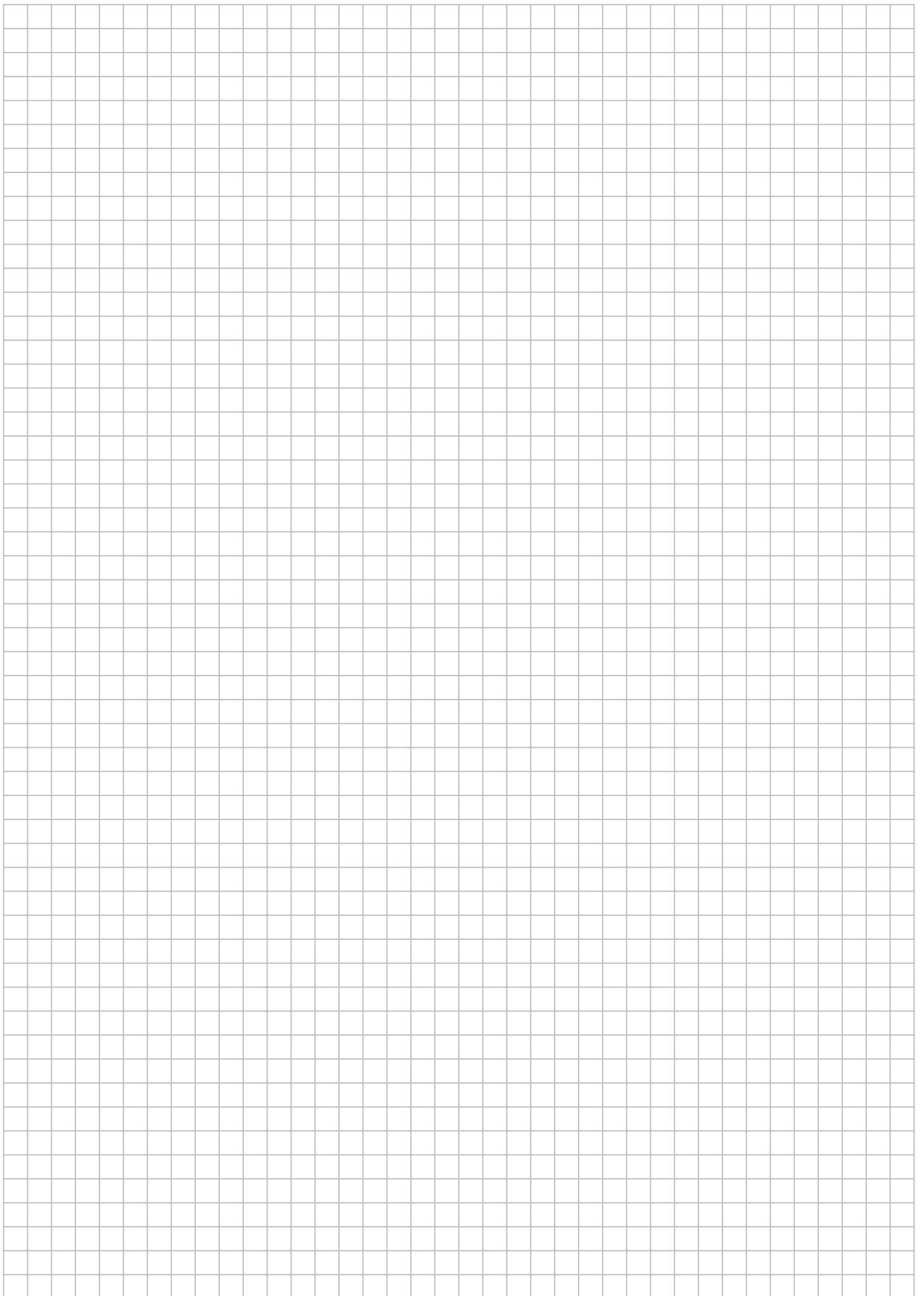
## EXEMPLARY ORDER FOR EXPANSION BOX TYPE AK-SN

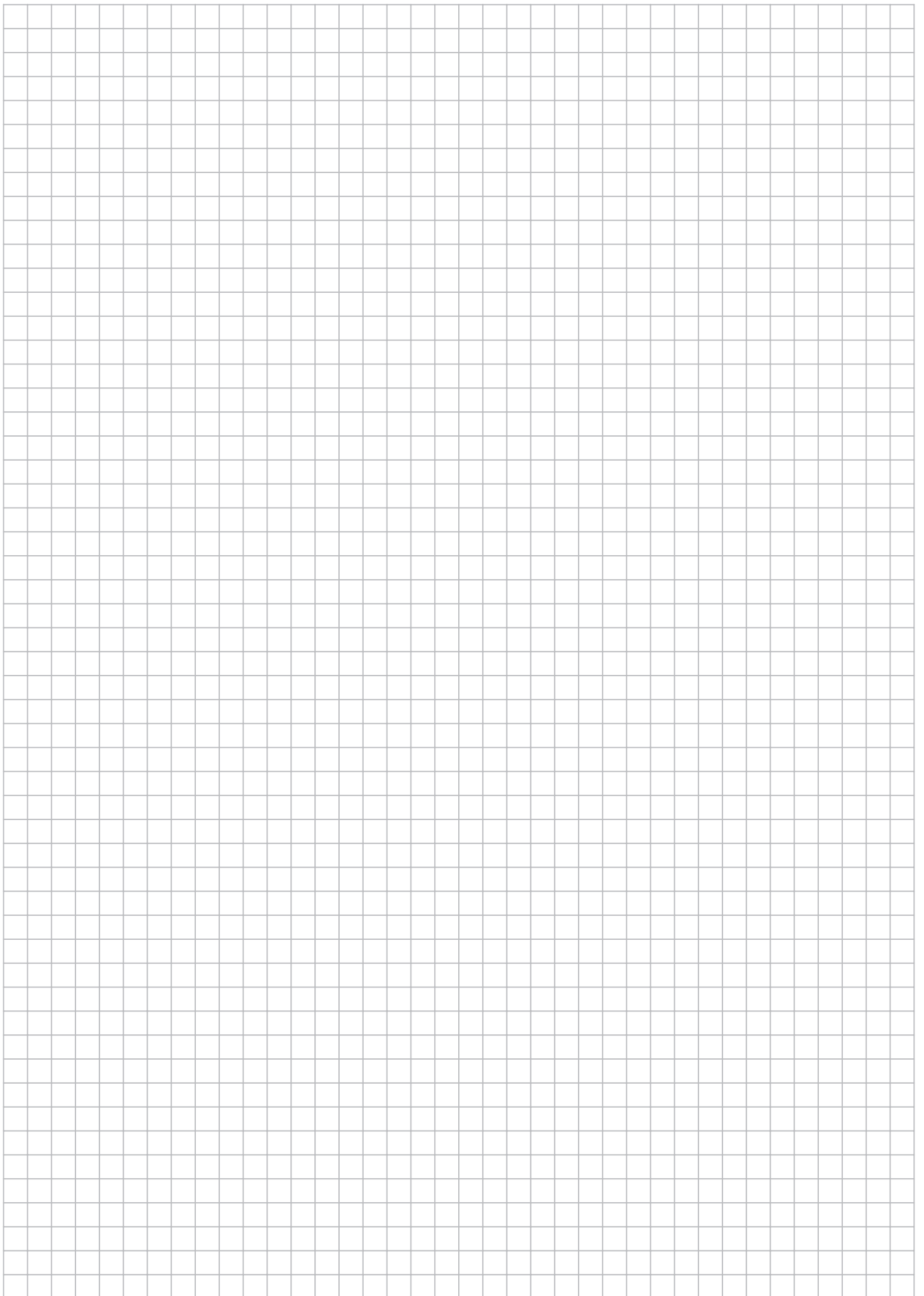














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