REMAK

CATALOGUE 10/2008

Duct units

Vento SYSTEM

Introduction

Vento duct air handling units are manufactured in accordance with valid Czech and European regulations and technical standards.

- Vento duct air handling units must be installed and used only in accordance with this documentation.

The manufacturer is not responsible for any damages resulting from use other than intended, and the customer bears the risks of such use.

- The installation and operating documentation must be available for the operating and servicing staff.

It is advisable to store this documentation close to the Vento unit.

- When handling, installing, wiring, commissioning, repairing or servicing the Vento duct air handling units, it is necessary to observe valid safety rules, standards and generally recognized technical rules.
- **In particular, it is necessary to use personal protective work aids (e.g. gloves) because of sharp edges and corners when performing any handling, installing, dismounting, repairing or checking of Vento duct units. All device connections must comply with the respective safety standards and regulations.**
- Any changes or modifications to individual components of the Vento system which could affect its safety and proper functioning are forbidden.
- Before installing and using the Vento air handling units, it is necessary to familiarize yourself with and observe the directions and recommendations included in the following chapters.
- The Vento duct air handling units, including their individual parts, are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for the proper selection and dimensioning of components concerning their suitability for a given application. The installation and commissioning may be performed only by an authorized company licensed in accordance with generally valid regulations.
- When disposing of components and materials, it is necessary to observe the respective environmental protection and waste disposal regulations. In case of final device liquidation, it is necessary to follow the policy of differential waste disposal. We recommend metal parts be scrapped and other parts be disposed of in accordance with separated waste regulations.
- Further information can be found in the AeroCAD planning software.

Up-to-date version of this document is available at website www.remak.eu

Duct units Vento

October 2008

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Fan Use

Fully controlled, low-pressure RP radial fans intended for the square duct can be universally used for complex air-conditioning, from simple venting installations to sophisticated air-handling systems. Ideally, they can be used along with other components of the Vento modular system which ensure inter-compatibility and balanced parameters.

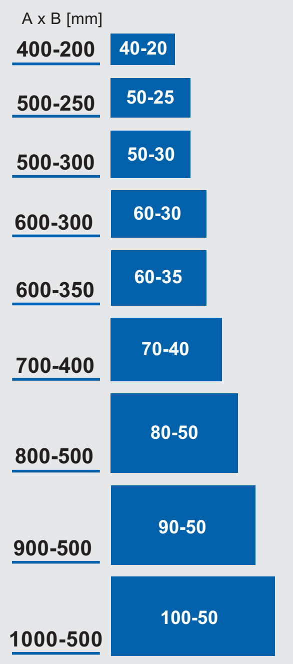
Operating Conditions, Position

These fans are designed for indoor applications. Outdoor applications are possible providing sufficient roofing is ensured. They are designed to transport air without solid, fibrous, sticky, aggressive, respectively explosive impurities. For outdoor applications it is necessary to finish the fans with a protective coating (except rating plates). The transported air must be free of corrosive chemicals or chemicals aggressive to zinc and/or aluminium. Acceptable temperature of transported air can range from -30 °C to +55 °C, and with types RP 40-20/20 up to +70 °C. The maximum nominal values for each fan are included in table 6. The RP fans can work in any position. When positioned under the ceiling, it is advisable to situate the fan with the motor cup directed downwards to ease access to the motor terminal box. However, if the transported air is oversaturated with moisture or if the risk of intensive steam condensation inside the fan exists, it is better to situate the fan's cup upwards.
We recommend adding a 1-1.5 m long piece of straight duct to the fan's outlet to reduce pressure losses in an assembly.

Dimensional Range

RP fans are manufactured in a range of nine sizes according to the A x B dimensions of the connecting flange. Several fans differing in the number of motor poles are available for each size. When planning the fan for the required air flow and pressure, the following general rule is applied; the lager fans with higher number of poles reach the required parameters at lower RPM, which results in lower noise and longer service life. Fans with higher number of poles also have lower air velocity in the cross section, which results in lower pressure losses in the duct and accessories, however, at higher investment costs. The standard dimensional and performance range of single-phase and three-phase RP fans enables the designers to optimize all parameters for air flow up to 11,730 m^3 per hour.

Fig. 1 - Dimensions



Materials

The external casing and connecting flanges of RP fans are made of galvanized steel sheets (Zn 275 g/m2). Impeller blades - with forward curved blades and diffusers - are made of galvanized sheet steel while motors are made of aluminium alloys, copper and plastics. All materials are carefully verified and checked so they ensure long service life and reliability of the fans.

Impellers

After connecting the fan with a three-phase motor to the power supply, the proper direction of the impeller rotation must be checked. The inspection opening on the motor cup is sealed with a rubber plug. The RP fans' impellers rotate always to the left, i.e. counter clockwise (looking through the inspection opening on the motor cup). Impellers along with the motor are perfectly statically and dynamically balanced.

Motors

Compact single-phase and three-phase asynchronous motors with an external rotor and a resistance armature are used as drives. The motors are situated inside the impeller, and during operation are optimally cooled by the flowing air. The motor's high quality enclosed ball bearings with permanent lubricating filling enable the fans to reach a service life above 40,000 operating hours without maintenance. The motor electric protection degree is mostly IP 54 for RP 40-20 and IP 44 for RP 50-25 with F insulation class. The motor windings are impregnated to provide them with additional protection against moisture. The motors feature low build-up current.

Electrical Equipment

Single-phase motors are equipped with a starting capacitor which is mounted on the fan casing. The wiring is terminated in a terminal box of IP 54 protection degree. For wiring diagrams, refer to the section "The Wiring".
Warning: Three-phase motors must be connected in accordance with the data stated in the section "Technical Data", respectively on the motor rating plate.

Motor Protection

As standard, permanent monitoring of the internal motor temperature is used in all motors. The limit temperature is monitored by thermal contacts (TK-thermo-contacts) situated in the motor winding. The thermo-contacts are miniature thermal tripping elements which after being connected to the protective contactor circuit protect the motor against overheating (damage) due to phase failure, forced motor braking, current protection circuit breakdown or excessive temperature of transported air. Thermal protection by means of thermo-contacts is comprehensive and reliable providing they are correctly connected. This type of protection is essential especially for speed controlled and frequently started motors and motors highly thermally loaded by hot transported air. Therefore, the fan motors cannot be protected by conventional thermal protection ensured by the motor overcurrent protective elements!

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Maximum thermo-contact permanent loading is 1.2 A at 250V / 50V (cos φ 0.6), (respectively 2 A at cos φ 1.0)

Fan Output Control

The output of all RP fans can be fully controlled by changing the speed. The fan's speed is changed depending on the voltage at the motor terminals. The fan parameter tables contain voltage controllers corresponding to each fan. Generally, several types of control can be used with fans. However, voltage control is the most suitable for RP fans.

Five Stage Voltage Control (Transformer)

Voltage control of single-phase and three-phase RP fans is the most suitable, technically as well as operationally. There is no interference, humming, squeaking or vibration of the motor.
RP fans can be steplessly controlled providing the change in voltage is stepless. In practice, stage voltage controllers are usually used. TRN stage voltage controllers can control the fan output in five stages in 20% steps, refer to Table 1 showing the correlation between the input voltage and selected stage of the controller for single-phase and three-phase motors.
RP fan motors can be operated within a range of approx. from 25% to 110% of the rated voltage. All values respect the 400/230 V power supply system. The range of TRN controllers is intended to control the speed, respectively output, of all Vento fans. The possibility of remote control (by manual switch or by a switch in the control unit, respectively by automatic switching of five stages based on the external control signal of 0 - 10V from the OSX control unit) is a significant feature of this product line.

Table 1 - the input voltage and controller's stage

Motor type	Curve characteristics – controller's stage				
	5	4	3	2	1
single-phase	230 V	180 V	160 V	130 V	105 V
three-phase	400 V	280 V	230 V	180 V	140 V

This product line includes single-phase and three-phase TRN controllers. These controllers cover every type of Vento fan.
Simplified TRR controllers can also be used; however, they do not provide protection function.

Stepless Electronic Control

Stepless electronic voltage control of the output is offered only with single-phase fans. The disadvantage of electronic control provided by PE 5 controllers is greater warming of motors. A partial disadvantage is also the fact that the designer does not have the possibility to exactly define for the user the stage of required output related to the load of the ventilated space. Stepless control can be provided by means of frequency inverters, which can be delivered on request.

Accessories

RP fans belong in the wide range of Vento modular venting and air-handling system components. Any air-handling set-up, from simple venting to sophisticated comfortable air-conditioning, can be created by selecting suitable elements. Universal duct RP fans can be used along with a wide range of elements and accessories:

- KFD Bag Filters and KF3, KF5, KF7 Filter Inserts
- VFK Insert Air Filters and VF3 Filter Inserts
- DV Elastic Connections
- LKR, LKS, LKSX, and LKSF Regulating and Closing Dampers
- PK Pressure Dampers
- PZ Louvers
- TKU Splitter Attenuators
- VO Water Heaters
- SUMX Mixing Sets
- EO, EOS, EOSX Electric Heaters
- CHF Direct Coolers
- CHV Water Coolers
- HRV Plate Heat Exchangers
- SKX Circulating Air Mixing Chambers
- Control Units and NS Sensors
- TRN Controllers, their controls, TRR and TRRD Controllers
- STE, STD Protecting Relays

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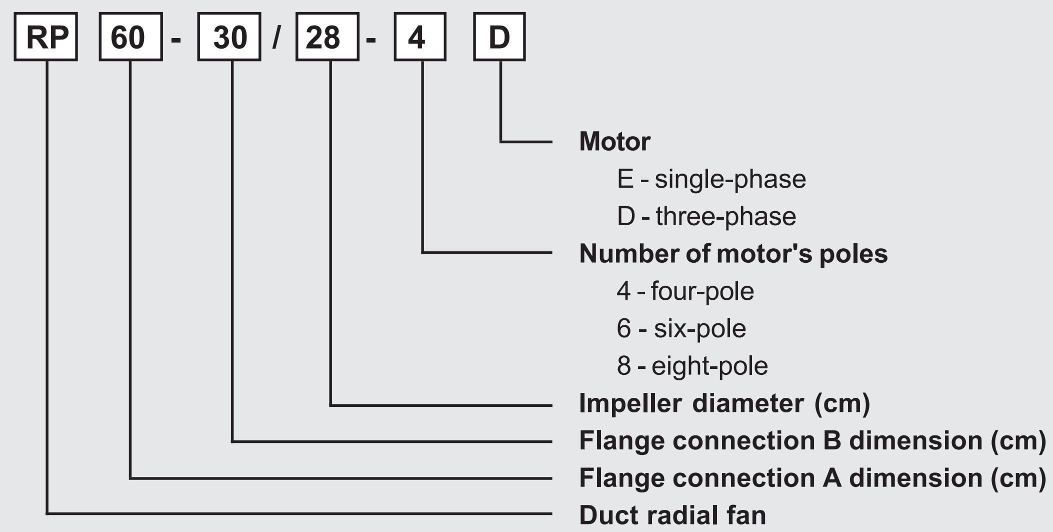
Fan Description and Designation

The key for type designation of RP fans in projects and orders is defined in figure # 2.

For example, type designation RP 60-30/28-4D specifies the type of fan, impeller and motor..

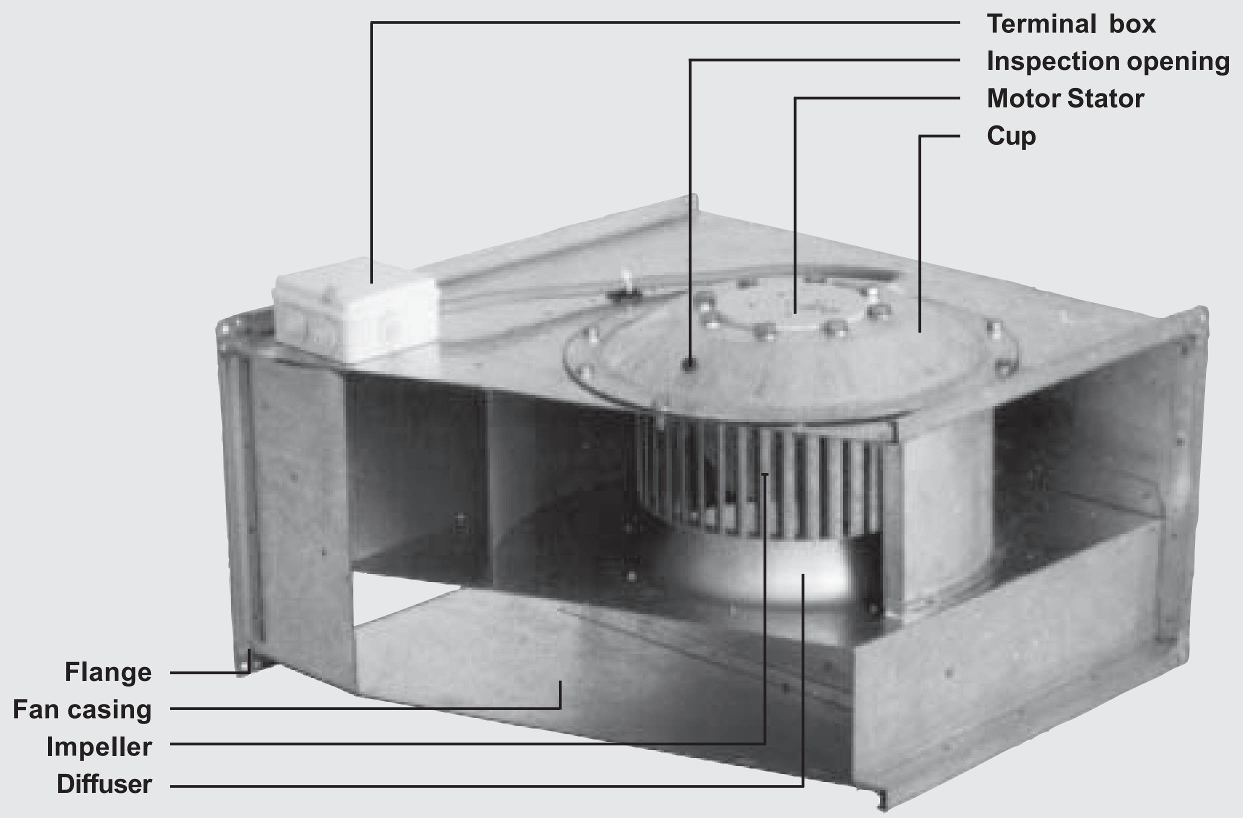
Figure 2 - Type designation of RP fans



The duct Vento RP radial fans are designed to be installed in a duct line or into the assembly of other Vento System air-handling elements. The Vento RP fan design is perfectly functional.

The most used names of the fan's individual parts and structure assemblies are defined on the fan's sectional view (see figure # 3).

Figure 3 - RP Fan Sectional View

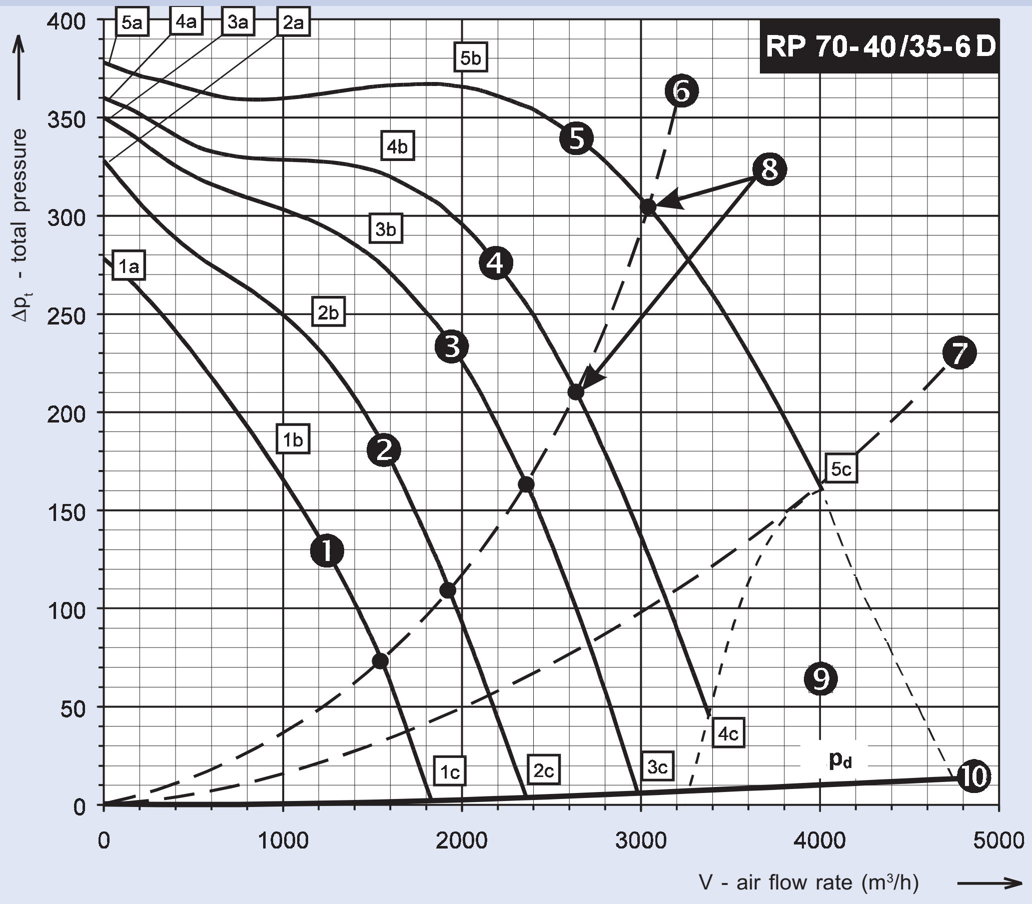


Technical Information

Operating Characteristics

The output characteristics of RP fans are measured in the most modern testing laboratory for aerodynamic and electric measurements of fans and pressure losses of passive elements. The Remak testing laboratory complies with EN 24 163 and AMCA STANDARD 210-74 Standards. The following text explains the relationships and correlation between important data contained in the "Data Section" of the catalogue.

Graph 1



Output characteristics in the "Data Section" starting on page 12 determine the relationship curve of the air flow rate V (m³/h) and total fan pressure $\Delta p_t = \Delta p_s + p_d$ (Pa). The example in Graph 1 gives a detailed explanation.
All RP fans are fully controllable, and connected to the TRN controller.
Each output stage set on the controller (stage 5, 4, 3, 2, and 1) corresponds to one of the characteristic curves ❺❹❸❷❶. If no controller is connected to the fan, the fan can only be operated in accordance with curve ❺.
The characteristic of the particular duct system has a parabolic map curve of the relation V-Δp_t (e.g. curve ❻).
The effective working point ❽ of the fan - duct system assembly will lie at the intersection of the fan curve corresponding to the selected output stage and the curve of the connected duct system. The output of the fan controlled by changing the voltage is dependent on the load. Therefore, not only are the voltage and speed changed but also the current and input. The tables next to the characteristics in the "Data Section" of this catalogue always include changes in these values for three selected points of each working characteristic, e.g. 5a, 5b and 5c of characteristic ❺.
Some RP fans have a so-called forbidden area. The forbidden (non-working) area ❾ is defined by the dashed lines, and it is marked in the graph when any characteristic ends with point "c", e.g. 5c, which does not lie on the dynamic pressure curve "p_d".
Such fan must not be operated with a free inlet or free outlet; it must always be connected to a duct system of which resistance characteristic, e.g. ❼, does not go through the forbidden area. This fan (if not controlled) must be throttled to the minimum pressure loss ?ps min in accordance with the data tables. If the fan is operated in the forbidden area without being protected by the prescribed method, the motor can be damaged due to electric overloading. If the protection is performed by the prescribed method, the thermo-contacts will activate the protection, and the fan will be stopped. The characteristics give the total pressure Δp_t (Pa). The fan static pressure value Δp_s can be calculated by subtracting the dynamic pressure p_d, which can also be plotted by curve ❿ on the graphs, i.e. $\Delta p_s = \Delta p_t - p_d$.
In the "Data Section" of the catalogue, below each RP fan graph across the entire width of the page you can find a table of fan parameters at selected working points. In this table you can read all important aerodynamic and electric parameters for a selected point.
Points 5a, 4a, 3a, 2a, and 1a are characterized by zero air flow, i.e. inlet is fully throttled. At these points the fan's motor has the lowest input, and it works with almost no load. Working points 5b, 4b, 3b, 2b, and 1b are characterized by the highest efficiency, and therefore it is advisable to select the effective working point in this area of the curve for the fan's operation; which of course is not compulsory because the motor can permanently work in any part of the characteristic marked by a solid line, i.e. a - c. Working points 5c, 4c, 3c, 2c, and 1c are characterized by maximum load of the motor and the highest air flow, and if the fan has no forbidden area then these points lie on curve ❼ (representing pd value) when the fan works with free inlet and free outlet, i.e. Δp_s = 0 Pa.

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As far as the fan's operation, shape of the working characteristic and the fan's state parameters are concerned it makes no difference whether the fan at the particular air flow rate is throttled to the pressure loss ?ps in the inlet or outlet, or whether the pressure loss ?ps is divided. A table showing the most important values is situated next to each fan's characteristic in the "Data Section" of this catalogue (Table 2). These values are also listed on the fan's rating plate.
The meaning of individual lines is as follows:

Table 2 - Fan Parameters

				RP 40-20/20-4D
1 –	Power supply	Y		3 x 400V 50Hz
2 –	Max. electric input	P_{max}	[W]	291
3 –	Max. current (5c)	I_{max}	[A]	0,50
4 –	Mean speed	n	[min^{-1}]	1420
5 –	Capacitor	C	[µF]	-
6 –	Max. working temp.	t_{max}	[°C]	70
7 –	Max. air flow rate	V_{max}	[m^3/h]	1292
8 –	Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	236
9 –	Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
10 –	Weight	m	[kg]	12,8
11 –	Five-stage controller		typ	TRN 2D
12 –	Protecting relay		typ	STD

1 - Value of nominal power supply voltage
2 - Maximum power input of the motor at working point 5c.
3 - Maximum current at nominal voltage at working point 5c.
4 - Mean speed, rounded to tens, measured at working point 5b.
5 - Capacitor capacity with single-phase fans.
6 - Maximum permissible transported air temperature.
7 - Maximum air flow at working point 5c.
8 - Maximum total pressure between points 5a - 5c
9 - Minimum permissible static pressure at point 5c.
10-Total weight of the fan.
11-Recommended fan output controller.
12-Recommended protecting relay of the fan without controller and control unit.

Noise Parameters

Noise parameters are measured in Remak's special acoustic chamber adjacent to the aerodynamic testing laboratory. The method of measurement enables the acoustic parameters to be measured at the selected fan load in accordance with ISO 3743.
The uniform method of evaluation and presentation of noise emissions of air-handling devices has not been constituted yet. Standards in effect allow the use of several methods. The facts mentioned above must always be taken into account when comparing data provided by different manufacturers [2.
To understand the data contained in this catalogue, refer to the following glossary, the description of used measuring methods, and the assessment outline of the measured data.

[2 **Attention! Some manufacturers present their noise parameters at the maximum fan speed area, i.e. at zero air flow rate, where the noise is the lowest. In practice, these values are not applicable.**

Sound Pressure

Sound pressure is the pressure induced by acoustic waves. The waves are a consequence of the noise source's mechanical vibrations, and they are superposed on atmospheric pressure. Sound pressure is directly perceived through the human ear as an effect of acoustic waves at the given observer location. Its value at the measuring site, respectively at the observation site, depends on the distance from the noise source, room size, reflection, acoustic wave absorption capability of insulation materials situated within the source's surrounding, etc. Values of sound pressure [Pa] perceivable by the human ear (from the audibility threshold to the threshold of feeling) lie within the range of several orders, which means that in practice the basic physical unit [Pa] is inapplicable. Therefore, the sound pressure level as a ratio has been implemented in acoustics.

Sound Pressure Level L_P

The sound pressure level, similarly as sound pressure, is a volume criterion at a particular measuring site, respectively observation site. Using this ratio the audible range of acoustic waves (noise, sound, tone, etc.) can be expressed by absolute values around 100 dB, i.e. from 40 dB to 140 dB.

$$L_P = 20 \log \frac{p}{p_0}$$

whrere p_0 is a reference sound pressure $p_0 = 2.10^{-5}$ Pa.

Noise and Noise Level

Noise is a type of acoustic wave. It is characterized by a higher number of non-periodic components and wide spectrum of frequencies.
The ear distinguishes not only noise intensity but also perceives its components depending on the frequency, i.e. components with the same sound pressure level but different frequency are perceived differently. Maximum human ear sensitivity ranges from 3500Hz to 4000Hz while this sensitivity drops in higher and lower frequency areas. Each noise component has its own partial sound pressure level. The total sound pressure level in a given location within the surroundings of the noise source is represented by a one-digit value giving the sound volume in this location which can be calculated from the sound pressure levels of its individual frequency components. For practical purposes, noise measurements are performed in accordance with the ISO 3743 - 2 Standard at frequencies ranging from 45 to 11200Hz. This range is divided into eight parts (octave bands) while the ratio of limiting frequencies is 1:2. Noise-meters are equipped with transmittance filters corresponding to the respective octave bands, while the value measured in a particular octave band is indicated as the mean frequency of the octave band. The above described differences in human physiological sensitivity to noise components of different frequencies can be simulated by so-called "Correcting Weighting A". Basically, it is a correction of the acoustic pressure level measured value within particular octave bands by correction factors set by the standard (for mean frequencies - refer to Table # 3).

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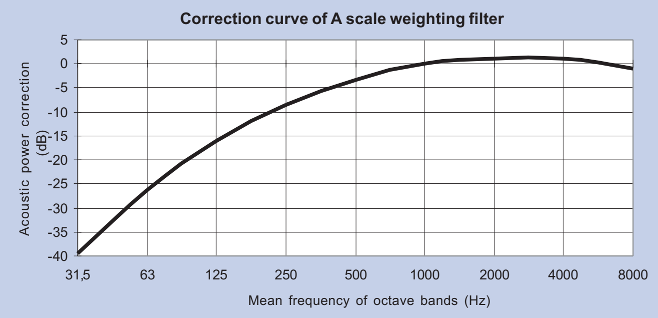
Correction of these measured values is called "Frequency Weighting". Values of the sound pressure in octave bands, corrected by the correction factors for these bands, are expressed as a sound level in octave bands $\mathbf{L_{pA\ okt}}$.
The total sound level $\mathbf{L_{pA}}$ can be calculated from the known values of the sound level in octave bands $\mathbf{L_{pA\ okt}}$

$$L_{PA} = 10 \log \sum_{i=1}^{n} 10^{\left(\frac{L_{PAi\ okt}}{10}\right)}$$

where $L_{PAi\ okt}$ okt is the sound pressure level in the "i" octave band.

Table 3 - Correction factors of A-scale weighting filt

Mean frequency of the octave band	Hz	31,5	63	125	250	500	1000	2000	4000	8000
Correction of the sound power K_{Ai}	dB	-39	-26	-16	-8,6	-3,2	0	1,2	1	-1,1



Sound Power

As mentioned in the preceding section, the sound pressure, sound pressure level and sound level depend on the actual conditions of measuring (distance from the sound source, room size, reflection, acoustic wave absorption capability of insulation materials situated within the source's surrounding, etc). Therefore, these values are not suitable to specify the acoustic properties of the device. The sound power value is used for this purpose; this value specifies the source of acoustic waves, e.g. a fan, independently of the current conditions of the acoustic measurement, and represents the total sound power radiated by the source to its surrounding. The sound power is measured in Watts. The following relationship is valid between sound power and sound pressure

$$W = S \cdot \frac{p^2}{\rho \cdot c}$$

Sound Power Level L_W

Sound power level specifies the source of acoustic waves independently of the environment. Sound power level is defined by the following relationship

$$L_W = 10 \log \frac{W}{W_0}$$

where W_0 is a reference sound power $W_0 = 10^{-12}$ W.

It is necessary to emphasize that the sound power level is not measured but calculated from the measured values of the sound pressure level.
$L_{pA\ okt.}$ and L_{pA} values are measured with noise sources, for example, fans, using noise meters, then the A-scale sound power level, i.e. L_{WA}, can be calculated, which is then used as a value to specify the acoustic properties of the device in question (fan).
In the "Data Section" of this catalogue you can find the L_{WA} value - A-scale sound power level and values L_{WAokt} for individual mean frequencies of octave bands

Measuring Method Used

It is necessary to stress the fact that the values presented by the manufacturer are measured under conditions specified by the standard used. These values cannot express noise conditions in a particular location or room in which the device, for example, fan, is to be installed. The actual sound level depends on many other factors such as the construction-acoustic properties of the room, respectively space, distance from the noise source, room interior furnishing, etc.
When working on a particular project, first it is necessary to familiarize yourself with the method used by the manufacturer to measure presented parameters, then to analyze the location of the device which is the noise source and make a preliminary calculation of the sound level in the place of movement of persons. If unfavourable noise conditions are expected, it is necessary to suggest measures to decrease the sound level.
Eventually, it is advisable to verify the actual sound level on the site, and if necessary suggest additional measures.
The method in accordance with the ČSN ISO 3743 Standard, i.e. technical methodology for reverberant chambers, was used to determine the noise parameters of fans, i.e. sound power level L_{WA}, presented in this catalogue. In accordance with this Standard, the sound pressure levels in octave bands L_{PAokt} were measured, from which the sound power levels in these octave bands L_{WA-okt} were calculated.
In the Data Section of this catalogue you can find, in addition to the characteristic of each fan, the values of sound power level L_{WA} [dB(A)] and L_{WAokt} [dB(A)] for working point 5b on the curve corresponding to nominal voltage, while the sound power presented was calculated from the measurement towards the inlet, outlet and surrounding (Table # 4).

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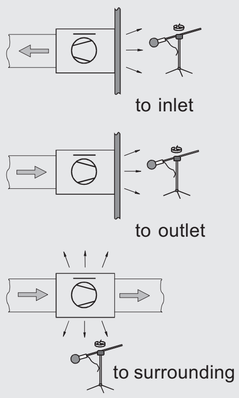
Table 4 - Sound power values

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	68	74	61
Sound power level L_{WAokt} [dB(A)]			
125 Hz	54	55	44
250 Hz	61	62	53
500 Hz	59	65	54
1000 Hz	62	70	57
2000 Hz	62	68	53
4000 Hz	60	66	49
8000 Hz	53	58	42

In air-handling equipment, the values of the sound power level will be closer to the values valid for working point 5b.
A schematic drawing of the measured fan position in the room in which the measurement is performed is shown in figure # 4 (towards inlet, outlet, surrounding).

Figure 4



Outline of Noise Attenuation Methods

The fans of the Vento air-handling system are intended for direct installation into duct lines, and thanks to the quality of their design they generally provide very favourable values of noise parameters. In some cases, especially if fans are not located in a separate technical background of the building, and for example are situated in the ceiling, it will be necessary to consider thoroughly the option of a suitable fan type and its working point which provide the required air flow rate, respectively pressure, at minimum noisiness.
Generally, we can say that fan noisiness depends on the following:

- Fan speed, i.e. number of motor's poles (with increasing speed the noisiness is increased significantly)

n Design (backward or forward curved impeller blades and shape of the casing).

- Air flow rate at the given working point.

When considering the noise parameters of the designed equipment, the following procedure is recommended:

1. Specify the maximum permissible sound level in the given location.

2. The relevant sound power level of the noise source can be calculated from the known, respectively considered data like room size, wall material and its related coefficient of sound absorption, and distance from the noise source.

3. If the noise is transmitted via a duct (the fan is situated outside the room) it is necessary to reduce the calculated values of the sound power by the attenuation corresponding to the planned duct line, ventilation grills, attenuators, etc.

4. From the catalogue select a suitable fan complying with the calculated value (if the fan is situated directly in the room - maximum value of the sound power, otherwise follow point 3), respectively the fan closest to the given value.

5. When selecting the fan, also take into account the option of the working point considering the required sound level. The fan's maximum value of the sound power level is within the area of maximum air flow (i.e. point 5c).

6. If no value of sound power listed in this catalogue complies with the requirements, it is possible to consult the manufacturer for values of the sound power of other fan output characteristics, i.e. curves # 4, 3, 2, or 1, or for other working points.

7. Apply additional measures to attenuate noise: attenuators (see "Accessories" Catalogue), attenuation by the ceiling, anti-noise insulation, change in the fan's location or duct line, etc.

Warning: The sound power level indicates the power radiated to the surrounding of the fan, and the sound level in the particular place, respectively in the room, cannot be directly assumed from its values without the appropriate calculation. The sound level values are, due to the influence of the environment (attenuation, directionality, reflection, etc.), numerically significantly lower than the values of the sound power level.

Markings Used

m	weight	kg
S	area, surface	m2
V	air flow rate	m3/h
n	speed	rpm
t	air temperature	°C
Δp_s	static pressure difference	Pa
Δp_t	total pressure difference Pa	
p_d	dynamic pressure	Pa
ρ	air specific density	kg/m^3
LW	sound power level	dB
L_{WA}	A scale sound power level	dB(A)
L_{WAokt}	A scale octave sound power level	dB(A)
L_{PA}	A scale sound pressure level	dB(A)
W	sound power	W
W0	reference sound power 10 $^{-12}$ W	W
p	sound pressure	Pa
p0	reference sound pressure 2.10 $^{-5}$	Pa
c	sound velocity	m/s
KA	A weighting filter correction	dB(A)
U	voltage	V
I	current	A
P	electric input	W
C	capacity	µF

Fan Parameters

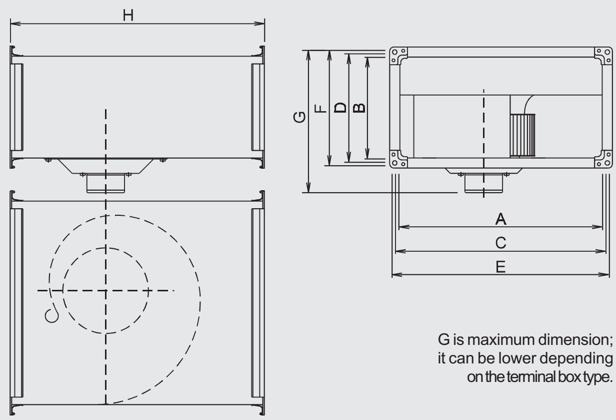
Dimensions, Weights and Performance

For important dimensions of RP fans, refer to Figure # 5 and Table # 5.

Table 5 - Fan dimensions

Fan	Dimensions in mm							
	A	B	C	D	E	F	G	H
RP 40-20/20-..	400	200	420	220	440	240	277	500
RP 50-25/22-..	500	250	520	270	540	290	349	530
RP 50-30/25-..	500	300	520	320	540	340	399	565
RP 60-30/28-..	600	300	620	320	640	340	399	642
RP 60-35/31-..	600	350	620	370	640	390	427	720
RP 70-40/35-..	700	400	720	420	740	440	477	780
RP 80-50/40-..	800	500	820	520	840	540	577	885
RP 90-50/45-..	900	500	930	530	960	560	577	985
RP 100-50/45-..	1000	500	1030	530	1060	560	577	985
RP 100-50/56-..	1000	500	1030	530	1060	560	577	1173

Figure 5 - Fan Dimensional Diagram



G is maximum dimension; it can be lower depending on the terminal box type.

Table 6 - Fan basic parameters and nominal values

Fan type	$V_{max.}$	$\Delta p_{t\ max.}$	$\Delta p_{s\ min.}$	n	U	$P_{max.}$	$I_{max.}$	$t_{max.}$	C	Controller	m
	m^3/h	Pa	Pa	min^{-1}	V	W	A	°C	F	typ	kg
Single-phase fans											
RP 40 - 20/20 - 4E	1200	233	0	1420	230	322	1,6	40	5	TRN 2E	13,4
RP 50 - 25/22 - 4E	1648	299	55	1420	230	548	2,3	40	8	TRN 4E	18,1
RP 50 - 30/25 - 4E	2305	360	0	1380	230	831	3,68	55	14	TRN 4E	22,8
RP 60 - 30/28 - 4E	2496	469	152	1400	230	1046	5,1	40	16	TRN 7E	31,7
Three-phase fans											
RP 40 - 20/20 - 4D	1292	236	0	1420	400	291	0,5	70	-	TRN 2D	12,8
RP 50 - 25/22 - 6D	1376	137	0	940	400	222	0,46	55	-	TRN 2D	16
RP 50 - 25/22 - 4D	1937	309	0	1440	400	590	1	40	-	TRN 2D	18,1
RP 50 - 30/25 - 6D	1811	163	0	940	400	356	0,69	55	-	TRN 2D	18,8
RP 50 - 30/25 - 4D	2576	414	0	1450	400	1004	1,97	50	-	TRN 2D	22,5
RP 60 - 30/28 - 6D	2531	239	0	960	400	575	1,28	55	-	TRN 2D	25,8
RP 60 - 30/28 - 4D	3178	469	0	1450	400	1397	2,38	40	-	TRN 4D	31,5
RP 60 - 35/31 - 6D	3687	281	0	910	400	948	1,86	40	-	TRN 2D	31,2
RP 60 - 35/31 - 4D	4512	617	136	1440	400	2464	4,1	40	-	TRN 7 D	38,9
RP 70 - 40/35 - 8D	3669	216	0	670	400	642	1,38	55	-	TRN 2D	44,5
RP 70 - 40/35 - 6D	4032	378	151	920	400	1096	2	40	-	TRN 4D	43,5
RP 70 - 40/35 - 4D	5981	806	340	1440	400	3527	6	40	-	TRN 7D	62
RP 80 - 50/40 - 8D	4720	298	0	700	400	1230	2,29	55	-	TRN 4D	57,1
RP 80 - 50/40 - 6D	7357	496	0	960	400	2824	5,11	50	-	TRN 7D	71
RP 80 - 50/40 - 4D	6831	1040	683	1410	400	4919	8,1	40	-	TRN 9D	78
RP 90 - 50/45 - 4D	6558	1498	1014	1260	400	4919	8,3	55	-	TRN 9D	96
RP 90 - 50/45 - 6D	9200	667	90	930	400	3780	6,8	55	-	TRN 7D	96
RP 90 - 50/45 - 8D	7810	386	0	690	400	1892	3,88	55	-	TRN 4D	93
RP 100 - 50/45 - 4D	6558	1498	1014	1260	400	4919	8,3	55	-	TRN 9D	96
RP 100 - 50/45 - 6D	9200	667	90	930	400	3780	6,8	55	-	TRN 7D	96
RP 100 - 50/45 - 8D	7810	386	0	690	400	1892	3,88	55	-	TRN 4D	93
RP 100 - 50/56 - 4D	11731	1039	0	1383	400	3205	5,5	50	-	TRN 7D	116

$V_{max.}$ – maximum air flow rate at minimum permissible pressure loss

$\Delta p_{t\ max.}$ – maximum total pressure of the fan is maximum sum of Δp_s and p_d ($\Delta p_s + p_d$) max.

$\Delta p_{s\ min.}$ – minimum allowed static pressure (pressure loss of connected duct) indicates the lowest value to which the fan must be throttled (at nominal voltage at working point 5c) not to be overloaded and thus opening the thermo-contacts and activating motor protection.

N – fan speed measured at the highest efficiency working point (5b), rounded to tens.

U – nominal power supply voltage of the motor without control (all values in the table are to this voltage).

$P_{max.}$ – maximum electric input of the motor at maximum loading, i.e. at air flow $V_{max.}$

$I_{max.}$ – maximum phase current at voltage U and maximum allowed loading, i.e. at air flow V_{max} at working point 5c (this value must be checked and measured current must be written on the guarantee card)

$t_{max.}$ – maximum permissible transported air temperature at air flow $V_{max.}$

C – prescribed capacitor capacity with single-phase fans

control – prescribed fan output voltage controller

m – weight of the fan (±10%)

Fan parameters

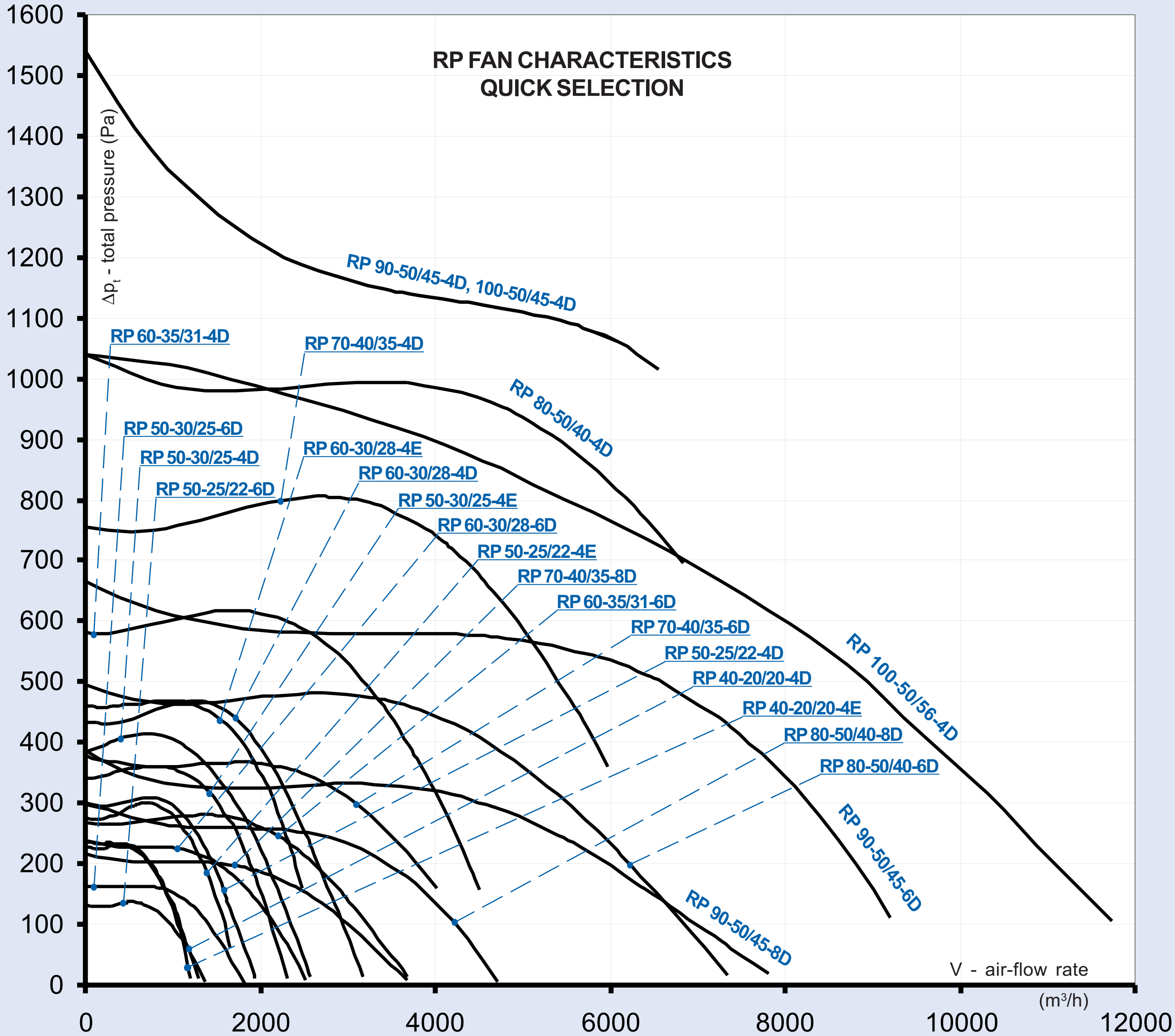
Data Section

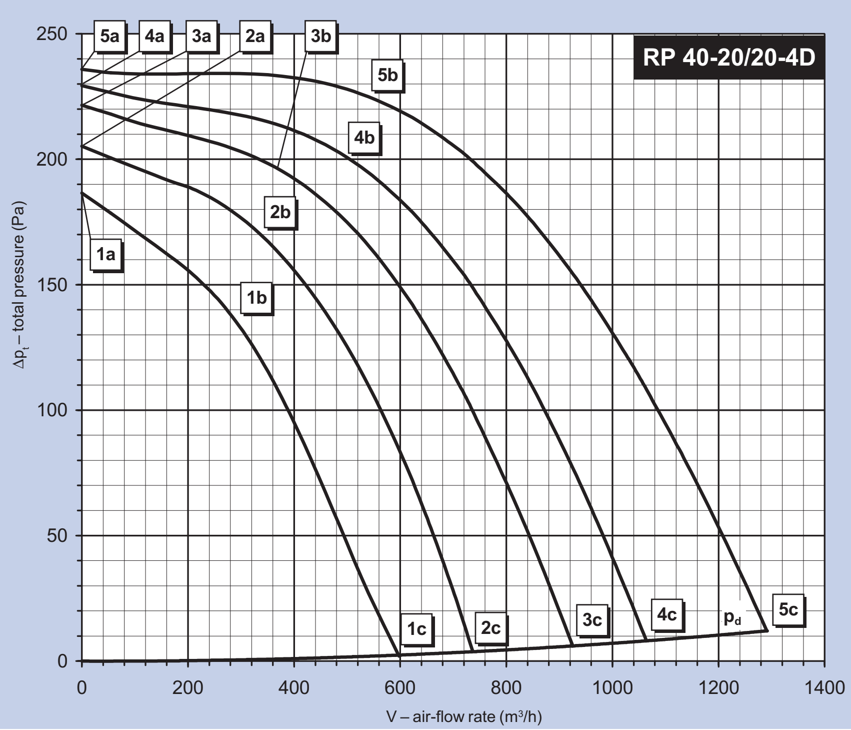
Table 7 contains all RP fans arranged according to total pressure and maximum air flow to make it transparent. However, in most cases the airflow-pressure interrelationship is more important than only the maxima of individual values.
Graph 2 enables quick selection of a suitable fan and alternate comparison of RP fans. Only the highest characteristics of each fan at nominal supply voltage, i.e. without a controller or with a controller set to five stage, are included in this graph.
The Data Section of the catalogue contains all important information and measured data of RP fans.

Table 7 - Fans listed according to pressure and output

FANS IN ASCENDING ORDER ACCORDING TO MAXIMUM OUTPUT			
ACCORDING TO MAX. PRESSURE		ACCORDING TO MAX. AIRFLOW	
Fan	Total pressure	Fan	Max. airflow
Type	$\Delta p_{t\,max.}$ (Pa)	Type	V (m^3/h)
RP 50-25/22-6D	137	RP 40-20/20-4D	1 292
RP 50-30/25-6D	163	RP 50-25/22-6D	1 376
RP 70-40/35-8D	216	RP 40-20/20-4E	1 420
RP 40-20/20-4E	233	RP 50-25/22-4E	1 648
RP 40-20/20-4D	236	RP 50-30/25-6D	1 811
RP 60-30/28-6D	239	RP 50-25/22-4D	1 937
RP 60-35/31-6D	281	RP 50-30/25-4E	2 305
RP 80-50/40-8D	298	RP 60-30/28-4E	2 496
RP 50-25/22-4E	299	RP 60-30/28-6D	2 531
RP 50-25/22-4D	309	RP 50-30/25-4D	2 624
RP 50-30/25-4E	360	RP 60-30/28-4D	3 178
RP 70-40/35-6D	378	RP 70-40/35-8D	3 669
RP 90-50/45-8D	386	RP 60-35/31-6D	3 687
RP 100-50/45-8D	386	RP 70-40/35-6D	4 032
RP 50-30/25-4D	390	RP 60-35/31-4D	4 512
RP 60-30/28-4E	469	RP 80-50/40-8D	4 720
RP 60-30/28-4D	469	RP 70-40/35-4D	5 981
RP 80-50/40-6D	496	RP 90-50/45-4D	6 558
RP 60-35/31-4D	617	RP 100-50/45-4D	6 558
RP 90-50/45-6D	667	RP 80-50/40-4D	6 831
RP 100-50/45-6D	667	RP 80-50/40-6D	7 357
RP 70-40/35-4D	806	RP 90-50/45-8D	7 810
RP 100-50/56-4D	1 039	RP 100-50/45-8D	7 810
RP 80-50/40-4D	1 040	RP 90-50/45-6D	9 200
RP 100-50/45-4D	1 498	RP 100-50/45-6D	9 200
RP 90-50/45-4D	1 498	RP 100-50/56-4D	11 731

Graph 2



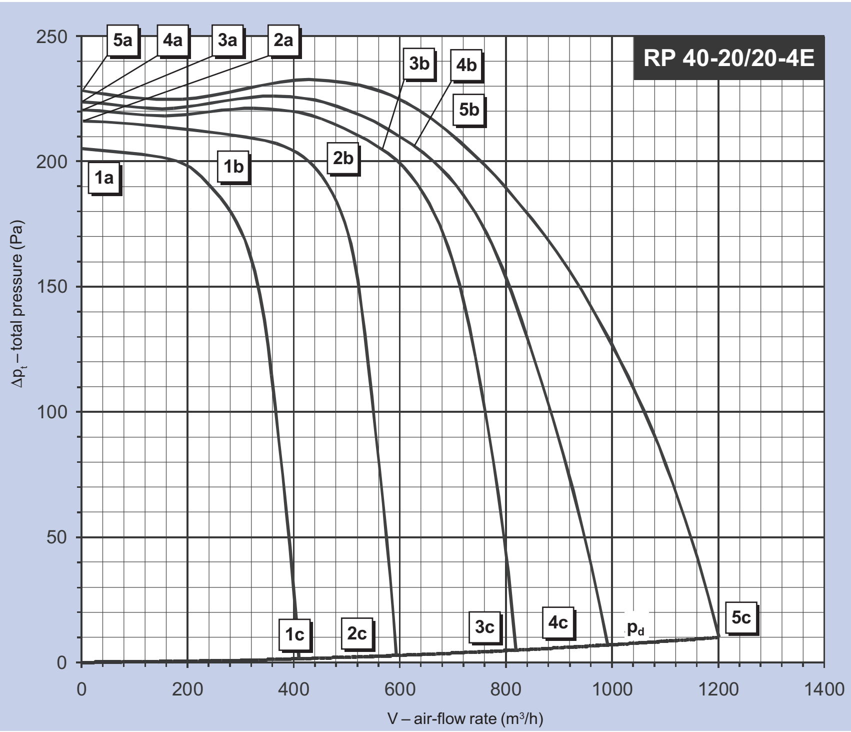


RP 40-20/20-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	291
Max. current (5c)	I_{max}	[A]	0,50
Mean speed	n	[min^{-1}]	1420
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	70
Max. air flow rate	V_{max}	[m^3/h]	1292
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	236
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	12,8
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	**5b**	**5b**	**5b**
Total sound power level L_{WA} [dB (A)]			
L_{WA}	68	74	61
Sound power level L_{WAokt} [dB (A)]			
125 Hz	54	55	44
250 Hz	61	62	53
500 Hz	59	65	54
1000 Hz	62	70	57
2000 Hz	62	68	53
4000 Hz	60	66	49
8000 Hz	53	58	42

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,30	0,32	0,50	0,19	0,26	0,50	0,17	0,22	0,47	0,17	0,22	0,43	0,15	0,22	0,37
Electric input	P	[W]	71	125	291	49	98	215	41	71	170	41	60	120	31	49	81
Speed	n	[min^{-1}]	1468	1418	1232	1438	1340	1011	1410	1319	892	1329	1226	734	1271	1094	590
Air flow rate	V	[m^3/h]	0	561	1292	0	515	1061	0	383	923	0	345	734	0	296	592
Static pressure	Δp_s	[Pa]	236	222	0	229	198	0	222	193	0	205	166	0	187	132	0
Total pressure	Δp_t	[Pa]	236	224	12	229	200	8	222	194	6	205	167	4	187	133	2

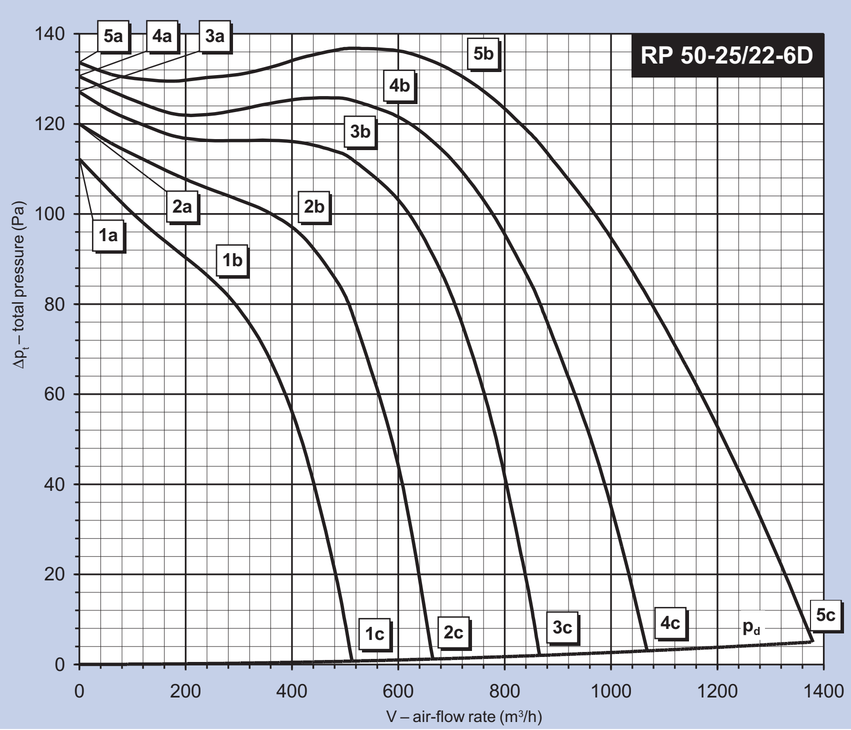


RP 40-20/20-4E

Power supply			230V 50Hz
Max. electric input	P_{max}	[W]	322
Max. current (5c)	I_{max}	[A]	1,60
Mean speed	n	[min^{-1}]	1420
Capacitor	C	[μF]	5
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1200
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	233
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	13,4
Five-stage controller		typ	TRN 2E
Protecting relay		typ	STE

	Inlet	Outlet	Surrounding
Point	**5b**	**5b**	**5b**
Total sound power level L_{WA} [dB (A)]			
L_{WA}	71	78	66
Sound power level L_{WAokt} [dB (A)]			
125 Hz	57	56	50
250 Hz	66	71	63
500 Hz	63	68	58
1000 Hz	63	73	59
2000 Hz	64	71	55
4000 Hz	62	69	50
8000 Hz	53	61	43

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,99	1,08	1,60	0,56	0,81	1,58	0,49	0,78	1,46	0,46	0,72	1,17	0,48	0,57	0,95
Electric input	P	[W]	144	197	322	91	141	237	77	122	189	62	92	122	49	56	75
Speed	n	[min^{-1}]	1388	1416	1244	1459	1387	885	1449	1363	649	1428	1319	520	1391	1337	399
Air flow rate	V	[m^3/h]	0	692	1200	0	629	998	0	576	809	0	459	598	0	254	405
Static pressure	Δp_s	[Pa]	228	210	0	224	204	0	221	200	0	216	190	0	205	187	0
Total pressure	Δp_t	[Pa]	228	213	10	224	207	5	221	202	3	216	191	2	205	187	1

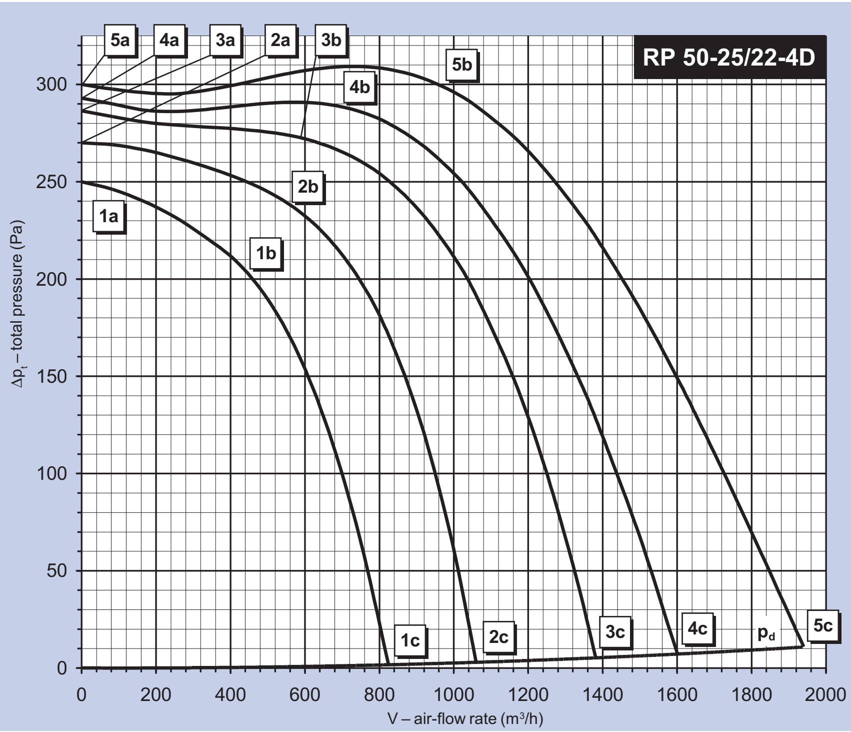


RP 50-25/22-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	222
Max. current (5c)	I_{max}	[A]	0,46
Mean speed	n	[min^{-1}]	940
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	1376
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	137
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	16
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	66	66	57
Sound power level L_{WAokt} [dB (A)]			
125 Hz	58	52	47
250 Hz	62	57	51
500 Hz	57	59	52
1000 Hz	57	60	51
2000 Hz	57	59	45
4000 Hz	54	57	42
8000 Hz	44	48	41

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,30	0,33	0,46	0,20	0,24	0,42	0,17	0,21	0,38	0,15	0,20	0,33	0,14	0,17	0,27
Electric input	P	[W]	62	110	222	36	68	151	31	56	111	26	44	73	22	30	45
Speed	n	[min^{-1}]	986	943	825	971	912	650	954	878	548	921	823	420	873	795	347
Air flow rate	V	[m^3/h]	0	735	1376	0	571	1064	0	490	864	0	399	665	0	259	511
Static pressure	Δp_s	[Pa]	134	130	0	131	123	0	127	113	0	120	96	0	112	85	0
Total pressure	Δp_t	[Pa]	134	132	5	131	124	3	127	114	2	120	96	1	112	85	1

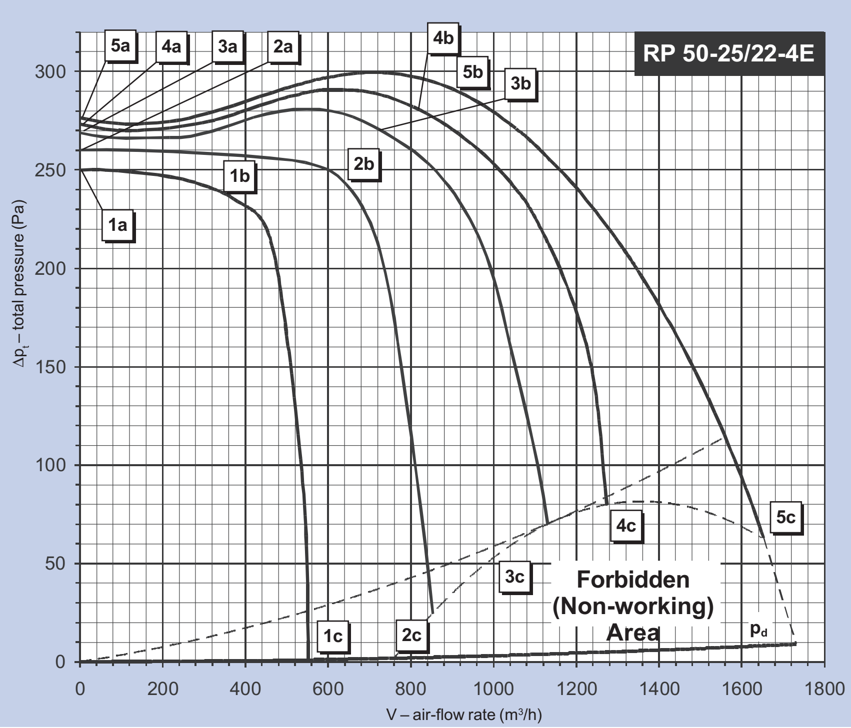


RP 50-25/22-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	590
Max. current (5c)	I_{max}	[A]	1,00
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1937
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	309
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	18,1
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	72	78	64
Sound power level L_{WAokt} [dB (A)]			
125 Hz	65	64	54
250 Hz	66	70	58
500 Hz	62	71	58
1000 Hz	62	73	57
2000 Hz	65	71	56
4000 Hz	62	69	52
8000 Hz	53	61	44

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,58	0,63	1,00	0,34	0,46	1,07	0,28	0,40	1,00	0,26	0,45	0,97	0,27	0,45	0,84
Electric input	P	[W]	119	249	590	85	174	478	67	131	379	60	121	251	54	96	167
Speed	n	[min^{-1}]	1485	1439	1306	1463	1400	1085	1448	1377	948	1409	1284	744	1353	1189	585
Air flow rate	V	[m^3/h]	0	951	1937	0	715	1605	0	592	1379	0	567	1060	0	452	825
Static pressure	Δp_s	[Pa]	300	300	0	293	284	0	286	272	0	270	234	0	250	198	0
Total pressure	Δp_t	[Pa]	300	303	11	293	285	7	286	273	5	270	235	3	250	199	2

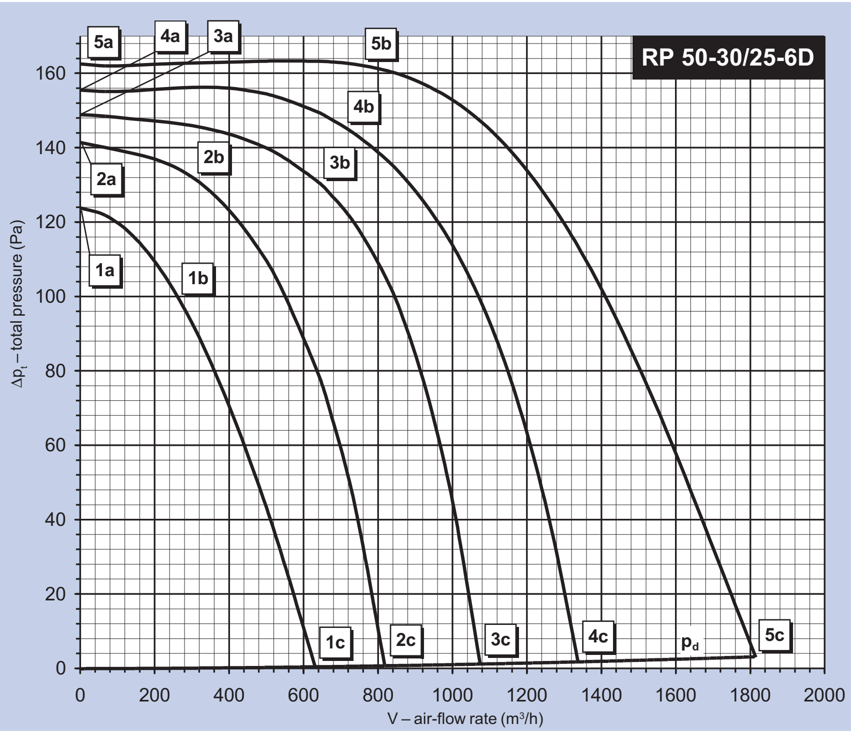


RP 50-25/22-4E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	499
Max. current (5c)	I_{max}	[A]	2,30
Mean speed	n	[min^{-1}]	1420
Capacitor	C	[µF]	8
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1648
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	299
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	55
Weight	m	[kg]	18,1
Five-stage controller		typ	TRN 4E
Protecting relay		typ	STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	73	77	65
Sound power level L_{WAokt} [dB (A)]			
125 Hz	65	61	57
250 Hz	67	67	59
500 Hz	61	68	57
1000 Hz	64	72	58
2000 Hz	66	70	57
4000 Hz	64	69	52
8000 Hz	56	61	44

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	230			180			160			130			105		
Current	I	[A]	1,07	1,33	2,30	0,69	1,15	2,25	0,66	1,11	2,20	0,70	1,11	2,01	0,66	0,90	1,64
Electric input	P	[W]	181	275	499	124	211	381	108	180	319	95	147	225	73	97	146
Speed	n	[min^{-1}]	1471	1419	1259	1466	1398	1081	1456	1373	881	1426	1318	541	1399	1316	416
Air flow rate	V	[m^3/h]	0	914	1648	0	818	1275	0	728	1128	0	614	845	0	350	557
Static pressure	Δp_s	[Pa]	277	288	55	273	280	75	269	270	70	260	244	25	250	231	0
Total pressure	Δp_t	[Pa]	277	290	63	273	282	80	269	272	73	260	245	27	250	231	1

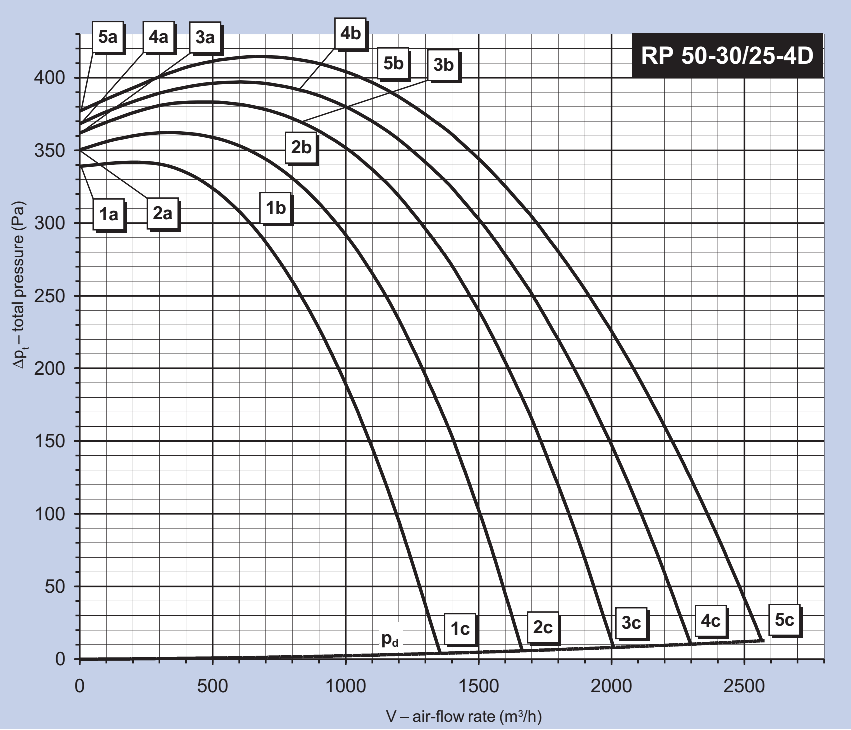


RP 50-30/25-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	356
Max. current (5c)	I_{max}	[A]	0,69
Mean speed	n	[min^{-1}]	940
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	1811
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	163
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	18,8
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	65	68	58
Sound power level L_{WAokt} [dB (A)]			
125 Hz	62	55	45
250 Hz	54	56	51
500 Hz	54	61	52
1000 Hz	55	63	54
2000 Hz	57	62	47
4000 Hz	54	59	43
8000 Hz	43	48	40

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	400			280			230			180			140		
Current	I	[A]	0,42	0,45	0,69	0,30	0,36	0,65	0,25	0,33	0,57	0,21	0,25	0,47	0,21	0,24	0,38
Electric input	P	[W]	76	133	356	49	104	223	42	88	157	37	51	98	33	41	59
Speed	n	[min^{-1}]	977	943	770	959	891	593	942	844	481	912	861	377	840	772	306
Air flow rate	V	[m^3/h]	0	776	1811	0	731	1334	0	652	1073	0	324	817	0	259	627
Static pressure	Δp_s	[Pa]	163	160	0	156	144	0	149	129	0	141	132	0	124	103	0
Total pressure	Δp_t	[Pa]	163	161	3	156	145	2	149	129	1	141	132	1	124	103	0

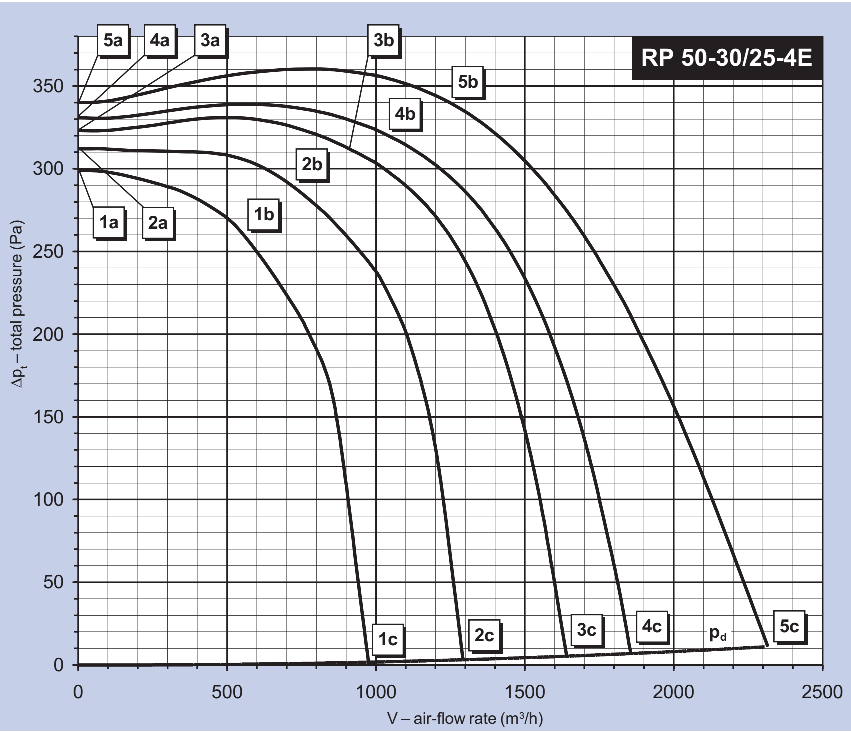


RP 50-30/25-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	1004
Max. current (5c)	I_{max}	[A]	1,97
Mean speed	n	[min^{-1}]	1450
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	50
Max. air flow rate	V_{max}	[m^3/h]	2576
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	414
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	22,5
Five-stage controller	typ		TRN 2D
Protecting relay	typ		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	74	79	69
Sound power level L_{WAokt} [dB (A)]			
125 Hz	67	63	56
250 Hz	65	67	59
500 Hz	63	71	61
1000 Hz	67	74	65
2000 Hz	68	73	62
4000 Hz	65	71	57
8000 Hz	57	61	49

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,30	1,37	1,97	0,72	0,88	1,92	0,60	0,89	2,10	0,52	0,90	1,99	0,49	0,93	1,77
Electric input	P	[W]	223	441	1004	133	271	803	120	268	700	114	246	519	97	205	358
Speed	n	[min^{-1}]	1479	1454	1362	1469	1417	1216	1457	1387	1096	1434	1336	904	1390	1277	731
Air flow rate	V	[m^3/h]	0	1110	2576	0	804	2306	0	828	2011	0	774	1666	0	679	1363
Static pressure	Δp_s	[Pa]	377	391	0	368	393	0	362	374	0	350	337	0	339	292	0
Total pressure	Δp_t	[Pa]	377	394	13	368	395	10	362	375	8	350	339	6	339	293	4



RP 50-30/25-4E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	831
Max. current (5c)	I_{max}	[A]	3,68
Mean speed	n	[min^{-1}]	1380
Capacitor	C	[µF]	14
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	2305
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	360
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	22,8
Five-stage controller	typ		TRN 4E
Protecting relay	typ		STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	75	81	68
Sound power level L_{WAokt} [dB (A)]			
125 Hz	66	64	57
250 Hz	66	67	60
500 Hz	65	73	61
1000 Hz	68	77	64
2000 Hz	69	74	59
4000 Hz	67	72	55
8000 Hz	58	62	46

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	1,23	1,94	3,68	1,11	1,87	3,64	1,09	1,76	3,51	1,02	1,62	3,07	0,98	1,55	2,64
Electric input	P	[W]	270	444	831	199	339	632	174	286	539	135	215	381	107	167	262
Speed	n	[min^{-1}]	1453	1382	1162	1436	1336	943	1424	1319	830	1402	1276	664	1368	1205	508
Air flow rate	V	[m^3/h]	0	1230	2305	0	1041	1854	0	915	1638	0	722	1289	0	585	974
Static pressure	Δp_s	[Pa]	340	338	0	331	320	0	323	308	0	312	286	0	299	253	0
Total pressure	Δp_t	[Pa]	340	341	11	331	322	7	323	310	5	312	287	3	299	254	2

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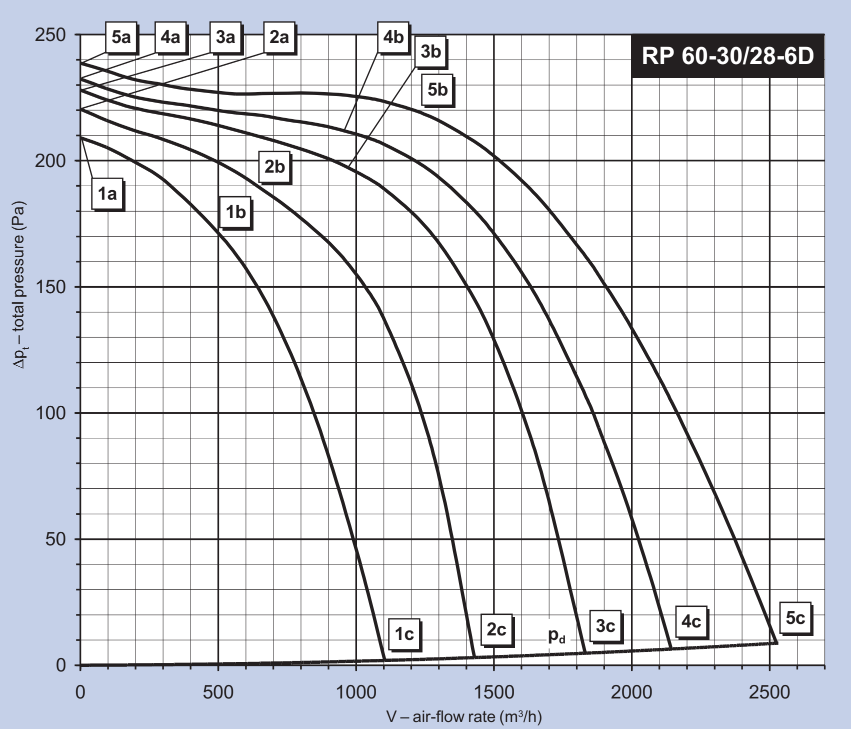
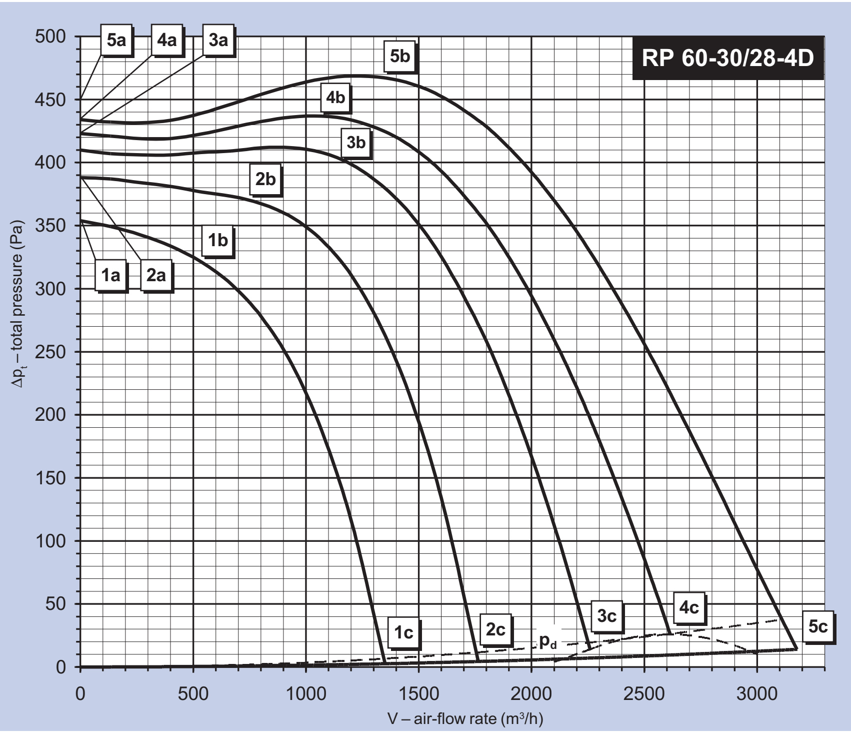


RP 60-30/28-6D

Power supply	Y		**3 x 400V 50Hz**
Max. electric input	P_{max}	[W]	**575**
Max. current (5c)	I_{max}	[A]	**1,28**
Mean speed	n	[min^{-1}]	**960**
Capacitor	C	[µF]	**-**
Max. working temp.	t_{max}	[°C]	**55**
Max. air flow rate	V_{max}	[m^3/h]	**2531**
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	**239**
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	**0**
Weight	m	[kg]	**25,8**
Five-stage controller		typ	**TRN 2D**
Protecting relay		typ	**STD**

	Inlet	Outlet	Surrounding
Point	**5b**	**5b**	**5b**
Total sound power level L_{WA} [dB (A)]			
L_{WA}	69	73	63
Sound power level L_{WAokt} [dB (A)]			
125 Hz	64	61	57
250 Hz	60	62	56
500 Hz	62	68	57
1000 Hz	60	68	56
2000 Hz	60	65	52
4000 Hz	59	64	47
8000 Hz	48	53	41

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	**U**	[V]		400			280			230			180			140	
Current	**I**	[A]	0,88	0,94	1,28	0,58	0,67	1,24	0,49	0,65	1,26	0,41	0,52	1,11	0,36	0,52	0,94
Electric input	**P**	[W]	145	267	575	82	178	445	79	172	355	70	113	237	50	88	145
Speed	**n**	[min^{-1}]	985	959	892	977	938	777	964	905	650	941	892	510	928	844	397
Air flow rate	**V**	[m^3/h]	0	1218	2531	0	966	2146	0	990	1827	0	647	1428	0	492	1106
Static pressure	Δp_s	[Pa]	239	218	0	232	211	0	228	198	0	220	188	0	209	172	0
Total pressure	Δp_t	[Pa]	239	220	9	232	212	6	228	199	5	220	189	3	209	172	2

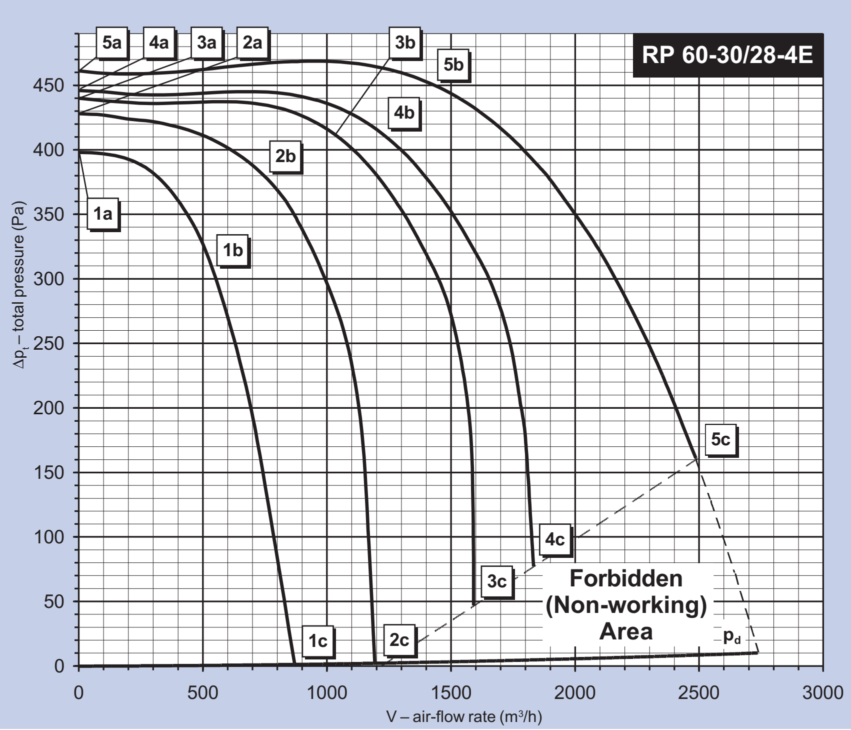


RP 60-30/28-4D

Power supply	Y		**3 x 400V 50Hz**
Max. electric input	P_{max}	[W]	**1397**
Max. current (5c)	I_{max}	[A]	**2,38**
Mean speed	n	[min^{-1}]	**1450**
Capacitor	C	[µF]	**-**
Max. working temp.	t_{max}	[°C]	**40**
Max. air flow rate	V_{max}	[m^3/h]	**3178**
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	**469**
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	**0**
Weight	m	[kg]	**31,5**
Five-stage controller		typ	**TRN 4D**
Protecting relay		typ	**STD**

	Inlet	Outlet	Surrounding
Point	**5b**	**5b**	**5b**
Total sound power level L_{WA} [dB (A)]			
L_{WA}	78	83	70
Sound power level L_{WAokt} [dB (A)]			
125 Hz	70	70	59
250 Hz	68	70	61
500 Hz	67	75	62
1000 Hz	72	78	66
2000 Hz	72	77	62
4000 Hz	69	75	58
8000 Hz	61	65	50

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	**U**	[V]		400			280			230			180			140	
Current	**I**	[A]	1,04	1,20	2,38	0,69	0,98	2,60	0,62	1,07	2,60	0,62	1,02	2,43	0,66	0,94	2,06
Electric input	**P**	[W]	267	512	1397	201	380	1088	181	372	870	161	285	612	142	206	393
Speed	**n**	[min^{-1}]	1483	1448	1307	1461	1409	1105	1438	1346	938	1404	1301	736	1344	1246	568
Air flow rate	**V**	[m^3/h]	0	1330	3178	0	1083	2614	0	1162	2260	0	850	1766	0	552	1348
Static pressure	Δp_s	[Pa]	434	467	0	423	433	16	410	401	7	388	361	0	354	318	0
Total pressure	Δp_t	[Pa]	434	469	14	423	435	26	410	403	14	388	362	4	354	318	3

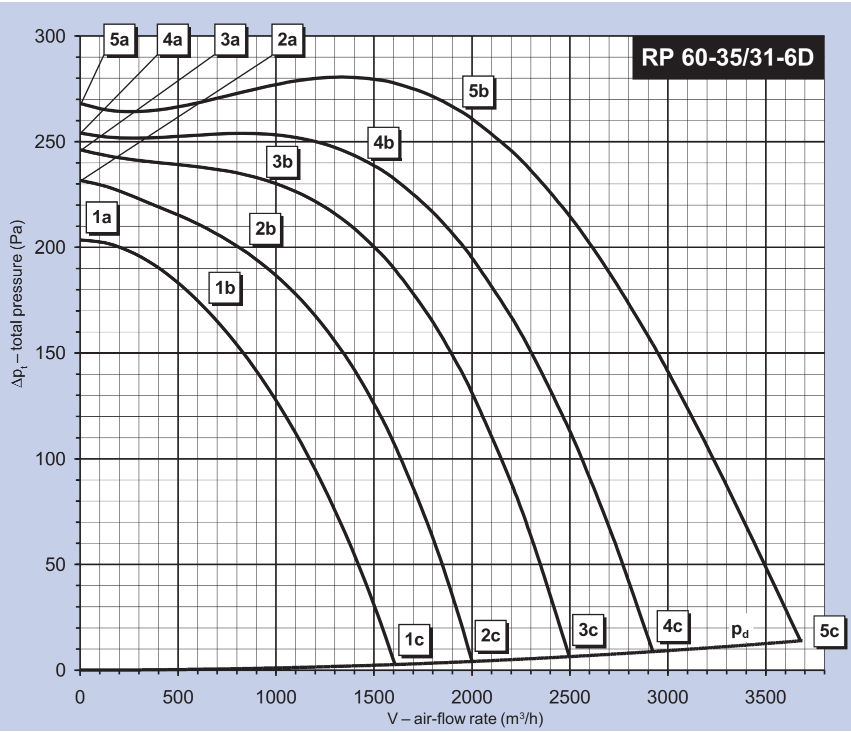


RP 60-30/28-4E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	1046
Max. current (5c)	I_{max}	[A]	5,10
Mean speed	n	[min^{-1}]	1400
Capacitor	C	[µF]	16
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	2496
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	469
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	152
Weight	m	[kg]	31,7
Five-stage controller		typ	TRN 7E
Protecting relay		typ	STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	77	83	70
Sound power level L_{WAokt} [dB (A)]			
125 Hz	71	70	61
250 Hz	68	72	64
500 Hz	67	75	63
1000 Hz	69	78	64
2000 Hz	71	77	61
4000 Hz	67	74	57
8000 Hz	59	65	47

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	2,08	2,96	5,10	1,42	2,66	5,10	1,43	2,52	5,10	1,40	2,38	4,30	1,49	2,43	3,48
Electric input	P	[W]	345	603	1046	247	452	775	225	389	681	185	294	457	158	234	294
Speed	n	[min^{-1}]	1465	1400	1237	1453	1353	898	1446	1345	760	1422	1288	499	1372	1157	385
Air flow rate	V	[m^3/h]	0	1465	2496	0	1222	1834	0	1054	1592	0	786	1218	0	584	882
Static pressure	Δp_s	[Pa]	461	439	152	446	411	72	440	406	43	428	369	0	398	294	0
Total pressure	Δp_t	[Pa]	461	442	161	446	413	77	440	408	47	428	370	2	398	294	1

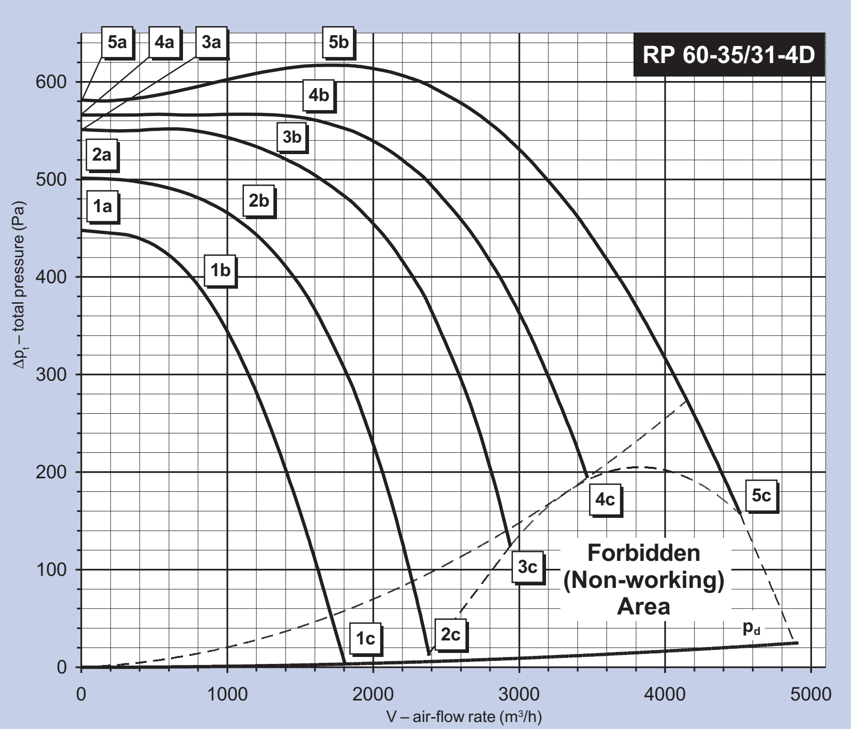


RP 60-35/31-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	948
Max. current (5c)	I_{max}	[A]	1,86
Mean speed	n	[min^{-1}]	910
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	3687
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	281
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	31,2
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	70	75	64
Sound power level L_{WAokt} [dB (A)]			
125 Hz	65	62	58
250 Hz	60	65	56
500 Hz	61	69	58
1000 Hz	62	69	58
2000 Hz	62	68	52
4000 Hz	61	67	49
8000 Hz	49	54	41

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,30	1,36	1,86	0,68	0,87	1,56	0,56	0,68	1,42	0,46	0,64	1,23	0,44	0,60	1,02
Electric input	P	[W]	226	476	948	120	287	606	109	186	457	87	152	302	69	110	194
Speed	n	[min^{-1}]	977	908	754	959	866	609	940	878	532	909	808	429	866	755	355
Air flow rate	V	[m^3/h]	0	1946	3687	0	1470	2932	0	930	2494	0	873	2000	0	688	1603
Static pressure	Δp_s	[Pa]	268	260	0	254	235	0	246	233	0	232	198	0	204	169	0
Total pressure	Δp_t	[Pa]	268	264	14	254	237	9	246	234	6	232	199	4	204	169	3

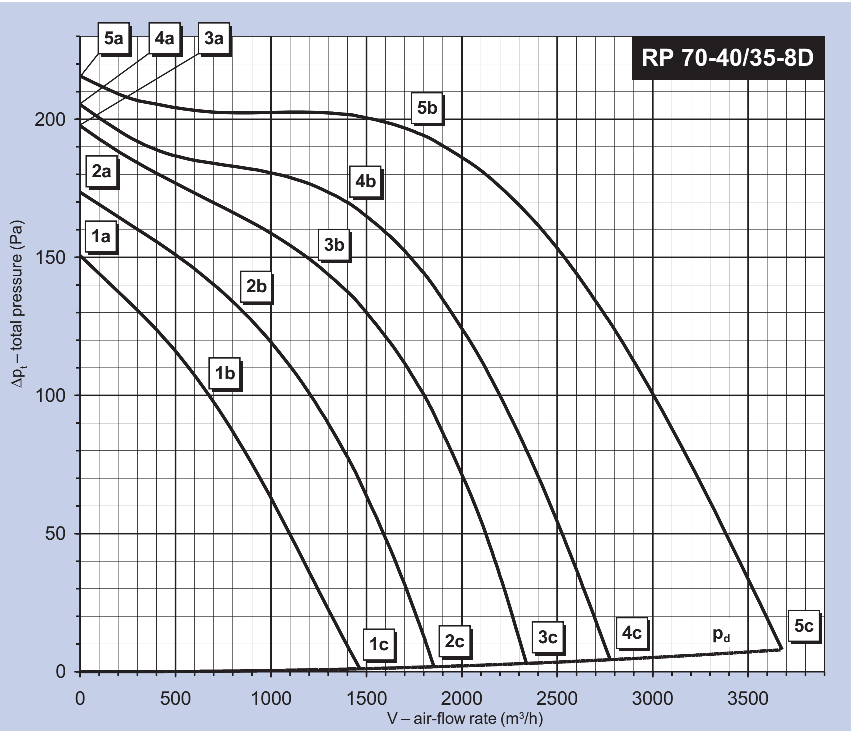


RP 60-35/31-4D

Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	2464
Max. current (5c)	I_{max}	[A]	4,10
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	4512
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	617
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	136
Weight	m	[kg]	38,9
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	78	83	72
Sound power level L_{WAokt} [dB (A)]			
125 Hz	72	69	67
250 Hz	67	70	61
500 Hz	67	74	64
1000 Hz	71	78	66
2000 Hz	71	77	63
4000 Hz	69	76	61
8000 Hz	60	66	52

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	400			280			230			180			140		
Current	I	[A]	1,41	1,72	4,10	1,04	1,62	4,10	1,06	1,62	4,10	1,07	1,73	4,10	1,13	1,77	3,39
Electric input	P	[W]	503	832	2464	351	666	1730	343	563	1374	295	484	1007	252	382	629
Speed	n	[min^{-1}]	1474	1440	1252	1445	1383	1083	1418	1346	912	1381	1270	603	1321	1164	461
Air flow rate	V	[m^3/h]	0	1754	4512	0	1533	3498	0	1324	2937	0	1064	2372	0	852	1808
Static pressure	Δp_s	[Pa]	581	614	136	566	561	182	551	524	115	501	460	6	448	383	0
Total pressure	Δp_t	[Pa]	581	617	157	566	563	194	551	526	124	501	461	12	448	384	3

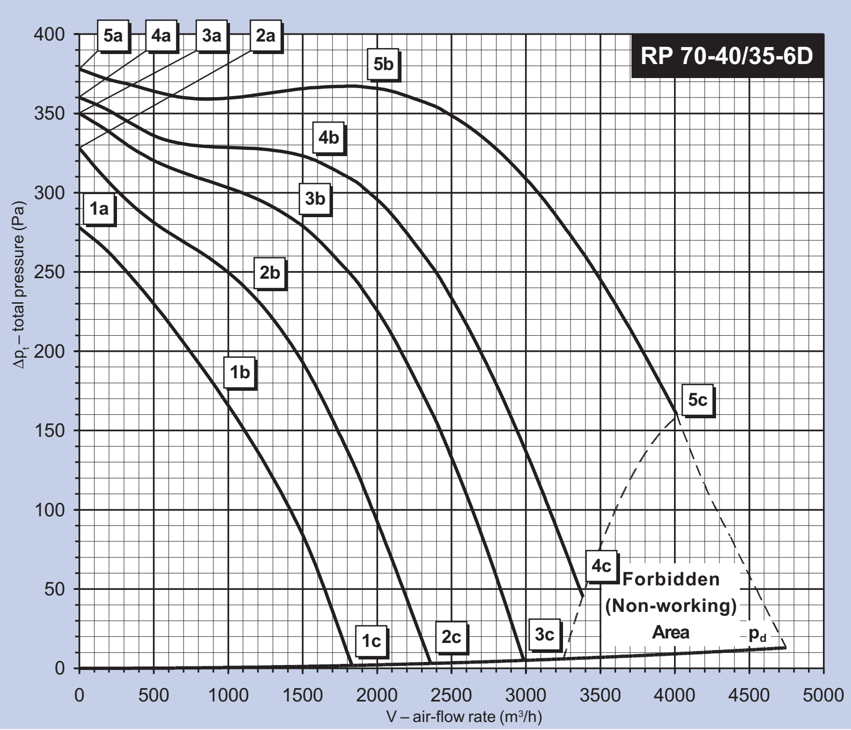


RP 70-40/35-8D

Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	642
Max. current (5c)	I_{max}	[A]	1,38
Mean speed	n	[min^{-1}]	670
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	3669
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	216
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	44,5
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	68	72	62
Sound power level L_{WAokt} [dB (A)]			
125 Hz	65	64	59
250 Hz	57	63	53
500 Hz	57	66	54
1000 Hz	59	65	53
2000 Hz	59	64	49
4000 Hz	58	63	46
8000 Hz	44	50	40

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	400			280			230			180			140		
Current	I	[A]	0,90	0,97	1,38	0,57	0,71	1,15	0,48	0,64	1,00	0,41	0,53	0,83	0,37	0,49	0,68
Electric input	P	[W]	166	318	642	100	205	390	84	167	277	71	111	179	60	84	113
Speed	n	[min^{-1}]	725	673	532	706	631	406	689	592	351	657	573	278	605	495	223
Air flow rate	V	[m^3/h]	0	1815	3669	0	1404	2783	0	1252	2330	0	840	1850	0	697	1468
Static pressure	Δp_s	[Pa]	216	191	0	205	166	0	198	147	0	174	130	0	151	97	0
Total pressure	Δp_t	[Pa]	216	193	8	205	167	4	198	148	3	174	130	2	151	97	1

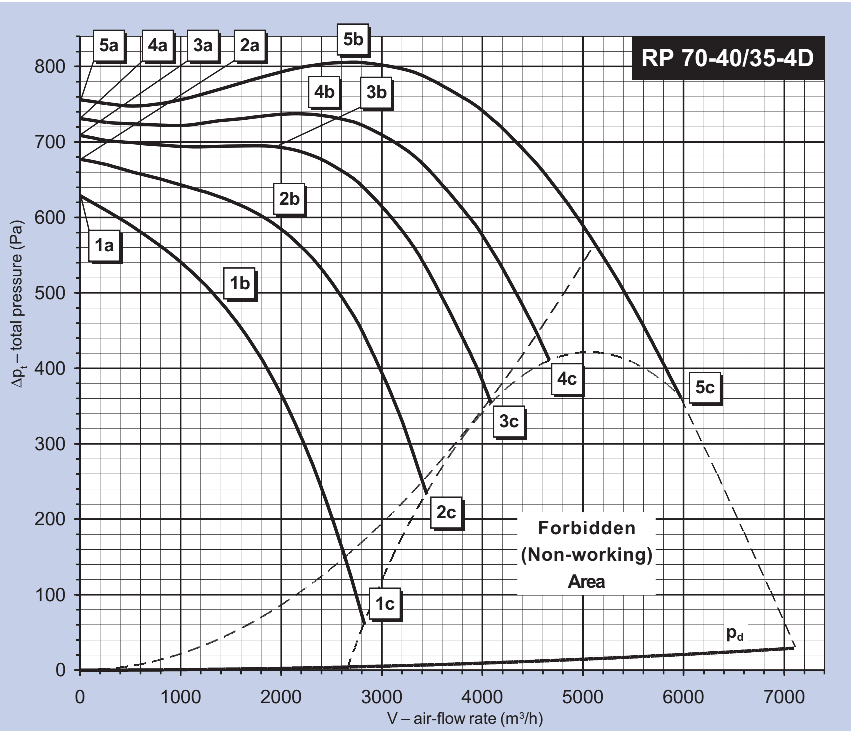


RP 70-40/35-6D

Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	1096
Max. current (5c)	I_{max}	[A]	2,00
Mean speed	n	[min^{-1}]	920
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	4032
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	378
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	151
Weight	m	[kg]	43,5
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	73	79	68
Sound power level L_{WAokt} [dB (A)]			
125 Hz	68	70	60
250 Hz	64	69	58
500 Hz	63	73	61
1000 Hz	66	73	62
2000 Hz	64	71	60
4000 Hz	63	69	57
8000 Hz	52	58	49

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,98	1,19	2,00	0,67	0,97	2,00	0,60	0,99	1,92	0,56	0,93	1,60	0,57	0,91	1,29
Electric input	P	[W]	206	500	1096	153	350	784	138	316	600	127	239	392	112	182	243
Speed	n	[min^{-1}]	977	922	779	954	872	566	935	813	424	896	756	354	835	644	285
Air flow rate	V	[m^3/h]	0	1992	4032	0	1540	3366	0	1486	2995	0	1167	2384	0	992	1835
Static pressure	Δp_s	[Pa]	378	367	151	360	319	39	350	279	0	328	234	0	278	167	0
Total pressure	Δp_t	[Pa]	378	369	160	360	320	45	350	280	5	328	235	3	278	168	2

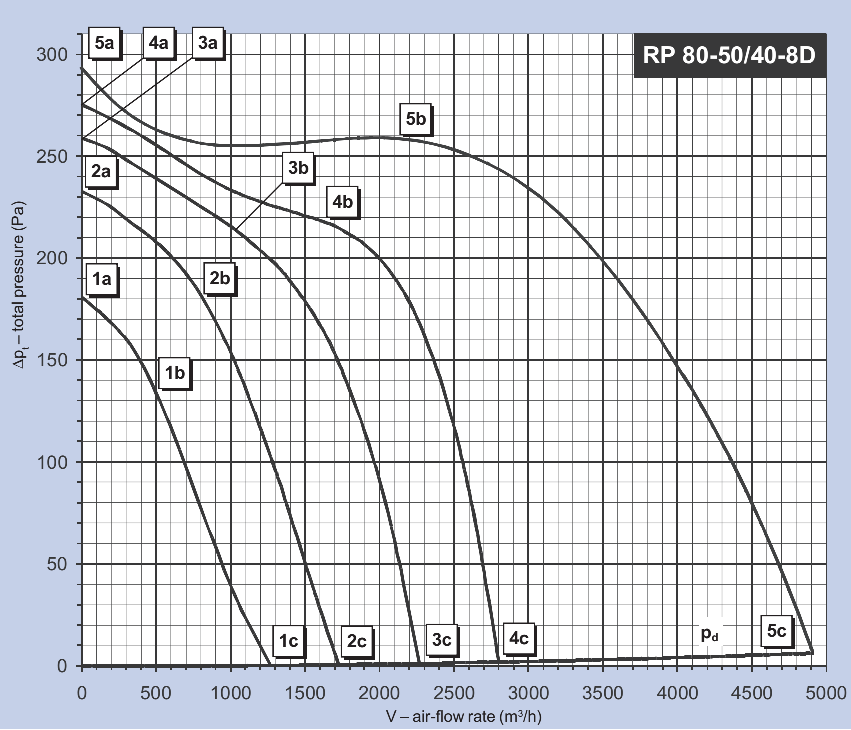


RP 70-40/35-4D

Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	3527
Max. current (5c)	I_{max}	[A]	6,00
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	5981
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	806
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	340
Weight	m	[kg]	62
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	84	90	77
Sound power level L_{WAokt} [dB (A)]			
125 Hz	77	79	70
250 Hz	75	78	68
500 Hz	74	83	71
1000 Hz	78	85	72
2000 Hz	78	83	67
4000 Hz	74	81	64
8000 Hz	64	70	54

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,98	2,67	6,00	1,54	2,61	6,00	1,41	2,68	6,00	1,84	3,34	6,00	1,98	3,27	5,73
Electric input	P	[W]	442	1231	3527	483	1065	2522	410	931	2028	503	924	1520	437	697	1055
Speed	n	[min^{-1}]	1478	1442	1312	1457	1397	1189	1441	1355	1083	1387	1244	891	1327	1157	598
Air flow rate	V	[m^3/h]	0	2577	5981	0	2148	4675	0	1979	4136	0	1977	3435	0	1410	2817
Static pressure	Δp_s	[Pa]	756	804	340	731	741	399	709	688	332	677	588	226	629	485	56
Total pressure	Δp_t	[Pa]	756	806	361	731	744	411	709	690	342	677	590	233	629	486	60

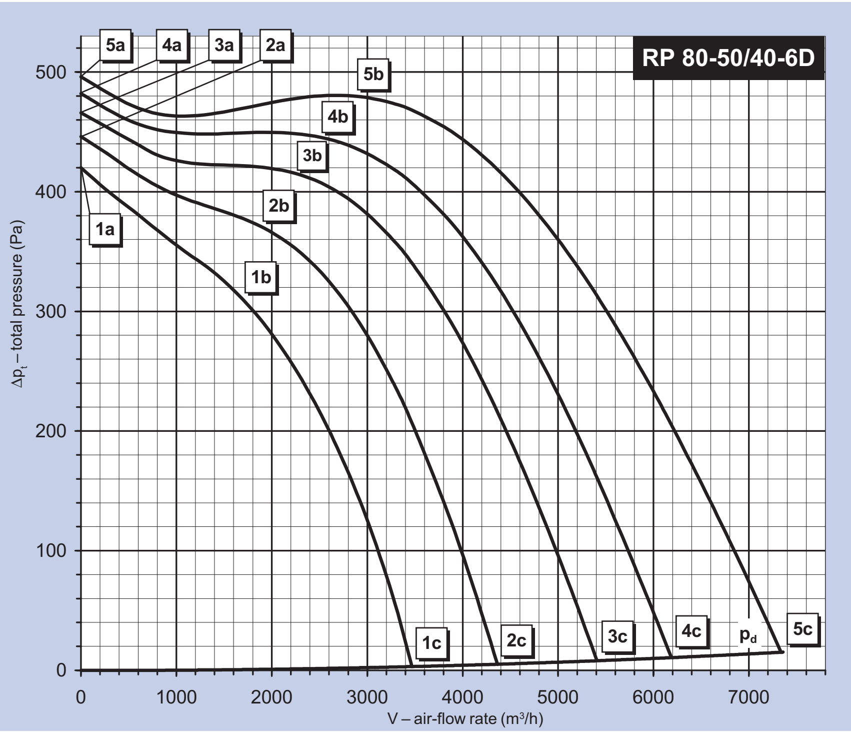


RP 80-50/40-8D

Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	1230
Max. current (5c)	I_{max}	[A]	2,29
Mean speed	n	[min^{-1}]	700
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	4720
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	298
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	57,1
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	69	74	63
Sound power level L_{WAokt} [dB (A)]			
125 Hz	62	61	58
250 Hz	60	63	56
500 Hz	59	68	56
1000 Hz	62	68	56
2000 Hz	62	68	52
4000 Hz	60	65	47
8000 Hz	48	52	41

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,88	1,05	2,29	0,56	0,85	1,80	0,53	0,72	1,52	0,54	0,70	1,24	0,62	0,72	1,00
Electric input	P	[W]	239	476	1230	159	321	646	147	226	438	136	180	271	115	132	158
Speed	n	[min^{-1}]	736	698	478	713	646	291	696	646	234	658	604	183	578	510	147
Air flow rate	V	[m^3/h]	0	2145	4720	0	1652	2800	0	1083	2259	0	802	1737	0	558	1343
Static pressure	Δp_s	[Pa]	298	256	0	275	216	0	259	208	0	233	180	0	181	129	0
Total pressure	Δp_t	[Pa]	298	257	6	275	217	2	259	208	1	233	180	1	181	129	0

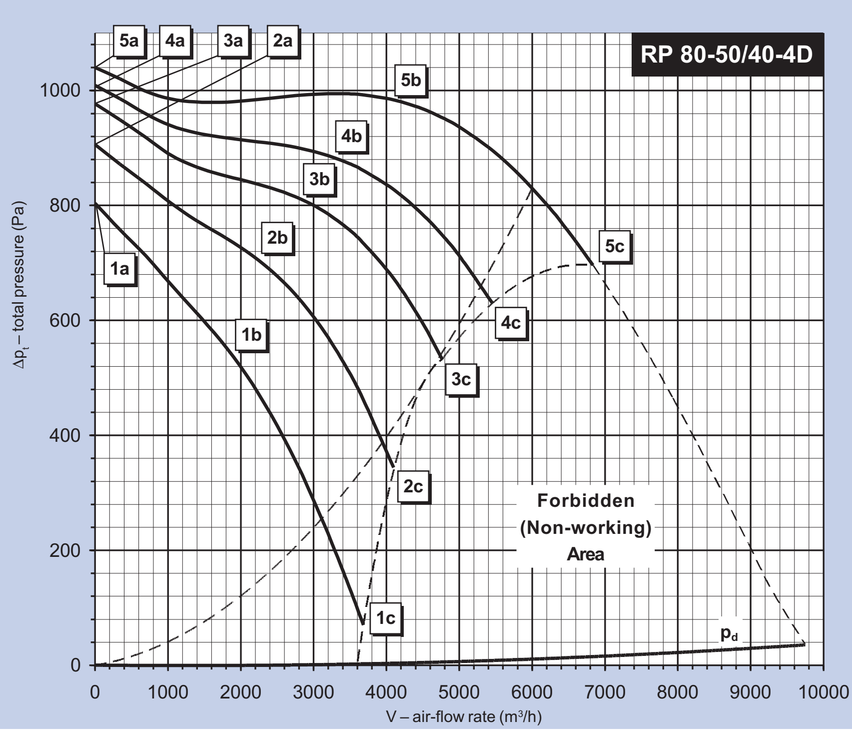


RP 80-50/40-6D

Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	2824
Max. current (5c)	I_{max}	[A]	5,11
Mean speed	n	[min^{-1}]	960
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	50
Max. air flow rate	V_{max}	[m^3/h]	7357
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	496
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	71
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	77	81	68
Sound power level L_{WAokt} [dB (A)]			
125 Hz	70	68	62
250 Hz	66	68	58
500 Hz	69	75	58
1000 Hz	71	75	60
2000 Hz	70	74	63
4000 Hz	67	72	53
8000 Hz	58	61	47

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,17	2,58	5,11	1,43	2,08	4,99	1,22	2,03	4,90	1,11	2,00	4,40	1,08	2,10	3,80
Electric input	P	[W]	441	1013	2824	276	724	1957	264	633	1556	229	512	1044	201	421	678
Speed	n	[min^{-1}]	992	960	835	980	928	710	967	899	621	948	853	507	917	774	409
Air flow rate	V	[m^3/h]	0	2918	7357	0	2518	6207	0	2255	5393	0	1943	4364	0	1767	3462
Static pressure	Δp_s	[Pa]	496	479	0	482	447	0	466	415	0	446	368	0	420	304	0
Total pressure	Δp_t	[Pa]	496	481	15	482	449	11	466	416	8	446	369	5	420	305	3

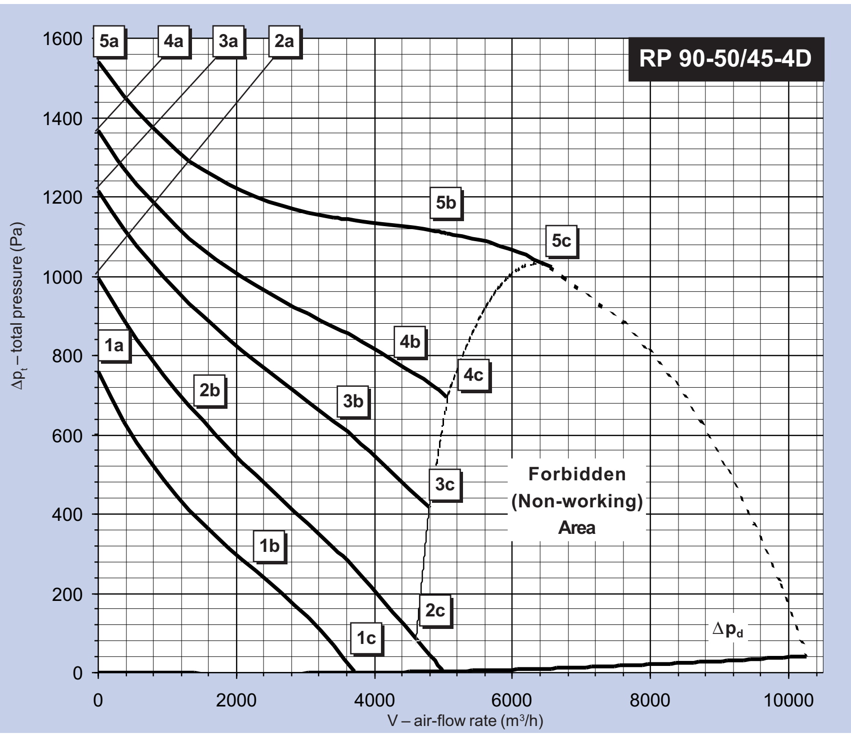


RP 80-50/40-4D

Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8,10
Mean speed	n	[min^{-1}]	1410
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	6831
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	1040
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	683
Weight	m	[kg]	78
Five-stage controller	typ		TRN 9D
Protecting relay	typ		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	88	92	77
Sound power level L_{WAokt} [dB (A)]			
125 Hz	81	76	71
250 Hz	74	78	67
500 Hz	74	83	68
1000 Hz	83	88	72
2000 Hz	82	86	69
4000 Hz	78	84	64
8000 Hz	70	73	65

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	3,00	5,01	8,10	2,38	4,91	8,10	2,33	4,93	8,10	2,54	4,88	8,10	2,96	5,21	8,10
Electric input	P	[W]	1217	2915	4919	903	2143	3498	782	1770	2800	721	1379	2117	671	1110	1516
Speed	n	[min^{-1}]	1480	1414	1322	1452	1348	1195	1427	1293	1088	1380	1214	890	1298	1055	548
Air flow rate	V	[m^3/h]	0	4135	6831	0	3307	5456	0	2894	4763	0	2306	4109	0	1957	3673
Static pressure	Δp_s	[Pa]	1040	982	683	1009	885	621	977	808	525	906	692	339	804	520	67
Total pressure	Δp_t	[Pa]	1040	987	696	1009	888	630	977	810	532	906	693	344	804	521	70

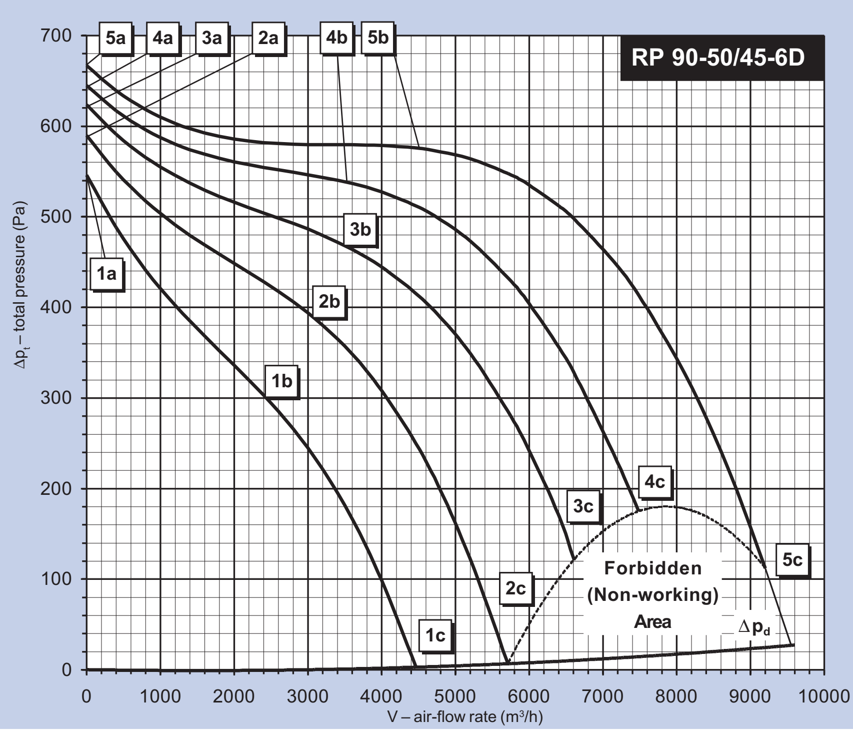


RP 90-50/45-4D

Power supply	D		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8,30
Mean speed	n	[min^{-1}]	1260
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	6558
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	1541
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	1014
Weight	m	[kg]	96
Five-stage controller	typ		TRN 9D
Protecting relay	typ		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	88	95	79
Sound power level L_{WAokt} [dB (A)]			
125 Hz	74	75	72
250 Hz	73	80	69
500 Hz	78	88	72
1000 Hz	83	91	74
2000 Hz	83	90	71
4000 Hz	79	85	66
8000 Hz	71	76	55

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	3,74	7,20	8,30	3,44	7,41	8,30	3,65	6,97	8,30	4,07	5,07	8,17	4,11	5,50	6,32
Electric input	P	[W]	1993	4269	4919	1402	3055	3367	1259	2318	2718	1073	1330	1927	829	1041	1119
Speed	n	[min^{-1}]	1396	1259	1211	1343	1069	997	1280	957	800	1137	1009	376	978	623	285
Air flow rate	V	[m^3/h]	0	5512	6558	0	4398	5055	0	3583	4805	0	1543	4986	0	2286	3707
Static pressure	Δp_s	[Pa]	1541	1089	1014	1367	787	693	1216	617	435	994	652	0	758	257	0
Total pressure	Δp_t	[Pa]	1541	1096	1023	1367	791	699	1216	619	440	994	652	5	758	258	3

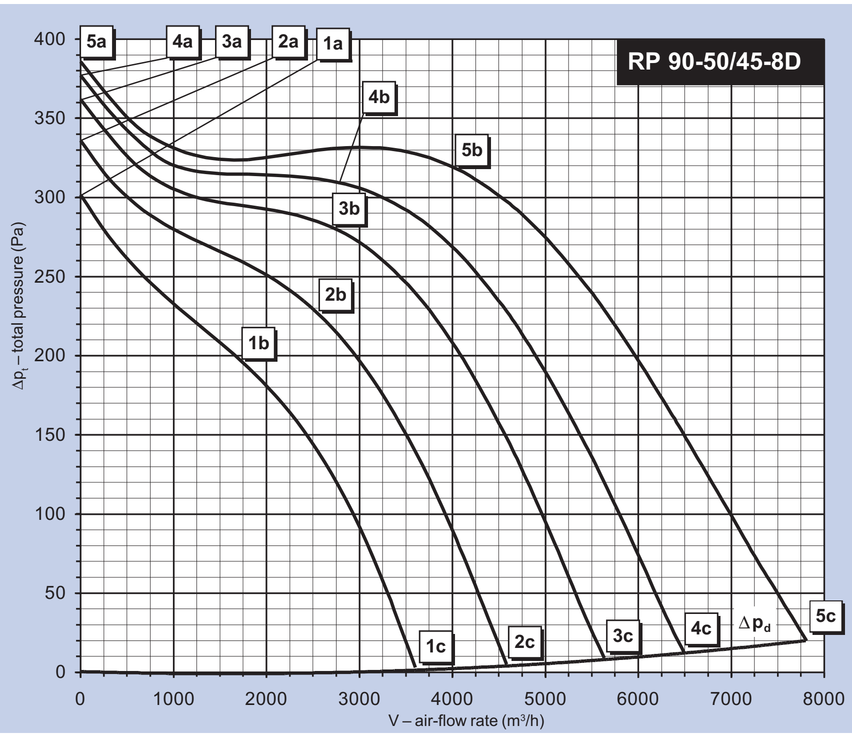


RP 90-50/45-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	3780
Max. current (5c)	I_{max}	[A]	6,80
Mean speed	n	[min^{-1}]	930
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	9200
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	667
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	90
Weight	m	[kg]	96
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	81	88	68
Sound power level L_{WAokt} [dB (A)]			
125 Hz	65	66	61
250 Hz	65	72	60
500 Hz	74	83	62
1000 Hz	75	82	62
2000 Hz	76	82	59
4000 Hz	72	78	54
8000 Hz	64	68	42

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,96	3,87	6,80	2,15	3,45	6,80	1,99	3,75	6,80	1,98	3,86	6,66	2,03	3,74	5,59
Electric input	P	[W]	665	1757	3780	564	1315	2785	518	1242	2271	476	1025	1640	415	760	1040
Speed	n	[min^{-1}]	968	926	832	948	879	713	931	825	621	899	749	443	846	659	351
Air flow rate	V	[m^3/h]	0	4463	9200	0	3575	7483	0	3503	6609	0	3154	5712	0	2550	4462
Static pressure	Δp_s	[Pa]	667	574	90	645	541	163	624	467	111	590	381	0	546	295	0
Total pressure	Δp_t	[Pa]	667	578	112	645	544	175	624	470	121	590	383	7	546	296	4

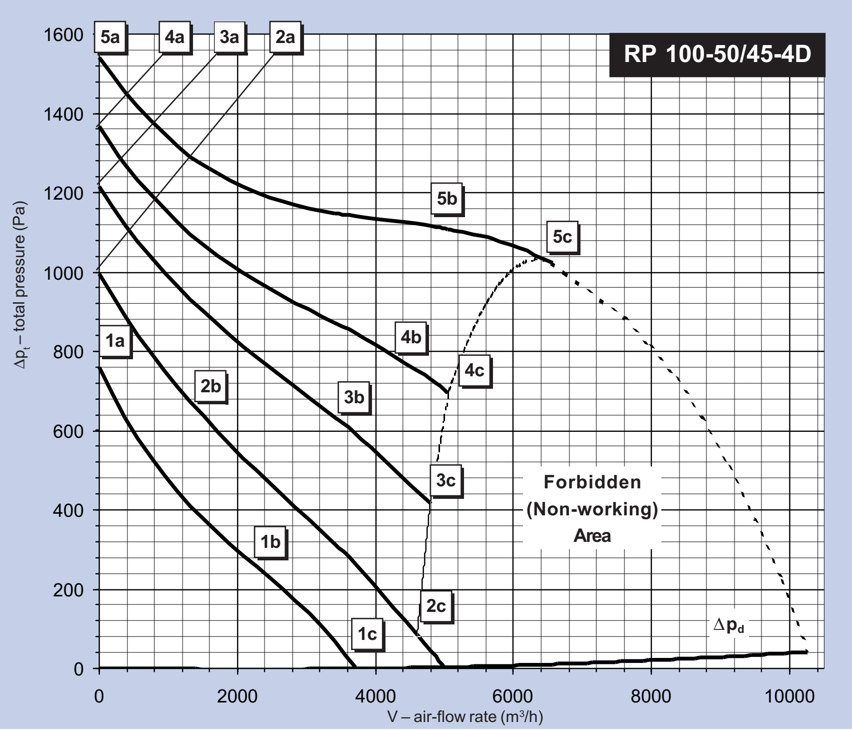


RP 90-50/45-8D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	1892
Max. current (5c)	I_{max}	[A]	3,88
Mean speed	n	[min^{-1}]	690
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	7810
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	386
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	93
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	74	81	62
Sound power level L_{WAokt} [dB (A)]			
125 Hz	59	58	54
250 Hz	61	69	55
500 Hz	68	77	57
1000 Hz	64	74	55
2000 Hz	69	75	52
4000 Hz	65	71	45
8000 Hz	55	61	39

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,20	2,49	3,88	1,54	2,03	3,78	1,32	1,87	3,61	1,14	1,92	3,20	1,08	1,67	2,73
Electric input	P	[W]	350	813	1892	264	624	1398	222	518	1081	196	455	733	178	311	477
Speed	n	[min^{-1}]	725	694	610	715	661	505	704	641	434	683	577	349	646	543	277
Air flow rate	V	[m^3/h]	0	3522	7810	0	2951	6493	0	2529	5632	0	2474	4581	0	1675	3603
Static pressure	Δp_s	[Pa]	386	328	0	377	307	0	362	284	0	336	230	0	302	195	0
Total pressure	Δp_t	[Pa]	386	329	20	377	309	12	362	286	9	336	232	5	302	195	3

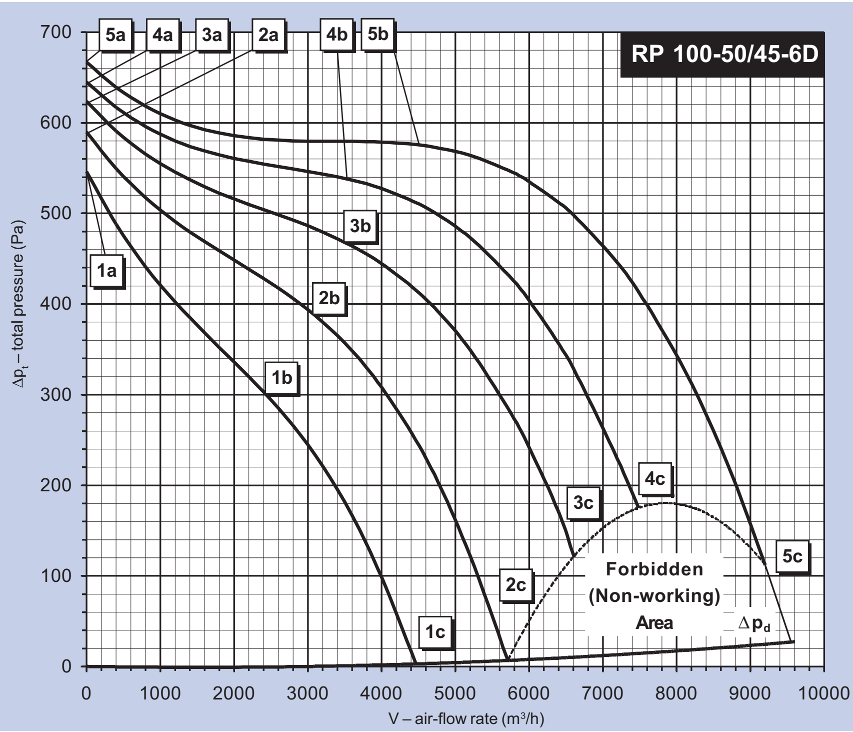


RP 100-50/45-4D

Power supply	D		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8,30
Mean speed	n	[min^{-1}]	1260
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	6558
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	1541
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	1014
Weight	m	[kg]	96
Five-stage controller		typ	TRN 9D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	88	95	79
Sound power level L_{WAokt} [dB (A)]			
125 Hz	74	75	72
250 Hz	73	80	69
500 Hz	78	88	72
1000 Hz	83	91	74
2000 Hz	83	90	71
4000 Hz	79	85	66
8000 Hz	71	76	55

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	3,74	7,20	8,30	3,44	7,41	8,30	3,65	6,97	8,30	4,07	5,07	8,17	4,11	5,50	6,32
Electric input	P	[W]	1993	4269	4919	1402	3055	3367	1259	2318	2718	1073	1330	1927	829	1041	1119
Speed	n	[min^{-1}]	1396	1259	1211	1343	1069	997	1280	957	800	1137	1009	376	978	623	285
Air flow rate	V	[m^3/h]	0	5512	6558	0	4398	5055	0	3583	4805	0	1543	4986	0	2286	3707
Static pressure	Δp_s	[Pa]	1541	1089	1014	1367	787	693	1216	617	435	994	652	0	758	257	0
Total pressure	Δp_t	[Pa]	1541	1096	1023	1367	791	699	1216	619	440	994	652	5	758	258	3

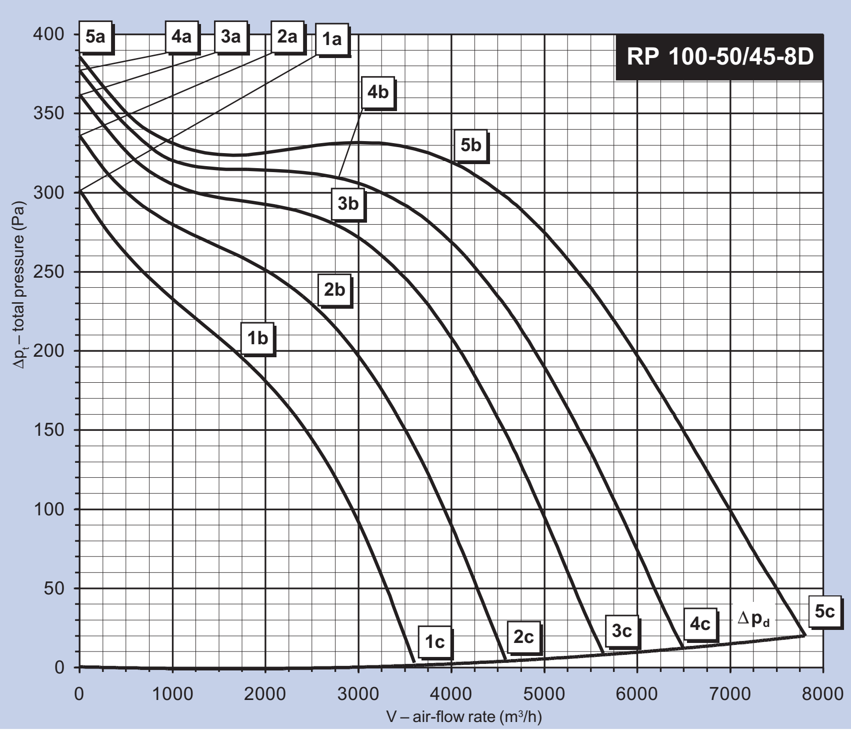


RP 100-50/45-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	3780
Max. current (5c)	I_{max}	[A]	6,80
Mean speed	n	[min^{-1}]	930
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	9200
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	667
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	90
Weight	m	[kg]	96
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	81	88	68
Sound power level L_{WAokt} [dB (A)]			
125 Hz	65	66	61
250 Hz	65	72	60
500 Hz	74	83	62
1000 Hz	75	82	62
2000 Hz	76	82	59
4000 Hz	72	78	54
8000 Hz	64	68	42

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,96	3,87	6,80	2,15	3,45	6,80	1,99	3,75	6,80	1,98	3,86	6,66	2,03	3,74	5,59
Electric input	P	[W]	665	1757	3780	564	1315	2785	518	1242	2271	476	1025	1640	415	760	1040
Speed	n	[min^{-1}]	968	926	832	948	879	713	931	825	621	899	749	443	846	659	351
Air flow rate	V	[m^3/h]	0	4463	9200	0	3575	7483	0	3503	6609	0	3154	5712	0	2550	4462
Static pressure	Δp_s	[Pa]	667	574	90	645	541	163	624	467	111	590	381	0	546	295	0
Total pressure	Δp_t	[Pa]	667	578	112	645	544	175	624	470	121	590	383	7	546	296	4

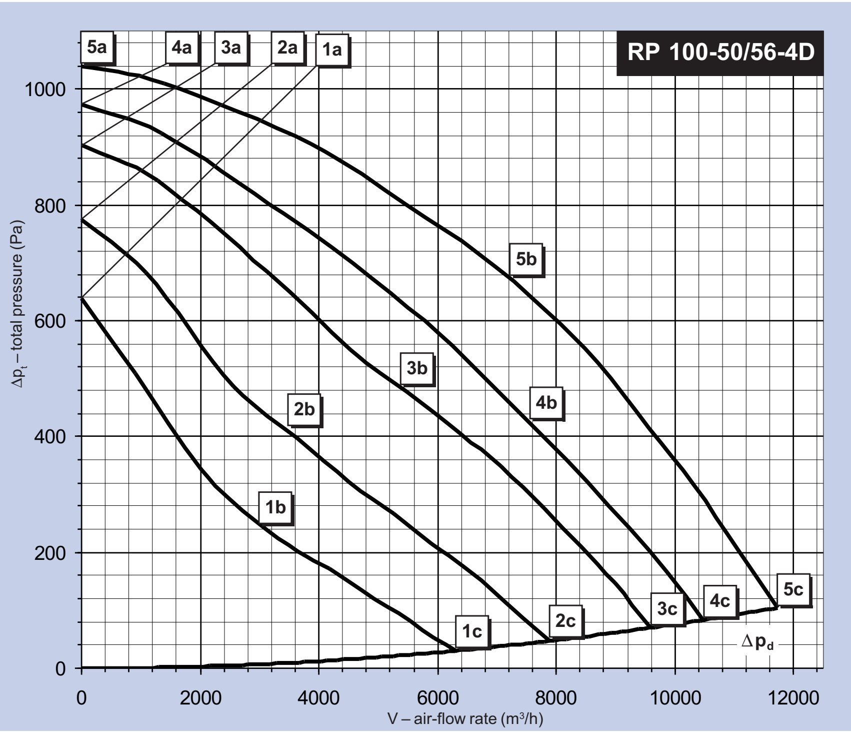


RP 100-50/45-8D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	1892
Max. current (5c)	I_{max}	[A]	3,88
Mean speed	n	[min^{-1}]	690
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	7810
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	386
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	93
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	74	81	62
Sound power level L_{WAokt} [dB (A)]			
125 Hz	59	58	54
250 Hz	61	69	55
500 Hz	68	77	57
1000 Hz	64	74	55
2000 Hz	69	75	52
4000 Hz	65	71	45
8000 Hz	55	61	39

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,20	2,49	3,88	1,54	2,03	3,78	1,32	1,87	3,61	1,14	1,92	3,20	1,08	1,67	2,73
Electric input	P	[W]	350	813	1892	264	624	1398	222	518	1081	196	455	733	178	311	477
Speed	n	[min^{-1}]	725	694	610	715	661	505	704	641	434	683	577	349	646	543	277
Air flow rate	V	[m^3/h]	0	3522	7810	0	2951	6493	0	2529	5632	0	2474	4581	0	1675	3603
Static pressure	Δp_s	[Pa]	386	328	0	377	307	0	362	284	0	336	230	0	302	195	0
Total pressure	Δp_t	[Pa]	386	329	20	377	309	12	362	286	9	336	232	5	302	195	3



RP 100-50/56-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	3205
Max. current (5c)	I_{max}	[A]	5,50
Mean speed	n	[min^{-1}]	1383
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	50
Max. air flow rate	V_{max}	[m^3/h]	11731
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	1039
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	116
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	92	98	80
Sound power level L_{WAokt} [dB (A)]			
125 Hz	73	78	67
250 Hz	80	90	72
500 Hz	88	93	74
1000 Hz	87	94	74
2000 Hz	85	90	74
4000 Hz	77	82	66
8000 Hz	68	71	60

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	3,20	5,20	5,40	3,30	5,90	6,00	3,60	6,10	6,20	4,00	5,80	6,20	4,20	5,40	5,70
Electric input	P	[W]	1546	3041	3142	1369	2512	2584	1261	2173	2198	1101	1539	1625	865	1064	1126
Speed	n	[min^{-1}]	1434	1358	1356	1372	1215	1208	1308	1109	1105	1177	944	901	1015	758	720
Air flow rate	V	[m^3/h]	0	6685	11731	0	6855	10471	0	5474	9578	0	3612	7875	0	2942	6312
Static pressure	Δp_s	[Pa]	1039	681	0	973	460	0	903	456	0	775	388	0	638	247	0
Total pressure	Δp_t	[Pa]	1039	715	104	973	495	83	903	478	70	775	398	47	638	254	30

Installation, Maintenance and Service

Installation

■ RP fans (including other Vento elements and equipment) are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for the proper selection of fan. The installation and commissioning may be performed only by an authorized company licensed in accordance with generally valid regulations.

■ The fan must be checked carefully before its installation, especially if it has been stored for a longer time. In particular, it is necessary to check all parts and cable insulation for damage, and whether the rotary parts can rotate freely.

n It is recommended to insert the DV elastic connections in front of and behind the fan (see Figure # 6).

■ It is advisable to always place the KFD or VFK air filters in front of the fan to protect the fan and duct against dirtying and dust fouling.

n If the fan is installed in such a way that persons or objects can come into contact with the impeller, the guard grid must be mounted.

■ In cramped areas, it is advisable to consider the necessity to situate directly behind the fan's outlet the duct adapting piece, attenuator, heat exchanger, heater, etc. Figure # 7 shows the fan's outlet design and arrangement. It is obvious that from the entire cross-section (e.g. 500 x 250) only 1/4 of the outlet cross-section is free.

Figure 6 - Application of elastic connections

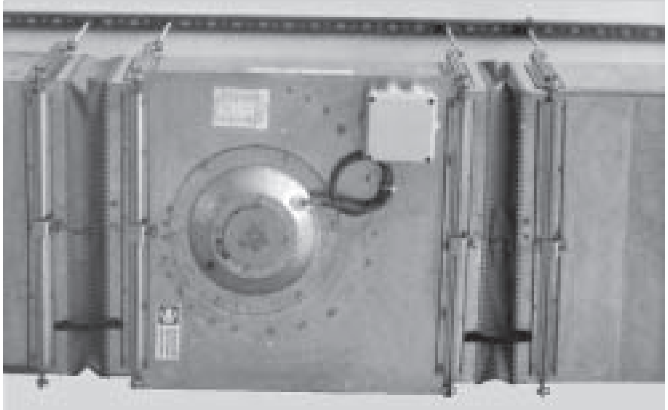
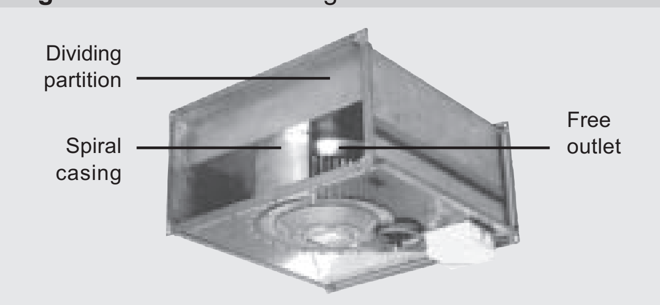


Figure 7 - Fan outlet arrangement

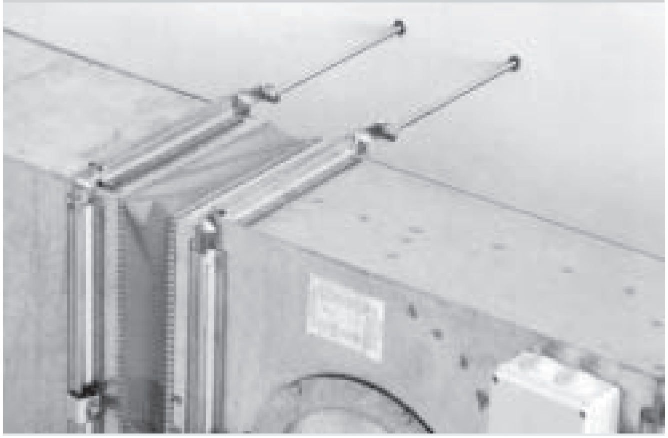


This means that the airflow velocities close behind the fan can be as much as four times higher than, for example, in the inlet. Therefore, the greater the distance of attenuators (or other resistant elements) from the outlet, the better (4. On the inlet side, the DV elastic connection will be sufficient as a distance piece in most cases.

■ The fan must be suspended by separate suspensions so that no loading can be transferred to the elastic connections or connected duct.

■ Anchoring to the ceiling with steel anchors and suspension using threaded rods (see fig. # 8), perforated galvanized strips (see fig. # 9) or an ancillary construction is recommended.

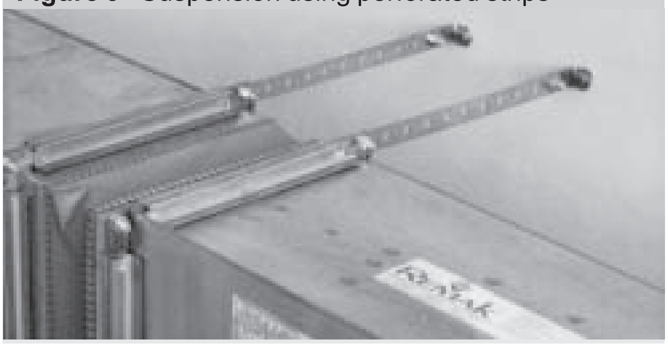
Figure 8 - Fan anchoring



■ RP fans can work in any position. When positioned under the ceiling, it is advisable to situate the fan with its motor cup directed downwards to ease access to the motor terminal b.

■ If transported air is oversaturated with moisture or if the risk of intensive and permanent steam condensation inside the fan exists (e.g. showers, kitchens, laundry plants, etc.), it is better to situate the fan's motor cap upwards!

Figure 9 - Suspension using perforated strips



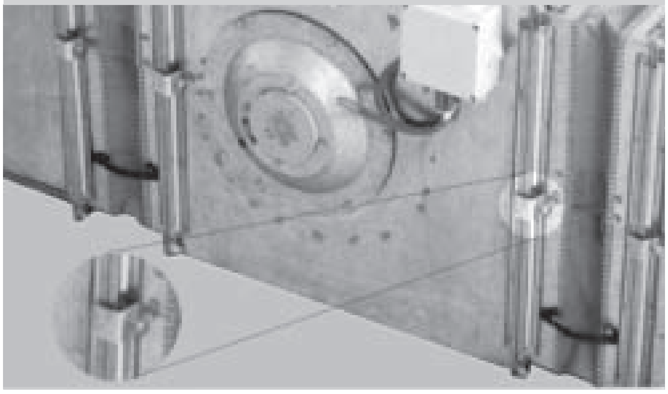
■ Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento system, use galvanized screws and nuts M8 (M10 only for RP 90-50 and RP 100-50). It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides, at least on one flange connection.

■ To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping (see fig. # 10).

(4 This recommendation applies for all duct fans

Installation, Maintenance and Service

Obrázek 10 – šroubovací spoje



Wiring

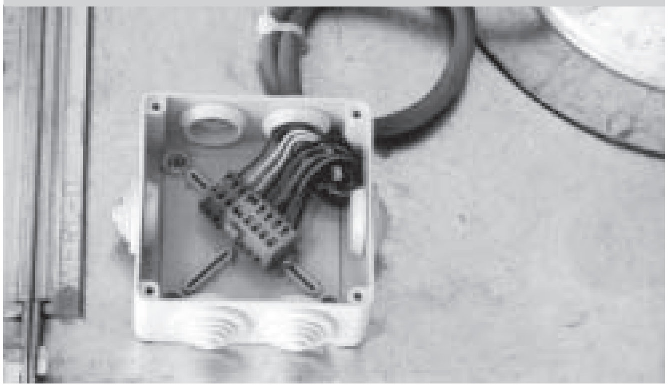
■ The wiring can be performed only by a qualified worker licensed in accordance with national regulations.

■ The fans can be equipped with two types of terminal boxes:

a) An all-plastic terminal box fixed with screws to the fan casing, and equipped with WAGO terminals; max. cross-section of connecting conductors 1.5 mm2 (see fig. # 11).

b) A plastic terminal box fixed with screws to the motor stator, and equipped with screw terminals (see fig. # 12).

Figure 11 - All-plastic terminal box on the casing



■ The wiring connection to the terminals can be performed following the marking on the motor cables in the terminal box, or following the label on the terminal box lid.

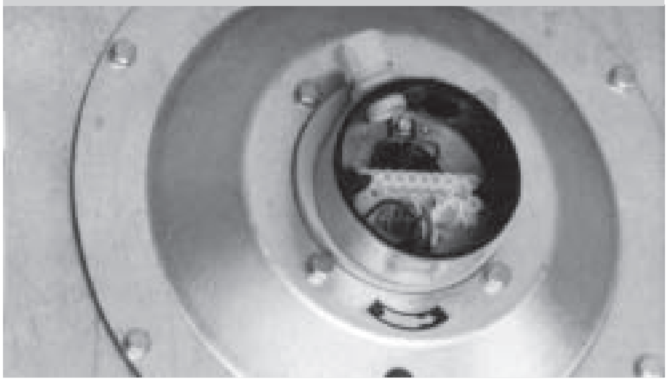
■ The following cables are recommended to connect fan motors:

HO5VVH2 - F 2Ax0.75	- thermo contact circuit
CYKY 3Cx1.5	- single-phase motor power supply
CYKY 4Bx1.5	- three-phase motor power supply

■ The fan can be started after its mounting into the duct system for which it has been designed, respectively fully throttled by closing either the intake or discharge to avoid its overloading! (Applicable for fans with non-working area). **The fan is loaded by increasing the air flow, i.e. by releasing the throttling**.

■ After starting the fan with three-phase motor, the correct direction of the impeller rotation must be checked. To do so, remove the rubber plug from the inspection opening in the fan cup (see fig. # 13).

Figure 12 - Plastic terminal box on the stator

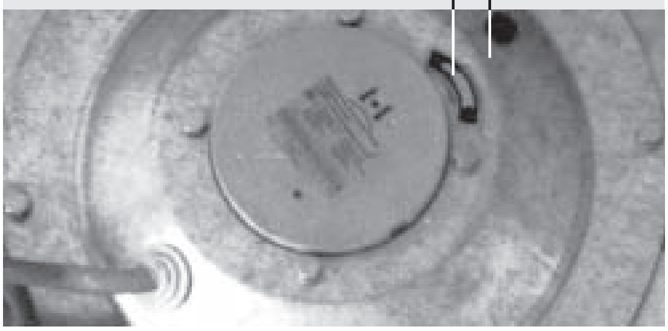


■ After starting the fan, the current must also be measured, and it must not exceed the maximum allowed current Imax. stated on the rating plate. If the measured values exceed the given current value, it is necessary to check the duct system regulation.

■ The fans are equipped with thermo-contacts situated in the motor winding; they are connected to the TK terminals. If the motor is overloaded, the thermo-contact will open. To evaluate the failure, the thermo-contact must be connected to the control or regulating system (e.g. control unit, TRN controller or STE(D) relay) which is able to evaluate the failure, and protect the motor against unwanted thermal effects. The proper functioning of the control system must ensure that after cooling down and the thermo-contact closing, the motors cannot be spontaneously started. Before restarting the fan (failure deblocking), it is necessary to check the duct system regulation, the electrical parameters of the motor and the entire wiring.

Figure 13 - Rubber plug of the inspection opening

Rubber plug
Arrow indicating the direction of rotation



Installation, Maintenance and Service

Oh the following pages you will find some basic examples of the fan connection to output controllers and control units. AeroCAD software is available for precise design of the wiring.

Operation, Maintenance and Service

The fan does not require special maintenance. During operation, it is especially necessary to check proper functioning of the fan, its smooth running, to keep it and its surroundings clean, and to load the fan only within the range given by its output characteristics.

If a failure occurs, make sure that the power supply is disconnected. Check the fan for foreign objects inside, free impeller rotation. If the fan does not run after it has been restarted, the following procedures must be followed depending on the protection system used:

- If the fan is protected by STE or STD relays: Turn the fan on/off using the buttons on the protecting relay.

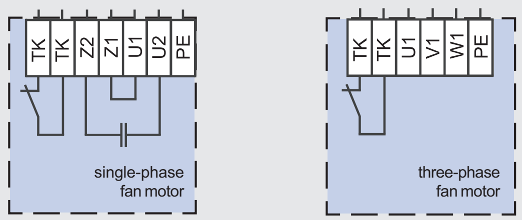
n If the fan is protected by a TRN controller: Turn the fan on/off using the switch on the remote controls of the controller.

- If the fan is protected by the control unit: Press the unblocking button on the control unit (the horn symbol), and restart the unit.

If the fan does not start: Check the wiring, and measure the motor winding impedance. If the motor is damaged, contact your supplier.

Warning! When performing any maintenance or repairs, the device must always be disconnected from the power supply!

Figure 14 - Wiring diagram



TK
– motor thermo-contact terminals
U1, U2
– single-phase motor power supply terminals 1f - 230V/50Hz
PE
– protective conductor terminal

TK
– motor thermo-contact terminals
U1, V1, W1
– three-phase motor power supply terminals 3f - 230V/50Hz
PE
– protective conductor terminal

The wiring diagrams with front-end elements (protective relays, controllers, control units) are included in the installation manual, respectively in the AeroCAD project.

Example A

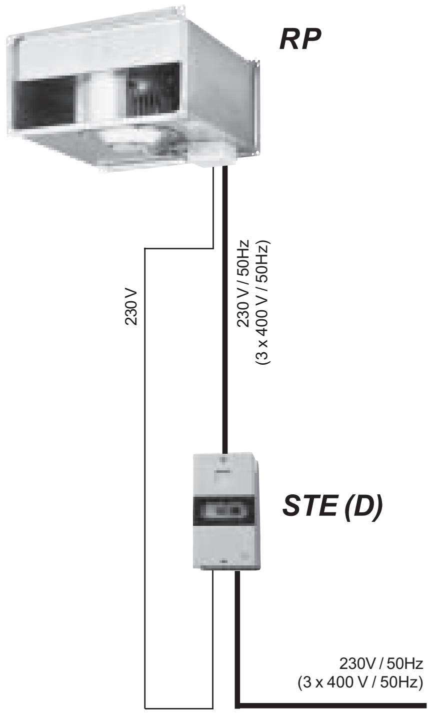
RP Fans without Output Control and with STE(D) Protecting Relay

The RP fan connection in a simple venting system without output control is shown in figure # 14.
This connection ensures:

- Full thermal protection of the fan using thermo-contacts and protecting relay, STE (single-phase) or STD (three-phase).
- Manual switching of the fan on/off using buttons on the STE(D) protecting relay.

After pressing the button marked "I" on the STE(D) protecting relay, the fan starts and the button will stay in the depressed position, signalling the fan's operation. The fan can be stopped by pressing the button marked "0".
If the motor winding is overheated above 130 °C due to overloading, the thermo-contacts in the motor winding will open. Upon the thermo-contacts opening, which are interconnected with the fan terminal box, the STE(D) protecting relay circuit TK, TK will be disconnected. As a reaction to this state, the STE(D) protecting relay will disconnect the power supply to the overheated motor. After cooling down, the motor is not automatically restarted. The failure must be confirmed (unblocked) by the operator by pressing the red "I" button.

Figure 14 - Fan connection



Example B

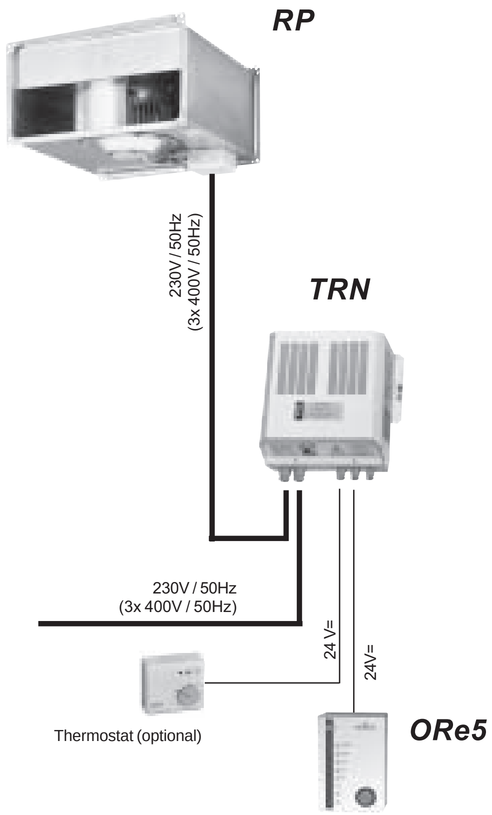
RP Fans with Output Control and TRN Controller

The RP fan connection in a venting system with output control using TRN controller with ORe5 controller is shown in figure # 15.
This connection ensures:

- The possibility of fan output selection within the stage range 1-5 as well as full protection via thermo-contacts.
- Fan switching on/off manually, by the ORe5 remote controller or any other switch (like room thermostat, gas detector, pressostat, hygrostat, etc).

Upon selecting the required output stage using a selector on the ORe5 controller the fan will start at corresponding speed. The closed switch connected to PT1, PT2 terminals and the thermo-contact circuit connected to TK,TK terminals are essential for the fan operation. The switch connected to PT1, PT2 terminals can externally stop the fan. If this option is not used, it will be necessary to interconnect terminals PT1 and PT2.
If the fan is overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding. As a reaction to this state, the controller will disconnect the fan power supply, and the red control light on the ORe controller will signal the failure. After cooling down, the motor is not automatically restarted. To restart the fan, it is necessary first to set the selector to the "STOP" position, and thus confirm failure removal, and then to set the required fan output. In this arrangement, the option "STOP" on Ore5 must not be blocked

Figure 15 - Fan connection



Example C

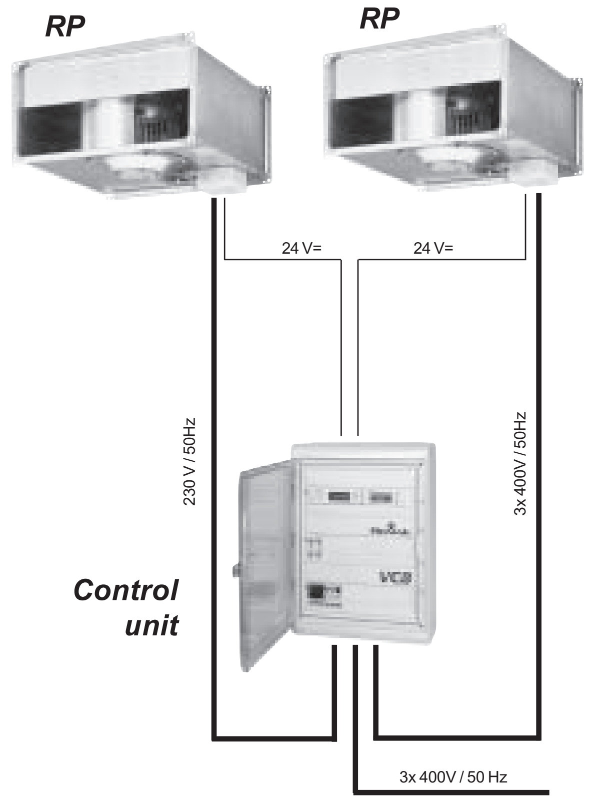
RP Fans without Output Control and with Control Unit

The RP fan without output control connection in more sophisticated venting systems using the control unit is shown in figure # 16.
This connection ensures:

- Full thermal protection of the fan via thermo-contacts and control unit.
- Fan switching on/off by the control unit. The motor protection must always be ensured by the control unit while TK,TK thermo-contact terminals are connected to 5a, 5a, 5b, 5b terminals in the control unit.

The air-handling system is started by the control unit. All protecting and safety functions of the fan as well as the entire system are ensured by the control unit.

Figure 16 - Fan connection



Example D

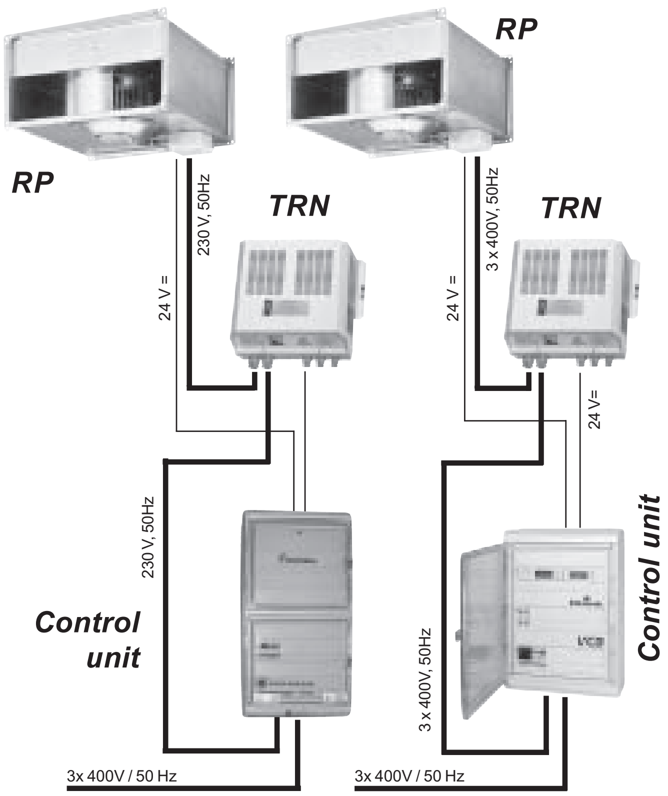
RP Fans with TRN Controllers and Control Unit

The RP fan with TRN output controllers and a common internal controller in more sophisticated venting systems using the control unit is shown in figure # 17. The internal controller is installed in the control unit during production.
This connection ensures:

- Fan switching on/off by the control unit. The motor protection must always be ensured by the control unit while TK,TK thermo-contact terminals are connected to 5a, 5a, 5b, 5b terminals in the control unit.
- Common selection of fan output by the internal selector within the stage range 1-5. The control unit can be equipped with two internal selectors, wile each fan can be controlled separately. In the connection according to example D, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller.

The air-handling system is started by the control unit. All protecting and safety functions of fans as well as the entire system are ensured by the control unit.

Figure 17 - Fan connection



Example E

RP Fans with Automatic Output Control, TRN Controller and OSX Control Unit

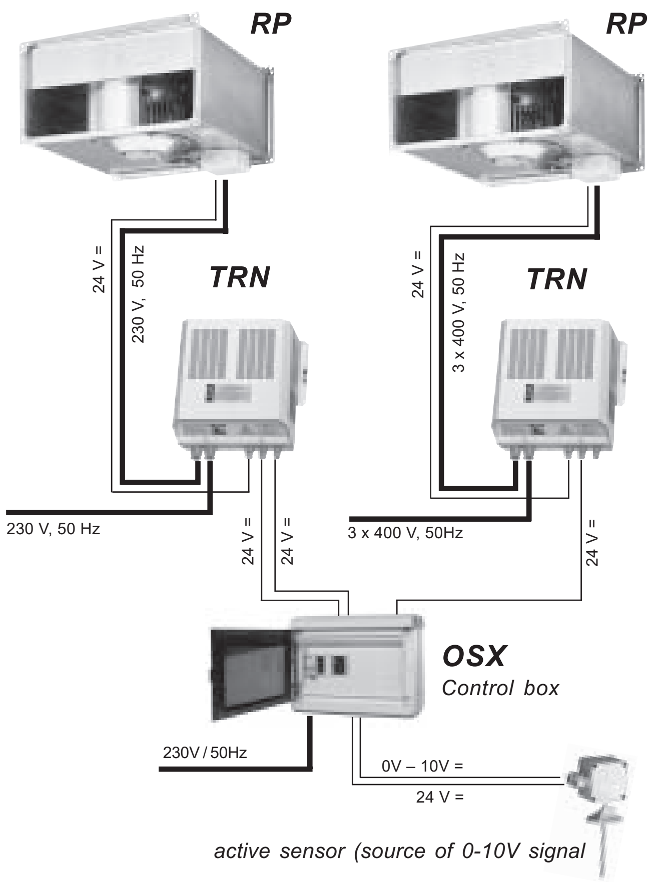
The RP fan connection in a special venting system with automatic output control using TRN controller and OSX control unit is shown in figure # 18. Two TRN controllers can be controlled by the OSX control unit. The fans are controlled together to the same output.
This connection ensures:

- Automatic selection of the fan output within the stage range 0 - 5 as well as its protection via thermo-contacts and the protection integrated into the TRN controller. Automatic selection of the controller output stage is ensured by the OX controller integrated into the OSX control unit in relation to any physical quantity which is read by the active sensor equipped with an analogue output (signal source 0- -10V). The OSX control unit has several additional functions. One of them is the possibility to stop fan operation using the "STOP" button regardless of the value of the input voltage.
- Manual start of the system at the output stage corresponding to the selected voltage. Regardless of the actual value of the control voltage, it is possible, using the "MANUAL" button, to connect the input of the OX controller for the voltage selected by the TEST trimmer OX controller. The OX controller factory default setting of this button feature is to the full output..

The fans in the picture are started, controlled and protected by TRN controller. Automatic OX controller evaluates the continuous signal of 0-10V coming from the converter (source of the signal) and in six adjustable levels switches stages 0-5. Thermal or pressure converter, converters for measurement of relative or absolute humidity, concentration of gas, vapours or explosives in air, sensors of air quality and many other converters of different physical quantities can be used as sources of the control signal.

If the fan is overloaded, the thermo-contacts TK, TK will disconnect due to overheating of the motor winding. The system will switch the power supply of the overloaded fan off, and the failure will be signalled by an LED on the OSX control panel. After cooling down, the motor is not automatically restarted. The failure must be confirmed by pressing the separate unblocking button on the OSX control panel for each fan. As most similar installations can vary from case to case, it is advisable to consult the operating conditions with the manufacturer.

Figure 18 - Fan connection



Technical information

Fan Applications

Fully controlled, low-pressure RQ Radial Fans intended for square ducts can be universally used for complex air-conditioning, from simple venting installations to sophisticated air-handling systems. Ideally, they can be used along with other components of the Vento modular system, which ensures inter-compatibility and balanced parameters.

Operating Conditions, Position

These fans are designed for indoor and outdoor applications, and to transport air without solid, fibrous, sticky, aggressive, respectively explosive impurities. The transported air must be free of corrosive chemicals and chemicals aggressive to zinc and/or aluminium.
The acceptable temperature of transported air can range from -30 °C to +55 °C, and with type RQ 20-4D up to +70 °C. The maximum nominal values for each fan are included in table 4. RQ fans can work in any position.

Dimensional Range

RQ fans are manufactured in a range of seven sizes according to the A x B dimensions of the connecting outlet flange. Several fans differing mainly in the number of poles the motor uses are available for each size. When planning the fan for the required air flow and pressure, the following general rule is applied; fan motors with a higher number of poles reach the required parameters at lower RPM, which results in lower noise and longer service life. Fans with a higher number of poles also have lower air velocity in the cross section, which results in lower pressure losses in the duct and accessories, however, at higher investment costs. The standard dimensional and performance range of single-phase and three-phase RQ fans enables designers to optimize all parameters for air flow up to 7.800 m³ per hour.

Materials

The external casing of RQ fans is made of galvanized steel sheets (Zn 275 g/m2). Impeller blades and diffusers are always made of galvanized sheet steel while motors are made of aluminium alloys, copper and plastics. The motor's high quality enclosed ball bearings with permanent lubricating filling enable the fans to reach a service life above 40,000 operating hours without maintenance. All materials are carefully verified, checked so they ensure long service life and reliability of the fans.

Motors

Compact single-phase and three-phase asynchronous motors with an external rotor and a resistance armature are used as drives. The motors are situated inside the impeller, and during operation are optimally cooled by the flowing air. The motors feature low build-up current. Impellers along with the motor are perfectly statically and dynamically balanced.
The motor electric protection degree is IP 54 for RQ and IP 44 for RQ 25 with F insulation class. The motor windings are impregnated to provide them with additional protection against moisture.

Electrical Equipment

The wiring is terminated in a terminal box of IP 54 protection degree. Single-phase motors are equipped with a starting capacitor which is mounted on the fan casing. For wiring diagrams, refer to a separate section.
Warning: Three-phase motors must be connected in accordance with the data stated in the section "Technical Data", respectively on the motor rating plate.

Motor Protection

As standard, permanent monitoring of the internal motor temperature is used in all motors. The limit temperature is monitored by thermal contacts (TK-thermo-contacts) situated in the motor winding. The thermo-contacts are miniature thermal tripping elements which after being connected to the protective contactor circuit protect the motor against overheating (damaging) due to phase failure, forced motor braking, current protection circuit breakdown or excessive temperature of the transported air. Thermal protection by means of thermo-contacts is comprehensive and reliable providing they are correctly connected. This type of protection is essential especially for speed controlled and frequently started motors and motors highly thermally loaded by hot transported air.
Therefore, the fan motors cannot be protected by conventional thermal protection ensured by the motor overcurrent protective elements!
Maximum permanent thermo-contact loading is 1.2 AMP at 250V / 50V (cos φ 0.6), (respectively 2 AMP at cos φ 1.0).

Fan Output Control

Generally, several types of control can be used with fans. However, voltage control is the most suitable for RQ fans. RQ fans can be steplessly controlled providing the change in voltage is stepless. In practice, stage voltage controllers are most often used. TRN stage voltage controllers can control the fan output in five stages in 20% steps, with which five pressure-airflow relation curves in the working characteristic of each fan comport.

Table 1 - input voltage and controller's stage

Motor type	Controller's stage and voltage				
	5	4	3	2	1
Single-phase	230 V	180 V	160 V	130 V	105 V
Three-phase	400 V	280 V	230 V	180 V	140 V

Refer to table 1[1] showing the correlation between the input voltage and selected stage of the controller for single-phase and three-phase motors. All values respect the European 400/230 V power supply system.
The recommended product line includes single-phase and three-phase TRN controllers (2. Simplified TRRE and TRRD controllers can also be used to control RQ fans; however, they do not provide a protection function [2]

[1] RQ fan motors can be operated within a range from approx. 25% to 110% of the rated voltage.
[2] For detailed information, refer to the chapter "Fan Output controllers".

Technical information

Measuring the Parameters

The output characteristics of RQ fans are measured in the modern REMAK testing laboratory for aerodynamic and electrical measurements of fans and pressure losses of passive elements. This testing laboratory is equipped with a LabView® computer system from National Instruments® for the automatic collection and evaluation of all measured data. This testing laboratory complies with EN 24 163 and AMCA STANDARD 210-74[3] Standards.

Noise parameters of RQ fans are measured in REMAK's acoustic testing laboratory in accordance with the ČSN ISO 3743 Standard, which establishes the technical method of the sound power level determination in a special reverberant chamber. A measuring line of aerodynamic parameters is used to set the fan to the required working point when measuring the noise.

Operating Characteristics

Output characteristics in the "Data Section" (page 40) determine the relationship curve of the air flow rate V (m3/h) and total fan pressure ?pt = ?ps + pd (Pa). For an explanation of the correlations and relations of important data, refer to the section "RS Fans" .

Noise Parameters

In the "Data Section" of this catalogue you will find noise parameters radiated to the outlet, surroundings and inlet. The total sound power level LWA [dB (A)], i.e. the total level of the radiated A-scale sound power, is always given.Further, the octave value LWAokt of the A-scale sound power level for octave bands from 125 Hz to 8 kHz is also given. [4]

Fan Description and Designation

A table showing the most important values is included in addition to each fan's characteristics in the "Data Section" of the catalogue. The meaning of individual lines is explained in the following table 2. These values are also listed on each fan's rating plate.

Type designation of RQ spiral fans in projects and orders is defined by the key (see figure # 1). For example, type designation RP 28-4D specifies the type of fan, impeller and motor [6]

Figure 1 – Fan designation

RQ | **28** - **4** | **D**

Motor
- E - single-phase
- D - three-phase

Number of motor's poles
- 4 - four-pole
- 6 - six-pole
- 8 - eight-pole

Impeller diameter (cm)

Fan Type

Accessories

RQ fans belong in the wide range of Vento modular venting and air-handling system components. Any air-handling set-up, from simple venting to sophisticated comfortable air-conditioning, can be created by selecting suitable elements. The following accessories can be ordered along with RQ fans:

- Elastic connections DV, DK, counter-flanges (page 241)
- TRN Controllers and their controls
- TRRE, TRRD Controllers
- STE, STD Protecting Relays

Table 2 - Fan marking

				RQ 28-4D
Fan type designation				
Value of nominal power supply voltage	Power supply	Y		**3 x 400V 50Hz**
Maximum power input of the motor at working point	Max. electric input	P_{max}	[W]	**1278**
Maximum current at nominal voltage at working point	Max. current (5c)	I_{max}	[A]	**2,22**
Mean speed, rounded to tens, measured at working point 5b	Mean speed	n	[min^{-1}]	**1420**
Capacitor capacity with single-phase fans	Capacitor	C	[µF]	**-**
Maximum permissible transported air temperature	Max. working temp.	t_{max}	[°C]	**50**
Maximum air flow at working point 5c	Max. air flow rate	V_{max}	[m^3/h]	**3130**
Maximum total pressure between points 5a - 5c	Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	**464**
Minimum permissible static pressure at point 5c	Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	**0**
Total weight of the fan	Weight	m	[kg]	**23**
Recommended fan output controller	Five-stage controller		typ	**TRN 4D**
Recommended protecting relay (5	Protecting relay		typ	**STD**

[3] For more detailed information on the testing method, refer to REMAK Air-handling Magazine No. 2.

[4] For a recap of technical acoustic terms, an explanation of the measuring methodology and an outline of noise attenuation, refer to the catalogue sections "Duct Radial Fans" or "RS Roof Fans.

[5] Operation of the fan without controller and control unit

[6] The requirement for non-standard materials must be expressly specified in your order..

Fan parameters

Dimensions, Weights and Performance

For important dimensions of RQ fans, refer to figure # 2 and table # 3.
Technical data are included in table # 4. All further important data are included along with each fan's characteristics in the "Data Section" of the catalogue.

Explanation of symbols used in table # 4

- $V_{max.}$ - maximum air flow rate at minimum permissible pressure loss
- n - fan speed measured at the highest efficiency working point (5b), rounded to tens
- U - nominal power supply voltage of the motor without control
- $P_{max.}$ - maximum power input of the motor
- $I_{max.}$ - maximum phase current at voltage U and maximum allowed loading, i.e. at air flow V_{max} at working point 5c
- $t_{max.}$ - maximum permissible transported air temperature at air flow $V_{max.}$
- C - prescribed capacitor capacity with single-phase fans
- control - prescribed fan output voltage controller
- m - weight of the fan (±10%)

Figure 2 - Fan Dimensions

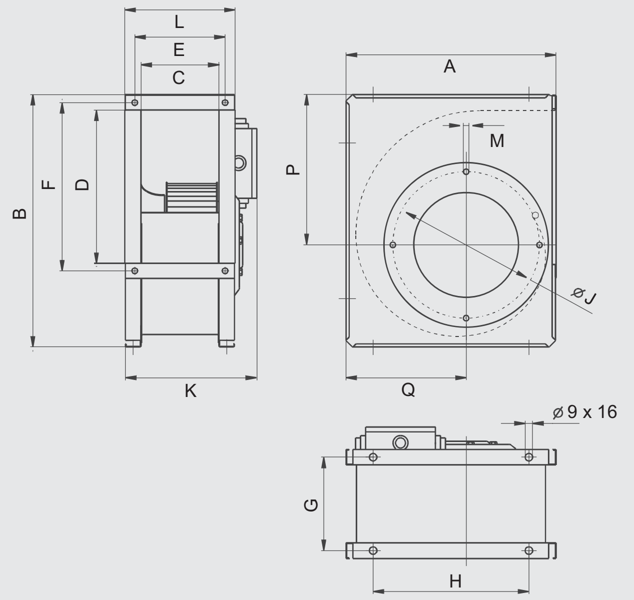


Table 3 - Fan Dimensions

Type	A	B	C	D	E	F	G	H	I	J	K	L	M	P	Q	DK [1]	DV [2]
RQ 20-..	335	405	125	250	145	270	150	250	225	235	203	172	8	236	193	200	200 x 125
RQ 22-..	370	445	140	280	160	300	170	300	245	260	221	190	8	263	215	225	280 x 140
RQ 25-..	410	495	160	315	180	335	190	300	270	285	243	212	8	289	236	250	315 x 160
RQ 28-..	460	545	180	355	200	375	210	350	295	315	263	232	8	322	263	280	355 x 180
RQ 31-..	515	615	200	400	220	420	230	400	325	350	285	254	8	360	312	315	400 x 200
RQ 35-..	580	690	225	450	245	470	250	400	340	390	303	272	8	403	330	355	450 x 225
RQ 40-..	655	770	250	500	270	520	280	450	380	445	331	300	8	451	370	400	500 x 250

[1] Fan's round elastic inlet connection [2] Fan's square elastic outlet connection

Table 4 - Fan's basic parameters and nominal values

Fan type	V_{max} m^3/h	ΔP_{max} W	n min^{-1}	U V	I_{max} A	t_{max} °C	C μF	Controller type	m kg
Single-phase fans									
RQ 20-4E	1135	303	1400	230	1,47	40	5	TRN 2E	9
RQ 22-4E	1627	508	1380	230	2,3	40	8	TRN 4E	14
RQ 25-4E	2350	861	1370	230	3,85	55	14	TRN 4E	17
RQ 28-4E	2607	1079	1370	230	5,1	40	16	TRN 7E	23
Three-phase fans									
RQ 20-4D	1240	290	1350	3x 400	0,49	70	–	TRN 2D	9
RQ 22-6D	1370	233	920	3x 400	0,46	55	–	TRN 2D	11
RQ 22-4D	1840	535	1410	3x 400	0,94	40	–	TRN 2D	14
RQ 25-6D	1780	337	910	3x 400	0,7	55	–	TRN 2D	14
RQ 25-4D	2701	1058	1430	3x 400	1,98	50	–	TRN 2D	15
RQ 28-6D	2730	643	950	3x 400	1,37	55	–	TRN 2D	17
RQ 28-4D	3130	1278	1420	3x 400	2,22	40	–	TRN 4D	23
RQ 31-6D	3798	946	920	3x 400	1,82	40	–	TRN 2D	23
RQ 31-4D	4482	2494	1410	3x 400	4,1	40	–	TRN 7D	30
RQ 35-8D	3723	672	650	3x 400	1,4	55	–	TRN 2D	37
RQ 35-6D	4022	1084	890	3x 400	2	40	–	TRN 2D	40
RQ 35-4D	5886	3534	1400	3x 400	6	40	–	TRN 7D	47
RQ 40-8D	4700	1274	670	3x 400	2,41	55	–	TRN 4D	48
RQ 40-6D	7800	2770	940	3x 400	5,1	50	–	TRN 7D	51
RQ 40-4D	6768	4873	1390	3x 400	8,1	40	–	TRN 9D	58

Fan parameters

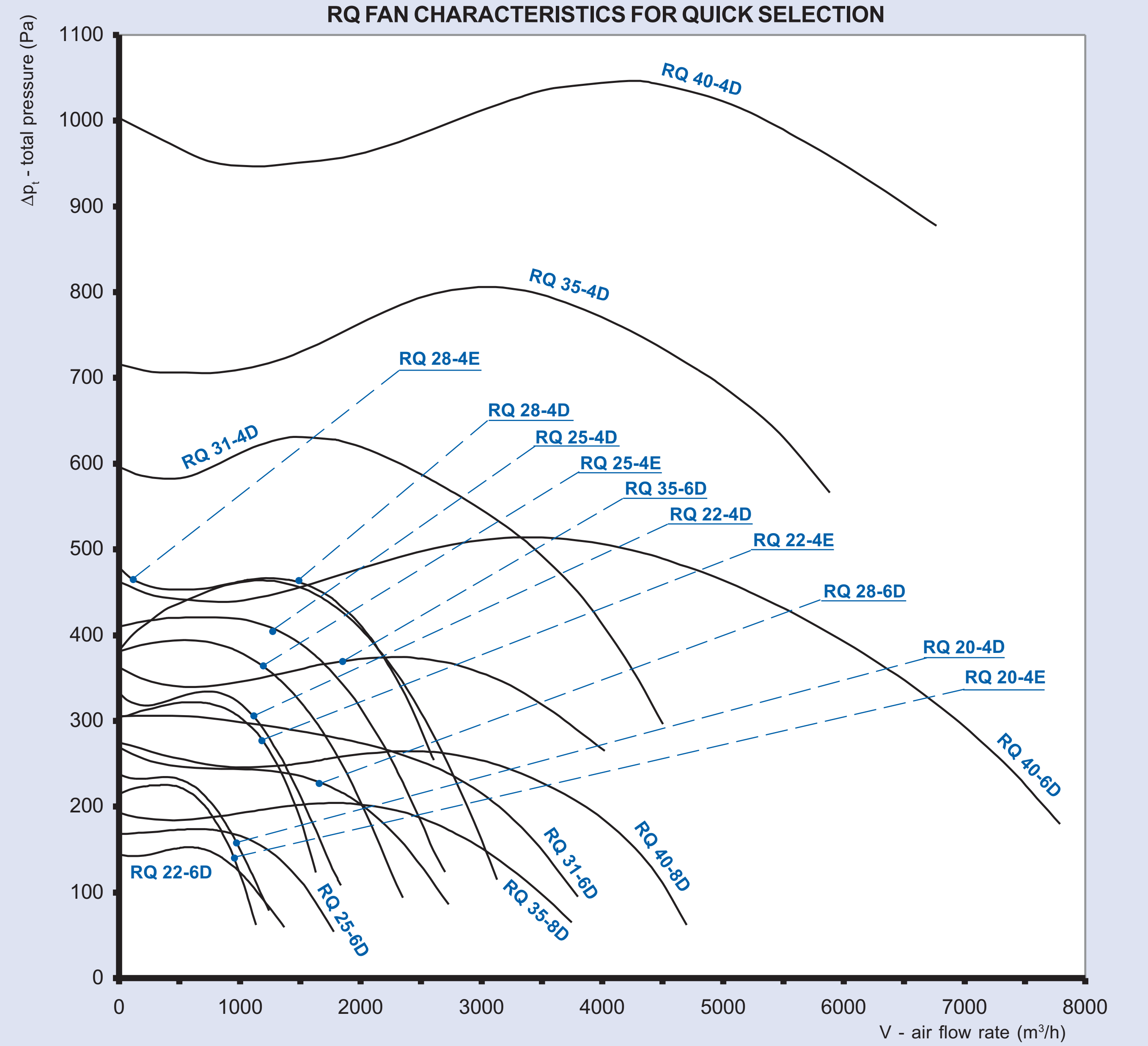
Data Sect

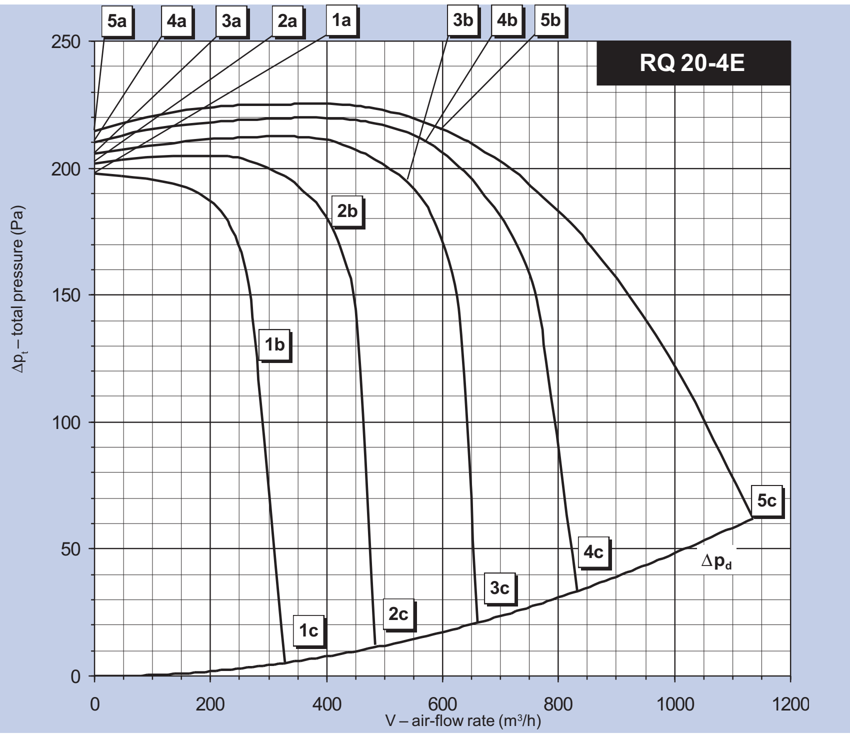
Table 5 contains all RQ fans arranged in one column according to total pressure and maximum air flow to make it transparent. However, in most cases the airflow-pressure interrelationship is more important than only the maxima of individual values.
Graph 1 enables quick selection of a suitable fan and alternate comparison of RQ fans. Only the highest characteristics of each fan at nominal supply voltage, i.e. without a controller or with a controller set to the fifth stage, are included in this graph.

Table 5 - Fans listed according to pressure/air flow

according to max. pressure		according to max. air flow	
Fan type	Total pressure $\Delta p_{t\ max}$ (Pa)	Fan type	Max.airflow V (m^3/h)
RQ 22-6D	153	RQ 20-4E	1135
RQ 25-6D	174	RQ 20-4D	1240
RQ 35-8D	204	RQ 22-6D	1370
RQ 20-4E	225	RQ 22-4E	1627
RQ 20-4D	238	RQ 25-6D	1780
RQ 28-6D	269	RQ 22-4D	1840
RQ 40-8D	275	RQ 25-4E	2350
RQ 31-6D	306	RQ 28-4E	2607
RQ 22-4E	322	RQ 25-4D	2701
RQ 22-4D	334	RQ 28-6D	2730
RQ 35-6D	374	RQ 28-4D	3130
RQ 25-4E	394	RQ 35-8D	3723
RQ 25-4D	421	RQ 31-6D	3798
RQ 28-4D	464	RQ 35-6D	4022
RQ 28-4E	479	RQ 31-4D	4482
RQ 40-6D	514	RQ 40-8D	4700
RQ 31-4D	629	RQ 35-4D	5886
RQ 35-4D	806	RQ 40-4D	6768
RQ 40-4D	1047	RQ 40-6D	7800

Graph 1



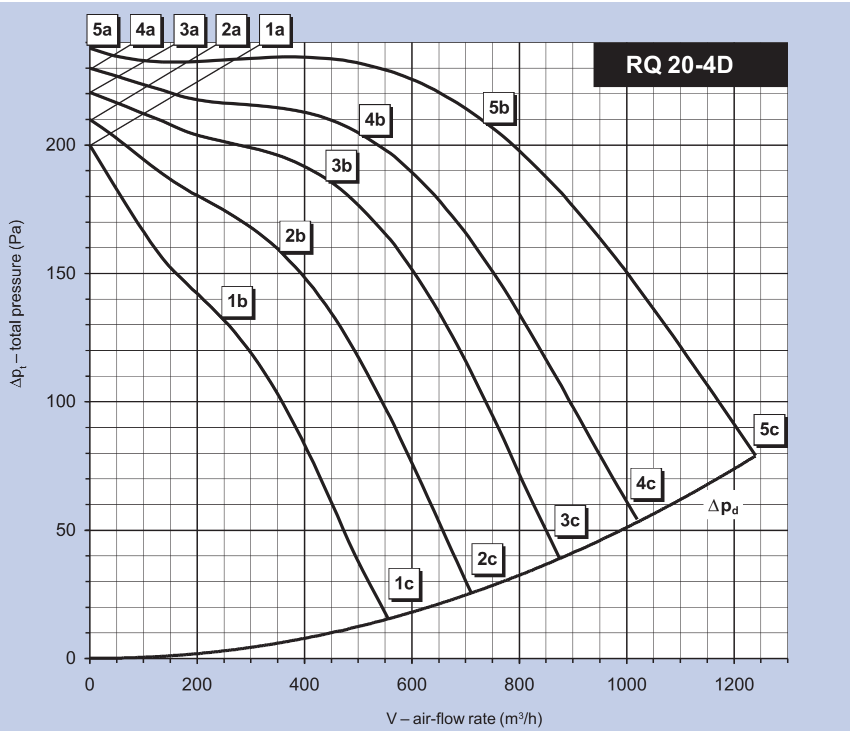


RQ 20-4E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	303
Max. current (5c)	I_{max}	[A]	1,47
Mean speed	n	[min^{-1}]	1400
Capacitor	C	[µF]	5
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1135
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	225
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	9
Five-stage controller		typ	TRN 2E
Protecting relay		typ	STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	72	76	64
Sound power level L_{WAokt} [dB (A)]			
125 Hz	55	52	46
250 Hz	65	64	60
500 Hz	63	69	58
1000 Hz	65	72	57
2000 Hz	66	69	54
4000 Hz	64	67	50
8000 Hz	55	59	40

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			140			105	
Current	I	[A]	0,89	0,95	1,47	0,51	0,75	1,21	0,50	0,77	0,95	0,46	0,72	0,83	0,46	0,64	0,77
Electric input	P	[W]	126	176	303	82	133	200	77	115	142	58	88	98	47	62	70
Speed	n	[min^{-1}]	1447	1403	1251	1438	1371	1175	1431	1349	1258	1415	1304	1236	1376	1260	1122
Air flow rate	V	[m^3/h]	0	602	1135	0	575	830	0	542	660	0	432	483	0	277	328
Static pressure	Δp_s	[Pa]	214	198	0	210	195	0	204	181	0	201	163	0	198	130	0
Total pressure	Δp_t	[Pa]	214	216	62	210	211	33	206	195	21	202	168	6	199	133	4

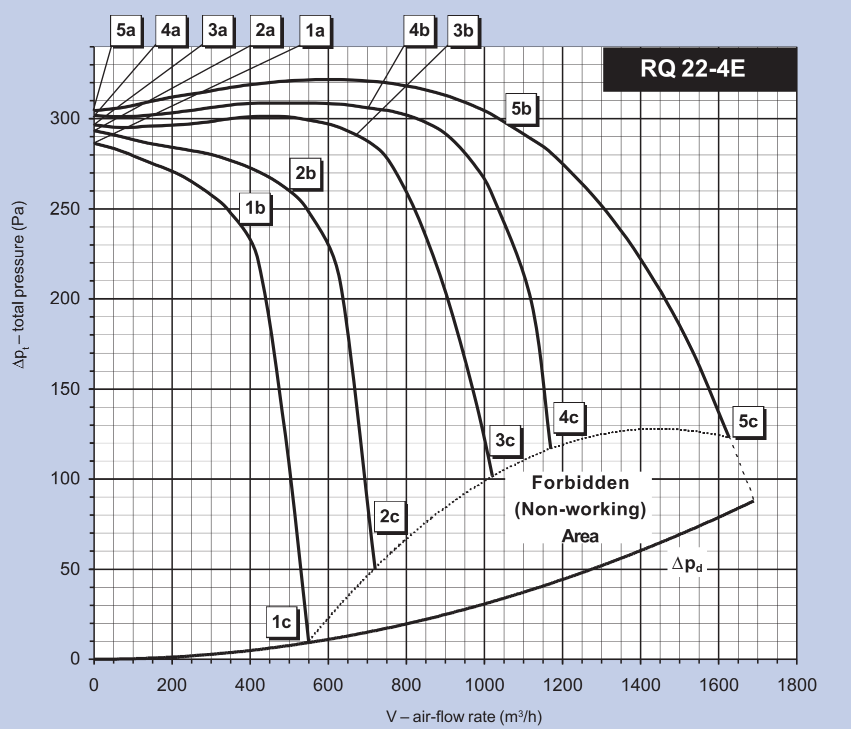


RQ 20-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	290
Max. current (5c)	I_{max}	[A]	0,49
Mean speed	n	[min^{-1}]	1350
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	70
Max. air flow rate	V_{max}	[m^3/h]	1240
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	238
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	9
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	71	74	62
Sound power level L_{WAokt} [dB (A)]			
125 Hz	50	51	42
250 Hz	65	62	53
500 Hz	63	68	55
1000 Hz	63	69	58
2000 Hz	65	68	55
4000 Hz	62	64	51
8000 Hz	54	58	44

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,30	0,34	0,49	0,19	0,26	0,48	0,17	0,24	0,46	0,16	0,24	0,41	0,16	0,22	0,35
Electric input	P	[W]	74	158	290	48	96	208	45	81	166	39	66	118	34	49	77
Speed	n	[min^{-1}]	1438	1347	1194	1404	1302	975	1370	1248	854	1310	1147	695	1216	1024	548
Air flow rate	V	[m^3/h]	0	735	1240	0	503	1020	0	436	875	0	367	710	0	291	555
Static pressure	Δp_s	[Pa]	237	183	0	229	191	0	220	177	0	209	150	0	200	117	0
Total pressure	Δp_t	[Pa]	238	211	79	230	204	54	221	187	39	210	157	26	200	122	16

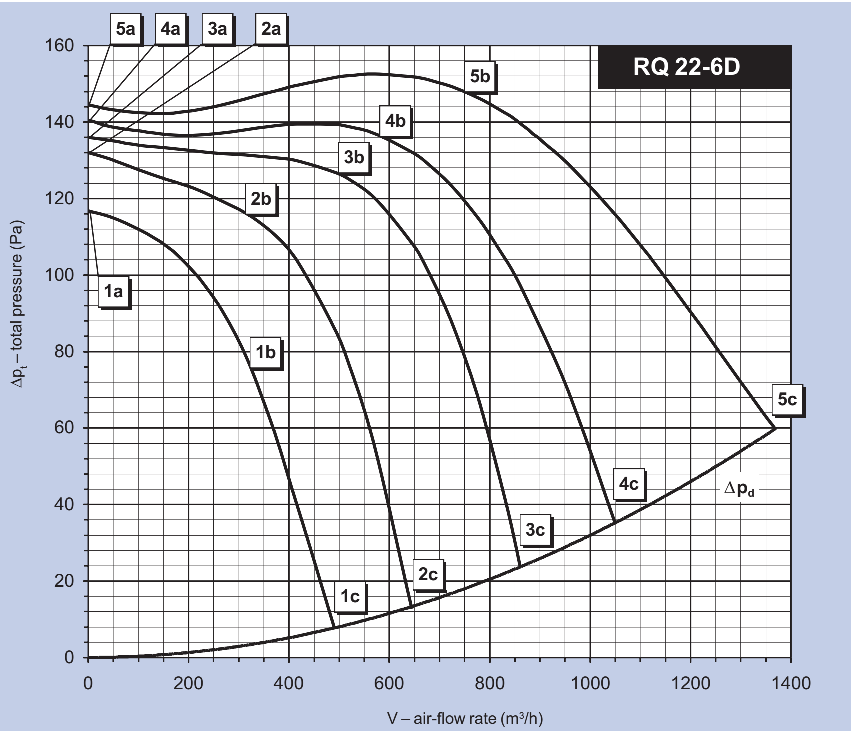


RQ 22-4E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	508
Max. current (5c)	I_{max}	[A]	2,30
Mean speed	n	[min^{-1}]	1380
Capacitor	C	[µF]	8
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1627
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	322
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	42
Weight	m	[kg]	14
Five-stage controller		typ	TRN 4E
Protecting relay		typ	STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	77	79	67
Sound power level L_{WAokt} [dB (A)]			
125 Hz	58	54	49
250 Hz	70	66	64
500 Hz	67	69	59
1000 Hz	70	75	60
2000 Hz	71	72	57
4000 Hz	69	71	55
8000 Hz	61	63	46

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	1,07	1,47	2,30	0,73	1,11	2,25	0,69	1,12	2,20	0,71	1,05	2,10	0,71	1,02	1,74
Electric input	P	[W]	192	320	508	128	202	380	115	182	324	90	136	239	78	108	157
Speed	n	[min^{-1}]	1446	1379	1244	1435	1376	1057	1425	1349	931	1401	1318	603	1365	1255	420
Air flow rate	V	[m^3/h]	0	1050	1627	0	700	1160	0	668	1016	0	506	724	0	385	549
Static pressure	Δp_s	[Pa]	303	263	42	300	293	76	298	276	69	294	251	33	286	236	0
Total pressure	Δp_t	[Pa]	304	297	123	301	308	118	298	290	100	295	258	50	287	240	10

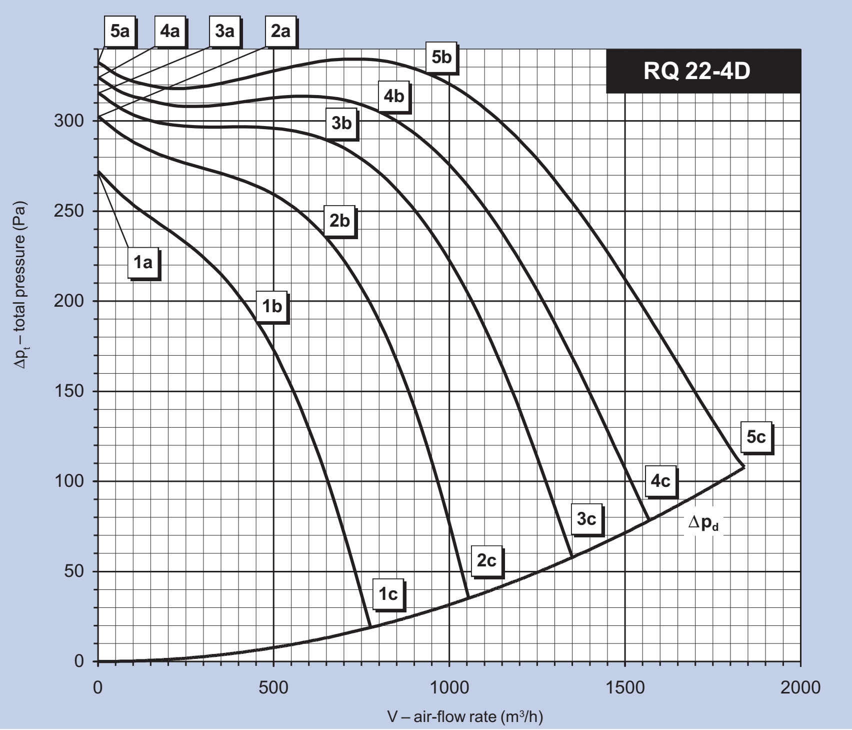


RQ 22-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	233
Max. current (5c)	I_{max}	[A]	0,46
Mean speed	n	[min^{-1}]	920
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	1370
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	153
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	11
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	66	68	57
Sound power level L_{WAokt} [dB (A)]			
125 Hz	48	46	40
250 Hz	60	58	51
500 Hz	59	62	52
1000 Hz	59	62	50
2000 Hz	60	61	48
4000 Hz	56	59	44
8000 Hz	46	50	39

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,30	0,32	0,46	0,20	0,24	0,44	0,17	0,22	0,41	0,14	0,18	0,34	0,13	0,17	0,28
Electric input	P	[W]	56	114	233	37	76	162	30	61	121	26	41	76	22	32	47
Speed	n	[min^{-1}]	964	924	809	953	885	617	945	865	533	920	844	415	872	778	313
Air flow rate	V	[m^3/h]	0	723	1370	0	586	1050	0	501	860	0	319	645	0	243	490
Static pressure	Δp_s	[Pa]	145	133	0	141	125	0	136	118	0	132	111	0	117	92	0
Total pressure	Δp_t	[Pa]	145	150	60	141	136	35	136	126	24	132	114	14	117	94	8

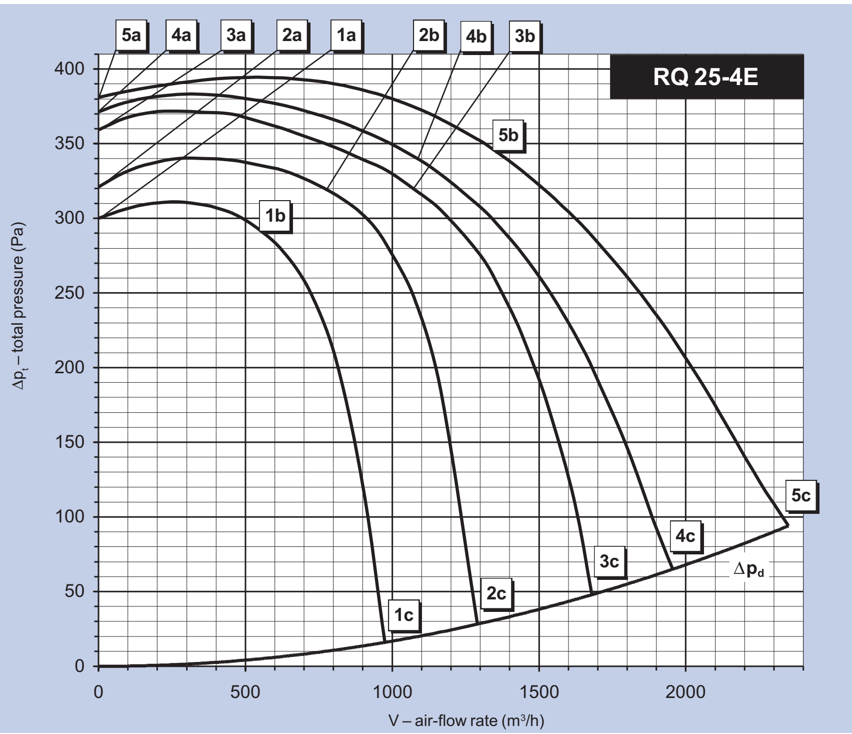


RQ 22-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	535
Max. current (5c)	I_{max}	[A]	0,94
Mean speed	n	[min^{-1}]	1410
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1840
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	334
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	14
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	66	68	57
Sound power level L_{WAokt} [dB (A)]			
125 Hz	48	46	40
250 Hz	60	58	51
500 Hz	59	62	52
1000 Hz	59	62	50
2000 Hz	60	61	48
4000 Hz	56	59	44
8000 Hz	46	50	39

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,58	0,63	0,94	0,32	0,48	1,00	0,27	0,46	1,02	0,26	0,53	0,97	0,28	0,52	0,81
Electric input	P	[W]	111	249	535	76	190	438	67	156	373	63	146	260	59	111	166
Speed	n	[min^{-1}]	1453	1407	1299	1437	1358	1117	1419	1324	956	1385	1203	761	1313	1086	576
Air flow rate	V	[m^3/h]	0	938	1840	0	784	1570	0	647	1349	0	645	1050	0	451	775
Static pressure	Δp_s	[Pa]	332	300	0	324	287	0	315	274	0	302	223	0	272	180	0
Total pressure	Δp_t	[Pa]	332	328	108	324	306	78	315	287	58	302	236	36	272	187	19

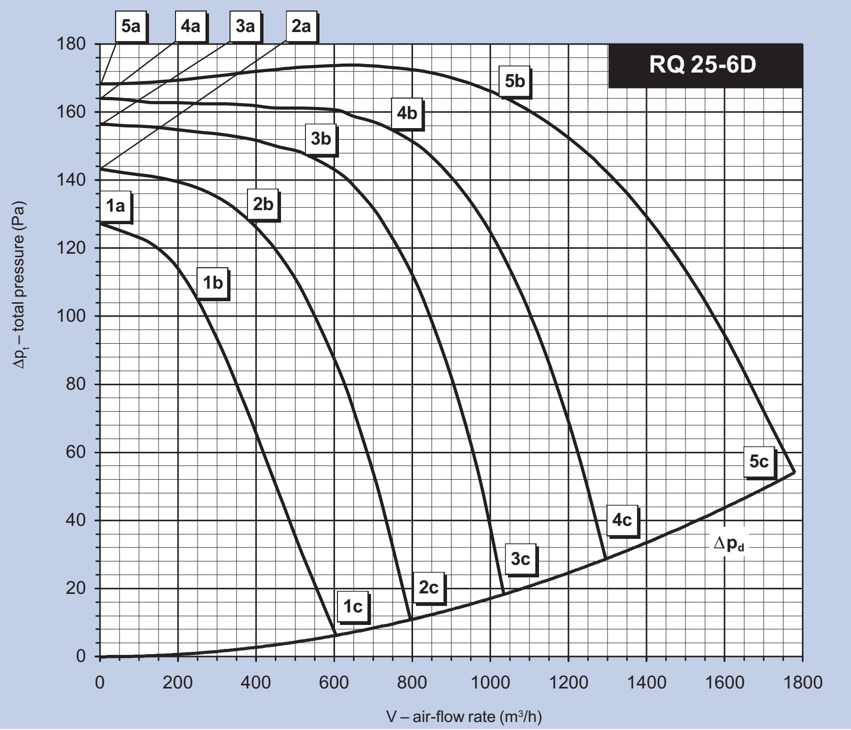


RQ 25-4E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	861
Max. current (5c)	I_{max}	[A]	3,85
Mean speed	n	[min^{-1}]	1370
Capacitor	C	[μF]	14
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	2350
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	394
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	17
Five-stage controller		typ	TRN 4E
Protecting relay		typ	STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	82	81	71
Sound power level L_{WAokt} [dB (A)]			
125 Hz	67	59	59
250 Hz	75	71	67
500 Hz	75	74	64
1000 Hz	73	76	64
2000 Hz	74	74	62
4000 Hz	75	72	58
8000 Hz	72	63	48

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			140			105	
Current	I	[A]	1,56	2,26	3,85	1,14	1,97	4,08	1,12	2,09	3,92	1,13	1,82	3,66	1,13	1,61	3,08
Electric input	P	[W]	320	503	861	209	354	702	180	335	591	148	241	448	122	170	298
Speed	n	[min^{-1}]	1431	1365	1204	1425	1340	990	1414	1293	884	1384	1273	683	1345	1237	504
Air flow rate	V	[m^3/h]	0	1346	2350	0	1040	1955	0	1059	1680	0	764	1290	0	538	975
Static pressure	Δp_s	[Pa]	377	314	0	370	328	0	359	301	0	321	308	0	299	290	0
Total pressure	Δp_t	[Pa]	380	345	94	370	346	65	360	320	48	321	318	29	300	295	17

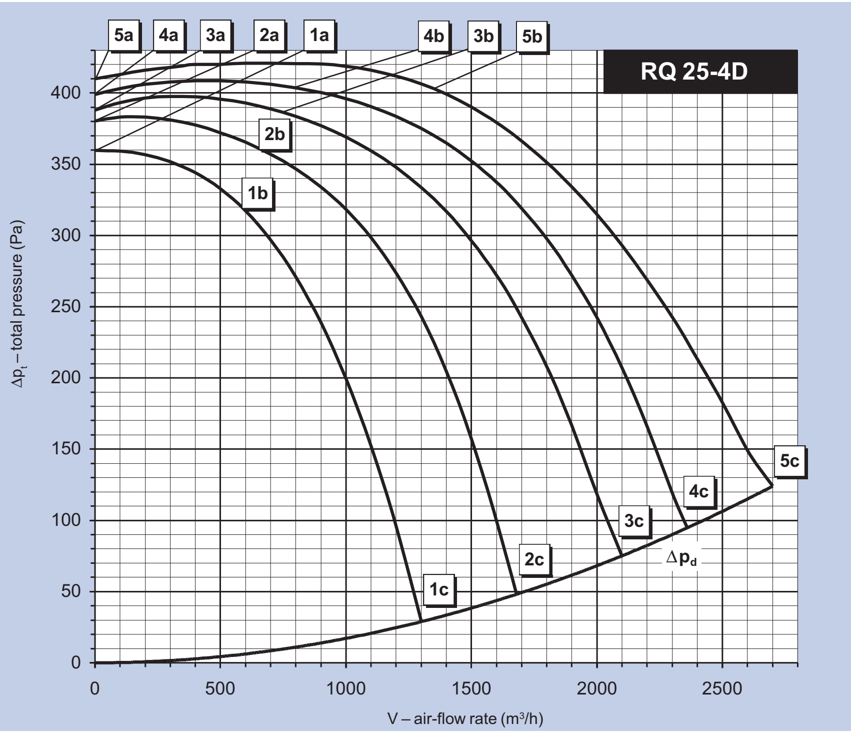


RQ 25-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	337
Max. current (5c)	I_{max}	[A]	0,70
Mean speed	n	[min^{-1}]	910
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	1780
Max. total pressure	$\Delta p_{t\ max.}$	[Pa]	174
Min. static pressure (5c)	$\Delta p_{s\ min.}$	[Pa]	0
Weight	m	[kg]	14
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	67	69	60
Sound power level L_{WAokt} [dB (A)]			
125 Hz	50	46	45
250 Hz	57	60	51
500 Hz	60	63	55
1000 Hz	61	64	54
2000 Hz	62	62	53
4000 Hz	58	60	45
8000 Hz	48	48	43

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,44	0,49	0,70	0,29	0,38	0,65	0,25	0,31	0,57	0,23	0,27	0,47	0,21	0,24	0,37
Electric input	P	[W]	83	173	337	56	113	227	47	78	155	43	56	98	35	41	59
Speed	n	[min^{-1}]	969	913	786	950	870	568	933	865	464	887	829	351	823	771	279
Air flow rate	V	[m^3/h]	0	1025	1780	0	750	1295	0	523	1035	0	375	795	0	244	602
Static pressure	Δp_s	[Pa]	169	149	0	163	143	0	156	142	0	143	125	0	126	108	0
Total pressure	Δp_t	[Pa]	169	167	54	164	153	29	156	148	18	143	127	11	127	109	6

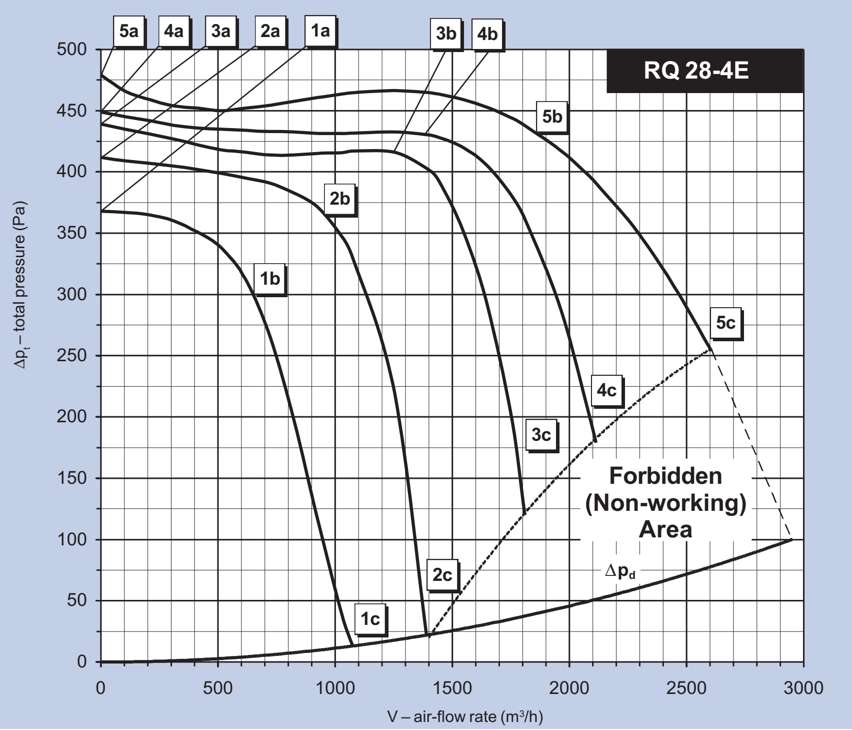


RQ 25-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	1058
Max. current (5c)	I_{max}	[A]	1,98
Mean speed	n	[min^{-1}]	1430
Capacitor	C	[μF]	
Max. working temp.	t_{max}	[°C]	50
Max. air flow rate	V_{max}	[m^3/h]	2701
Max. total pressure	$\Delta p_{t\ max.}$	[Pa]	421
Min. static pressure (5c)	$\Delta p_{s\ min.}$	[Pa]	0
Weight	m	[kg]	15
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	80	83	70
Sound power level L_{WAokt} [dB (A)]			
125 Hz	63	59	54
250 Hz	70	70	62
500 Hz	71	76	64
1000 Hz	74	78	64
2000 Hz	75	77	63
4000 Hz	72	75	59
8000 Hz	65	67	49

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,28	1,37	1,98	0,69	0,83	2,10	0,57	0,77	2,20	0,53	0,77	2,10	0,50	0,84	1,83
Electric input	P	[W]	211	484	1058	134	263	872	121	234	757	109	200	542	99	180	357
Speed	n	[min^{-1}]	1466	1428	1344	1454	1420	1197	1444	1395	1060	1419	1350	849	1381	1265	679
Air flow rate	V	[m^3/h]	0	1347	2701	0	799	2360	0	741	2100	0	643	1680	0	600	1300
Static pressure	Δp_s	[Pa]	411	371	0	400	392	0	389	379	0	380	354	0	360	312	0
Total pressure	Δp_t	[Pa]	411	402	124	400	403	95	389	388	75	380	361	49	360	318	29

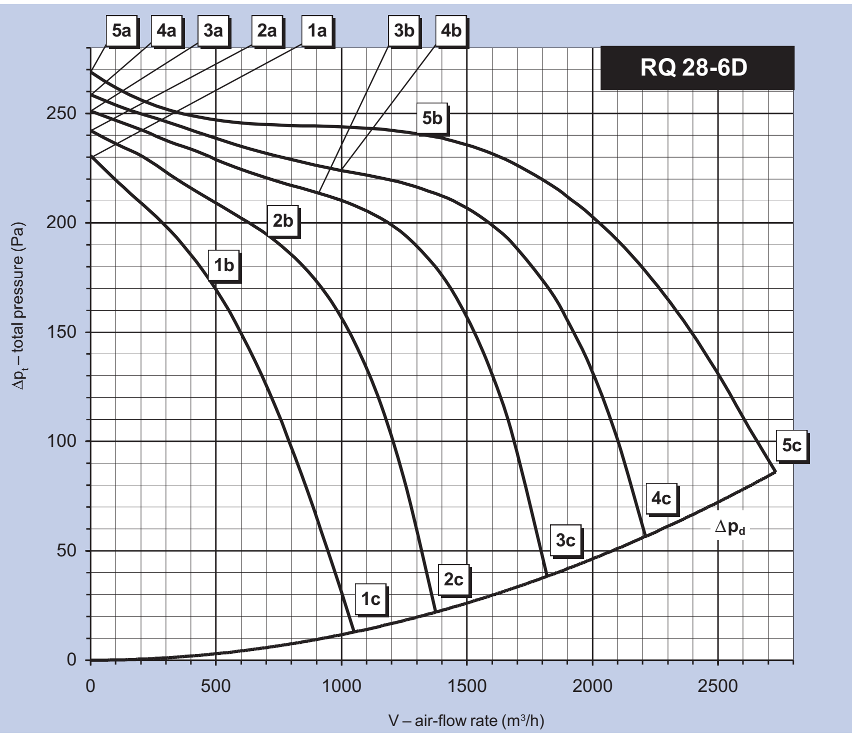


RQ 28-4E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	1079
Max. current (5c)	I_{max}	[A]	5,10
Mean speed	n	[min^{-1}]	1370
Capacitor	C	[µF]	16
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	2607
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	479
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	176
Weight	m	[kg]	23
Five-stage controller		typ	TRN 7E
Protecting relay		typ	STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	82	84	72
Sound power level L_{WAokt} [dB (A)]			
125 Hz	69	60	58
250 Hz	71	73	65
500 Hz	72	76	64
1000 Hz	77	80	68
2000 Hz	77	78	64
4000 Hz	73	76	61
8000 Hz	65	68	51

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	2,48	3,70	5,10	1,88	3,04	5,10	1,88	2,97	5,10	1,83	2,80	4,49	1,83	2,61	3,62
Electric input	P	[W]	448	783	1079	335	544	843	300	471	718	240	360	495	194	262	316
Speed	n	[min^{-1}]	1447	1371	1271	1430	1342	1062	1417	1310	845	1389	1249	560	1338	1146	434
Air flow rate	V	[m^3/h]	0	1850	2607	0	1392	2114	0	1261	1800	0	974	1390	0	666	1075
Static pressure	Δp_s	[Pa]	477	398	176	450	405	128	441	400	55	412	351	0	370	291	0
Total pressure	Δp_t	[Pa]	478	437	254	450	428	179	441	418	120	412	362	23	370	296	13

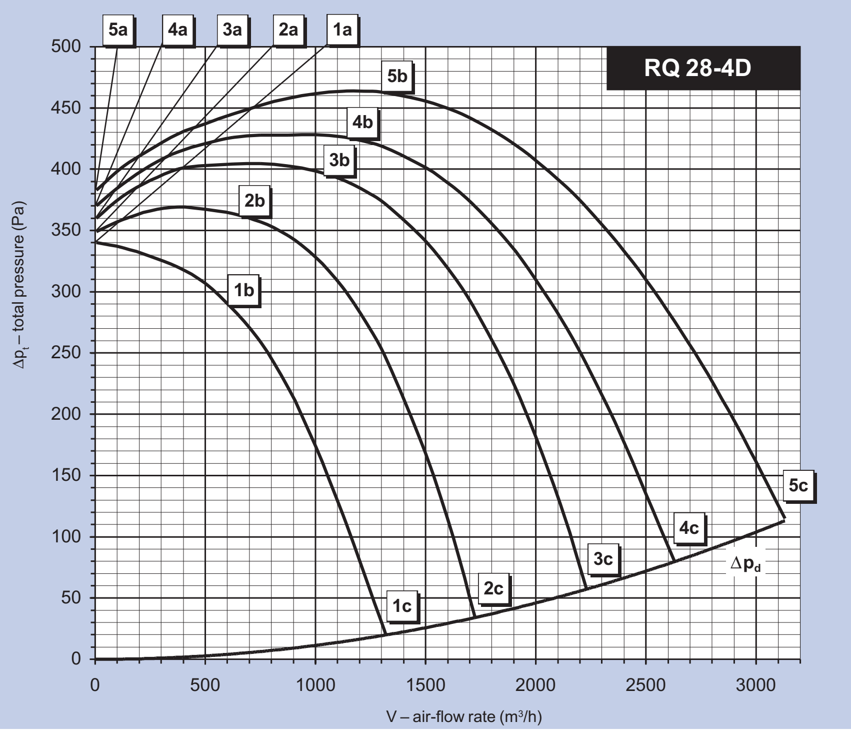


RQ 28-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	643
Max. current (5c)	I_{max}	[A]	1,37
Mean speed	n	[min^{-1}]	950
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	2730
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	269
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	17
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	71	74	62
Sound power level L_{WAokt} [dB (A)]			
125 Hz	56	52	47
250 Hz	60	62	54
500 Hz	65	69	58
1000 Hz	65	68	55
2000 Hz	65	66	53
4000 Hz	62	65	49
8000 Hz	54	55	41

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,88	0,96	1,37	0,59	0,71	1,38	0,49	0,65	1,32	0,43	0,61	1,12	0,39	0,56	0,92
Electric input	P	[W]	130	271	643	90	187	487	73	162	366	69	130	230	59	94	136
Speed	n	[min^{-1}]	975	946	866	966	924	713	957	900	581	937	861	440	903	805	343
Air flow rate	V	[m^3/h]	0	1280	2730	0	995	2210	0	906	1820	0	708	1375	0	491	1050
Static pressure	Δp_s	[Pa]	269	213	0	259	214	0	251	204	0	241	178	0	230	166	0
Total pressure	Δp_t	[Pa]	269	242	86	259	226	57	251	214	39	241	184	22	230	169	13

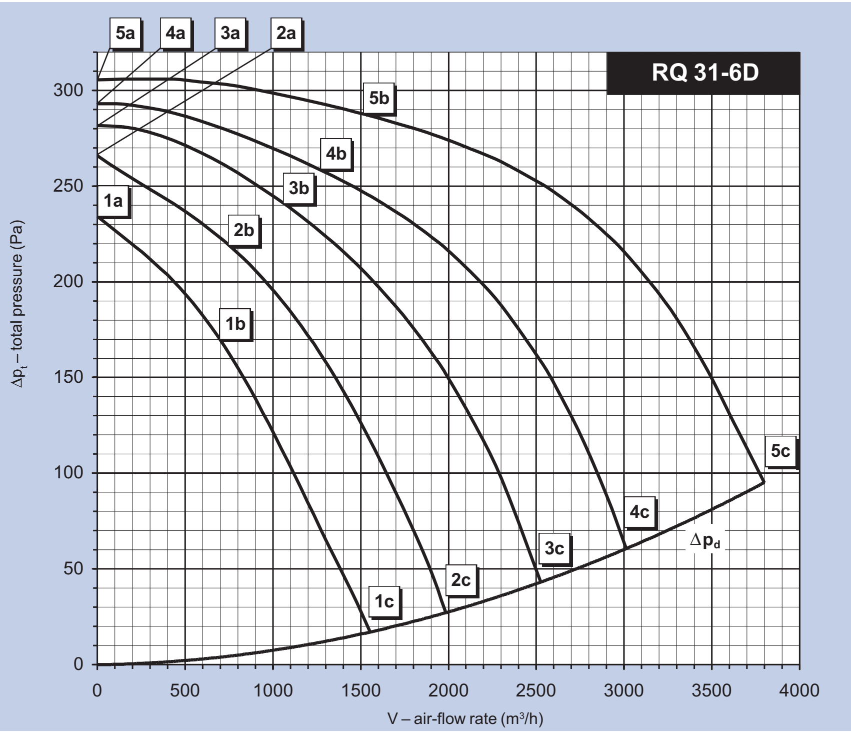


RQ 28-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	1278
Max. current (5c)	I_{max}	[A]	2,22
Mean speed	n	[min^{-1}]	1420
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	3130
Max. total pressure	$\Delta p_{t\ max.}$	[Pa]	464
Min. static pressure (5c)	$\Delta p_{s\ min.}$	[Pa]	0
Weight	m	[kg]	23
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	80	82	69
Sound power level L_{WAokt} [dB (A)]			
125 Hz	66	60	55
250 Hz	68	69	62
500 Hz	70	74	61
1000 Hz	75	77	63
2000 Hz	75	76	61
4000 Hz	71	74	58
8000 Hz	63	65	48

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,01	1,16	2,22	0,72	1,01	2,50	0,63	1,03	2,48	0,69	0,89	2,26	0,76	1,05	1,92
Electric input	P	[W]	252	484	1278	205	393	1044	193	361	833	176	247	567	157	226	364
Speed	n	[min^{-1}]	1452	1418	1286	1426	1365	1076	1406	1320	917	1357	1301	720	1281	1152	544
Air flow rate	V	[m^3/h]	0	1305	3130	0	1158	2630	0	1053	2230	0	661	1725	0	616	1320
Static pressure	Δp_s	[Pa]	381	442	0	370	409	0	360	384	0	350	357	0	340	284	0
Total pressure	Δp_t	[Pa]	382	462	113	370	425	80	360	397	58	350	362	34	340	288	20



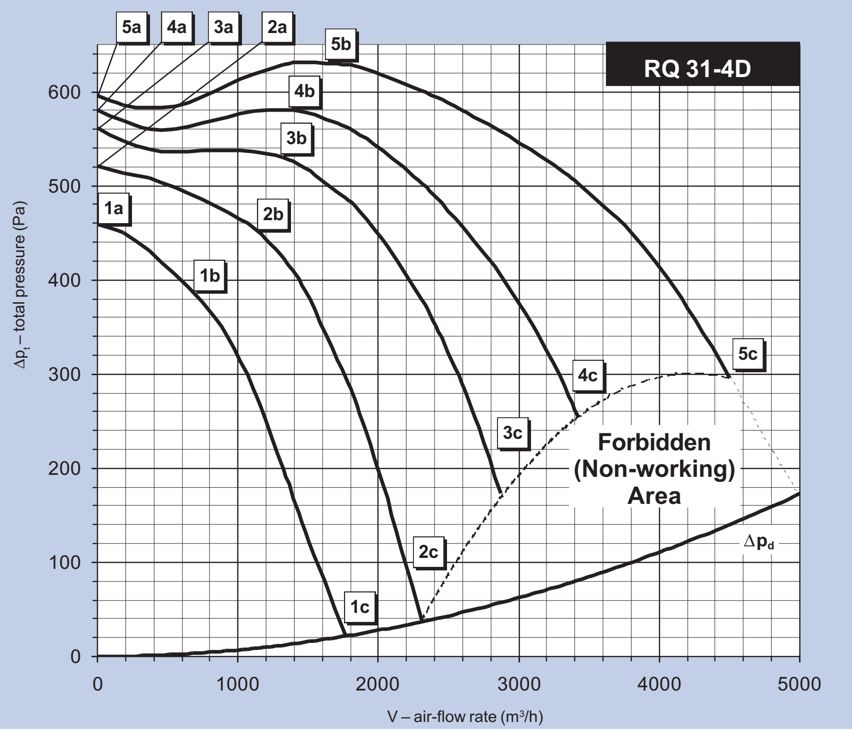
RQ 31-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	946
Max. current (5c)	I_{max}	[A]	1,82
Mean speed	n	[min^{-1}]	920
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	3798
Max. total pressure	$\Delta p_{t\ max.}$	[Pa]	306
Min. static pressure (5c)	$\Delta p_{s\ min.}$	[Pa]	0
Weight	m	[kg]	23
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	74	76	63
Sound power level L_{WAokt} [dB (A)]			
125 Hz	58	54	50
250 Hz	61	63	58
500 Hz	67	71	56
1000 Hz	68	71	57
2000 Hz	67	69	55
4000 Hz	66	69	48
8000 Hz	55	56	44

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,11	1,17	1,82	0,63	0,79	1,64	0,54	0,73	1,49	0,48	0,64	1,29	0,47	0,66	1,06
Electric input	P	[W]	189	373	946	117	261	639	105	205	471	99	156	310	80	124	201
Speed	n	[min^{-1}]	968	924	766	949	878	601	931	852	510	896	817	410	845	728	323
Air flow rate	V	[m^3/h]	0	1510	3798	0	1266	3010	0	1055	2525	0	776	1985	0	691	1555
Static pressure	Δp_s	[Pa]	305	272	0	292	247	0	281	232	0	264	215	0	232	168	0
Total pressure	Δp_t	[Pa]	305	288	95	292	258	61	281	240	43	264	219	27	232	171	18

RQ 31-4D

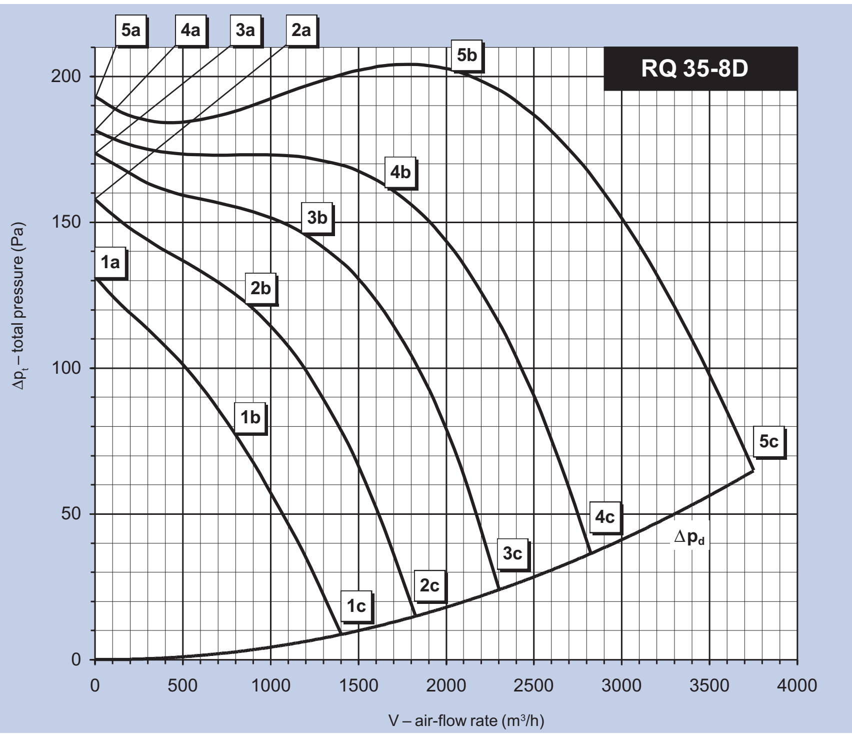


RQ 31-4D			
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	2494
Max. current (5c)	I_{max}	[A]	4,10
Mean speed	n	[min^{-1}]	1410
Capacitor	C	[μF]	–
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	4482
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	629
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	157
Weight	m	[kg]	30
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	84	86	73
Sound power level L_{WAokt} [dB (A)]			
125 Hz	68	63	59
250 Hz	70	73	66
500 Hz	73	78	65
1000 Hz	80	82	68
2000 Hz	78	80	65
4000 Hz	75	78	62
8000 Hz	68	69	50

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,22	1,71	4,10	0,91	1,53	4,10	0,86	1,61	4,10	0,94	1,87	3,96	1,08	1,65	3,25
Electric input	P	[W]	327	852	2494	300	642	1746	265	572	1389	255	528	983	237	360	603
Speed	n	[min^{-1}]	1457	1408	1231	1433	1364	1039	1412	1315	865	1372	1205	567	1296	1152	437
Air flow rate	V	[m^3/h]	0	1879	4482	0	1393	3426	0	1284	2863	0	1171	2310	0	702	1770
Static pressure	Δp_s	[Pa]	596	605	157	572	569	174	547	520	116	520	438	0	467	380	0
Total pressure	Δp_t	[Pa]	596	629	296	572	582	255	547	532	173	520	447	37	467	383	22

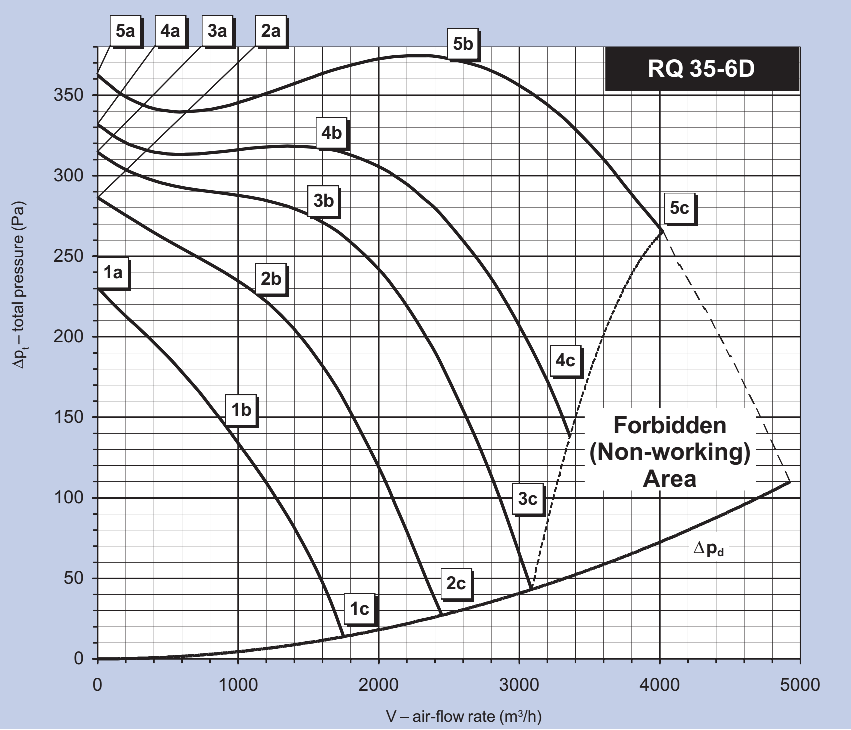
RQ 35-8D



RQ 35-8D			
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	672
Max. current (5c)	I_{max}	[A]	1,40
Mean speed	n	[min^{-1}]	650
Capacitor	C	[μF]	
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	3723
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	204
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	5
Weight	m	[kg]	37
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	69	72	62
Sound power level L_{WAokt} [dB (A)]			
125 Hz	55	48	45
250 Hz	60	62	59
500 Hz	63	68	55
1000 Hz	63	66	53
2000 Hz	63	64	50
4000 Hz	61	64	46
8000 Hz	51	51	44

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,83	0,94	1,40	0,54	0,75	1,19	0,46	0,62	1,02	0,42	0,55	0,86	0,40	0,54	0,69
Electric input	P	[W]	159	336	672	109	237	407	92	166	284	75	114	177	61	89	107
Speed	n	[min^{-1}]	714	654	514	698	605	386	678	589	316	644	556	252	581	435	201
Air flow rate	V	[m^3/h]	0	2022	3723	0	1637	2825	0	1177	2300	0	842	1823	0	792	1400
Static pressure	Δp_s	[Pa]	193	182	0	182	151	0	173	140	0	158	121	0	131	74	0
Total pressure	Δp_t	[Pa]	193	201	67	182	163	37	173	146	24	158	124	15	131	77	9

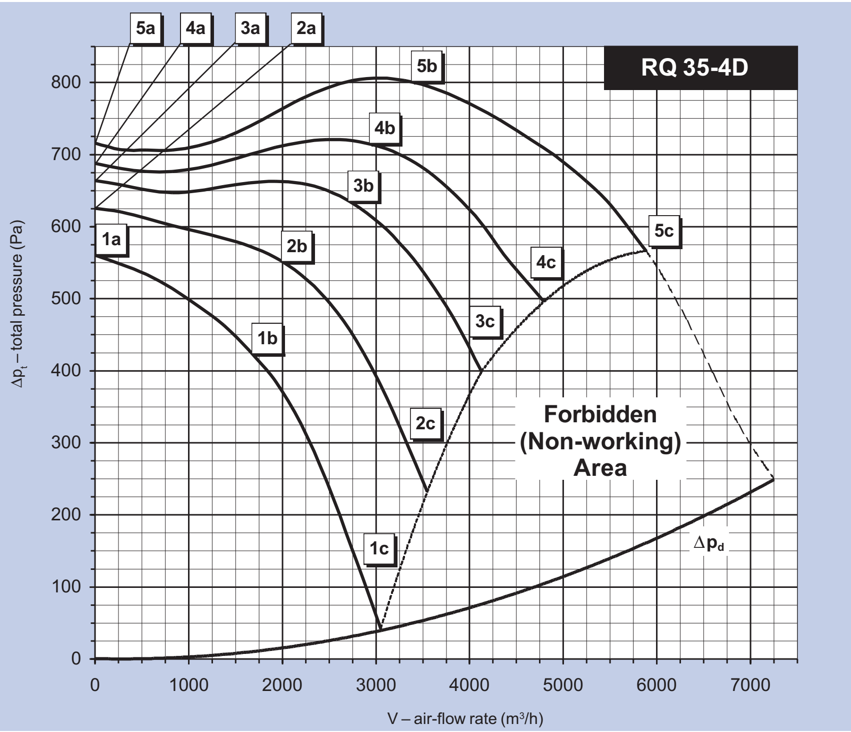


RQ 35-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	1084
Max. current (5c)	I_{max}	[A]	2,00
Mean speed	n	[min^{-1}]	890
Capacitor	C	[µF]	
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	4022
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	374
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	192
Weight	m	[kg]	40
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	76	78	65
Sound power level L_{WAokt} [dB (A)]			
125 Hz	61	55	51
250 Hz	62	66	57
500 Hz	69	73	59
1000 Hz	72	72	59
2000 Hz	69	71	56
4000 Hz	68	70	53
8000 Hz	59	61	41

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,07	1,38	2,00	0,73	1,03	2,00	0,66	1,07	1,98	0,64	0,96	1,65	0,64	0,90	1,24
Electric input	P	[W]	241	629	1084	186	372	791	167	343	636	151	247	407	121	168	215
Speed	n	[min^{-1}]	965	893	789	940	862	602	915	798	431	868	746	339	772	609	250
Air flow rate	V	[m^3/h]	0	2497	4022	0	1573	3360	0	1553	3088	0	1138	2450	0	881	1751
Static pressure	p_s	[Pa]	352	344	192	331	308	87	313	262	0	286	219	0	230	142	0
Total pressure	p_t	[Pa]	352	372	265	331	319	138	313	272	43	286	224	27	230	146	14

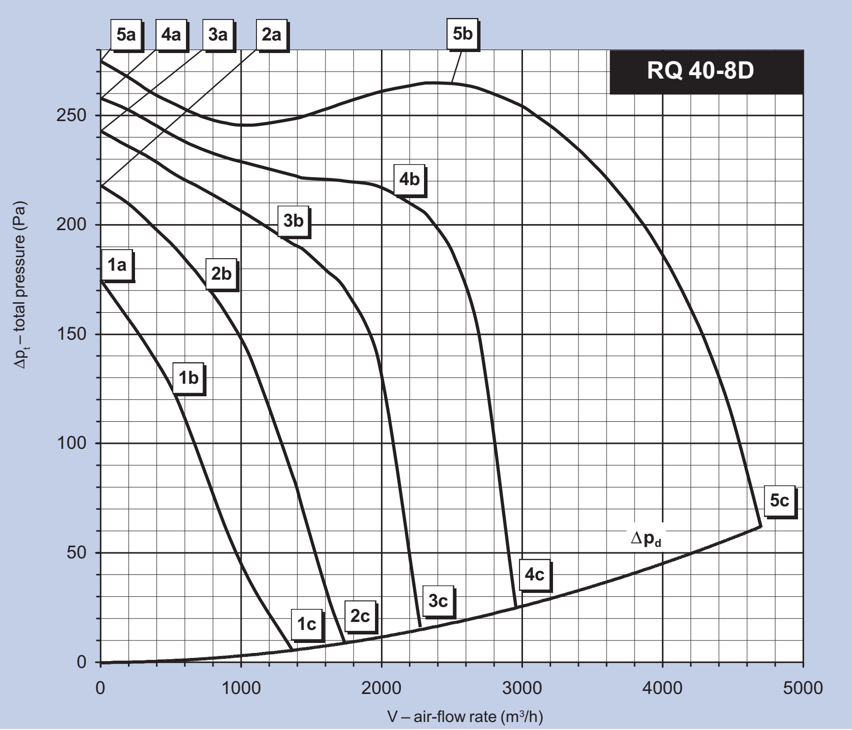


RQ 35-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	3534
Max. current (5c)	I_{max}	[A]	6,00
Mean speed	n	[min^{-1}]	1400
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	5886
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	806
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	410
Weight	m	[kg]	47
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	87	90	76
Sound power level L_{WAokt} [dB (A)]			
125 Hz	71	67	60
250 Hz	70	75	66
500 Hz	77	82	68
1000 Hz	84	86	72
2000 Hz	82	83	69
4000 Hz	78	81	64
8000 Hz	70	72	55

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,07	3,24	6,00	1,50	3,15	6,00	1,46	3,43	6,00	1,57	3,36	6,00	1,82	3,44	5,74
Electric input	P	[W]	564	1724	3534	478	1343	2563	454	1218	2063	425	939	1575	397	728	1089
Speed	n	[min^{-1}]	1330	1400	1292	1325	1340	1158	1321	1276	1036	1362	1204	829	1307	1073	526
Air flow rate	V	[m^3/h]	0	3366	5886	0	2848	4795	0	2590	4128	0	2009	3549	0	1670	3051
Static pressure	Δp_s	[Pa]	718	752	410	680	686	392	665	618	322	626	532	175	560	417	0
Total pressure	Δp_t	[Pa]	718	803	566	680	722	496	665	648	399	626	550	232	560	429	42

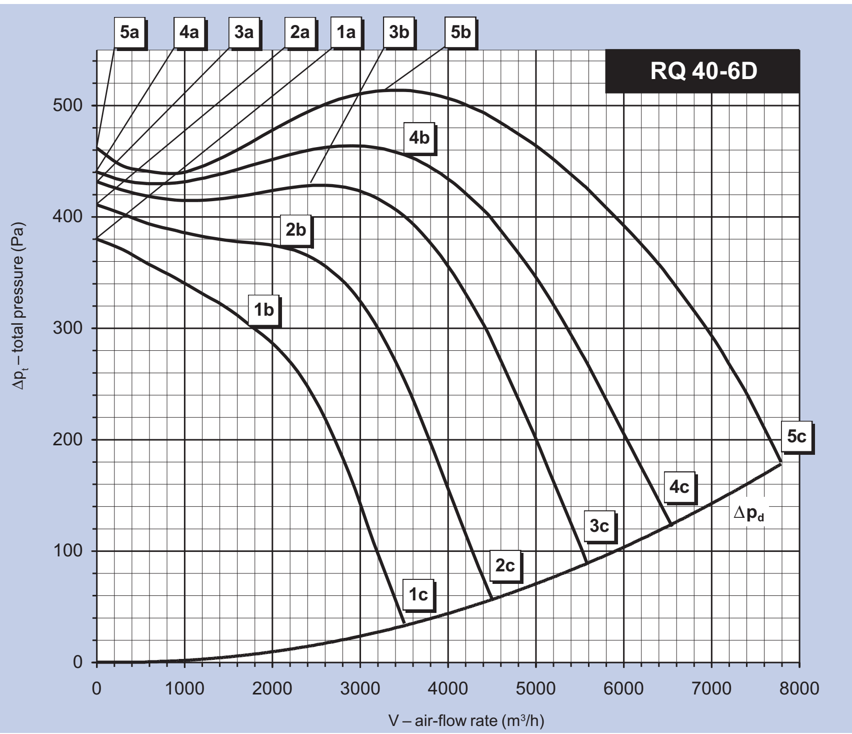


RQ 40-8D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	1274
Max. current (5c)	I_{max}	[A]	2,41
Mean speed	n	[min^{-1}]	670
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	4700
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	275
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	48
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	72	75	65
Sound power level L_{WAokt} [dB (A)]			
125 Hz	60	54	52
250 Hz	59	64	57
500 Hz	67	70	59
1000 Hz	66	69	61
2000 Hz	66	68	57
4000 Hz	63	66	54
8000 Hz	51	53	45

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,87	1,07	2,41	0,62	1,03	1,94	0,56	0,81	1,60	0,58	0,71	1,27	0,63	0,72	1,00
Electric input	P	[W]	221	495	1274	164	396	673	154	257	449	134	170	271	117	131	166
Speed	n	[min^{-1}]	715	669	427	697	610	279	679	616	227	639	594	168	560	508	139
Air flow rate	V	[m^3/h]	0	2479	4700	0	2112	2955	0	1294	2275	0	758	1740	0	515	1370
Static pressure	Δp_s	[Pa]	273	250	0	258	203	0	242	189	0	218	171	0	174	124	0
Total pressure	Δp_t	[Pa]	274	267	62	258	215	25	242	194	18	218	173	9	174	125	6

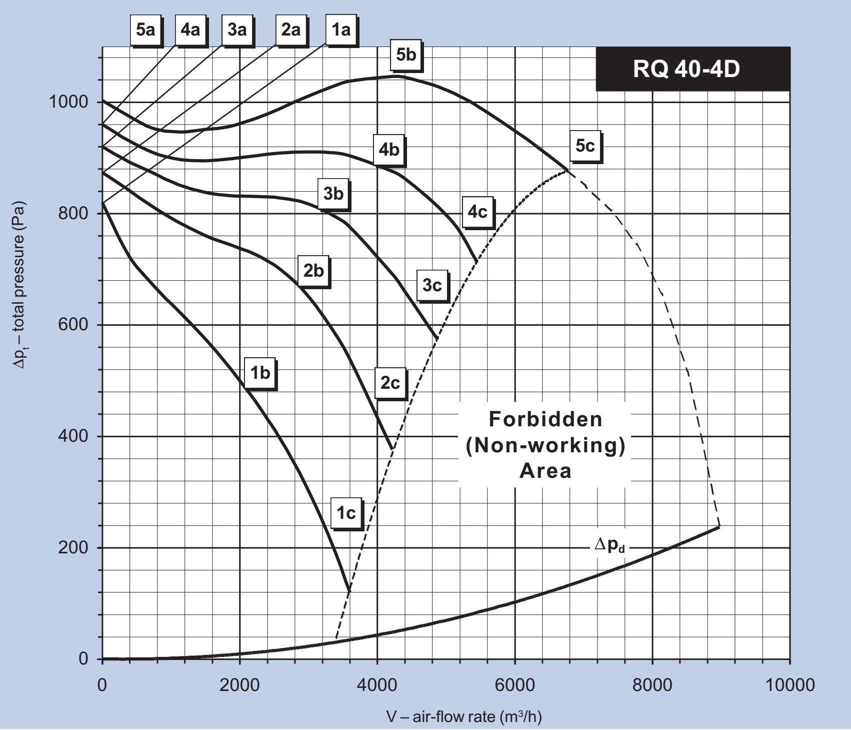


RQ 40-6D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	2770
Max. current (5c)	I_{max}	[A]	5,10
Mean speed	n	[min^{-1}]	940
Capacitor	C	[µF]	
Max. working temp.	t_{max}	[°C]	50
Max. air flow rate	V_{max}	[m^3/h]	7800
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	514
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	51
Five-stage controller		typ	TRN 7D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	80	83	69
Sound power level L_{WAokt} [dB (A)]			
125 Hz	66	60	55
250 Hz	65	70	61
500 Hz	73	78	63
1000 Hz	75	77	63
2000 Hz	74	76	62
4000 Hz	70	74	55
8000 Hz	62	64	44

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,27	2,70	5,10	1,49	2,65	5,66	1,29	2,15	5,35	1,18	2,15	4,73	1,18	2,18	3,96
Electric input	P	[W]	382	999	2770	302	1011	2235	271	669	1717	246	552	1134	219	438	710
Speed	n	[min^{-1}]	975	939	829	962	879	665	952	878	572	932	831	453	897	754	363
Air flow rate	V	[m^3/h]	0	3236	7800	0	3509	6530	0	2424	5585	0	2083	4500	0	1768	3501
Static pressure	Δp_s	[Pa]	460	489	0	440	424	0	430	411	0	410	363	0	380	291	0
Total pressure	Δp_t	[Pa]	461	518	180	440	459	122	430	428	88	410	375	57	380	300	35



RQ 40-4D

Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	4873
Max. current (5c)	I_{max}	[A]	8,10
Mean speed	n	[min^{-1}]	1390
Capacitor	C	[μF]	
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	6768
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	1047
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	746
Weight	m	[kg]	58
Five-stage controller		typ	TRN 9D
Protecting relay		typ	STD

	Inlet	Outlet	Surrounding
	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	91	94	78
Sound power level L_{WAokt} [dB (A)]			
125 Hz	76	73	49
250 Hz	77	79	62
500 Hz	81	86	68
1000 Hz	87	90	73
2000 Hz	85	89	74
4000 Hz	82	85	68
8000 Hz	73	76	58

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	3,13	5,06	8,10	2,33	5,50	8,10	2,44	5,10	8,10	2,62	5,83	8,10	2,91	5,44	8,10
Electric input	P	[W]	1053	2786	4873	838	2383	3467	830	1838	2798	745	1615	2129	648	1142	1541
Speed	n	[min^{-1}]	1450	1386	1299	1423	1287	1160	1391	1253	1053	1364	1143	926	1272	994	541
Air flow rate	V	[m^3/h]	0	4125	6768	0	3937	5447	0	3053	4804	0	2852	4200	0	2098	3602
Static pressure	Δp_s	[Pa]	1003	1009	746	960	865	629	920	783	520	874	647	330	818	472	83
Total pressure	Δp_t	[Pa]	1003	1058	877	960	909	714	920	810	585	874	670	372	818	485	120

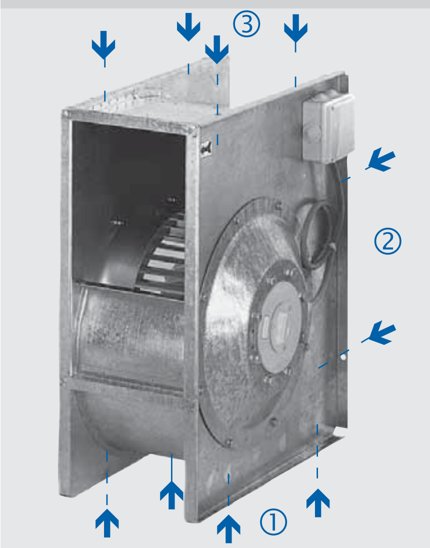
Installation, Maintenance and Service

Installation

■ RQ fans (including other Vento elements and equipment) are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for the proper selection of fan. The installation and commissioning may be performed only by an authorized company licensed in accordance with generally valid regulations.

■ The fan must be checked carefully before its installation, especially if it has been stored for a longer time. In particular, it is necessary to check all parts and the cable insulation for damage, and to see whether the rotating parts can rotate freely.

Figure 3 - Anchoring openings



■ It is recommended to use elastic connections; a DV elastic connection on the discharge side and the DK elastic connection on the intake side.

■ It is advisable to always place an air filter in front of the fan to protect it and the duct against dirtying and dust fouling.

■ If the fan is installed in such a way that persons or objects can come into contact with the impeller, the guard grid must be mounted.

■ The RQ fans are provided on three sides with anchoring holes to be anchored to the foundations in one of three possible positions ① ② ③ (see fig. #3). The RQ fans can be anchored with four anchoring bolts; however, we recommend using silent-blocks to eliminate the transfer of vibrations.

■ All versions of RQ fans can work in any position.

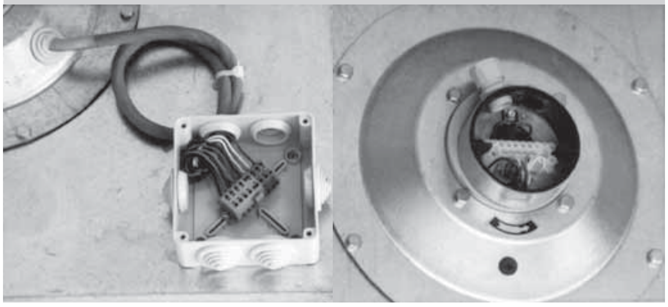
■ Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento system, use galvanized screws and nuts M8. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides, at least on one flange connection.

Elektroinstalace

■ The wiring can be performed only by a qualified worker licensed in accordance with national regulations.

Installation, Maintenance and Service

Figure 4 and 5 – Plastic terminal box

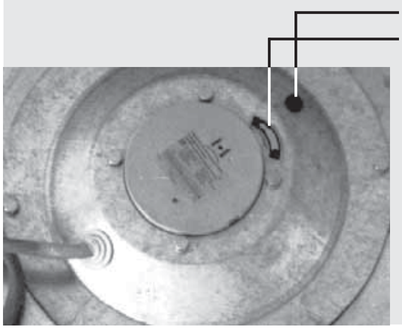


■ RQ fans can be equipped with two types of connecting terminal boxes:
a) An all-plastic terminal box fixed with screws to the fan casing, and equipped with WAGO terminals; max. cross-section of connecting conductors 1.5 mm2 (see fig. # 4).
b) A plastic terminal box fixed with screws to the motor stator, and equipped with screw terminals (see fig. # 5).
■ The wiring connection to the terminals can be performed following the marking on the motor cables, description of terminals or the label on the terminal box lid.
■ The following cables are recommended to connect fan motors:

H05VVH2 -F 2Ax0,75	– thermo-contact circuit
CYKY 3Cx1,5	– single-phase motor supply
CYKY 4Bx1,5	– three-phase motor supply

■ The fan can be started after its mounting into the duct system for which it has been designed; respectively fully throttled by closing either the intake or discharge to avoid its overloading!
■ **<u>The fan is loaded by increasing the air flow, i.e. by releasing the throttling.</u>**
■ After starting the fan with three-phase motor, the proper direction of the impeller rotation must be checked.

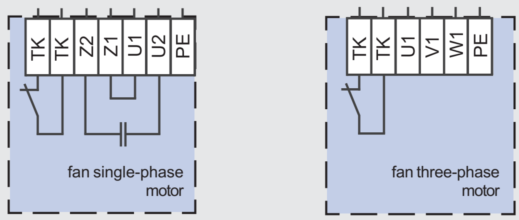
Figure 6 – Rubber plug location



After connecting the fan with three-phase motor, the proper direction of the impeller rotation must be checked. The inspection opening on the motor cup is sealed with a rubber plug. The RQ fans' impellers rotate always to the left, i.e. counter clockwise (looking through the inspection opening on the motor cup).

To do so, remove the rubber plug from the inspection opening in the fan cup (see. figure 6).
■ After starting the fan, the current must also be measured, and it must not exceed the maximum allowed current $I_{max.}$ stated on the rating plate. If the measured values exceed the given current value, it is necessary to check the duct system regulation.
■ The fans are equipped with thermo-contacts situated in the motor winding; they are connected to the TK terminals. If the motor gets too hot, the thermo-contact will open. The thermo-contact must be connected to the control or regulating system (e.g. control unit, TRN controller or STE relay) which is able to evaluate the failure, and protect the motor against unwanted thermal effects. The proper functioning of the controller must ensure that after cooling down and the thermo-contact closing, the motor cannot be spontaneously started. Before restarting the fan (failure unblocking), it is necessary to check the duct system regulation, the electrical parameters of the motor and the entire wiring.
■ If the fans are operated without connection to this protection, our warranty for a damaged motor will become void.

Figure 7 - Terminal wiring diagram



TK
- motor thermo-contact terminals
U1, U2
- single-phase motor power supply terminals 1f - 230V/50Hz
PE
- protective conductor terminal

TK
- motor thermo-contact terminals
U1, V1, W1
- three-phase motor power supply terminals 3f - 230V/50Hz
PE
- protective conductor terminal

The wiring diagrams with front-end elements (protective relays, controllers, control units) are included in the installation manual, respectively in the AeroCAD project of their elements (see figure # 7).

Operation, Maintenance and Service

The fan does not require special maintenance. During operation, it is necessary to check the proper functioning of the fan, its smooth running, to keep it and its surroundings clean, and to load the fan only within the range given by its output characteristics.
■ If a failure occurs, make sure that the power supply is disconnected, and check the fan for foreign objects inside, and free rotation. If the fan does not run after it has been restarted, the following procedures must be followed depending on the protection system used:
• If the fan is protected by STE or STD relays:
Turn the fan on/off using the buttons on the protecting relay.
• If the fan is protected by a TRN controller:
Turn the fan on/off using the switch on the remote controls of the controller.
• If the fan is protected by the control unit:
It is necessary to turn the unit on again.
If the fan does not start:
Check the wiring, and measure the motor winding impedance. If the motor is damaged, contact your supplier.
Warning! When performing any maintenance or repairs, the device must always be disconnected from the power supply!

Example A

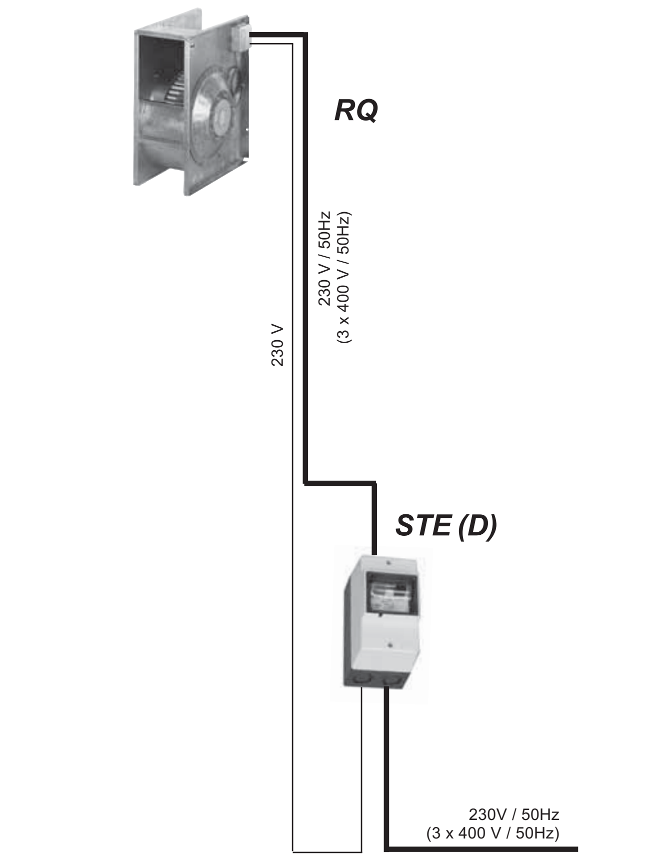
RQ Fans without Output Control and with STE Protecting Relay

The RQ fan connection in a simple venting system without output control is shown in figure # 8.
This connection ensures:

- Thermal protection of the fan using thermo-contacts and protecting relay, STE (single-phase) or STD (three-phase).
- Manual switching on/off of the fan using buttons on the STE(D) protecting relay

After pressing the button marked "I" on the STE(D) protecting relay, the fan starts and the button will stay in the depressed position, signalling the fan's operation. The fan can be stopped by pressing the button marked "0".
If the motor winding is overheated above +130 °C due to overloading, the thermo-contacts in the motor winding will open. Upon the thermo-contacts opening, which are interconnected with the fan terminal box, the STE(D) protecting relay circuit TK, TK will be disconnected. As a reaction to this state, the STE(D) protecting relay will disconnect the power supply to the overheated motor. After cooling down, the motor is not automatically started. The failure must be confirmed (unblocked) by the operator by pressing the red "I" button.

Figure 8 - Fan connection



Example A

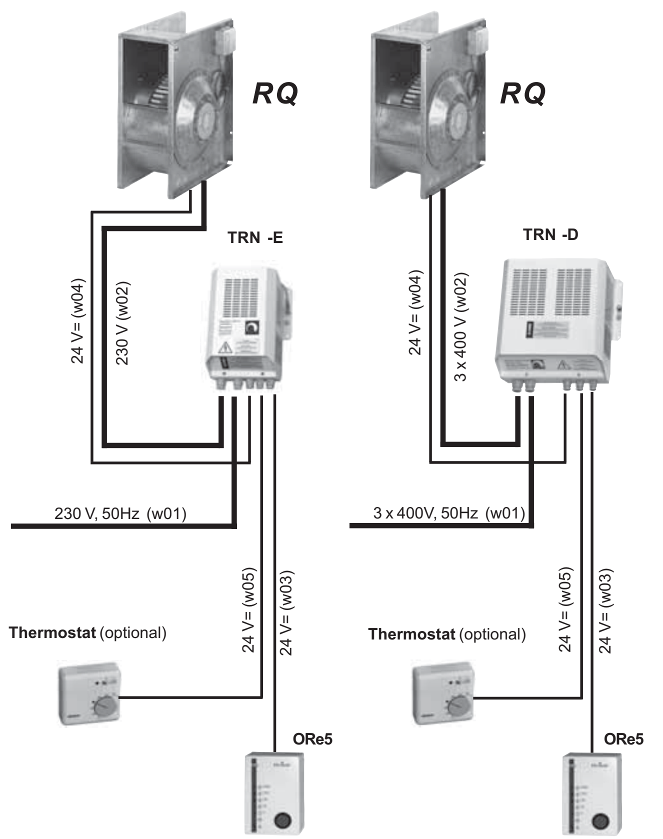
RQ Fans with Output Control and TRN Control

The RQ fan connection in a simple venting system with one or more fans which must be controlled independently using the TRN controller with ORe5 controller is shown in figure # 9.
This connection of the speed controller ensures:

- The possibility of fan output selection within the stage range 1-5.
- Thermal protection of the fan
- Fan switching on/off manually by the ORe5 remote controller.
- Fan switching on/off manually by any other switch (like room thermostat, gas detector, pressostat, hygrostat, etc.) on terminals PT1, PT2.

Upon selecting the required output stage using a selector on the ORe5 controller, the fan will start at the corresponding speed. The closed switch connected to PT1, PT2 terminals and the thermo-contact circuit connected to TK, TK terminals are essential for the fan operation. The switch connected to PT1, PT2 terminals can externally stop the fan. If this possibility is not used, it will be necessary to interconnect terminals PT1 and PT2. If the fan is overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding. As a reaction to this state, the controller will disconnect the fan power supply, and the red control light on the ORe5 controller will signal the failure. After cooling down, the motor is not automatically started. To restart the fan, it is necessary first to set the selector to the "STOP" position, and thus confirm failure removal, and then to set the required fan output. In this arrangement, the option "STOP" must not be blocked.

Figure 9 - Fan connection



Example C

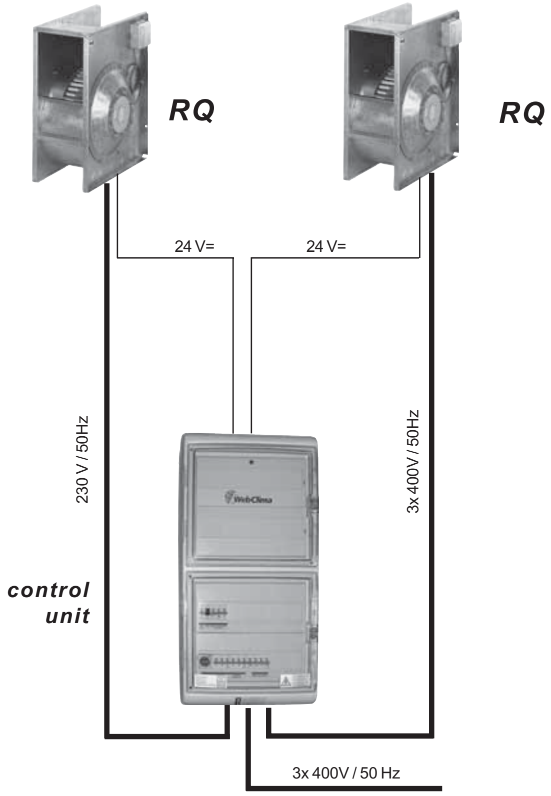
RQ Fans without Output Control and with Control Unit

The RQ fan without output control connection in more sophisticated venting systems using the control unit is shown in figure # 10.
Among others, this connection ensures:

- The motor protection (TK thermo-contact terminals are connected to 5a, 5a, 5b, 5b terminals in the control unit).
- Manual or programmable switching on/off of the entire device using a control unit.

The air-handling system is started by the control unit. All protecting and safety functions of fans as well as the entire system are ensured by the control unit.

Figure 10 - Fan connection



Example D

RQ Fans with TRN Controllers and Control Unit

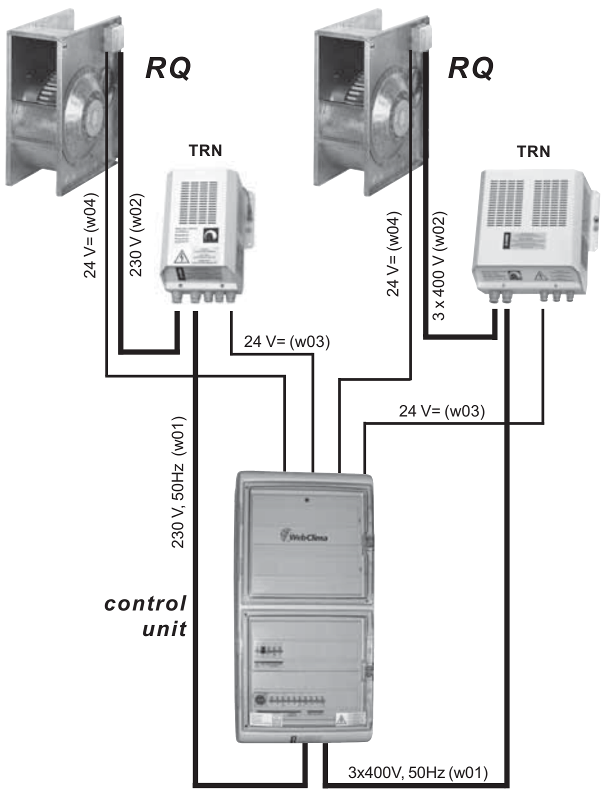
Connection of RQ fans equipped with an output control with two TRN controllers and an independent internal control for each controller is shown in figure # 11. The internal controller is installed in the control unit during production. Among others, this connection ensures:

- Manual selection of the fan output within the stage range 1-5, independently for the inlet and outlet (this can be used to get the required overpressure or underpressure in the room).
- Thermal protection of the motor (connecting the TK, TK thermo-contact terminals to 5a, 5a, 5b, 5b terminals in the control unit).
- Manual or programmable switching on/off of the entire device using a control unit.

In this connection, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller.

The air-handling system is started by the control unit. Internal controls are integrated into the control unit to control the controllers separately. Other properties are influenced by the setting options of connected components (controllers, controls). All protecting and safety functions of fans as well as the entire system are ensured by the control unit.

Figure 11 - Fan connection



Technical information

Fan Applications

Fully controlled, low-pressure RO radial fans are intended to be installed directly in square air ducts. They can be used for air-conditioning, from simple venting installations to more sophisticated air-handling systems. Thanks to easy maintenance and cleaning, they are especially used for kitchen hood exhausting. Ideally, they can be used along with other components of the Vento modular system, which ensure inter-compatibility and balanced parameters.

Operating Conditions, Position

These fans are designed for indoor and outdoor applications, and to transport air without solid, fibrous, sticky, aggressive, respectively explosive impurities. For outdoor applications it is necessary to finish the fans with a protective coating (except the rating plates). The transported air must be free of corrosive chemicals or chemicals aggressive to zinc, aluminium and/or plastics.
Acceptable temperature of transported air can range from -15 °C to +40 °C (and with some types, up to +70 °C, see table # 2).
The RO fans can work in any position, which enables free access to the terminal box and motor.
We recommend adding a 1 to 1.5 m long piece of straight duct to the fan's outlet to reduce pressure losses in an assembly.

Dimensional Range

RO fans are manufactured in a range of three sizes according to the A x B dimensions of the connecting outlet flange (300 x 150, 400 x 200, 500 x 250 mm).

Materials

The external casing and connecting flanges of RO Fans are made of galvanized steel sheets (Zn 275 g/m^2). Impeller blades are made of plastics while diffusers are made of galvanized sheet steel, and motors are made of aluminium alloys, copper and plastics. All materials are carefully verified and checked so they ensure long service life and reliability of the fans. Impellers along with the motor are perfectly statically and dynamically balanced.

Motors

Compact single-phase synchronous motors with an external rotor and a resistance armature are used as drives. The motors are situated inside the impeller, and during operation are optimally cooled by the flowing air.
The motor's high quality enclosed ball bearings with permanent lubricant filling enable the fans to reach a service life above 40,000 operating hours without maintenance.
The motor electric protection degree is IP 54, insulation class B. The motor windings are impregnated to provide them with additional protection against moisture.

Electrical Equipment

Single-phase motors are equipped with a starting capacitor which is mounted on the fan casing. The wiring is terminated in a terminal box of IP 54 protection degree. For wiring diagrams, refer to Page # 60.

Motor Protection

As standard, permanent and automatic monitoring of the internal motor temperature is used in all motors of RO fans. The limit temperature is monitored by thermal contacts (TK-thermo-contacts) situated in the motor winding. The thermo-contacts are miniature thermal tripping elements which are connected in series with the supply circuit, and thus automatically protect the motor against overloading due to excessive temperature of transported air, etc.

Speed Control

The output of all RO fans can be fully controlled by changing the speed. The fan's speed is changed depending on the voltage at the motor terminals. The following controllers can be used to control the fans:

- PE 2,5 for stepless control
- TRN or TRRE2 for the five-stage control

Accessories

RO fans are part of the wide range of Vento modular venting and air-handling system components. Any air-handling set-up, from simple venting to sophisticated comfortable air-conditioning, can be created by selecting suitable elements.

Fan Description and Designation

Type designation of RO duct fans in projects and orders is defined by the key shown in figure # 1.
For example, type designation RO 40-20 / 22-2E specifies the type of fan, impeller and motor.

Figure 1 - Type designation key of RO fans

RO 40 - 20 / 22 - 2 E

- **E** – **Motor**: E - single-phase
- **2** – **Number of motor's poles**
- **22** – **Impeller diameter (cm)**
- **20** – **Flange connection B dimension (cm)**
- **40** – **Flange connection A dimension (cm)**
- **RO** – **Duct hinged radial fan**

Fan Parameters

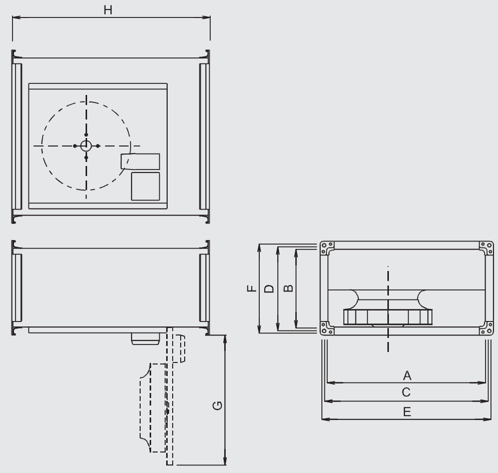
Dimensions, Weights and Performance

For important dimensions of RO fans, refer to figure # 2 and table # 1.
Basic parameters and nominal values of RO fans are included in table # 2 .

Table 1 - RO Fan Dimensions

TYPE	Dimensions in mm							
	A	B	C	D	E	F	G	H
RO 30-15/18-2E	300	150	320	170	340	190	300	400
RO 40-20/22-2E	400	200	420	220	440	240	350	500
RO 40-20/25-2E	400	200	420	220	440	240	350	500
RO 50-25/25-2E	500	250	520	270	540	290	420	530

Figure 2 - RO Fan Dimensions



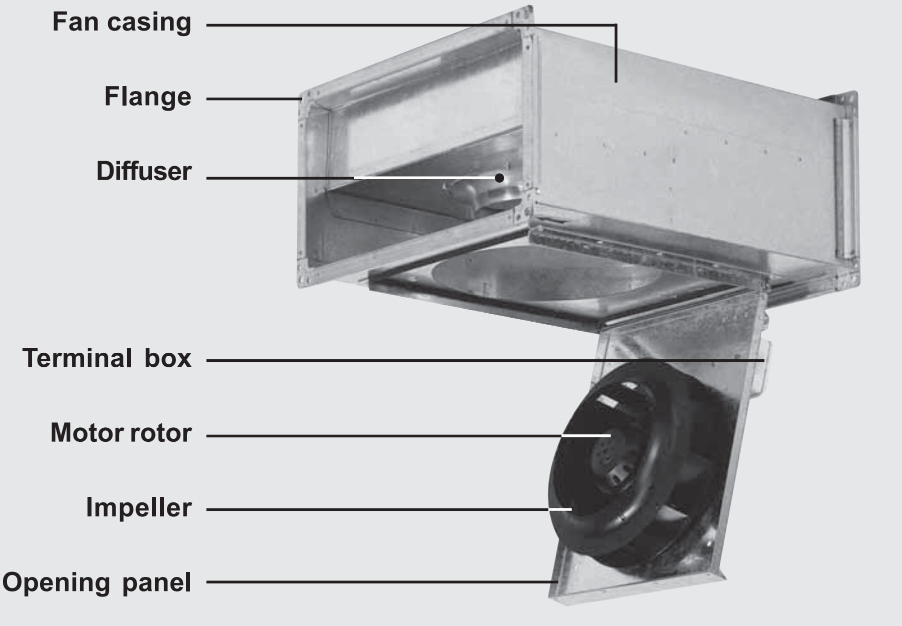
$V_{max.}$ - maximum air flow rate at minimum permissible pressure loss (free inlet and outlet)
$\Delta p_{t\ max.}$ - maximum total pressure of the fan is maximum sum of Δp_s and p_d (Δp_s + p_d) max.
$\Delta p_{s\ min.}$ - min. permissible static pressure (i.e. pressure loss of the connected duct)
n - fan speed measured at the highest efficiency working point (5b), rounded to tens
U - nominal power supply voltage of the motor without control (all values in the table are related to this voltage)
$P_{max.}$ - maximum electrical input of the motor at maximum loading
$I_{max.}$ - maximum phase current at voltage U and maximum allowed loading
$t_{max.}$ - maximum permissible transported air temperature
C - prescribed capacitor capacity with single-phase fans
control - prescribed fan output voltage controller
m - weight of the fan (±10%)

Table 2 - Basic parameters and nominal values

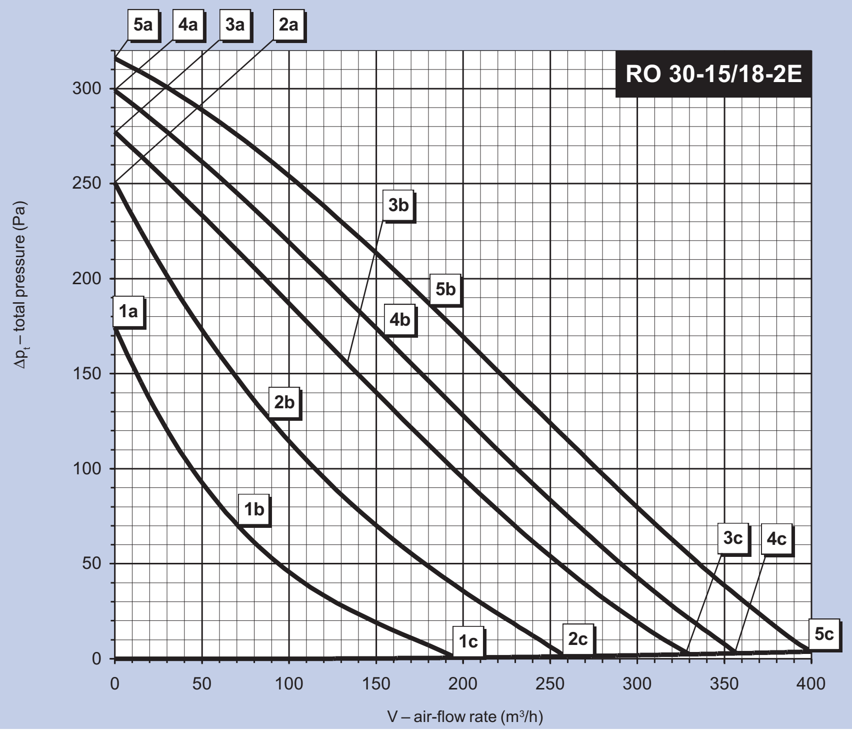
Fan	$V_{max.}$	$\Delta p_{t\ max.}$	$\Delta p_{s\ min.}$	n	U	$P_{max.}$	$I_{max.}$	$t_{max.}$	C	Control.	m
type	m^3/h	Pa	Pa	min^{-1}	V	W	A	°C	µF	type*	kg
single-phase fans											
RO 30-15/18-2E	400	316	0	2480	230	61	0,28	40	1,5	TRN 2E	8
RO 40-20/22-2E	798	506	0	2520	230	106	0,53	60	3	TRN 2E	11
RO 40-20/25-2E	1199	554	0	2150	230	148	0,78	40	4	TRN 2E	12
RO 50-25/25-2E	1371	594	0	2310	230	200	0,99	70	5	TRN 2E	15

*** PE 2,5 stepless fan output controllers are also recommended for RO fans**

Figure 3 - Fan design



The Vento RO radial duct fans are designed to be installed in duct lines or the assembly of other Vento System air-handling elements. The Vento RO fan design is perfectly functional.

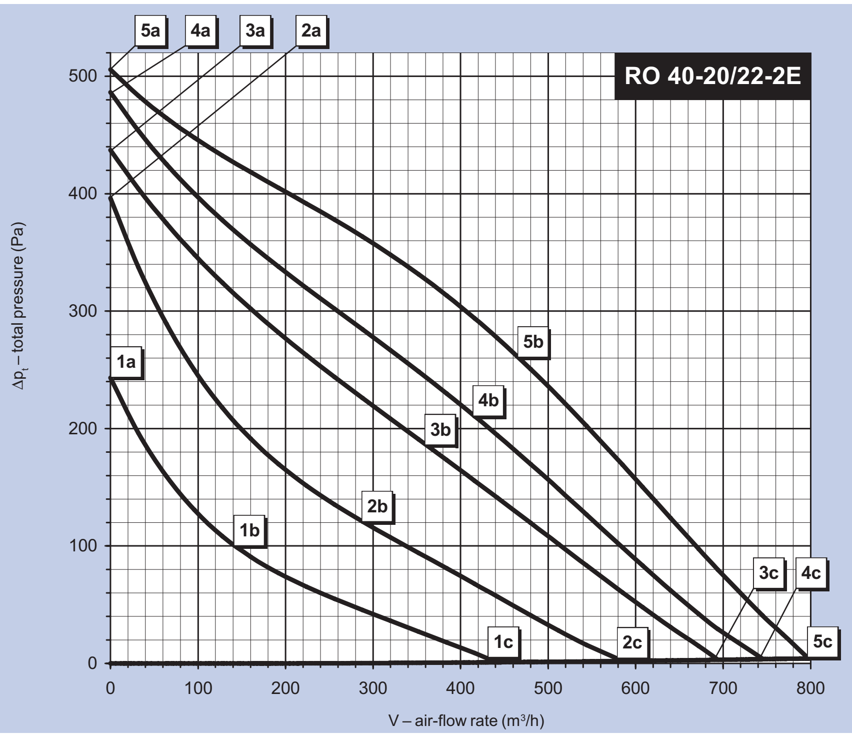


RO 30-15/18-2E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	61
Max. current (5c)	I_{max}	[A]	0,28
Mean speed	n	[min^{-1}]	2480
Capacitor	C	[μF]	1,5
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	400
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	316
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	8
Five-stage controller		typ	TRN 2E
Protecting relay		typ	–

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	64	69	57
Sound power level L_{WAokt} [dB (A)]			
125 Hz	39	38	32
250 Hz	59	58	51
500 Hz	56	63	53
1000 Hz	58	65	55
2000 Hz	58	62	50
4000 Hz	54	58	43
8000 Hz	42	43	39

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,26	0,26	0,28	0,20	0,21	0,23	0,19	0,21	0,22	0,19	0,19	0,20	0,17	0,17	0,18
Electric input	P	[W]	55	57	61	36	38	41	31	33	35	24	25	26	18	18	19
Speed	n	[min^{-1}]	2556	2480	2438	2413	2304	2190	2263	2160	2017	1908	1856	1590	1457	1388	1199
Air flow rate	V	[m^3/h]	0	182	400	0	156	357	0	136	330	0	90	259	0	72	195
Static pressure	Δp_s	[Pa]	316	184	0	299	168	0	277	154	0	250	120	0	174	68	0
Total pressure	Δp_t	[Pa]	316	185	4	299	169	3	277	154	2	250	120	1	174	69	1

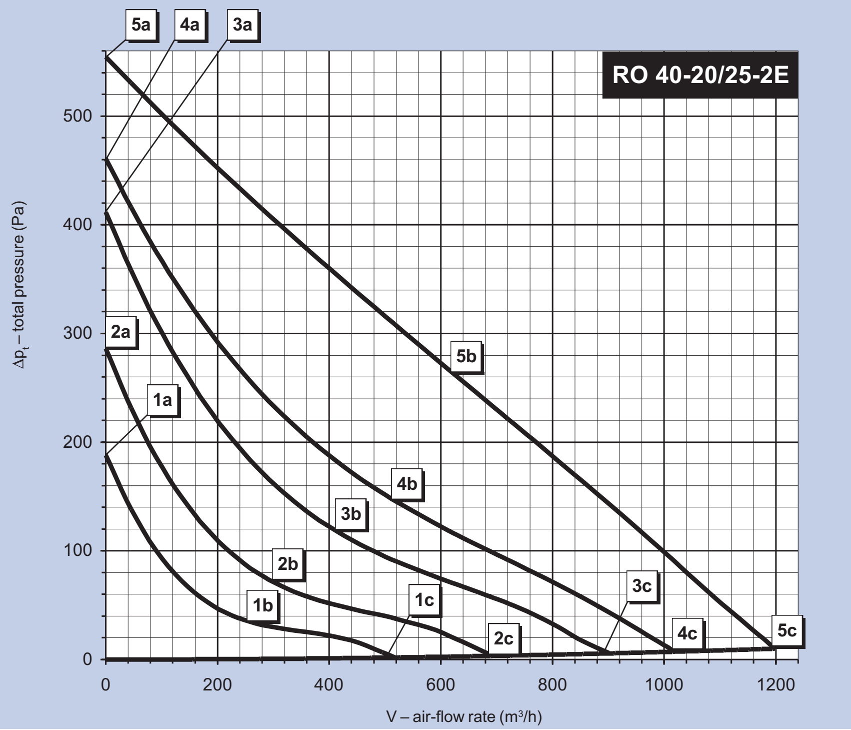


RO 40-20/22-2E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	106
Max. current (5c)	I_{max}	[A]	0,53
Mean speed	n	[min^{-1}]	2520
Capacitor	C	[μF]	3
Max. working temp.	t_{max}	[°C]	60
Max. air flow rate	V_{max}	[m^3/h]	798
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	506
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	11
Five-stage controller		typ	TRN 2E
Protecting relay		typ	–

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	72	77	64
Sound power level L_{WAokt} [dB (A)]			
125 Hz	51	46	45
250 Hz	60	65	57
500 Hz	65	71	60
1000 Hz	67	72	60
2000 Hz	66	72	57
4000 Hz	62	65	51
8000 Hz	56	56	39

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			140			105	
Current	I	[A]	0,45	0,53	0,48	0,43	0,52	0,46	0,43	0,52	0,46	0,45	0,49	0,46	0,42	0,43	0,42
Electric input	P	[W]	99	118	106	77	93	82	68	81	74	57	62	59	43	44	43
Speed	n	[min^{-1}]	2652	2519	2610	2480	2246	2424	2351	2050	2274	1943	1641	1893	1479	1318	1433
Air flow rate	V	[m^3/h]	0	464	798	0	415	745	0	362	694	0	288	585	0	145	442
Static pressure	Δp_s	[Pa]	506	267	0	486	214	0	437	189	0	396	123	0	243	100	0
Total pressure	Δp_t	[Pa]	506	268	4	486	215	4	437	190	3	396	124	2	243	100	1

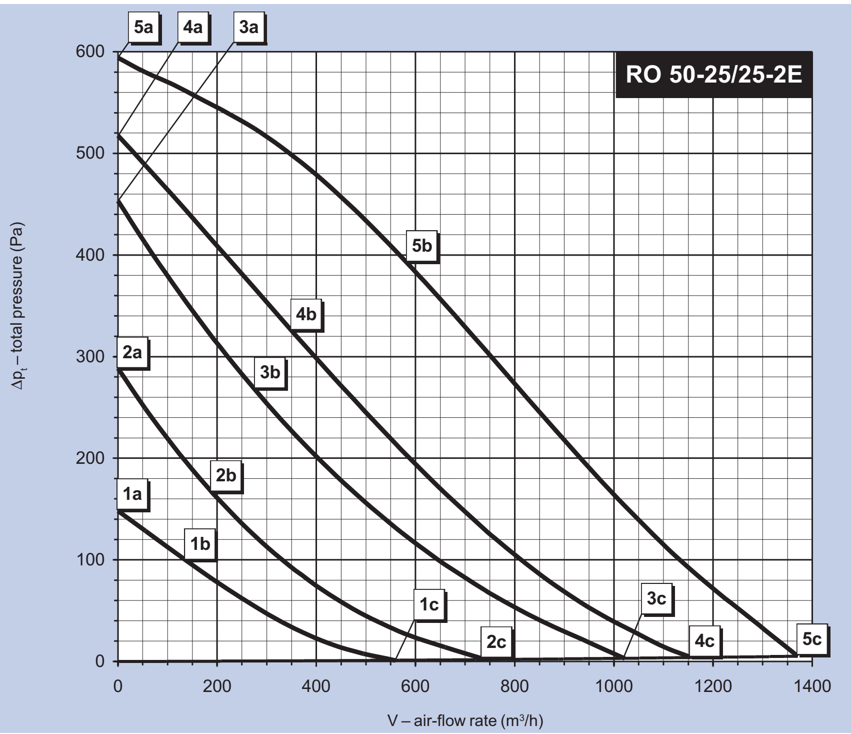


RO 40-20/25-2E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	148
Max. current (5c)	I_{max}	[A]	0,78
Mean speed	n	[min^{-1}]	2150
Capacitor	C	[µF]	4
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1199
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	554
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	12
Five-stage controller		typ	TRN 2E
Protecting relay		typ	–

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	71	77	65
Sound power level L_{WAokt} [dB (A)]			
125 Hz	51	51	42
250 Hz	56	61	55
500 Hz	64	72	63
1000 Hz	67	71	60
2000 Hz	65	72	57
4000 Hz	62	66	54
8000 Hz	54	57	41

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	230			180			160			130			105		
Current	I	[A]	0,59	0,78	0,65	0,63	0,72	0,64	0,59	0,68	0,61	0,53	0,59	0,55	0,47	0,49	0,48
Electric input	P	[W]	133	178	148	111	128	113	95	108	97	68	75	72	49	51	50
Speed	n	[min^{-1}]	2518	2154	2429	2087	1704	2068	1939	1459	1840	1633	1113	1432	1273	849	1066
Air flow rate	V	[m^3/h]	0	622	1199	0	539	1021	0	431	901	0	328	695	0	266	517
Static pressure	Δp_s	[Pa]	554	267	0	461	145	0	412	118	0	286	65	0	188	37	0
Total pressure	Δp_t	[Pa]	554	270	10	461	147	7	412	119	6	286	66	3	188	38	2



RO 50-25/25-2E

Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	200
Max. current (5c)	I_{max}	[A]	0,99
Mean speed	n	[min^{-1}]	2310
Capacitor	C	[µF]	5
Max. working temp.	t_{max}	[°C]	70
Max. air flow rate	V_{max}	[m^3/h]	1371
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	594
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	15
Five-stage controller		typ	TRN 2E
Protecting relay		typ	–

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	74	80	67
Sound power level L_{WAokt} [dB (A)]			
125 Hz	58	55	51
250 Hz	65	68	60
500 Hz	66	76	63
1000 Hz	70	73	61
2000 Hz	66	74	59
4000 Hz	65	69	53
8000 Hz	55	60	41

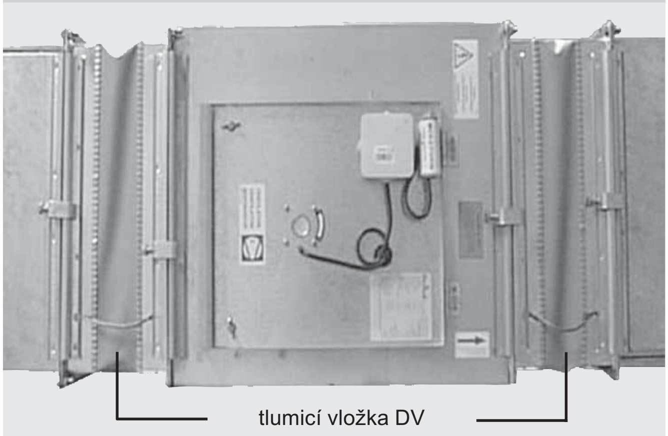
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	230			180			160			140			105		
Current	I	[A]	0,77	0,99	0,91	0,77	0,90	0,89	0,77	0,85	0,86	0,73	0,75	0,76	0,64	0,65	0,65
Electric input	P	[W]	174	200	200	136	160	158	122	135	134	92	95	95	65	67	67
Speed	n	[min^{-1}]	2560	2307	2431	2289	1993	2058	2096	1866	1817	1585	1406	1339	1162	1077	1020
Air flow rate	V	[m^3/h]	0	584	1371	0	352	1155	0	279	1022	0	195	740	0	148	560
Static pressure	Δp_s	[Pa]	594	384	0	518	325	0	453	270	0	288	170	0	148	98	0
Total pressure	Δp_t	[Pa]	594	385	5	518	325	4	453	270	3	288	170	2	148	98	1

Installation, Maintenance and Service

Installation

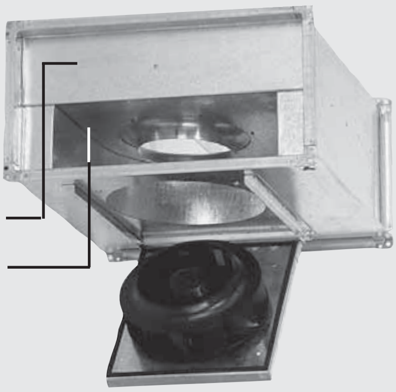
- RO fans (including other Vento elements and equipment) are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the fan. The installation and commissioning may be performed only by an authorized company licensed in accordance with generally valid regulations.
- The fan must be checked carefully before its installation, especially if it has been stored for a longer time. In particular, it is necessary to check all parts and the cable insulation for damage, and whether the rotary parts can rotate freely.
- It is recommended to insert the DV elastic connections in front of and behind the fan.

Figure 4 - Application of elastic connections



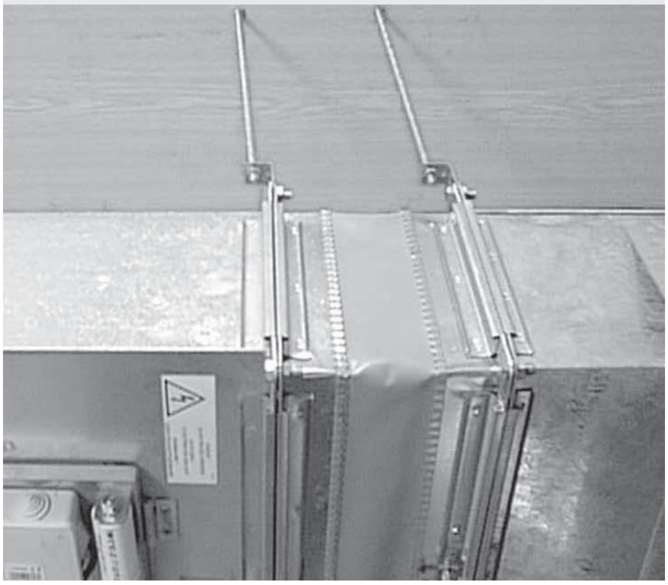
- It is advisable to always place the KFD or VFK air filters in front of the fan to protect the fan and duct against dirtying and dust fouling.

Figure 5 - Design and arrangement of the outlet



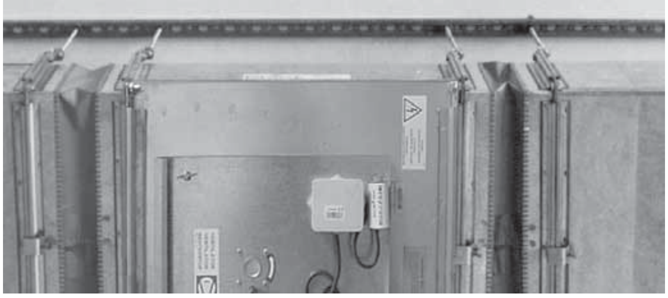
- If the fan is installed in such a way that persons or objects can come into contact with the impeller, the guard grid must be mounted.
- In cramped spaces, it is advisable to consider the necessity to situate directly behind the fan's outlet the duct adapting piece, attenuator, heat exchanger, heater, etc. Figure # 5 shows the fan's outlet design and arrangement. It is obvious that from the entire cross-section (e.g. 500 x 250) only about 1/2 of the entire outlet cross-section is free. This means that the airflow velocities close behind the fan can be as much as two times higher than, for example in the inlet. Therefore, the longer the distance of the attenuators (or other resistant elements) from the outlet, the better [2]. On the inlet side the DV elastic connection will be sufficient as a distance piece in most cases.

Figure 6 - Anchoring to the ceiling



- The fan must be suspended by separate suspensions so that no loading can be transferred to the elastic connections or connected duct.
- Anchoring to the ceiling with steel anchors and suspension using threaded rods, perforated galvanized strips or ancillary construction is recommended.

Figure 7 - Anchoring using threaded rods



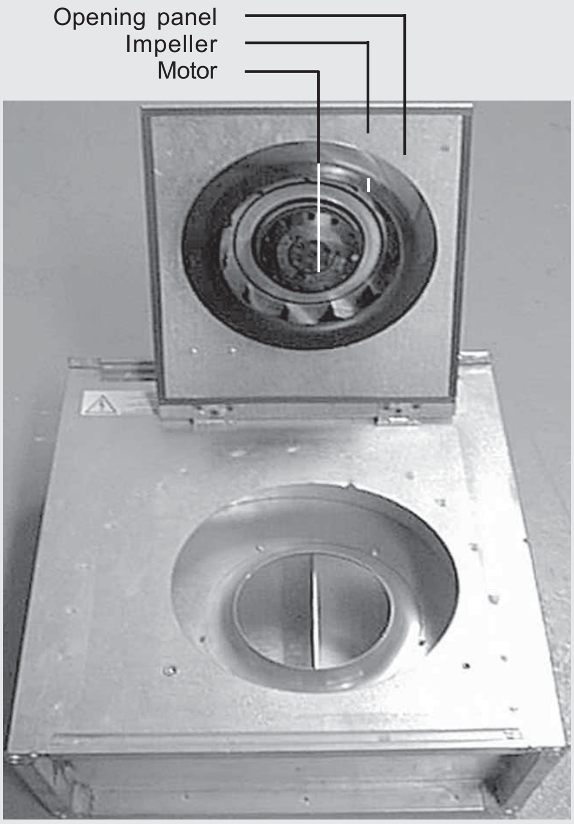
- The RO fans can work in any position. When positioned under the ceiling, it is advisable to situate the fan with its service panel directed downwards to ease access to the motor terminal box.
- If transported air is oversaturated with moisture or if the risk of intensive and permanent steam condensation inside the fan exists (e.g. showers, kitchens, laundry plants), it is better to situate the opening panel upwards!

[2] This recommendation applies for all duct fans

Installation, Maintenance and Service

■ Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento system, use galvanized screws and M8 nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides, at least on one flange connection.
■ To brace flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping.
■ After loosening the two wing screws, the hinged opening panel on which the motor and impeller are fixed can be easily opened.
■ The motor and impeller must be periodically checked and cleaned. Especially if the fan is connected to the outlet from a kitchen or an exhaust hood, and the greasy dirt can be expected, the impeller and motor must be regularly cleaned with warm water and detergent.

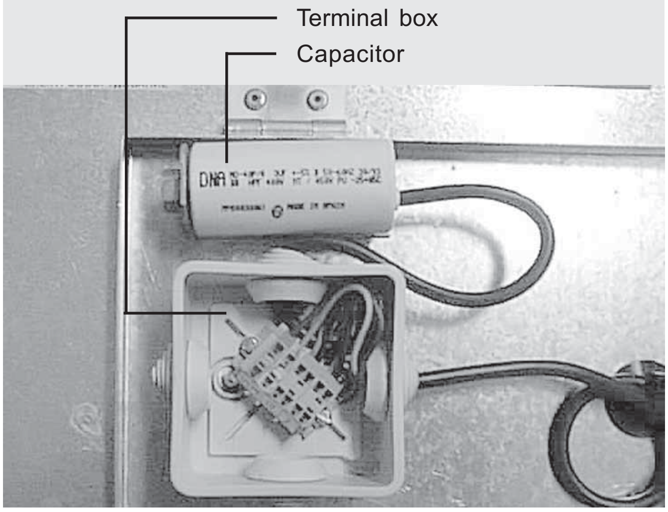
Figure 8 - Hinged service panel



Wiring

■ The wiring can be performed only by a qualified worker licensed in accordance with national regulations.
■ The fans are equipped with an all-plastic terminal box fixed with screws to the fan service panel. The terminal box is equipped with WAGO terminals; max. cross-section of connecting conductors 1.5 mm2 (see fig. # 9).
■ The wiring connection to the terminals can be performed following the label on the terminal box lid.
■ CYKY 3Cx1,5 cable is recommended to connect the fan motor to the power supply.
■ After starting the fan, the current must also be measured, and it must not exceed the maximum allowed current Imax. stated on the rating plate. If the measured values exceed the current value, it is necessary to check whether the rotary parts can rotate freely.

Figure 9 - Plastic terminal box



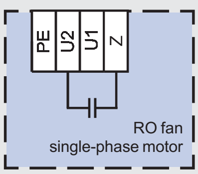
■ The fans are equipped with thermo-contacts situated in the motor winding. If the motor gets too hot, the thermo-contact will automatically disconnect the power supply. After cooling down, the thermo-contact closes, and connects the power supply. Activated thermal protection mostly signals a failure. If this is the case, it is necessary to check the duct system regulation, the electrical parameters of the motor and the entire wiring.

Operation, Maintenance and Service

■ The fan does not require special maintenance. During operation, it is necessary to check proper functioning of the fan, its smooth running, to keep it and its surroundings clean, and to load the fan only within the range given by its output characteristics.
■ If a failure occurs, make sure that the power supply is disconnected, and check the fan for foreign objects inside, and free rotation, respectively whether the motor has overheated.
■ If the fan does not start: Check the wiring, and measure the motor winding impedance. If the motor is damaged, contact your supplier or authorized service centre.
Warning! When performing any maintenance or repairs, the device must always be disconnected from the power supply!

The wiring diagrams with front-end elements (protective relays, controllers, control units) are included in the installation manual, respectively in the AeroCAD project.

Figure 10 - Terminal wiring diagram



U1, U2
– single-phase motor power supply terminals
1f – 230V/50Hz
PE
– protective conductor terminal

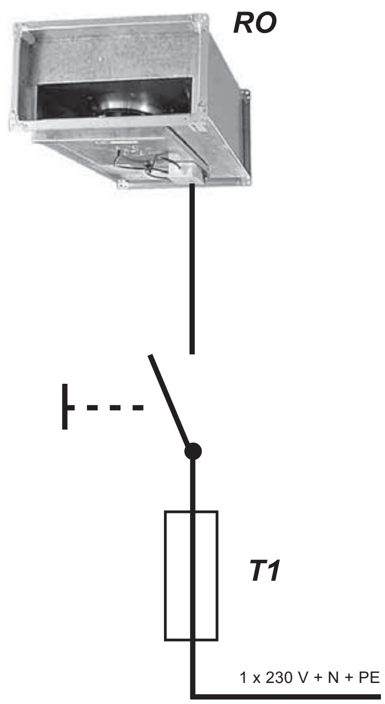
Example A

RO Fans without Output Control

An RO fan connection in a simple venting system without output control is shown in figure # 11.
This connection ensures:
- Full thermal protection of the fan via built-in thermo-contacts which are connected in series with the motor winding. Fuse T1 protects only against short circuit.
- Manual switching on/off of the fan using a switch.

If the motor winding is overheated above +130 °C due to overloading, the thermo-contacts in the motor winding will open. Upon the thermo-contacts opening, the power supply will be automatically cut. After cooling down, the fan is automatically started.

Figure 11 - Fan connection



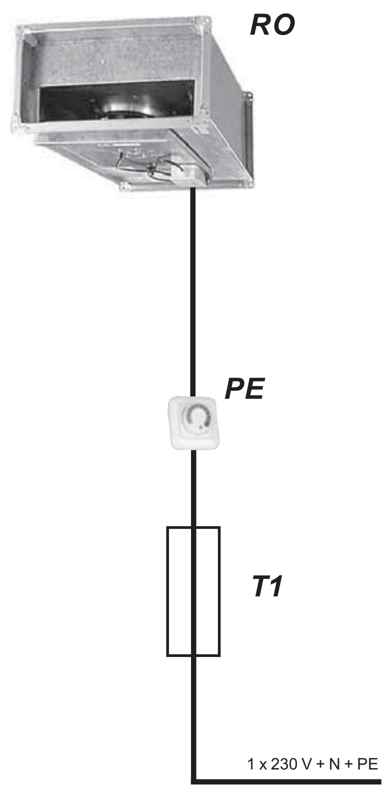
Example B

RO Fans with Output Control using PE Controller

An RO fan connection in a venting system with output control using the PE controller is shown in figure # 12.
This connection ensures:
- Full thermal protection of the fan via built-in thermo-contacts which are connected in series with the motor winding. Fuse T1 protects only against short circuit.

The PE Controller ensures:
- Stepless output control
- Signalling of the fan's operation
- It enables turning the fan on/off manually.

Figure 12 - Fan connection



Example C

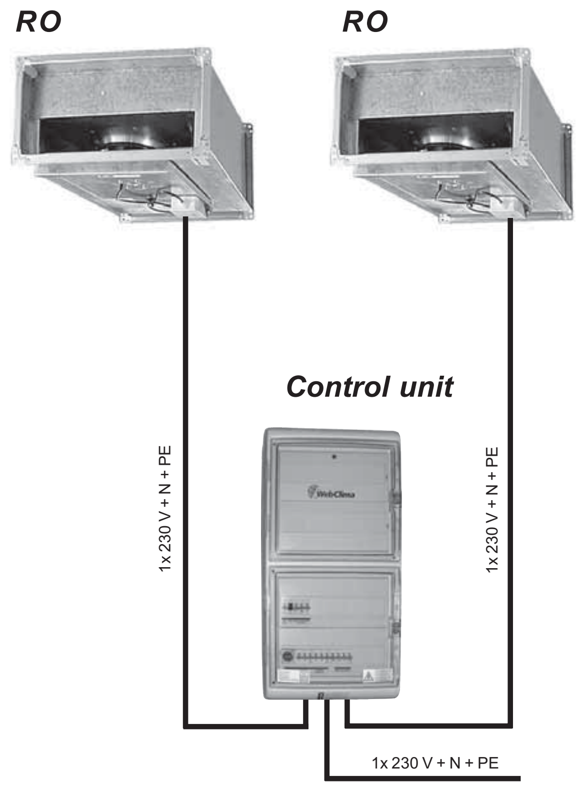
RO Fans without Output Control with a control unit

An RO fan without output control connection in more sophisticated venting systems using the control unit is shown in figure # 13.
This connection ensures:

- Automatic thermal protection of the fan via built-in thermo-contacts, which are connected in series with the motor winding.
- The fan switching on/off by the control unit.

The air-handling system is started by the control unit. All protection and safety functions of the entire system are ensured by the control unit.

Figure 13 - Fan connection



Example D

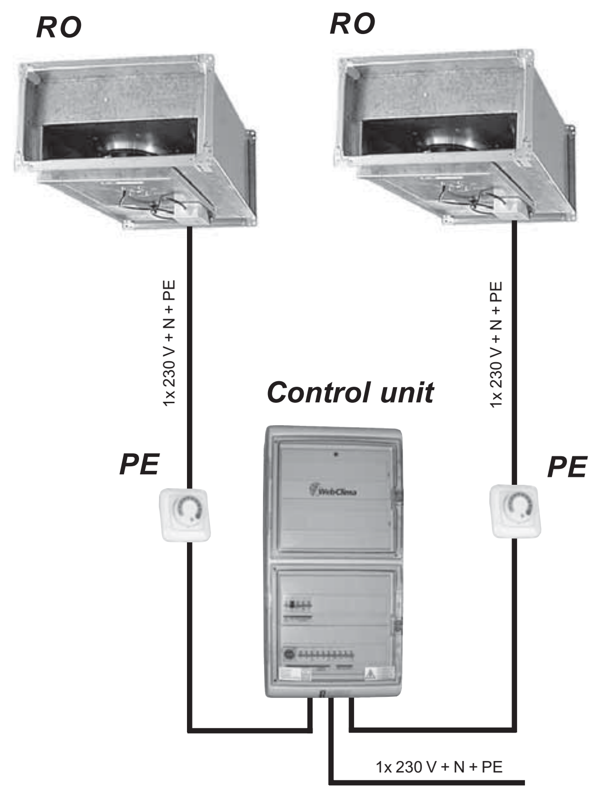
RO Fans with Output Control using PE Controllers with a control unit

An RO fan connection with PE output controllers and a control unit is shown in figure # 14.
This connection ensures:

- The fan switching on/off by the control unit.
- Stepless fan output control using the PE controller; however, it does not provide the possibility to switch the fan off.

The air-handling system is started by the control unit. All protection and safety functions of the entire system are ensured by the control unit.

Figure 14 - Fan connection



Technical Information

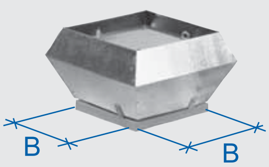
Fan Applications
These quiet, fully controllable, roof fans with vertical outlet are intended for air exhaust. The fans can be used to ventilate apartments, bathrooms, department stores, community centres, swimming pools, gymnasiums, kitchens and canteens, storage halls, stables, industrial and production plants, etc. Using a roof adaptor, the fans can be situated on flat as well as sloping roofs.

Operating Conditions, Position
The fans are designed for outdoor applications1), and to transport air without solid, fibrous, sticky, aggressive, respectively explosive impurities (an adequate surface finish is a condition for outdoor applications). The transported air must be free of corrosive chemicals or chemicals aggressive to zinc and/or aluminium. Acceptable temperature of the transported air can range from -15 °C (with some types -30 °C) to +40 °C (with some types up to +70 °C). The maximum values for each fan are included in table # 6. The RS fans can work only in the horizontal position (i.e. the impeller rotation axis is in the vertical position).

Dimensional Range
RS fans are manufactured in a range of five sizes according to the dimensions of the base (see figure # 1). Several fans differing in the number of poles the motor uses are available for each size. When planning a fan for the required air flow and pressure, the following general rule is applied; fan motors with a higher number of poles reach the required parameters at lower RPM, which results in lower noise and longer service life.

Figure 1 - Dimensional range of RS fans

dimensional range	B [mm]
30	300
40	400
56	560
63	630
90	900



The standard dimensional and performance range of single-phase and three-phase RS fans enables designers to optimize all parameters for air flows from 400 m^3/h up to 10,600 m^3/h.

Materials
The external casing of RS fans is made of galvanized steel sheets. The galvanized surface (Zn 275 g/m2) needs to be finished in a protective coating matching the building's colour. The fan base is always finished in backed enamel. Impeller blades (RS 30 plastic blades) and diffusers are made of galvanized sheet steel while motors are made of aluminium alloys, copper and plastics. The motor's high quality enclosed ball bearings with permanent lubricant filling enable the fans to reach a service life above 40,000 operating hours without maintenance. All used materials ensure long service life and reliability of the fans.

Motors
Compact single-phase and three-phase asynchronous motors with an external rotor and a resistance armature are used as drives. The motor electric protection degree is IP 44 for the RS 40/32 dimensional range and IP 54 for the RS 56/35 and higher dimensional ranges. The insulation class is B for the RS 30 dimensional range and the F for RS 40 dimensional range. The motors are situated inside the impeller, and during operation are optimally cooled by the flowing air. The motors feature low build-up current. The motor windings are impregnated against moisture. Impellers along with the motor are statically and dynamically balanced. After starting a fan with three-phase motor, the proper direction of the impeller rotation must follow the direction of the arrow on the fan supporting plate.

Wiring
The wiring is terminated in a terminal box of IP 54 protection degree. Single-phase motors are equipped with a starting capacitor which is mounted next to the terminal box. For the wiring diagrams, refer to page 74.

Motor Protection
As standard, permanent monitoring of the internal motor temperature is used in all motors. The limit temperature is monitored by thermal contacts (TK-thermo-contacts) situated in the motor winding. The thermo-contacts (TK) are miniature thermal tripping elements which after being connected to the protective contactor circuit protect the motor against overheating due to phase failure, forced motor braking, current protection circuit breakdown or excessive temperature of the transported air. The thermal protection by means of thermo-contacts is complex and reliable providing they are correctly connected. This type of protection is essential especially for speed controlled and frequently started motors and motors highly thermally loaded by hot transported air. The fan motors are equipped with thermo-contacts in two versions:

- **Serial Thermo-Contact (self-acting)**

The motor thermo-contact connected in series to the motor winding will disconnect the power supply if the winding temperature exceeds +130 °C. After cooling down, the thermo-contact closes and the fan starts. All RS 30 fans are equipped with serial thermo-contacts.

- **Brought-Out Thermo-Contact (control)**

The fan equipped with a thermo-contact brought out into the terminal box (TK terminals) must be connected to the protective device. When the temperature exceeds critical values, the thermo-contact will disconnect the control circuit of the protective device, which will further disconnect the motor power supply. All fans, except the RS 30 line, are equipped with brought-out thermo-contacts.

The fan motors with brought-out TK thermo-contacts cannot be protected by conventional overcurrent protection elements! Using thermal protection is the most important condition for warranty validity.

1) Suitable surface protection is supposed

Technical Information

Maximum thermo-contact permanent loading is 1.2 A at 250 V / 50 Hz (cos ? 0.6), (respectively 2 A at cos ? 1.0). Maximální trvalé zatížení termokontaktů při 250V / 50 Hz (cos φ 0,6) je 1,2 A (resp. 2 A při cos φ 1,0).

Fan Output Control

The output of all RS fans can be fully controlled by changing the speed. The following types of control can be used:

Stepless Voltage Control

RS fans can be steplessly controlled providing the change in voltage is stepless. The fan output stepless control from 0 % to 100 % can be ensured by PE 2,5 and PE 5 controllers (only single-phase motors up to 5 A). PE controllers are very suitable for the smallest RS 30 fans with a serial thermo-contact.

Five-Stage Voltage Control

In practice, stage voltage controllers are most often used. TRN or TRRE(D) stage voltage controllers can control the fan output in five stages in 20% steps, with which five pressure-airflow relation curves in working characteristic of each fan comport.

Tabulka 1 – závislost napětí a stupně regulace

Motor type	Characteristic curve – regulator level				
	5	4	3	2	1
1 - phase	230 V	180 V	160 V	130 V	105 V
3 - phase	400 V	280 V	230 V	180 V	140 V

Refer to table 1(1 showing the correlation between the input voltage and selected stage of the controller for single-phase and three-phase motors. All values respect the 400/230 V power supply system.
The following type line of controllers is recommended: TRN - E for single-phase motors and TRN - D for three-phase motors.
(2 Simplified TRRE and TRRD controllers can also be used to control RS fans; however, they do not provide a protection function.

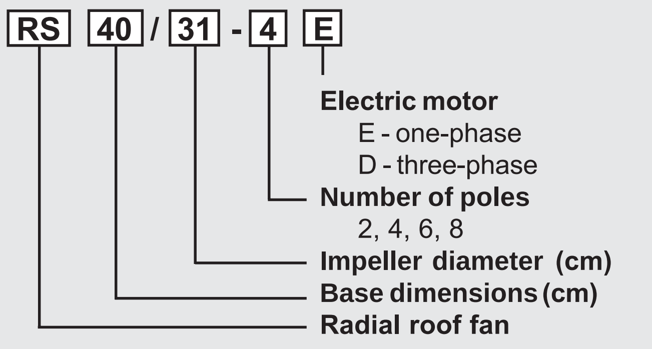
Stepless Electronic Control

Stepless electronic voltage control of the output is offered only with single-phase fans. The disadvantage of electronic control provided by PE 2,5 and PE 5 controllers is greater warming of the motors. A partial disadvantage can also be that when determining operating modes, the designer has no option to exactly define the controller's stage of the required output related to the load of the ventilated space. Stepless control can also be provided by means of frequency inverters, which can be delivered on request.

Service Data

A table showing the most important values is situated next to each fan's characteristics in the "Data Section" of the catalogue. The meaning of individual lines is explained in the following table # 2. These values are also listed on each fan's rating plate.

Figure 1 - Fan type designation



Fan Description and Designation

Type designation of RS roof fans in projects is defined by the key shown in figure # 2.
For example, type designation RO 40/31-4D specifies the type of fan, impeller and motor. (3

Accessories

RS fans are part of the wide range of Vento modular venting and air-handling system components. Any air-handling set-up, from simple venting to sophisticated comfortable air-conditioning, can be created by selecting suitable elements; however, RS fans can only used for the air outlet. To make the installation easier, special accessories can be delivered:

- NK roof adaptor - short
- NDH roof adaptor with an attenuator - long
- VS low-pressure damper
- STE and STD protecting relays
- PE electronic controller for single-phase fans
- TRN five-stage controllers and their controls

Table 2 - Fan designation

				RS 56/40-4D
data on nominal feeding voltage	Connection			3 x 400V 50Hz
maximum electric motor input specified	Max. electric input	P_{max}	[W]	438
max. current at nominal voltage	Max. current (5c)	I_{max}	[A]	0,82
average rotation speed at point 5 b	Mean rotation speed	n	[min^{-1}]	1330
capacitor capacity for one-phase fans	Capacitor	C	[µF]	-
highest permissible temperature of the transported air	Max. working temperature	t_{max}	[°C]	55
maximum airflow rate at working point 5c	Max. airflow rate	V_{max}	[m^3/h]	3800
maximum total pressure, between points 5a - 5c	Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	436
minimum permissible static pressure at point 5c	Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
fan total weight	Weight	m	[kg]	30,8
recommended regulator for fan output regulation	5- level regulator		typ	TRD 2
recommended protective relay	Protective relay		typ	STD

(1 RS fan motors can be operated within a range approx. from 25% to 110% of the rated voltage.
(2 For detailed information, refer to the chapter "Fan Output controllers".

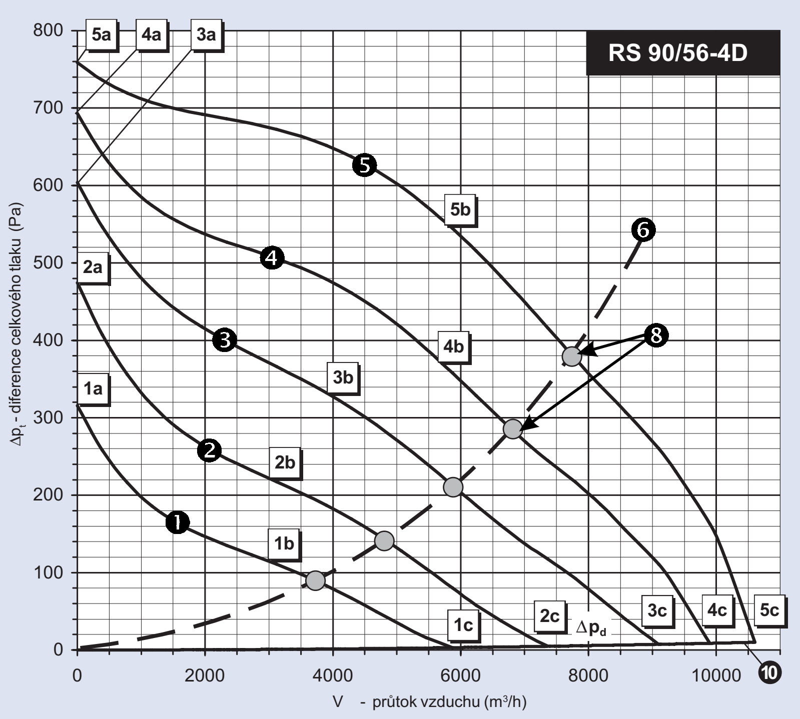
(3 The requirement for non-standard materials (casing made of aluminium) must be expressly specified in your order.
(4 The fan is operated without controller or control unit

Technical Information

Operating Characteristics

RS fans output characteristics are tested in the most modern testing laboratory for the aerodynamic and electric measuring of fans and pressure loss of passive components in the Czech and Slovak Republics. The REMAK testing laboratory complies with DIN 24 163 standard and AMCA STANDARD 210-74.[1

Graf 1



In the following text, the connections and relations of the important data in the table are explained.

The output characteristics in the data section from page 13 define the airflow rate V (m³/h) and the total fan pressure Äp_t = Äp_s + Äp_d (Pa). Graph 1 is an example for detailed explanation. All RS fans are fully controllable and when connected to 5-level TRE or TRD regulator, they can be operated at one of five output levels.

Each output level set on the regulator (levels 5, 4, 3, 2, 1) is represented by a characteristics curve ❺❹❸❷❶. If there is no regulator connected to the fan, the fan can be run on curve ❺ only. The characteristic of the particular piping is a parabolic curve V - Δp_t (for instance curve ❻). The real working point ❽ of the combination fan-piping will lie at the point of intersection of the curve representing the fan adjusted to the particular output level and the curve representing the connected piping. The fan output regulated by changing the voltage depends on load, therefore not only the voltage and rotation speed are changing, but also the current and input. The tables near characteristics in the data section of the catalogue show the changes in these values always for three selected points of each working characteristic, for instance 5a, 5b and 5c of characteristic ❺.

The characteristics show the total pressure Δp_t (Pa). The value of fan static pressure Δp_s can be found out by deducting the dynamic pressure Äp_d, which is represented by curve ❿ in the graph as well, this means

$\Delta p_s = \Delta p_t - \Delta p_d$.

In the data section of the catalogue, there is a table of RS fan parameters in the selected working points across the entire page width. Any important aerodynamic and electric parameters of the fan at the given point can be read out from this table.

5a, 4a, 3a, 2a and 1a points are characterised by zero airflow rate, this means by complete throttling. The electric motor input is minimal in these points and the motor is almost idle. 5b, 4b, 3b, 2b and 1b working points are characterised by maximum effectiveness and it is advisable to make a selection in this part of the curve, which is of course not a necessary precondition, because the fan can work permanently in any a-c characteristic zone demarcated by a full line. 5c, 4c, 3c, 2c and 1c working points are characterised by full motor load and the maximum airflow rate. These points lie on curve 10 (representing Δp_d value), when the fan works with free suction and free delivery, it means Δp_s = 0 Pa. RS fans with backward curved impeller blades have no prohibited (working) zone. They can be overloaded on hard braking or, in case of three-phase fans, on reverse rotation.

Noise Parameters

In the catalogue, there is noise data for emission, suction and environments. Like the duct fans, the value of L_{wA} [dB(A)] is specified, meaning the total level of emitted acoustic output weighed by A filter. Moreover, for octave bands from 125 Hz to 8 kHz there is the value of $L_{w\,rel}$, meaning the relative level of acoustic output. Using the formula $L_{wAokt} = L_{wA} + L_{w\,rel}$ we can find out the octave values of A-weighted L_{wAokt} acoustic output levels. Knowledge of these octave levels is necessary for analysis of VZT noise with a particular fan.

Measuring methods applied

Like the other Vento system fans, the noise data of RS roof fans are measured in REMAK's noise testing room. Measurements were made in accordance with the ČSN ISO 3743 standard, which specifies so-called technical methods of acoustic output level determination in a special reverberation room. To set the fan to the required working point in noise measurement, a metering line of fan aerodynamic parameters is used, completing the acoustic testing room. A summary of technical acoustic terms, clarification of the applied measuring methods and an outline of noise damping methods are included in the RMK 01.1. and RMK 01.2. catalogues for RS duct fans.

Calculation of noise level

In the calculation of noise around the fan, we specify a L_{pA} noise level value at a place where people stay or where the limit has to be adhered to. In the case of the roof fan, we are interested in the L_{pA} value in the selected

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spot in the exterior surrounding the fan and in L_{pA} in the room, from which the fan sucks air. These tasks are absolutely different in principle and therefore the general calculation procedure for both cases is outlined in the following chapters..

Noise level in exterior

In the calculation of noise level at the given distance around the roof fan we can presume that the acoustic pressure values in the field of reflected sound waves are negligible and therefore it is possible to determine the noise level from the equation of noise propagation in a free space. In that case, the following equation is applicable:

$$L_{p(A)} = L_{p(A)} + 10 \log [Q / (4p\ r^2)] \quad (1)$$

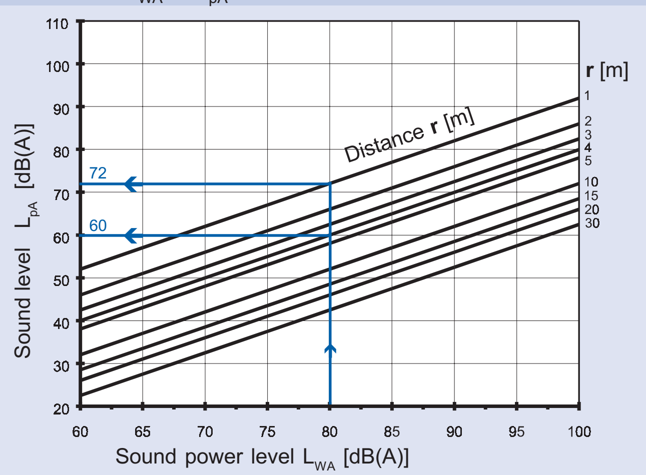
$L_{p(A)}$ noise level	[dB]
$L_{w(A)}$ acoustic output level (A)	[dB]
Q directivity factor for the given direction (1-8)	[-]
r distance (source - person)	[m]

Directivity factor Q characterises the influence of limiting surfaces on noise propagation, being a function of solid angle x to which the fan is emitting. It can be calculated from the following relation:

$$Q = 4p/v \quad (2)$$

If the emission angle is 180° as in most cases of RS fan installations, the Q factor is equal to 2.

Graph 2 - L_{WA} to L_{pA} conversion depending on distance r



Using the (1) equation, $L_{p(A)}$ values were calculated for various $L_{w(A)}$ values and selected r values (i.e. distances from fan) and then indicated in the Graph 2. This graph can be used for simple and quick determination of noise level (acoustic pressure level weighed by A function) at r distance from the fan.

Suction noise level in the room

Any noise emitted by the fan is propagated by connected piping, to places from which the air is being pulled. The noise is on one hand damped by the piping, dampers and other components, and on the one hand the noise of some components is added to the original noise, especially the noise of ventilating outlets. To be able to determine the suction noise level in the room, it is especially necessary to find out the total acoustic output level emitted to the room from which the air is being pulled. Because of the frequency dependence of noise propagation, and its damping, the levels of emitted acoustic output have to be calculated separately for particular octave bands. The damping factors of dampers and particular sections of piping routes are gradually deducted from the values of the acoustic output emitted by fan suction as far as the ventilated room, for which we want to know the noise level:

$$L_{wokt\ (i+1)} = L_{wokt\ (i)} - D_{okt\ (i)} \quad (3)$$

$L_{wokt\ (i+1)}$ is the level of acoustic output in the given octave behind the i-th component of pipeline. $D_{okt\ (i)}$ is the damping level in octaves for the i-th component of pipeline.The noise of the particular components of the piping route depends especially on airflow velocity. However this noise is lower than the noise emitted by the fan for many components and therefore it can be disregarded. The level of noise of the i-th component has to be compared to $L_{wokt\ (i+1)}$, meaning the fan acoustic output level decreased by the damping factor of the preceding components. It is applicable especially for ventilating outlets, where the fan noise can be damped to such an extent that the outlet noise itself is higher than the damped fan noise, especially at higher airflow velocities.

Using the general equation (2) applicable for the total acoustic pressure in the closed room, it is possible to calculate the octave level of acoustic pressure L_{pokt} from the values of the L_{wokt} acoustic output emitted to the room.

$$L_P = L_W + 10 \log [Q/(4p\ r^2) + 4.(1 - б_m)/(S.\ б_m)] \quad (4)$$

L_P acoustic pressure level	[dB]
L_W acoustic output level	[dB]
Q directivity factor for the given direction (1-8)	[-]
r distance (source - person)	[m]
$б_m$ mean factor of acoustic absorptive power	[-]
S room area	[m²]

The total acoustic pressure level in the room can be calculated from the following formula:

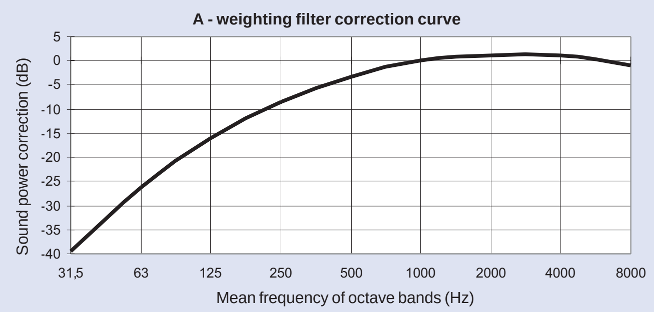
$$L_{PA} = 10.\log У10^{0,1(Lpokt + KAokt)} \quad (5)$$

The values of K_{Aokt} corrective factor for the particular octave bands are shown in table 3.

If the calculated noise level in the given place is not satisfying, it will be necessary to take additional anti-noise measures, for instance to insert another noise damper into the unit.

Table 3 - A-weighting filter correction values

Mean frequency of octave bands	Hz	31,5	63	125	250	500	1000	2000	4000	8000
Sound power correction K_{Al}	dB	-39	-26	-16	-8,6	-3,2	0	1,2	1	-1,1



Fan Parameters

Dimensions, Weights and Perform

For the most important data and dimensions of RS fans, refer to figure # 3 and table # 4.

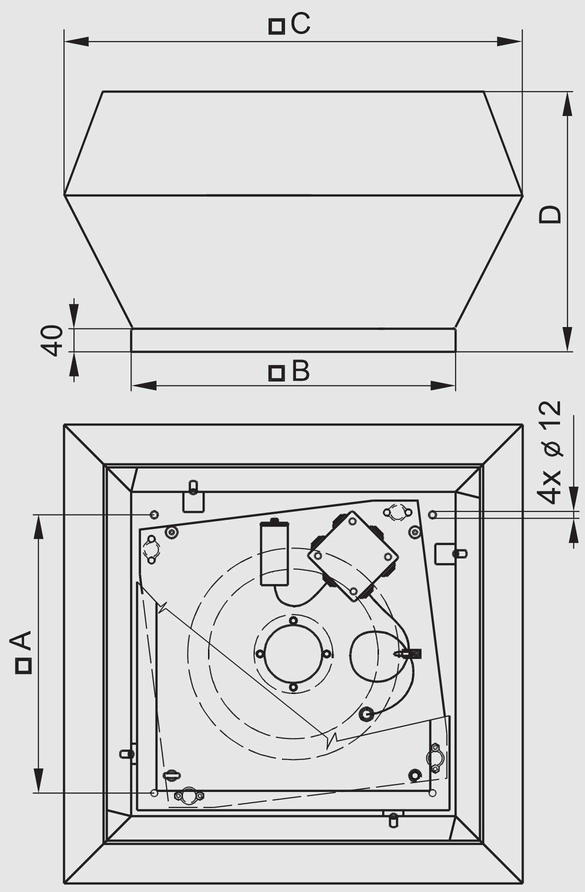
Table 4 - Basic dimensional Range

Dimensional range	Dimensions in mm			
	A	B	C	D
RS 30/..-..	245	300	365	170
RS 40/..-..	330	400	580	350
RS 56/..-..	450	560	780	435
RS 63/..-..	535	630	870	580
RS 90/..-..	750	900	1250	666

For operating fan parameters and the allocation of output controllers, refer to table # 5.
Legend:

- $V_{max.}$ - maximum airflow rate
- **n** - fan rotation speed measured at the working point with maximum effectiveness (5b) rounded to tens
- **u** - motor nominal feeding voltage without regulation (all table values are related to this voltage)
- $P_{max.}$ - maximum electric motor input
- $I_{max.}$ - maximum phase current at U (this value has to be checked after making the connection and the measured current has to be recorded into the Guarant. Certificate)
- $t_{max.}$ - maximum permitted temperature of the transported air for $V_{max.}$ airflow rate
- **C** - prescribed capacity of one-phase fan capacitors
- **control.** - prescribed voltage regulator for fan regulation
- **m** - fan weight (±10%)

Figure 3 - Basic dimensions of the fan



* holes for fixation screws

Table 5 - Basic parameters and nominal values

Fan type	V_{max}	P_{max}	n	U	I_{max}	t_{max}	C	Control.	m
	m^3/h	W	min^{-1}	V	A	°C	µF	typ	kg
Single-phase fans									
RS 30/18-2E	416	60	2390	230	0,27	40	1,5	PE 2,5	6,5
RS 30/22-2E	810	118	2530	230	0,53	60	3	PE 2,5	7,5
RS 30/22-4E	570	43	1400	230	0,2	60	1,5	PE 2,5	7
RS 40/31-4E	1365	126	1310	230	0,61	50	3	TRN 2E	16,5
RS 40/32-4E	1645	163	1320	230	0,82	70	4	TRN 2E	17,5
RS 56/35-4E	2698	306	1350	230	1,41	65	6	TRN 2E	35
RS 56/40-4E	3750	471	1330	230	2,12	40	10	TRN 4E	37
RS 63/45-4E	5200	720	1250	230	3,28	60	12	TRN 4E	50
Three-phase fans									
RS 56/35-4D	2675	279	1280	400	0,49	60	-	TRN 2D	34
RS 56/40-4D	3800	438	1330	400	0,82	55	-	TRN 2D	35
RS 63/45-4D	5261	696	1220	400	1,3	40	-	TRN 2D	46
RS 63/50-6D	5015	718	870	400	0,91	45	-	TRN 2D	48
RS 63/50-4D	7625	1202	1320	400	2,11	45	-	TRN 2D	54
RS 90/56-6D	7018	646	820	400	1,39	40	-	TRN 2D	89
RS 90/56-4D	10600	2062	1300	400	4,04	40	-	TRN 4D	100
RS 90/63-6D	9600	1189	880	400	2,29	70	-	TRN 4D	103

Fan Parameters

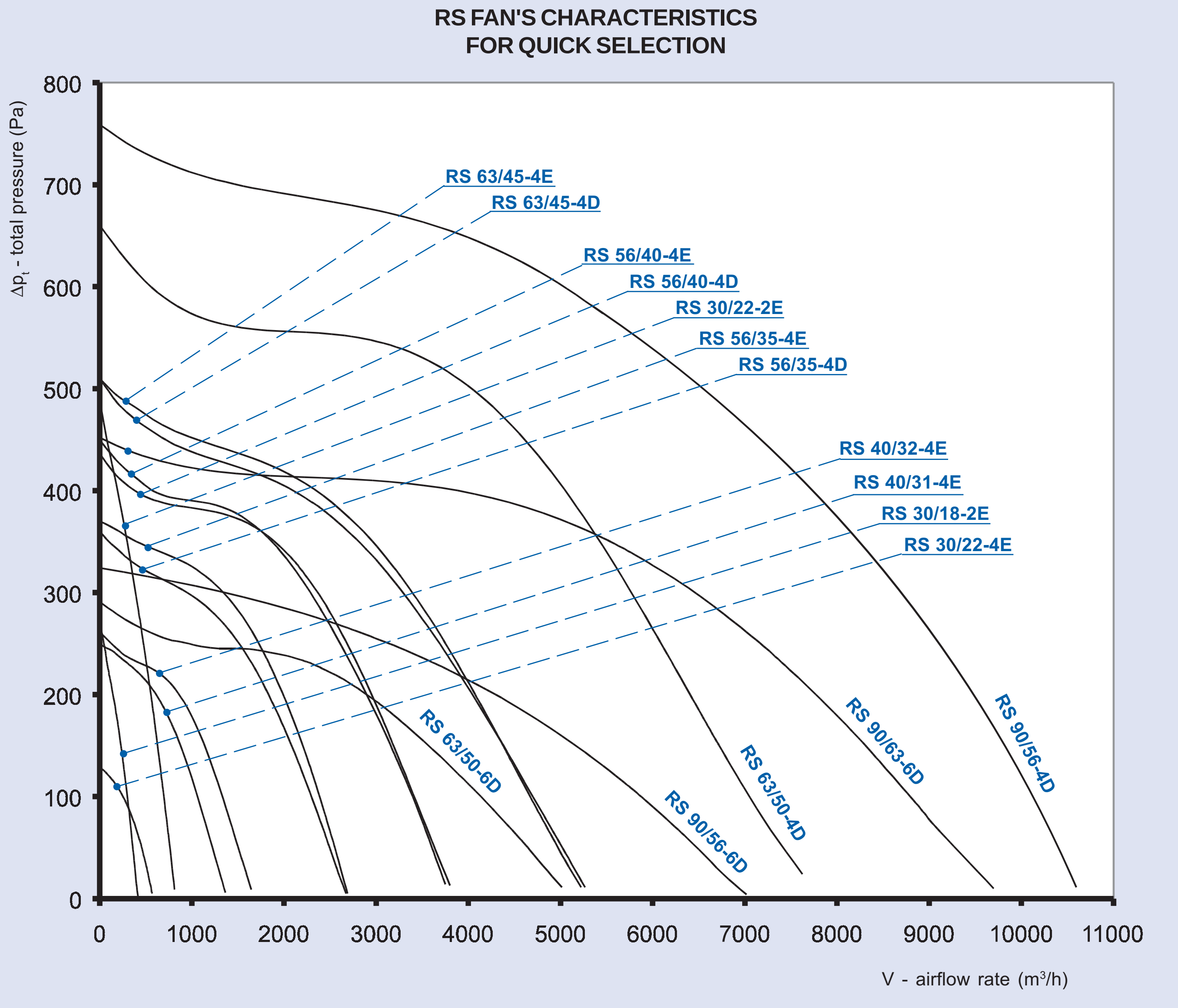
Data Section

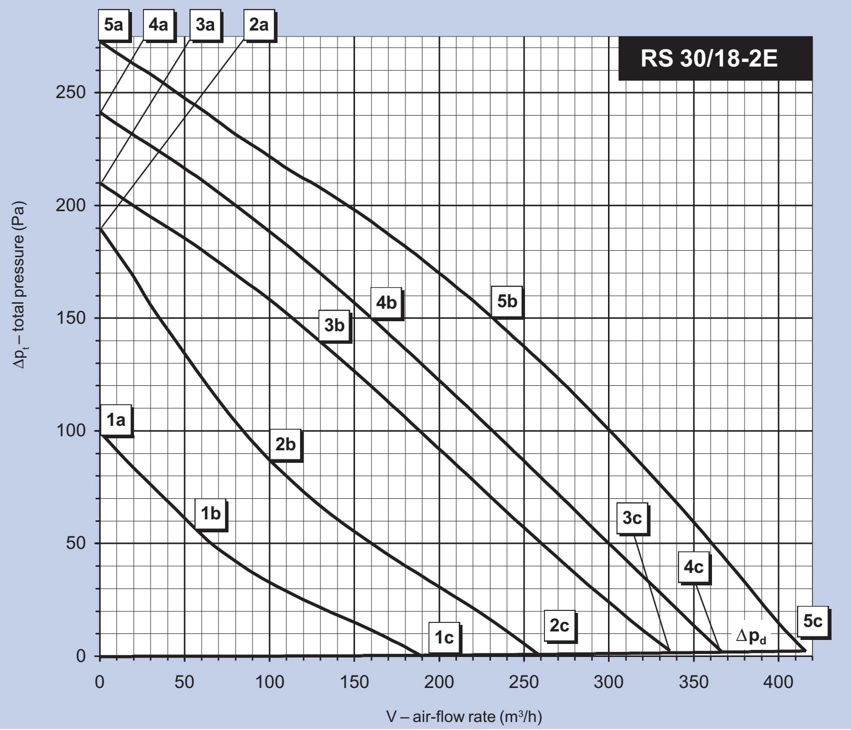
All RS fans arranged in the first column according to total pressure and according to maximum air flow in the second column are listed in table # 6.
However, in most cases the air flow rate-pressure interrelationship is more important than only the maxima of individual values.
Graph # 3 enables the quick selection of a suitable fan and a comparison of all RS fans.
Only the highest characteristics of each fan at nominal supply voltage, i.e. without or with a controller set to the fifth stage, are included in this graph.
The Data Section of the catalogue contains all important information and measured data of RS fans.

Table 6 - Fan overview

FAN CLASSIFICATION IN ASCENDING ORDER ACCORDING TO MAX. OUTPUT			
ACCORDING TO MAX. PRESSURE		ACCORDING TO MAX. AIRFLOW RATE	
Fan type	Total pressure $\Delta p_{t\ max}$ (Pa)	Fan type	Max. airflow V (m^3/h)
RS 30/22-4E	130	RS 30/18-2E	416
RS 40/31-4E	250	RS 30/22-4E	570
RS 40/32-4E	261	RS 30/22-2E	810
RS 30/18-2E	273	RS 40/31-4E	1365
RS 63/50-6D	290	RS 40/32-4E	1645
RS 90/56-6D	324	RS 56/35-4D	2675
RS 56/35-4D	360	RS 56/35-4E	2698
RS 56/35-4E	370	RS 56/40-4E	3750
RS 56/40-4D	436	RS 56/40-4D	3800
RS 56/40-4E	450	RS 63/50-6D	5015
RS 90/63-6D	452	RS 63/45-4E	5200
RS 30/22-2E	490	RS 63/45-4D	5261
RS 63/45-4D	510	RS 90/56-6D	7018
RS 63/45-4E	510	RS 63/50-4D	7625
RS 63/50-4D	660	RS 90/63-6D	9600
RS 90/56-4D	760	RS 90/56-4D	10600

Graph 3

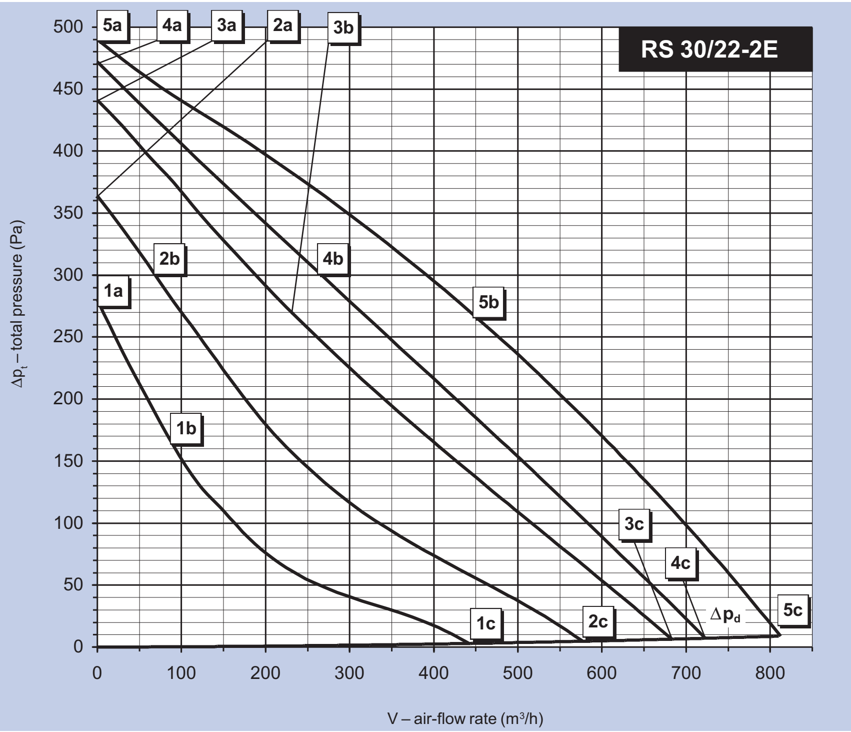




RS 30/18-2E			
Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	60
Max. current (5c)	I_{max}	[A]	0,27
Mean speed	n	[min^{-1}]	2390
Capacitor	C	[μF]	1,5
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	416
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	273
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	5,9
Five-stage controller		typ	PE 2,5
Protecting relay		typ	-

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	67	70
Sound power level L_{WAokt} [dB (A)]		
125 Hz	42	44
250 Hz	56	56
500 Hz	64	66
1000 Hz	59	65
2000 Hz	58	64
4000 Hz	53	59
8000 Hz	46	47

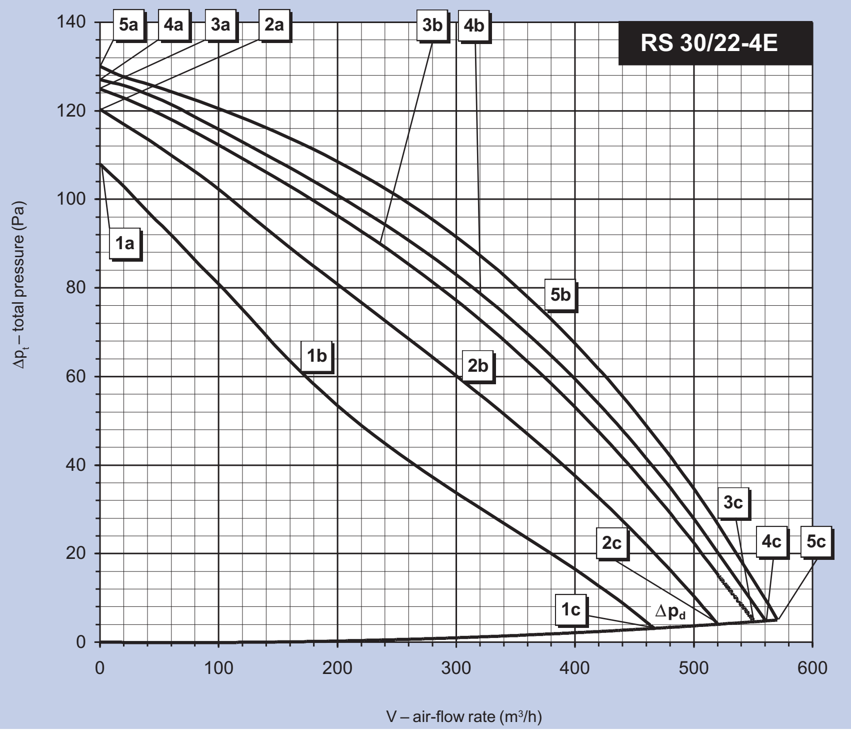
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,26	0,27	0,27	0,20	0,22	0,22	0,20	0,21	0,22	0,19	0,20	0,20	0,17	0,17	0,18
Electric input	P	[W]	56	60	60	36	40	40	32	34	35	25	26	26	18	18	19
Speed	n	[min^{-1}]	2523	2390	2450	2398	2208	2207	2218	2081	2021	1820	1643	1572	1282	1282	1146
Air flow rate	V	[m^3/h]	0	230	416	0	161	366	0	131	335	0	100	260	0	58	190
Static pressure	Δp_s	[Pa]	273	151	0	241	150	0	210	140	0	190	86	0	99	55	0
Total pressure	Δp_t	[Pa]	273	152	2	241	150	2	210	140	2	190	86	1	99	55	0



RS 30/22-2E			
Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	118
Max. current (5c)	I_{max}	[A]	0,53
Mean speed	n	[min^{-1}]	2530
Capacitor	C	[μF]	3
Max. working temp.	t_{max}	[°C]	60
Max. air flow rate	V_{max}	[m^3/h]	810
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	490
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	6,4
Five-stage controller		typ	PE 2,5
Protecting relay		typ	-

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	74	76
Sound power level L_{WAokt} [dB (A)]		
125 Hz	49	50
250 Hz	65	65
500 Hz	71	71
1000 Hz	67	71
2000 Hz	65	70
4000 Hz	62	63
8000 Hz	56	52

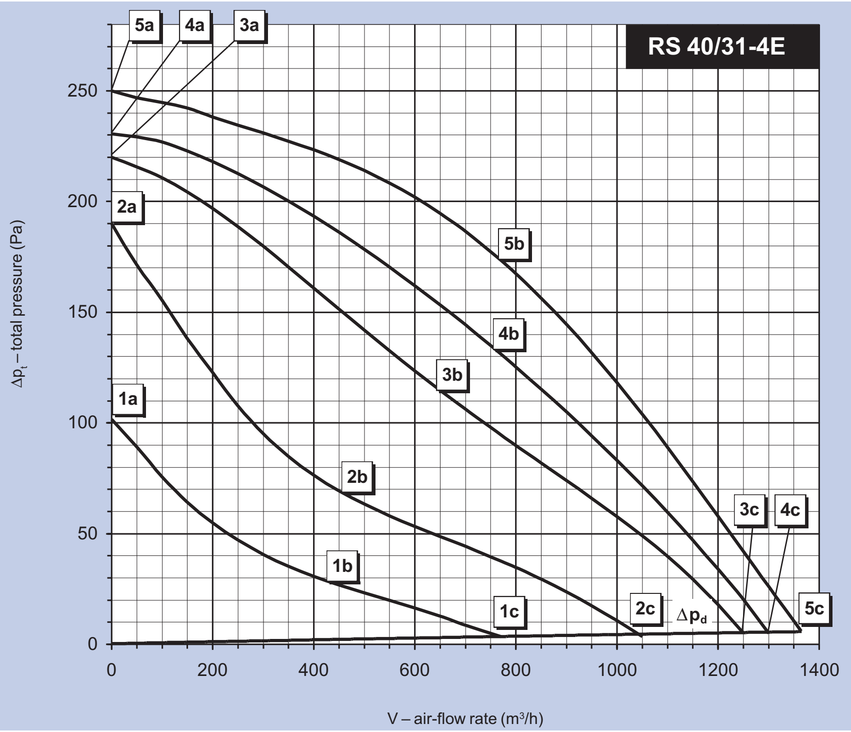
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,43	0,53	0,49	0,47	0,48	0,45	0,36	0,48	0,45	0,38	0,38	0,46	0,39	0,39	0,41
Electric input	P	[W]	95	118	105	84	85	80	58	76	72	49	49	59	40	40	43
Speed	n	[min^{-1}]	2710	2530	2630	2392	2362	2442	2524	2214	2290	2253	2253	1925	1716	1716	1482
Air flow rate	V	[m^3/h]	0	445	810	0	267	720	0	235	680	0	77	575	0	88	445
Static pressure	Δp_s	[Pa]	490	263	0	472	301	0	441	269	0	364	294	0	280	165	0
Total pressure	Δp_t	[Pa]	490	266	9	472	302	7	441	270	6	364	294	5	280	165	3



			RS 30/22-4E
Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	43
Max. current (5c)	I_{max}	[A]	0,20
Mean speed	n	[min^{-1}]	1400
Capacitor	C	[µF]	1,5
Max. working temp.	t_{max}	[°C]	60
Max. air flow rate	V_{max}	[m^3/h]	570
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	130
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	6,5
Five-stage controller		typ	PE 2,5
Protecting relay		typ	-

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	61	59
Sound power level L_{WAokt} [dB (A)]		
125 Hz	40	40
250 Hz	52	53
500 Hz	55	53
1000 Hz	56	52
2000 Hz	55	48
4000 Hz	50	45
8000 Hz	42	43

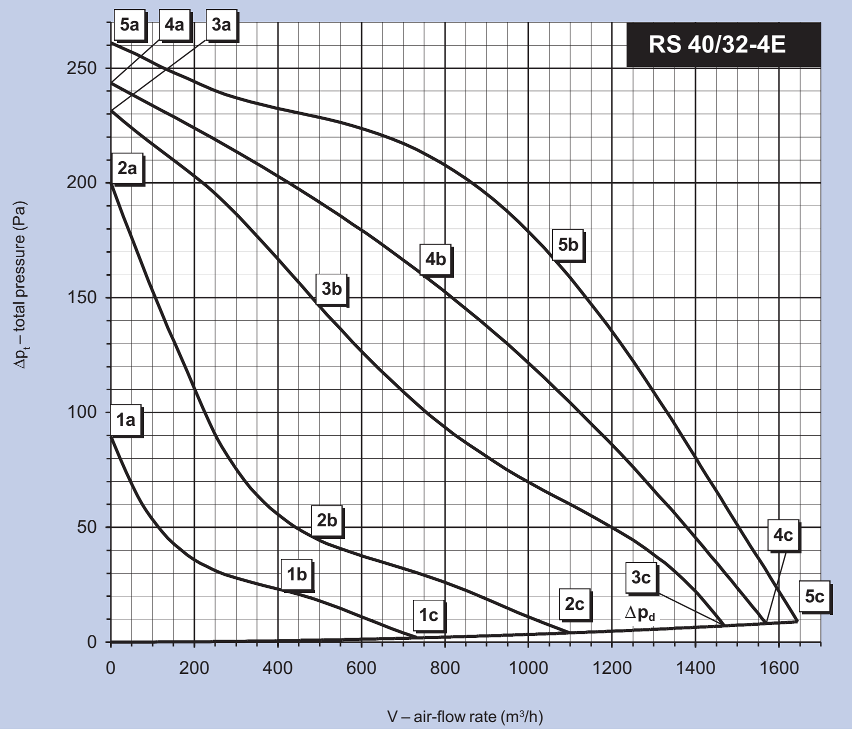
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,19	0,20	0,20	0,14	0,17	0,15	0,13	0,16	0,14	0,12	0,16	0,14	0,12	0,15	0,14
Electric input	P	[W]	39	43	40	24	29	26	20	26	22	16	21	18	13	16	14
Speed	n	[min^{-1}]	1431	1396	1418	1405	1346	1384	1389	1305	1357	1333	1197	1286	1225	1075	1149
Air flow rate	V	[m^3/h]	0	379	570	0	322	560	0	338	550	0	307	520	0	165	460
Static pressure	Δp_s	[Pa]	130	72	0	127	77	0	125	73	0	120	57	0	108	62	0
Total pressure	Δp_t	[Pa]	130	74	6	127	78	5	125	74	5	120	58	4	108	62	3



			RS 40/31-4E
Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	126
Max. current (5c)	I_{max}	[A]	0,61
Mean speed	n	[min^{-1}]	1310
Capacitor	C	[µF]	3
Max. working temp.	t_{max}	[°C]	50
Max. air flow rate	V_{max}	[m^3/h]	1365
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	250
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	15
Five-stage controller		typ	TRN 2E
Protecting relay		typ	STE

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	65	69
Sound power level L_{WAokt} [dB (A)]		
125 Hz	47	45
250 Hz	51	57
500 Hz	58	60
1000 Hz	57	64
2000 Hz	61	63
4000 Hz	57	60
8000 Hz	45	47

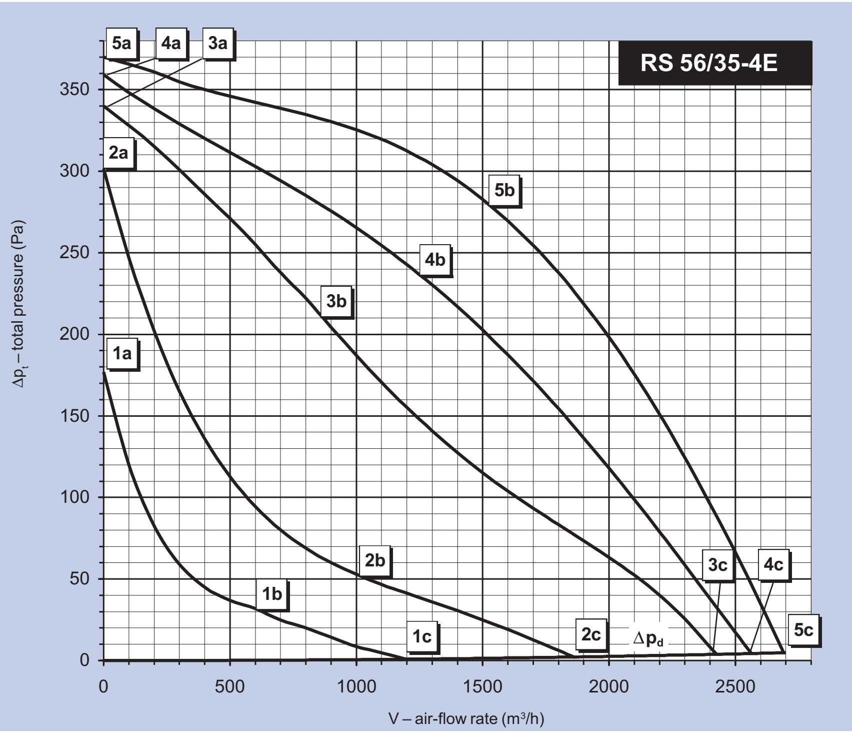
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,57	0,61	0,57	0,43	0,53	0,45	0,42	0,53	0,44	0,42	0,48	0,43	0,39	0,40	0,39
Electric input	P	[W]	109	126	110	74	91	77	65	79	68	52	55	52	36	36	36
Speed	n	[min^{-1}]	1370	1305	902	1319	1189	1060	1265	1072	1234	1085	810	1045	739	602	768
Air flow rate	V	[m^3/h]	0	777	1365	0	768	1300	0	646	1250	0	457	1045	0	430	770
Static pressure	Δp_s	[Pa]	250	171	0	231	129	0	220	113	0	190	68	0	102	28	0
Total pressure	Δp_t	[Pa]	250	173	6	231	131	5	220	115	6	190	69	3	102	28	2



RS 40/32-4E			
Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	163
Max. current (5c)	I_{max}	[A]	0,82
Mean speed	n	[min^{-1}]	1320
Capacitor	C	[μF]	4
Max. working temp.	t_{max}	[°C]	70
Max. air flow rate	V_{max}	[m^3/h]	1645
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	261
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	17,4
Five-stage controller		typ	TRN 2E
Protecting relay		typ	STE

	Inlet	Surrounding
Point	**5b**	**5b**
Total sound power level L_{WA} [dB (A)]		
L_{WA}	64	67
Sound power level L_{WAokt} [dB (A)]		
125 Hz	51	50
250 Hz	57	56
500 Hz	58	61
1000 Hz	55	62
2000 Hz	56	60
4000 Hz	56	59
8000 Hz	49	52

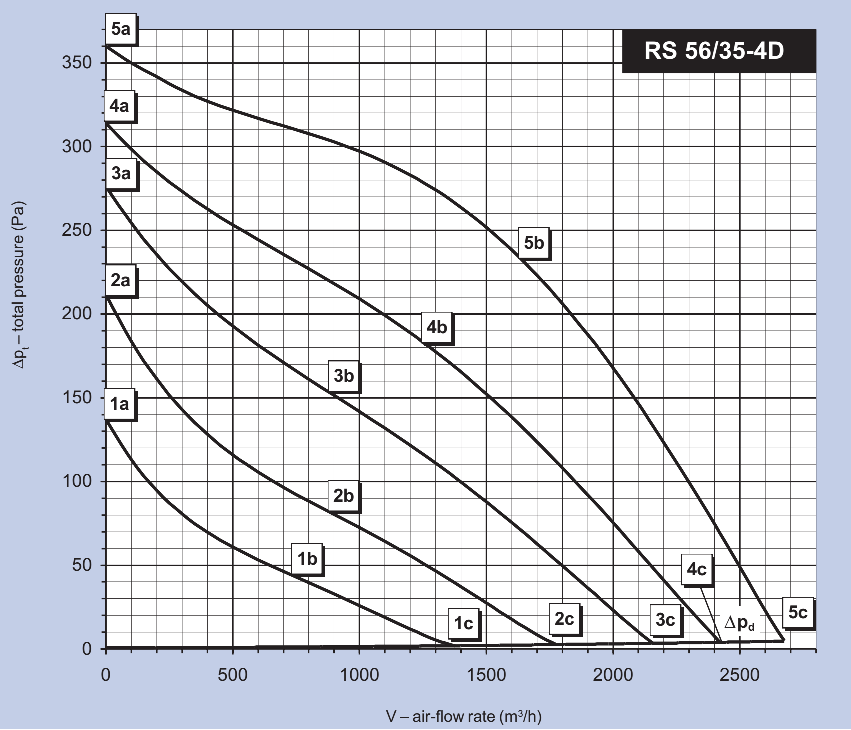
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,71	0,82	0,73	0,57	0,78	0,63	0,57	0,77	0,65	0,64	0,76	0,71	0,61	0,63	0,62
Electric input	P	[W]	130	163	136	92	128	104	84	110	95	75	83	80	54	55	54
Speed	n	[min^{-1}]	1392	1319	1372	1338	1188	1303	1290	1103	1233	1082	662	915	683	483	614
Air flow rate	V	[m^3/h]	0	1066	1645	0	743	1565	0	491	1470	0	485	1100	0	415	740
Static pressure	Δp_s	[Pa]	261	164	0	244	160	0	232	147	0	200	46	0	90	21	0
Total pressure	Δp_t	[Pa]	261	167	9	244	161	8	232	148	7	200	47	4	90	22	2



RS 56/35-4E			
Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	306
Max. current (5c)	I_{max}	[A]	1,41
Mean speed	n	[min^{-1}]	1350
Capacitor	C	[μF]	6
Max. working temp.	t_{max}	[°C]	65
Max. air flow rate	V_{max}	[m^3/h]	2698
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	370
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	29,6
Five-stage controller		typ	TRN 2E
Protecting relay		typ	STE

	Inlet	Surrounding
Point	**5b**	**5b**
Total sound power level L_{WA} [dB (A)]		
L_{WA}	74	77
Sound power level L_{WAokt} [dB (A)]		
125 Hz	55	59
250 Hz	63	63
500 Hz	64	68
1000 Hz	63	70
2000 Hz	70	73
4000 Hz	69	71
8000 Hz	57	60

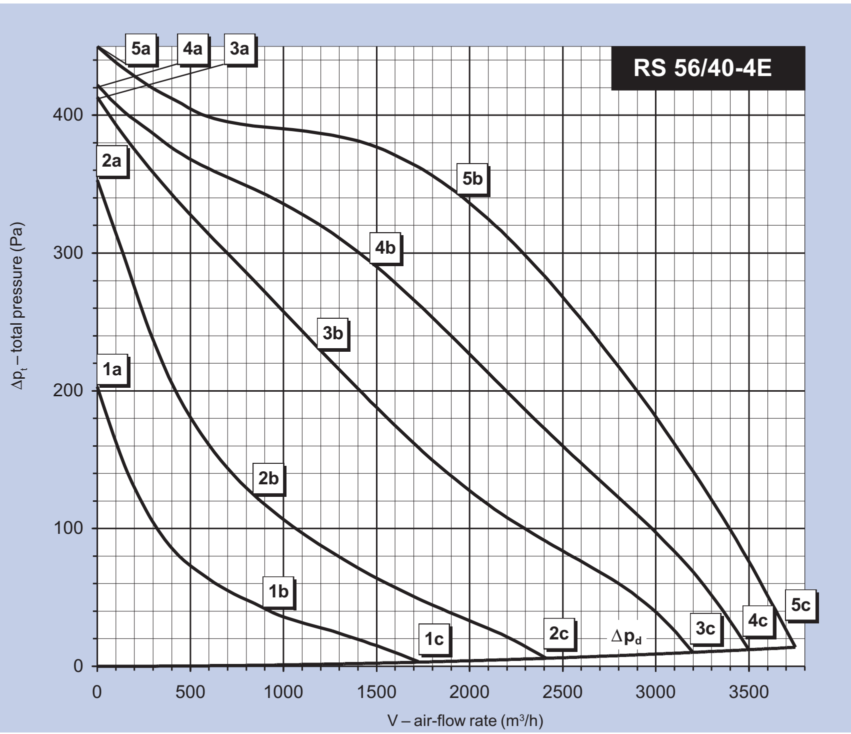
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,95	1,41	1,11	0,89	1,52	1,18	0,97	1,49	1,28	1,08	1,60	1,44	1,19	1,31	1,29
Electric input	P	[W]	196	306	237	159	260	209	156	222	195	136	181	168	113	117	115
Speed	n	[min^{-1}]	1419	1345	1392	1380	1224	1321	1337	1150	1248	1214	696	948	886	483	615
Air flow rate	V	[m^3/h]	0	1547	2698	0	1243	2550	0	867	2425	0	1018	1840	0	614	1200
Static pressure	Δp_s	[Pa]	370	277	0	359	238	0	340	214	0	302	53	0	177	31	0
Total pressure	Δp_t	[Pa]	370	279	5	359	239	4	340	214	4	302	53	2	177	31	1



RS 56/35-4D			
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	279
Max. current (5c)	I_{max}	[A]	0,49
Mean speed	n	[min^{-1}]	1280
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	60
Max. air flow rate	V_{max}	[m^3/h]	2675
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	360
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	30,4
Five-stage controller	typ		TRN 2D
Protecting relay	typ		STD

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	76	78
Sound power level L_{WAokt} [dB (A)]		
125 Hz	52	55
250 Hz	64	61
500 Hz	65	66
1000 Hz	64	69
2000 Hz	73	75
4000 Hz	71	73
8000 Hz	57	61

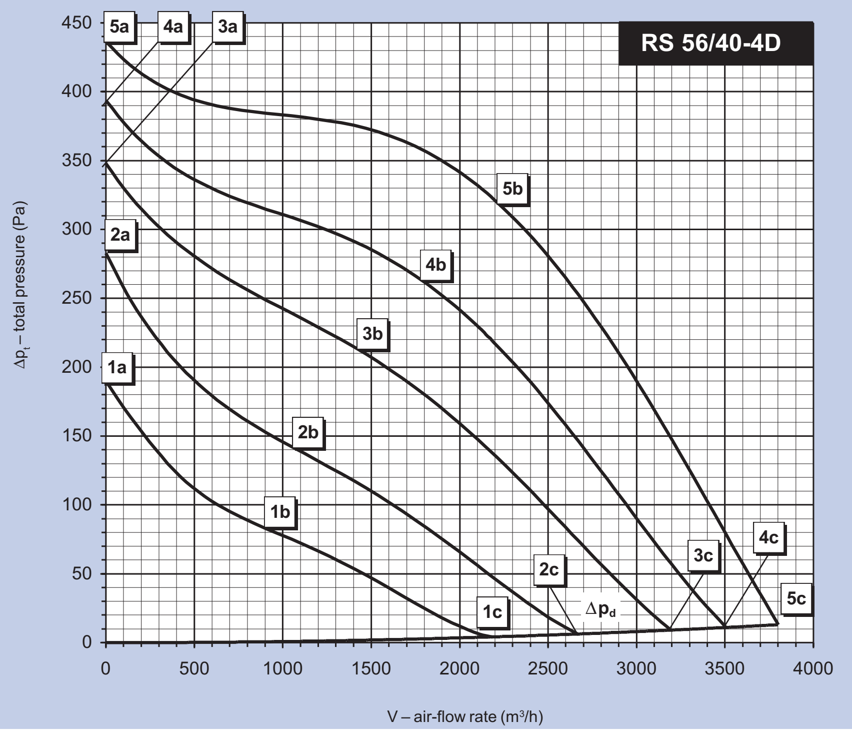
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,37	0,49	0,41	0,33	0,50	0,40	0,34	0,48	0,42	0,35	0,46	0,41	0,34	0,39	0,37
Electric input	P	[W]	160	279	206	132	213	170	120	170	149	99	126	114	73	84	79
Speed	n	[min^{-1}]	1385	1282	1348	1285	1093	1207	1188	978	1081	1022	741	889	816	572	698
Air flow rate	V	[m^3/h]	0	1647	2675	0	1252	2401	0	891	2140	0	880	1765	0	716	1350
Static pressure	Δp_s	[Pa]	360	234	0	314	183	0	276	154	0	212	81	0	137	47	0
Total pressure	Δp_t	[Pa]	360	236	5	314	184	4	276	154	3	212	81	2	137	47	1



RS 56/40-4E			
Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	471
Max. current (5c)	I_{max}	[A]	2,12
Mean speed	n	[min^{-1}]	1330
Capacitor	C	[μF]	12
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	3750
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	450
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	29,8
Five-stage controller	typ		TRN 4E
Protecting relay	typ		STE

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	75	76
Sound power level L_{WAokt} [dB (A)]		
125 Hz	58	62
250 Hz	66	66
500 Hz	68	69
1000 Hz	65	70
2000 Hz	66	69
4000 Hz	70	70
8000 Hz	60	61

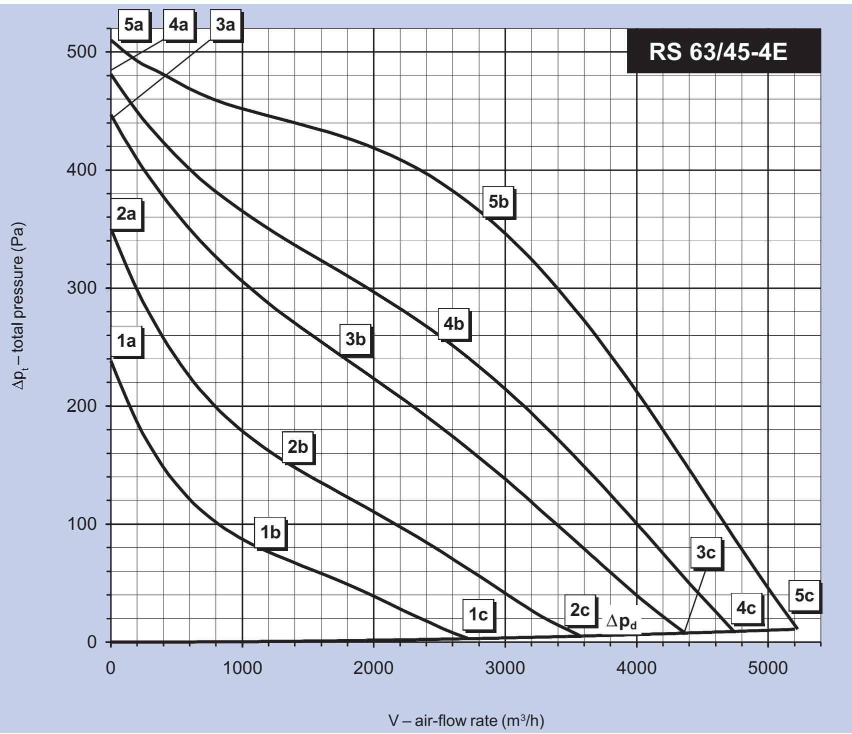
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	1,43	2,12	1,78	1,39	2,23	1,90	1,43	2,24	2,02	1,56	2,09	2,02	1,60	1,77	1,73
Electric input	P	[W]	318	471	397	254	382	331	229	329	305	193	238	233	149	156	154
Speed	n	[min^{-1}]	1412	1329	1371	1374	1203	1284	1338	1074	1182	1200	788	889	897	527	633
Air flow rate	V	[m^3/h]	0	1944	3750	0	1494	3500	0	1180	3200	0	844	2400	0	895	1725
Static pressure	Δp_s	[Pa]	450	339	0	422	295	0	413	238	0	353	127	0	203	45	0
Total pressure	Δp_t	[Pa]	450	343	14	422	297	12	413	239	10	353	128	6	203	46	3



			RS 56/40-4D
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	438
Max. current (5c)	I_{max}	[A]	0,82
Mean speed	n	[min^{-1}]	1330
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	55
Max. air flow rate	V_{max}	[m^3/h]	3800
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	436
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	30,8
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	75	75
Sound power level L_{WAokt} [dB (A)]		
125 Hz	56	56
250 Hz	65	64
500 Hz	67	68
1000 Hz	64	69
2000 Hz	64	68
4000 Hz	71	70
8000 Hz	60	61

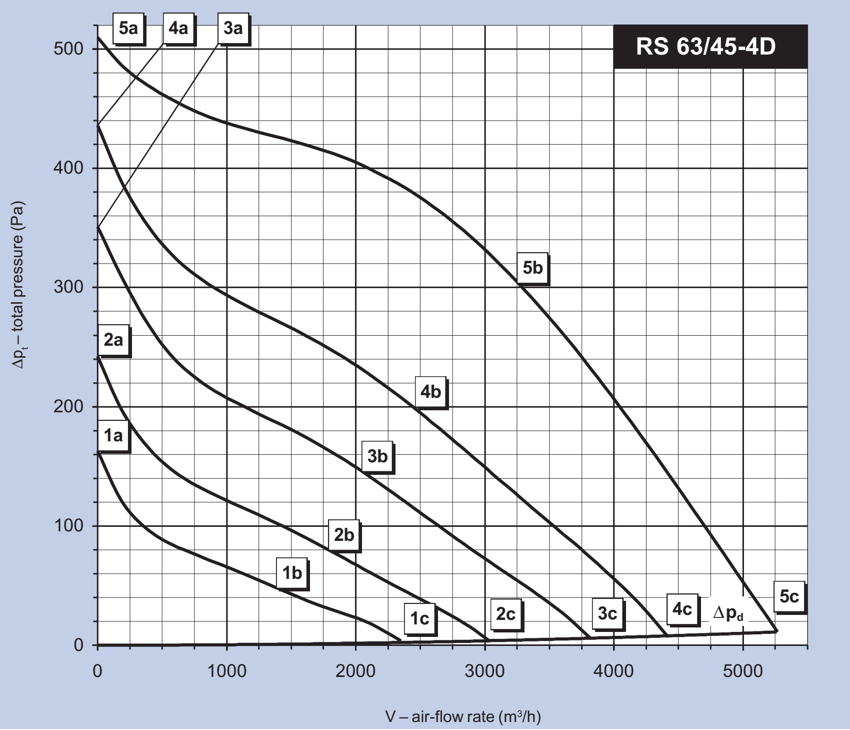
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,63	0,82	0,71	0,52	0,84	0,67	0,55	0,85	0,71	0,60	0,82	0,74	0,60	0,73	0,68
Electric input	P	[W]	245	438	331	205	358	278	191	298	250	165	222	201	128	152	142
Speed	n	[min^{-1}]	1413	1334	1381	1338	1180	1268	1261	1049	1157	1112	850	966	929	654	776
Air flow rate	V	[m^3/h]	0	2226	3800	0	1778	3490	0	1423	3170	0	1089	2630	0	926	2115
Static pressure	Δp_s	[Pa]	436	310	0	394	263	0	348	212	0	283	140	0	190	83	0
Total pressure	Δp_t	[Pa]	436	314	13	394	266	11	348	213	6	283	141	6	190	83	4



			RS 63/45-4E
Power supply	Y		230V 50Hz
Max. electric input	P_{max}	[W]	720
Max. current (5c)	I_{max}	[A]	3,28
Mean speed	n	[min^{-1}]	1250
Capacitor	C	[µF]	12
Max. working temp.	t_{max}	[°C]	60
Max. air flow rate	V_{max}	[m^3/h]	5200
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	510
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	40,5
Five-stage controller		typ	TRN 4E
Protecting relay		typ	STE

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	75	78
Sound power level L_{WAokt} [dB (A)]		
125 Hz	61	61
250 Hz	69	70
500 Hz	70	72
1000 Hz	67	73
2000 Hz	65	70
4000 Hz	60	66
8000 Hz	55	62

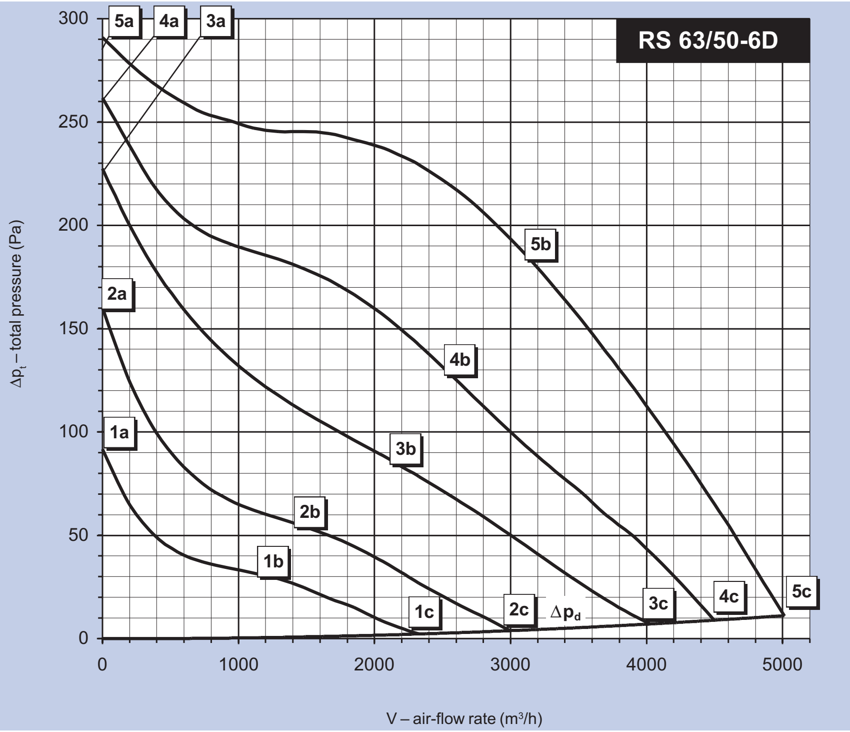
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	2,12	3,28	2,75	2,09	3,43	2,87	2,16	3,25	2,92	2,30	3,05	2,89	2,30	2,69	2,61
Electric input	P	[W]	448	720	597	371	591	506	340	493	450	291	371	354	230	261	256
Speed	n	[min^{-1}]	1378	1254	1317	1304	1069	1193	1250	993	1101	1109	801	897	907	588	688
Air flow rate	V	[m^3/h]	0	2840	5200	0	2556	4700	0	1786	4300	0	1283	3500	0	1089	2700
Static pressure	Δp_s	[Pa]	510	357	0	481	248	0	447	248	0	351	158	0	238	79	0
Total pressure	Δp_t	[Pa]	510	360	11	481	251	9	447	249	7	351	158	5	238	79	3



RS 63/45-4D			
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	696
Max. current (5c)	I_{max}	[A]	1,30
Mean speed	n	[min^{-1}]	1220
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	5261
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	510
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	40
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Surrounding
Point	**5b**	**5b**
Total sound power level L_{WA} [dB (A)]		
L_{WA}	74	76
Sound power level L_{WAokt} [dB (A)]		
125 Hz	61	65
250 Hz	66	69
500 Hz	70	70
1000 Hz	65	71
2000 Hz	65	69
4000 Hz	60	63
8000 Hz	53	58

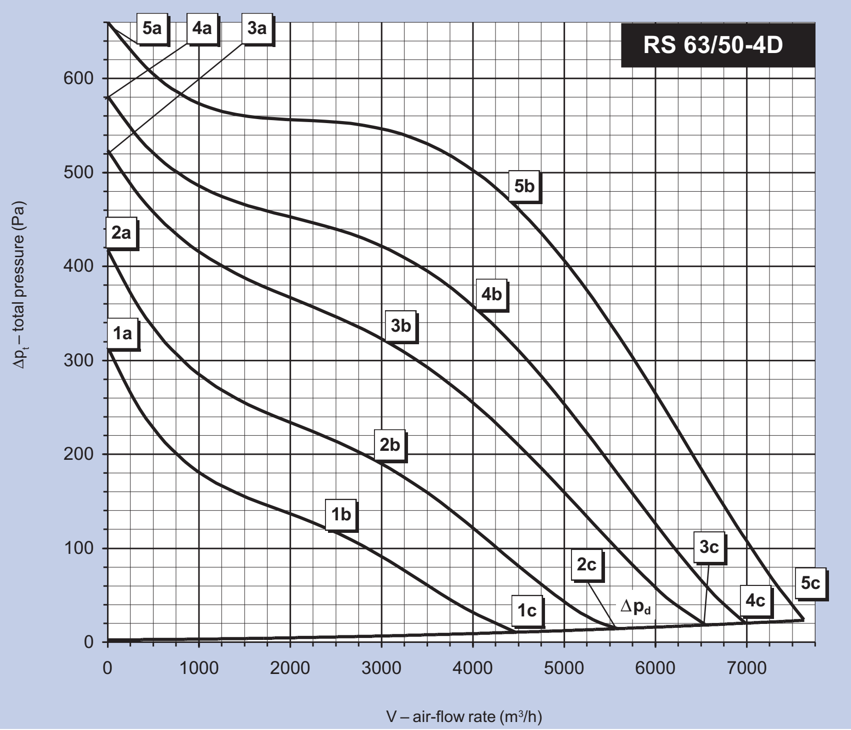
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,88	1,30	1,06	0,86	1,23	1,06	0,85	1,12	1,01	0,84	0,98	0,92	0,75	0,81	0,78
Electric input	P	[W]	415	696	544	339	473	412	277	357	323	199	225	214	136	140	137
Speed	n	[min^{-1}]	1358	1221	1305	1211	966	1097	1087	817	951	895	645	761	718	501	591
Air flow rate	V	[m^3/h]	0	3240	5261	0	2439	4420	0	2055	3825	0	1776	3040	0	1356	2350
Static pressure	Δp_s	[Pa]	510	301	0	436	195	0	351	142	0	242	78	0	163	47	0
Total pressure	Δp_t	[Pa]	510	305	11	436	197	8	351	143	6	242	80	4	163	48	2



RS 63/50-6D			
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	718
Max. current (5c)	I_{max}	[A]	0,91
Mean speed	n	[min^{-1}]	870
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	45
Max. air flow rate	V_{max}	[m^3/h]	5015
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	290
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	40,7
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Surrounding
Point	**5b**	**5b**
Total sound power level L_{WA} [dB (A)]		
L_{WA}	70	70
Sound power level L_{WAokt} [dB (A)]		
125 Hz	51	53
250 Hz	62	64
500 Hz	62	63
1000 Hz	62	66
2000 Hz	64	62
4000 Hz	63	59
8000 Hz	49	49

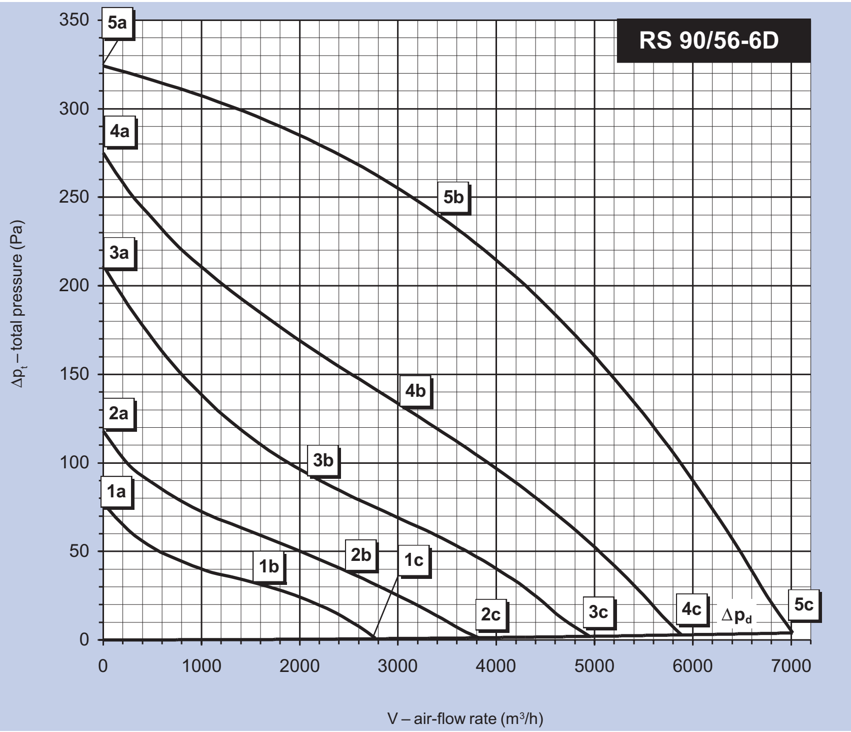
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,69	0,91	0,75	0,59	0,92	0,72	0,61	0,88	0,73	0,63	0,77	0,70	0,57	0,62	0,59
Electric input	P	[W]	406	718	509	337	567	429	303	433	367	241	281	253	162	170	165
Speed	n	[min^{-1}]	938	872	918	882	724	827	815	590	729	677	455	558	515	345	432
Air flow rate	V	[m^3/h]	0	3110	5015	0	2456	4499	0	2108	3960	0	1437	2999	0	1165	2325
Static pressure	Δp_s	[Pa]	290	180	0	262	128	0	227	80	0	160	54	0	92	29	0
Total pressure	Δp_t	[Pa]	290	184	11	262	130	9	227	82	7	160	54	4	92	30	2



			RS 63/50-4D
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	1202
Max. current (5c)	I_{max}	[A]	2,11
Mean speed	n	[min^{-1}]	1320
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	45
Max. air flow rate	V_{max}	[m^3/h]	7625
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	660
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	48,4
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	80	82
Sound power level L_{WAokt} [dB (A)]		
125 Hz	62	70
250 Hz	73	74
500 Hz	76	75
1000 Hz	72	76
2000 Hz	72	76
4000 Hz	71	70
8000 Hz	65	62

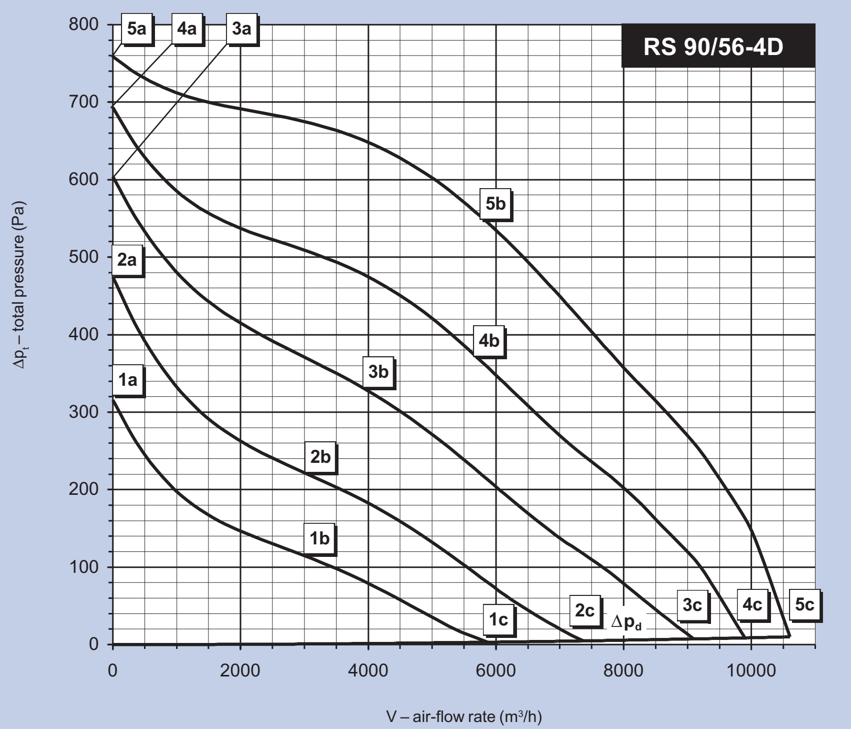
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,38	2,11	1,77	1,35	2,30	1,79	1,45	2,30	1,90	1,64	2,28	1,95	1,58	2,01	1,83
Electric input	P	[W]	647	1202	951	556	1015	761	522	831	685	462	619	530	339	411	382
Speed	n	[min^{-1}]	1409	1323	1364	1334	1168	1265	1260	1062	1167	1117	855	997	959	685	816
Air flow rate	V	[m^3/h]	0	4312	7625	0	4058	6910	0	3060	6500	0	2941	5455	0	2425	4420
Static pressure	Δp_s	[Pa]	660	465	0	581	340	0	524	317	0	417	181	0	314	117	0
Total pressure	Δp_t	[Pa]	660	473	23	581	347	20	524	321	20	417	184	12	314	120	11



			RS 90/56-6D
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	646
Max. current (5c)	I_{max}	[A]	1,39
Mean speed	n	[min^{-1}]	820
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	7018
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	324
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	70
Five-stage controller		typ	TRN 2D
Protecting relay		typ	STD

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	70	75
Sound power level L_{WAokt} [dB (A)]		
125 Hz	55	59
250 Hz	64	66
500 Hz	63	70
1000 Hz	67	70
2000 Hz	60	67
4000 Hz	56	64
8000 Hz	46	58

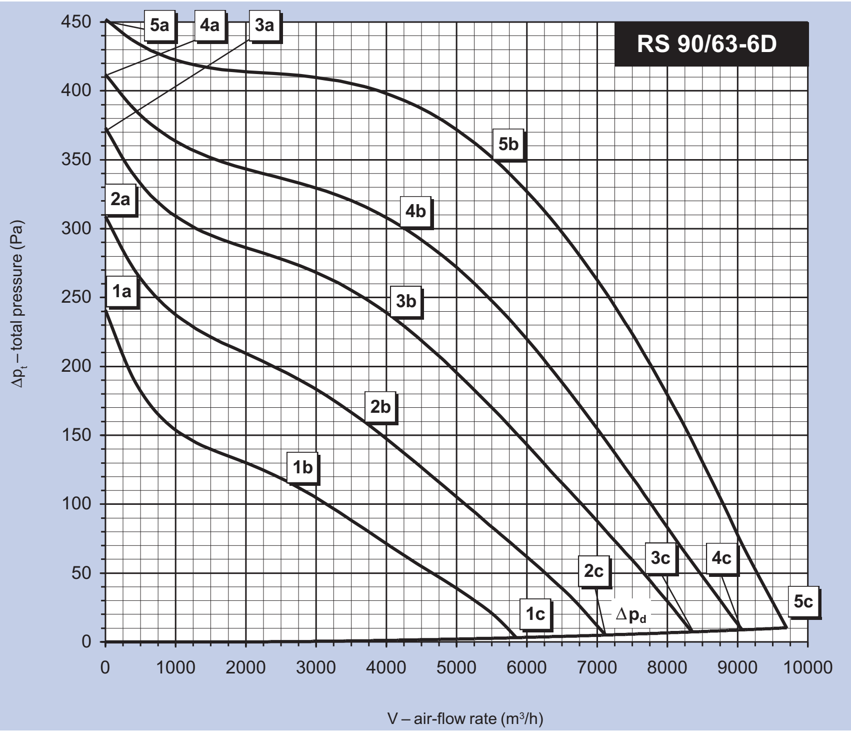
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,02	1,39	1,17	0,93	1,34	1,15	0,92	1,18	1,09	0,90	0,97	0,92	0,75	0,77	0,76
Electric input	P	[W]	383	646	503	309	452	391	260	317	298	188	198	190	121	122	120
Speed	n	[min^{-1}]	907	822	871	816	635	735	726	519	614	510	411	477	385	313	351
Air flow rate	V	[m^3/h]	0	3460	7018	0	3022	5881	0	2068	4954	0	2513	3800	0	1522	2768
Static pressure	Δp_s	[Pa]	324	239	0	275	132	0	212	95	0	118	38	0	77	31	0
Total pressure	Δp_t	[Pa]	324	240	4	275	133	3	212	96	2	118	38	1	77	32	1



RS 90/56-4D			
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	2062
Max. current (5c)	I_{max}	[A]	4,04
Mean speed	n	[min^{-1}]	1300
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	10600
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	760
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	77
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	83	87
Sound power level L_{WAokt} [dB (A)]		
125 Hz	70	72
250 Hz	76	78
500 Hz	76	80
1000 Hz	77	81
2000 Hz	75	81
4000 Hz	71	78
8000 Hz	64	69

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,84	4,04	3,40	2,52	4,06	3,20	2,57	3,86	3,20	2,62	3,46	3,13	2,51	2,97	2,77
Electric input	P	[W]	1201	2062	1700	949	1596	1245	824	1219	980	664	846	769	487	552	520
Speed	n	[min^{-1}]	1399	1303	1345	1301	1103	1212	1211	960	1138	1059	786	903	863	605	714
Air flow rate	V	[m^3/h]	0	5744	10600	0	5528	9900	0	3962	9100	0	3002	7365	0	3003	5780
Static pressure	Δp_s	[Pa]	760	548	0	690	375	0	602	329	0	472	219	0	319	118	0
Total pressure	Δp_t	[Pa]	760	550	10	690	377	9	602	330	7	472	220	5	319	118	3



RS 90/63-6D			
Power supply	Y		3 x 400V 50Hz
Max. electric input	P_{max}	[W]	1189
Max. current (5c)	I_{max}	[A]	2,29
Mean speed	n	[min^{-1}]	880
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	70
Max. air flow rate	V_{max}	[m^3/h]	9600
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	452
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	78
Five-stage controller		typ	TRN 4D
Protecting relay		typ	STD

	Inlet	Surrounding
Point	5b	5b
Total sound power level L_{WA} [dB (A)]		
L_{WA}	75	82
Sound power level L_{WAokt} [dB (A)]		
125 Hz	61	65
250 Hz	69	72
500 Hz	71	75
1000 Hz	68	76
2000 Hz	66	77
4000 Hz	61	73
8000 Hz	55	62

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,68	2,29	1,98	1,46	2,20	1,75	1,46	2,23	1,80	1,50	2,15	1,90	1,52	1,91	1,77
Electric input	P	[W]	650	1189	1188	541	899	760	476	766	620	403	573	510	326	396	367
Speed	n	[min^{-1}]	938	880	893	885	790	750	837	706	770	758	592	663	645	487	549
Air flow rate	V	[m^3/h]	0	5553	9600	0	4241	9063	0	4067	8338	0	3708	7120	0	2644	5850
Static pressure	Δp_s	[Pa]	452	345	0	412	304	0	372	235	0	310	155	0	241	115	0
Total pressure	Δp_t	[Pa]	452	348	10	412	306	9	372	237	8	310	156	5	241	116	3

Installation, Maintenance and Service

Installation

RS fans (including other Vento elements and equipment) are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the fan. The installation and commissioning may be performed only by an authorized company licensed in accordance with generally valid regulations.

- The fan must be checked carefully before its installation, especially if it has been stored for a longer period. In particular, it is necessary to check all parts and the cable insulation for damage, and whether the rotary parts can rotate freely.
- The RS fans can work only in the horizontal position (i.e. the impeller rotation axis is in the vertical position). The same applies also for their transport.
- It is recommended to install the RS fan on a roof adaptor. A self-acting pressure damper connected to the fan intake prevents air backdraught.
- RS fans and roof adaptors manufactured in the standard version need to be finished in a protective coating matching the building's colour (according to the architect's choice) after installation.

Wiring

The wiring can be performed only by a qualified worker licensed in accordance with national regulations.

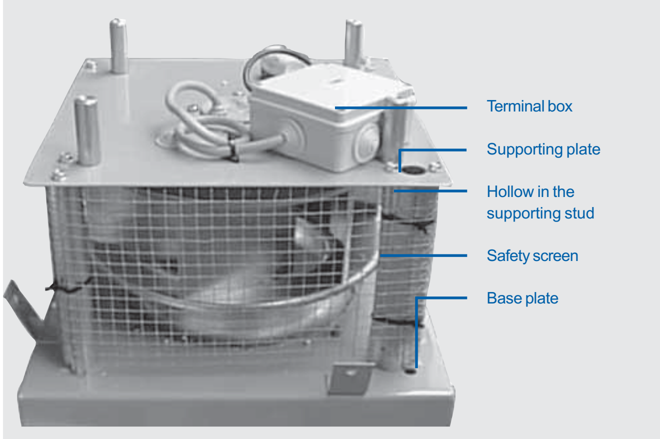
- The fans are equipped with an all-plastic terminal box fixed by screws to the fan supporting plate. The terminal box is equipped with WAGO terminals.
- The wiring connection to the terminals can be performed following the marking on the motor cables in the terminal box, the description of terminals or the label on the terminal box lid.
- The following cables are recommended to connect fan motors:

HO5VVH2 - F 2Ax0,75 - thermo-contact circuit

CYKY 3Cx1,5 - single-phase motor power supply

CYKY 4Bx1,5Y - three-phase motor power supply

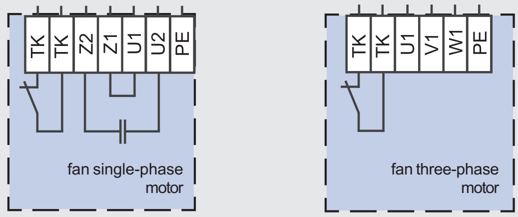
Figure 4 - Fan without casing



- The wiring cables are led from the terminal box through one of the hollow supporting studs as far as to below the fan base plate, and then through the roof adaptor into the ventilated space (see figure # 4).

The wiring diagrams with front-end elements (protective relays, controllers, control units) are included in the installation manual, respectively in the AeroCAD project of their elements (see figure # 5).

Figure 5 - Wiring diagram



TK
- Terminals of the motor thermo-contacts
U1, U2
- Single-phase motor power supply terminals 1f - 230V/50Hz
PE
- protective conductor terminal

TK
- Terminals of the motor thermo-contacts
U1, V1, W1
- Three-phase motor power supply 3f - 400V/50Hz
PE
- protective conductor terminal

- After starting the fan with three-phase motor, the right direction of the impeller rotation must be checked following the direction of the arrow on the fan supporting plate.
- After starting the fan, the current must also be measured, and it must not exceed the maximum allowed current Imax. stated on the rating plate. If the current values exceed the allowed current value, it is necessary to check the duct system regulation, and to check the direction of rotation.
- Safety guards and heads must not be removed if the fan is in operation. The fan must be installed in such a way that neither persons nor objects can come into contact with the impeller.
- The fans are equipped with thermo-contacts situated in the motor winding; they are connected to the TK terminals. If the motor gets too hot, the thermo-contact will disconnect the control circuit of the protective contactor, and after cooling down, the thermo-contact connects it again. The RS 30 line is equipped with a self-acting thermo-contact connected in series to the power supply.
- The wiring must be performed in accordance with the project and the Catalogue (respectively Installation manual). Before putting the controller into operation, a wiring inspection must be performed.
- Before putting the device into operation, all the checks and settings must be performed.

Warning: When performing any maintenance or repairs, the device must always be disconnected from the power supply!

Installation, Maintenance and Service

Operation, Maintenance and Service

The fan does not require special maintenance. A regular check must be performed at least once a year, as part of the summer service inspection.

- During operation, it is necessary to check the proper functioning of the fan, its smooth running, to keep it and its surroundings clean, and to load the fan only within the range given by its output characteristics.
- If a failure occurs, make sure that the power supply is disconnected, and check the fan for foreign objects inside, and free rotation. If the fan does not run after it has been restarted, the following procedures must be followed depending on the protection system used:

• If the fan is protected by STE or STD relays:
Turn the fan on/off using the buttons on the protecting relay.
• If the fan is protected by a TRN controller:
Turn the fan on/off using the switch on the remote controls of the controller.
• If the fan is protected by the control unit:
Press the unblocking button

- If the fan does not start:

Check the wiring, and measure the motor winding impedance. If the motor is damaged, contact your supplier.

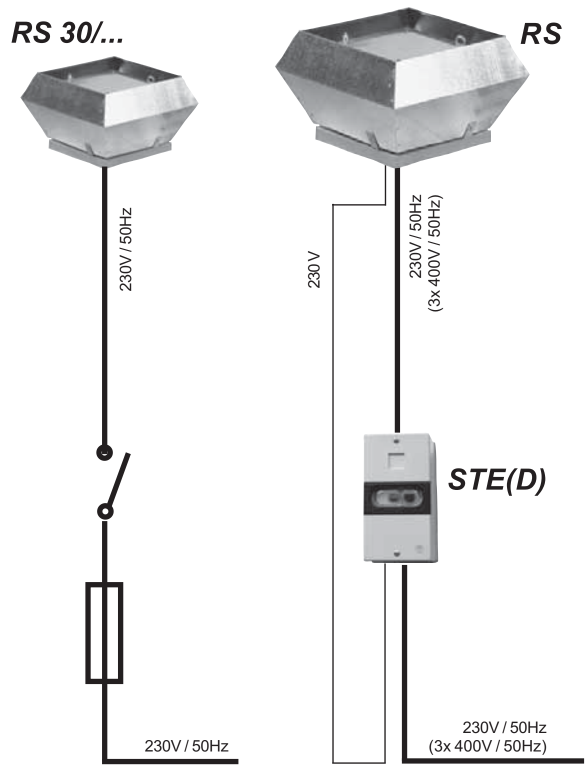
Example A

RS Fans without Output Control

An RS fan connection in a simple venting system without output control is shown in figure # 6.
This connection ensures:
- Full thermal protection of the fan
- Manual switching on/off of the fan from STE(D) relay

After pressing the button marked "I" on the STE(D) protecting relay, the fan starts and the button will stay in the depressed position, signalling the fan's operation. The fan can be stopped by pressing the button marked "0".
If the motor winding is overheated above +130 °C due to overloading, the thermo-contacts in the motor winding will open. Upon the thermo-contacts opening, which are interconnected with the fan terminal box terminals, the STE(D) protecting relay circuit TK, TK will be disconnected. As a reaction to this state, the STE(D) protecting relay will disconnect the power supply to the overheated motor. After cooling down, the motor is not automatically started. The failure must be confirmed (unblocked) by the operator by re-pressing the red "I" button.
The RS 30 fans are protected against overloading by thermo-contacts connected in series with the power supply. If the motor is overheated, the thermo-contacts automatically disconnect the power supply circuit of the motor winding

Figure 6 - Fan connection



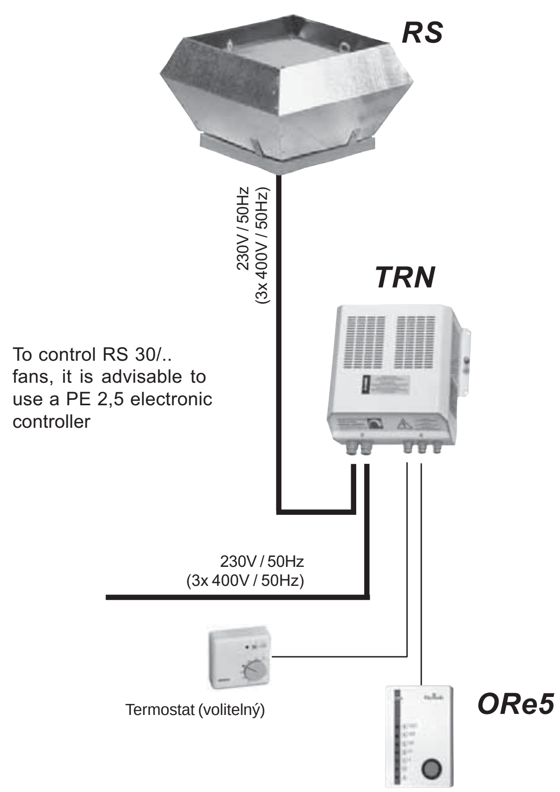
Example B

RS Fans with Output Control and TRN Controller

An assembly of the RS fan with TRN and ORe5 controllers is shown in figure # 7. This connection ensures:
- The possibility of fan output selection within the stage range 1 - 5.
- Thermal protection of the fan
- Fan switching on/off manually, by the ORe5 remote controller.
- Fan switching on/off externally, by any other switch (such as room thermostat, gas detector, pressostat, hygrostat, etc.) on terminals PT1, PT2.

Upon selecting the required output stage using a selector on the ORe5 controller, the fan will start at the corresponding speed. The closed switch connected to PT1, PT2 terminals and the thermo-contact circuit connected to TK, TK terminals are essential for the fan operation. The switch connected to PT1a, PT2 terminals can be used to stop the fan externally. If this possibility is not used, it will be necessary to interconnect terminals PT1 and PT2.
If the fan is overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding. As a reaction to this state, the controller will disconnect the fan power supply, and the red control light on the ORe5 controller will signal the failure. After cooling down, the motor is not automatically started. To re-start the fan, it is necessary first to set the selector to the "STOP" position, and thus confirm failure removal, and then to set the required fan output. In this arrangement, the "STOP" option on the ORe5 controller must not be blocked.

Figure 7 - Fan connection



Example C

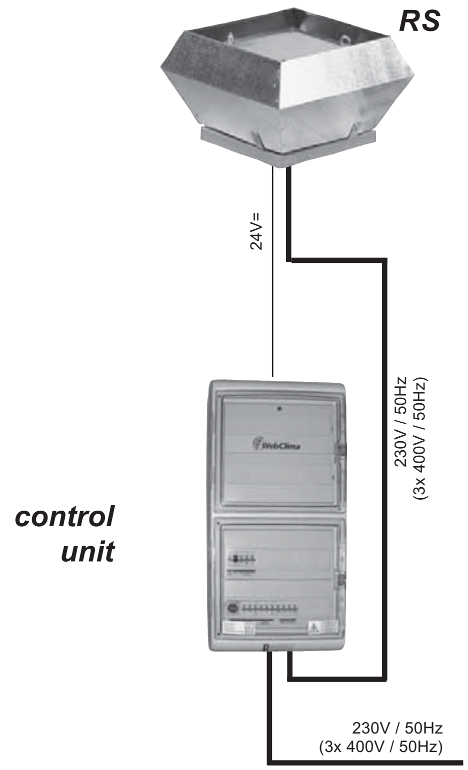
RS Fans without Output Control and with Control Unit

An RS fan without output control connection in more sophisticated venting systems using the control unit is shown in figure # 8.This connection ensures:

- Full thermal protection of the fan
- Manual/automatic switching on/off of the fan

The air-handling system can be started by the control unit, manually or automatically following the program.
The motor protection must always be ensured by the control unit while TK, TK thermo-contact terminals are connected to terminals in the control unit.
The RS 30 fans are protected against overloading by thermo-contacts connected in series with the power supply. If the motor is overheated, the thermo-contacts automatically disconnect the power supply circuit of the motor winding.

Figure 8 - Fan connection



Example D

RS Fans with TRN Controllers and Control Unit

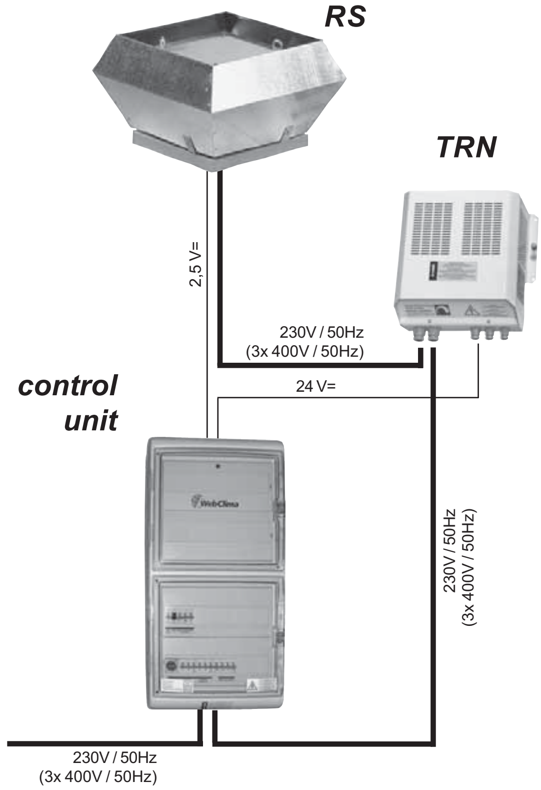
An assembly of the RS fan with TRN controller and control unit is shown in figure # 9. The internal controller is installed in the control unit during production.
This connection ensures:

- Manual selection of the fan output within the stage range 1-5.
- Thermal protection of the fan (by connecting the TK thermo-contact terminals to terminals in the control unit).
- Manual or programmable switching on/off of the entire device from the control unit.

In this connection, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller.

The air-handling system is started by the control unit. Internal control is built into the control unit to control the controller. The internal controller is provided only with positions 1 - 5 to set the required fan output. All protection and safety functions of the fans as well as the entire system are ensured by the control unit.

Figure 9 - Fan connection



Example E

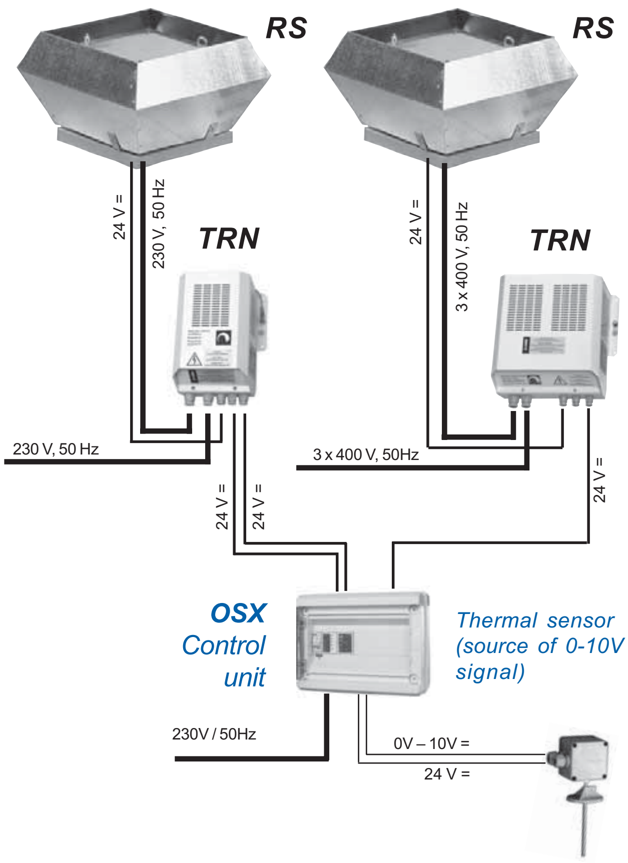
RS Fan with Automatic Output Control, TRN Controller and OSX control unit

An assembly of RS fans with TRN controllers and a common OSX unit is shown in figure # 10.
The fans are controlled at the same output stage.
This connection ensures:

- Automatic switching on/off of the fan at the selected value of input control voltage.
- Manual switching on/off of the fan from the OSX unit.
- Fan switching on/off, by the "external switching" function.
- Automatic selection of the fan output stage ranging from 1 to 5 depending on the physical quantity which is read by the sensor equipped with a unified analogue output (signal source of 0-10 V).
- Manual start-up of the system at the preset output stage via the "MANUAL" button. The factory default settings of the OSXe controller enable start-up of the assembly at full output using the "MANUAL" button.
- Thermal protection of the fans

The fans in the picture are started, controlled and protected by TRN controllers. The OSX unit evaluates signal coming from a converter (signal source), and automatically switches stages 0-5 of the controller. Thermal or pressure converters, converters for the measurement of relative or absolute humidity, concentration of gases, vapours or explosives in the air, sensors of air quality and many other converters of different physical quantities can be used as sources of the control signal.
For detailed information on the OSX unit, refer to the applicable documentation.

Figure 10 - Fan connection



Accessories

NK and NDH Roof Adaptors

NK (see figure # 11) and NDH (see figure # 12) universal roof adaptors serve to fit RS fans on the roof, and they can also be used to connect a square air duct. The adaptors are terminated in a 150 mm wide base shoe (base plate) to fit and install them on the roof. The adaptors must be firmly anchored to the roof structure. Four M8 threads, spacing E x E, situated on the bottom side of the base enable the square air duct to be connected. The adaptors are made of galvanized steel sheets with waterproof sealing. Inner anti-condensate insulation is made of 20 mm thick, flame retardant polyethylene foam plates which are glued and mechanically secured by pins. Four M8 threads, spacing A x A, situated on the top side of the adaptor enable the RS fan to be connected. Both types of adaptors in their upper part provide enough room for the VS back-flow damper. NDH roof adaptor is equipped with an additional attenuator.
For pressure losses of NDH roof adaptors, refer to page 78. For attenuation capacity in octave bands Dokt and inherent noise $L_{WA\ okt}$ of NDH roof adaptors, refer to page 79. The values are without A-weighting filter corrections.

Figure 11 - Dimensions of NK roof adapter

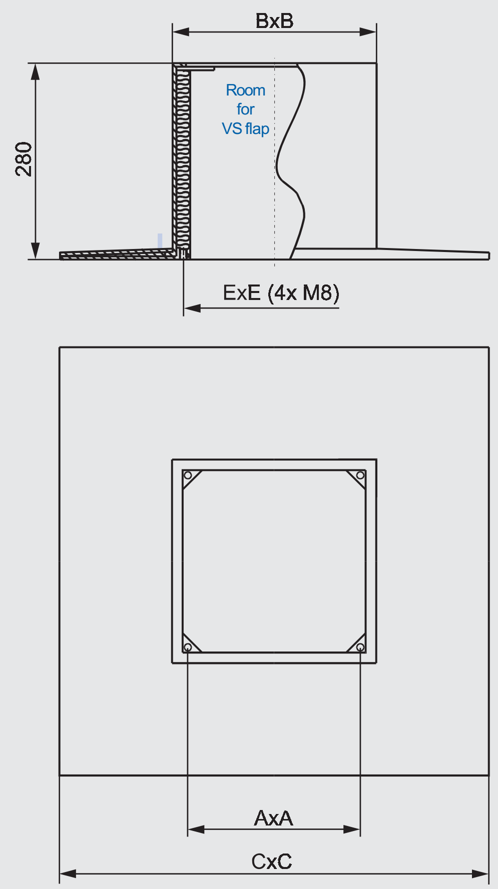


Figure 12 - Dimensions of NDH roof adaptors

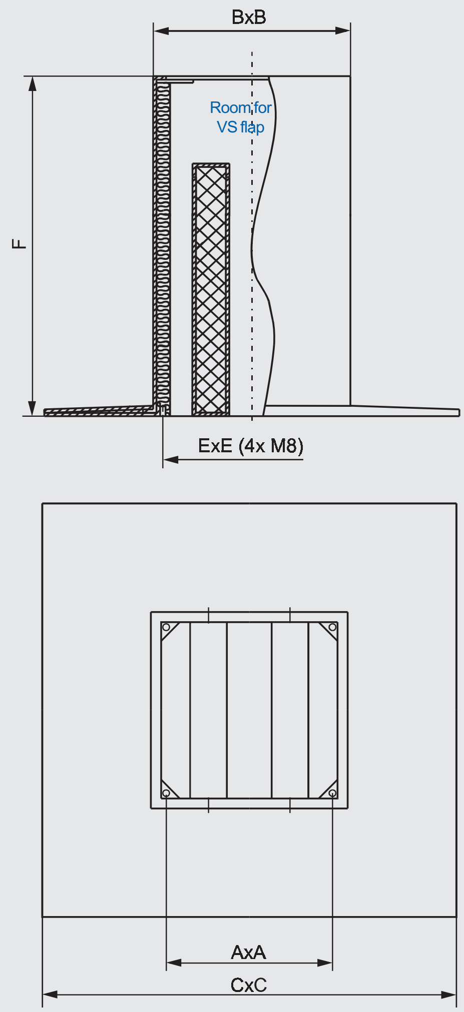


Table 7 - Dimensions of NK roof adaptors

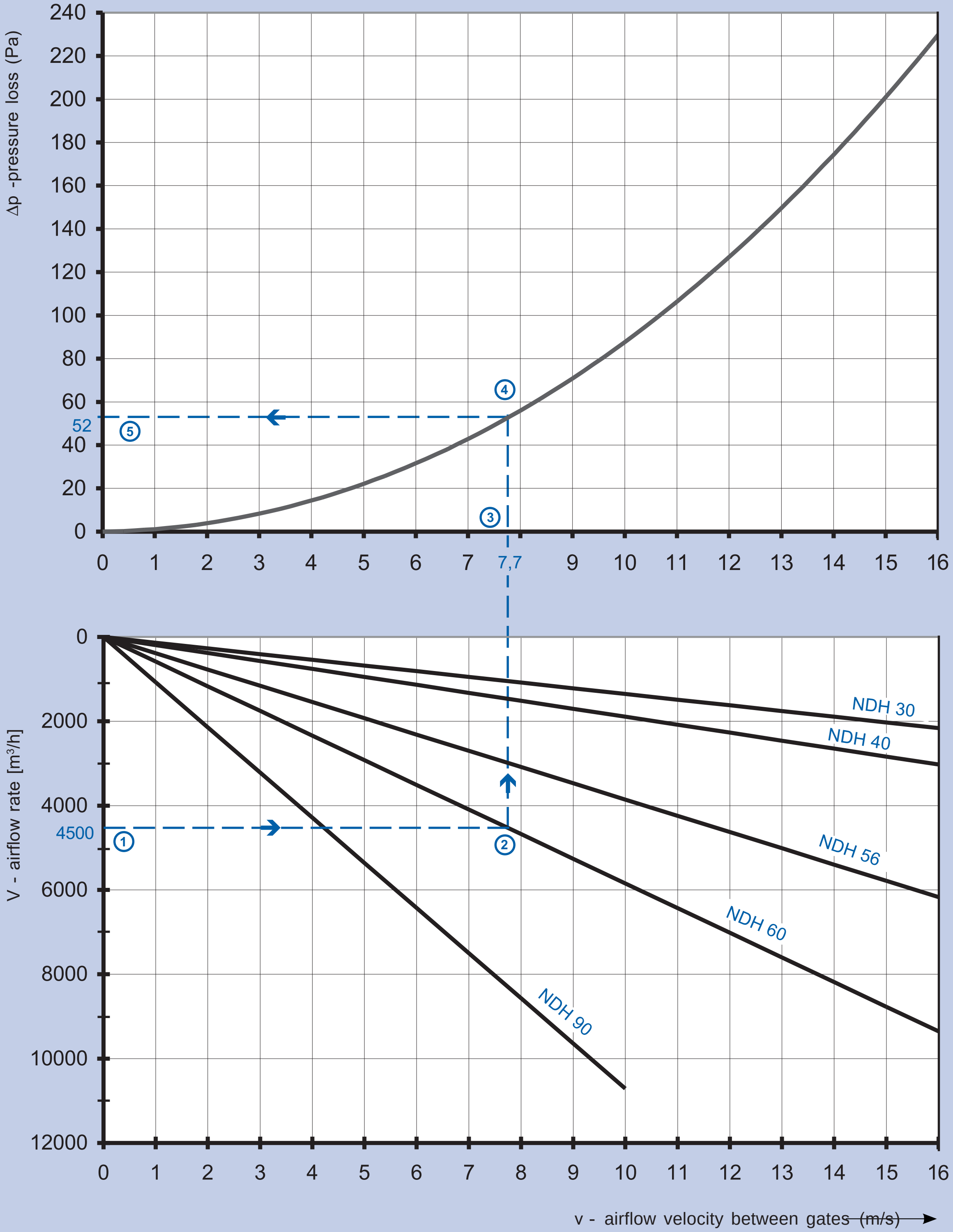
SIZE	A	B	C	E
NK 30	245	290	610	270
NK 40	330	390	710	370
NK 56	450	550	870	530
NK 63	535	620	940	600
NK 90	750	890	1210	870

Table 8 - Dimensions of NDH roof adaptors

SIZE	A	B	C	F	E
NDH 30	245	290	610	850	270
NDH 40	330	390	710	850	370
NDH 56	450	550	870	850	530
NDH 63	535	620	940	850	600
NDH 90	750	890	1210	900	870

Accessories

Air pressure losses of all NDH roof adaptors

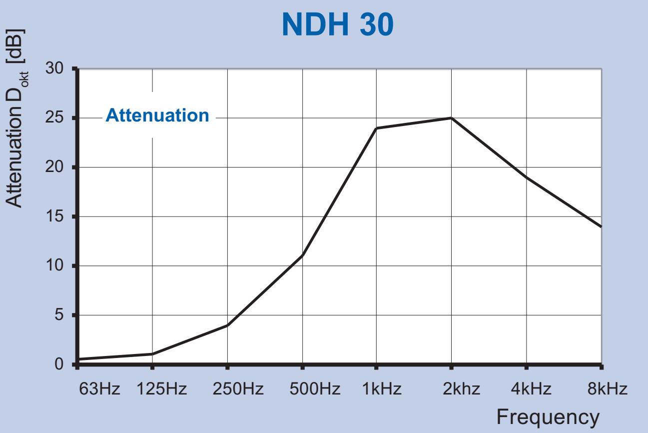


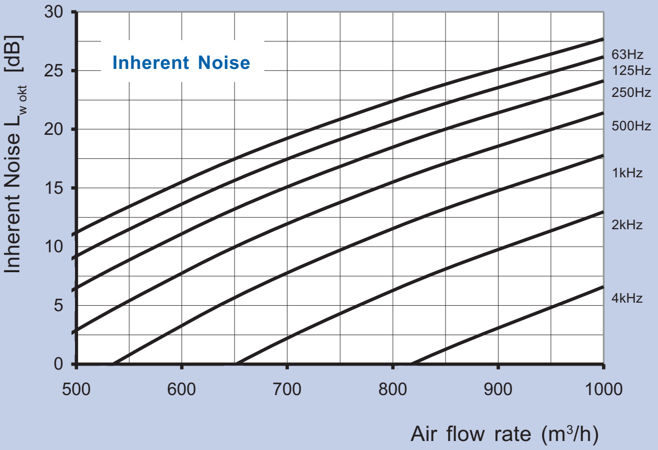
Pressure loss nomograph is applicable for all NDH roof extensions. For a selected airflow rate of ①, it is possible to read out the airflow velocity in the bottom graph ③ between the gates of the NDH roof extension ②, and then it is possible to specify the respective pressure loss ⑤ of the NDH roof extension for the known velocity ④.

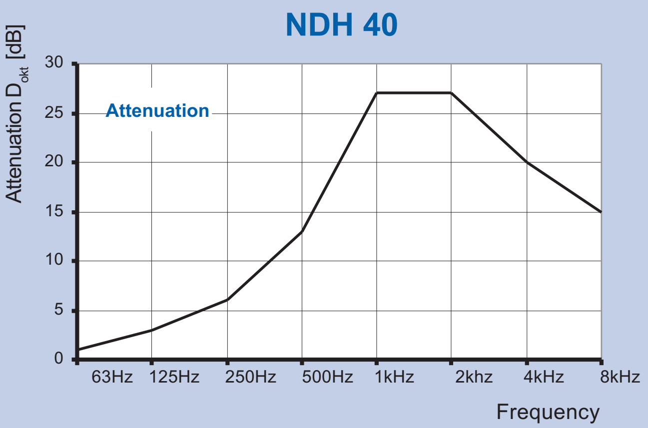
Example: In case of a flow rate of 4500 m³/h, airflow velocity between the gates will be 7,7 m/s for the NDH 60 roof extension. Pressure loss for the given airflow rate will be 52 Pa.

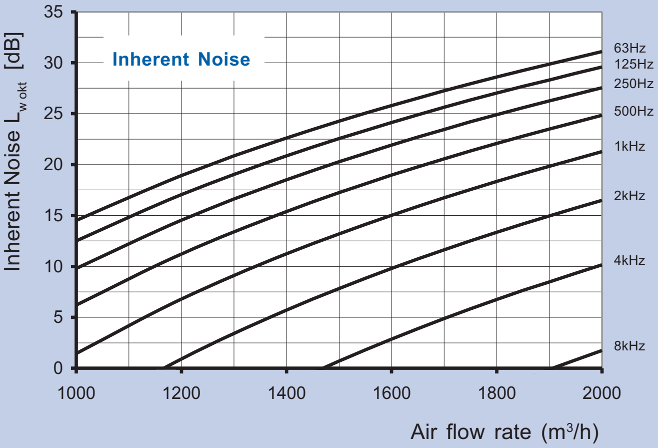
Accessories

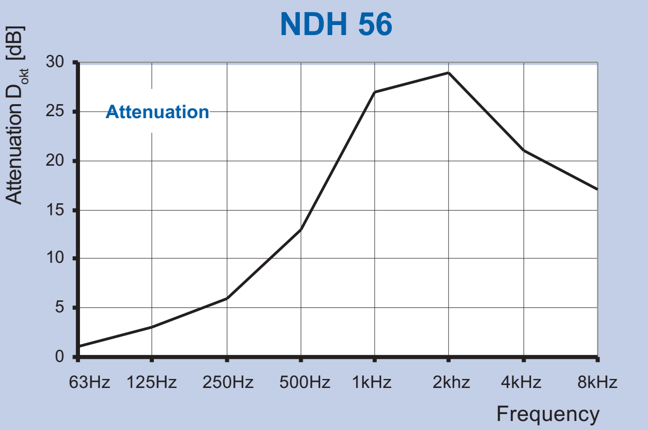
Attenuation and Inherent Noise of NDH Roof Adaptors

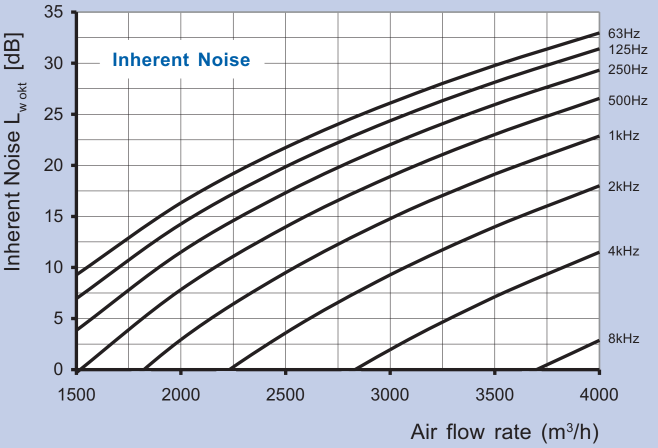


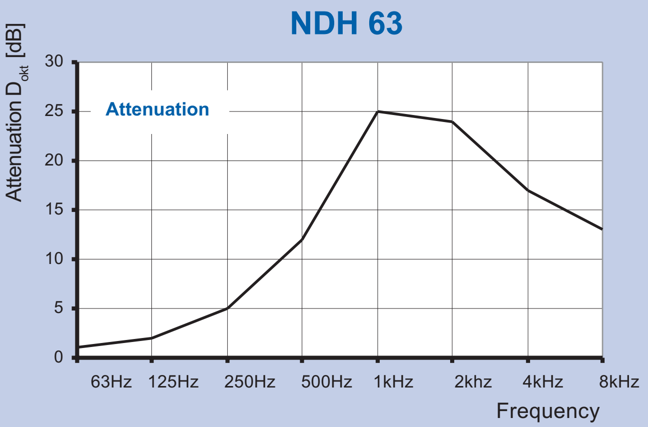


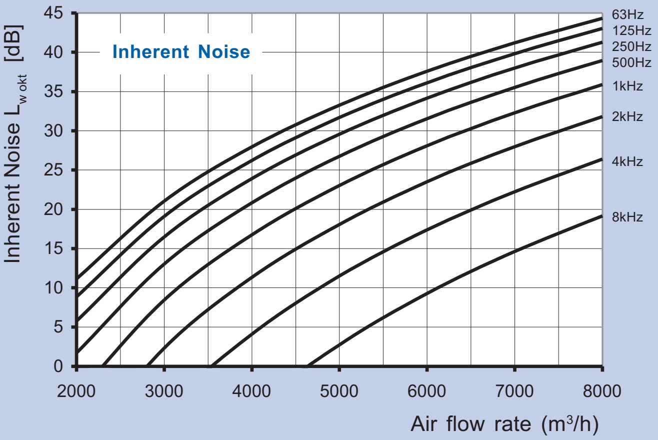






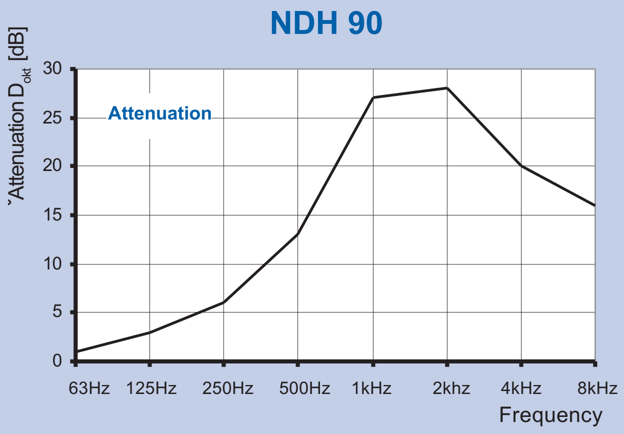


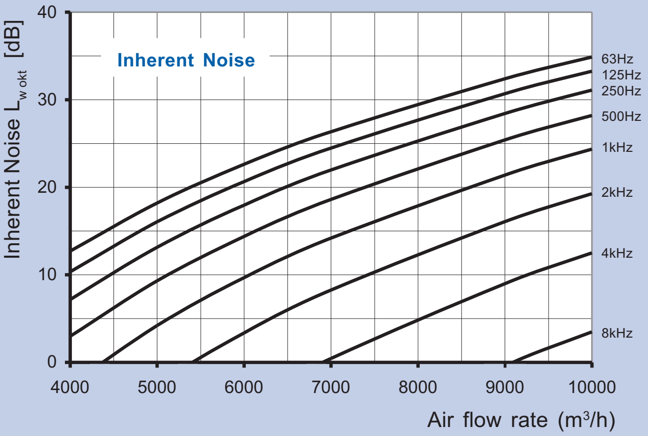




Accessories

Attenuation and Inherent Noise of NDH Roof Adaptors





VS low-pressure dampers

VS low-pressure back-flow damper designed to block back-airflow into ventilated room. Upon starting the fan, the damper is automatically opened by the negative pressure. Light damper flaps are made of thin aluminium sheets. The low-pressure damper is equipped with a single flange made of galvanized steel sheet. It can be installed directly on the base plate of the fan using screws threaded into prepared threads in the base plate. VS low-pressure dampers are intended for NK and NDH roof adaptors. For the pressure loss characteristics of VS low-pressure dampers, refer to the next page.

DK Elastic Connections

The DK round elastic connection serves to eliminate the transfer of vibrations to the connected air duct. If the NDH roof adaptor is not installed, it can be used to connect the round duct to the roof fan. The DK elastic connection can be connected to the roof fan's base plate using prepared threads. It is made of an elastic sleeve resistant to temperatures up to +70 °C. At both ends, it is terminated in flanges made of galvanized steel sheets. The flanges are conductively interconnected by a copper girdle.

Figure 13 - Dimensions of low-pressure dampers

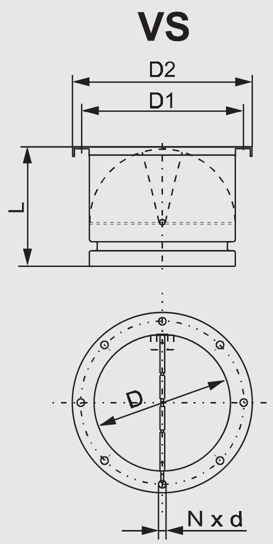


Figure 14 - Dimensions of elastic connections

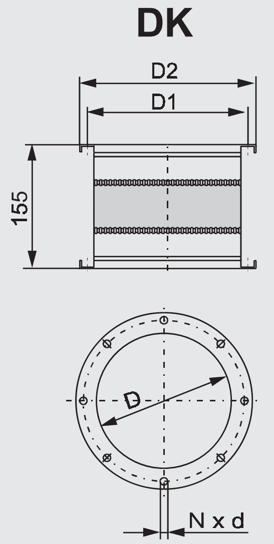


Table 9 - Dimensions of low-pressure dampers in mm

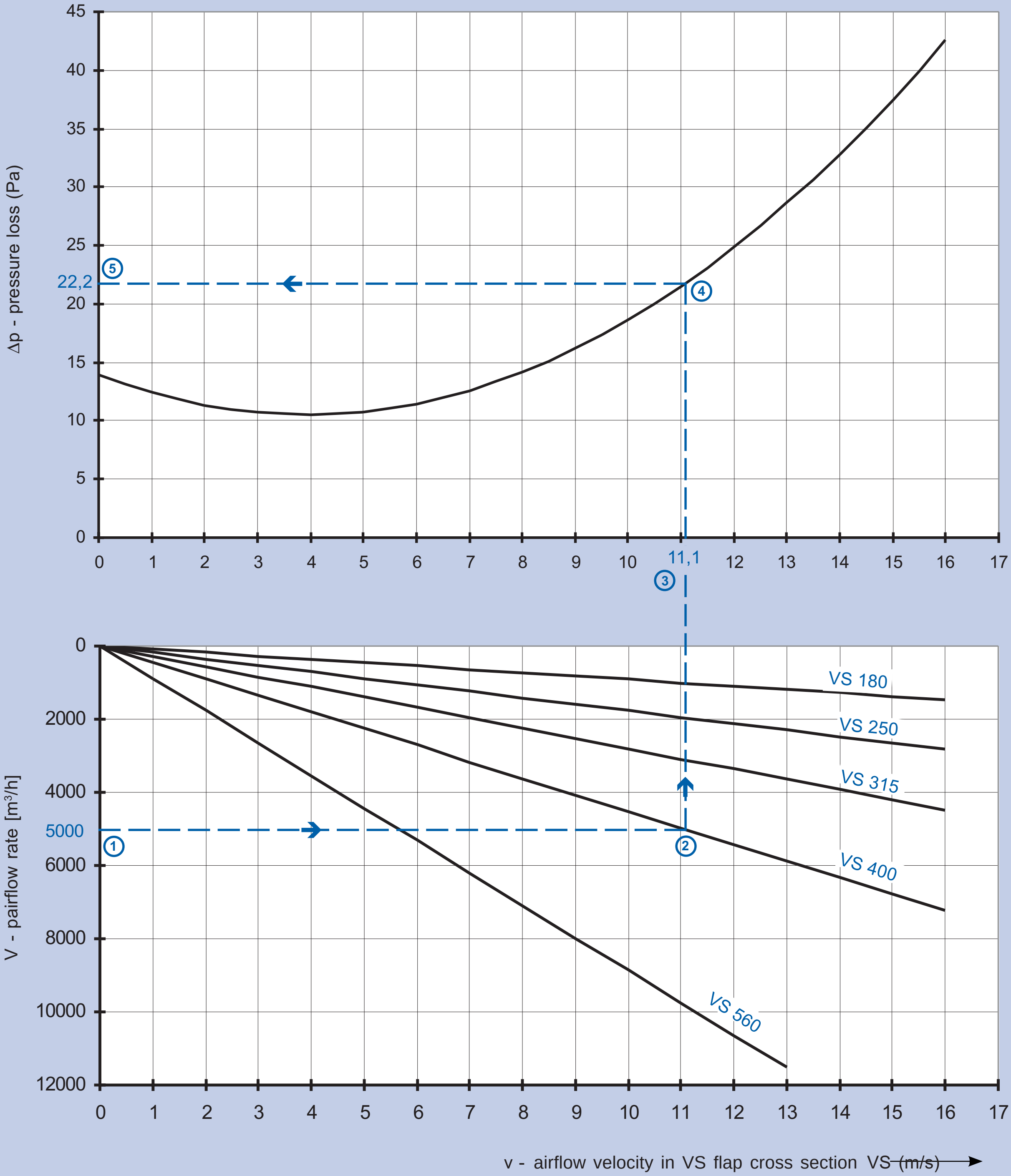
Damper	Fan	D	D1	D2	d	N	L
VS 180	RS 30	180	215	240	10	8	150
VS 250	RS 40	250	285	310	10	8	150
VS 315	RS 56	315	350	375	10	12	150
VS 400	RS 63	400	445	480	12	12	185
VS 560	RS 90	560	605	640	12	16	250

Table 10 - Dimensions of elastic connections in mm

Connection	Fan	D1	D2	d	N
DK 180	RS 30	215	240	10	8
DK 250	RS 40	285	310	10	8
DK 315	RS 56	350	375	10	12
DK 400	RS 63	445	480	12	12
DK 560	RS 90	605	640	12	16

Accessories

Air Pressure Loss of VS Low-Pressure Dampers



The pressure loss nomograph is applicable for all VS flaps. For a selected airflow rate of ①, it is possible to read out the airflow velocity in the bottom graph ③, in the free VS flap cross section ②, and then it is possible to specify the respective pressure loss of the VS flap ⑤ for the known velocity ④.

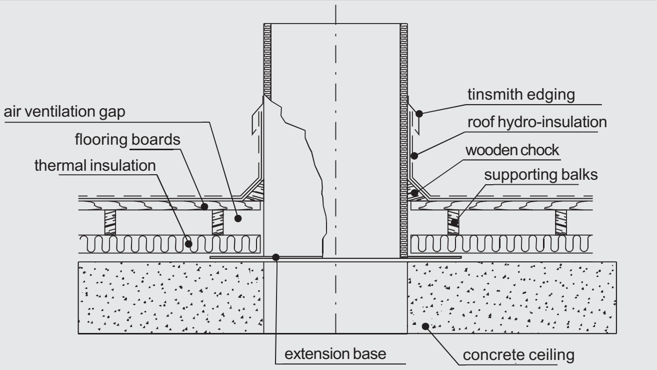
Example: In the case of a flow rate of 5000 m³/h, the airflow velocity will be 11,1 m/s for the flap. The VS 400 flap pressure loss for the given airflow rate will be 22 Pa.

Accessories

Fan Accessories Installation

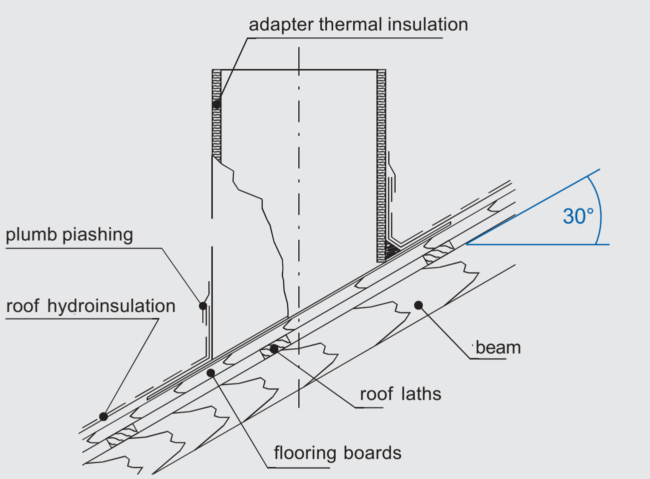
■ NK or NDH roof adaptors make the installation of RS fans significantly easier. The roof adaptors can be used on almost any type of roof.
■ The opening in the roof construction must not be larger than the adaptor platform and it should be of a precise square shape. The adaptor platform must be drilled and screwed to the roof construction.
■ The contact surfaces of the roof adaptor base and roof construction must be thoroughly sealed with sealing cement.
■ The wiring cable can be led through the roof adaptor and through one of the fan supporting studs into the terminal box (see figure # 4).
■ Roof hydro-insulation must always be applied on the roof adaptor up to a height of 30 cm above the roof. The end of the roof hydro-insulation must be completed with sealing cement and flashing to prevent water penetration (see fig. # 15).

Obrázek 15 – střešní nástavec na ploché střeše



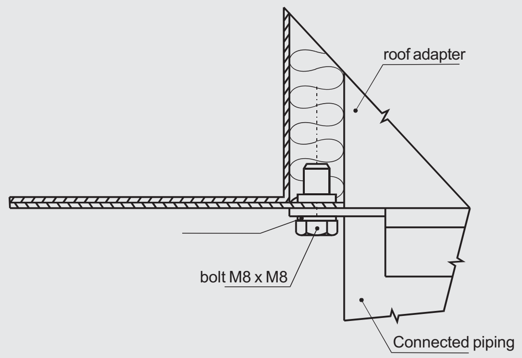
■ After installation, the roof adaptors need to be finished in a protective coating matching the building's colour according to the architect's choice.
■ It is advisable to seal all screw joints on the fan with silicone cement.
■ Roof adaptors for applications on sloping roofs can be delivered with their platforms adjusted to the roof slope. Specify the roof slope angle in your order (see fig. #16).

Figure 16 - Roof adaptor on sloping roof



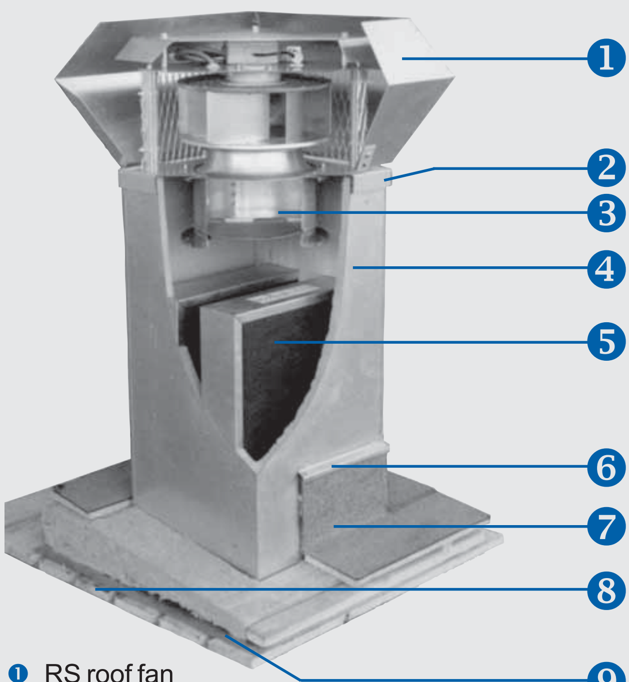
■ Standard roof adaptors (without slope) can also be connected to the air-handling duct. The details of the connection are shown in figure #17. Four M8 riveted nuts are situated in the adaptor's base plate. The dimensions of the nut pitches are shown in the figure in the introduction part.

Figure 17 - duct connection to the roof adaptor



■ Before installation, paste the bottom side of the fan base and upper plate of the roof adaptor with self-sticking sealing. To install the base, use galvanized M8 screws and nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection, or use Cu conductor wiring.

Figure 18 - Fan base installation



1. RS roof fan
2. Fan base
3. VS automatic over-pressure flap
4. NDH roof extension with thermal insulation
5. Noise damper in NDH roof extension
6. Tinsmith edging
7. Roof hydro-insulation
8. Roof baby squares and flooring boards
9. Roof extension base

Technical information

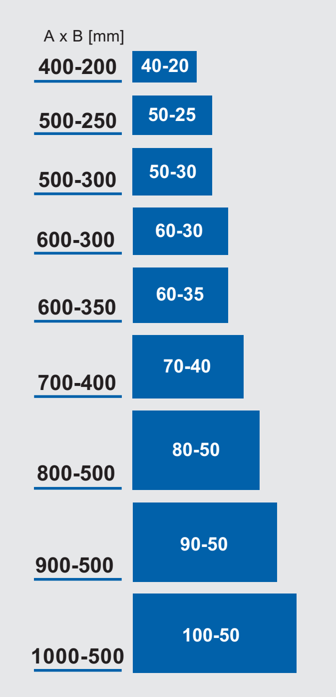
Use of fans

Fully controllable, low-pressure, radial noise-insulated, RPH duct fans can be used universally, from simple ventilation units to complex air-conditioning devices for comprehensive air handling. By noise insulation is meant the reduction of the acoustic output level in the direction of "the surroundings". In order to reduce the acoustic output level in the direction of "intake" and "exhaust", it is necessary to supplement the fan with noise-insulated attenuators.
It is always ideal to connect them with further elements of the Vento construction system that guarantee mutual compatibility and balance of the parameters.

Operating conditions, position

The fans are intended for inside use in an environment free of moisture condensate (normal influence class) to transport air that is void of solid, fibrous, adhesive, aggressive or explosive admixtures. The air must not contain chemical agents that cause corrosion or disintigration of zinc and aluminium. The minimum temperature of the transported air is -30 °C. The nominal limiting values, including the maximum temperatures of the transported air, are listed in table 3. RPH fans can operate only in a horizontal position. When located under the ceiling, it is suitable to mount the fan with the motor's cup pointing downward in order to facilitate access to the terminal box and the motor.
For intake and exhaust, RPH fans must always be equipped with noise-insulated dilatation inserts and noise-insulated attenuators, or a noise-insulated duct. The hanging of the RPH fan must always be done by using hangings that suppress noise and vibration (for example, "silent blocks"). In order to attain lower pressure losses in the system, we recommend designing a straight duct with a length of 1–1.5 m for the fan's exhaust.

Picture 1 – fan sizes



Sizes

RPH fans are manufactured in nine sizes according to the AxB dimension of the connecting flange. For every size, there are several fans at your disposal that differ particularly in the number of poles of the electric motor used. When selecting a fan for the required airflow and pressure, the general rule applies that larger fans with a greater number of poles attain the required parameters at lower revolutions, which causes less noise and provides longer service life. Fans with a greater number of poles also have lower air velocities in the cross-section, whereby lower pressure losses in the duct and accessories are attained, although at the cost of making a greater investment. The standard manufacturing sizes and outputs of the single-phase and three-phase RPH fans enable project designers to optimally set all parameters for airflow up to 9,200 m^3/h.

Materials

The outer casing of RPH fans and connecting flanges are made of galvanized, zinc-coated metal sheet (Zn 275 g/m^2).
The rotor blades and diffusers are made of zinc-coated steel sheet and the electric motors are of aluminium alloys, copper and plastic. The noise insulation is made of non-combustible, rot-resistant, waterproof mineral wool. All materials are carefully inspected and checked, and they guarantee the long service life and reliability of the fans.

Rotors

The rotational direction of the rotors must be controlled on three-phase fans after connection. A synthetic rubber seal closes the service aperture on the motor cup. The rotors of RPH fans always rotate to the left in a counter-clockwise direction (as seen from the service aperture on the cup). Rotors and motor are perfectly balanced both statically and dynamically.

Electric motors

Asynchronous, single-phase and three-phase, compact motors provide the drive with an external rotor and resistive armature. The electric motors are placed inside the rotor and are optimally cooled by flowing air during operation. The high-quality, encased ball bearings with their long-lasting lubrication filling give the fans a service life of more than 40,000 hours of operation without maintenance. The protection for the individual motors is mainly IP 54, and for RPH 40-20 and RPH 50-25, it is IP 44 with the insulation class F. The coils have an additional protection against moisture by impregnation. The motors use very little current when they begin to run.

Electrical installation

The single-phase electric motors are equipped with a cast starting capacitor that is affixed underneath the cover. The electrical installation ends with a terminal box that has IP 40 protection. The connection diagrams are shown in the separate chapter "Electrical installation" on page 21.
Attention: The three-phase motors must always be connected according to the data in the technical parameters, or according to the data on the motor plate.

Protection of the electric motor

As standard equipment on all motors, there is permanent monitoring of the motor's internal temperature. The permissible limiting temperature is registered by thermo contacts that are located in the coils of the electric motor.

Technical information

The thermo contacts are miniature switching elements dependent on temperature that are connected to the control circuit of the protective contactor. They protect the motor against overheating (damaging), loss of one phase of the net, hard braking of the motor, interruption of the current circuit of protection and excessive temperature of the transported air.
When they are properly connected, thermal protection by means of thermo contacts is comprehensive, reliable and indispensable, particularly on motors that have revolution control and on motors that are frequently started up or under the thermal load of the transported air.
For these reasons, it is not possible to protect the electric motors of the fans using conventional protection dependent on current by means of over-tension, motor-safeguarding elements!
The maximum load capacity of the thermo contacts is 2A / 250V / 50 Hz /cos φ 0.6/

Control of fan output

The output of all RPH fans can be fully controlled by changing the revolutions. Altering the voltage on the terminals of the electric motor can change the revolutions. The electric motors of RPH fans can be operated in a range of approximately 25 % to 110 % of the nominal voltage. Several means of control can generally be used on the fans. Voltage regulation is, however, the most suitable manner of control for RPH fans.
The corresponding voltage controllers are listed in the tables of fan parameters for each of them.

Table 1 – relation between voltage and control steps

Type of motor	Map curve – step of controller				
	5	4	3	2	1
1 – phase	230 V	180 V	160 V	130 V	105 V
3 – phase	400 V	280 V	230 V	180 V	140 V

Five-step voltage control (transformer)

Voltage control of singe-phase and three-phase RPH fans is technically and operationally the most favorable. There is no disturbing, humming, whistling or vibrating of the motor.
RPH fans can be controlled steplessly when the voltage change occurs gradually. In practice, controllers are more frequently used that have a voltage change in steps. Fan output can be controlled in five steps by TRN voltage controllers. One step amounts to about 20 %, to which corresponds table 1, which shows the reciprocal relation of the outlet voltage and the controller step set for single-phase and three-phase electric motors.

Stepless electronic control

We offer stepless electronic voltage control of output only on single-phase fans. A disadvantage of electronic control by PE 2.5 and PE 5 controllers is the greater heating-up of the motors. Sometimes it can also be a disadvantage that the project designer, when determining the operation modes, does not have the possibility of exactly defining for the operator the output step required in dependence on the load of the ventilated room. Stepless control can be provided by means of frequency converters, which can be delivered as per requirement.

Accessories

RPH fans form part of a broad assortment of the elements of the Vento ventilating and air-conditioning construction system. By choosing the suitable elements, you can put together an air-handling device for simple ventilation or for comfortable and comprehensive air conditioning as you like. The universal RPH duct fans can be used with a whole range of elements and accessories.

- KFD bag filters and KF3, KF5 and KF7 Z-line filters
- VFK bag filters and VF3 bag filters
- DV elastic connections
- LKR, LKS, LKSX, LKSF control and closing dampers
- PK backdraught shutters
- PZ louvers
- TKU attenuators
- VO water heaters
- SUMX mixing sets
- EO, EOS and EOSX electric heaters
- CHF direct coolers
- CHV water coolers
- HRV plate heat exchangers
- SKX mixing sections for circulation air
- NS control units and feelers
- TRN controllers and their drivers and TRRE and TRRD controllers
- STE and STD protection relays

Technical information

Type designation

Illustration 2 defines the key to the type designation of RPH duct fans when designing and ordering.

The designation, RPH 60-30/28-4D for example, specifies the fan type, rotor and electric motor.

Illustration 2 – type key to designating RP fans

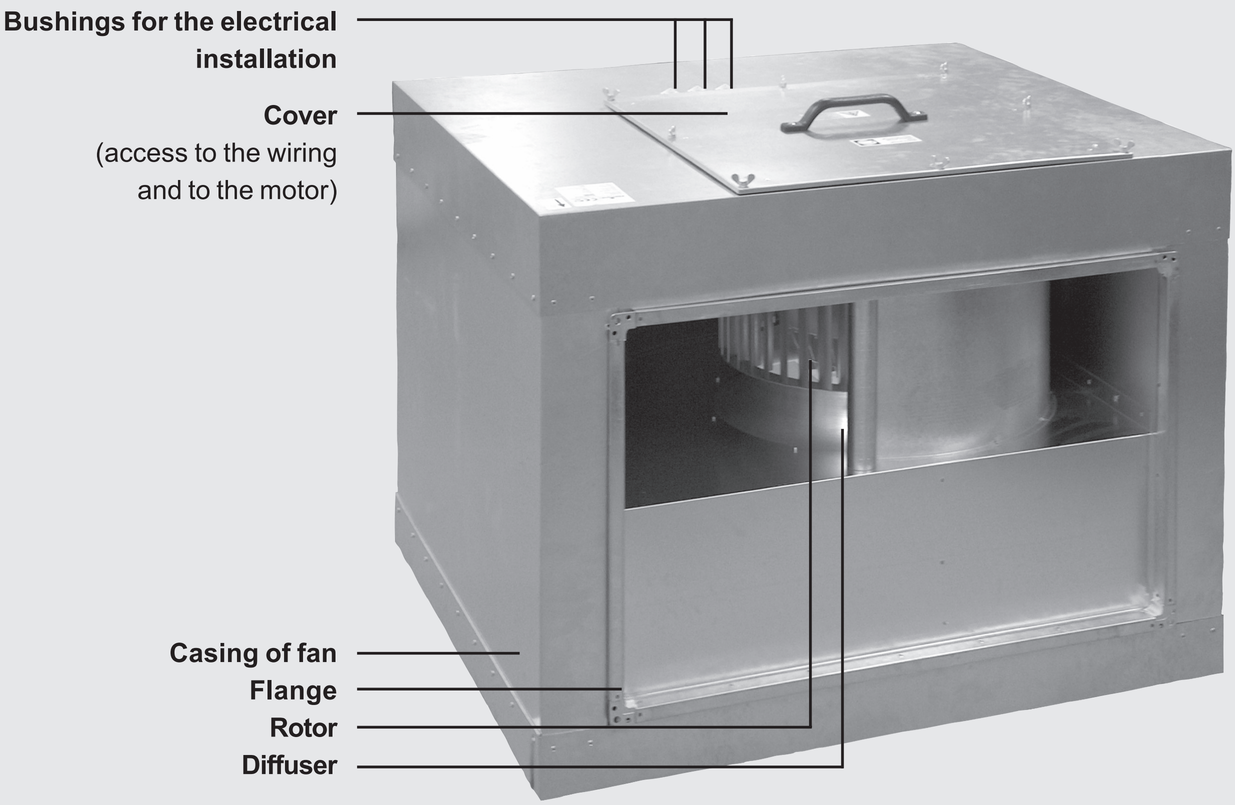
RPH 60 - 30 / 28 - 4 D

- **D – Electric motor**
  - E – single-phase
  - D – three-phase
- **4 – Number of electric motor poles**
  - 4 – four-pole
  - 6 – six-pole
  - 8 – eight-pole
- **28 – Diameter of rotor (cm)**
- **30 – Connecting size B of flange (cm)**
- **60 – Connecting size A of flange (cm)**
- **RPH – Radial, noise-insulated, duct fan**

Vento RPH duct fans are designed for installing in a duct line or in a system of further air-conditioning elements of the Vento system. The RPH Vento fan has a perfectly functional construction.

The most frequently used designations for elements of the individual components and fan construction groups are defined in the illustration (illustration 3).

Illustration 3 – construction of RPH fan



Fan parameters

Dimensions, weights and outputs

Illustration 4 and table 2 contain important dimensions for fans of the RP type.

Table 2 – fan dimensions

Type	Dimensions in mm								
	A	B	C	D	E	F	G	H	I
RPH 40-20/20-..	400	200	420	220	440	240	475	500	620
RPH 50-25/22-..	500	250	520	270	540	290	525	530	720
RPH 50-30/25-..	500	300	520	320	540	340	575	565	720
RPH 60-30/28-..	600	300	620	320	640	340	575	642	820
RPH 60-35/31-..	600	350	620	370	640	390	625	720	820
RPH 70-40/35-..	700	400	720	420	740	440	675	780	920
RPH 80-50/40-..	800	500	820	520	840	540	775	885	1020
RPH 90-50/45-..	900	500	930	530	960	560	775	985	1120
RPH 100-50/45-..	1000	500	1030	530	1060	560	775	985	1220

Illustration 4 – dimensional illustration of fan

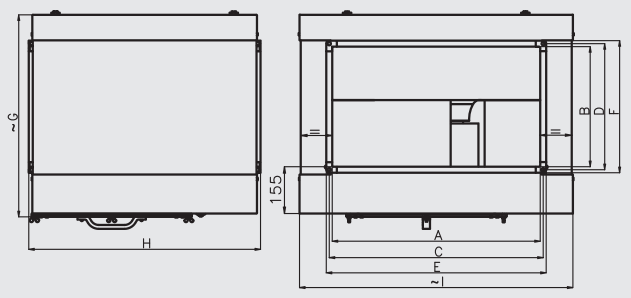


Table 3 – basic parameters and nominal values for the fans

Fan type	$V_{max.}$ m³/h	$p_{t\,max.}$ Pa	$p_{s\,min.}$ Pa	n min⁻¹	U V	$P_{max.}$ W	$I_{max.}$ A	$t_{max.}$ °C	C μF	Controlller type	m kg
Single-phase fans											
RPH 40 - 20/20 - 4E	1200	233	0	1420	230	322	1,6	40	5	TRN 2E	36
RPH 50 - 25/22 - 4E	1648	299	55	1420	230	548	2,3	40	8	TRN 4E	45
RPH 50 - 30/25 - 4E	2305	360	0	1380	230	831	3,68	55	14	TRN 4E	53
RPH 60 - 30/28 - 4E	2496	469	152	1400	230	1046	5,1	40	16	TRN 7E	68
Three-phase fans											
RPH 40 - 20/20 - 4D	1292	236	0	1420	400	291	0,5	70	–	TRN 2D	36
RPH 50 - 25/22 - 6D	1376	137	0	940	400	222	0,46	55	–	TRN 2D	43
RPH 50 - 25/22 - 4D	1937	309	0	1440	400	590	1	40	–	TRN 2D	45
RPH 50 - 30/25 - 6D	1811	163	0	940	400	356	0,69	55	–	TRN 2D	49
RPH 50 - 30/25 - 4D	2576	414	0	1450	400	1004	1,97	50	–	TRN 2D	52
RPH 60 - 30/28 - 6D	2531	239	0	960	400	575	1,28	55	–	TRN 2D	62
RPH 60 - 30/28 - 4D	3178	469	0	1450	400	1397	2,38	40	–	TRN 4D	68
RPH 60 - 35/31 - 6D	3687	281	0	910	400	948	1,86	40	–	TRN 2D	72
RPH 60 - 35/31 - 4D	4512	617	136	1440	400	2464	4,1	40	–	TRN 7 D	80
RPH 70 - 40/35 - 8D	3669	216	0	670	400	642	1,38	55	–	TRN 2D	93
RPH 70 - 40/35 - 6D	4032	378	151	920	400	1096	2	40	–	TRN 2D	92
RPH 70 - 40/35 - 4D	5981	806	340	1440	400	3527	6	40	–	TRN 7D	110
RPH 80 - 50/40 - 8D	4720	298	0	700	400	1230	2,29	55	–	TRN 4D	118
RPH 80 - 50/40 - 6D	7357	496	0	960	400	2824	5,11	50	–	TRN 7D	132
RPH 80 - 50/40 - 4D	6831	1040	683	1410	400	4919	8,1	40	–	TRN 9D	139
RPH 90 - 50/45 - 4D	6558	1498	1014	1260	400	4919	8,3	55	–	TRN 9D	168
RPH 90 - 50/45 - 6D	9200	667	90	930	400	3780	6,8	55	–	TRN 7D	168
RPH 90 - 50/45 - 8D	7810	386	0	690	400	1892	3,88	55	–	TRN 4D	165
RPH 100 - 50/45 - 4D	6558	1498	1014	1260	400	4919	8,3	55	–	TRN 9D	177
RPH 100 - 50/45 - 6D	9200	667	90	930	400	3780	6,8	55	–	TRN 7D	177
RPH 100 - 50/45 - 8D	7810	386	0	690	400	1892	3,88	55	–	TRN 4D	174

$V_{max.}$ - maximal air-flow at minimal allowed pressure loss

$\Delta p_{t\,max.}$ - maximal total pressure of fan is maximum of sum Δp_s and p_d $(\Delta p_s + p_d)_{max.}$

$\Delta p_{s\,min.}$ - minimal allowed static pressure (pressure loss of connected ductwork) tells the lowest value the fan must be throttled to (at nominal voltage in point 5c), so that the fan wasn´t being overloaded and therefore the thermocontacts didn´t disconnect and the protection wasn´t activated

n - fan speed measured in operating point with highest efficiency (5b), rounded to the tenth

U - nominal supply voltage of motor without control (all values in the table refer to this voltage)

$P_{max.}$ - maximal input of electromotor at highest load, that´s at air-flow $V_{max.}$

$I_{max.}$ - maximal phase current at voltage U and highest allowed load, that´s at air-flow $V_{max.}$ in point 5c (after connection, it´s necessary to check this value and measured current write to the certificate of warranty)

$t_{max.}$ - highest allowed temperature of transported air at air-flow V_{max}.

C - specified condensor capacity of single-phase fans

controller - specified voltage controller for fan control

m - mass of fan

Fan parameters

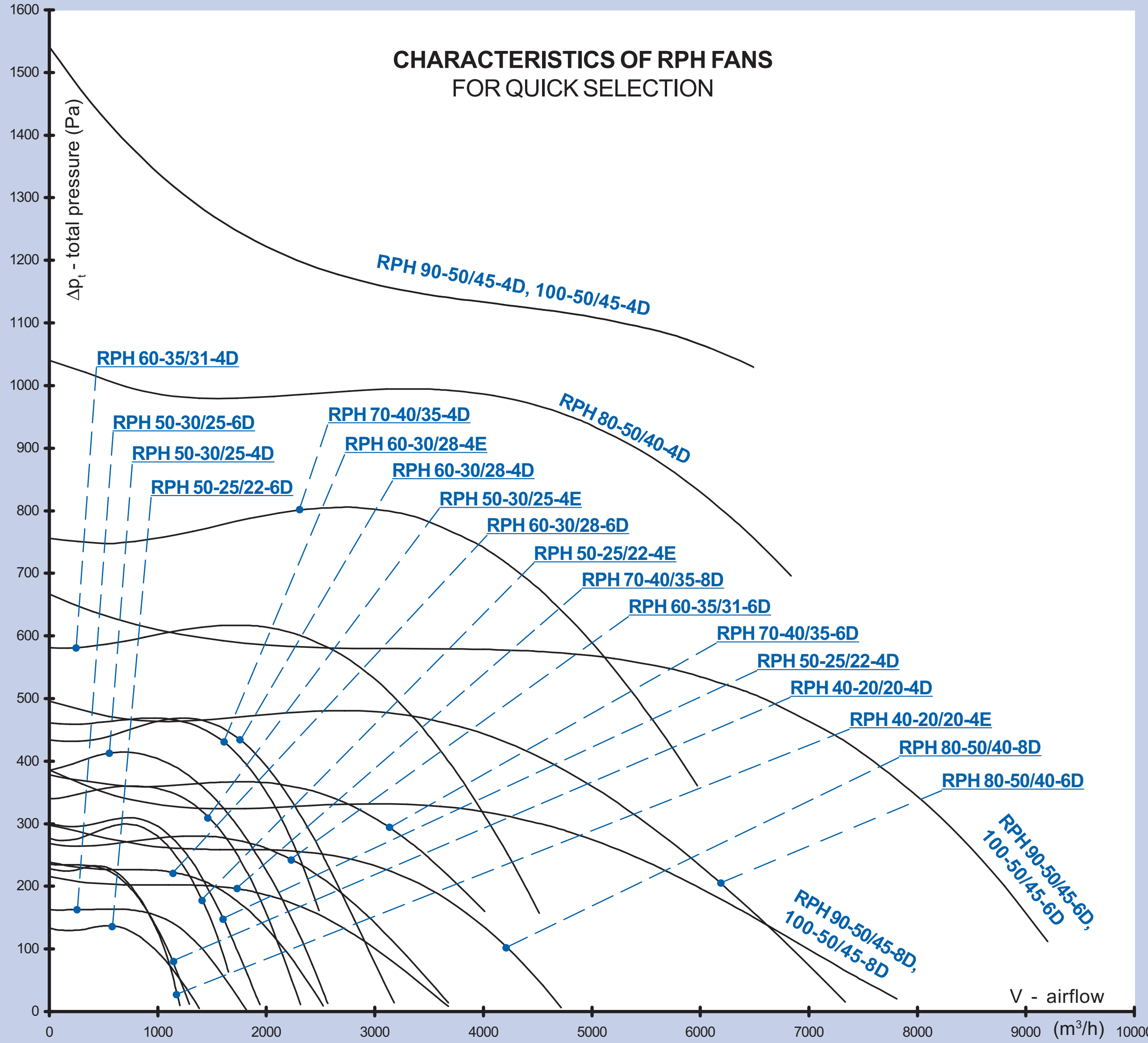
Data part

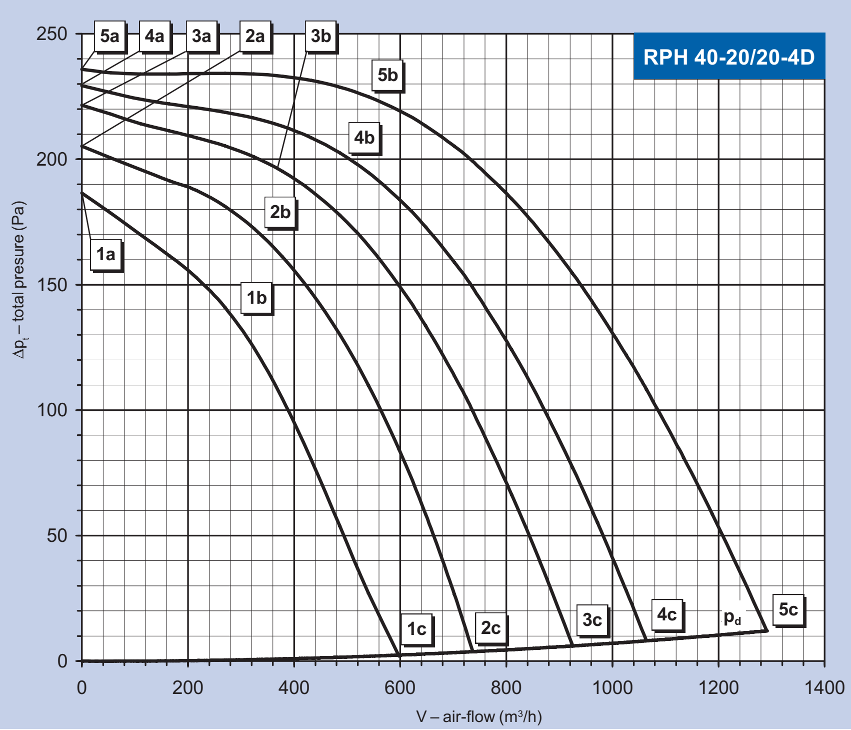
Table 4 provides an over-view of all RPH fans ordered according to maximum total pressure and maximum airflow. In the majority of cases, however, the reciprocal relation airflow - pressure is more important than merely the maximums of the individual quantities. Graph 1 serves to quickly choose a suitable fan and to compare one RPH fan with another. Only the highest characteristics of each fan are noted in it when the fan is fed with the nominal voltage, i.e. without a controller or with a controller set at the fifth step. All important information and appropriate data regarding RPH fans are contained in the data part of the catalog (pages 8 - 20).
The noise parameters "levels of acoustic output into the intake" and "levels of acoustic output into the exhaust" are measured according to the Czech norm ČSN ISO 3743-2. The noise parameters "levels of acoustic output into the surroundings" are calculated from the values for acoustic output measured according to ČSN EN ISO 11546-1. The output characteristics of the fans are measured according to the norms DIN 24 163 and AMCA Standard 210-74.

Table 4 – fans according to pressure and output

ACCORDING TO MAXIMUM PRESSURE		ACCORDING TO MAXIMUM AIRFLOW	
Fan type	Total pressure $\Delta P_{t\,max}$ (Pa)	Fan type	Max. airflow V (m³/h)
RPH 50-25/22-6D	137	RPH 40-20/20-4D	1 292
RPH 50-30/25-6D	163	RPH 50-25/22-6D	1 376
RPH 70-40/35-8D	216	RPH 40-20/20-4E	1 420
RPH 40-20/20-4E	233	RPH 50-25/22-4E	1 648
RPH 40-20/20-4D	236	RPH 50-30/25-6D	1 811
RPH 60-30/28-6D	239	RPH 50-25/22-4D	1 937
RPH 60-35/31-6D	281	RPH 50-30/25-4E	2 305
RPH 80-50/40-8D	298	RPH 60-30/28-4E	2 496
RPH 50-25/22-4E	299	RPH 60-30/28-6D	2 531
RPH 50-25/22-4D	309	RPH 50-30/25-4D	2 624
RPH 50-30/25-4E	360	RPH 60-30/28-4D	3 178
RPH 70-40/35-6D	378	RPH 70-40/35-8D	3 669
RPH 90-50/45-8D	386	RPH 60-35/31-6D	3 687
RPH 100-50/45-8D	386	RPH 70-40/35-6D	4 032
RPH 50-30/25-4D	390	RPH 60-35/31-4D	4 512
RPH 60-30/28-4E	469	RPH 80-50/40-8D	4 720
RPH 60-30/28-4D	469	RPH 70-40/35-4D	5 981
RPH 80-50/40-6D	496	RPH 90-50/45-4D	6 558
RPH 60-35/31-4D	617	RPH 100-50/45-4D	6 558
RPH 90-50/45-6D	667	RPH 80-50/40-4D	6 831
RPH 100-50/45-6D	667	RPH 80-50/40-6D	7 357
RPH 70-40/35-4D	806	RPH 90-50/45-8D	7 810
RPH 80-50/40-4D	1 040	RPH 100-50/45-8D	7 810
RPH 100-50/45-4D	1 498	RPH 90-50/45-6D	9 200
RPH 90-50/45-4D	1 498	RPH 100-50/45-6D	9 200

Graph 1



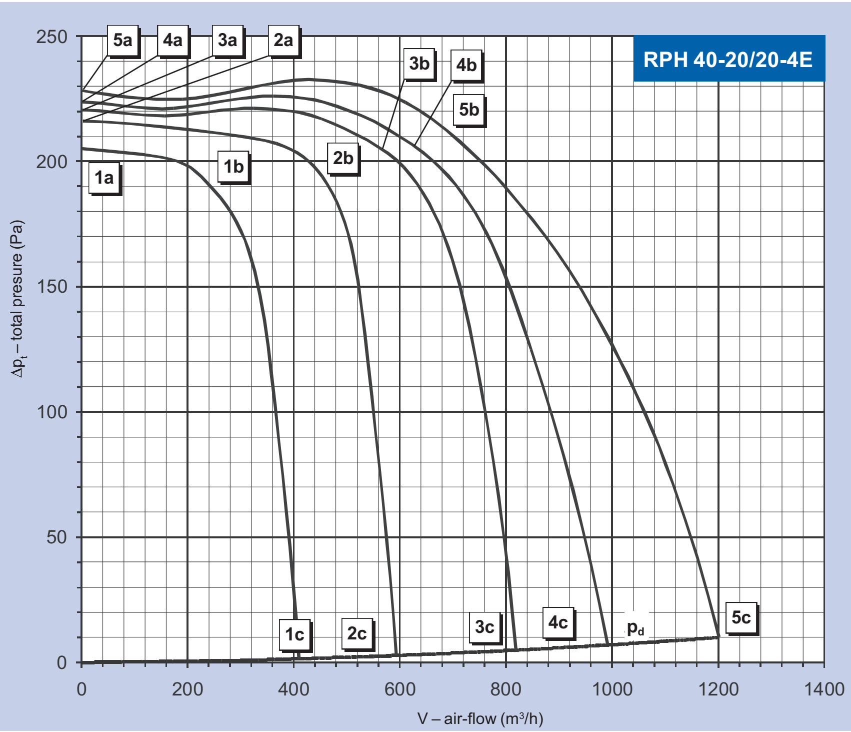


RPH 40-20/20-4D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	291
Current max.	I_{max}	[A]	0,50
Speed average	n	[min^{-1}]	1420
Condenser	C	[μF]	-
Op. temperature max.	t_{max}	[°C]	70
Air-flow max.	V_{max}	[m^3/h]	1292
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	236
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	36
Five-speed controller		type	TRN 2D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	68	74	34
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	54	55	30
250 Hz	61	62	32
500 Hz	59	65	20
1000 Hz	62	70	10
2000 Hz	62	68	0
4000 Hz	60	66	0
8000 Hz	53	58	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,30	0,32	0,50	0,19	0,26	0,50	0,17	0,22	0,47	0,17	0,22	0,43	0,15	0,22	0,37
Electric input	P	[W]	71	125	291	49	98	215	41	71	170	41	60	120	31	49	81
Speed	n	[min^{-1}]	1468	1418	1232	1438	1340	1011	1410	1319	892	1329	1226	734	1271	1094	590
Air-flow	V	[m^3/h]	0	561	1292	0	515	1061	0	383	923	0	345	734	0	296	592
Static pressure	Δp_s	[Pa]	236	222	0	229	198	0	222	193	0	205	166	0	187	132	0
Total pressure	Δp_t	[Pa]	236	224	12	229	200	8	222	194	6	205	167	4	187	133	2



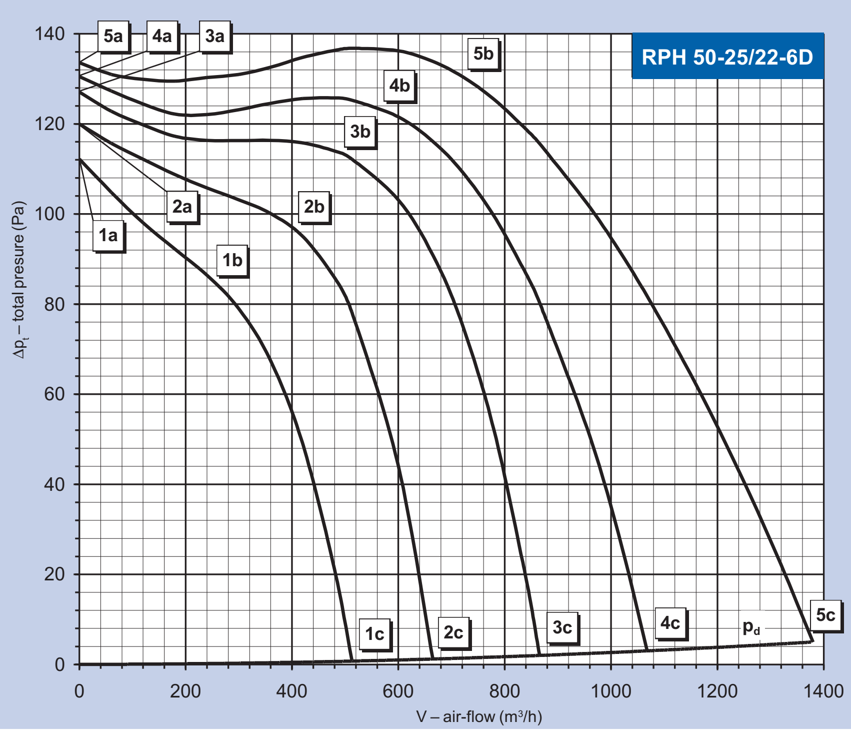
RPH 40-20/20-4E

Connection			230V 50Hz
Electric input max.	P_{max}	[W]	322
Current max.	I_{max}	[A]	1,60
Speed average	n	[min^{-1}]	1420
Condenser	C	[μF]	5
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	1200
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	233
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	36
Five-speed controller		type	TRN 2E
Five-speed controller		type	STE

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	71	78	43
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	57	56	36
250 Hz	66	71	42
500 Hz	63	68	24
1000 Hz	63	73	12
2000 Hz	64	71	0
4000 Hz	62	69	0
8000 Hz	53	61	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	0,99	1,08	1,60	0,56	0,81	1,58	0,49	0,78	1,46	0,46	0,72	1,17	0,48	0,57	0,95
Electric input	P	[W]	144	197	322	91	141	237	77	122	189	62	92	122	49	56	75
Speed	n	[min^{-1}]	1388	1416	1244	1459	1387	885	1449	1363	649	1428	1319	520	1391	1337	399
Air-flow	V	[m^3/h]	0	692	1200	0	629	998	0	576	809	0	459	598	0	254	405
Static pressure	Δp_s	[Pa]	228	210	0	224	204	0	221	200	0	216	190	0	205	187	0
Total pressure	Δp_t	[Pa]	228	213	10	224	207	5	221	202	3	216	191	2	205	187	1

[1)] Value calculated according to the methodology see Fan Parameters - Data part page 7

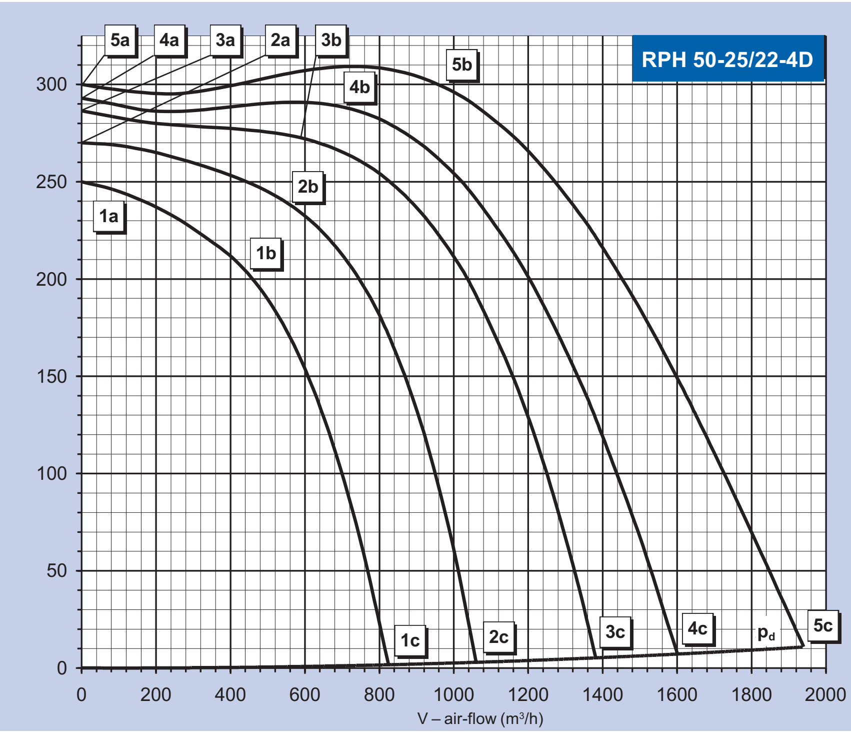


RPH 50-25/22-6D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	222
Current max.	I_{max}	[A]	0,46
Speed average	n	[min^{-1}]	940
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	1376
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	137
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	43
Five-speed controller		type	TRN 2D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	66	66	35
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	58	52	33
250 Hz	62	57	30
500 Hz	57	59	18
1000 Hz	57	60	4
2000 Hz	57	59	0
4000 Hz	54	57	0
8000 Hz	44	48	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	400			280			230			180			140		
Current	I	[A]	0,30	0,33	0,46	0,20	0,24	0,42	0,17	0,21	0,38	0,15	0,20	0,33	0,14	0,17	0,27
Electric input	P	[W]	62	110	222	36	68	151	31	56	111	26	44	73	22	30	45
Speed	n	[min^{-1}]	986	943	825	971	912	650	954	878	548	921	823	420	873	795	347
Air-flow	V	[m^3/h]	0	735	1376	0	571	1064	0	490	864	0	399	665	0	259	511
Static pressure	Δp_s	[Pa]	134	130	0	131	123	0	127	113	0	120	96	0	112	85	0
Total pressure	Δp_t	[Pa]	134	132	5	131	124	3	127	114	2	120	96	1	112	85	1

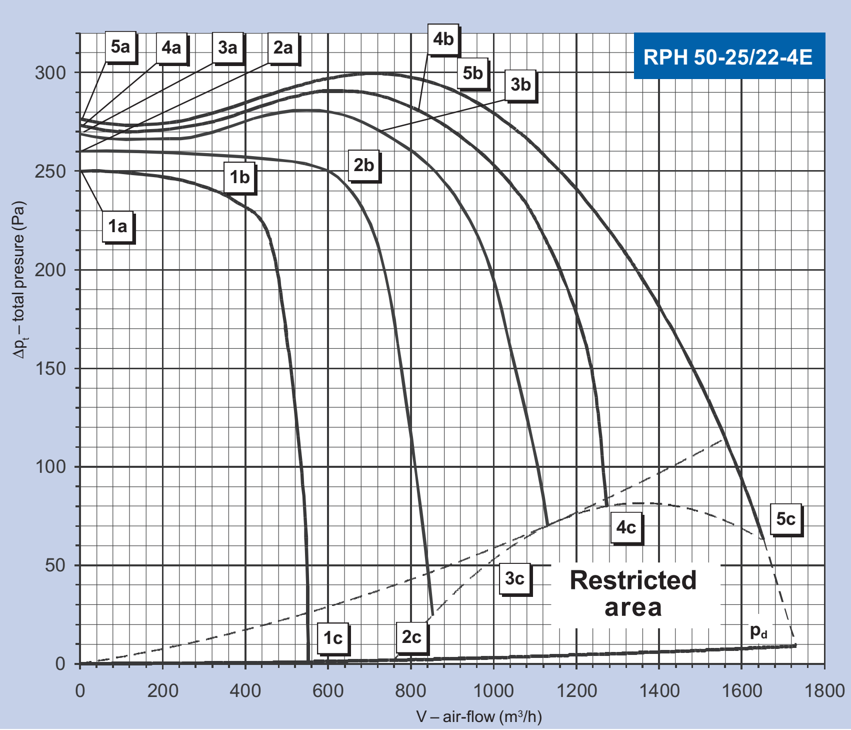


RPH 50-25/22-4D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	590
Current max.	I_{max}	[A]	1,00
Speed average	n	[min^{-1}]	1440
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	1937
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	309
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	45
Five-speed controller		type	TRN 2D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	72	78	42
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	65	64	40
250 Hz	66	70	37
500 Hz	62	71	24
1000 Hz	62	73	10
2000 Hz	65	71	0
4000 Hz	62	69	0
8000 Hz	53	61	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	400			280			230			180			140		
Current	I	[A]	0,58	0,63	1,00	0,34	0,46	1,07	0,28	0,40	1,00	0,26	0,45	0,97	0,27	0,45	0,84
Electric input	P	[W]	119	249	590	85	174	478	67	131	379	60	121	251	54	96	167
Speed	n	[min^{-1}]	1485	1439	1306	1463	1400	1085	1448	1377	948	1409	1284	744	1353	1189	585
Air-flow	V	[m^3/h]	0	951	1937	0	715	1605	0	592	1379	0	567	1060	0	452	825
Static pressure	Δp_s	[Pa]	300	300	0	293	284	0	286	272	0	270	234	0	250	198	0
Total pressure	Δp_t	[Pa]	300	303	11	293	285	7	286	273	5	270	235	3	250	199	2

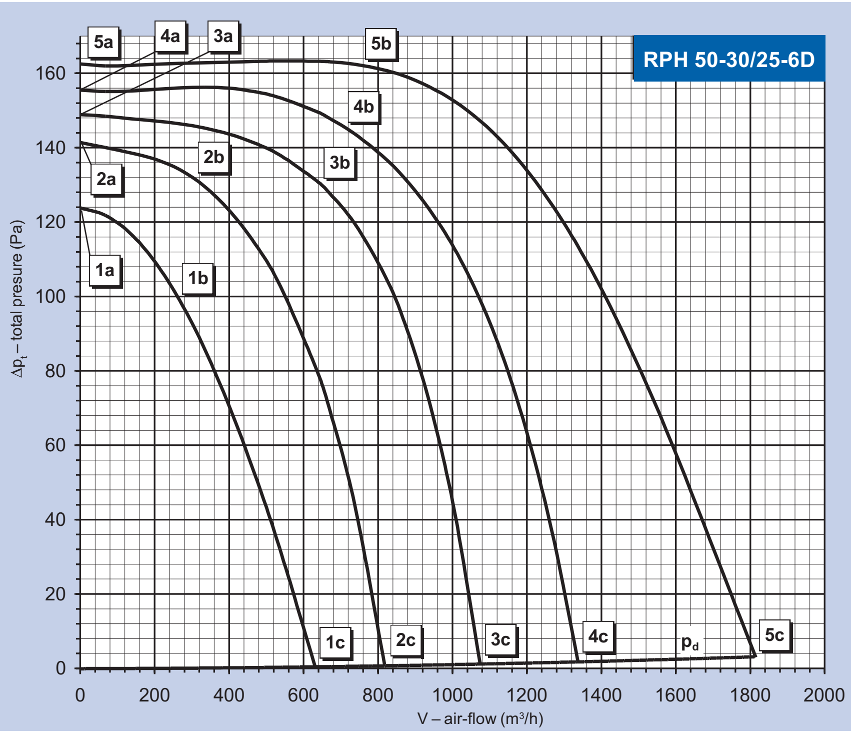


RPH 50-25/22-4E

Connection	Y		230V 50Hz
Electric input max.	P_{max}	[W]	499
Current max.	I_{max}	[A]	2,30
Speed average	n	[min^{-1}]	1420
Condenser	C	[μF]	8
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	1648
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	299
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	55
Weight.	m	[kg]	45
Five-speed controller		type	TRN 4E
Five-speed controller		type	STE

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	73	77	4
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	65	61	43
250 Hz	67	67	38
500 Hz	61	68	23
1000 Hz	64	72	11
2000 Hz	66	70	0
4000 Hz	64	69	0
8000 Hz	56	61	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	1,07	1,33	2,30	0,69	1,15	2,25	0,66	1,11	2,20	0,70	1,11	2,01	0,66	0,90	1,64
Electric input	P	[W]	181	275	499	124	211	381	108	180	319	95	147	225	73	97	146
Speed	n	[min^{-1}]	1471	1419	1259	1466	1398	1081	1456	1373	881	1426	1318	541	1399	1316	416
Air-flow	V	[m^3/h]	0	914	1648	0	818	1275	0	728	1128	0	614	845	0	350	557
Static pressure	Δp_s	[Pa]	277	288	55	273	280	75	269	270	70	260	244	25	250	231	0
Total pressure	Δp_t	[Pa]	277	290	63	273	282	80	269	272	73	260	245	27	250	231	1



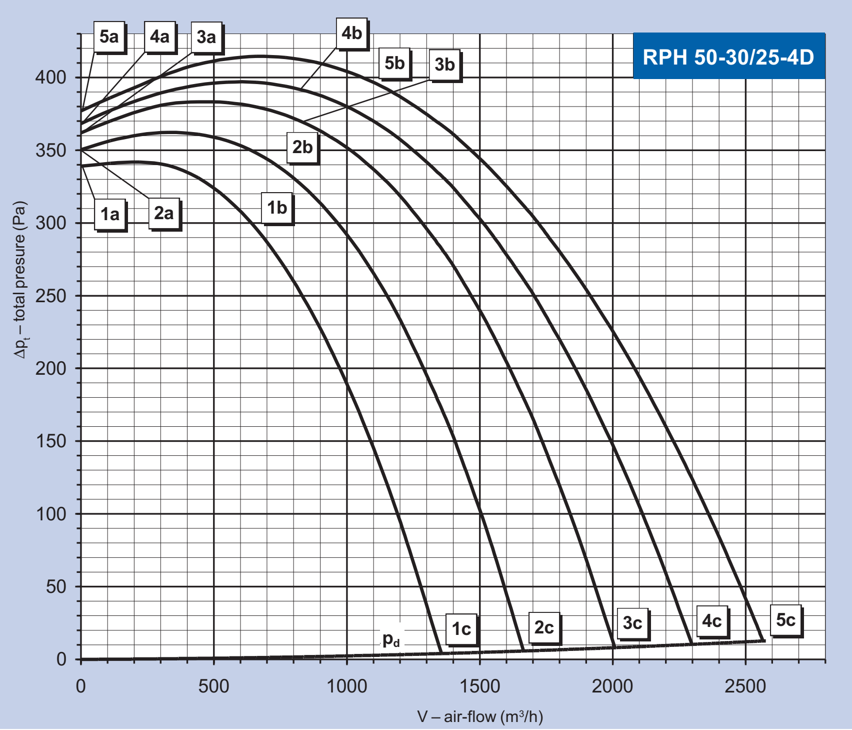
RPH 50-30/25-6D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	356
Current max.	I_{max}	[A]	0,69
Speed average	n	[min^{-1}]	940
Condenser	C	[μF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	1811
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	163
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	49
Five-speed controller		type	TRN 2D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	65	68	34
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	62	55	31
250 Hz	54	56	30
500 Hz	54	61	18
1000 Hz	55	63	7
2000 Hz	57	62	0
4000 Hz	54	59	0
8000 Hz	43	48	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,42	0,45	0,69	0,30	0,36	0,65	0,25	0,33	0,57	0,21	0,25	0,47	0,21	0,24	0,38
Electric input	P	[W]	76	133	356	49	104	223	42	88	157	37	51	98	33	41	59
Speed	n	[min^{-1}]	977	943	770	959	891	593	942	844	481	912	861	377	840	772	306
Air-flow	V	[m^3/h]	0	776	1811	0	731	1334	0	652	1073	0	324	817	0	259	627
Static pressure	Δp_s	[Pa]	163	160	0	156	144	0	149	129	0	141	132	0	124	103	0
Total pressure	Δp_t	[Pa]	163	161	3	156	145	2	149	129	1	141	132	1	124	103	0

[1)] Value calculated according to the methodology see Fan Parameters - Data part page 7

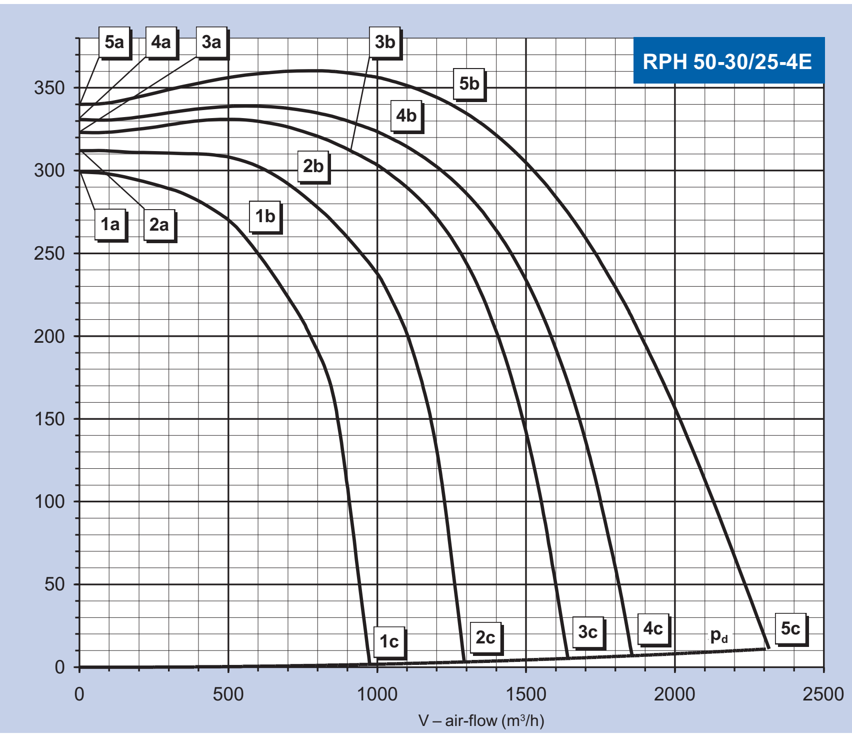


RPH 50-30/25-4D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	1004
Current max.	I_{max}	[A]	1,97
Speed average	n	[min^{-1}]	1450
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	50
Air-flow max.	V_{max}	[m^3/h]	2576
Total pressure max.	$\Delta p_{t\ max.}$	[Pa]	414
Static pressure min.	$\Delta p_{s\ min.}$	[Pa]	0
Weight.	m	[kg]	52
Five-speed controller		type	TRN 2D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	74	79	44
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	67	63	42
250 Hz	65	67	38
500 Hz	63	71	27
1000 Hz	67	74	18
2000 Hz	68	73	7
4000 Hz	65	71	0
8000 Hz	57	61	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,30	1,37	1,97	0,72	0,88	1,92	0,60	0,89	2,10	0,52	0,90	1,99	0,49	0,93	1,77
Electric input	P	[W]	223	441	1004	133	271	803	120	268	700	114	246	519	97	205	358
Speed	n	[min^{-1}]	1479	1454	1362	1469	1417	1216	1457	1387	1096	1434	1336	904	1390	1277	731
Air-flow	V	[m^3/h]	0	1110	2576	0	804	2306	0	828	2011	0	774	1666	0	679	1363
Static pressure	Δp_s	[Pa]	377	391	0	368	393	0	362	374	0	350	337	0	339	292	0
Total pressure	Δp_t	[Pa]	377	394	13	368	395	10	362	375	8	350	339	6	339	293	4



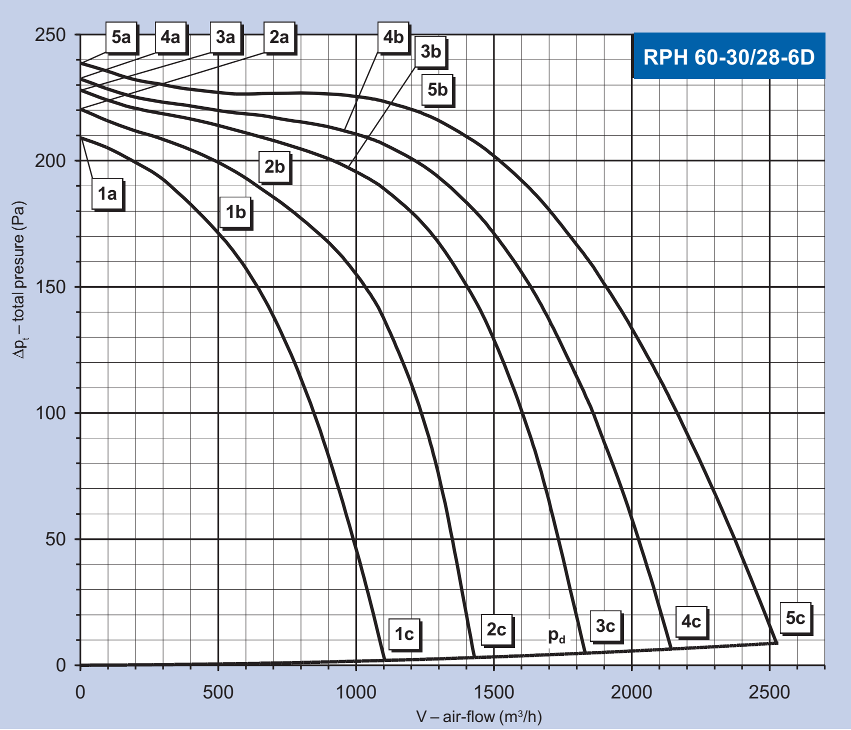
RPH 50-30/25-4E

Connection	Y		230V 50Hz
Electric input max.	P_{max}	[W]	831
Current max.	I_{max}	[A]	3,68
Speed average	n	[min^{-1}]	1380
Condenser	C	[µF]	14
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	2305
Total pressure max.	$\Delta p_{t\ max.}$	[Pa]	360
Static pressure min.	$\Delta p_{s\ min.}$	[Pa]	0
Weight.	m	[kg]	53
Five-speed controller		type	TRN 4E
Five-speed controller		type	STE

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	75	81	45
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	66	64	43
250 Hz	66	67	39
500 Hz	65	73	27
1000 Hz	68	77	17
2000 Hz	69	74	4
4000 Hz	67	72	0
8000 Hz	58	62	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		230			180			160			130			105	
Current	I	[A]	1,23	1,94	3,68	1,11	1,87	3,64	1,09	1,76	3,51	1,02	1,62	3,07	0,98	1,55	2,64
Electric input	P	[W]	270	444	831	199	339	632	174	286	539	135	215	381	107	167	262
Speed	n	[min^{-1}]	1453	1382	1162	1436	1336	943	1424	1319	830	1402	1276	664	1368	1205	508
Air-flow	V	[m^3/h]	0	1230	2305	0	1041	1854	0	915	1638	0	722	1289	0	585	974
Static pressure	Δp_s	[Pa]	340	338	0	331	320	0	323	308	0	312	286	0	299	253	0
Total pressure	Δp_t	[Pa]	340	341	11	331	322	7	323	310	5	312	287	3	299	254	2

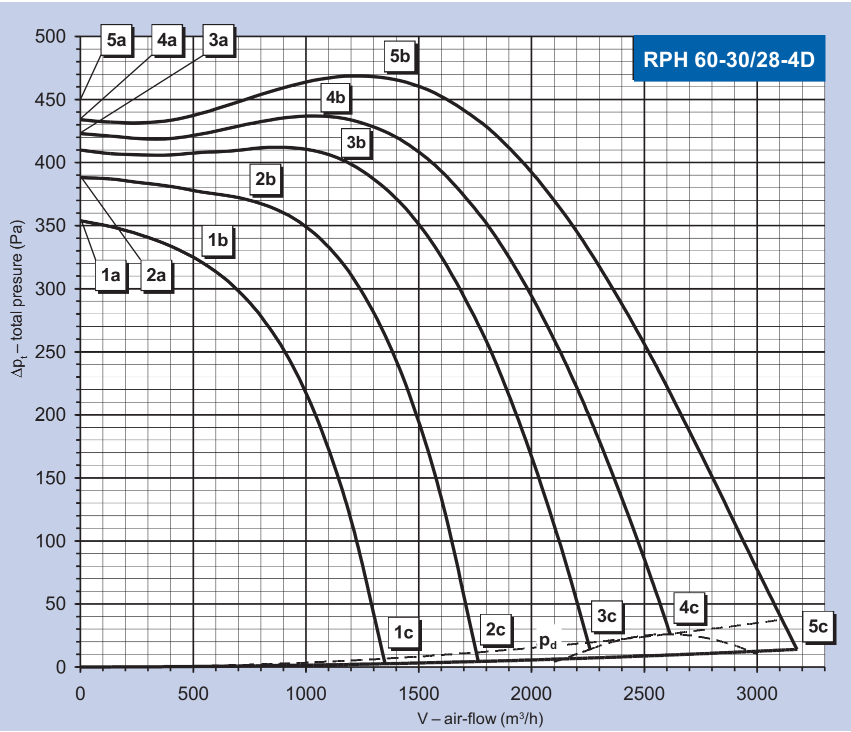
[1] Value calculated according to the methodology see Fan Parameters - Data part page 7



RPH 60-30/28-6D			
Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	575
Current max.	I_{max}	[A]	1,28
Speed average	n	[min^{-1}]	960
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	2531
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	239
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	62
Five-speed controller		type	TRN 2D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	69	73	44
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	64	61	43
250 Hz	60	62	35
500 Hz	62	68	23
1000 Hz	60	68	9
2000 Hz	60	65	0
4000 Hz	59	64	0
8000 Hz	48	53	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,88	0,94	1,28	0,58	0,67	1,24	0,49	0,65	1,26	0,41	0,52	1,11	0,36	0,52	0,94
Electric input	P	[W]	145	267	575	82	178	445	79	172	355	70	113	237	50	88	145
Speed	n	[min^{-1}]	985	959	892	977	938	777	964	905	650	941	892	510	928	844	397
Air-flow	V	[m^3/h]	0	1218	2531	0	966	2146	0	990	1827	0	647	1428	0	492	1106
Static pressure	Δp_s	[Pa]	239	218	0	232	211	0	228	198	0	220	188	0	209	172	0
Total pressure	Δp_t	[Pa]	239	220	9	232	212	6	228	199	5	220	189	3	209	172	2

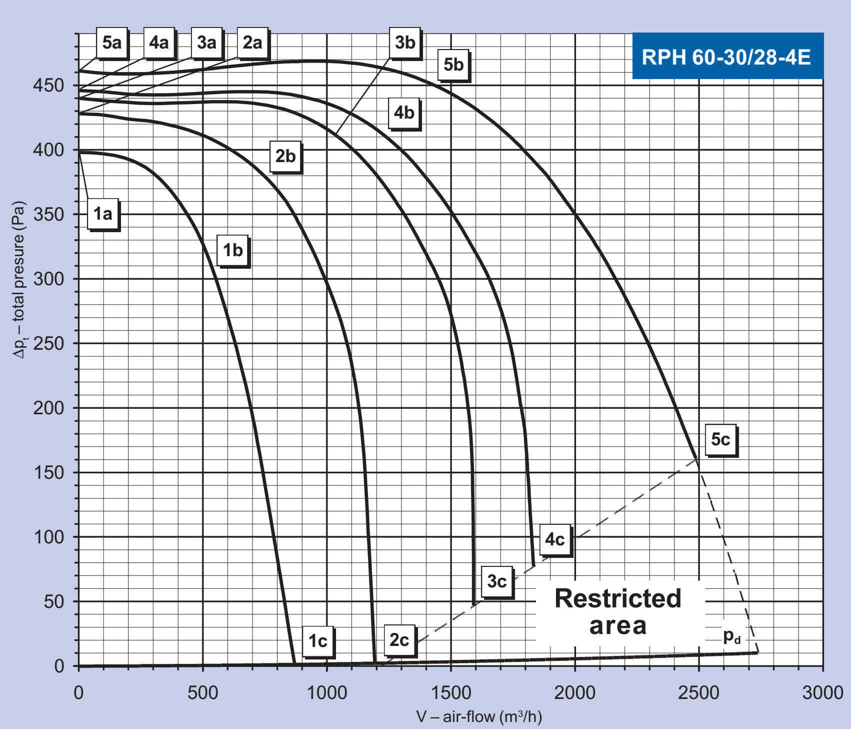


RP 60-30/28-4D			
Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	1397
Current max.	I_{max}	[A]	2,38
Speed average	n	[min^{-1}]	1450
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	3178
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	469
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	68
Five-speed controller		type	TRN 4D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	78	83	46
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	70	70	45
250 Hz	68	70	40
500 Hz	67	75	28
1000 Hz	72	78	19
2000 Hz	72	77	7
4000 Hz	69	75	0
8000 Hz	61	65	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,04	1,20	2,38	0,69	0,98	2,60	0,62	1,07	2,60	0,62	1,02	2,43	0,66	0,94	2,06
Electric input	P	[W]	267	512	1397	201	380	1088	181	372	870	161	285	612	142	206	393
Speed	n	[min^{-1}]	1483	1448	1307	1461	1409	1105	1438	1346	938	1404	1301	736	1344	1246	568
Air-flow	V	[m^3/h]	0	1330	3178	0	1083	2614	0	1162	2260	0	850	1766	0	552	1348
Static pressure	Δp_s	[Pa]	434	467	0	423	433	16	410	401	7	388	361	0	354	318	0
Total pressure	Δp_t	[Pa]	434	469	14	423	435	26	410	403	14	388	362	4	354	318	3

1) Value calculated according to the methodology see Fan Parameters - Data part page 7

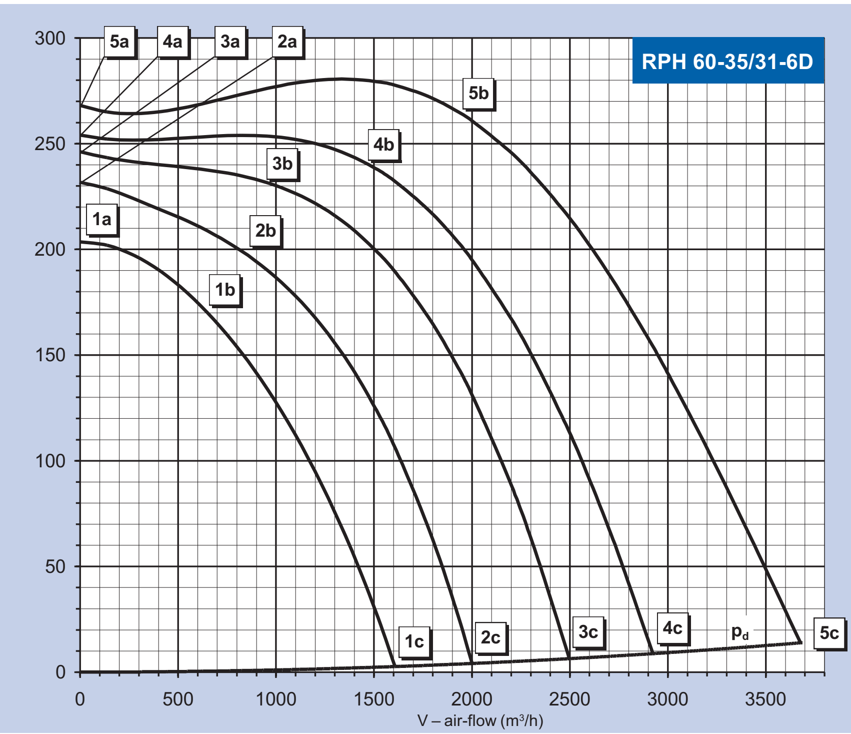


RPH 60-30/28-4E

Connection	Y		230V 50Hz
Electric input max.	P_{max}	[W]	1046
Current max.	I_{max}	[A]	5,10
Speed average	n	[min^{-1}]	1400
Condenser	C	[µF]	16
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	2496
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	469
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	152
Weight.	m	[kg]	68
Five-speed controller		type	TRN 7E
Five-speed controller		type	STE

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	77	83	49
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	71	70	47
250 Hz	68	72	43
500 Hz	67	75	29
1000 Hz	69	78	17
2000 Hz	71	77	6
4000 Hz	67	74	0
8000 Hz	59	65	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	230			180			160			130			105		
Current	I	[A]	2,08	2,96	5,10	1,42	2,66	5,10	1,43	2,52	5,10	1,40	2,38	4,30	1,49	2,43	3,48
Electric input	P	[W]	345	603	1046	247	452	775	225	389	681	185	294	457	158	234	294
Speed	n	[min^{-1}]	1465	1400	1237	1453	1353	898	1446	1345	760	1422	1288	499	1372	1157	385
Air-flow	V	[m^3/h]	0	1465	2496	0	1222	1834	0	1054	1592	0	786	1218	0	584	882
Static pressure	Δp_s	[Pa]	461	439	152	446	411	72	440	406	43	428	369	0	398	294	0
Total pressure	Δp_t	[Pa]	461	442	161	446	413	77	440	408	47	428	370	2	398	294	1



RPH 60-35/31-6D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	948
Current max.	I_{max}	[A]	1,86
Speed average	n	[min^{-1}]	910
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	3687
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	281
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	72
Five-speed controller		type	TRN 2D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	70	75	45
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	65	62	44
250 Hz	60	65	35
500 Hz	61	69	24
1000 Hz	62	69	11
2000 Hz	62	68	0
4000 Hz	61	67	0
8000 Hz	49	54	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]	400			280			230			180			140		
Current	I	[A]	1,30	1,36	1,86	0,68	0,87	1,56	0,56	0,68	1,42	0,46	0,64	1,23	0,44	0,60	1,02
Electric input	P	[W]	226	476	948	120	287	606	109	186	457	87	152	302	69	110	194
Speed	n	[min^{-1}]	977	908	754	959	866	609	940	878	532	909	808	429	866	755	355
Air-flow	V	[m^3/h]	0	1946	3687	0	1470	2932	0	930	2494	0	873	2000	0	688	1603
Static pressure	Δp_s	[Pa]	268	260	0	254	235	0	246	233	0	232	198	0	204	169	0
Total pressure	Δp_t	[Pa]	268	264	14	254	237	9	246	234	6	232	199	4	204	169	3

[1)] Value calculated according to the methodology see Fan Parameters - Data part page 7

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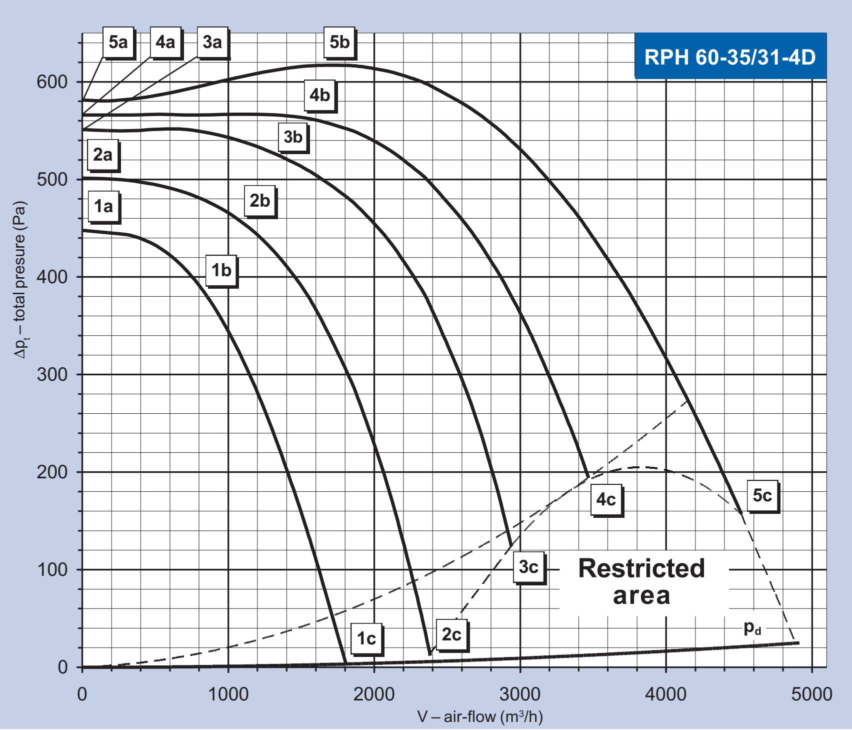
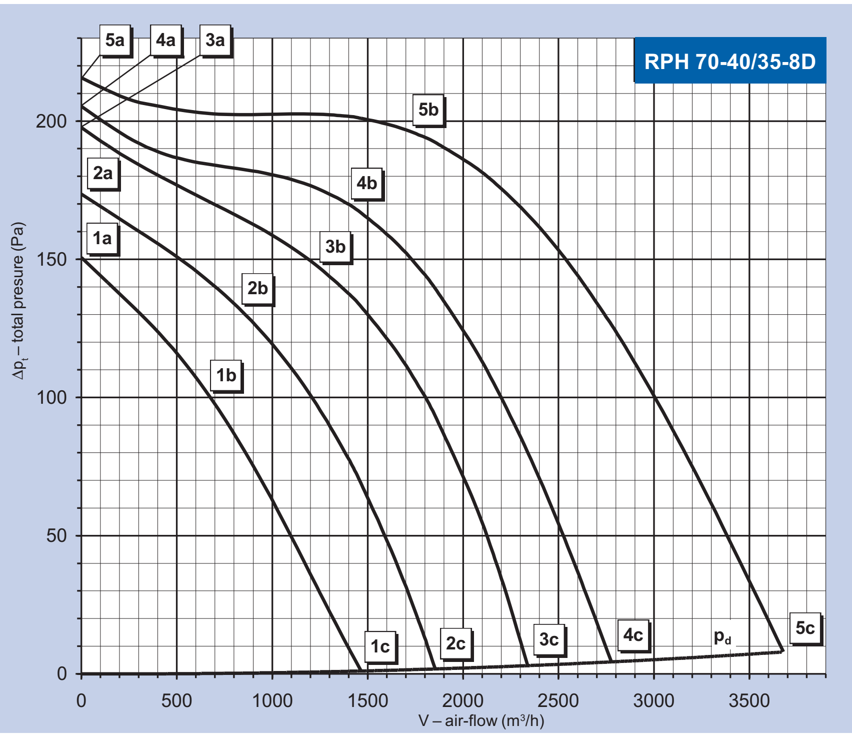


RPH 60-35/31-4D

Connection	Y		3x400V 50Hz
Electric input max.	P_{max}	[W]	2464
Current max.	I_{max}	[A]	4,10
Speed average	n	[min^{-1}]	1440
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	4512
Total pressure max.	$\Delta p_{t\ max.}$	[Pa]	617
Static pressure min.	$\Delta p_{s\ min.}$	[Pa]	136
Weight.	m	[kg]	80
Five-speed controller		type	TRN 7D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	78	83	53
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	72	69	53
250 Hz	67	70	40
500 Hz	67	74	30
1000 Hz	71	78	19
2000 Hz	71	77	8
4000 Hz	69	76	0
8000 Hz	60	66	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,41	1,72	4,10	1,04	1,62	4,10	1,06	1,62	4,10	1,07	1,73	4,10	1,13	1,77	3,39
Electric input	P	[W]	503	832	2464	351	666	1730	343	563	1374	295	484	1007	252	382	629
Speed	n	[min^{-1}]	1474	1440	1252	1445	1383	1083	1418	1346	912	1381	1270	603	1321	1164	461
Air-flow	V	[m^3/h]	0	1754	4512	0	1533	3498	0	1324	2937	0	1064	2372	0	852	1808
Static pressure	Δp_s	[Pa]	581	614	136	566	561	182	551	524	115	501	460	6	448	383	0
Total pressure	Δp_t	[Pa]	581	617	157	566	563	194	551	526	124	501	461	12	448	384	3



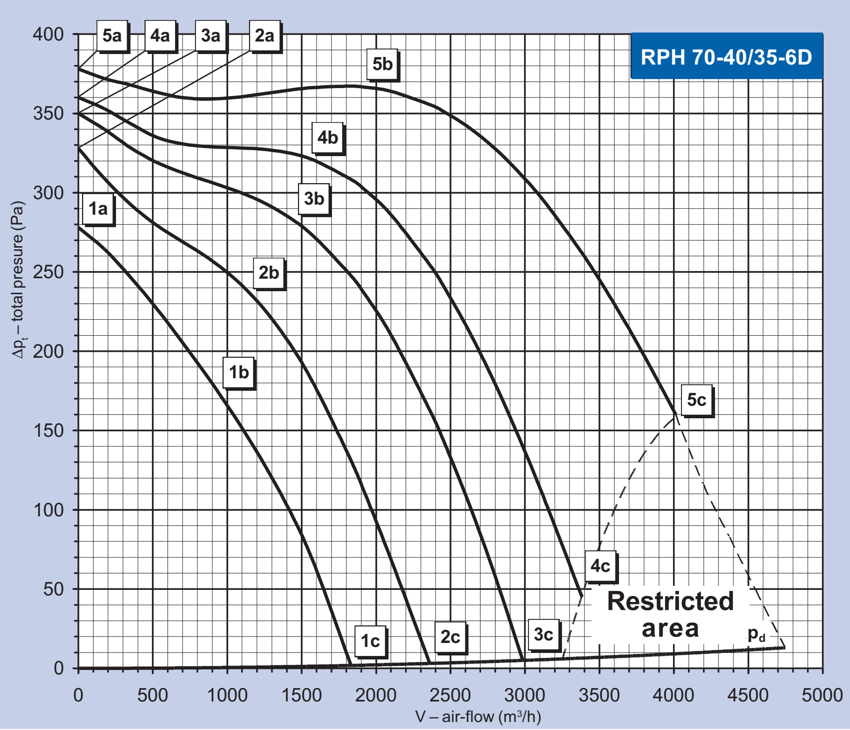
RPH 70-40/35-8D

Connection	Y		3x400V 50Hz
Electric input max.	P_{max}	[W]	642
Current max.	I_{max}	[A]	1,38
Speed average	n	[min^{-1}]	670
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	3669
Total pressure max.	$\Delta p_{t\ max.}$	[Pa]	216
Static pressure min.	$\Delta p_{s\ min.}$	[Pa]	0
Weight.	m	[kg]	93
Five-speed controller		type	TRN 2D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	68	72	45
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	65	64	45
250 Hz	57	63	32
500 Hz	57	66	20
1000 Hz	59	65	6
2000 Hz	59	64	0
4000 Hz	58	63	0
8000 Hz	44	50	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,90	0,97	1,38	0,57	0,71	1,15	0,48	0,64	1,00	0,41	0,53	0,83	0,37	0,49	0,68
Electric input	P	[W]	166	318	642	100	205	390	84	167	277	71	111	179	60	84	113
Speed	n	[min^{-1}]	725	673	532	706	631	406	689	592	351	657	573	278	605	495	223
Air-flow	V	[m^3/h]	0	1815	3669	0	1404	2783	0	1252	2330	0	840	1850	0	697	1468
Static pressure	Δp_s	[Pa]	216	191	0	205	166	0	198	147	0	174	130	0	151	97	0
Total pressure	Δp_t	[Pa]	216	193	8	205	167	4	198	148	3	174	130	2	151	97	1

[1] Value calculated according to the methodology see Fan Parameters - Data part page 7

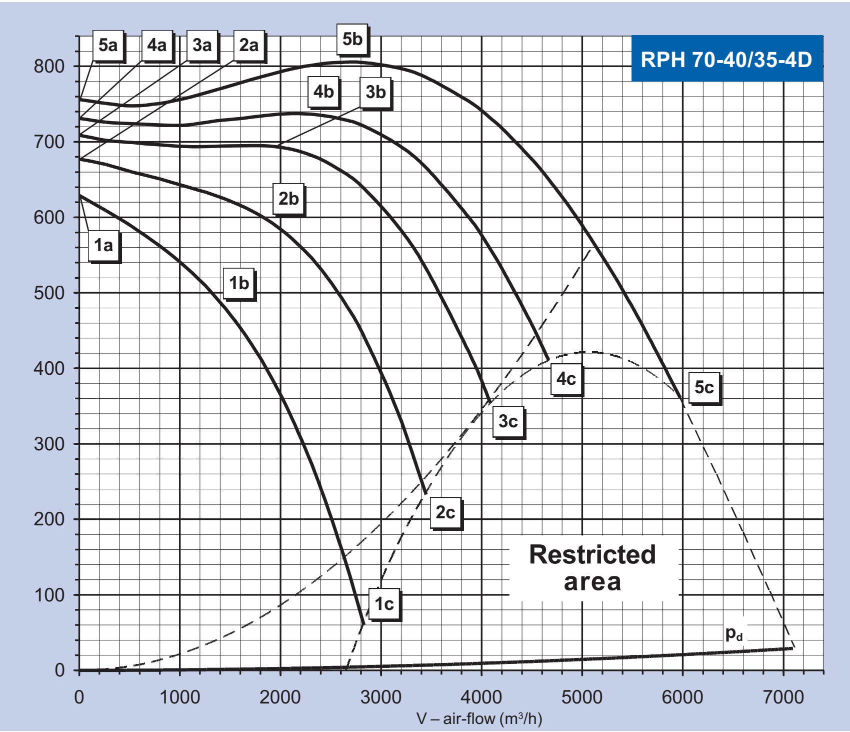


RPH 70-40/35-6D

Connection	Y		3x400V 50Hz
Electric input max.	P_{max}	[W]	1096
Current max.	I_{max}	[A]	2,00
Speed average	n	[min^{-1}]	920
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	4032
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	378
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	151
Weight.	m	[kg]	92
Five-speed controller		type	TRN 4D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	73	79	47
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	68	70	46
250 Hz	64	69	37
500 Hz	63	73	27
1000 Hz	66	73	15
2000 Hz	64	71	5
4000 Hz	63	69	0
8000 Hz	52	58	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,98	1,19	2,00	0,67	0,97	2,00	0,60	0,99	1,92	0,56	0,93	1,60	0,57	0,91	1,29
Electric input	P	[W]	206	500	1096	153	350	784	138	316	600	127	239	392	112	182	243
Speed	n	[min^{-1}]	977	922	779	954	872	566	935	813	424	896	756	354	835	644	285
Air-flow	V	[m^3/h]	0	1992	4032	0	1540	3366	0	1486	2995	0	1167	2384	0	992	1835
Static pressure	Δp_s	[Pa]	378	367	151	360	319	39	350	279	0	328	234	0	278	167	0
Total pressure	Δp_t	[Pa]	378	369	160	360	320	45	350	280	5	328	235	3	278	168	2



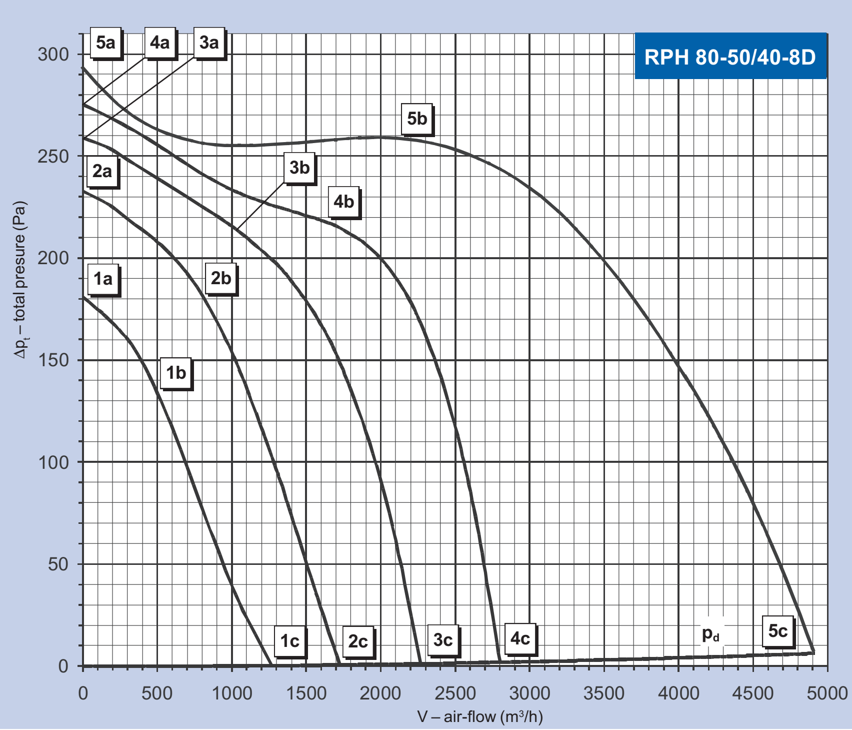
RPH 70-40/35-4D

Connection	Y		3x400V 50Hz
Electric input max.	P_{max}	[W]	3527
Current max.	I_{max}	[A]	6,00
Speed average	n	[min^{-1}]	1440
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	5981
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	806
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	340
Weight.	m	[kg]	110
Five-speed controller		type	TRN 7D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	84	90	57
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	77	79	56
250 Hz	75	78	47
500 Hz	74	83	37
1000 Hz	78	85	25
2000 Hz	78	83	12
4000 Hz	74	81	0
8000 Hz	64	70	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,98	2,67	6,00	1,54	2,61	6,00	1,41	2,68	6,00	1,84	3,34	6,00	1,98	3,27	5,73
Electric input	P	[W]	442	1231	3527	483	1065	2522	410	931	2028	503	924	1520	437	697	1055
Speed	n	[min^{-1}]	1478	1442	1312	1457	1397	1189	1441	1355	1083	1387	1244	891	1327	1157	598
Air-flow	V	[m^3/h]	0	2577	5981	0	2148	4675	0	1979	4136	0	1977	3435	0	1410	2817
Static pressure	Δp_s	[Pa]	756	804	340	731	741	399	709	688	332	677	588	226	629	485	56
Total pressure	Δp_t	[Pa]	756	806	361	731	744	411	709	690	342	677	590	233	629	486	60

[1)] Value calculated according to the methodology see Fan Parameters - Data part page 7

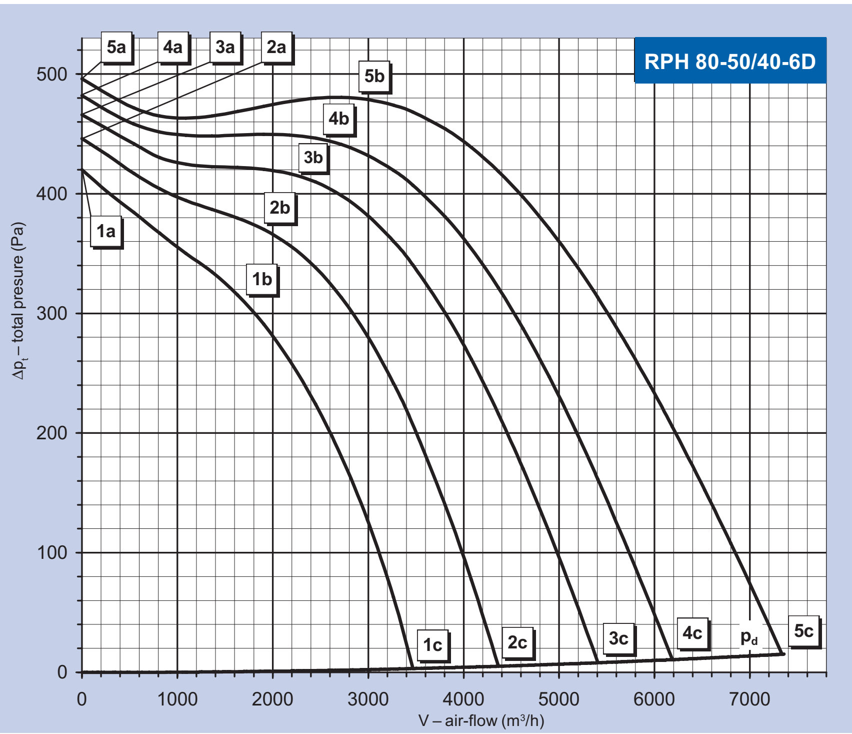


RPH 80-50/40-8D

Connection	Y		3x400V 50Hz
Electric input max.	P_{max}	[W]	1230
Current max.	I_{max}	[A]	2,29
Speed average	n	[min^{-1}]	700
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	4720
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	298
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	118
Five-speed controller		type	TRN 4D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	69	74	45
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	62	61	44
250 Hz	60	63	35
500 Hz	59	68	22
1000 Hz	62	68	9
2000 Hz	62	68	0
4000 Hz	60	65	0
8000 Hz	48	52	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,88	1,05	2,29	0,56	0,85	1,80	0,53	0,72	1,52	0,54	0,70	1,24	0,62	0,72	1,00
Electric input	P	[W]	239	476	1230	159	321	646	147	226	438	136	180	271	115	132	158
Speed	n	[min^{-1}]	736	698	478	713	646	291	696	646	234	658	604	183	578	510	147
Air-flow	V	[m^3/h]	0	2145	4720	0	1652	2800	0	1083	2259	0	802	1737	0	558	1343
Static pressure	Δp_s	[Pa]	298	256	0	275	216	0	259	208	0	233	180	0	181	129	0
Total pressure	Δp_t	[Pa]	298	257	6	275	217	2	259	208	1	233	180	1	181	129	0



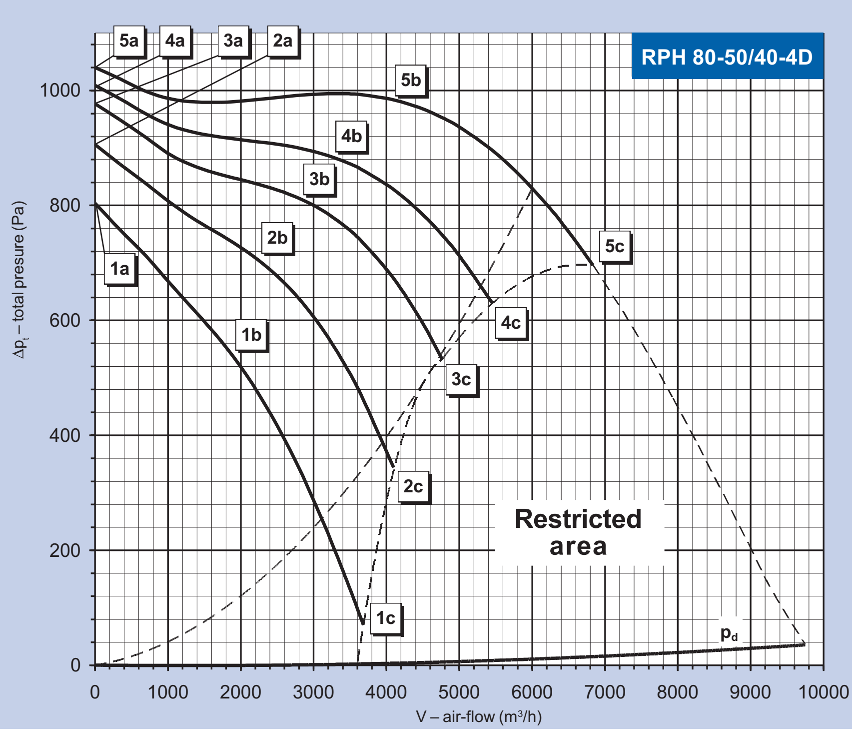
RPH 80-50/40-6D

Connection	Y		3x400V 50Hz
Electric input max.	P_{max}	[W]	2824
Current max.	I_{max}	[A]	5,11
Speed average	n	[min^{-1}]	960
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	50
Air-flow max.	V_{max}	[m^3/h]	7357
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	496
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	132
Five-speed controller		type	TRN 7D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	77	81	48
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	70	68	48
250 Hz	66	68	37
500 Hz	69	75	24
1000 Hz	71	75	13
2000 Hz	70	74	8
4000 Hz	67	72	0
8000 Hz	58	61	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,17	2,58	5,11	1,43	2,08	4,99	1,22	2,03	4,90	1,11	2,00	4,40	1,08	2,10	3,80
Electric input	P	[W]	441	1013	2824	276	724	1957	264	633	1556	229	512	1044	201	421	678
Speed	n	[min^{-1}]	992	960	835	980	928	710	967	899	621	948	853	507	917	774	409
Air-flow	V	[m^3/h]	0	2918	7357	0	2518	6207	0	2255	5393	0	1943	4364	0	1767	3462
Static pressure	Δp_s	[Pa]	496	479	0	482	447	0	466	415	0	446	368	0	420	304	0
Total pressure	Δp_t	[Pa]	496	481	15	482	449	11	466	416	8	446	369	5	420	305	3

[1] Value calculated according to the methodology see Fan Parameters - Data part page 7

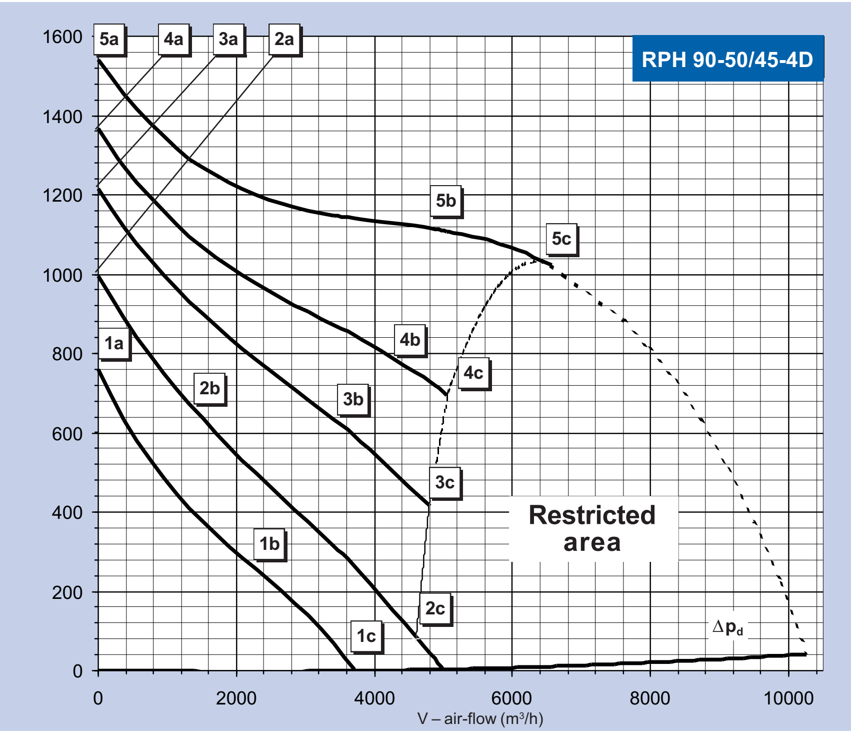


RPH 80-50/40-4D

Connection	Y		3x400V 50Hz
Electric input max.	P_{max}	[W]	4919
Current max.	I_{max}	[A]	8,10
Speed average	n	[min^{-1}]	1410
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	40
Air-flow max.	V_{max}	[m^3/h]	6831
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	1040
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	683
Weight.	m	[kg]	139
Five-speed controller		type	TRN 9D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	88	92	57
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	81	76	57
250 Hz	74	78	46
500 Hz	74	83	34
1000 Hz	83	88	25
2000 Hz	82	86	14
4000 Hz	78	84	0
8000 Hz	70	73	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	3,00	5,01	8,10	2,38	4,91	8,10	2,33	4,93	8,10	2,54	4,88	8,10	2,96	5,21	8,10
Electric input	P	[W]	1217	2915	4919	903	2143	3498	782	1770	2800	721	1379	2117	671	1110	1516
Speed	n	[min^{-1}]	1480	1414	1322	1452	1348	1195	1427	1293	1088	1380	1214	890	1298	1055	548
Air-flow	V	[m^3/h]	0	4135	6831	0	3307	5456	0	2894	4763	0	2306	4109	0	1957	3673
Static pressure	Δp_s	[Pa]	1040	982	683	1009	885	621	977	808	525	906	692	339	804	520	67
Total pressure	Δp_t	[Pa]	1040	987	696	1009	888	630	977	810	532	906	693	344	804	521	70



RPH 90-50/45-4D

Connection	D		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	4919
Current max.	I_{max}	[A]	8,30
Speed average	n	[min^{-1}]	1260
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	6558
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	1541
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	1014
Weight.	m	[kg]	168
Five-speed controller		type	TRN 9D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	88	95	58
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	74	75	58
250 Hz	73	80	48
500 Hz	78	88	38
1000 Hz	83	91	27
2000 Hz	83	90	16
4000 Hz	79	85	0
8000 Hz	71	76	0

Parameters of selected operating [1]			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	3,74	7,20	8,30	3,44	7,41	8,30	3,65	6,97	8,30	4,07	5,07	8,17	4,11	5,50	6,32
Electric input	P	[W]	1993	4269	4919	1402	3055	3367	1259	2318	2718	1073	1330	1927	829	1041	1119
Speed	n	[min^{-1}]	1396	1259	1211	1343	1069	997	1280	957	800	1137	1009	376	978	623	285
Air-flow	V	[m^3/h]	0	5512	6558	0	4398	5055	0	3583	4805	0	1543	4986	0	2286	3707
Static pressure	Δp_s	[Pa]	1541	1089	1014	1367	787	693	1216	617	435	994	652	0	758	257	0
Total pressure	Δp_t	[Pa]	1541	1096	1023	1367	791	699	1216	619	440	994	652	5	758	258	3

[1] Value calculated according to the methodology see Fan Parameters - Data part page 7

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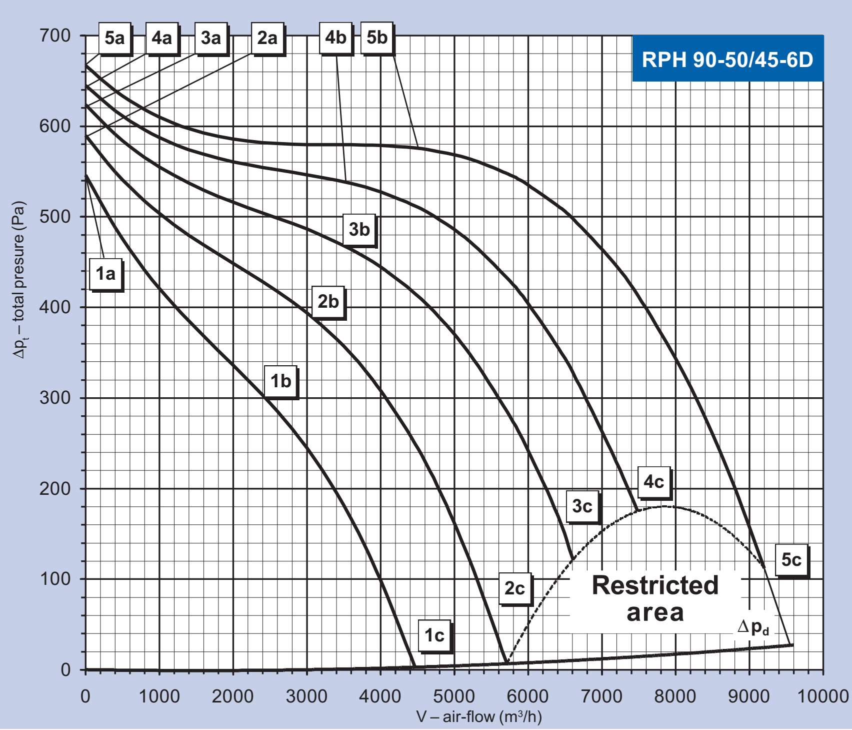
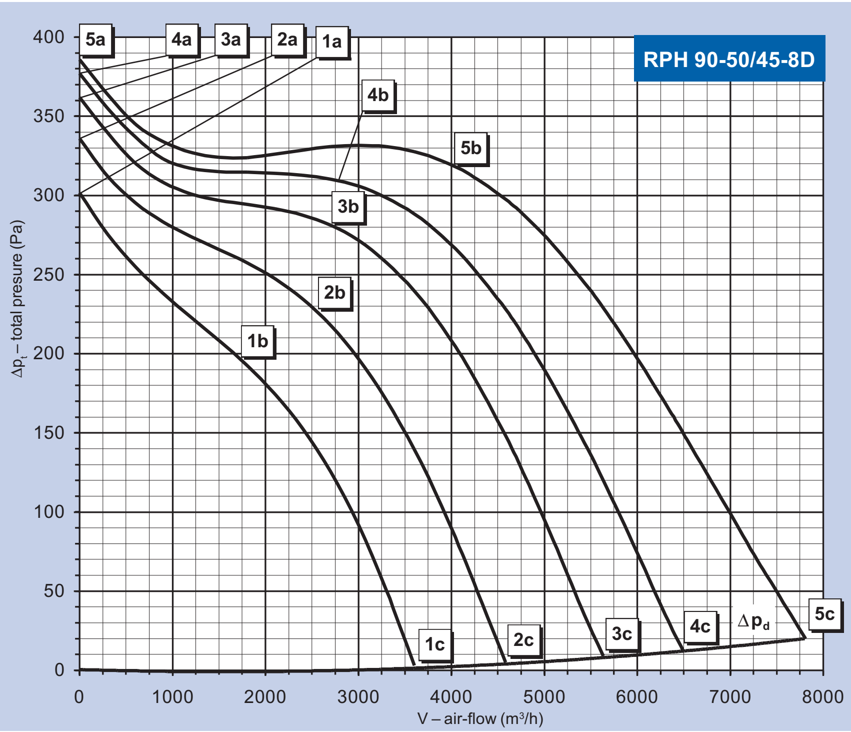


RPH 90-50/45-6D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	3780
Current max.	I_{max}	[A]	6,80
Speed average	n	[min^{-1}]	930
Condenser	C	[μF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	9200
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	667
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	90
Weight.	m	[kg]	168
Five-speed controller		type	TRN 7D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	81	88	48
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	65	66	47
250 Hz	65	72	39
500 Hz	74	83	28
1000 Hz	75	82	15
2000 Hz	76	82	4
4000 Hz	72	78	0
8000 Hz	64	68	0

Parameters of selected operating [1]			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,96	3,87	6,80	2,15	3,45	6,80	1,99	3,75	6,80	1,98	3,86	6,66	2,03	3,74	5,59
Electric input	P	[W]	665	1757	3780	564	1315	2785	518	1242	2271	476	1025	1640	415	760	1040
Speed	n	[min^{-1}]	968	926	832	948	879	713	931	825	621	899	749	443	846	659	351
Air-flow	V	[m^3/h]	0	4463	9200	0	3575	7483	0	3503	6609	0	3154	5712	0	2550	4462
Static pressure	Δp_s	[Pa]	667	574	90	645	541	163	624	467	111	590	381	0	546	295	0
Total pressure	Δp_t	[Pa]	667	578	112	645	544	175	624	470	121	590	383	7	546	296	4



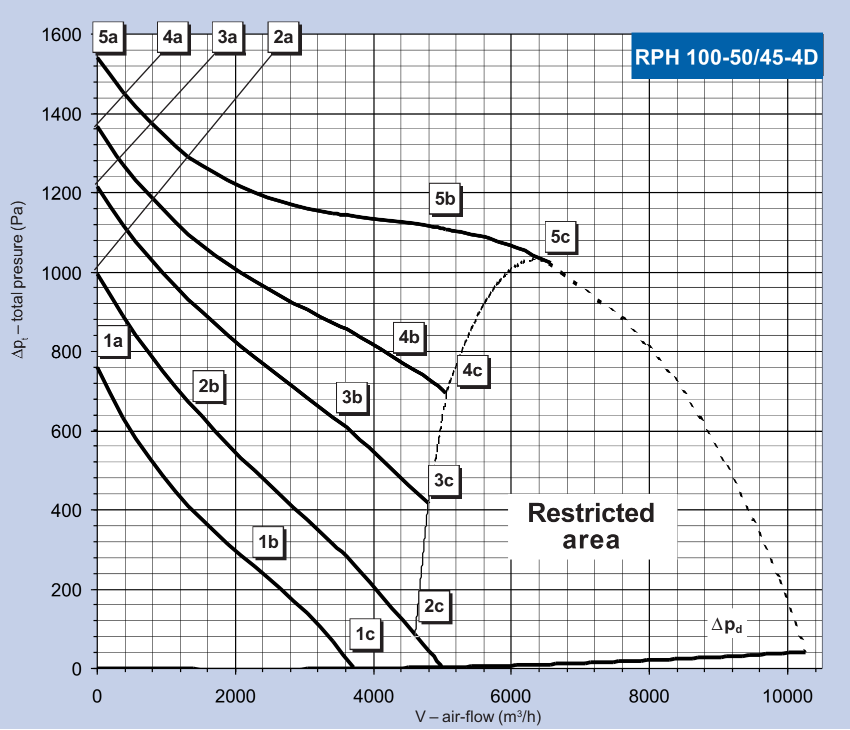
RP 90-50/45-8D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	1892
Current max.	I_{max}	[A]	3,88
Speed average	n	[min^{-1}]	690
Condenser	C	[μF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	7810
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	386
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	165
Five-speed controller		type	TRN 4D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	74	81	41
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	59	58	40
250 Hz	61	69	34
500 Hz	68	77	23
1000 Hz	64	74	8
2000 Hz	69	75	0
4000 Hz	65	71	0
8000 Hz	55	61	0

Parameters of selected operating [1]			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,20	2,49	3,88	1,54	2,03	3,78	1,32	1,87	3,61	1,14	1,92	3,20	1,08	1,67	2,73
Electric input	P	[W]	350	813	1892	264	624	1398	222	518	1081	196	455	733	178	311	477
Speed	n	[min^{-1}]	725	694	610	715	661	505	704	641	434	683	577	349	646	543	277
Air-flow	V	[m^3/h]	0	3522	7810	0	2951	6493	0	2529	5632	0	2474	4581	0	1675	3603
Static pressure	Δp_s	[Pa]	386	328	0	377	307	0	362	284	0	336	230	0	302	195	0
Total pressure	Δp_t	[Pa]	386	329	20	377	309	12	362	286	9	336	232	5	302	195	3

[1] Value calculated according to the methodology see Fan Parameters - Data part page 7

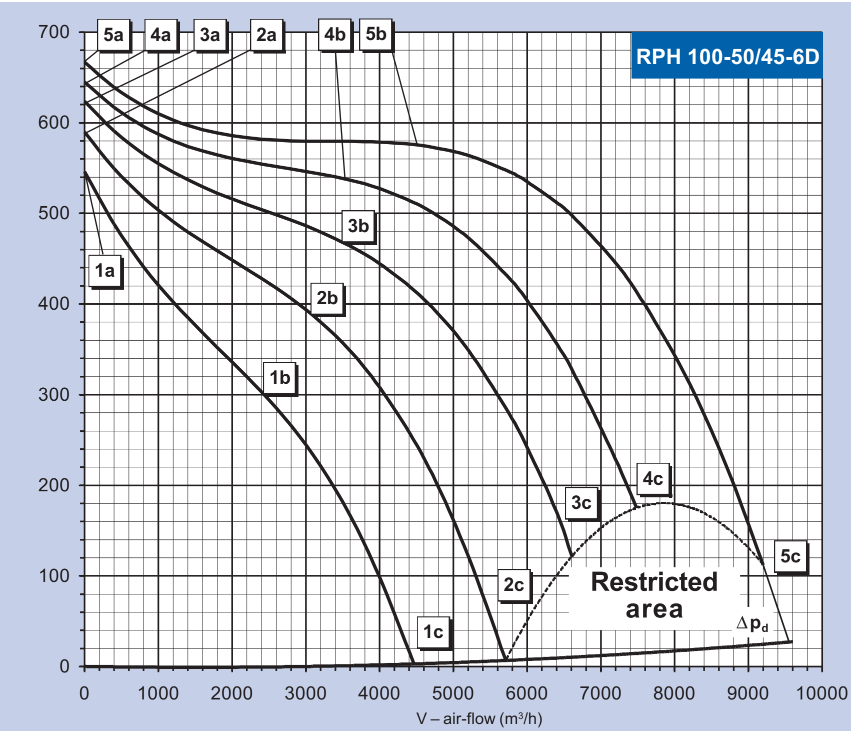


RPH 100-50/45-4D

Connection	D		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	4919
Current max.	I_{max}	[A]	8,30
Speed average	n	[min^{-1}]	1260
Condenser	C	[μF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	6558
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	1541
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	1014
Weight.	m	[kg]	177
Five-speed controller		type	TRN 9D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	88	95	58
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	74	75	58
250 Hz	73	80	48
500 Hz	78	88	38
1000 Hz	83	91	27
2000 Hz	83	90	16
4000 Hz	79	85	0
8000 Hz	71	76	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	3,74	7,20	8,30	3,44	7,41	8,30	3,65	6,97	8,30	4,07	5,07	8,17	4,11	5,50	6,32
Electric input	P	[W]	1993	4269	4919	1402	3055	3367	1259	2318	2718	1073	1330	1927	829	1041	1119
Speed	n	[min^{-1}]	1396	1259	1211	1343	1069	997	1280	957	800	1137	1009	376	978	623	285
Air-flow	V	[m^3/h]	0	5512	6558	0	4398	5055	0	3583	4805	0	1543	4986	0	2286	3707
Static pressure	Δp_s	[Pa]	1541	1089	1014	1367	787	693	1216	617	435	994	652	0	758	257	0
Total pressure	Δp_t	[Pa]	1541	1096	1023	1367	791	699	1216	619	440	994	652	5	758	258	3



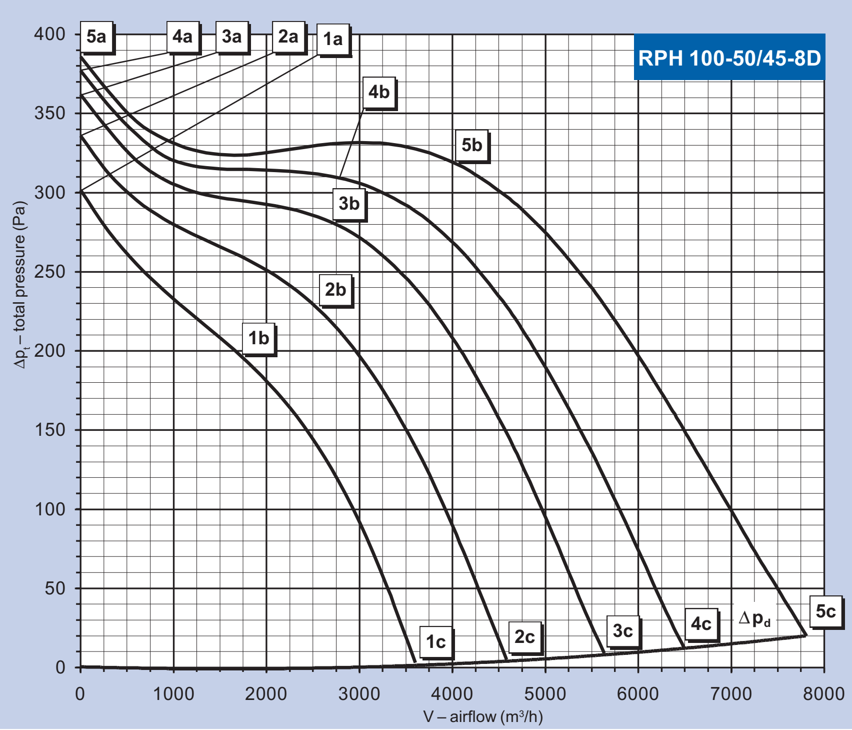
RPH 100-50/45-6D

Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	3780
Current max.	I_{max}	[A]	6,80
Speed average	n	[min^{-1}]	930
Condenser	C	[μF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	9200
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	667
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	90
Weight.	m	[kg]	177
Five-speed controller		type	TRN 7D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout
Point	5b	5b	5b
Total sound power level L_{WA} [dB(A)]			
L_{WA}	81	88	48
Sound power levels L_{WAokt} [dB(A)]			
125 Hz	65	66	47
250 Hz	65	72	39
500 Hz	74	83	28
1000 Hz	75	82	15
2000 Hz	76	82	4
4000 Hz	72	78	0
8000 Hz	64	68	0

Parameters of selected operating			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,96	3,87	6,80	2,15	3,45	6,80	1,99	3,75	6,80	1,98	3,86	6,66	2,03	3,74	5,59
Electric input	P	[W]	665	1757	3780	564	1315	2785	518	1242	2271	476	1025	1640	415	760	1040
Speed	n	[min^{-1}]	968	926	832	948	879	713	931	825	621	899	749	443	846	659	351
Air-flow	V	[m^3/h]	0	4463	9200	0	3575	7483	0	3503	6609	0	3154	5712	0	2550	4462
Static pressure	Δp_s	[Pa]	667	574	90	645	541	163	624	467	111	590	381	0	546	295	0
Total pressure	Δp_t	[Pa]	667	578	112	645	544	175	624	470	121	590	383	7	546	296	4

1) Value calculated according to the methodology see Fan Parameters - Data part page 7



RPH 100-50/45-8D			
Connection	Y		3 x 400V 50Hz
Electric input max.	P_{max}	[W]	1892
Current max.	I_{max}	[A]	3,88
Speed average	n	[min^{-1}]	690
Condenser	C	[µF]	-
Op. temperature max.	t_{max}	[°C]	55
Air-flow max.	V_{max}	[m^3/h]	7810
Total pressure max.	$\Delta p_{t\,max.}$	[Pa]	386
Static pressure min.	$\Delta p_{s\,min.}$	[Pa]	0
Weight.	m	[kg]	174
Five-speed controller		type	TRN 4D
Five-speed controller		type	STD

	Inlet	Outlet	Breakout [1]
Point	5b	5b	5b
Celková hladina akustického výkonu L_{WA} [dB(A)]			
L_{WA}	74	81	41
Hladiny akustického výkonu L_{WAokt} [dB(A)]			
125 Hz	59	58	40
250 Hz	61	69	34
500 Hz	68	77	23
1000 Hz	64	74	8
2000 Hz	69	75	0
4000 Hz	65	71	0
8000 Hz	55	61	0

Parameters of selected operating [1]			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,20	2,49	3,88	1,54	2,03	3,78	1,32	1,87	3,61	1,14	1,92	3,20	1,08	1,67	2,73
Electric input	P	[W]	350	813	1892	264	624	1398	222	518	1081	196	455	733	178	311	477
Speed	n	[min^{-1}]	725	694	610	715	661	505	704	641	434	683	577	349	646	543	277
Air-flow	V	[m^3/h]	0	3522	7810	0	2951	6493	0	2529	5632	0	2474	4581	0	1675	3603
Static pressure	Δp_s	[Pa]	386	328	0	377	307	0	362	284	0	336	230	0	302	195	0
Total pressure	Δp_t	[Pa]	386	329	20	377	309	12	362	286	9	336	232	5	302	195	3

1) Value calculated according to the methodology see Fan Parameters - Data part page 7

Installation

■ RPH fans are not intended to be sold directly to the final user due to their conception. Each installation must be carried out on the basis of professional planning by a qualified designer of air-handling equipment, who assumes responsibility, among other things, for the correct selection of the fan. The installation of the device and its putting in operation must be done only by a professional installation firm.

■ Before installing, it is necessary to carefully check the fan, especially if it has been stored for a longer period of time. Above all, it is necessary to check whether any of the components have been damaged, whether the insulation of the cables is in order and whether the rotating parts of the fan can rotate freely.

■ We recommend installing DV elastic connections with noise insulation in front of and behind the fan.

■ To protect the fan and duct against contamination and dust, it is expedient to always use a KFD or VFK air filter with a filtration insert.

■ Should the fan be so installed that people or objects might come in contact with the rotor, it is necessary to install a protective grating.

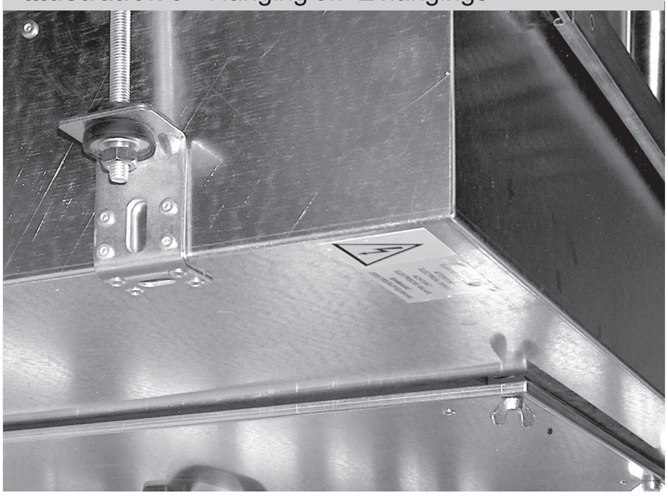
■ The fan must always be affixed to separate hangings so that it does not burden the attenuating inserts or the connected duct. The hangings must be insulated against noise and vibration (elastic attenuator).

■ As a suitable installation, an anchoring on the ceiling is recommended with the help of steel wall clamps and a hanging across so-called "Z hangings" with the appropriate load capacity (for example, ZZTP hangings with an integrated silent block and a load capacity of 80 kg) and their fixation with steel rivets - see illustration 5, or fixation on an auxiliary construction.

■ The airflow direction is indicated by an arrow located on the fan case.

■ RPH fans can operate only in a horizontal position. When located under the ceiling, it is expedient to install the fan with the motor's cup pointing downward in order to facilitate access to the terminal box and motor.

Illustration 5 – Hanging on "Z hangings



Installation, maintenance, service

In places where there is little room, it should be considered whether the duct adapting piece, the noise attenuator, the heat exchanger, the heater etc. have to be located immediately behind the fan's exhaust. The construction and arrangement of the fan's exhaust is similar to that of the RP fan. Only about 1 of the total exhaust cross-section is free out of the whole cross-section (500 x 250 for example).
That means that closely behind the fan, there are speeds in the free exhaust that are 4 times higher than, for example, in the intake. Thus the greater the distance of the attenuators (or of other resistances) from the exhaust is the better. (1 On the exhaust side, the DV elastic connection (noise-insulated) suffices in most cases as a sufficient distance.

Before installing, self-adhering sealings are to be affixed to the front connecting surface of the flange. The mounting of the flanges of the individual components of the Vento system is done by means of zinc-coated M8 nuts and bolts (M10 only on RPH 90-50 and RPH 100-50). It is necessary to secure bonding by means of fan-shaped rests from both sides on one flange connection.

For strengthening, it is favourable to connect flanges having a side longer than 40 cm in the middle with a screw clamp, which prevents the flange profile from opening.

Electric installation

Only someone who is certified according to the national regulations can do the electrical installation.

WAGO terminals are used, max. connecting cross-section 1.5 mm^2

Connection to the terminals is done according to the description on the cables of the electric motor in the terminal box or according to the description of the terminals, see illustration 7 on page 22.

To connect the electric motors of the fans, we recommend the following cables:

HO5VVH2 - F 2Ax0,75	– circuit of thermo contract
CYKY 3Cx1,5	– power supply of single-phase motors
CYKY 4Bx1,5	– power supply of three-phase motors

After mounting on the duct network for which it has been designed, the fan is put into operation sometimes fully throttled with closed intake or exhaust so that there is no overloading of the fan! (valid for fans with a non-operating area). **The fan is put under load by increasing the airflow, i.e. loosening the throttle.**

After being put into operation, it is necessary to check the correct rotation direction of the rotor on three-phase fans. This can be done by removing the synthetic rubber plug of the service aperture on the fan's cup.

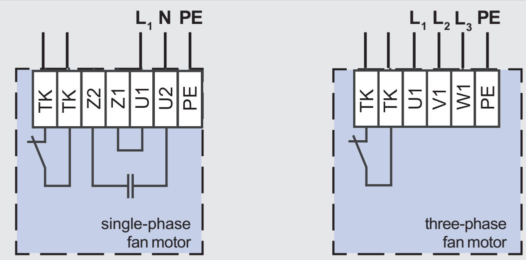
After putting the fan into operation, it is necessary to measure the current, which must not exceed the permissible current Imax. on the manufacturing plate. Should the values for current be higher, it is necessary to check the control of the duct network.

The fans are equipped with thermo contacts that are located in the motor's coils and led off to the TK terminals. When the motor is overloaded, the thermo contact expands. To evaluate the defect, it is necessary to connect the terminals of the thermo contact to the control system, which is able to evaluate the defect and protect the motor from undesired thermal effects (for example, on the control unit, the TRN controllers and the STE(D) relays). When the control system functions properly, the motors are not put back into operation, even after the thermo contact has cooled down and switched. Before putting back into operation again (by deblocking the defect), it is necessary to conduct a check of the duct network control, the electric parameters and the whole electrical installation.

Operation, maintenance and service

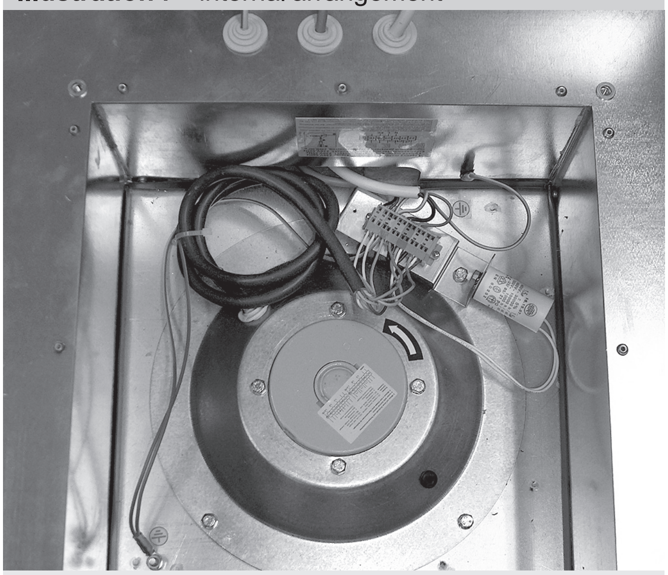
When in operation, it is particularly necessary to watch over the correct functioning (smooth running) of the fan, to see to it that the fan and surrounding area are clean and to put the fan only under a load within the range of its output characteristics.
When there is a defect, it is necessary to thoroughly verify that the net voltage is disconnected, to check whether there are foreign objects in the fan and whether the fan can rotate freely.

Illustration 6 – connection diagram



TK - terminals of the motor's thermo contact
U1, U2 - terminals of the power supply for the single-phase motor 1f - 230V/50Hz
U1, V1, W1 - terminals of the power supply for the three-phase motor 3f - 400V/50Hz
PE - terminal for the protective conductor

Illustration 7 – internal arrangement



The internal arrangement on the 3f fan is similar.

(1 The recommendation mentioned is valid for all duct fans.

Installation, maintenance and service

Should the fan fail to start running again after being turned on, it is necessary to adhere to the following procedures depending on the manner in which the fan is safeguarded:

- When the fan is safeguarded by a STE or STD relay: turn the fan on and off by means of the buttons on the protective relay.
- When the fan is safeguarded by a TRN controller: turn the fan on and off by means of the switch on the controller's remote control.
- When the fan is safeguarded by a control unit: press the deblocking button on the control unit (symbol of a horn) and put the unit into operation again.

In case the fan does not start running: check the electrical installation and measure the resistance of electric motor's coils. When the motor is damaged, contact your supplier.

Attention!
When performing maintenance or repair work, it is necessary to always disconnect the device from the electricity net! To ensure there is no voltage, it is necessary to disengage the electrical installation by means of the separate blocking switch (or by the control unit with such a switch).
The wiring diagrams of a fan with front-end elements (protection relay, controllers, control units) are components of the installation instructions.

Declaration of conformance

The RPH fan is manufactured in conformance with:

- Government regulation No.163/2002 Sb.

The designation CE on the product expresses conformance with:

- the guideline of Counsel 73/23/EHS in the wording of the guideline of Counsel 93/68/EH (with Government regulation No.: 17/2003 Sb.)
- the guideline of Counsel 89/336/EHS in the wording of the guideline of Counsel 91/263/EHS, the guideline of Counsel 92/31/EHS and the guideline of Counsel 93/68/EHS (with Government regulation No.: 18/2003 Sb.)
- the guideline of the European Parliament and counsel 98/37/ES in the wording of article 21 paragraph 1 of the guideline of the European Parliament and counsel 98/79/ES (with Government regulation No.: 24/2003 Sb.)

Example A

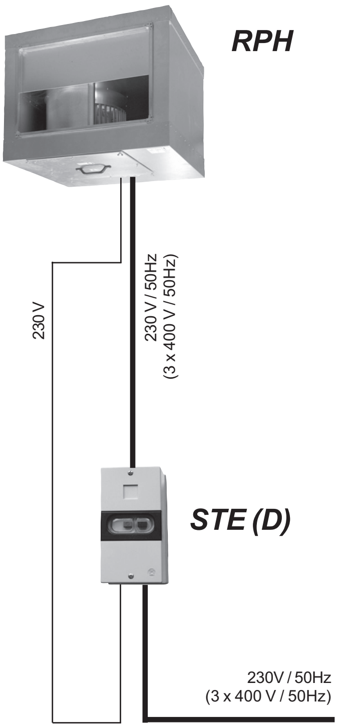
RPH fans without output control with STE(D) protection relay

Illustration 8 shows the connection of the RPH fan in a simple ventilation device without fan output control.
This manner of connection ensures:

- full thermal protection of the fan by means of ther mo contacts and STE protection relay (single-phase) or STD relay (three-phase).
- manual turning on and of the fan's running by means of the buttons on the STE(D) protection relay.

After pressing the black button with the designation "I" on the STE(D) protection relay, the fan will start running, and the button will remain in the pressed position, which signals the fan's running. The fan stops running when the red button with the designation "O" is pressed.
When the motor's coils heat up to over 130 °C as a result of overloading, the thermo contacts in the electric motor's coils are disconnected. Through the disconnection of the thermo contacts, which are led out to the terminal box of the fan, the TK, TK circuit of the STE(D) protection relay is disconnected. The STE(D) reacts to this state by shutting off the power supply to the overheated fan motor. The motor does not start running again by itself after it has cooled down. The operating personnel must confirm the defect (deblock) by pressing once again the black button with the designation "I".

Illustration 8 - connection of fan



Example B

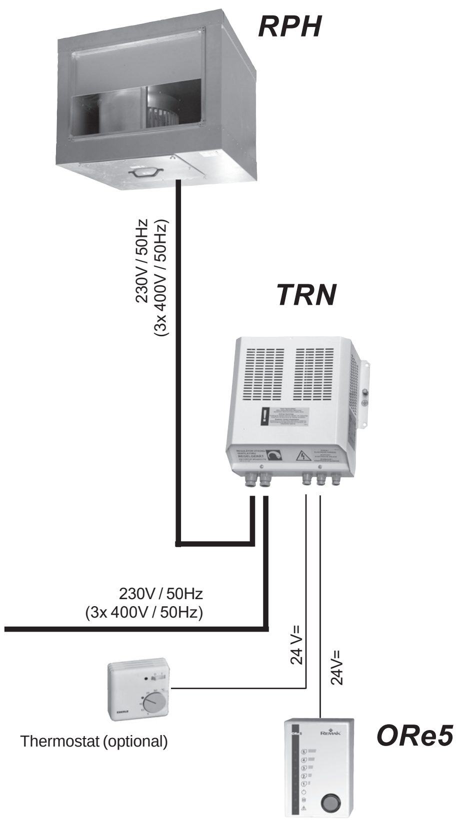
RPH fans with output control with a TRN controller

Illustration 9 shows the connection of the RPH fan in a ventilation device with control of the air output with the help of a TRN controller with an Ore5 driver.
This manner of connection ensures:

- the possibility of selecting fan output in steps 1-5 and also its full protection by means of the connected thermo contacts.
- the turning on and off of the fan's running on a controller or from the Ore5 remote control, or, in certain cases, by any switch (room thermostat, gas detector, presostat, hygrostat etc.).

By setting the required output step using the selection button on the Ore5, the fan will start running with the appropriate revolutions. The condition for the fan's running is the switching of the switch connected to the PT1, PT2 terminals and the circuit of motor thermo contacts connected to the TK, TK terminals of the corresponding controller. By means of the switch on the PT1, PT2 terminals, the fan is stopped externally. If this possibility is not used, it is necessary to jointly connect the PT1 and PT2 terminals.
When the fan is overloaded as a result of the motor's coils overheating, the circuit of thermo contacts is disconnected. The controller reacts to this state by disconnecting the power supply to the fan, and a defect is signaled on the Ore driver by a red signal. The motor does not start running again by itself after the coils have cooled down. To put the fan back into operation, it is necessary to first set the position "STOP" with the help of the selection button, thus confirming the removal of the defective state, and to then set the required fan output. With this arrangement, the selection "STOP" must not be blocked on the Ore5.

Illustration 9 - connection of the fan



Example C

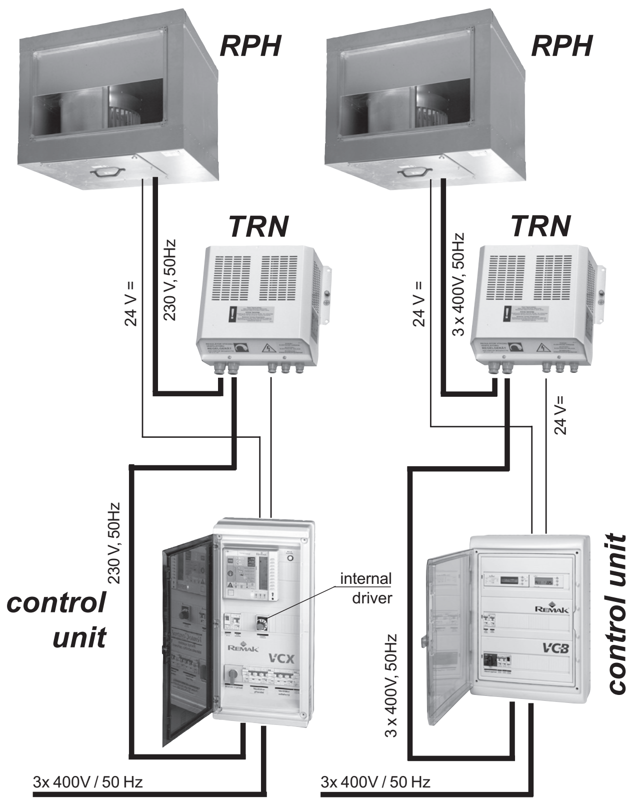
RPH fans with TRN output controllers with a control unit

Illustration 10 shows the connection of RPH fans with TRN output controllers with a common internal driver in a more complicated air-conditioning device that has a control unit.
This manner of connection ensures:

- the turning on and off of the fans by the control unit. Protection of the motors must always be ensured by the control unit through connecting the TK, TK terminals of the thermo contacts to the 5a, 5a, 5b, 5b terminals in the control unit.
- the connection of the fans shown through joint fan output selection by an internal driver in steps 1-5. The unit must be equipped with two internal drivers that can control each fan separately. In the connection D, all supplementary functions of the controller must always be blocked by connecting the PT2 terminals and the E48 in the controller.

The air-handling device is put into operation by the control unit. One internal driver for the remote control of the controller is built into the control unit. The internal driver has the positions 1-5 for setting the required step of fan output. The control unit provides all protection and safety functions of the fans and the whole system.

Illustration 10 - connection of fan



Technical information

Applications of Ex Fans

Ex versions of fully controlled, low-pressure RP and RQ radial Fans can be universally used for complex air-conditioning, from simple venting installations to sophisticated air-handling systems. Thanks to their special design, which in accordance with the EN 13463-1 and 13463-5 standards prevents mechanically generated sparks, and the "e" version of the motor in accordance with the EN 50014 standard, these fans are intended for applications in explosion hazardous areas.

Operating Conditions, Position

These fans are designed for indoor and outdoor applications, and to transport air without solid, fibrous, sticky or aggressive impurities. The transported air must be free of corrosive chemicals or chemicals aggressive to zinc, copper and/or aluminium. The allowed temperatures of the transported air ranges from -20 °C up to +40 °C
These fans are designed for use in **Zone 1** in reference to the classification of explosion hazardous areas in accordance with the ČSN EN 60079-10 and ČSN EN 60079-14 standards and, of course, they can also be used in areas with lower class of explosion hazard, i.e. Zone 2. Explosion-proof RP and RQ Ex fans, secure version "e", belong according to ČSN EN 60079-0 to Group II (2 and Thermal Class T3, and are labelled with the Ex **EEx e II T3** marks.
The fans themselves are labelled with the Ex **II 2 G c T3** marks proving their explosion-proof design.
The fans can work in any position
When positioned under the ceiling, it is advisable to situate the RP Ex fan with its cup directed downwards to ease access to the motor terminal box. However, if transported air is oversaturated with moisture or if the risk of intensive steam condensation inside the fan exists, it is advisable to situate the fan's cup upwards. We recommend adding a 1 to 1.5 m long piece of straight duct to the fan's outlet to reduce pressure losses in the assembly.
RQ Ex fans are mostly installed in the horizontal position of the motor shaft rotation (however, this is not a condition of use). The square sidewalls of the fan serve also as legs to fix the fan onto the base using anchor bolts. The fan can be positioned in four positions turned by 90o.

Dimensional Range

RP Ex fans are manufactured in a range of six sizes according to the A x B dimensions of the connecting flange.
RQ Ex fans are manufactured in a range of three sizes according to the impeller's diameter, see figure # 1.
The standard dimensional and performance range of explosion-proof fans enables the designers to optimize all parameters for air flow up to 5,800 m³ per hour.

(1 Group II. - Electrical equipment for explosion hazardous areas (except underground mines with presence of methane).

Figure 1 - Dimensional Range

RP Ex Fans A x B [mm]		RQ Ex Fans Diameter [mm]	
400-200	40-20	200	20
500-250	50-25	220	22
600-300	60-30	280	28
600-350	60-35		
700-400	70-40		
800-500	80-50		

Materials

The external casing and connecting flanges of RP Ex and RQ Ex fans are made of galvanized sheet steel (Zn 275 g/m2), respectively stainless steel. Impeller blades are made of galvanized sheet steel, diffusers are made of copper, and the motors' casings are made of aluminium alloys. The internal structure of the motors consists of steel, copper and plastic parts. All materials are carefully verified and checked so they ensure long service life and reliability of the fans.

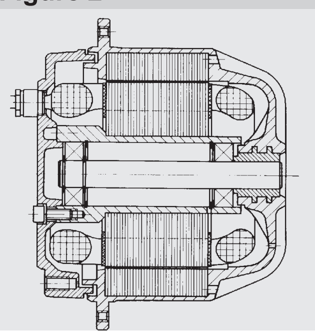
Impellers

Impellers of RP Ex and RQ Ex fans are equipped with forward curved blades. After connecting the motor to the wiring, the impeller's direction of rotation must be checked. The fans' impellers must always rotate to the left, i.e. counter clockwise (looking through the inspection opening on the motor cup). The inspection opening on the motor cup is sealed with a rubber plug. Impellers along with the motor are perfectly statically and dynamically balanced.

Motors

Compact three-phase asynchronous motors with an external rotor and a resistance armature of appropriate output and speed, and approved in accordance with the 94/9/ES (ATEX) Directive are used as drives, see figure #2. The motors are situated inside the impeller, and during operation are optimally cooled by the flowing air. The motor's high quality enclosed ball bearings with permanent lubricant filling enable the fans to reach a service life of more than 40,000 operating hours without maintenance. The motor electrical protection degree is IP 44, insulation class F. The motor windings are impregnated to

Figure 2



Technical information

provide them with additional protection against moisture. The motors feature relatively low build-up current.

Electrical Equipment

The fan's wiring is terminated in a special explosion-proof terminal box of IP 66 protection degree. For wiring diagrams of motors, refer to the section "Wiring".
Attention! The motors must not be delta connected. They must always be star connected.

Motor Protection

As standard, permanent monitoring of the internal motor temperature is used in all motors. The temperature inside the motor is read by temperature-sensitive sensors (thermistors) situated in the motor winding (2. The thermistors must be connected to the trip relay which, after reaching a temperature of 130 °C, disconnects the protective contactor circuit. This system protects the motor against unfavourable operating conditions, e.g. overloading due to phase failure, forced motor braking, current protection circuit breakdown or excessive temperature of the transported air. This thermal protection is comprehensive and reliable providing it is correctly connected. RP Ex and RQ Ex fans have been approved by Notified Body ES 1026, Fyzikálně-technický ústav Ostrava-Radvanice, to be operated only in connection with the prescribed thermal protection (refer to the wiring diagrams in the chapter "Wiring").

Figure 3 - Thermistor

<u>Therefore, it is forbidden to protect the fan motors by conventional thermal protection ensured by the motor overcurrent protective elements!</u>

Speed Control

Generally, several types of control can be used with fans; however, voltage control is the most suitable for Vento fans. The fan output can be fully controlled by changing the speed. The fan's speed is changed depending on the voltage at the motor terminals. RP Ex and RQ Ex fans can be steplessly controlled providing the change in voltage is stepless.
In practice, stage voltage controllers are usually used.

Five-Stage Voltage Control

The voltage control of Vento fans is the most suitable, technically as well as operationally. There is no interference, humming, squeaking or vibration of the motor; furthermore, voltage controlled motors feature lower warming.
TRN and TRR voltage controllers can control the fan output in five stages in 20 % steps, with which five pressure-airflow relation curves in the working characteristics of each fan comport.
Ex fan motors can be operated within a range from 25% to 100% of the rated voltage. Refer to table # 1 showing the correlation between the input voltage and selected stage of the controller.
Ex fans are delivered only with three-phase motors. Three-phase TRN or TRRD controllers are used to control speed, respectively output.
Four types of TRN controllers, TRN 2D, TRN 4D, TRN 7N, and TRN 9N, are manufactured according to their current ratings. The option of remote control (by manual switch ORe5 or by an OCm controller in the control unit, respectively by automatic switching of the five stages of the OXe controller based on an external control signal of 0 - 10 V) is a significant feature of this product line. TRN controllers are equipped with integrated fan protection, which is activated by connecting to the thermistor relay. Four types of simpler TRRD controllers, TRRD 2, TRRD 4, TRRD 7 and TRRD 9, are also manufactured. These controllers cannot be remotely controlled (therefore, they must be situated within reach of the operator), and they do not contain any fan protection (this must be provided by another device).

Table 1 - input voltage and controller's stage

3-phase fan motor	Curve characteristics – controller's stage				
	5	4	3	2	1
Voltage (V)	400	280	230	180	140

Accessories

RP Ex and RQ Ex fans are part of the wide range of Vento modular venting and air-handling system components. Any air-handling set-up, from simple venting to sophisticated comfortable air-conditioning, can be created by selecting suitable elements. When designing a particular air-handling device, it is necessary to keep in mind the environment for which the air-handling device is intended.

For example, all the protection elements (thermistor relay, TRN, or WebClima) must be situated outside explosion hazardous areas.

(2 The motors of RP and RQ fans intended for non-explosive environment are equipped with a thermo-contact which when opening can cause sparking inside the motor (this is impermissible in Zone 1 areas). Therefore, Ex-type fans are provided with PTC thermistors, which must be connected to the thermistor relay. As far as operation is concerned, the system of thermistors and tripping device comports with the system of thermo-contacts used for RP and RQ fans intended for non-explosive environment.

Technical information

Fan Description and Designation

The type designation of RP Ex and RQ Ex explosion-prove fans in projects and orders is defined by the key shown in figure # 4.
RQ 28-4D Ex or RP 60-30/28-4D Ex specifies the type of fan, impeller and motor.

Operating Characteristics

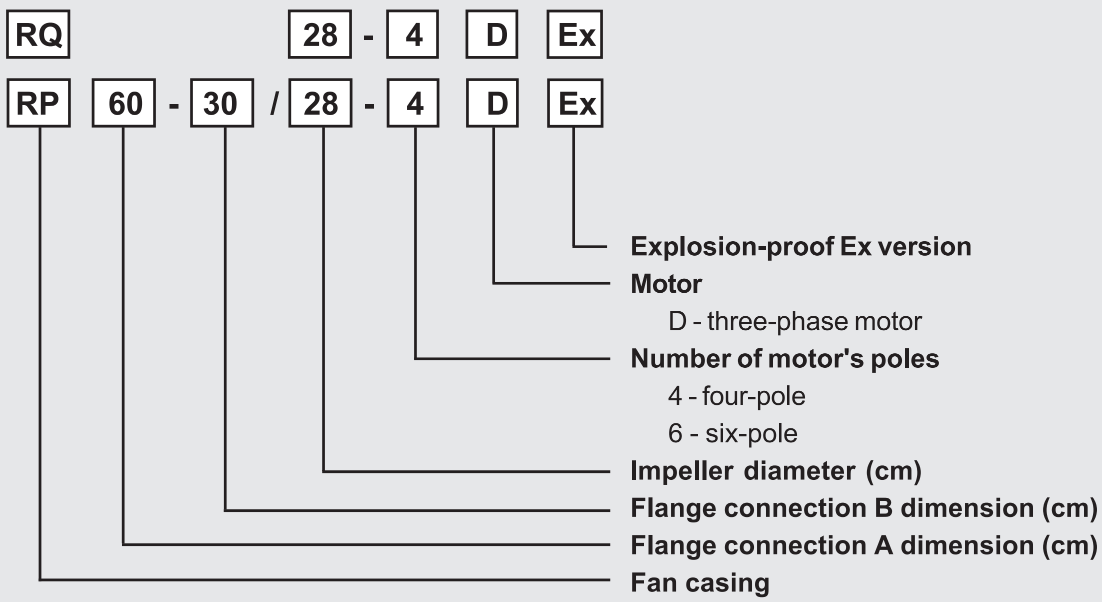
Output characteristics of RP Ex and RQ Ex fans are measured in the most modern testing laboratory for aerodynamic and electrical measurements of fans and pressure losses of passive elements within the Czech Republic.
A table showing the most important values is situated next to each fan's characteristic in the "Data Section" of the catalogue (see table # 2). These values are also listed on the fan's rating plate.
The meaning of individual lines is as follows:

Table 2

				RP 70-40/35-6D Ex
1 –	Power supply	Y		3x400V 50Hz
2 –	Max. electric input	P_{max}	[W]	1100
3 –	Max. current (5c)	I_{max}	[A]	2,00
4 –	Mean speed	n	[min^{-1}]	900
5 –	Capacitor	C	[µF]	-
6 –	Max. working temp.	t_{max}	[°C]	40
7 –	Max. air flow rate	V_{max}	[m^3/h]	4108
8 –	Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	360
9 –	Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	150
10 –	Weight	m	[kg]	36
11 –	Five-stage controller		typ	TRD 2
12 –	Protecting relay		typ	term. relay+STD

1 - Power supply voltage
2 - Maximum power input of the motor at working point 5c of the fan characteristics
3 - Maximum current at nominal voltage at working point 5c of the fan characteristics
4 - Mean speed, rounded to tens, measured at working point 5b of the fan characteristics
6 - Maximum permissible transported air temperature
7 - Maximum air flow rate at working point 5c of the fan characteristics
8 - Maximum total pressure between points 5a - 5c of the fan characteristics
9 - Minimum permissible static pressure at point 5c of the fan characteristics
10 - Total weight of the fan
11 - Recommended fan output controller
12 - Compulsory protection tripping device + prescribed protection

Figure 4 – Type designation key of Ex fans



Fan parameters

Dimensions, Weights and Performance of RP EX Fans

For important dimensions of RP Ex fans, refer to figure # 5 and table # 3 & # 4.

Table 3 - RP Ex Fan Dimensions

Type	Dimensions in mm							
	A	B	C	D	E	F	G	H
RP 40-20/20-4D Ex	400	200	420	220	440	240	277	500
RP 50-25/22-4D Ex	500	250	520	270	540	290	349	530
RP 60-30/28-4D Ex	600	300	620	320	640	340	399	642
RP 60-35/31-4D Ex	600	350	620	370	640	390	427	720
RP 70-40/35-6D Ex	700	400	720	420	740	440	477	780
RP 80-50/40-6D Ex	800	500	820	520	840	540	577	885

Figure 5 - RP Ex fan dimensional diagram

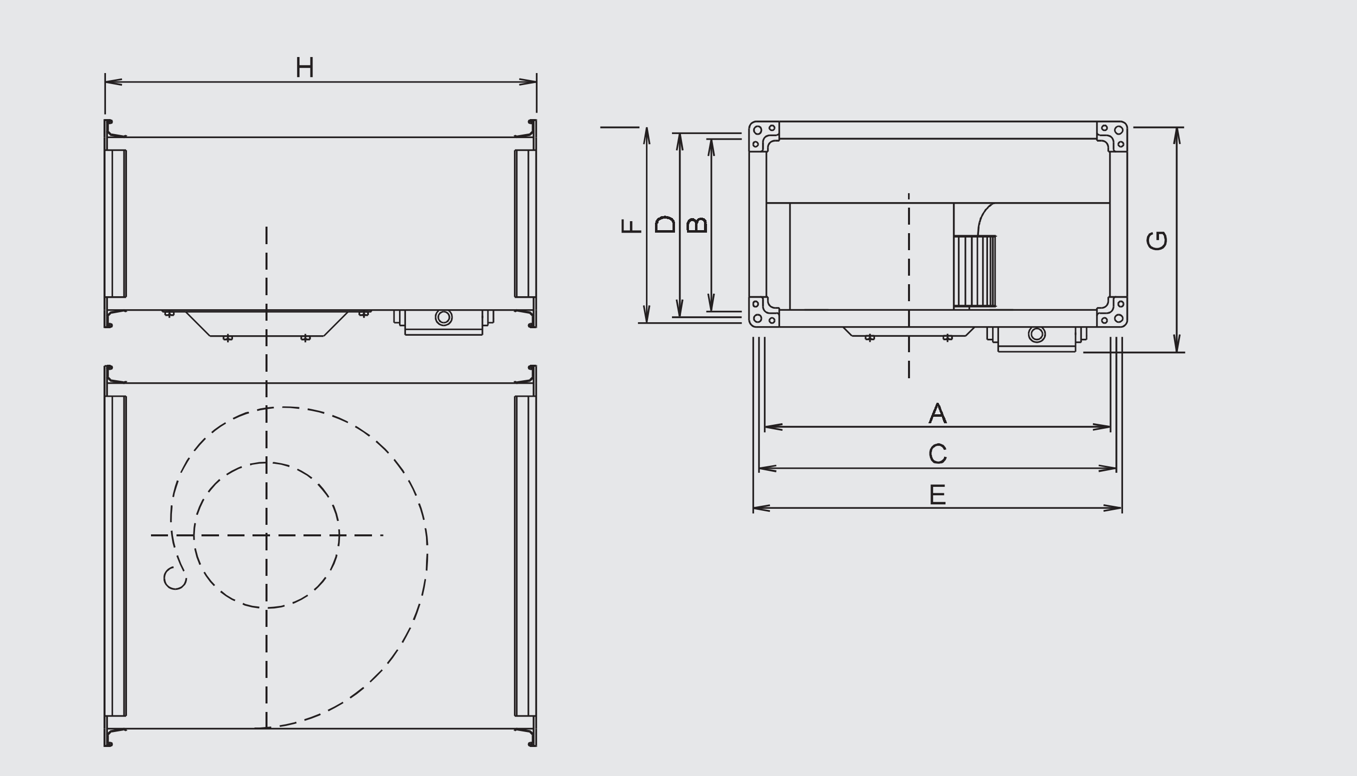
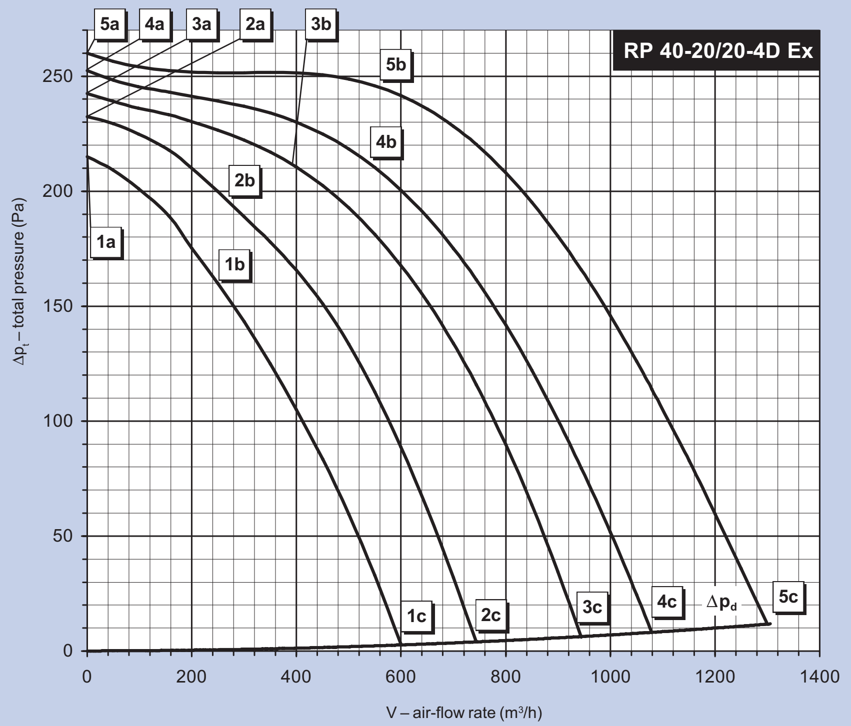


Table 4 - RP Ex fan basic parameters and nominal values

Order	Fan	$V_{max.}$	$\Delta p_{t\ max.}$	$\Delta p_{s\ min.}$	n	U	$P_{max.}$	$I_{max.}$	$t_{max.}$	control.	m*
No.	type	m^3/h	Pa	Pa	min^{-1}	V	W	A	°C	type	kg
1391	**RP 40-20/20-4D Ex**	1306	260	0	1400	400	281	0,5	40	TRN 2	13
1392	**RP 50-25/22-4D Ex**	1813	320	60	1430	400	545	0,93	40	TRN 2	18
1393	**RP 60-30/28-4D Ex**	3195	480	0	1440	400	1300	2,32	40	TRN 4	33
1394	**RP 60-35/31-4D Ex**	3950	603	220	1440	400	2044	3,9	40	TRN 4	47
1395	**RP 70-40/35-6D Ex**	4108	360	150	900	400	1100	2	40	TRN 2	44
1396	**RP 80-50/40-6D Ex**	5829	496	238	930	400	1950	3,7	40	TRN 4	68

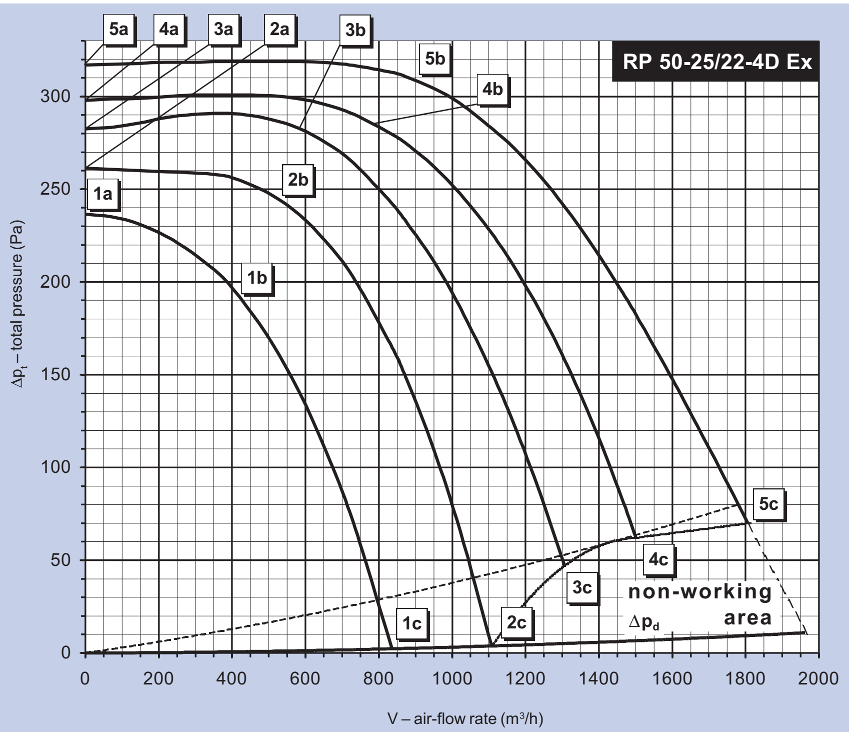
$V_{max.}$ – maximum air flow rate at minimum permissible pressure loss
$\Delta p_{t\,max.}$ – maximum total pressure of the fan is the maximum sum of Δp_s and Δp_d $(\Delta p_s + \Delta p_d)_{max.}$
$\Delta p_{s\,min.}$ – minimum allowed static pressure (i.e. pressure loss of connected duct) indicates the lowest value to which the fan must be throttled (at nominal voltage at working point 5c) so not to be overloaded and thus activating motor protection
n – fan speed measured at the highest efficiency working point (5b), rounded to tens
U – nominal power supply voltage of the motor without control (all values in the table are related to this voltage)
$P_{max.}$ – maximum electrical input of the motor at maximum loading, i.e. at air flow $V_{max.}$
$I_{max.}$ – maximum phase current at voltage U and maximum allowed loading, i.e. at air flow V_{max} at working point 5c (this value must be checked and the measured current must be written down on the guarantee card)
$t_{max.}$ – maximum permissible transported air temperature at air flow $V_{max.}$
controll. – prescribed fan output voltage controller
m* – weight of the fan (±10%)



RP 40-20/20-4D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	281
Max. current (5c)	I_{max}	[A]	0,50
Mean speed	n	[min^{-1}]	1400
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1306
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	260
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	13
Five-stage controller	typ		TRN 2
Protecting relay	typ		term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	67	73	61
Sound power level L_{WAokt} [dB (A)]			
125 Hz	55	51	48
250 Hz	58	59	52
500 Hz	56	64	54
1000 Hz	62	69	56
2000 Hz	61	67	54
4000 Hz	59	65	49
8000 Hz	49	56	42

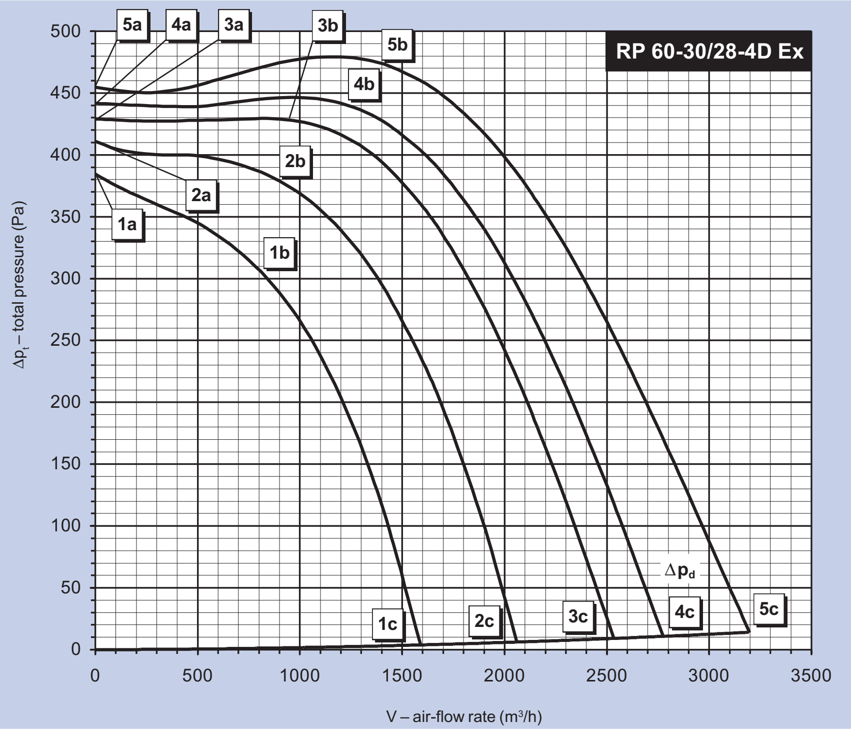
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,32	0,34	0,50	0,20	0,27	0,49	0,17	0,22	0,47	0,15	0,19	0,42	0,14	0,20	0,36
Electric input	P	[W]	64	123	281	43	103	217	36	71	172	35	50	119	29	44	81
Speed	n	[min^{-1}]	1457	1397	1222	1430	1308	1014	1409	1303	895	1346	1265	712	1285	1135	586
Air flow rate	V	[m^3/h]	0	563	1306	0	556	1078	0	395	945	0	271	744	0	261	600
Static pressure	Δp_s	[Pa]	260	242	0	252	209	0	242	210	0	232	195	0	215	156	0
Total pressure	Δp_t	[Pa]	260	244	12	252	211	8	242	211	6	232	196	4	215	157	3



RP 50-25/22-4D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	545
Max. current (5c)	I_{max}	[A]	0,93
Mean speed	n	[min^{-1}]	1430
Capacitor	C	[μF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1813
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	320
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	60
Weight	m	[kg]	18
Five-stage controller	typ		TRN 2
Protecting relay	typ		term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	71	76	63
Sound power level L_{WAokt} [dB (A)]			
125 Hz	60	55	51
250 Hz	62	62	54
500 Hz	60	67	56
1000 Hz	66	72	58
2000 Hz	65	70	56
4000 Hz	63	68	51
8000 Hz	51	57	41

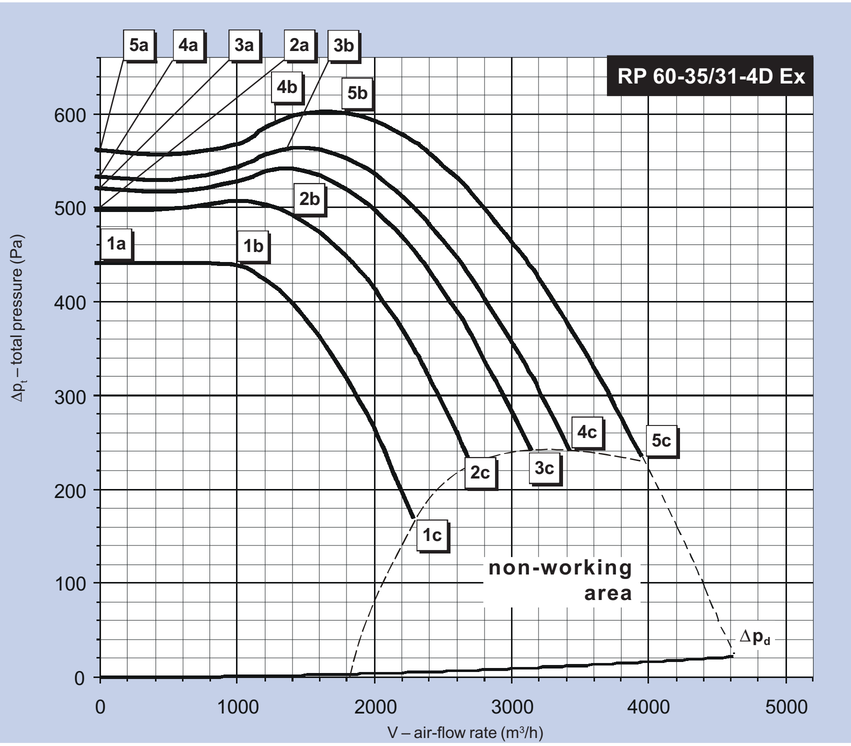
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,59	0,62	0,93	0,37	0,48	0,95	0,37	0,44	0,97	0,31	0,45	0,99	0,35	0,48	0,83
Electric input	P	[W]	164	248	545	105	180	414	113	143	341	76	124	264	75	104	168
Speed	n	[min^{-1}]	1458	1425	1300	1432	1371	1120	1384	1348	971	1374	1274	733	1271	1136	567
Air flow rate	V	[m^3/h]	0	882	1813	0	756	1497	0	587	1295	0	508	1113	0	423	834
Static pressure	Δp_s	[Pa]	317	307	60	298	288	55	282	275	42	261	245	0	237	189	0
Total pressure	Δp_t	[Pa]	317	309	70	298	289	62	282	276	47	261	246	4	237	190	2



RP 60-30/28-4D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	1300
Max. current (5c)	I_{max}	[A]	2,32
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	3195
Max. total pressure	$\Delta p_{t\ max.}$	[Pa]	480
Min. static pressure (5c)	$\Delta p_{s\ min.}$	[Pa]	0
Weight	m	[kg]	33
Five-stage controller	typ		TRN 4
Protecting relay	typ		term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	77	83	69
Sound power level L_{WAokt} [dB (A)]			
125 Hz	68	66	61
250 Hz	67	67	59
500 Hz	65	75	63
1000 Hz	72	79	64
2000 Hz	71	77	61
4000 Hz	69	75	56
8000 Hz	60	66	46

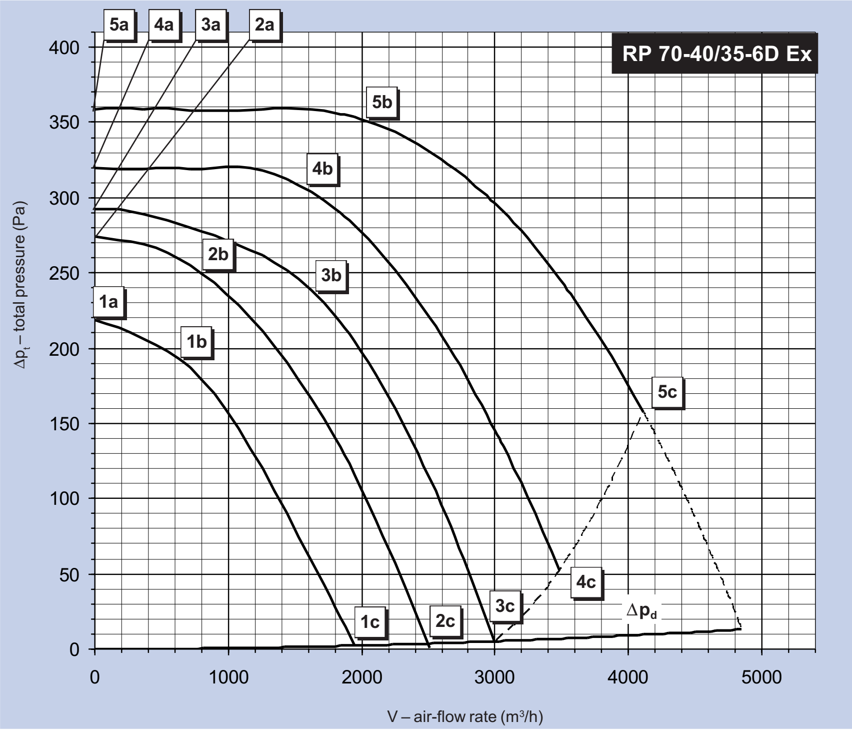
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,29	1,39	2,32	0,77	1,11	2,49	0,68	0,98	2,50	0,67	1,06	2,40	0,72	1,18	2,08
Electric input	P	[W]	248	502	1300	192	418	1037	175	323	882	170	293	634	150	252	412
Speed	n	[min^{-1}]	1476	1440	1326	1453	1385	1152	1437	1376	1056	1395	1297	854	1326	1167	673
Air flow rate	V	[m^3/h]	0	1400	3195	0	1233	2771	0	964	2528	0	907	2068	0	816	1600
Static pressure	Δp_s	[Pa]	455	474	0	442	441	0	429	425	0	411	374	0	385	304	0
Total pressure	Δp_t	[Pa]	455	476	14	442	443	11	429	427	9	411	376	6	385	305	4



RP 60-35/31-4D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	2044
Max. current (5c)	I_{max}	[A]	3,90
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	3950
Max. total pressure	$\Delta p_{t\ max.}$	[Pa]	603
Min. static pressure (5c)	$\Delta p_{s\ min.}$	[Pa]	220
Weight	m	[kg]	47
Five-stage controller	typ		TRN 4
Protecting relay	typ		term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	80	86	71
Sound power level L_{WAokt} [dB (A)]			
125 Hz	69	67	62
250 Hz	69	71	61
500 Hz	69	78	66
1000 Hz	75	82	65
2000 Hz	74	80	63
4000 Hz	72	78	59
8000 Hz	67	69	49

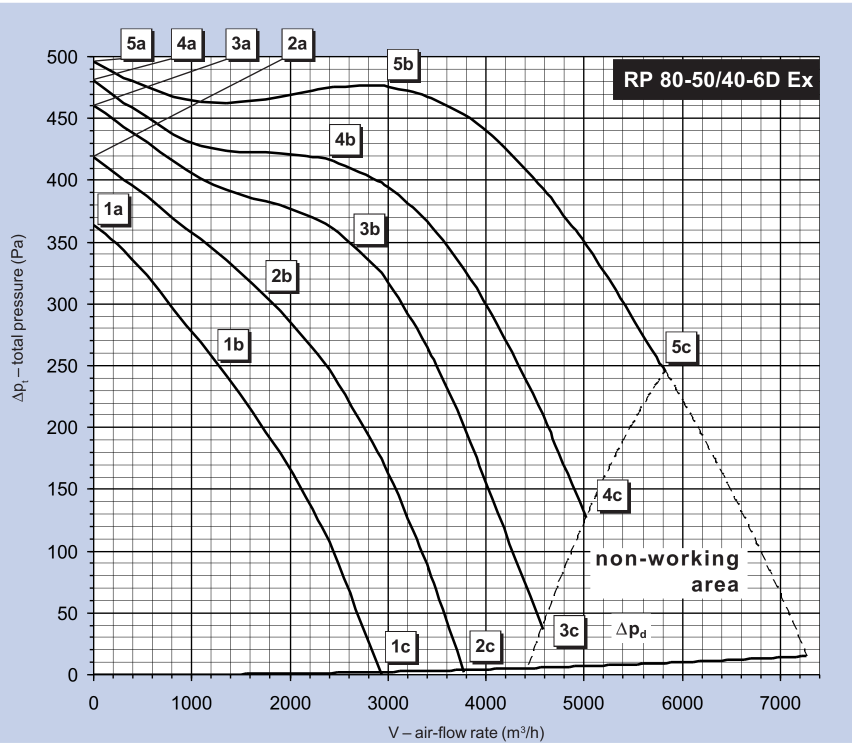
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,64	2,81	3,90	2,08	2,10	3,90	1,73	1,94	3,90	1,71	2,21	3,90	1,86	2,13	3,90
Electric input	P	[W]	376	682	2044	419	478	1558	499	601	1390	444	610	1089	413	476	858
Speed	n	[min^{-1}]	1453	1437	1375	1422	1413	1271	1403	1383	1207	1360	1304	1096	1288	1248	945
Air flow rate	V	[m^3/h]	0	1765	3950	0	1281	3445	0	1344	3099	0	1436	2707	0	1069	2282
Static pressure	Δp_s	[Pa]	561	603	220	532	544	222	519	534	241	498	486	216	439	433	164
Total pressure	Δp_t	[Pa]	562	606	236	533	546	234	520	535	251	500	489	223	440	434	169



RP 70-40/35-6D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	1100
Max. current (5c)	I_{max}	[A]	2,00
Mean speed	n	[min^{-1}]	900
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	4108
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	360
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	150
Weight	m	[kg]	44
Five-stage controller	typ		TRN 2
Protecting relay	typ		term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	75	81	66
Sound power level L_{WAokt} [dB (A)]			
125 Hz	65	66	56
250 Hz	63	66	56
500 Hz	66	75	60
1000 Hz	70	76	62
2000 Hz	68	75	56
4000 Hz	67	73	55
8000 Hz	56	63	40

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,09	1,27	2,00	0,83	1,03	2,00	1,03	1,22	1,90	0,75	0,75	1,55	0,75	0,75	1,27
Electric input	P	[W]	316	534	1100	246	374	819	382	422	644	188	188	393	154	154	246
Speed	n	[min^{-1}]	948	903	763	905	846	563	819	737	436	804	804	359	700	700	278
Air flow rate	V	[m^3/h]	0	2035	4108	0	1579	3484	0	1677	2995	0	798	2510	0	706	1943
Static pressure	Δp_s	[Pa]	360	351	150	321	305	43	292	232	0	274	251	0	219	187	0
Total pressure	Δp_t	[Pa]	360	354	160	321	306	50	293	234	5	274	251	4	219	187	2



RP 80-50/40-6D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	1950
Max. current (5c)	I_{max}	[A]	3,70
Mean speed	n	[min^{-1}]	930
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	5829
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	496
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	238
Weight	m	[kg]	68
Five-stage controller	typ		TRN 4
Protecting relay	typ		term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	75	80	67
Sound power level L_{WAokt} [dB (A)]			
125 Hz	69	65	60
250 Hz	64	70	59
500 Hz	67	74	62
1000 Hz	68	74	60
2000 Hz	68	74	57
4000 Hz	64	71	52
8000 Hz	54	61	40

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	2,11	2,45	3,70	1,32	1,89	3,70	1,19	2,12	3,70	1,17	1,83	3,27	1,19	1,62	2,66
Electric input	P	[W]	419	951	1950	324	678	1483	300	692	1204	279	474	836	239	331	508
Speed	n	[min^{-1}]	980	934	835	951	883	659	930	801	518	888	769	394	821	711	308
Air flow rate	V	[m^3/h]	0	3006	5829	0	2403	5020	0	2648	4577	0	1777	3775	0	1249	2932
Static pressure	Δp_s	[Pa]	496	475	238	482	416	124	461	350	35	418	304	0	364	250	0
Total pressure	Δp_t	[Pa]	496	477	248	482	417	131	461	352	41	418	305	4	364	251	2

Parametry ventilátorů

Dimensions, Weights and Performance

For important dimensions of RQ Ex fans, refer to Figure # 6 and Table # 4 & # 5.

Table 4 - RQ Ex types and dimensions

Type	Dimensions in mm											
	A	B	C	D	E	F	G	H	J	K	L	M
RQ 20-4D Ex	335	405	125	250	145	270	150	250	235	203	173	4x-M6
RQ 22-4D Ex	370	445	140	280	160	300	170	300	260	223	193	8x-M6
RQ 28-4D Ex	460	545	180	355	200	375	210	350	315	260	230	4x-M6

Figure 6 – control drawing of RQ Ex fan

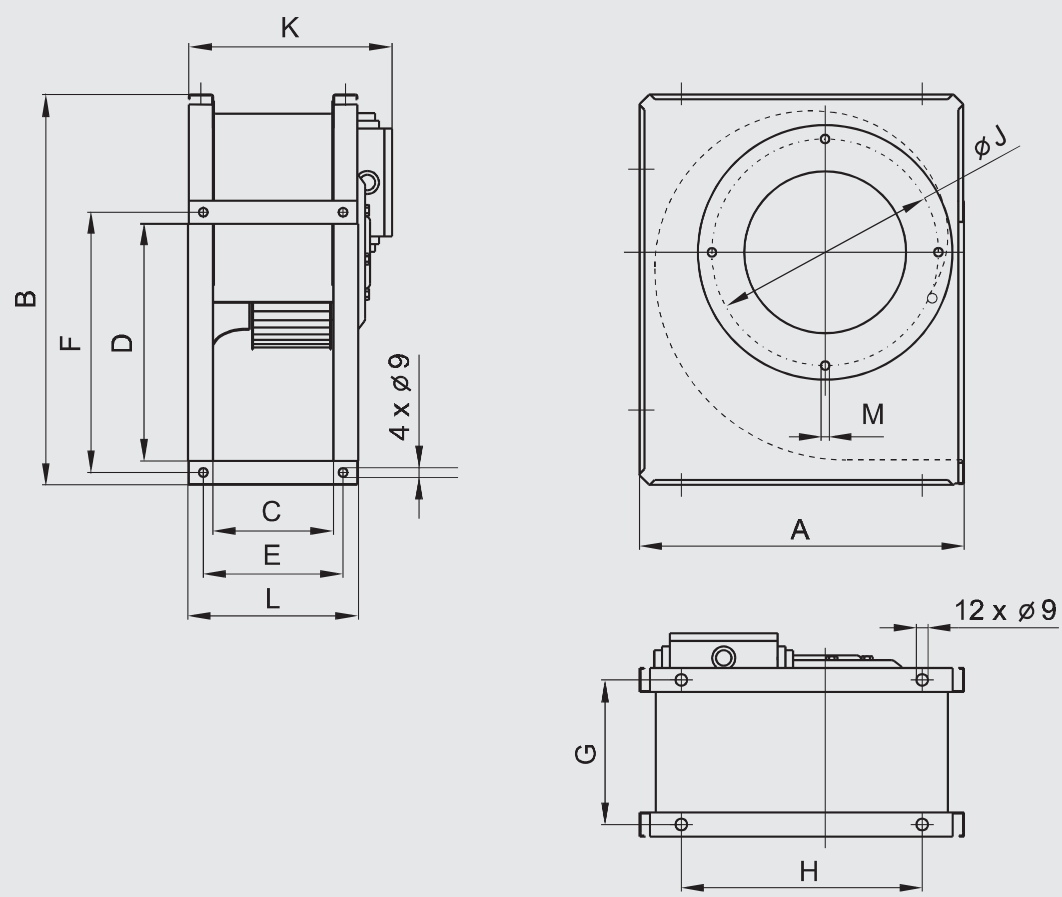
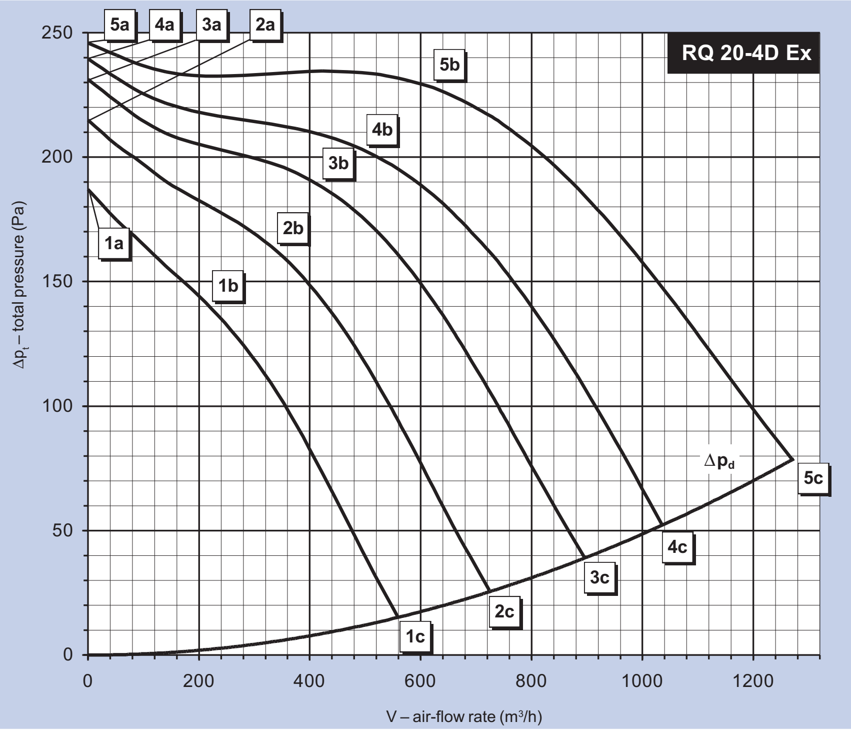


Table 5 – RQ Ex fan basic parameters and nominal values

Order No.	Fan type	$V_{max.}$ m^3/h	$\Delta p_{t\,max.}$ Pa	$\Delta p_{s\,min.}$ Pa	n min^{-1}	U V	$P_{max.}$ W	$I_{max.}$ A	$t_{max.}$ °C	control. type	m* kg
1491	**RQ 20-4D Ex**	1273	246	0	1380	400	278	0,48	40	TRN 2	9
1492	**RQ 22-4D Ex**	1836	320	8	1420	400	524	0,93	40	TRN 2	11
1493	**RQ 28-4D Ex**	3202	483	0	1440	400	1254	2,25	40	TRN 4	23

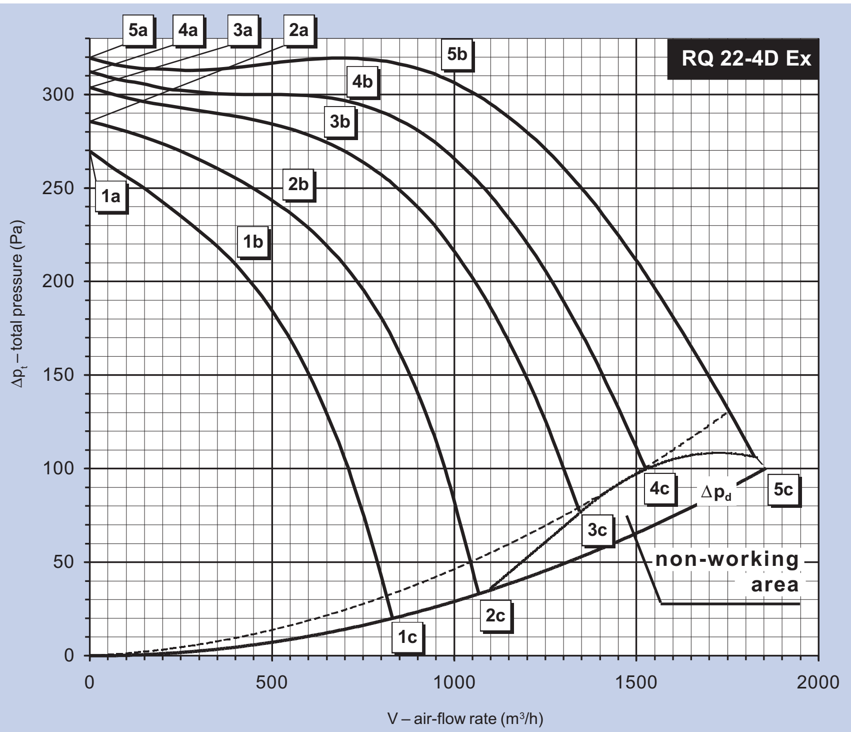
$V_{max.}$ – maximum air flow rate at minimum permissible pressure loss
$\Delta p_{t\,max.}$ – maximum total pressure of the fan is the maximum sum of Δp_s and Δp_d $(\Delta p_s + \Delta p_d)_{max.}$
$\Delta p_{s\,min.}$ – minimum allowed static pressure (i.e. pressure loss of connected duct) indicates the lowest value to which the fan must be throttled (at nominal voltage at working point 5c) so not to be overloaded and thus activating motor protection
n – fan speed measured at the highest efficiency working point (5b), rounded to tens
U – nominal power supply voltage of the motor without control (all values in the table are related to this voltage)
$P_{max.}$ – maximum electrical input of the motor at maximum loading, i.e. at air flow $V_{max.}$
$I_{max.}$ – maximum phase current at voltage U and maximum allowed loading, i.e. at air flow V_{max} at working point 5c (this value must be checked and the measured current must be written down on the guarantee card)
$t_{max.}$ – maximum permissible transported air temperature at air flow $V_{max.}$
control. – prescribed fan output voltage controller
m* – weight of the fan (±10%)



RQ 20-4D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	278
Max. current (5c)	I_{max}	[A]	0,48
Mean speed	n	[min^{-1}]	1380
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1273
Max. total pressure	$\Delta p_{t\ max.}$	[Pa]	246
Min. static pressure (5c)	$\Delta p_{s\ min.}$	[Pa]	0
Weight	m	[kg]	9
Five-stage controller		typ	TRN 2
Protecting relay		typ	term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	70	71	61
Sound power level L_{WAokt} [dB (A)]			
125 Hz	49	49	41
250 Hz	64	58	57
500 Hz	62	64	55
1000 Hz	63	66	54
2000 Hz	64	65	53
4000 Hz	61	62	47
8000 Hz	53	56	41

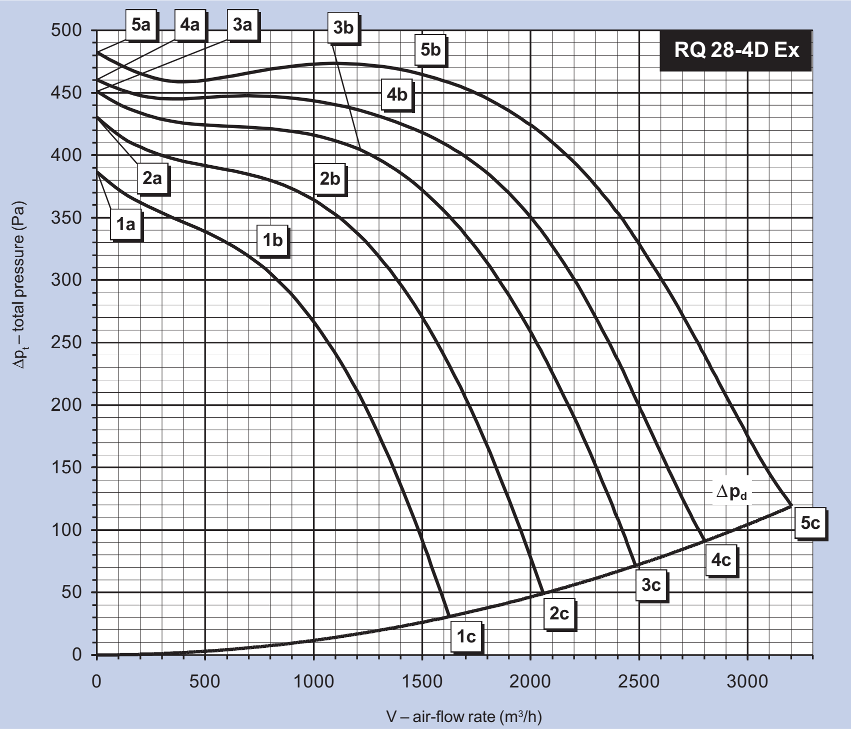
Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,31	0,34	0,48	0,19	0,26	0,47	0,16	0,24	0,45	0,15	0,23	0,41	0,15	0,20	0,35
Electric input	P	[W]	68	143	278	46	98	204	40	81	162	35	63	115	30	43	76
Speed	n	[min^{-1}]	1457	1384	1224	1427	1313	1013	1399	1261	873	1346	1183	721	1256	1119	567
Air flow rate	V	[m^3/h]	0	627	1273	0	498	1039	0	425	895	0	340	726	0	217	561
Static pressure	Δp_s	[Pa]	246	208	0	240	193	0	231	178	0	215	154	0	187	138	0
Total pressure	Δp_t	[Pa]	246	227	79	240	205	52	231	187	39	215	159	26	187	140	15



RQ 22-4D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	524
Max. current (5c)	I_{max}	[A]	0,93
Mean speed	n	[min^{-1}]	1420
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	1836
Max. total pressure	$\Delta p_{t\ max.}$	[Pa]	320
Min. static pressure (5c)	$\Delta p_{s\ min.}$	[Pa]	8
Weight	m	[kg]	14
Five-stage controller		typ	TRN 7
Protecting relay		typ	term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	76	77	66
Sound power level L_{WAokt} [dB (A)]			
125 Hz	57	53	48
250 Hz	66	66	59
500 Hz	67	70	60
1000 Hz	70	72	61
2000 Hz	71	70	57
4000 Hz	68	69	54
8000 Hz	60	61	43

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	0,57	0,61	0,93	0,33	0,45	0,95	0,29	0,45	0,97	0,27	0,45	0,94	0,27	0,44	0,80
Electric input	P	[W]	122	253	524	83	169	407	73	149	341	66	123	249	58	96	161
Speed	n	[min^{-1}]	1474	1420	1308	1449	1386	1145	1431	1337	1014	1388	1257	753	1332	1178	596
Air flow rate	V	[m^3/h]	0	962	1836	0	708	1531	0	645	1337	0	534	1072	0	406	831
Static pressure	Δp_s	[Pa]	320	282	8	312	283	32	304	266	23	286	232	0	270	202	0
Total pressure	Δp_t	[Pa]	320	309	106	312	298	100	304	278	75	286	241	33	270	206	20



RQ 28-4D Ex			
Power supply	Y		3x400V 50Hz
Max. electric input	P_{max}	[W]	1245
Max. current (5c)	I_{max}	[A]	2,25
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[µF]	-
Max. working temp.	t_{max}	[°C]	40
Max. air flow rate	V_{max}	[m^3/h]	3202
Max. total pressure	$\Delta p_{t\,max.}$	[Pa]	483
Min. static pressure (5c)	$\Delta p_{s\,min.}$	[Pa]	0
Weight	m	[kg]	23
Five-stage controller		typ	TRN 4
Protecting relay		typ	term. relay+STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level L_{WA} [dB (A)]			
L_{WA}	80	83	71
Sound power level L_{WAokt} [dB (A)]			
125 Hz	64	58	59
250 Hz	68	70	63
500 Hz	70	75	63
1000 Hz	75	78	66
2000 Hz	75	77	64
4000 Hz	71	75	60
8000 Hz	62	68	46

Parameters in selected working points			5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage	U	[V]		400			280			230			180			140	
Current	I	[A]	1,19	1,37	2,25	0,77	1,12	2,41	0,68	1,16	2,43	0,69	1,16	2,32	0,73	1,12	2,07
Electric input	P	[W]	235	530	1245	201	432	1027	183	394	829	174	322	611	157	245	411
Speed	n	[min^{-1}]	1476	1436	1328	1451	1385	1167	1430	1333	1033	1391	1269	861	1328	1189	689
Air flow rate	V	[m^3/h]	0	1485	3202	0	1289	2801	0	1211	2494	0	999	2063	0	742	1624
Static pressure	Δp_s	[Pa]	483	440	0	461	415	0	451	384	0	430	340	0	387	305	0
Total pressure	Δp_t	[Pa]	483	465	119	461	434	91	451	401	72	430	363	49	387	311	31

Markings Used

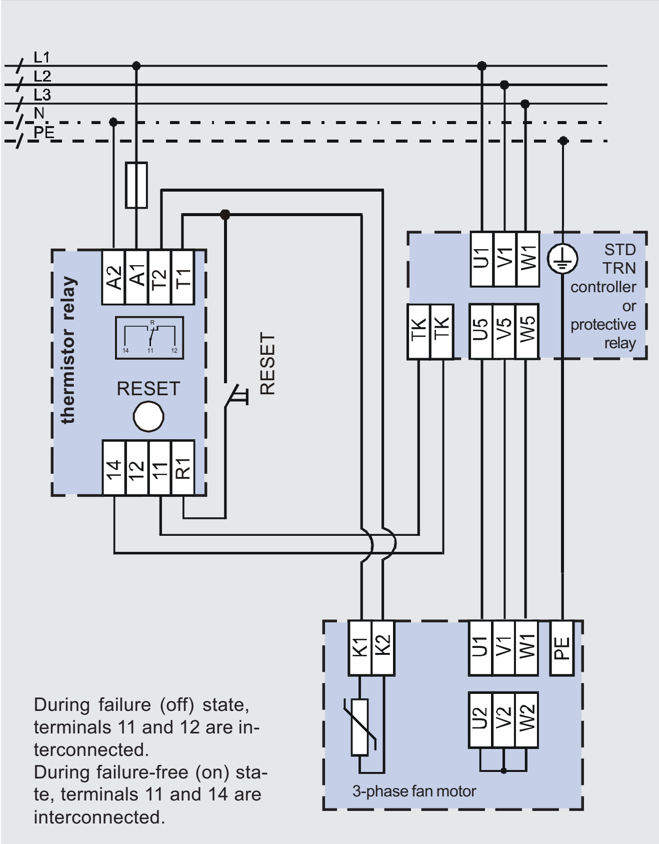
m	weight	kg
S	area, surface	m2
V	air flow rate	m3/h
n	speed	rpm
t	air temperature	°C
Δp_s	static pressure difference	Pa
Δp_t	total pressure difference	Pa
p_d	dynamic pressure	Pa
ρ	air specific density	kg/m^3
LW	sound power level	dB
L_{WA}	A scale sound power level	dB(A)
L_{WAokt}	A scale octave sound power level	dB(A)
L_{PA}	A scale sound pressure level	dB(A)
U	voltage	V
I	current	A
P	electric input	W

Thermistor Protection of Ex Fans

The temperature inside the motors of all RP Ex and RQ Ex fans is permanently read by temperature sensitive sensors (PTC thermistors) situated in the motor winding. The thermistors must be connected to the thermistor relay, which disconnects the protective circuit of the STD or TRN controllers.

■ At a maximum, two fans can be connected to the thermistor relay, and they must be connected in series. It necessary to be aware of the fact that this type of combined connection will cause both fans to be stopped even if only one of the motors fails.

Figure 9 - Example of the thermistor relay's wiring

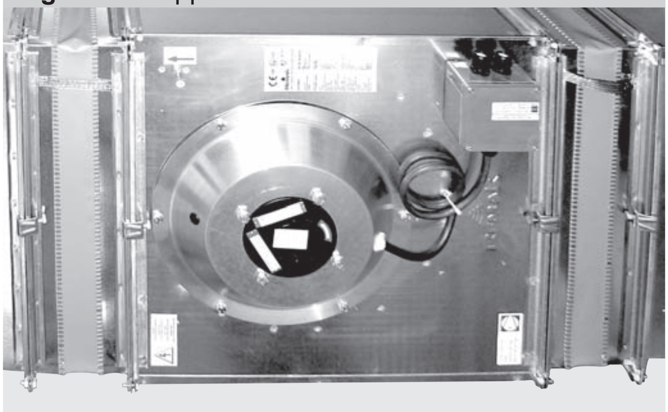


Installation, Maintenance and Service

Installation

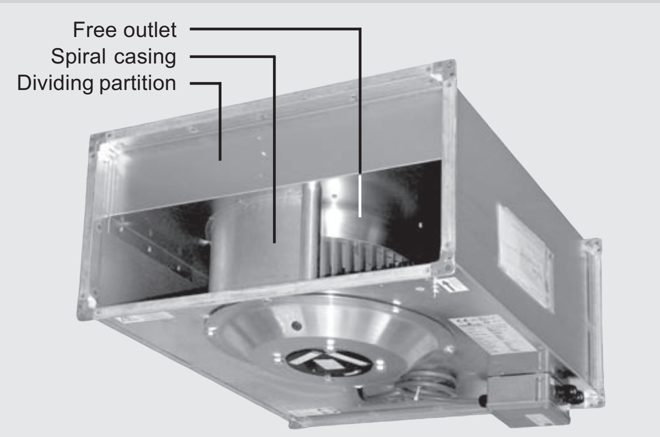
- RP Ex and RQ Ex fans, including other Vento elements and equipment, are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the fan. The installation and commissioning may be performed only by a specialized assembling company licensed in accordance with generally valid regulations.
- The fan must be checked carefully prior its installation. In particular, it is necessary to check the parts and cable insulation for damage, and to see whether the rotating parts can rotate freely. Minimum clearance between rotating and fixed parts is **4 mm**.
- It is recommended to insert elastic connections in front of and behind the fan, see figure 10.

Figure 10 - Application of elastic connections



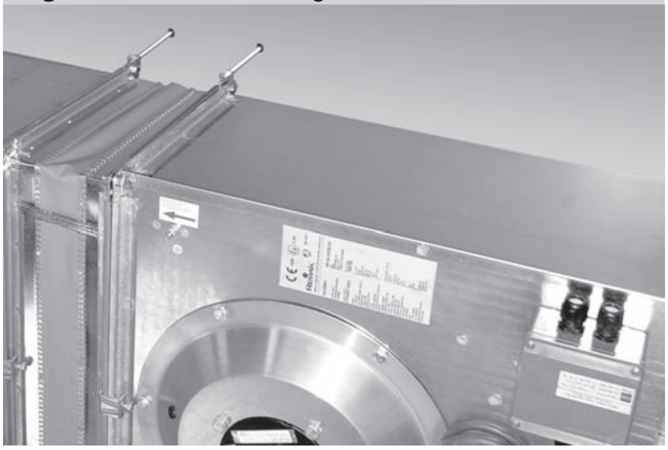
- It is advisable to place an air filter in front of the fan to protect it and the duct against dirtying and dust fouling.
- If the fan is installed in such a way that persons or objects can come into contact with the impeller, the guard grid must be mounted.

Figure 11 - Fan outlet arrangement



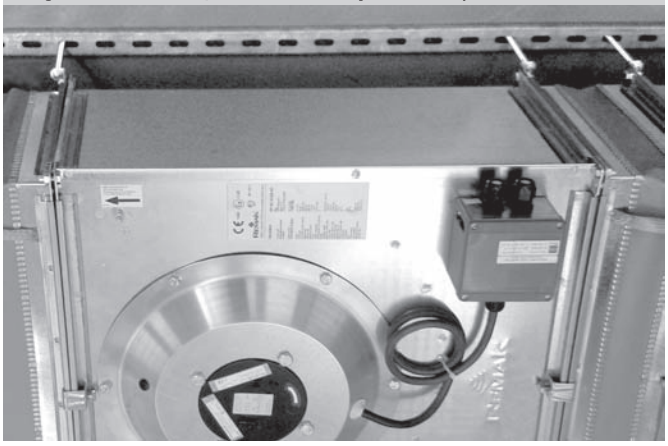
- If the fans draw in air from the open space, respectively if the suction of foreign objects cannot be eliminated, the fans' inlets must be provided with a protecting grid of IP 20 protection.
- We recommend adding a 1.5 m long piece of straight duct to the fan's outlet to get optimal pressure conditions. In cramped spaces, it is advisable to consider the necessity to situate directly behind the fan's outlet the duct adapting piece, attenuator, heat exchanger, heater, etc. Figure 11 shows the fan's outlet design and arrangement. From this figure, it is obvious that from the entire cross-section (e.g. 500 x 250), only about 1/4 of the outlet cross-section is free. This means that the airflow velocities close behind the fan can be as much as four times higher than, for example, in the inlet. Therefore, the greater the distance of the attenuators (or other resistant elements) from the outlet, the better. On the inlet side, an elastic connection will be sufficient as a distance piece in most cases.

Figure 12 - Fan anchoring



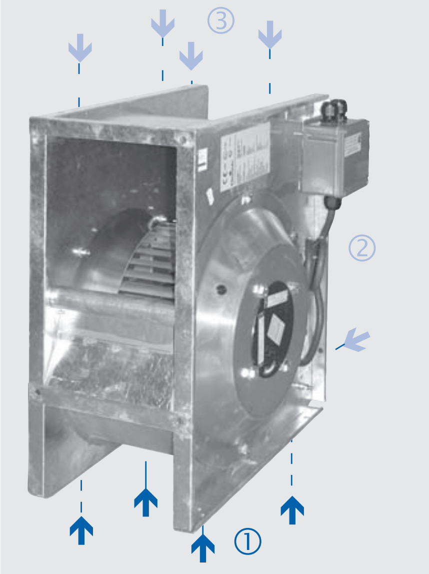
- The fan must be suspended by separate suspensions, or fixed to the foundations, so that no loading can be transferred to the elastic connections or connected duct.
- Anchoring to the ceiling with steel anchors and suspension using threaded rods (see fig. #12), perforated galvanized strips (see fig. #13) or ancillary construction is recommended for RP Ex fans.

Figure 13 - Suspension using ancillary construction



- RQ Ex fans are provided on three sides with anchoring holes to be anchored to the foundation in one of three possible positions ① ② ③ (see figure # 14). RQ Ex fans can be anchored with four anchoring bolts; however, we recommend using silent-blocks to eliminate the transfer of vibrations.

Figure 14



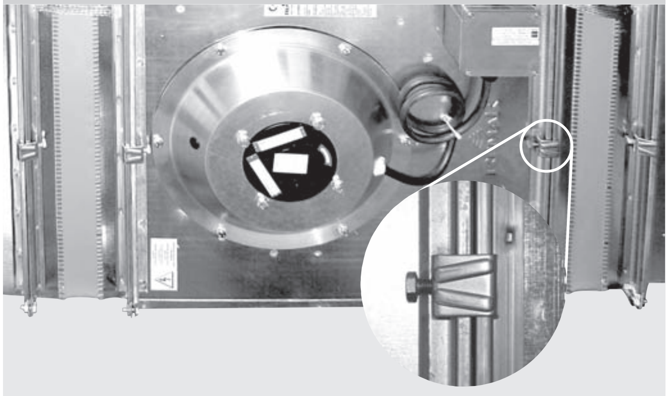
■ The fans can work in any position. When positioned under the ceiling, it is advisable to situate the fan with its cup directed downwards to ease access to the motor terminal box, see figure # 11.

■ If transported air is oversaturated with moisture or if the risk of intensive and permanent steam condensation inside the fan exists, it is advisable to situate the fan's motor cap upwards to enable better condensate drainage!

■ Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento system, use galvanized M8 screws and nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection, or use Cu conductor wiring.

■ To brace flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping (see fig. # 15).

Figure 15 – screw clamps



Wiring

■ The wiring can be performed only by a qualified worker licensed in accordance with national regulations.

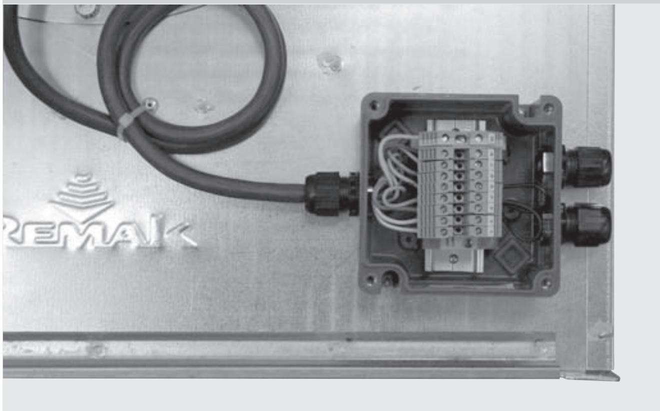
■ The fans are equipped with a plastic terminal box intended for Zone 1 EEx e II T6.
The terminal box is fixed with screws to the fan casing, and equipped with labelled screw terminals (see figure # 16).

■ Open the terminal box only if not energized.

■ The wiring connection to the terminals can be performed following the marking on the motor cables, description of terminals or the label on the terminal box lid.

■ To connect the fan motor to the supply, use only cables approved for this purpose. CYKY 4Bx1,5 for the power supply and CYKY 2Bx1,5 for the thermistor circuit are recommended. For a list of recommended cables related to the wiring on pages 16-21, refer to table # 6.

Figure 16 - All-plastic terminal box on the casing



■ After starting the fan, the proper direction of the impeller rotation must be checked. To do so, remove the rubber plug from the inspection opening in the fan cup (see. figure # 17).

■ After starting the fan, the current must also be measured, and it must not exceed the maximum allowed current stated on the rating plate (Imax.). If the measured values exceed the given current value, it is necessary to check the duct system regulation.

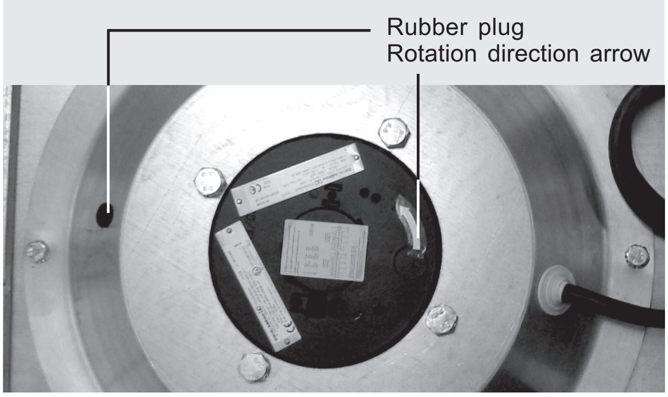
■ The fan can be started after its mounting into the duct system for which it has been designed, or fully throttled by closing either the intake or discharge to avoid its overloading! The fan is loaded by increasing the air flow, i.e. by releasing the throttling.

n The fan installation must comply with the ČSN EN 60079-14 Standard for Electrical Appliances Intended for Explosive Gaseous Atmosphere, Art. 14 Electrical Installations in Dangerous Areas.

Table 6 - Recommended cables

Marking	Connection	Cable Type	Voltage
w 01	Controller power supply	CYKY 4B x 1,5	3x400V / 50Hz
w 02	Fan's motor power supply	CYKY 4B x 1,5	3x400V / 50Hz
w 03	Remote controller	SYKFY 2 x 5 x 0,35	24V =
w 04	Motor's thermistors (K1, K2)	CYKY 2B x 1,5	2,5V =
w 05	External start (PT1, PT2)	CYSY 2A x 0,75	24V =
w 06	Thermistor relay power supply	CYKY 2B x 1,5	230V / 50Hz
w 07	Connection of the thermistor relay with protection	CYKY 2B x 1,5	24V =
w 08	Control unit power supply	CYKY 5C x 2,5	3x400V / 50Hz

Figure 17



Installation, Maintenance and Service

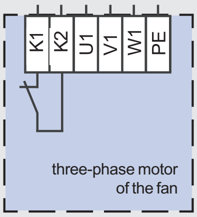
Operation, Maintenance and Service

The fan does not require special maintenance. During operation, it is necessary to check proper functioning of the fan, its smooth running, to keep it and its surroundings clean, and to load the fan only within the range given by its output characteristics.
If a failure occurs, make sure that the power supply is disconnected. Check the fan for foreign objects inside and free impeller rotation. If the fan does not run after it has been restarted, the following procedures must be followed depending on the protection system used:

- If the fan is protected by an STD relay, turn the fan on/off using the buttons on the protecting relay.
- If the fan is protected by a TRN controller, turn the fan off and on using the switch on the remote controls of the controller.

If the fan does not start, check the wiring and measure the motor winding impedance. If the motor is damaged, contact your supplier.
Attention! When performing any maintenance or repairs, the device must always be disconnected from the power supply!

Figure 14 - Wiring diagram



K1, K2
– motor thermistor terminals
U1, V1, W1
– three-phase motor power supply terminals 3f - 3x 400V/50Hz
PE
– - protective conductor terminal

The wiring diagrams with front-end elements (protective relays, controllers, control units) are included in the installation manual, respectively in the AeroCAD project.

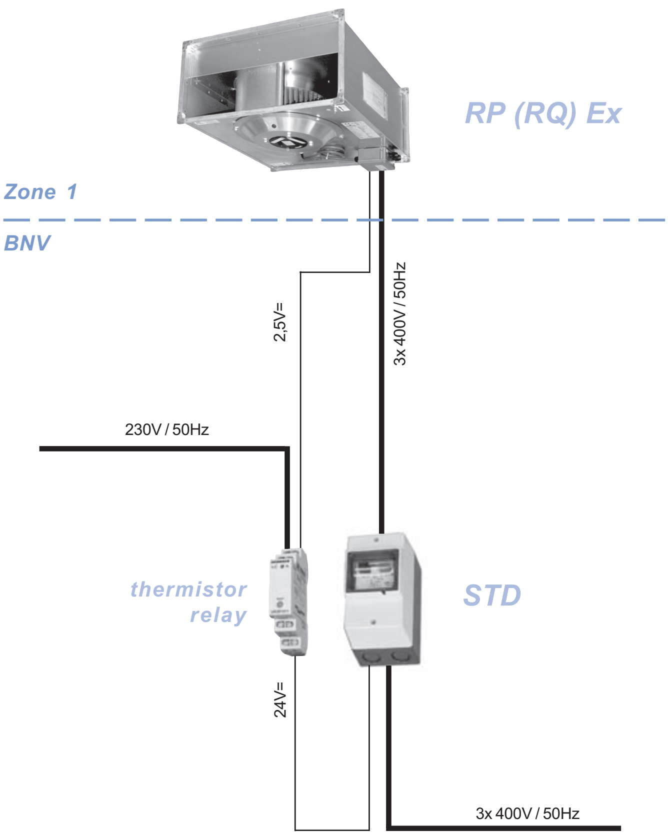
A

Fan equipped with thermal protection, without Output Control

An RP (RQ) Ex fan connection in a simple venting system without output control is shown in figures # 19.a and 19.b.
This type of connection ensures full thermal protection of the fan using thermistors, thermistor relay and protecting relay STD. The connection shown in the figures enables manual turning of the fan on/off using the buttons on the protecting relay.

After pressing the button marked "I" on the STD protecting relay, the fan starts and the button will stay in the depressed position, signalling the fan's operation. The fan can be stopped by pressing the button marked "0".
If the motor is overheated above 130°C due to overloading, the impedance of the K1 and K2 thermistors in the motor winding will be increased several times.
The thermistor relay will detect the increased impedance and open contacts 11 and 14. Upon opening contacts 11 and 14, the STD protecting relay circuit TK, TK will be disconnected. As a reaction to this state, the STD relay will disconnect the power supply to the overheated motor. After cooling down, the motor is not automatically started. The failure must be confirmed (unblocked) by the operator by pressing the red "I" button.

Figure 19 - Fan connection



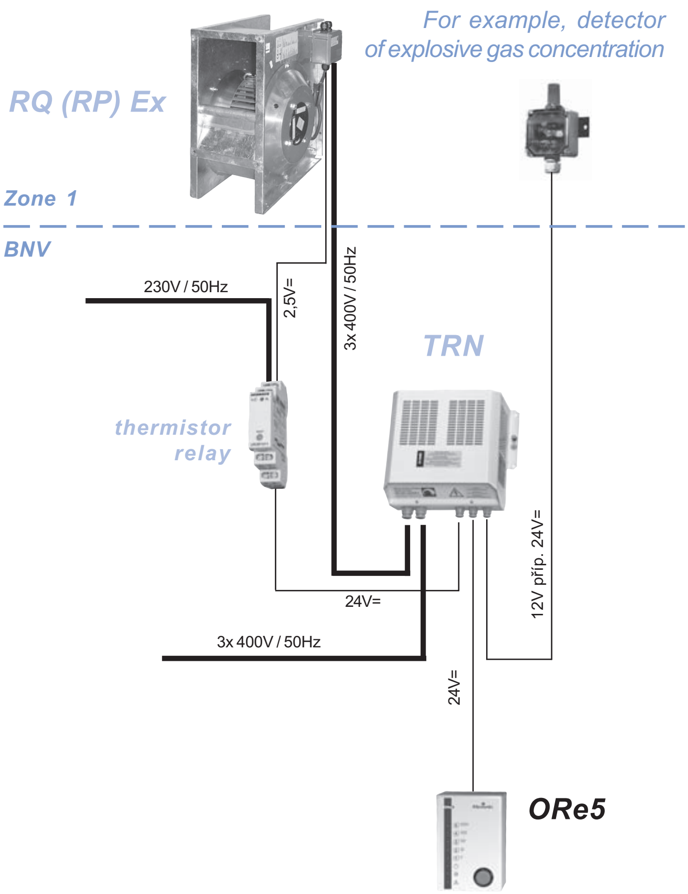
B

Fan with Output Control and Protection Controller

An RP (RQ) Ex fan connection in a venting system with output control using the TRN controller equipped with an ORe5 control unit is shown in figures # 20.a and 20.b.
In addition to the selection of the fan output within the stage range "0" - "5", this type of connection also ensures its protection via thermistors, thermistor relay and the protection integrated into the TRN controller.
The connection shown in the pictures also enables the fan to be switched on/off manually, by the ORe5 remote controller or any other switch (like room thermostat, gas detector, pressostat, hygrostat, etc.) on the PT1 and PT2 terminals.

After turning the selector to position "1" to "5", the fan will start at the corresponding output (1 to 5), and an indicator signalling the fan's operation will light up. The closed switch connected to PT1, PT2 terminals and closed terminals 11 and 14 of the thermistor relay connected to TK, TK terminals of the controller are essential for fan operation. The switch connected to PT1, PT2 terminals is used to stop and start the fan without other relations so that the fan after being started runs at the output preset on ORe5. If this possibility is not used, it will be necessary to interconnect terminals PT1 and PT2. If the fan is overloaded, contacts 11 and 14 of the tripping device will open due to overheating of the motor. As a reaction to this state, the controller will disconnect the power supply to the motor, and turn off the fan operation signalling indicator. After cooling down, the motor is not automatically started. First, it is necessary to confirm (unblock) the failure removal by turning the selector to position "0". After turning the selector to position "1" to "5", the fan will start at the corresponding output. In this arrangement, position "0" on the ORe5 control unit must not be blocked

Figure 20 - Fan connection



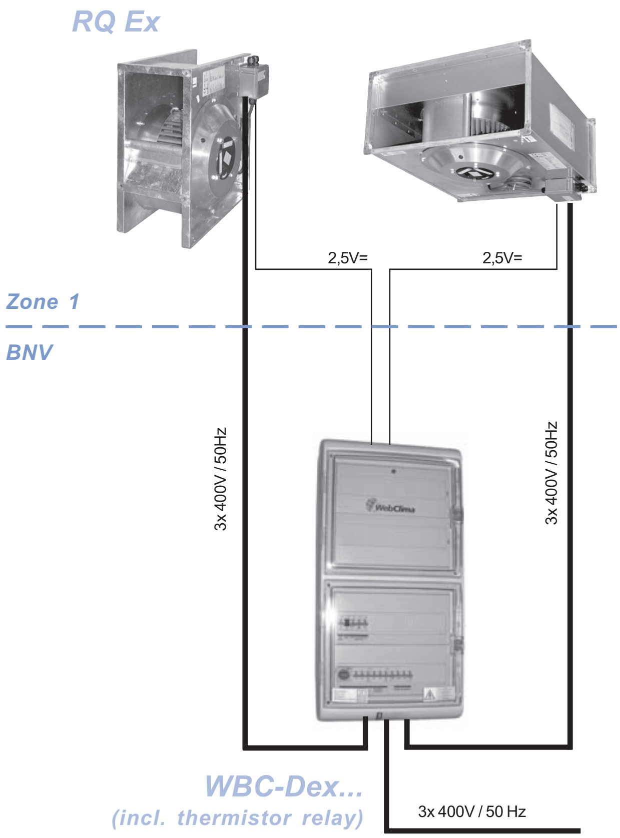
C

Fans with Control Unit without Output Control

An RP (RQ) Ex fan without output control connection in a more sophisticated venting system equipped with a WebClima control unit (e.g. with air heating) is shown in figures # 21.a and 21.b.
This type of connection ensures full thermal protection of the fan using thermistors and a WBC-Dex control unit which already contains a thermistor relay installed in the factory. Fan switching on/off is ensured by the control unit. The motor protection must always be ensured by the control unit by connecting the TK, TK thermistor terminals to the 5a, 5a, 5b and 5b terminals in the control unit.

The air-handling system is started by the control unit. All protection and safety functions of the fan as well as the entire system are ensured by the WebClima control unit.

Figure 21 - Fan connection



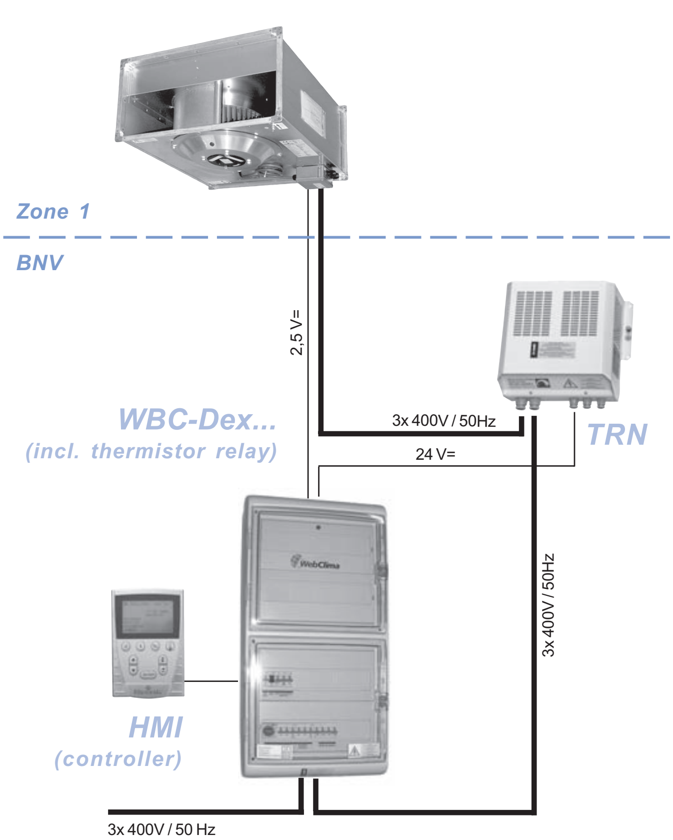
D

Fan with Control Unit and Output Control

An RP (RQ) Ex fan equipped with an output controller and an OC controller connection in a more sophisticated venting system with a WebClima control unit (e.g. with air heating) is shown in figures # 22.a and 22.b.
This type of connection ensures full thermal protection of the fan using thermistors and a WBC-Dex control unit which already contains a thermistor relay installed in the factory. Fan switching on/off is ensured by the control unit. The motor protection must always be ensured by the control unit by connecting the TK, TK thermistor terminals to the 5a, 5a, 5b and 5b terminals in the control unit. The OCe controller is installed in the control unit during production. This connection of the speed controller enables the option of fan output in the range from stage "1" to stage "5".
In the D connection example, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller.

The air-handling system is started by the control unit. An OCe internal controller is integrated into the control unit, which enables remote control of the controller. The OCe controller is provided only with positions "1" to "5" to set the required fan output. Stages "1" to "3" can be blocked. All protection and safety functions of the fan as well as the entire system are ensured by the WebClima control unit.

Figure 22 - Fan connection



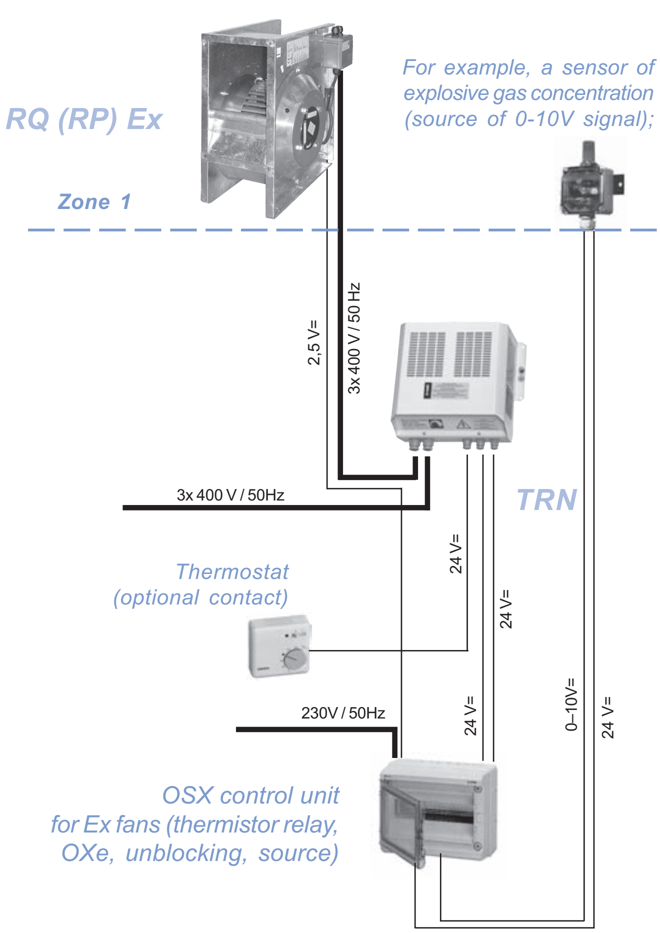
E

Fan with Automatic Output Control for Special Applications

An RP (RQ) Ex fan connection in a special venting system with automatic output control using the TRN controller equipped with an OXe controller integrated into the OSX control unit is shown in figures # 22.a and 22.b. Two TRN controllers can be controlled by the OSX control unit. In addition to automatic fan output control within the stage range "0" - "5", this type of connection also ensures fan protection via thermistors, thermistor relay and the protection integrated into the TRN controller. This type of connection enables the fan to be switched on/off manually, by any other switch (like room thermostat, gas detector, pressostat, hygrostat, etc.) on terminals PT1, PT2.
Automatic selection of the controller output stage is ensured by the OXe controller in relation to any physical quantity which is read by the active sensor equipped with an analogue output (signal source 0-10V). Ex fans use mostly an explosion gas concentration sensor.

~~The fan in the picture is started, control~~led and protected by the TRN controller. An automatic driver of the OXe controller evaluates the continuous 0-10V signal from a converter (signal source), and in five adjustable levels switches stages "1" to "5" of the controller. Thermal or pressure converters, converters for the measurement of relative or absolute humidity, concentration of gases, vapours or explosives in air, sensors of air quality and many other converters of different physical quantities can be used as sources of the control signal.
The closed electrical circuit between TK, TK terminals situated in the control unit and closed external switch connected to PT1, PT2 terminals are essential for the fan's operation.
The switch connected to PT1, PT2 terminals can be used to stop and start the fan separately without other relations. The PT1, PT2 terminals in the controller can also be interconnected with analogous terminals in the OSX control unit, and thus enable the fan to be stopped by the button from the control unit. If this possibility is not used, it will be necessary to interconnect terminals PT1 and PT2.
If the fan is overloaded, contacts TK, TK in the OSX control unit will be disconnected due to overheating of the motor. As a reaction to this state, the controller will turn the overheated motor off. After cooling down, the motor is not automatically started. The failure must be confirmed by pressing the separate unblocking button which is situated inside the OSX control unit. As most similar special installations can vary from case to case, it is advisable to consult the specific connection with the manufacturer. The manufacturer will deliver an OSX control unit adapted according to the disposition, modification and number of individual devices. The following specification must be attached to your order:
- Type of fan No. 1
- Type of fan No. 2
- Type of controller No. 1
- Type of controller No. 2
- Type and manufacturer of the sensor (converter) provided with a 0-10V output.
- Specification of the physical quantity read by the sensor (converter) and its range.
- Specification of the sensor (converter) power supply

Figure 23 - Fan connection



Technical information

Why Control Fan Output?

Requirements for efficiency of air-handling device operation cannot be reduced just on the heat-output control area. Maximum energy savings can only be produced by the full control, i.e. control of heating, cooling, mixing, as well as the air flow control. The following sections contain brief description of the most common reasons for application of air flow control.

Energy Savings

If the air flow rate in a ventilated room is reduced by the controller to the half the inputs of the fan, heater and cooler will also be reduced to the half. Air-handling devices are often designed for applications with time varying requirements for the air exchange. The reasons can be as the following: variable loading due to varying number of persons in the ventilated room (restaurants, theatres, concert or dancing halls, etc.) or varying heat gain (loss) caused by internal sources or insolation, varying emissions of pollutants, humidity, etc. The highest energy savings can be produced by using controllable fans and designing the air-handling device with variable air flow rates.

Noise Level Reduction

Some air-handling devices can be dimensioned to be permanently operated at full output. However, on some conditions temporary noise level reduction can be requested.
Vice versa - other air-handling devices can be designed to be permanently operated at lower air flow rates with the possibility to increase the air flow rate temporarily.

Process Ventilation

In practice, fully controllable fans of Vento and AeroMaster systems have proved their advantages in many cases. Just to give a few examples, they are used in aerodynamic testing laboratories, testing wind tunnels, air douches and oases with varying air flow rates, process cooling of machines or air exchangers, etc. They are frequently used in boiler houses requiring varying supply of combustion air depending on the number and output of currently used boilers. When air-conditioning clean areas, the fan output controllers can automatically keep required positive pressure Dps=const. at different air flow rates. And vice versa, sometimes the fan output controllers can automatically ensure constant air flow rate V=const. at variable pressure loss, e.g. caused by the filter fouling.

Troubleshooting the Project

In places with insufficient energy sources for heating (cooling), which do not allow the heaters (coolers) to be dimensioned for the full air flow rates at minimum (maximum) outdoor temperatures, air flow control can be used to compensate insufficiency in heating (cooling) output. Adjustment of the system, i.e. increasing/decreasing the air flow rate, can be performed manually by the operator, or automatically using standard REMAK governing and controlling components.

Fan Speed Control

The fan output can be controlled by changing the impeller's speed. Generally, several types of control can be used with fans. However, voltage control is the most suitable for fans equipped with resistance armature motors. There is no interference, humming, squeaking or vibration of the motor. Furthermore, voltage controlled motors feature lower warming. RP, RQ, RO and RS fans, including their modifications, can be steplessly controlled providing the change in voltage is stepless. In practice, stage-switching voltage controllers are usually used.

Five Stage Voltage Control

TRN, TRRE or TRRD stage voltage controllers can control the fan output in five stages by 20% steps, with which five pressure-airflow relation curves in working characteristic of each fan comport.
RP, RQ, RO and RS fan motors, including their modifications, can be operated within the range approx. from 25% to 110% of the rated voltage. The following table shows the correlation between the input voltage and selected stage of the controller for single-phase and three-phase motors.

Table 1 - input voltage and stage of the controller

Motor type	Characteristics curve – Controller's stage				
	5	4	3	2	1
single-phase	230 V	180 V	160 V	130 V	105 V
three-phase	400 V	280 V	230 V	180 V	140 V

Stepless Electronic Control

Stepless electronic output control is suitable for single-phase fans; especially for RO fans (all sizes) and RS fans (size RS 30/...). Higher warming of motors at lower speed and noisiness can be considered as disadvantages of electronic control using PE 2,5 and PE 5 controllers. As a partial disadvantage can also be pointed the fact that when determining operating modes the designer does not have the possibility to exactly define the controller's stage of required output related to the load of the ventilated space. However, when used in simple air-handling systems, the stepless (continuous) control can provide some advantages.

Speed Control using Frequency Converters

Despite the continuous advancement in development of frequency converters, it still represents higher investment using them to control the fan output, and technically they are more convenient for standard motors, which are not designed for voltage control.

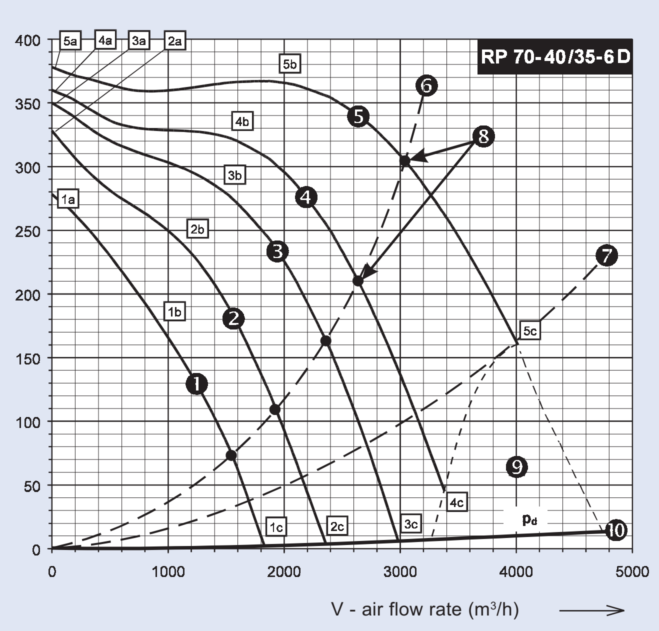
Working Characteristics and Control

Working Characteristics and Control

Technical information

The following text explains relationships of fan control and their working characteristics. Output characteristics determine the relationship curve of the air flow rate V (m3/h) and total fan pressure ?pt (Pa). An example in figure # 1 gives detailed explanation. All RP, RQ, RO and RS fans, including their modifications, are fully controllable, and they can be operated in connection with TRN or TRRE(D) five-stage controllers in one of five output stages. Each output stage set on the controller (stage 5,4,3,2, and 1) corresponds to one of the values of the controller's input voltage (see table #1, page 91). Each input voltage corresponds to one of the fan's working curves, the so-called fan's characteristic curve ❺❹❸❷❶ (see figure # 1).
If no controller is connected to the fan, then the fan can only be operated in accordance with curve ❺.

Figure 1 - Input voltage working characteristic



The characteristic of the particular duct system has a parabolic map curve of the relation V-Δp_t (e.g. curve ❻). Effective working point ❽ of the fan - duct system assemblage will lie at the intersection of the fan curve corresponding to the selected output stage and the curve of the connected duct system. The output of the fan controlled by changing the voltage is dependent on the load. Therefore, not only the voltage and speed are changed but also the current and input. Numerical values can be found in data tables, which include changes of these values for three selected points of each working characteristic, e.g. 5a, 5b and 5c of characterist ❺. Some fans have the so-called forbidden area. The forbidden (non-working) area ❾ is defined by dashed lines. It is marked in figure #1 when any characteristic ends with point "c", e.g. 5c, which does not lie on the dynamic pressure "p_d" curve ❿.
Such the fan must not be operated with free inlet or free outlet; it must always be connected to the duct system of which resistance characteristic, e.g. ❼, does not go through the forbidden area. This fan must be throttled to the minimum pressure loss Δp_s min in accordance with data tables of the respective fan. If the fan is operated in the forbidden area without being protected by the prescribed way the motor can be damaged due to electric overloading. If the protection is performed by the prescribed way the thermo-contacts will activate the protection at internal motor temperature of 130°C, and the fan will be stopped.

Warning! In some cases, if the fan's motor is cooled by the freezing air the motor protection may not be activated and motor will not be damaged. However, the controller is not cooled the same way as the fan's motor, and the winding of the controller might be overloaded and damaged due to exceeding current. Therefore, after connecting the fan, the check of input current is essential. The phase current must not exceed maximum allowed value in any controller's output stage.

For assignment of the controller to the fan, refer to the catalogue of the respective fan. The controller's version must comply with the fan (single-phase/three-phase), and the controller's maximum current must be higher than, or at least equal to, maximum current of the fan, refer to the fan's catalogue.

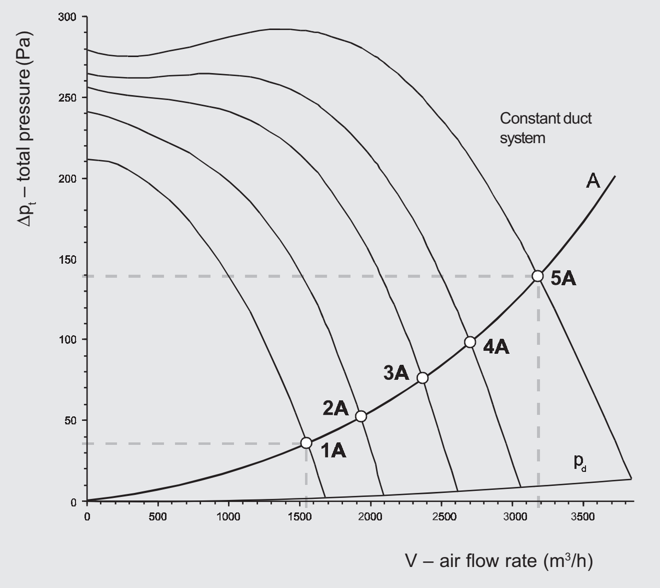
Example: According to RP fans' catalogue, RP 70-40/35-4D three-phase fan has maximum current Imax = 6 Amp. TRN 7D three-phase controller is the closest controller with higher maximum current. This controller is also recommended in the "Data Section" of the RP fan Catalogue.

Technical information

Air Flow Control

Fan output control is mostly used in systems with variable air flow and constant duct system. We suppose that the characteristic curve of the duct system has determinate parabolic course, and the goal of the control is, to change the air flow rate. The working characteristic of the fan can be changed from the maximum air flow rate, which corresponds to working point 5A (see figure # 2), by switching the output stages, and thus to move the working point along the duct system's characteristic curve A from point 5A to points 4A, 3A, 2A or 1A, where the air flow rate is the lowest.

Figure 2 - Maximum air flow rate



It is common practice to assemble similar air-handling systems with variable air flow rates using components of Vento system. Examples of these applications are presented in scheme diagrams on the following pages.

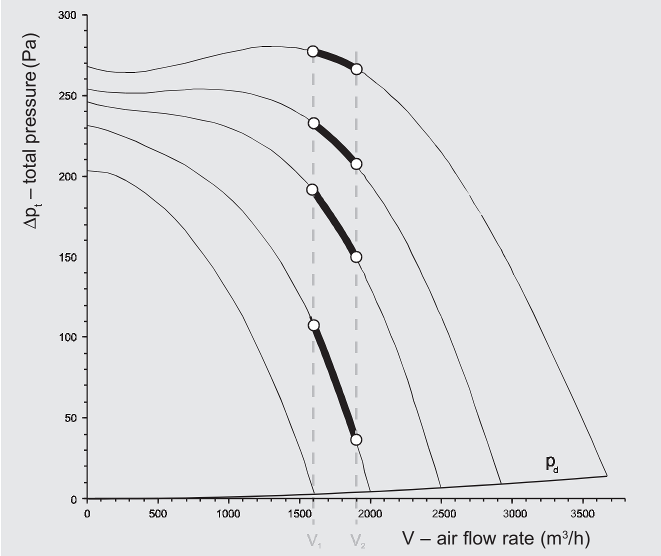
Pressure Control

Fan control can also ensure the constant air flow rate in a variable duct system. This type of control is applied with air-handling systems if aerodynamic properties of the duct system are significantly changed in the course of time, and these changes must be compensated by the fan. As a good example of such the situation we can use the filter fouling in air-handling systems intended for clean areas, which can produce pressure loss of hundreds of Pa, this could cause significant reduction of air flow. If the constant air flow rate is required a simple air-handling assembly can be configured from Vento system components; this assembly will keep the air flow rate in a very narrow range even though the initial minimum pressure loss in the duct system at the required air flow rate will only be for example 10% or 20% of the eventual pressure loss.

Let's suppose that the required air flow rate needs to be kept automatically without need for the operator's assistance. An example of the situation when the air flow rate of about 1,750 m³ per hour has to be kept within the pressure difference ranging from 40 Pa to 270 Pa is shown in figure # 3. Let's select the permissible air flow rate fluctuation, e.g. in the range [V1 = 1,500, V2 = 1,900], i.e. ± 150 m³/h (± 8.5% of required value).

The working point of the given air-handling assembly can lie on highlighted segments of characteristic curves within the determined range of the fan's working characteristics.

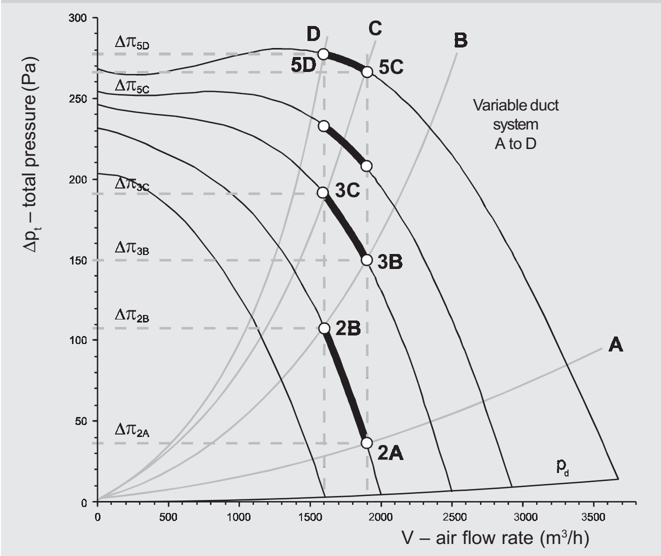
Figure 3 - Fan working characteristics



The duct system's characteristic curves going through the initial and end points of particular segments are shown in figure # 4. The duct system's rising characteristic curves are marked with letters A to D. Let's suppose that during service life of air filters initial A curve for clean filters will gradually change to end D curve for fouled filters, which must be replaced.

The entire air-handling assembly will be controlled depending on sensed value Δpt, which in this case represents the difference between total pressure pt2 behind the fan and static pressure ps1 in front of the fan ($\Delta p_t = p_{t2} - p_{s1}$). If we omit influence of dynamic pressure, which in this case represents about 4 Pa, the measurement of static pressure in front of and behind the fan (pressure differential) will be sufficient.

Figure 4 - Duct system characteristics



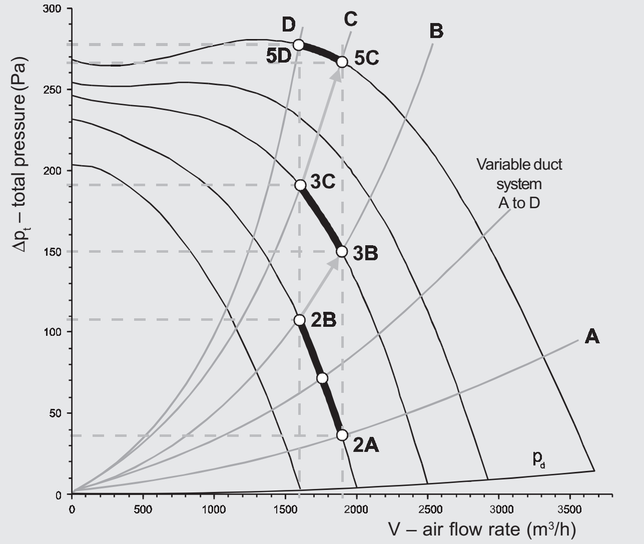
Technical information

The following Vento components are needed to configure a simple pressure controlled air-handling assembly:

- Fan (for example RP 60-35/31-6D)
- Fan output controller (for example TRN 2D)
- OSX control unit
- Differential pressure sensor of working range, e.g. from 0 to 30 Pa, which provides output signal of 0–10V

The air-handling assembly will work so that the differential pressure sensor will generate continuous analogue signal of 0 to 10 V. When adjusting the assembly, individual comparison levels will be preset by the trimmer on the face panel of OSX control unit; these levels define selected pressure differential corresponding to a certain output stage of the controller. In our demonstration example, these levels will be preset so that the second output stage will be switched at pressure differential lower than Dp2B. If pressure differential goes above the value of Dp2B the controller will automatically switch to stage # 3. If pressure differential goes above the value of? Dp3C the controller will automatically switch to stage # 4, respectively stage # 5. Output stage # 4 can be skipped because duct system characteristic C goes through point 3C, and its working point 5C on curve # 5 also lies within the determined air flow range.
Figure # 5 shows all possible operational states of example air-handling assembly. Initial working point will be 2A (fan characteristic curve 2, duct system characteristic curve A). Gradual filter fouling increases quickness of the duct system characteristic curve until the state marked with curve B is reached. The working point will also be moved along the highlighted segment as far as to point 2B when the pressure differential reaches the first comparison level Δp2B. At that moment, OSX control unit will switch from output stage # 2 to output stage # 3 while the working point will jump from point 2B to point 3B. Continuing filter fouling will move the working point up, along the highlighted segment, as far as to point 3C when the pressure differential reaches level Dp3C corresponding to the second comparison level. At that moment, OSX control unit will switch from output stage # 3 to output stage # 5. Further filter fouling will move the working point to the end point marked 5D, which represents the value seven-times higher than the one at point 2A. After replacing the air filters, the air-handling assembly will again start at point 2A.

Obrázek 5 – pracovní stavy zařízení



Examples of air-handling assemblies equipped with air flow and pressure control

Figure 6

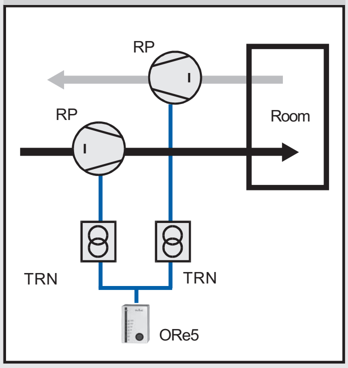
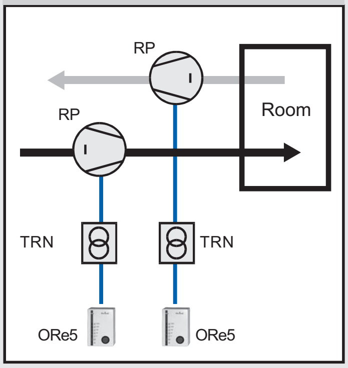


Figure 7



◀ Air-Handling Assembly with Manual Air Flow Control

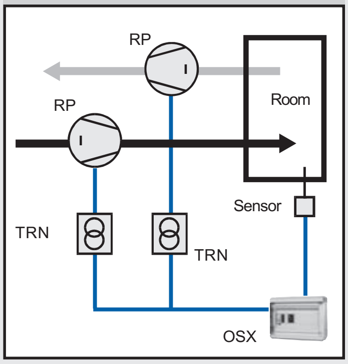
A simple air-handling system with variable air flow rate is shown in figure # 6. Adjustment of the inlet and outlet fan air flow rate is performed manually using common option on ORe5 controller. The same air-handling assembly is shown in figure 7; however, here the inlet and outlet fan air flow rates can be adjusted individually using two separate ORe5 controllers.

If ORe5 controller is replaced by other relay switching logic system, the above-mentioned model can be used for a stage-type air flow control dependant on the selected logic system. For example, to increase the quantity of combustion air according to the number of currently operated boilers, etc.

Air-Handling Assembly with Automatic Air Flow Control ▶

A simple air-handling system with automatic air flow rate control is shown in figure # 8. Aside from several additional functions, OSX control unit mainly ensures automatic control of the fan outputs depending on input information coming from the sensor. A converter of any physical quantity to unified analogue signal can serve as a sensor. Most often, physical quantity which we want to influence by changing the air flow is measured, i.e. temperature (ventilation to reduce thermal loading), humidity (keeping the level of absolute or relative air humidity), concentration of gases or vapours (reducing the concentration of explosives or other hazardous substances), air quality (ventilation of restaurants), pressure, pressure differential (keeping constant positive pressure in clean areas, or negative pressure in polluted hazardous areas), etc.

Figure 8

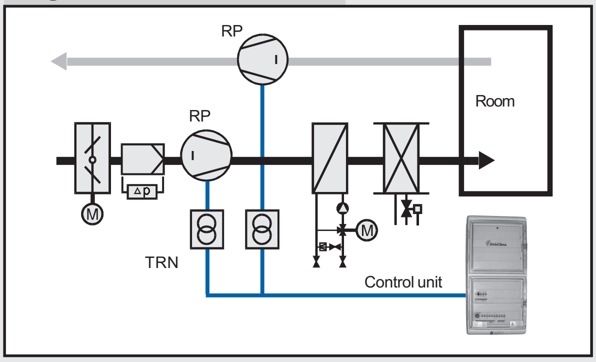


Technical information

More Sophisticated Air-Handling Assembly with Manual Air Flow Control ▶

A more sophisticated air-handling assembly with air heating and cooling, which is equipped with a control unit, is shown in figure # 9. In this case, it is advisable to install internal controls of the controllers directly into the control unit (instead of using separate ORe5 controllers). Internal controls can again be common ("dependent") for inlet and outlet, or separate ("independent") for each controller.

Figure 9



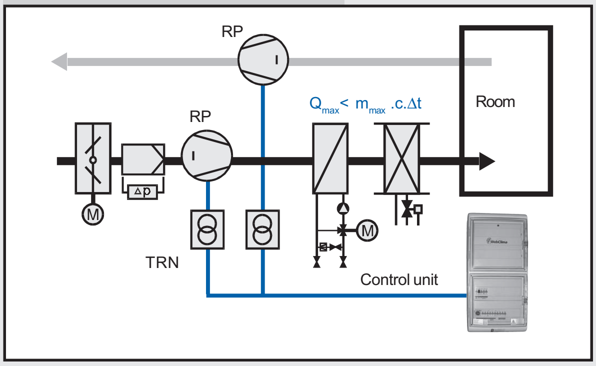
◀ Air-Handling Assembly Featuring Autonomous Air Flow Control

Figure # 10 shows an example of the assembly, which does not, or cannot, provide sufficient heating (cooling) output, i.e.

$Q_{max} < m_{max} \cdot c \cdot \Delta t$

The problem of insufficient heating (cooling) output can be solved by automatic reduction of the air flow rate.
The adjustment of this system by reducing or increasing the air flow rate can be ensured by adding an OX controller to the control unit. If the unit is not able to reach the required outlet temperature the air flow rate will be automatically reduced until the required temperature is reached.

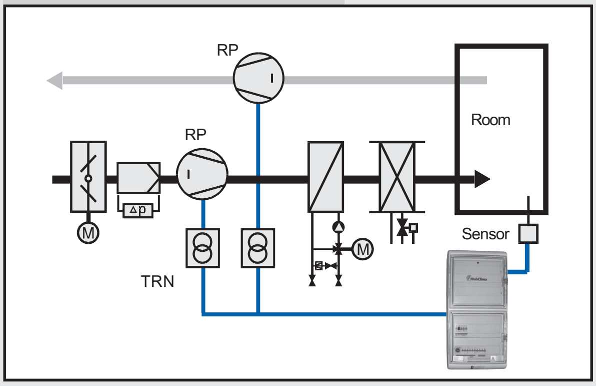
Figure 10



◀ Air-Handling Assembly with Automatic Air Flow Control

Figure # 11 shows a similar assembly, when the control unit is, as in the previous example, extended with an OX controller; however, its input is not connected to the unit internal control signal but to external signal coming from the sensor of any physical quantity. As far as the function is concerned, this assembly is as same as the model with OSX unit shown in figure # 8. The only difference is, that the control unit with an integrated OX controller controls not only the fan output but also heating, cooling, respectively mixing. So, this is an example of the fully controlled air-handling assembly.

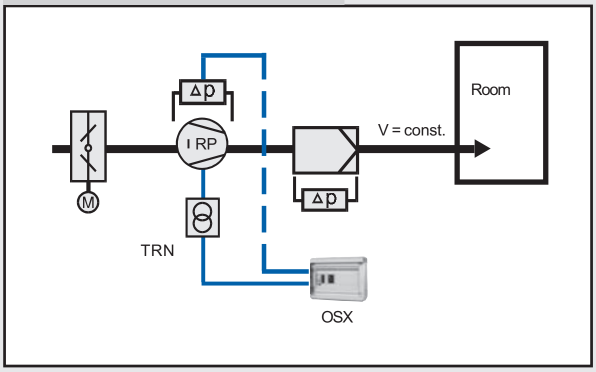
Figure 11



Air-Handling Assembly with Pressure Control ▶

An example of the assembly which ensures constant air flow rate in a variable duct system (e.g. great change in pressure loss due to fouling of end filters) is shown in figure # 12. A simple and fully automatic assembly keep the air flow rate within very narrow range. This air-handling assembly will work so that the differential pressure sensor will generate 0 to 10V continuous analogue signal. According to this signal, OSX control unit switches the controller's output stages. For the detailed analysis of an example air-handling assembly, refer to page 104.

Figure 12

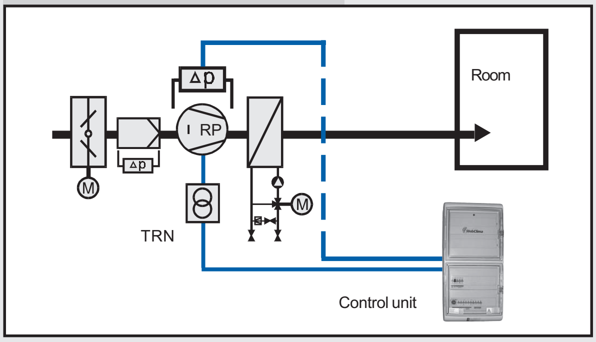


◀ More Sophisticated Air-Handling Assembly with Pressure Control

Figure # 13 shows an example of the assembly which ensures constant air flow rate in a variable duct system (e.g. great change in pressure loss due to fouling of end filters).

As far as the air flow control principle is concerned, this assembly corresponds with the assembly shown in figure # 12. However, in this case the OSX unit is replaced with a control unit equipped with an OX controller. So, this assembly is fully and automatically controlled (i.e. control of operation, temperature and pressure; and control of cooling and mixing, respectively control of heat exchange can also be added).

Figure 13



Technical information

Types of Voltage Controllers

PE controllers are intended for the switching and stepless control of single-phase fans. Electronic thermistor PE controllers are not equipped with an integrated motor protection. Therefore, without additional components they can be only recommended for the fans equipped with their own protection using the so-called series thermo-contact (RO a RS 30/...). These controllers are manually operated by the rotary selector situated on the front panel. They can be installed into the mounting box embedded under the plaster.

TRRE (D) controllers are intended for the switching and five-stage speed control of RP, RQ, RO and RS fans, including their modifications. The TRRE(D) transformer controllers are not equipped with an integrated fan motor protection. Therefore, they must be used in connection with control units, respectively STE(D) protecting relays. These controllers are manually operated by the rotary selector situated on the front panel, and therefore, they must be within the operator's reaching range.

TRN controllers are intended for the switching and five-stage speed control of RP, RQ, RO and RS fans, including their modifications. As standard, the TRN transformer controllers are equipped with an integrated fan motor protection. They are operated using remote controller. Therefore, they can be situated out of the operator's reaching range. These controllers enable direct control from the control unit, respectively fully automatic control.

Table 2 - Specification of controllers

The controllers are intended for special voltage-controllable asynchronous motors with a resistance armature. This table provides a review and specification of individual controllers based on their specification, use, properties, accessories and comfort.					
Controller's type	**TRN-E**	**TRN-D**	**TRRE**	**TRRD**	**PE**
Controller's specification					
Single-phase fans	●		●		●
Three-phase fans		●		●	
Maximum fan's current $I_{max.}$ (A)	< 7	< 9	< 7	< 9	< 5
Type of control					
Stage control (5 stages)	●	●	●	●	
Stepless control (no stages)					●
Equipment					
Integrated thermal protection of the fan	●	●			
Integrated control			●	●	●
světelná signalizace chodu na regulátoru nebo ovladači	●	●	●	●	●
Accessories					
External protection of the fan required			●	●	●
External control required	●	●			
Control and Modes					
Switch off blocking (output stage "0") enabled	●[1)]	●[1)]	●	●	●
Blocking of some output stages (1 - 5) enabled	1- 3	1- 3	0 - 3	0 - 3	*)
Controller must be within the operator's reach			●	●	●
Manual control enabled	●	●	●	●	●
Automatic control enabled	●	●			
Control from the control unit enabled	●	●			
Remote (external) switching on/off enabled	●	●			
Other information					
For details, refer to	pages 97 - 104		pages 105 - 108		pages 109

*) It enables (stepless) setting of the fan speed to minimum.

TRN Transformer Controllers

Application of TRN Controllers
TRN transformer controllers are intended for the switching and five-stage speed control of RP, RQ, RO and RS fans, including their modifications.

Concept of Controllers
Control and power parts of TRN controllers are separated and interconnected by the cable. Separated concept of controllers provides high variability, excellent layout planning and functional flexibility. It is advisable to place the output controller close to the fan, e.g. in a machine room, in the ceiling, etc. While the remote control can be conveniently situated within of the operator's reach. TRN controllers enable direct control from the control unit, respectively fully automated control using special control elements.

Integrated Basic Features
As standard, TRN controllers (resp. in connection with remote controls) provide the following properties and features:

Start-up
Starting /stopping the fan using remote control.

Fan Output Control
Five-stage fan output (speed) control depending on the command coming from the controller.

Thermal Protection of Fans
Permanent monitoring of the motor temperature (state of thermo-contacts in the motor winding). Switching the fans automatically off if the maximum permissible temperature has been exceeded. The designer decides whether the protection will be active by selecting one of recommended ways of the wiring (refer to the Wiring Diagrams).

Safety Blocking after Activating the Protection
After the thermal protection has been activated the safety blocking function blocks the fan against spontaneous starting. After checking the fan the controller must be unblocked turning the selector to the "0" position.

External Start-up
Remote (external) starting and stopping of the fan other than using connected controller. This feature can be used to start or block the fan by an external switch (thermostat, pressostat, manostat, hygrostat, gas detector, any auxiliary contact, etc...). If the fan is started by the external switch the fans' operation and output will be controlled by the connected controller, and vice versa, if output stage 1-5 is preset on the controller the fan's operation will be controlled the external switch.

Blocking of Output Stages
Controllers and controls support electronic blocking of some output stages by simple settings performed on the controller and/or remote control device. One or any combination of stages can be blocked (applies for stages which can be blocked). For example, this feature can be used if the fan cannot be switched off by the controller but only by the external switch (i.e. function of external start-up is used). The blocking serves for the minimum air flow rate setting, i.e. to limit low outputs etc. The blocking of stages # 1, 2 and 3 can be performed directly in TRN controller. Blocking of stage "0" in an ORe5 controller, which can be operated independently or combined with a control unit, is performed in case of the controller switching by the contact, or if it is combined with a control unit (compulsory for electrical heating). For blocking settings of TRN controllers, refer to the section "Wiring". For blocking of the "0" stage in an ORe5 controller, refer to the documentation delivered with the controller.

Operation, Output and Failure Signalling
Controllers signal current operation state on an ORe5:
- Operation or stop mode
- Active output stage
- Failure

Permanent Elimination of Some Functions
If TRN controllers are powered from the parent control system, e.g. REMAK control units, by no means the following functions may be used:
- Protection function
- Function of external start-up

The protection function can be permanently disabled by interconnecting the controller's TK, TK terminals. If this is the case, the TK terminals in the fan's terminal box must be connected to corresponding terminals in a control unit. The failure of the fan will be evaluated by the parent control system. External start-up function can be permanently disabled by interconnecting the controller's PT1, PT2 terminals. Both, protection and start-up functions can be disabled by interconnecting the controller's terminals PT2 and E48 - see the wiring diagram on page 100.
The wiring diagram of the controller in a parent control unit system is always included in the wiring diagram of the parent control unit..

Operating Conditions, Position
These controllers are intended for indoor applications in a dry, dust and chemical free environment. They are designed for normal environmental conditions in accordance with ČSN 33 2000-3 (IEC 364-3).
- Degree of protection: IP 20
- Permissible ambient temperature: +5 °C to +40 °C
- Position: always vertical or horizontal.

The controllers can be situated on a wall, air-handling duct or ancillary construction. They can be mounted on A and B combustibility grade materials in accordance with the ČSN EN 13 501-1 and ČSN 73 0823 standards.
The installation must be performed considering the weight of the controller, easy cable wiring, barrier-free service access, and free cooling openings. The controller casing is provided with ventilation openings – it must not be covered.

Table 3 - Controller Output Range

Three-phase (3x400V)	Single-phase (1x230V)	Max. current (A)
TRN 2D	TRN 2E	2
TRN 4D	TRN 4E	4
TRN 7D	TRN 7E	7
TRN 9D	–	9

TRN Transformer Controllers

Dimensional and Output Range

Totally seven types of TRN five-stage controllers are manufactured in accordance with table #3 and figure # 14, see below.

Figure 14 - Type designation

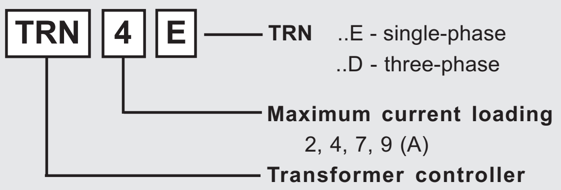


Figure 15 - Dimensions and weights

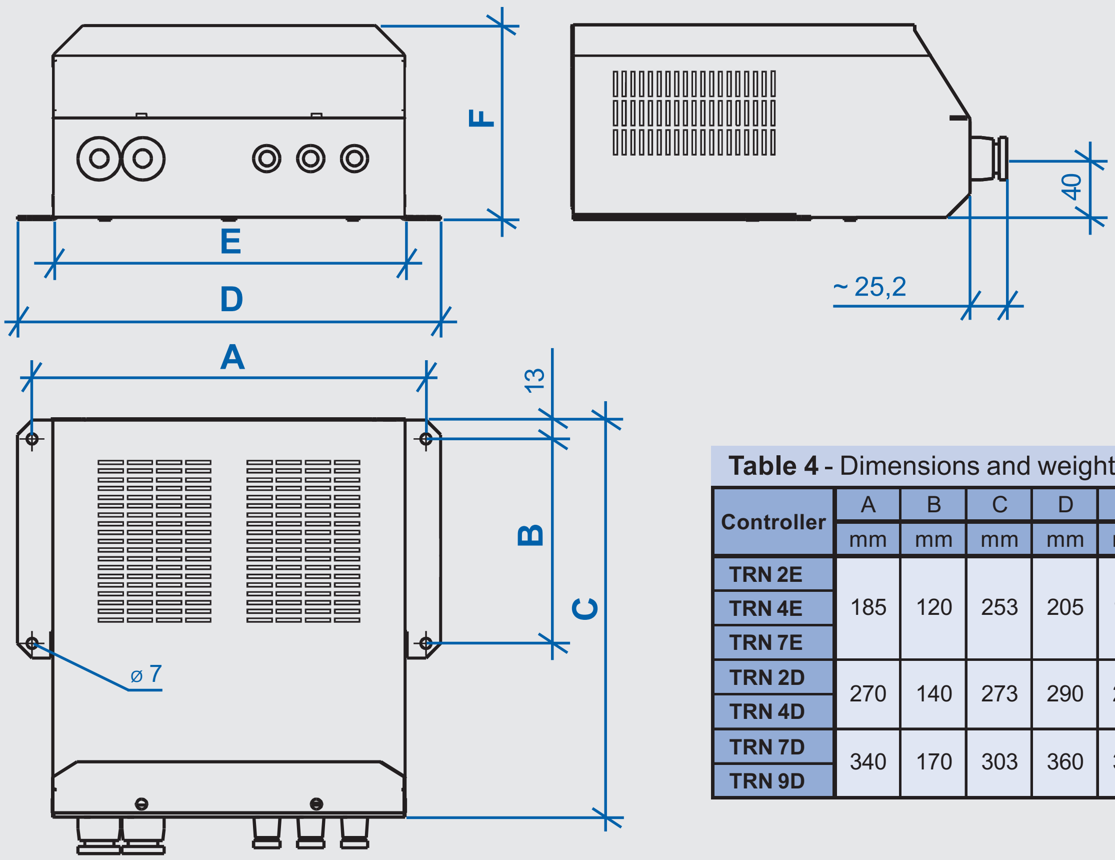


Table 4 - Dimensions and weights of controllers

Controller	A	B	C	D	E	F	m
	mm	mm	mm	mm	mm	mm	kg
TRN 2E							5
TRN 4E	185	120	253	205	157	134	7
TRN 7E							8
TRN 2D	270	140	273	290	242	134	10
TRN 4D							14
TRN 7D	340	170	303	360	312	157	26
TRN 9D							32

Designation of Control

Example: Designation TRN 4E specifies a single-phase fan controller designed for maximum current of 4 A.

Materials

External casings of all types of controllers are made of steel sheet finished with RAL 9002 sprayed powder coating. Plastics, copper, aluminium, transformer steel and galvanized sheets are used in the internal structure of the controller. Internal electronic components of the controller are situated on printed circuit boards provided with protecting coating. Switching and protection elements are used in both, power and control electronics.
All components and materials are carefully checked so they ensure long life service and reliability of the controllers.

Controls of TRN Controllers

Several types of controls can be used to control TRN controllers. Each control enables one or two fan output controllers to be controlled.
The controllers can be specified according to their location and the way of control:

Table 5 - Controller types

	Control
According to location	Independent
	From the control unit
According to type	Manual
	Automatic

Integrated controllers and their description are a part of the control unit configuration, and they must be consulted with the manufacturer.
Note: Some control systems (e.g. VCB) enable using internal manual controls of the controllers in a time (automatic) mode - program.
The use of ORe5 remote controller with manual selection of output stage and light signalling of operation is essential if no control unit is used in the control system. However, its combination with a control unit can also be used in some cases. It is intended for separate interior installation.
Automatic control without using the control unit can be solved by using OSX unit, refer to page 135.

TRN Transformer Controllers

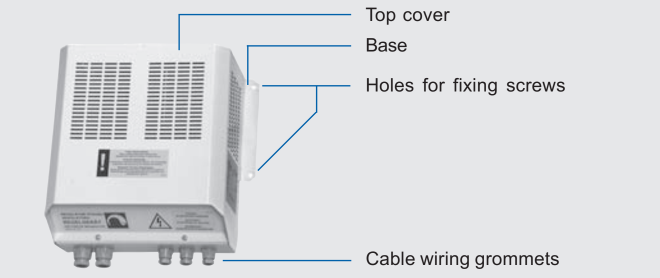
Installation

TRN controllers are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the controller.

■ The installation and commissioning can be performed only by an authorized company licensed in accordance with valid regulations.

■ The controller must be checked carefully before its installation, especially if it was stored for a longer time. In particular, it is necessary to check all parts and cable insulation for damage.

Figure 16 – Controller description



■ It is advisable to place the TRN output controller close to the fan, e.g. in a machine room, in the ceiling, etc. The controller can be placed on a wall, air-handling duct or ancillary construction. With regard to its weight, the controller is installed in three steps:

- First, fix the base with 4 screws of 6 mm diameter.
- Hang the controller supporting plate, including wiring, on the base, and secure it with a screw.
- Finally, fix the controller cover.

■ The installation must be performed considering the weight of the controller, easy wiring, barrier-free service access, and free cooling openings.

■ As the controller contains sensitive electro-mechanical parts, take care and keep the controller interior clean. Especially, it is necessary to avoid the controller being contaminated with dirt from a construction site (dust, sand, plaster, etc).

■ The remote control can be situated at any distance from the controller, and mounted on a wall at the operator's location.

Wiring

The wiring can be performed only by a qualified worker licensed in accordance with national regulations.

■ Cables for the power supply, fan motors connection and control are led through plastic grommets, and connected to the WAGO terminals in the lower part of the controller casing. The controller's entry is provided with plastic grommets. An example of a layout of individual connection points for all controller sizes is shown in figure # 17.

■ For types of corresponding fuses for respective controllers, refer to table # 6. To make replacing the fuse easy, free access and the necessary handling space must be provided.

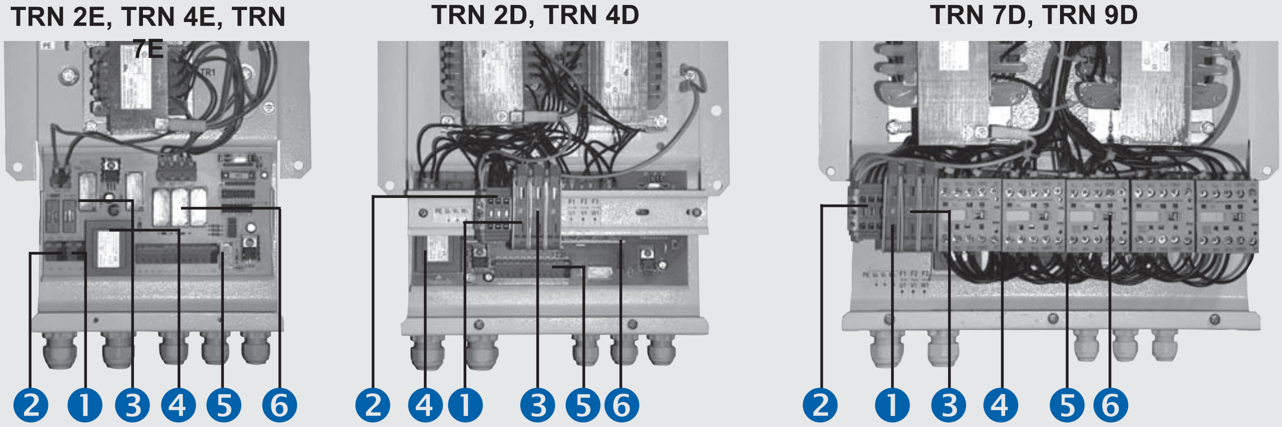
■ Each fan must be connected to a separate controller. If the same output stage for two fans (inlet, outlet) is needed, it is possible to control both controllers by one remote control. For more detailed information, refer to the operating instructions of individual controllers.

■ As standard, the TRN controllers are equipped with integrated fan motor protection. The TK, TK terminals in the controller serve to interconnect the TK, TK terminals of the fan motor thermo-contacts.

Table 6 - Fuses

Controller type	Phase	Power supply
TRN 2E	1 x T 4A	160 mA
TRN 4E	1 x T 6,3A	160 mA
TRN 7E	1 x T 10A	160 mA
TRN 2D	3 x T 4A	160 mA
TRN 4D	3 x T 8A	160 mA
TRN 7D	3 x T 12,5A	160 mA
TRN 9D	3 x T 12,5A	160 mA

Figure 17 - Controller connecting points



power supply terminals ❶, fan motor connecting terminals ❷, fuses ❸, power supply ❹, remote control connecting terminal box ❺, assembly of switching relays (or contactors) ❻.

TRN Transformer Controllers

- If the fan motor is overheated due to overloading or emergency, the thermo-contacts will open and the controller will stop the fan. When the motor cools down, and the failure is removed, the fan can be restarted from the zero position on the remote control.
- The TRN controllers enable remote (external) starting/stopping of the fan independently of the controller. This function can be controlled by connecting or disconnecting the circuit between the PT1 and PT2 terminals. This feature can be used to start the fan by an external switch (thermostat, pressostat, hygrostat, auxiliary contact, etc...).
- After connecting the controller, the current must be measured, and it must not exceed maximum allowed value in any output stage. The maximum current value is stated on the rating plate, and also as a numerical part of the type designation code of the controller (e.g. TRN 7D means Imax. = 7A).
- If the current values are higher, check whether the controller is connected to the appropriate fan; the rated current of the fan should be lower or equal to I max. of the controller.
- If the measured current value still exceeds the maximum permissible value even though the connected fan complies with the above-mentioned criteria, immediately check the duct system regulation. The fan is probably operated in a so-called forbidden (non-working) area of the fan output characteristics. The proper current value Imax can be reached by air flow throttling. If the current value does not drop even after adjusting the air-handling system, it is necessary to check the electrical parameters of the entire wiring.
- The installation of the controller must be performed in accordance with the project and catalogue (respectively Installation Manual). Before putting the controller into operation, a wiring inspection must be performed.

Blocking of Output Stages

For each output stage which can be blocked (1, 2, 3) there serves one connection - "jumper". A combination of their states assigns blocked output stages. Their settings are independent; however, in practice the lowest stages are blocked, usually dependently, as indicated in the following table:

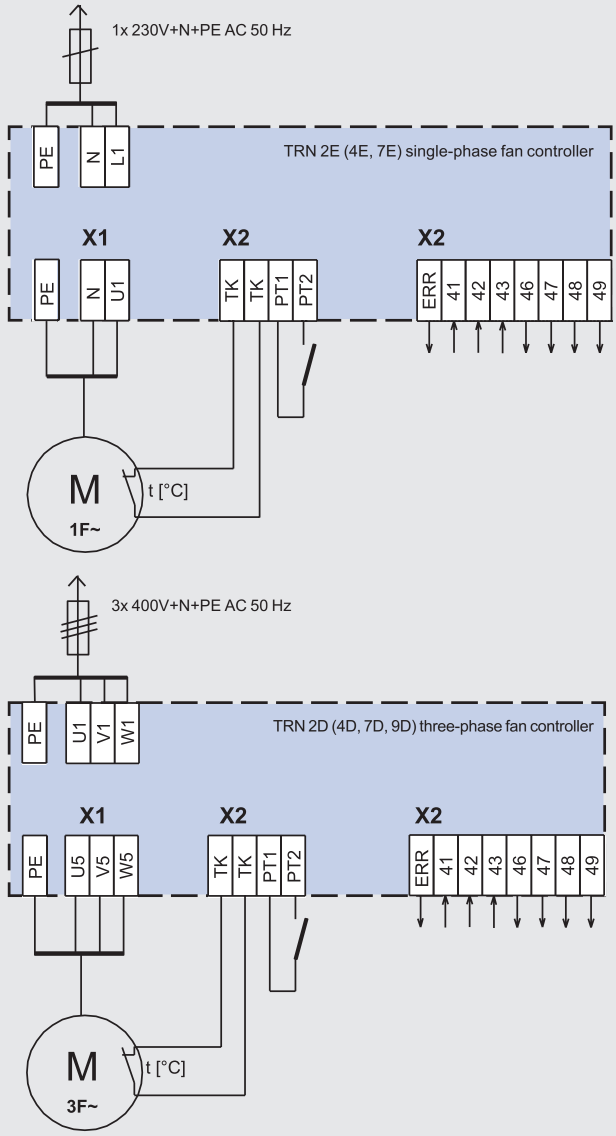
Table 7 - Blocking of output stages

Blocking of output stages	"Jumper" settings		
	J1	J2	J3
No blocking	ON	ON	ON
stage 1	OFF	ON	ON
stage 1 + stage 2	OFF	OFF	ON
stage 1 + stage 2 + stage 3	OFF	OFF	OFF

ON … connected
OFF … disconnected

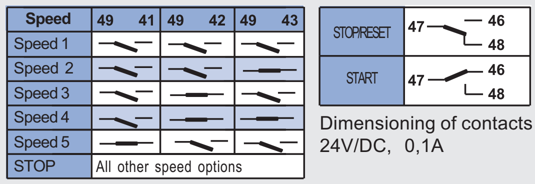
Wiring diagram

Figure 18 - TRN controller terminal diagram



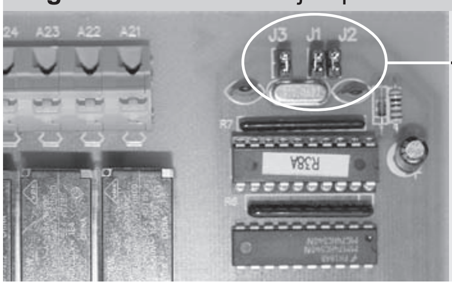
48 : 0V/DC
49 : +24V/DC, 80 mA
TK, TK : thermo-contact terminals
PT1, PT2 : external switching terminals (e.g. room thermostat)
L1, N, PE : 230V power supply

U1, N, PE : motor controlled voltage
U1, V1, W1, PE : 400V power supply
U5, V5, W5 : controlled motor voltage



Dimensioning of contacts
24V/DC, 0,1A

Figure 19 - Location of jumpers



Jumpers
J1, J2, J3

Transformátorové regulátory TRN

For recommended cables to connect or interconnect the assembly components, refer to table # 8.

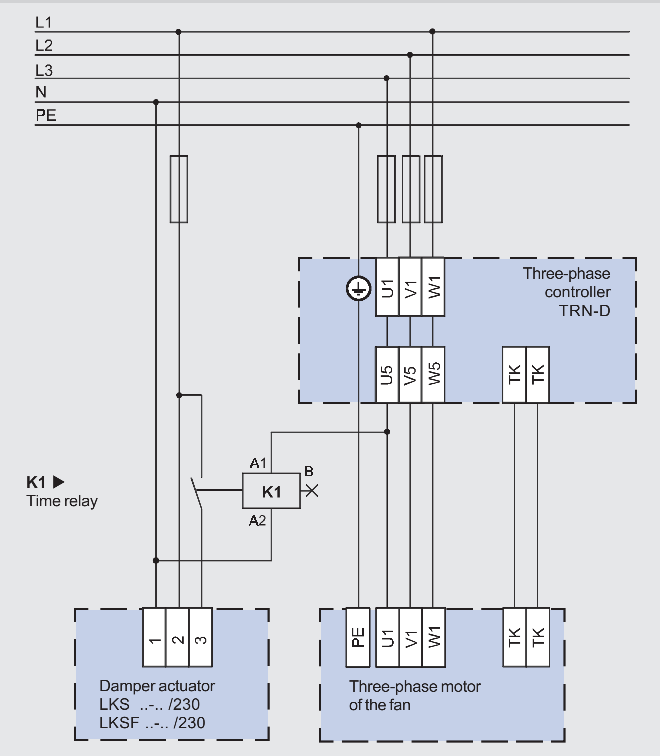
Table 8 - Recommended cables

Type	Connection	Cable	Voltage
TRN-E	feed to TRN-E	CYKY 3Cx1,5	230V ~
	feed to motor		
	to control	SYKFY 4x2x0,5	24V =
	to thermocontacts	CYSY 2Ax0,75	24V=
	external start-up		
TRN-D	feed to TRN-D	CYKY 4Bx1,5	3x400V ~
	feed to motoru		
	to control	SYKFY 4x2x0,5	24V =
	to thermocontacts	CYSY 2Ax0,75	230V ~
	external start-up		24V =

Control of LSK, LKSF Dampers

Simple air-handling systems equipped with a controlled fan sometimes require damper control to open the damper at the fan start-up. As the voltage on the controller's output terminals varies depending on the output stage selected this voltage cannot be used to control the damper actuator directly. Recommended solution is based on the power supply versatility of some time-relays, which can work at input voltage ranging from 24V to 240V AC/50Hz.
K1 relay provides one switching contact, which can be used to control LM230 or LF230 actuator. Alternatively, a pressure differential sensor can be used, e.g. P33V (suitably adjusted) situated on the fan, which ensures opening of the damper if the preset pressure difference has been indicated at the fan start-up.

Figure 20 - LKS and LKSF damper wiring diagram



Control Stages

RP, RQ, RO and RS fan motors, including their modifications, can be operated within the range approx. from 25% to 110% of the rated voltage. The following table shows the correlation between the input voltage and selected stage of the controller for single-phase and three-phase motors.

Table 9 - input voltage and selected stage

Motor type	Curve characteristics – controller's stage				
	5	4	3	2	1
single-phase	230 V	180 V	160 V	130 V	105 V
three-phase	400 V	280 V	230 V	180 V	140 V

Installation Examples

On following pages you find illustrations of installations and wiring of TRN controllers; simple assemblies using only ORe5 controllers are completed with their wiring diagrams.

Installations using ORe5 controller

A One TRN controller featuring protection function equipped with an ORe5 controller.
B Two TRN controllers featuring protection function equipped with a common ORe5 controller.
C Control unit with two TRN controllers and a common ORe5 controller.

Installations using controller installed directly into the control unit

D Control unit with two TRN controllers and common internal controller
E Control unit with two TRN controllers and integrated individual internal controllers
F Two TRN controllers featuring protection function equipped with a common OSX unit.

The wiring diagrams with front-end elements (protective relays, controllers, control units) - see examples- are included in the installation manual, respectively in the AeroCAD project of these front-end elements.

Most of control system functions are set as soon as the system is connected. It is only necessary to set the blocking of control stages. For blocking procedure of TRN controllers, refer to the section "Wiring". The blocking of individual controllers is described in their accompanying documentation.

All non-standard connections must be consulted with the manufacturer in writing, respectively control of the controllers must be a part of the air-handling device configuration - i.e. an AeroCAD project or a letter of inquiry. The manufacturer's approval of the controller's wiring is essential for validity of the guaranty.

Example A

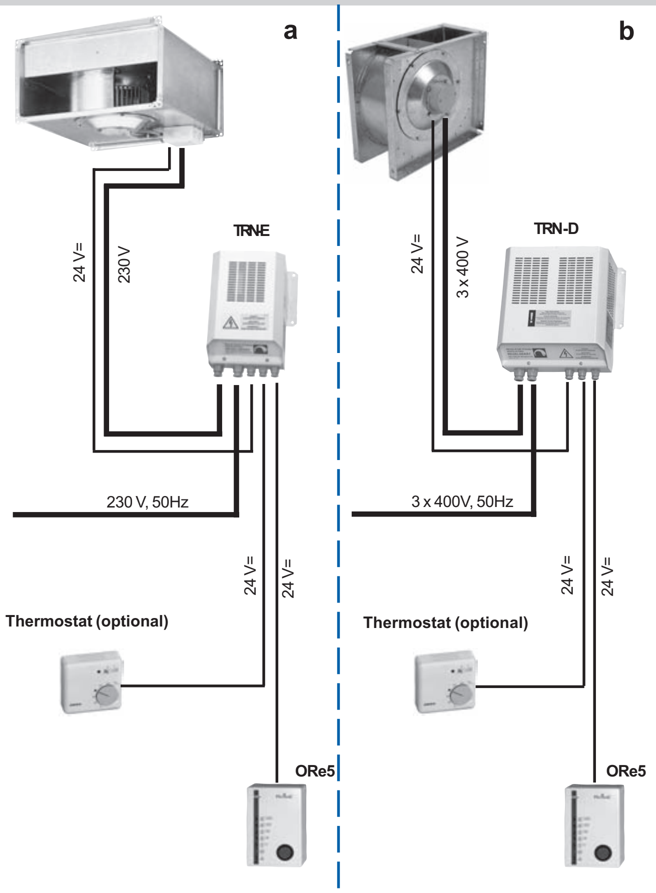
One TRN controller featuring protection function equipped with an ORe5 controller

An assembly of TRN controllers with individual ORe5 controller in a single venting system with one or more fans which must be controlled independently is shown in figure # 21 (a = single-phase, b = three-phase).
This connection of the speed controller ensures:

- The possibility of fan output selection within the stage range "1" to "5".
- Thermal protection of the fan
- Fan switching on/off manually, by the ORe5
- Fan switching on/off externally, by any other switch (like room thermostat, gas detector, pressostat, hygrostat, etc.) on terminals PT1, PT2

Upon selecting the required output stage using a selector on the ORe5 controller, the fan will start at corresponding speed. The closed switch connected to PT1, PT2 terminals and the thermo-contact circuit connected to TK, TK terminals are essential for the fan operation. The switch connected to PT1, PT2 terminals can externally stop the fan. If this possibility is not used, it will be necessary to interconnect terminals PT1 and PT2.
If the fan is overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding. As a reaction to this state, the controller will disconnect the fan power supply, and the red control light on ORe5 controller will signal the failure. After cooling down, the motor is not automatically started. To restart the fan, it is necessary first to set the selector to the "STOP" position, and thus confirm failure removal, and then to set the required fan output. In this arrangement, the option "STOP" on ORe5 controller must not be blocked
.

Figure 21 - Connection of Controllers



Example B

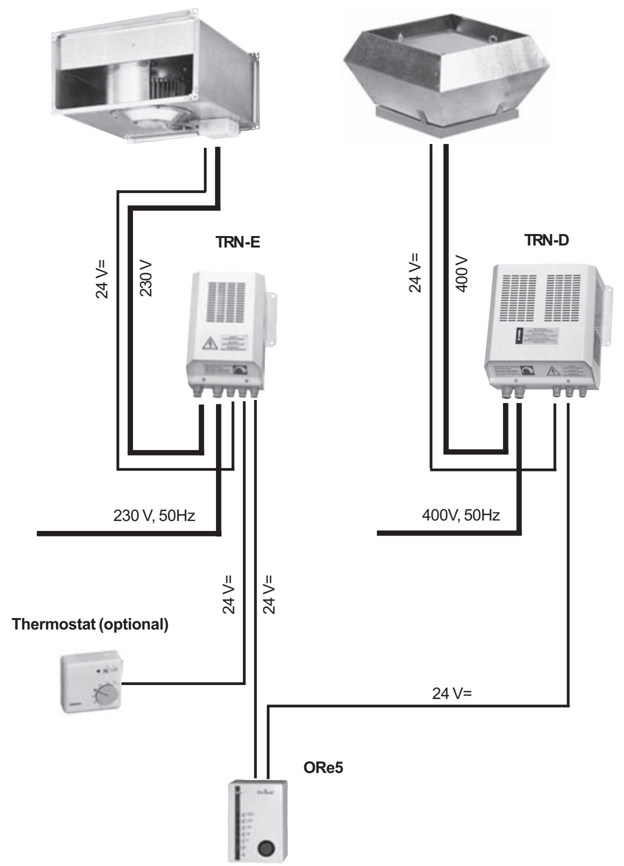
Two TRN controllers featuring protection function equipped with a common ORe5 controller

An assembly of two TRN controllers with a common ORe5 controller in a single venting system is shown in figure # 22. The fans are always controlled together to the same output stage.
This connection of the speed controller ensures:

- The possibility of fan output selection within the stage range "1" to "5".
- Thermal protection of the fans
- Common fan switching on/off manually, from ORe5
- Assembly switching on/off externally by any other switch (like room thermostat, gas detector, pressostat, hygrostat, etc.) on terminals PT1, PT2. External switching of the controller is independent; this example shows external starting of only one controller (TRN-E).

Upon selecting the required output stage using a selector on ORe5 controller the fan will start at corresponding speed. The closed switch connected to PT1, PT2 terminals and the thermo-contact circuit connected to corresponding controller TK, TK terminals are essential for the fan operation. The switch connected to PT1, PT2 terminals can externally stop the fan. If this possibility is not used, it will be necessary to interconnect terminals PT1 and PT2. If the fan is overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding. As a reaction to this state, the controller will disconnect power supply to the overloaded fan. If this controller is the so-called reference controller, i.e. the controller's ERR terminal is connected to ERR terminal on ORe5 controller, the failure will be signalled by the red indicator on the ORe5 controller. If the thermo-contact circuit of the second fan is not simultaneously disconnected the second fan stay in operation. After cooling down, the fan is not automatically started. To restart the fan, it is necessary first to set the selector to the "STOP" position, and thus confirm failure removal, and then to set the required fan output. In this arrangement, the option "STOP" on ORe5 controller must not be blocked.

Figure 22 - Connection of Controllers



Example C

Control unit (in this example VCX) with two TRN controllers and a common ORe5 controller

An assembly of the control unit with two TRN controllers with a common ORe5 controller is shown in figure # 23. Among others, this connection ensures:

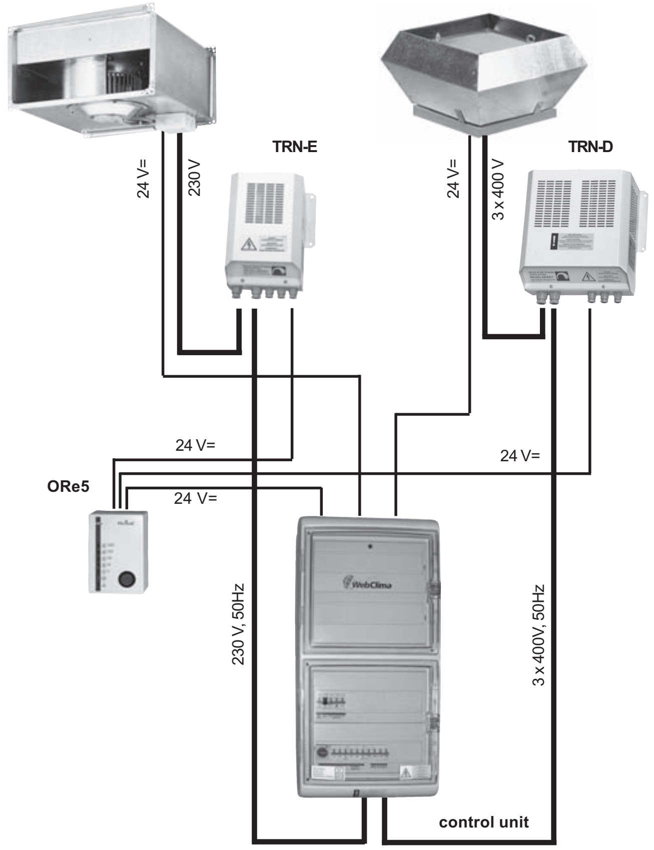
- The possibility of fan output selection within the stage range "1" to "5".
- Thermal protection of the motor (TK thermo-contact terminals are connected to 5a, 5a, 5b, 5b terminals in the control unit).
- Manual switching on/off using ORe5 controller.
- Programmable switching on/off of the entire device from the control unit.

In this assembly connection the following is essential:

- All additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller.
- The "STOP" position on ORe5 controller must be blocked (same as in the following examples with a control unit).

After setting the required speed turning the selector to the required position (1 to 5), the control unit will be switched on, and fans will start at the corresponding output. The ORe5's indicator will light up indicating the selected fan output stage and assembly operation. If the fans are overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding. As a reaction to this state, the control unit will stop the assembly in emergency mode. The red indicator will light up indicating the failure on the ORe5 controller and control unit. After the motor winding has cooled down, the thermo-contact will close; however, the control unit will block the fan start-up until the operator confirms the failure removal by pressing an unblocking button on the control unit

Figure 23 - Connection of Controllers



Example D

Control unit with two controllers and common internal control of the controllers (VCB, WBC + MCU-1, PAD3)

An assembly of the control unit with two TRN controllers and a common internal controller is shown in figure # 24. The internal controller is installed in the control unit during production.

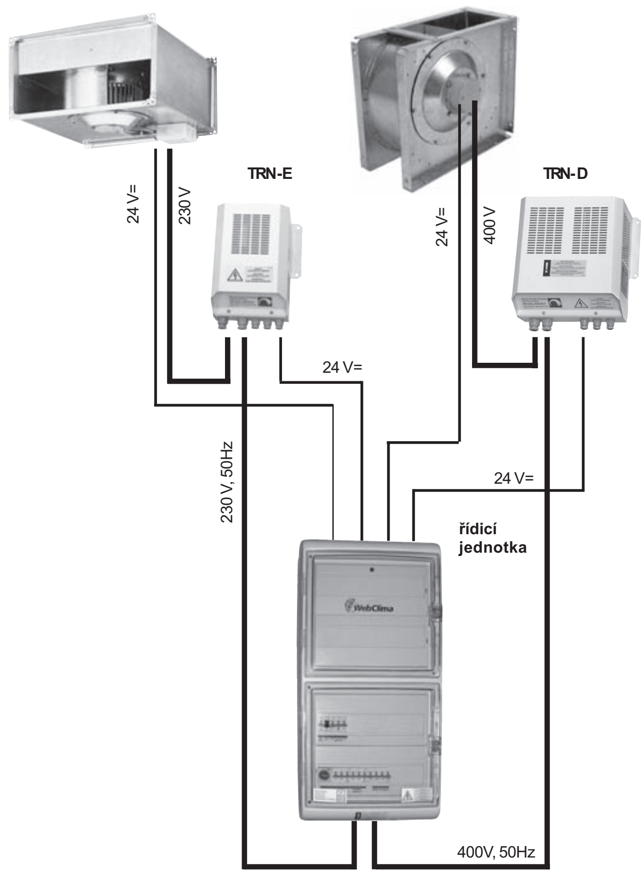
Among others, this connection ensures:

- Manual selection of the fan output within the stage range "1" to "5".
- Thermal protection of the motor (TK thermo-contact terminals are connected to 5a, 5a, 5b, 5b terminals in the control unit).
- Manual or programmable switching on/off of the entire device using a control unit.

In this installation, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller (for details, refer to page 97).

The air-handling system is started by the control unit. Internal control is integrated in the control unit to control the controllers conjointly. Internal controller is provided only with positions "1" to "5" to set the required fan output. The lowest stages "1" to "3" can be blocked. All protection and safety functions of the fans as well as the entire system are ensured by the control unit.

Figure 24 - Connection of Controllers



Example E

Control unit with two controllers and internal control of the controllers (in this example: VCB, WBC + MCU-2)

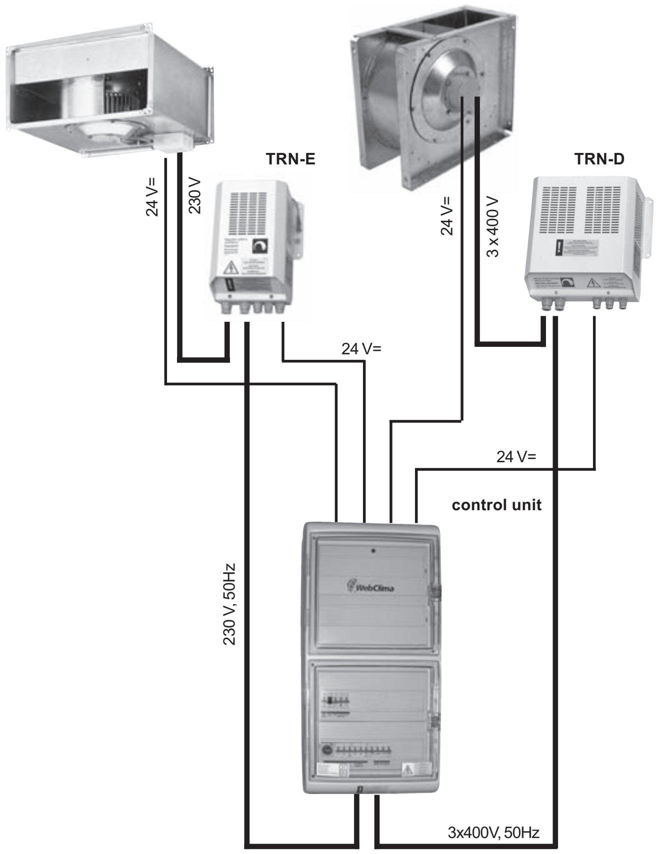
An assembly of the control unit with two TRN controllers and a separate internal controller for each controller is shown in figure # 25. Internal controllers are installed into the control unit during production (optional for MCU-2).
Among others, this connection ensures:

- Manual selection of the fan output within the stage range 1-5, independently for the inlet and outlet (this can be used to get the required positive or negative air pressure in the room).
- Thermal protection of the motor (by connecting the motor TK, TK thermo-contact terminals to 5a, 5a, 5b, 5b terminals in the control unit).
- Manual or programmable switching on/off of the entire device using the control unit.

In this installation, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller.

The air-handling system is started by the control unit. Internal controls are integrated in the control unit to control the controllers individually. Internal controllers are provided with positions "1" to "5" to set the required fan output stage. The lowest stages "1" to "3" can be blocked. All protection and safety functions of the fans as well as the entire system are ensured by the control unit.

Figure 25 - Connection of Controllers



Example F

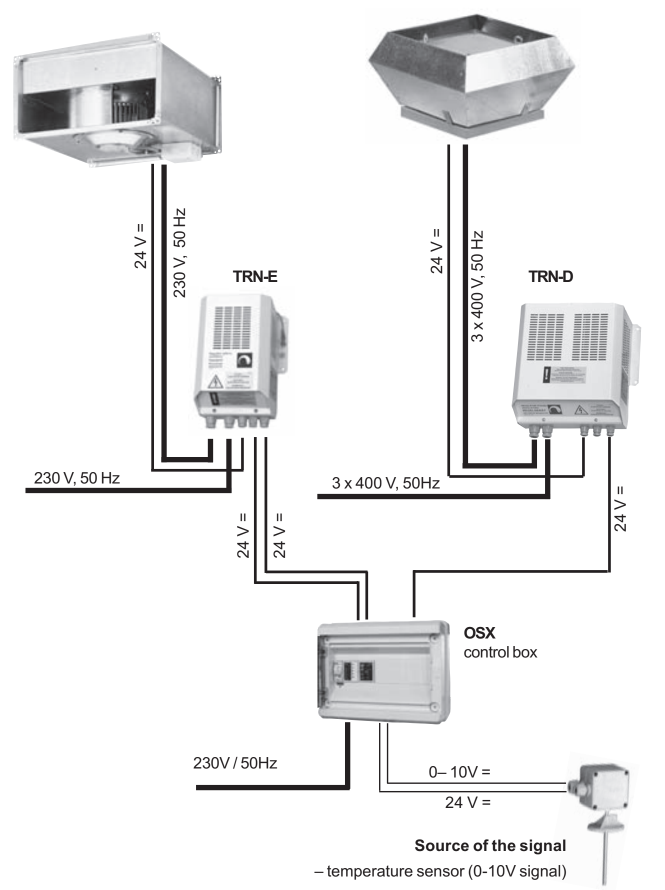
Two TRN controllers featuring protection function equipped with a common OSX unit.

An assembly of the control unit with TRN controllers and a common OSX unit is shown in figure # 26. The fans are controlled together to the same output stage.
Among others, this assembly depending on its connection ensures the following:

- Automatic switching on/off of the fan at the selected value of input control voltage.
- Manual switching on/off of the fan from the OSX unit.
- Fan switching on/off, by external switching function.
- Automatic selection of the fan output stage ranging from "1" to "5" depending on a physical quantity, which is read by the sensor equipped with a unified analogue output (signal source of 0-10V).
- Manual start-up of the system at the MANUALLY preset (by the button) output stage. The factory default setting of the OSX controller enables MANUAL start of the assembly at the full output using this button.
- Thermal protection of the fans

The fans on the picture are started, controlled and protected by TRN controllers. OSX unit evaluates signal coming from a converter (signal source), and in five adjustable levels automatically switches stages "0" to "5" of the controller. Thermal or pressure converters, converters for the measurement of relative or absolute humidity, concentration of gases, vapours or explosives in air, sensors of air quality and many other converters of different physical quantities can be used as sources of the control signal.
For detailed information about OSX (for explosion-proof fans OSX-Ex) units, refer to their accompanying documentation. For the wiring diagrams of OSX (for explosion-proof fans OSX-Ex) units, refer to their accompanying documentation.

Figure 26 - Connection of Controllers



TRRE and TRRD Transformer Controllers

Application of TRRE and TRRD Controllers

TRRE (single-phase) and TRRD (three-phase) transformer controllers are intended for the switching and five-stage speed control of voltage controllable fans (e.g. RP, RQ, RO and RS fans, including their modifications).

Design of Controllers

TRRE(D) controllers are equipped with an integrated control and power systems. Unlike TRN controllers, these cheaper controllers are not equipped with thermal protection of the fans. For transparent comparison of controller types, refer to table # 2.

Integrated Basic Features

As standard, TRRE and TRRD controllers provide the following properties and features:

■ Start-up

Starting /stopping the fan using the rotary selector situated on the front panel.

■ Fan Output Control

Five-stage fan output (speed) control by changing the input voltage, which corresponds with the position of the selector on the front panel.

■ Blocking of Output Stages

These controllers enable mechanical blocking of output stages 0-3 by simple adjustment of the rotary switch coulisse, refer to the following page. The blocking serves for the minimum air flow rate setting, i.e. to limit low outputs (e.g. air-handling systems equipped with an electric heater).

■ Operation, Output and Failure Signalling

Controllers signal current state of operation:

- Operation mode (the green indicator lights up)
- Stop mode (selector in the "0" position, the indicator does not light)
- Active output stage (selector's positions 1-5)
- Failure (selector's positions 1-5, the indicator does not light)

Operating Conditions, Position

These controllers are intended for indoor applications in a dry, dust and chemical free environment. They are designed for normal environmental conditions in accordance with ČSN 33 2000-3 (IEC 364-3).

- Degree of protection: IP 20
- Permissible ambient temperature: +5 °C to +40 °C
- Position: always vertical or horizontal.

The controllers can be situated on a wall, air-handling duct or ancillary construction; however, always only in the vertical or horizontal position. The installation must be performed considering the weight of the controller. They can be mounted on A and B combustibility grade materials in accordance with the ČSN EN 13 501-1 standard. The controller casing is provided with ventilation openings which must not be covered. Permanent and easy access to the controller must be ensured.

Materials

External casings of all controller types are made of steel sheet finished with RAL 9002 sprayed powder coating. Plastics, copper, aluminium, transformer steel and galvanized sheets are used in the internal controller's structure. Switching and protection elements (switches, fuses, indicators, etc.) are used in both, power and control wiring. All components and materials are carefully checked so they ensure long life service and reliability of the controllers.

Dimensional and Output Range

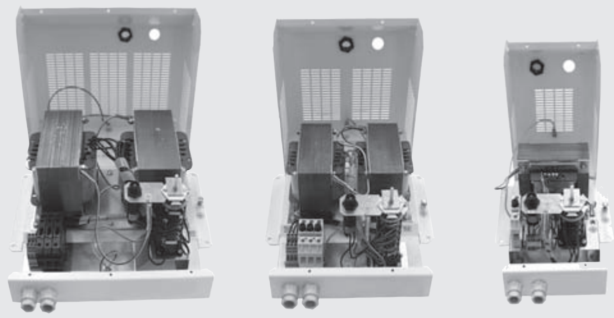
Totally seven types of TRRE (D) five-stage controllers are manufactured in accordance with table #10 and figure # 27.

Table 10 - Types of controllers

Three-phase (3x400V)	Single-phase (1x230V)	Max. current (A)
TRRD 2	TRRE 2	2
TRRD 4	TRRE 4	4
TRRD 7	TRRE 7	7
TRRD 9	–	9

Figure 27 - Types of TRRE(D) controllers

Controllers - top cover closed

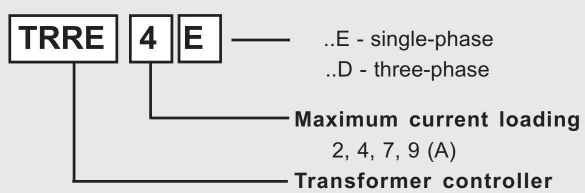


Controllers - top cover open

Designation of Controllers

Example: Designation TRRE 4 specifies a single-phase fan controller designed for maximum current of 4 Amp.

Figure 28 - Type designation



TRRE and TRRD Transformer Controllers

Figure 29 - Controller dimensions

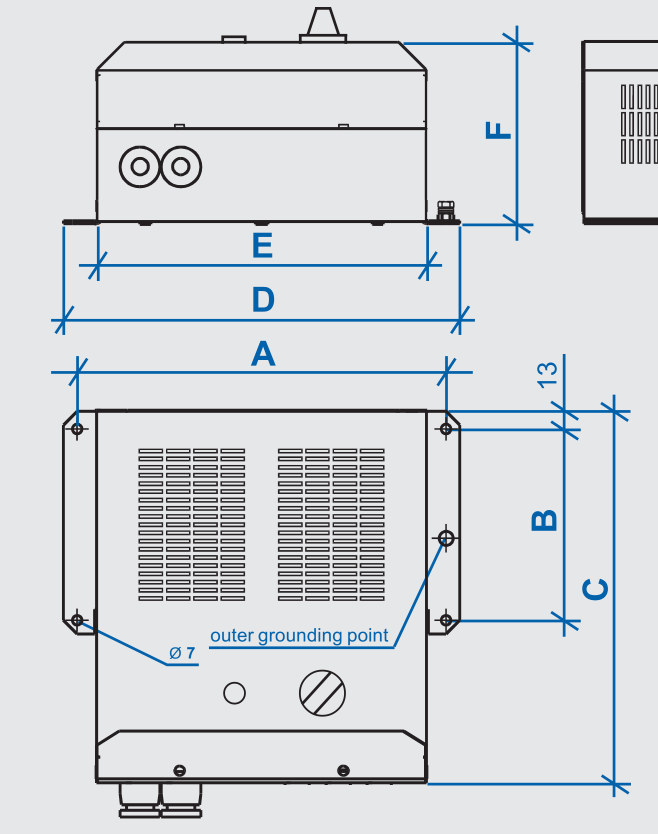


Table 11 - Controller dimensions

Controller	A	B	C	D	E	F	m
	mm	mm	mm	mm	mm	mm	kg
TRRE 2	185	120	253	205	157	134	5
TRRE 4							7
TRRE 7							8
TRRD 2	270	140	273	290	242	134	10
TRRD 4							14
TRRD 7	340	170	303	360	312	157	26
TRRD 9							32

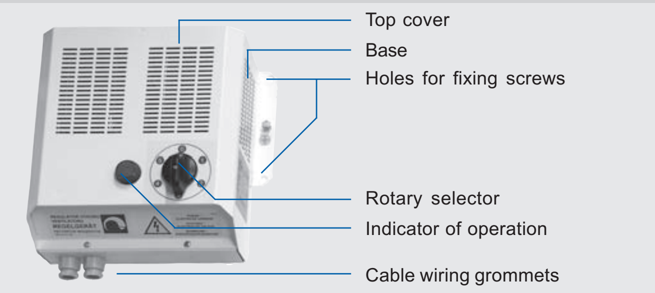
Installation

TRRE and TRRD controllers are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the controller.

■ The installation and commissioning can be performed only by an authorized company licensed in accordance with valid regulations.

■ The controller must be checked carefully before its installation, especially if it was stored for a longer time.

Obrázek 30 – popis regulátoru



In particular, it is necessary to check all parts and cable insulation for damage:

• First, fix the base with 4 screws of 6 mm diameter (see figure # 30).

• Hang the controller supporting plate, including wiring, on the base, and secure it with a screw.

• Finally, fix the controller cover

■ The controller must be placed within reach of the operator. The installation must be performed considering the weight of the controller, easy wiring, free cooling openings and its degree of electrical protection.

■ As the controller contains sensitive electro-mechanical parts, take care during installation and keep the controller's interior clean (avoid dust, sand, plaster, etc).

■ The controllers enable mechanical blocking of output stages 0-3. The blocking serves for the minimum air flow setting, i.e. to limit low outputs or to block the "0" stage if the control unit is used. The controller's blocking can be simply carried out by bending the corresponding lamella on the rotary switch coulisse.

Figure 31 - Mechanical blocking of output stages

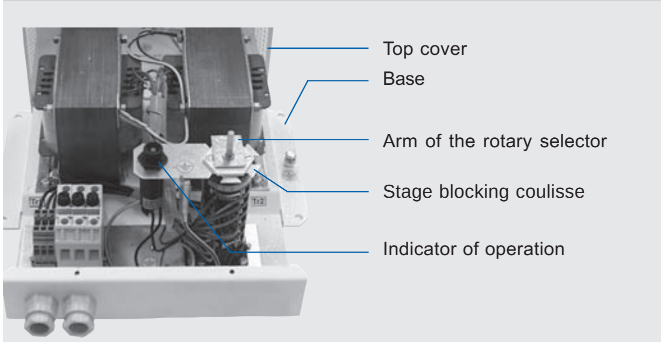
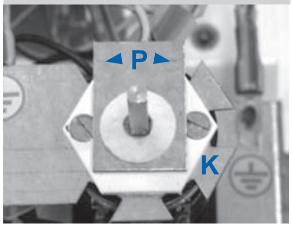


Figure 32



◄ The blocking of a selected output stage can be simply carried out by bending the corresponding lamella on the rotary switch coulisse K up, 90° aslant (see figure # 32). Thus the arm of the rotary switch P is blocked from passing through the position of the given output stage.

TRRE and TRRD Transformer Controllers

Figure 33

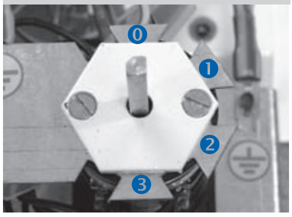


Figure 34

◀ Stages 0 - 3 can be blocked by bending the corresponding lamellas on the rotary switch coulisse ⓿❶❷❸. (see figure # 33). One or the range of two, three or four successive positions of the rotary switch can be blocked.

◀ Figure 34 shows blocking of the output sta ❶. The rotary switch can be turned right or left so all stages except stage ❶ are available.

Wiring

The wiring can be performed only by a qualified worker licensed in accordance with national regulations.

■ Cables for the power supply, fan motors connection and control are led through plastic grommets and connected to the WAGO terminals in the lower part of the controller casing. The controller's entry is provided with plastic grommets. An example of a layout of individual connection points for all controllers' sizes is shown in figure on page 130.

■ The TRRE and TRRD controllers are not equipped with an integrated fan motor protection. Therefore, external protection devices must be used (STE, STD relays or control unit).

■ After connecting the controller and starting the fan, the current must be measured, and it must not exceed the maximum allowed value in any output stage. The maximum current value is stated on the rating plate, and also as a numerical part of the type designation code of the controller (e.g. TRRD 7 means $I_{max.}$ = 7Amp).

■ If the current values are higher, check whether the controller is connected to the appropriate fan; the rated current of the fan should be lower or equal to Imax. of the controller.

■ If the measured current value still exceeds the maximum permissible value even though the connected fan complies with the above-mentioned criteria, immediately check the duct system regulation. The fan is probably being operated in a so-called forbidden (non-working) area of the fan output characteristics. The proper current value Imax. can be reached by air flow throttling.

■ If the current value does not drop even after adjusting the duct system regulation, it is necessary to check the electrical parameters of the entire wiring.

■ Each fan should be connected to a separate controller. If this recommendation cannot be fulfilled, max. two fans can be connected to one controller, and enough current margins must be kept; i.e. the minimum rating current of the controller must be 20% higher than the sum of the maximum currents of connected fans.

Example: The maximum sum of currents of two RP 60-35/31-6D fans is 2 x 1.86Amp = 3.72Amp. Adding 20% of safety margin, it makes the total controller's current of 4.46 Amp. Then, the closet bigger controller's size is TRRD 7.

■ For types of corresponding fuses for respective controllers, refer to table # 13.

■ For recommended cables to connect or interconnect the assembly components, refer to table # 12. Marking of the cables corresponds to the wiring diagrams.

Table 12 - Recommended cables

Type	Connection	Mark.	Cable	Voltage
TRRE	feed to TRE	w 01	CYKY 3Cx1,5	230V ~
	feed to motor	w 02		
TRRD	feed to TRD	w 01	CYKY 4Bx1,5	3x400V ~
	feed to motor	w 02		

Table 13 - Fuses

Controller	Phase fuses
TRRE 2	1 x T 4A
TRRE 4	1 x T 6,3A
TRRE 7	1 x T 10A
TRRD 2	3 x T 4A
TRRD 4	3 x T 8A
TRRD 7	3 x T 12,5A
TRRD 9	3 x T 12,5A

■ Each installation of the controller must be performed on a basis of the project and in accordance with the controller's documentation, respectively documentation other connected equipment.

■ The wiring must be checked before putting the device into operation.

Wiring diagram

On following page you find illustrations of installations and wiring of TRRE and TRRD controllers.

G – Installation including STE(D) protecting relay

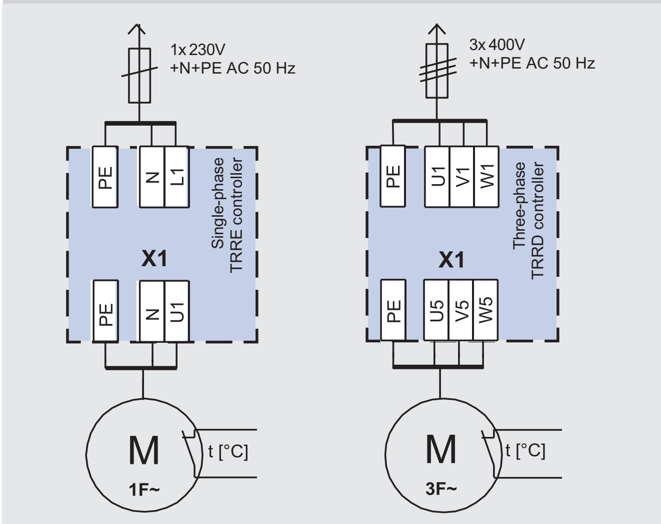
One TRRE controller with STE protecting relay
One TRRD controller with STD protecting relay

H – Installation including the control unit

Control unit (VCX) with two TRRE and TRRD controllers

Non-standard assembly connections must be consulted with the manufacturer in writing. The controller's wiring in accordance with the manufacturer's prescription or approval is essential for validity of the guarantee.

Figure 35 - TRRE(D) controller terminal diagram



Example G

One TRRE(D) controller with STE(D) protecting relay

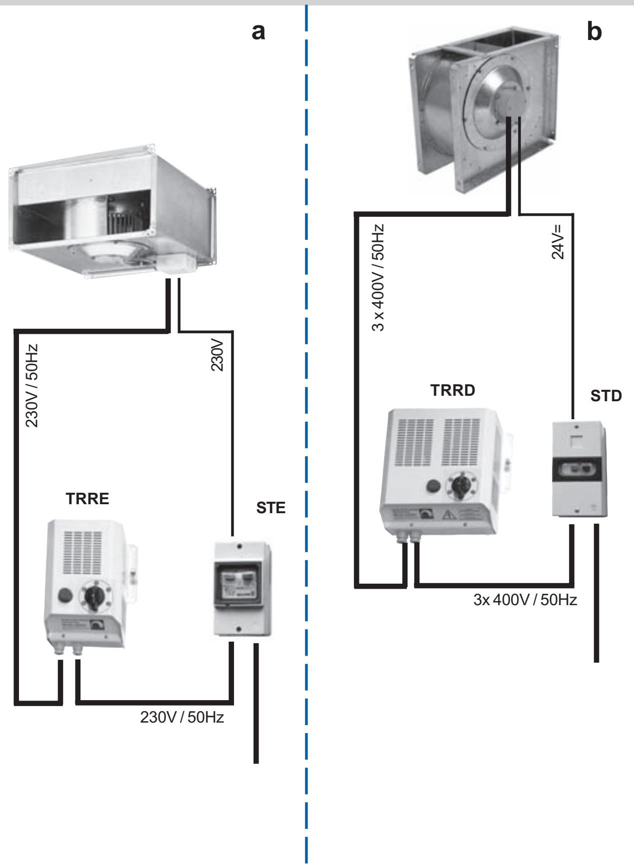
An assembly of TRRE and TRRD controllers with a fan and STE and STD protecting relays in a single venting system is shown in figure # 36 (a = single-phase, b = three-phase). This connection ensures::

- Manual selection of the fan output within the stage range "1" to "5".
- Thermal protection of the fan by STE(D) relay
- Manual switching on/off of the fan.

The controller and protecting relay must be placed within the operator's reach. To ensure control exactness in this application, it is advisable to block the "0" position. In this case, the air-handling assembly will be started from STE(D) protecting relay. The blocking is not essential; however, without the blocking it will be possible to switch the fans off from both, protecting relay and controller.

After turning the selector to position 1-5, the fan will start at the corresponding output. An indicator on the front panel will light up indicating the fan's operation.
If the fan is overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding, and STE(D) protecting relay disconnect the power supply to TRRE(D) controller. The air-handling assembly can be restarted after removing the failure cause and unblocking the STE(D) protecting relay.

Figure 36 - Connection of Controllers



Example H

Control unit with TRR(D) controllers

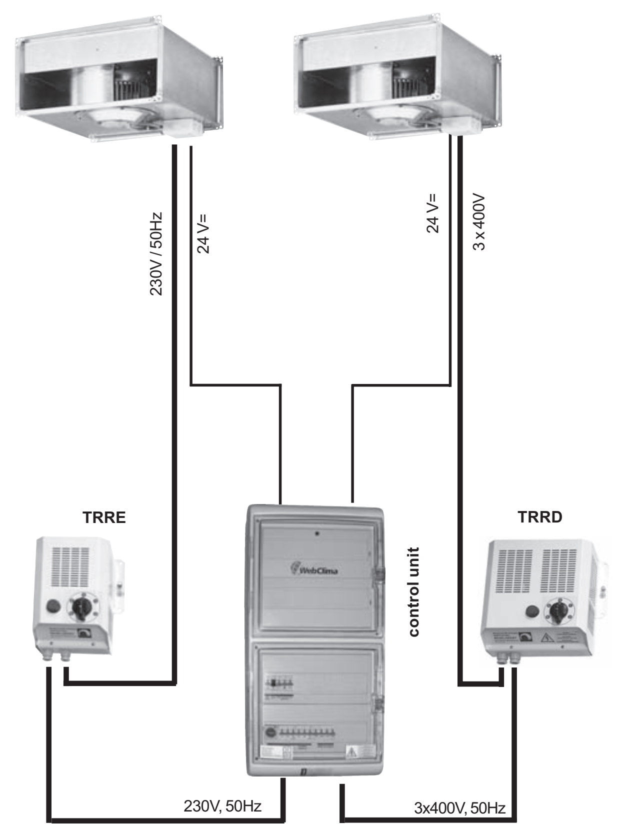
An assembly of the control unit with TRRE and TRRD controllers is shown in figure # 37.
This connection ensures:

- Manual selection of the fan output within the stage range "1" to "5".
- Thermal protection of the motor (TK thermo-contact terminals are connected to 5a, 5a, 5b, 5b terminals in the control unit).
- Manual or programmable switching on/off of the entire device using the control unit.

Position "1" on the controller must be blocked in the assembly with a control unit (fro the details, refer to page 97). The controller must be placed within the operator's reach.

The required fan output can be set by switching the selector's positions "1" to "5". After starting the air-handling assembly from the control unit, an indicator on the TRRE(D) controller's front panel will light up indicating the fan's operation. All protection and safety functions of the fans as well as the entire system are ensured by the control unit.

Figure 37 - Connection of Controllers



PE electronic controllers

Application of PE Controllers

PE electronic controllers are intended for the switching and stepless control of single-phase motors equipped with a resistance armature. These controllers are not equipped with an integrated motor protection. Therefore, without additional components they can be only recommended for RO and RS 30/... fans (which are equipped with their own protection using the series thermo-contacts situated in the power supply circuit).

Integrated Basic Features

As standard, PE controllers provide the following: features:

■ **Start-up**

Starting /stopping the fan using the rotary selector situated on the controller's front panel.

■ **Fan Output Control**

Stepless fan output (speed) control by changing the input voltage turning the selector on the front panel.

■ **Switch Off Blocking**

The blocking of the motor switching off can be enabled by the wiring shown in figure # 32. The blocking must be active if connected to the control unit.

■ **Minimum Output Setting**

Minimum fan speed can be set by the setting screw (marked "MIN"); this setting is not used to block the fan switching off - see the section "Wiring".

■ **Operation and Output Signalling**

PE controllers signal the following states of operation:

- Operation (indicated on the control button)
- Stop (the indicator does not light)
- Position of the control selector indicates approximate output stage.

Designation of Controllers

Two types of controllers, PE 2,5 and PE 05, are delivered. The number in the controller's designation indicates the rated current value.

Table 14 - Technical parameters

Technical parameters	PE 2,5	PE 05
Rated voltage	220V / 240V, 50Hz	
Rated current range	0.1 to 2.5 Amp	0.2 to 5 Amp
Maximum current	2.5 Amp	5 Amp
Blow-out fuse	F 2,5	F 2,5
Protection against overloading	Thermal limiter	
Dimensions WxHxD [mm]	81 x 81 x 22	81 x 152 x 24
Weight	0.3 kg	0.5 kg

Operating Conditions, Position

These controllers are intended for indoor applications in a dry, dust and chemical free environment. They are designed for normal environmental conditions in accordance with IEC 364-3 (ČSN 33 2000-3). They can be installed into the mounting box embedded under the plaster. Degree of protection: IP 20. Permissible ambient temperature: +5 °C to +40°C.

Wiring

The wiring can be performed only by a qualified worker licensed in accordance with valid regulations.

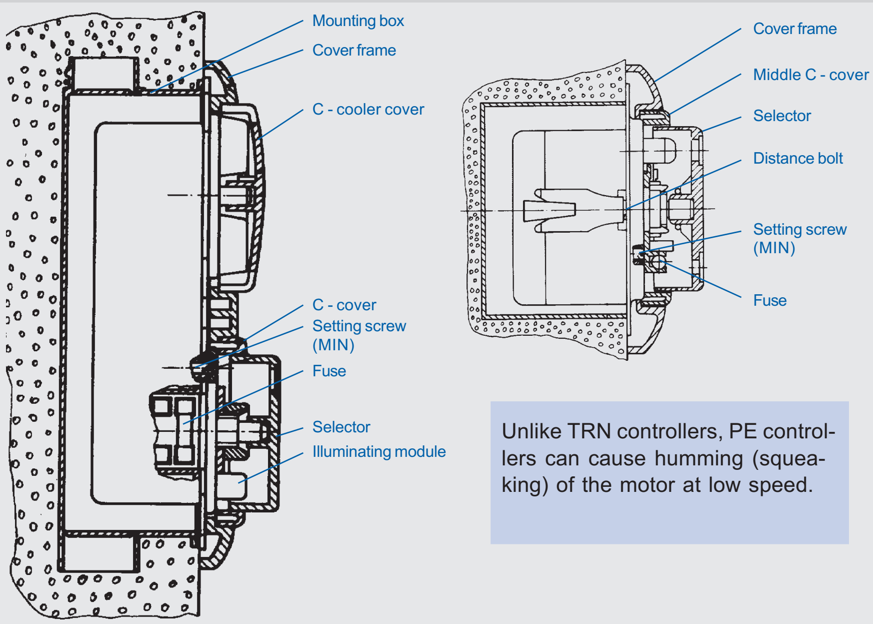
■ After disconnecting the power supply, the controller can be connected using connecting terminals directed upwards (PE 2,5) or directed downwards (PE 05).

■ **Warning!** If PE controller works in assembly with a control unit, L1 phase conductor must be connected to the controller's ↑**1** 1 terminal. If this is the case, the fan cannot be switched off by the controller. In all other cases, L1 phase is connected to the controller's ↓ **3** terminal.

■ Minimum fan speed can be set using the setting screw (marked "MIN") to enable the safe fan's restart even encountering pressure resistance when the power supply has been resumed after its failure.

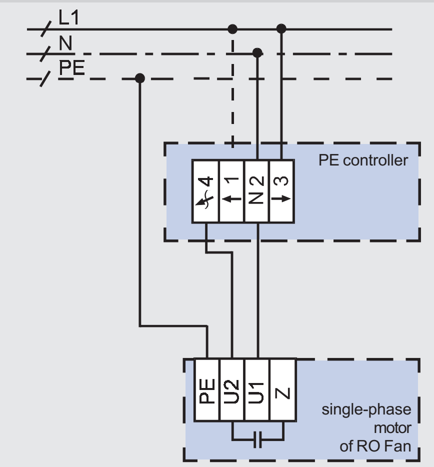
■ After the wiring has been completed replace the frame and cover using plastic matrix. Slide the control button on the shaft, and turn it to the right until the stop

Figure 38 - PE thyristor controller



Unlike TRN controllers, PE controllers can cause humming (squeaking) of the motor at low speed.

Figure 39 - Controller's wiring



Attention!
If PE controller works in assembly with a control unit L1 phase conductor must be connected to the controller's ↑**1** terminal (dashed line). If this is the case, the fan cannot be switched off by the controller. In all other cases, L1 phase is connected to the controller's ↓ **3** terminal. Then, the fan can be switched off by the controller.

Technical Information

Applications of Heate

Electric heaters are intended for air heating, from simple venting installations to sophisticated air-handling systems. They are designed to be installed directly in square air ducts. Ideally, they can be used along with other components of the Vento modular system which ensure inter-compatibility, balanced parameters, safety and efficiency of operation.

Working Environment

Electric heaters are intended for normal environmental conditions in accordance with ČSN 33 2000-3 (IEC 364-3). The transported air must be free of corrosive chemicals or chemicals aggressive to aluminium, copper and zinc, respectively to plastics. Further, the transported air must be free of solid, fibrous, sticky, aggressive, flammable or explosive impurities.

- Degree of protection: IP 40
- Permissible air temperature: -25 °C to +40 °C
- Location: indoor, or outside under projecting roof

Dimensional and Output Range

Electric heaters are delivered in a range of nine standardized sizes according to the A x B dimensions of the connecting flange, and in a range of three types according to the method of control - EO, EOS, EOSX. Electric heaters can be connected to air ducts in the same way as any other Vento duct system component. Several output versions of electric heaters are manufactured for each standardized size (see table # 1). According to the heating output, in total nine electric heater versions of gradually growing maximum heating output from 3 kW to 45 kW are manufactured. Higher outputs can be reached by assembling several heaters in series.

Table 1 – Output Range

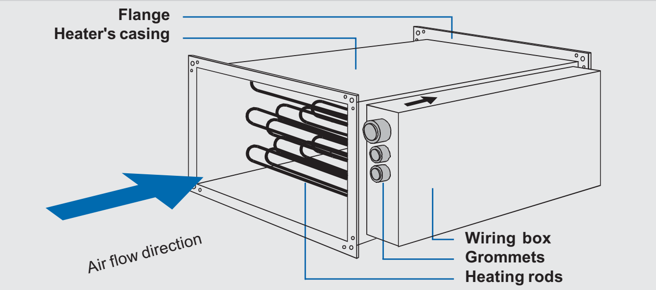
Type	Dimensional range	Output [kW] 3,0	4,5	6,0	7,5	12,0	15,0	22,5	30,0	45,0
EO	30-15									
	40-20									
	50-25									
	50-30									
	60-30									
	60-35									
	70-40									
	80-50									
	90-50									
EOS	30-15									
	40-20									
	50-25									
	50-30									
	60-30									
	60-35									
	70-40									
	80-50									
	90-50									
EOSX	30-15									
	40-20									
	50-25									
	50-30									
	60-30									
	60-35									
	70-40									
	80-50									
	90-50									

Position and Location

The heaters can operate in any position except the position with the wiring distribution box directed downwards (there is a risk of condensate penetration from the air duct). When projecting the layout of the heater location, we recommend observing the following principles:

- An air filter must be installed at a sufficient distance in front of the heater to avoid its fouling (according to fire regulations, direct installation of the air filter just in front of the heater is forbidden).
- We recommend adding a 1 m long piece of straight duct to the heater's inlet to reduce thermal load of connected devices.
- The heater's casing must be situated at a safe distance from flammable or easily inflammable materials (min. 5 cm).
- The location of the heater must allow free cooling.
- Free access to the heater must always be ensured to enable checks and service.
- The prescribed air flow direction through the heater is marked on the heater's wiring box by an arrow (see figure # 1).

Figure 1 - Air flow direction

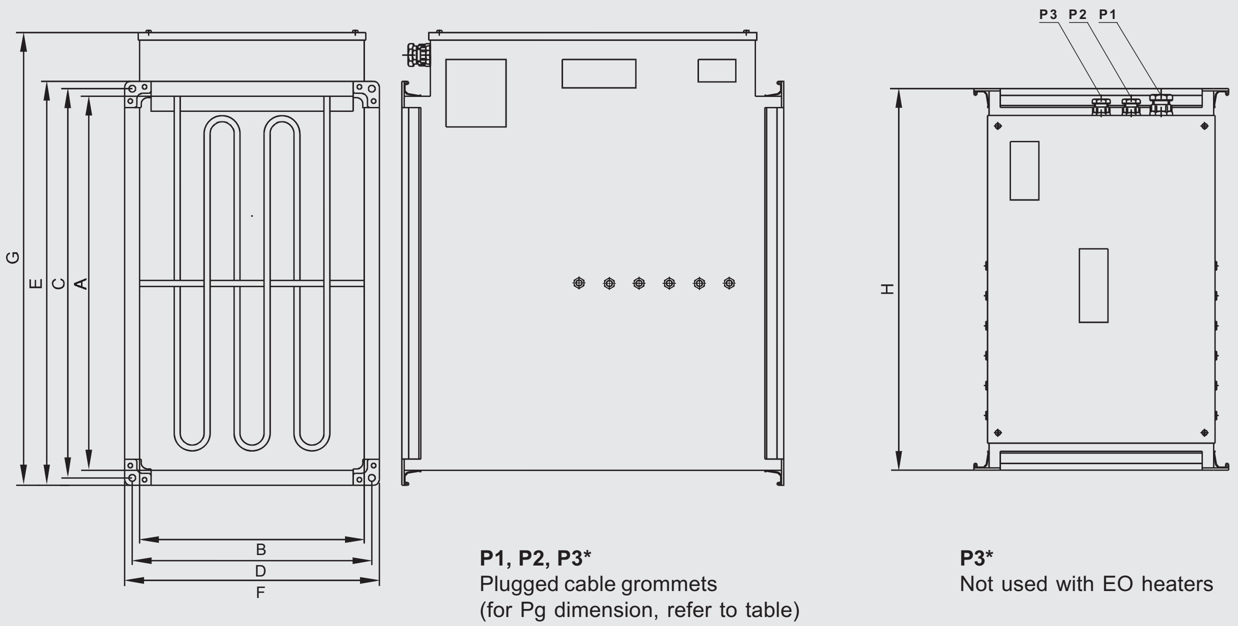


Materials and Design

As standard, the external casing of the heater, casing of the wiring box and connecting flanges are made of galvanized sheet steel (protecting layer of 275 g/m2 Zn). Heating rods are made of stainless steel. The heating rods of the 50-25 and larger heater sizes are fixed to aluminium braces to eliminate vibrations. The cooler of the power semiconductor relays is made of ribbed sectional aluminium. Plastics, copper, aluminium and brass are used in the internal wiring. All components and materials are carefully checked so they ensure long life service and reliability of the heaters.
put.

Parameters

Figure 3 - Dimensions and weights



P1, P2, P3*
Plugged cable grommets
(for Pg dimension, refer to table)

P3*
Not used with EO heaters

Table 2 - Dimensional Range

	A	B	C	D	E	F	G	H	Weight*	P1	P2	P3*
Type / Dimensions	mm	mm	mm	mm	mm	mm	mm	mm	kg	Pg	Pg	Pg
EO.. 30-15/3	300	150	320	170	340	190	407	360	6,5	13,5	11	11
EO.. 30-15/4									6,8			
EO.. 40-20/6	400	200	420	220	440	240	507	390	9,3	16		
EO.. 40-20/12								510	12,6			
EO.. 50-25/7	500	250	520	270	540	290	607	390	11,5	21		
EO.. 50-25/15								510	16,5			
EO.. 50-25/22								630	19,5			
EO.. 50-30/7		300		320		340		390	12,3			
EO.. 50-30/15								510	17,0			
EO.. 50-30/22								630	22,2			
EO.. 60-30/15	600		620		640		707	510	18,6			
EO.. 60-30/22								630	23,5			
EO.. 60-30/30								750	30,5			
EO.. 60-35/15		350		370		390		510	19,5			
EO.. 60-35/22								630	25,8			
EO.. 60-35/30								750	30,8			
EO.. 70-40/15	700	400	720	420	740	440	807	510	21,0			
EO.. 70-40/45							852	750	33,5			
EO.. 70-40/30							807	990	45,0	29		
EO.. 80-50/15	800	500	820	520	840	540	907	510	24,0	21		
EO.. 80-50/30							907	750	37,2			
EO.. 80-50/45							952	990	50,5	29		
EO.. 90-50/30	900		930	530	960	560	1015	750	43,7	21		
EO.. 90-50/45							1060	990	57,0	29		

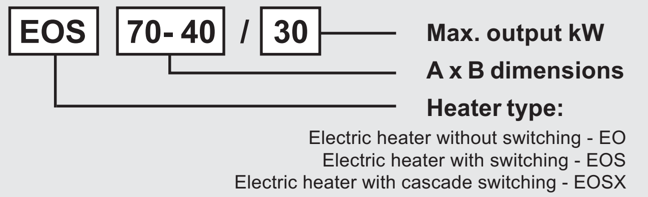
* Weight ±10 %

Parameters

Designation of Heaters

Type designation of the electric heaters in projects and orders is defined by the key in figure # 2. The heater's type designation includes its rounded up max. output.

Figure 2 - Type designation



Output and Pressure Loss Determination

EO, EOS and EOSX electric heaters are dimensioned according to required heating output **Q** according to maximum air flow rate **V** and required heating-up **ΔT**.

■ Preliminary correlations of parameters (Q, V, DT) for all output ranges of standard heaters are included in the graph, see figure # 4. Heating-up DT for the corresponding air flow rate is valid providing the heater works at maximum output. If a control unit is used, the heaters' output will be controlled according to actual need in relation to the required outlet air temperature.

■ Pressure losses of EO, EOS and EOSX electric heaters are included in the nomogram, see figure 5.

Each heater in the table is marked with a number ❶❷❸❹❺ in accordance with its output and connecting dimensions, and each number comports with one pressure loss/air flow rate correlation characteristic.

(1 This function must be ensured by the control unit..

(2 For details on blocking of individual controllers' stages, refer to the controllers' documentation, respectively fan output control on page # 122.

Planning the heater

When dimensioning and planning the electric heater, it is necessary to observe the following safety principles:

■ The heaters must be situated at a safe distance from flammable or easily inflammable materials. The location of the heater must allow free space for heater surface cooling.

■ To reduce the heat loading (by heat radiation and/or conduction) of connected devices, we recommend inserting at least a 1 m piece of air duct in front of and behind the heater.

■ At a minimum distance of 1–1.5 m in front of the heater, an air filter must be installed to avoid its fouling. Without using an air filter, there is a danger of the heating rods fouling and eventually being damaged due to insufficient cooling.

According to fire regulations, direct installation of the air filter just in front of the heater is forbidden!

■ It is necessary to keep free access to the heater, especially to its wiring distribution box, to enable easy checks, inspections and service.

■ The heaters can operate in any position except the position with the wiring distribution box (switchboard) directed downwards (there is a risk of condensate penetration from the air duct).

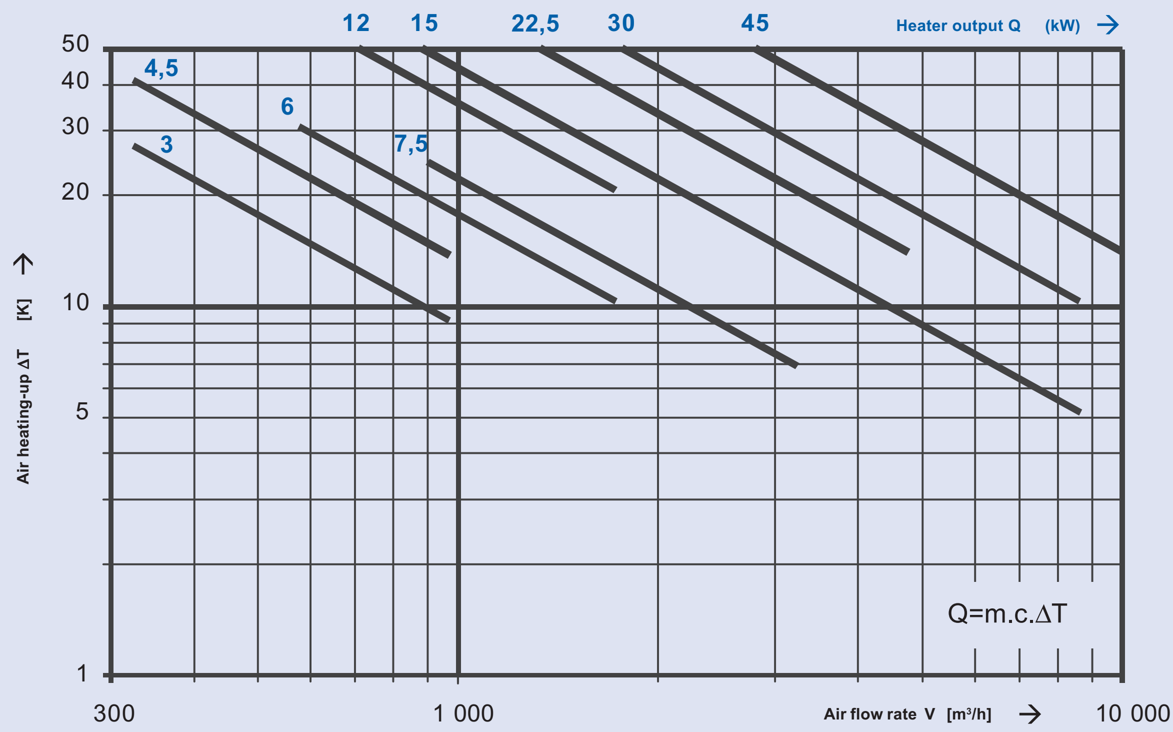
■ The heater output must be automatically controlled so that the outlet air temperature is limited to +40°C.

■ The operation of the heater must be blocked if the fan is out of operation for any reason. (1

■ Either the air-handling device is switched off manually or automatically the heater must be switched off first, and then with a time delay sufficient for heater cooling, the dampers can be closed and the fan switched off.

■ The speed of the air flow in the electric heater should not fall below 1–2 meters per second. If the output of the fan is controlled by the TRN controller, it is possible to block the lower stages of the controller so that the speed of the air flow will not fall below the above-mentioned value.(2

Figure 4 - The air temperature growth in the heater in relation to the air flow rate



Parameters

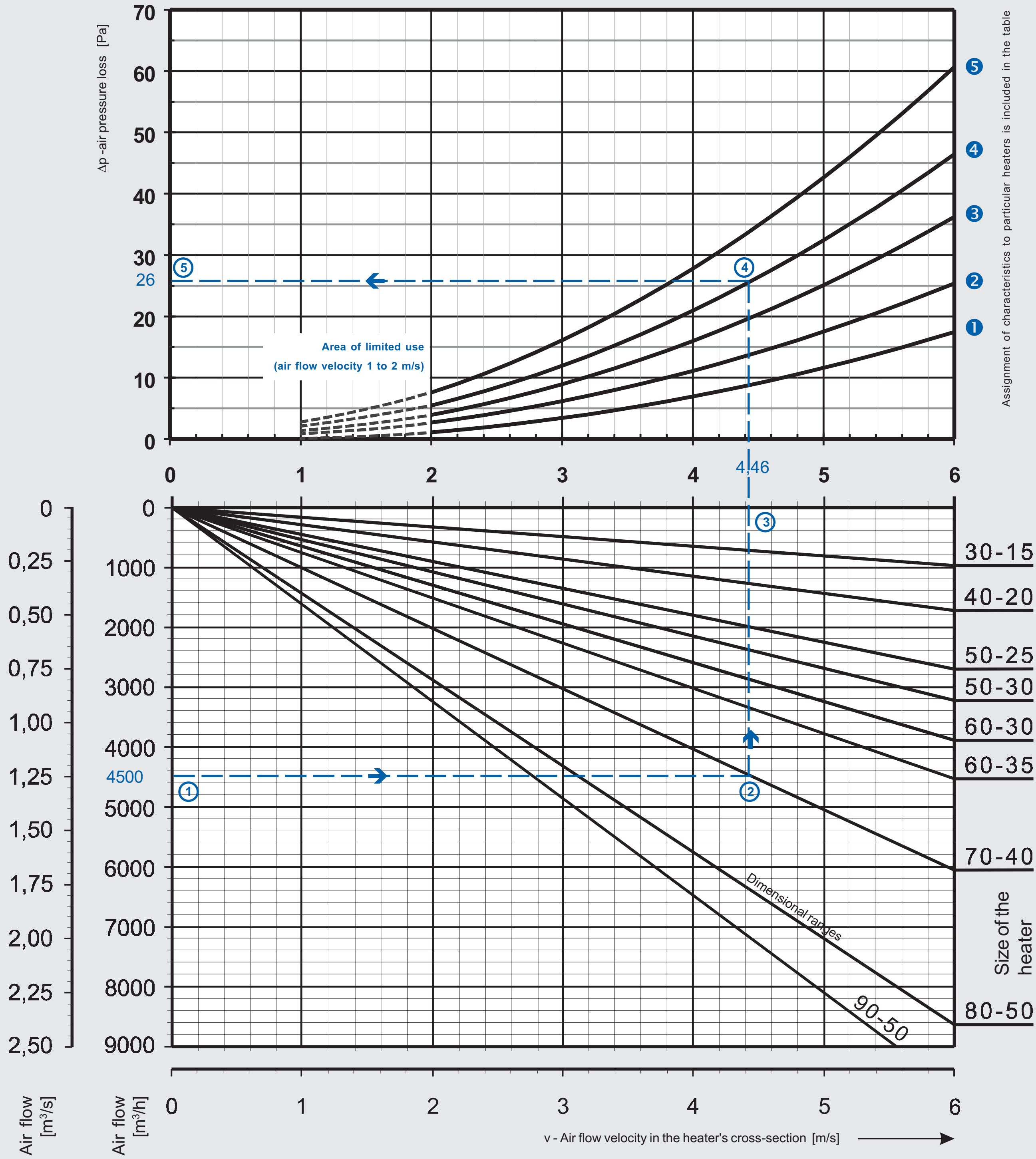
Figure 5 - Pressure losses in heaters

Each EO, EOS or EOSX heater in the table is marked with one number in accordance with its output and connecting dimensions:

❶ ❷ ❸ ❹ ❺

Each number comports with one pressure loss/air flow rate correlation characteristic.

Output / dimension		30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50
3,0	kW	❷								
4,5	kW	❸								
6,0	kW		❸							
7,5	kW			❷	❷					
12,0	kW		❺							
15,0	kW			❹	❹	❸	❷	❷	❶	
22,5	kW			❺	❺	❹	❸			
30,0	kW					❺	❹	❹	❷	❷
45,0	kW							❹	❷	❸



The nomogram of pressure losses is valid for all EO, EOS and EOSX heaters. For selected air flow rate ① the air flow velocity ③ in the free heater's cross-section ② can be read, and then the corresponding heater's air pressure loss ⑤ can be determined in the upper part ④.

Example: At an air flow rate of 4,500 m³/h, the velocity of the air flow in the electric EOS 70-40/30 heater will be 4.46 m/s. The heater's air pressure loss for the above-mentioned air flow rate according to the table will be 26 Pa on curve ❹.

Control

Basic Differences in Control

EO Heaters

The ON/OFF control of the heater's output is used for both units in a basic EO heater arrangement with a control unit, while the full output rate is connected upon any request for heating output (see figure # 8A).
Heating output is switched by the contactor in a control unit. Taking into account the type of switching (by the contactor) it is advisable to use EO heaters especially for applications not too demanding for switching.

EOS Heaters

The ON/OFF control of the heater's output is used for both units in a basic EOS heater arrangement with a control unit, while the full output rate is connected upon any request for heating output (see figure # 8A).
The control unit can be optionally configured for a pulse functioning mode of width modulation (PV current valve). If this is the case, the heating output will be fed precisely in accordance with the request from the control unit, which will always switch the full output for a short time period. The switching interval is 4 seconds.

EOSX Heaters

The design of EOSX electric heaters uses sequential switching of individual sections. The control unit switches individual sections of the EOSX heater according to requests of the heating mode (see figure # 8C). These heaters can be judged as more favourable as far as stability of the mains is considered. [(3]

Table 3 -Types of control

Type of control	Type of heater		
	EO	EOS	EOSX
A	●		
A		●	
A	●		
A		●	
B		●	
C			●

The control unit must be configured for each type of control!

Control and Protection Correlations

EO, EOS, EOSX electric heaters are powered, controlled and protected by the control unit.
■ Connection of EO, EOS and EOSX heaters to the control unit is shown in figures 6 and 7.

Figure 6 - Example of heater connection (VCB unit)

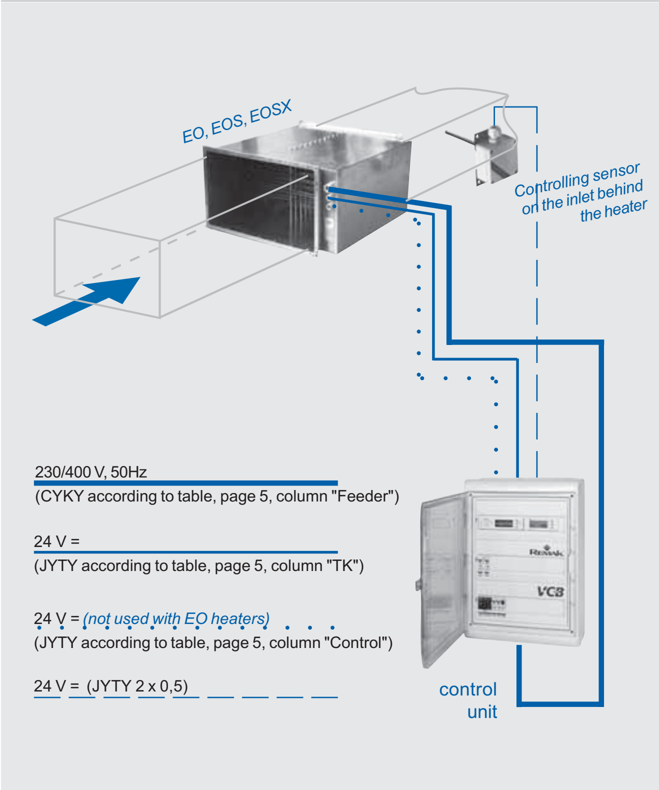
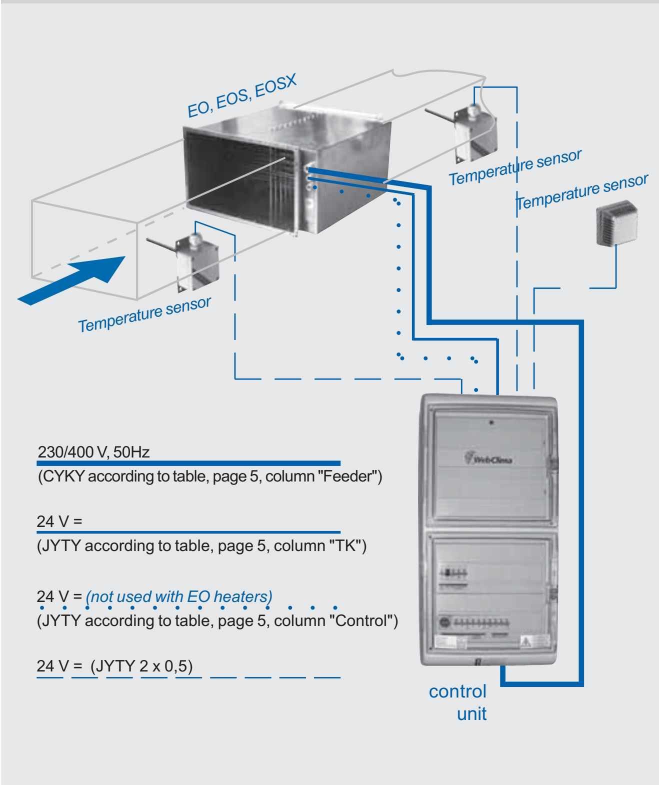


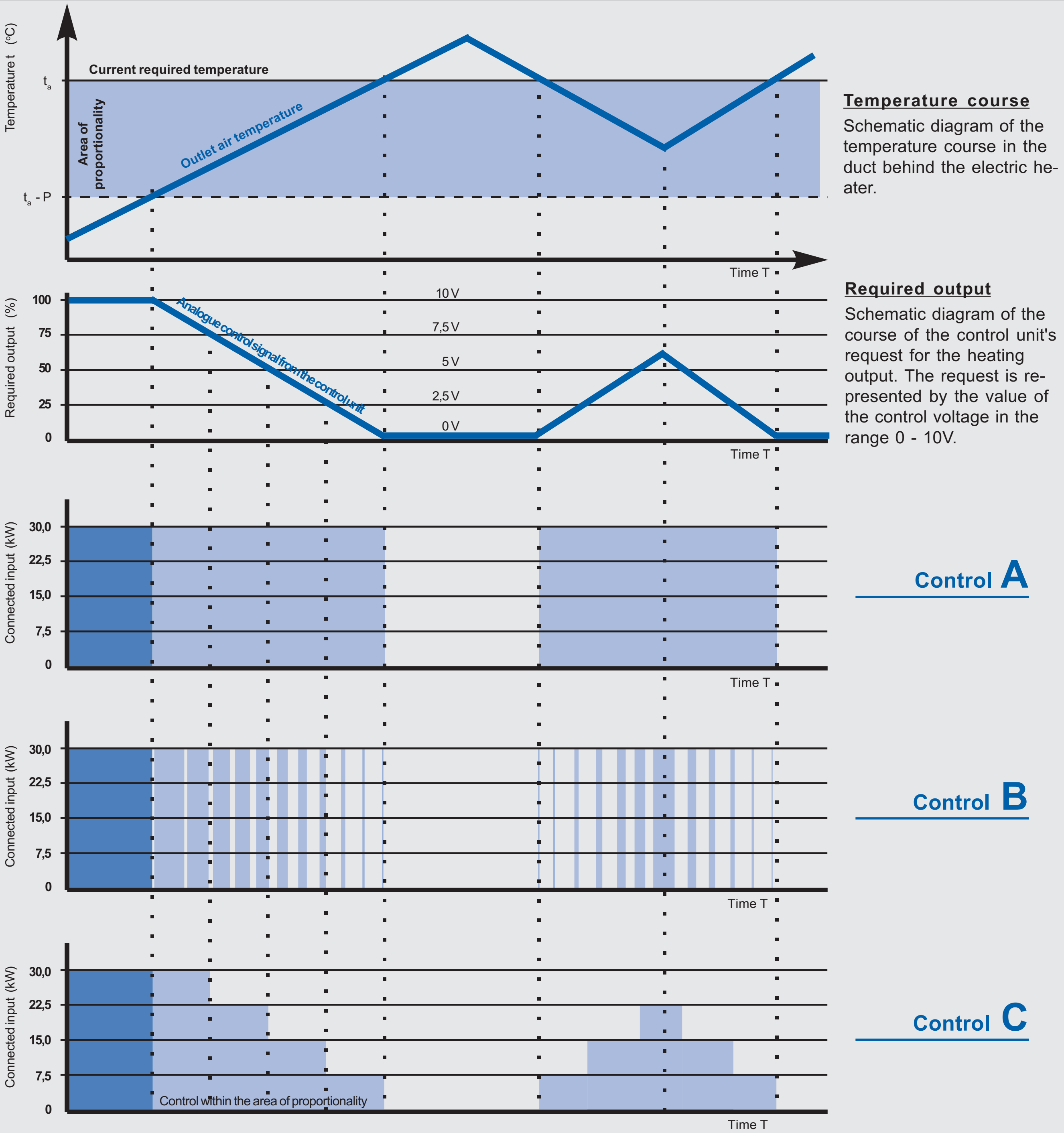
Figure 7 - Example of heater connection (WBC unit)



(3 (3 EOSX heaters are manufactured with an output from 12 kW and higher, because the symmetry of the phase loading distribution into the sections cannot be ensured at lower outputs.

Control

Figure 8 - Simplified model of switching (control) of electric heaters depending on the temperature course (4



Control A

Two-step ON/OFF control. Electrical input is connected by steps (see figure # 8A), however, heating output has a continuous course because of thermal inertia.

Control B

Two-step control using pulse width modulation. Electrical input is connected by pulses with continuous change of the switching time within a constant time period of 4 seconds (see figure # 8). The switching time, i.e. aliquot part of the time period of 4 seconds, is proportionate to the request for heating output. Output distribution is controlled an electronic module inside the control unit (the so-called PV current valve). Providing the output is properly dimensioned and the control pressure data points of the control unit are properly set, the fluctuation of the outlet temperature behind the heater will be within ± 0.5 °C. Control mode B is suitable for installations requiring minimum fluctuation of the outlet temperature.

Control C

Cascade type of control by switching individual sections of the heater. Electrical input is connected gradually by cascades of the particular EOSX heater according to the request for heating output (see figure # 8). This type of control is especially suitable for installations requiring distribution of the electrical input due to loading of the mains.

(4 (4 This example shows only a simplified model.

Installation, Service and Maintenance

Installation

EO, EOS and EOSX electric heaters, including other Vento elements and equipment, are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the heater and accessories.

- The heater must be checked carefully before its installation, especially if it was stored for a longer time. It is necessary to check parts for damage, and in particular, whether the heating rods, thermal fuses, insulation of conductors, terminals, etc are in good condition.
- The heaters can operate in any position except the position with the wiring distribution box directed downwards.
- The heater must be installed so that the prescribed air flow direction through the heater is retained. The prescribed air flow direction is marked on the terminal box with an arrow. The correct air flow direction can also be determined according to the position of the aluminium cooler, which must be situated in cold air flow (in front of the heating rods).
- There is no need for individual suspensions to install the electric heaters. They can be inserted into the duct line, but they must not be exposed to any strain or torsion caused by the connected duct line.
- The heaters must be situated at a safe distance from flammable or easily inflammable materials. The location of the heater must allow free space for heater surface cooling.
- It is necessary to keep easy access to the heater, especially to its wiring distribution box.
- Before installation, paste up to +100 °C heat resistant sealing onto the connecting flange facing the heater.
- Heaters with dimensions up to 80-50 mm are connected to the air-handling duct by 20 mm wide bar flanges and four M8 screws on each flange. Heaters with dimensions up to 90-50 mm are connected to the air-handling duct by 30 mm wide bar flanges and four M10 screws on each flange. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping.
- The lid of the wiring distribution box of heaters up to 30 kW is fixed with four M4 screws, while the lid of the wiring distribution box of 45 kW heaters is fixed with six M4 screws.
- It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides, at least on one flange connection.
- The electric heater output must be automatically controlled. REMAK units are recommended to supply, control and protect electric heaters.

Wiring and Commissioning

The installation of the heater must be performed in accordance with the project and catalogue (respectively Installation Manual). The installation and commissioning can be performed only by a company specialized in wiring and licensed in accordance with valid regulations.

- For the wiring diagrams of terminals of electric heaters, refer to page 152.
- The wiring must be checked before putting the device into operation.
- Before putting the device into operation, all the checks and settings must be performed in accordance with the Service Manual. The Service Manual (provided by the manufacturer) includes a detailed description of steps to activate the device and to perform regular inspections. Results of inspections are recorded in the record sheet inserted into the Service Manual.
- Proper functioning of the protective and emergency thermostats connection must be checked before commissioning the electric heater. When the circuit of the emergency thermostats is disconnected, the control unit must disconnect the power supply to the heater power circuit, and signal failure of the heater due to overheating.
- The EOSX heaters are controlled by a voltage of 10-40V/DC from the control unit. When connecting the heater, it is necessary to observe the proper polarity - the heater Q14 terminal (+). If the polarity is reversed, the heater will not heat.
- The control voltage of the EOSX heater is led through a limiting thermostat with a switching point of +45 °C, which is situated on the cooler of the SSR switching relays.
- The heater is provided with two emergency thermostats adjusted to +80 °C (5. The thermostats are connected to terminals E3 and GE.

Troubleshooting

When you start the air-handling system for the first time, you could face an undesirable situation. The following text includes the most common problems and their causes:

Permanently low output air temperature
- Too low a temperature was set on the control unit.
- Too low heater output for the given air flow and ΔT.
- Incorrect connection (polarity) of Q14, GC terminals.
- The limiting thermostat is defective.
- The electric heater's control circuit has been disconnected.

Permanently high output air temperature
- Too high a temperature was set on the control unit.
- The SSR switching relay is defective.

The output air temperature fluctuates
- Too high EO or EOS heater output for the given air flow and ΔT.

As far as the control quality is concerned, higher temperature fluctuation can be expected with EO and EOS heaters connected to the control unit than with EOSX or EOS heaters equipped with a current valve

Repeated activation of emergency temperature protection
- No air flow due to incorrect installation.
- Failure of the emergency thermostat.
- The emergency circuit has been disconnected.
- The SSR switching relay is defective

The above-mentioned failures, which repeatedly activate thermal protection, are serious and must be removed immediately.

(5 First thermostat is adjusted to +80 °C. The second one can be adjusted in a range of +50 °C to +90 °C; factory default setting is +80 °C. If a change in temperature is required, it is advisable to use only the range +50 °C to +80 °C (table 6, page 119).

Installation, Service and Maintenance

Electrical Equipment

For basic electrical parameters and recommended cables to connect the electric heaters to the control unit, refer to Table 6 on page 150. The markings used in this table have the following meaning:

Feeder - Power supply of the heater
TK - Protecting thermo-contact circuit
Control - Control and governing circuit(s)

The heater supply cables must be dimensioned in accordance with valid technical standards, and the maximum current, cable bedding and length must also be taken into account. The cable sections are valid for CYKY cables, type of cable bedding: B, C, E in air at ambient temperature up to +30 °C (ČSN 33 2000-5-523, resp. IEC 364-5-523).

- The cables are led through grommets into the wiring distribution box, which is an integral part of the heater. Inside the wiring distribution box, the cables are interconnected with inner wiring using screw-free clip terminals.
- The heating rods of all heaters are designed for 230V voltage.
- The heaters are provided with two-stage thermal protection with two stand-alone thermostats (for details, refer to the chapter "Thermal Protection").
- Simpler and cheaper heaters in the EO product line, designed for less demanding conditions, are switched by the contactor directly in the control unit.

Table 4 - Switching options

Type of heater >	EO	EOS	EOSX
Without switching [1]	●		
Output switching by SSR [2]		●	
Output switching by SSR in cascades [2]			●

- EOS and EOSX heaters are switched by electronic non-contact SSR (Solid State Relay) switching relays which are characterized by long service life (indefinite number of closures compared to contactors), low input (15 mW) to switch output rates in kW's, switching at zero voltage, abatable nuisance, without sparking, optically separated input and output (dielectric strength of 4 kV). Possible methods of control are described in a separate section..

Thermal Protection

Generally, if the electric heaters are not properly protected and controlled, they can be dangerous. Aside from electrical protection, attention must also be paid to thermal protection. When creating the project layout, we recommend observing the following principles:

- The electric heater output must be automatically controlled (6.
- The operation of the heater must be blocked if the fan is out of operation for any reason, or the speed of the air flow falls below the accepted level.[6]
- Either the air-handling device is switched off manually or automatically the heater must be switched off first, and then with time delay sufficient for heater cooling, the dampers can be closed and the fan switched off (6.
- An air filter must be placed at a sufficient distance in front of the heater. Without an air filter, there is a danger of the heating rods fouling and being damaged due to insufficient cooling. Sufficient protection can be ensured by a KFD filter with a filter insert.
- Gradual filter fouling causes a reduction in the air flow rate.

Therefore, it is necessary to monitor the filter condition via the differential pressure sensor, and change the filter insert in time [7].

- The speed of the air flow in the electric heater should not fall below 1 - 2 meters per second. If the output of the fan is controlled by the TRN controller, it is possible to block the lower stages of the controller so that the speed of the air flow will not fall below the limit value (8.

As a consequence of breakdown or failing to observe any of the above-mentioned recommendations, an emergency situation could occur due to overheating. Complex and system protection can be ensured by proper connection of the electric heater to the control unit.

As standard, all heaters are equipped with stand-alone thermal limiters in accordance with the ČSN 33 2000-4-42 (IEC 364-4-42) standards. The thermal limiters (thermostats) in cooperation with a control unit permanently prevent the limit temperature in the air-duct and in the wire distribution box from being exceeded (table # 5).

Table 5 - Protecting thermostats

Type of the heater >	EO	EOS	EOSX
I. Protecting thermostat 50-90°C (80°C)*	●	●	●
II. Protecting thermostat 80°C	●	●	●
III. Protecting thermostat 45°C		●	●

Basic (emergency) thermal protection

Thermal protection of all electric heaters is ensured by two emergency thermostats connected into a serial loop. The thermostats are adjusted in production to +80oC; one reads the temperature among the heating rods while the other reads the temperature inside the wiring distribution box. If the thermo-contact in the loop trips (due to the heater overheating), the power supply of the electric heater must be disconnected.[6]

Extended thermal protection

The thermal protection of EOS and EOSX electric heaters is extended by a protective SSR circuit. The temperature of the cooler of the SSR switching relays is read by the third protective thermostat set to a switching point of +45 °C. When this temperature is exceeded, the control signal to SSR is interrupted. After cooling down, the thermostat will automatically switch the control circuit, while the fans work without stopping all the time.

[6] This function must be ensured by the control unit

[7] This function is normally ensured by the control unit in association with a P33N differential switch is situated of the filter

[8] For detailed description of blocking of individual controller's stages, refer to the section concerning TRN output controllers.

Installation, Service and Maintenance

Table 6 - Basic electrical parameters

Series	Dimensional range	Type / size	Output	Voltage	Current	Heating rods	Output spliting	Output of sections	Feeder	TK	Control
		Designation	Q	U	I	n	1/s	Qs	Recommended cables		
			kW	V	A	ks x kW		kW	CYKY	JYTY	JYTY
EO	30-15	EO 30-15/3	3,0	3 x 400	6,5	2 x 1,5	1/1	3,0	5C x 1,5	2A x 1	–
		EO 30-15/4	4,5			3 x 1,5		4,5			
	40-20	EO 40-20/6	6,0		8,7	3 x 2,0		6,0			
		EO 40-20/12	12,0		17,4	6 x 2,0		12,0	5C x 6		
	50-25	EO 50-25/7	7,5		10,9	3 x 2,5		7,5	5C x 2,5		
		EO 50-25/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EO 50-25/22	22,5		32.6	9 x 2,5		22,5	5C x 10		
	50-30	EO 50-30/7	7,5		10,9	3 x 2,5		7,5	5C x 2,5		
		EO 50-30/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EO 50-30/22	22,5		32,6	9 x 2,5		22,5	5C x 10		
	60-30	EO 60-30/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EO 60-30/22	22,5		32,6	9 x 2,5		22,5	5C x 10		
		EO 60-30/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
	60-35	EO 60-35/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EO 60-35/22	22,5		32,6	9 x 2,5		22,5	5C x 10		
		EO 60-35/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
	70-40	EO 70-40/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EO 70-40/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
		EO 70-40/45	45,0		65,2	18 x 2,5		45,0	5C x 35		
	80-50	EO 80-50/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EO 80-50/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
		EO 80-50/45	45,0		65,2	18 x 2,5		45,0	5C x 35		
	90-50	EO 90-50/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
		EO 90-50/45	45,0		65,2	18 x 2,5		45,0	5C x 35		
EOS	30-15	EOS 30-15/3	3,0	3 x 400	6,5	2 x 1,5	1/1	3,0	5C x 1,5	2A x 1	2A x 1
		EOS 30-15/4	4,5			3 x 1,5		4,5	5C x 1,5		
	40-20	EOS 40-20/6	6,0		8,7	3 x 2,0		6,0	5C x 1,5		
		EOS 40-20/12	12,0		17,4	6 x 2,0		12,0	5C x 6		
	50-25	EOS 50-25/7	7,5		10,9	3 x 2,5		7,5	5C x 2,5		
		EOS 50-25/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EOS 50-25/22	22,5		32,6	9 x 2,5		22,5	5C x 10		
	50-30	EOS 50-30/7	7,5		10,9	3 x 2,5		7,5	5C x 2,5		
		EOS 50-30/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EOS 50-30/22	22,5		32,6	9 x 2,5		22,5	5C x 10		
	60-30	EOS 60-30/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EOS 60-30/22	22,5		32,6	9 x 2,5		22,5	5C x 10		
		EOS 60-30/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
	60-35	EOS 60-35/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EOS 60-35/22	22,5		32,6	9 x 2,5		22,5	5C x 10		
		EOS 60-35/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
	70-40	EOS 70-40/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EOS 70-40/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
		EOS 70-40/45	45,0		65,2	18 x 2,5		45,0	5C x 35		
	80-50	EOS 80-50/15	15,0		21,7	6 x 2,5		15,0	5C x 6		
		EOS 80-50/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
		EOS 80-50/45	45,0		65,2	18 x 2,5		45,0	5C x 35		
	90-50	EOS 90-50/30	30,0		43,5	12 x 2,5		30,0	5C x 16		
		EOS 90-50/45	45,0		65,2	18 x 2,5		45,0	5C x 35		
EOSX	40-20	EOSX 40-20/12	12,0	3 x 400	17,4	6 x 2,0	1/2	6-6	5C x 6	2A x 1	3A x 1
	50-25	EOSX 50-25/15	15,0		21,7	6 x 2,5	1/2	7,5-7,5			
		EOSX 50-25/22	22,5		32,6	9 x 2,5	1/3	7,5-15	5C x 10		
	50-30	EOSX 50-30/15	15,0		21,7	6 x 2,5	1/2	7,5-7,5	5C x 6		
		EOSX 50-30/22	22,5		32,6	9 x 2,5	1/3	7,5-15	5C x 10		
	60-30	EOSX 60-30/15	15,0		21,7	6 x 2,5	1/2	7,5-7,5	5C x 6		
		EOSX 60-30/22	22,5		32,6	9 x 2,5	1/3	7,5-15	5C x 10		
		EOSX 60-30/30	30,0		43,5	12 x 2,5	1/4	7,5-7,5-15	5C x 16		4D x 1
	60-35	EOSX 60-35/15	15,0		21,7	6 x 2,5	1/2	7,5-7,5	5C x 6		3A x 1
		EOSX 60-35/22	22,5		32,6	9 x 2,5	1/3	7,5-15	5C x 10		
		EOSX 60-35/30	30,0		43,5	12 x 2,5	1/4	7,5-7,5-15	5C x 16		4D x 1
	70-40	EOSX 70-40/15	15,0		21,7	6 x 2,5	1/2	7,5-7,5	5C x 6		3A x 1
		EOSX 70-40/30	30,0		43,5	12 x 2,5	1/4	7,5-7,5-15	5C x 16		4D x 1
		EOSX 70-40/45	45,0		65,2	18 x 2,5	1/3	15-15-15	5C x 35		
	80-50	EOSX 80-50/15	15,0		21,7	6 x 2,5	1/2	7,5-7,5	5C x 6		3A x 1
		EOSX 80-50/30	30,0		43,5	12 x 2,5	1/4	7,5-7,5-15	5C x 16		4D x 1
		EOSX 80-50/45	45,0		65,2	18 x 2,5	1/3	15-15-15	5C x 35		
	90-50	EOSX 90-50/30	30,0		43,5	12 x 2,5	1/4	7,5-7,5-15	5C x 16		
		EOSX 90-50/45	45,0		65,2	18 x 2,5	1/3	15-15-15	5C x 35		

Installation, Service and Maintenance

Operation, Maintenance and Service

The electric heater needs to be regularly checked at least at the beginning of each heating season in the scope of the service inspection.

Figure 9 - Location of the switches' cooler

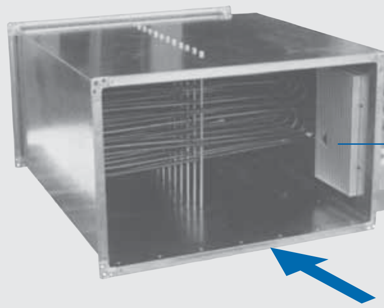


Figure 10 - View into the EO wiring box

EO... / 3–45 (switching relays are not included)

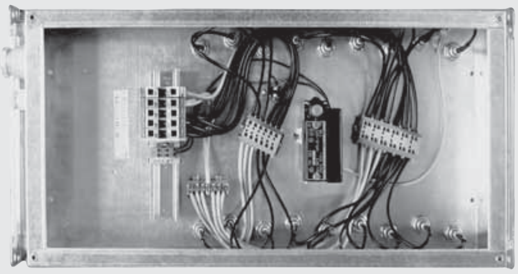


Figure 11 - Wiring boxes of EOS heater

EOS... / 3 (two single-phase SSR switching relays are included)

View into the EOS 30-15/3 wiring box after removing the protecting cover.

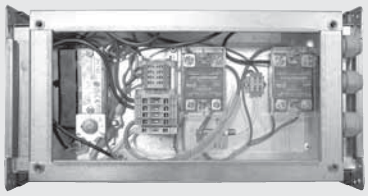
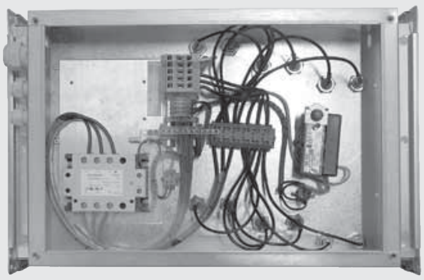


Figure 12 - EOS heater wiring box - cover removed

EOS... / 4–15 (one single-phase SSR switching relay is included)

View into the EOS 50-30/15 wiring box after removing the protecting cover



- During operation, the heater must be checked for surface cleanness, surface temperature, and the connected cables for damage.
- It is necessary to inspect the proper switching functions of protective devices. If the air-handling device is stopped by the emergency system due to heater overheating, it is necessary to find and remove the failure following the respective installation manual.

Figure 13 - EOSX heater wiring box

EOS... /22 – 45
EOSX .../12 – 45

(two or three three-phase SSR switching relays are included)
View into the EOS 70-40/30 heater's wiring box

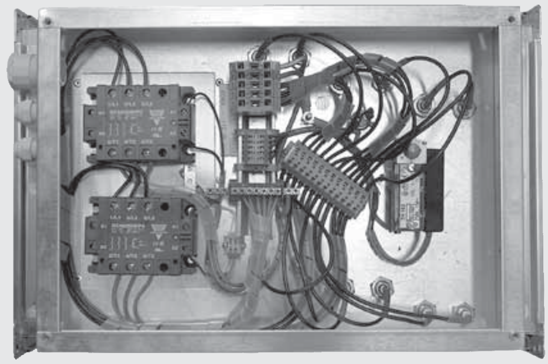
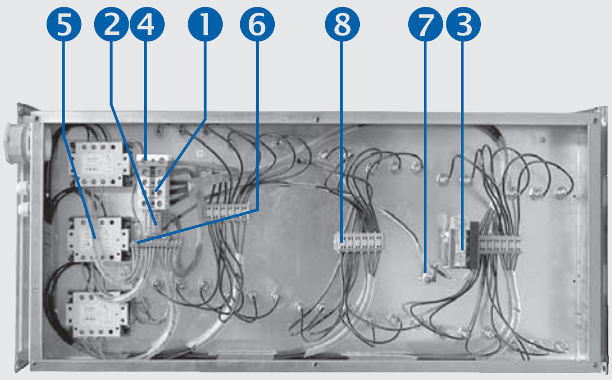


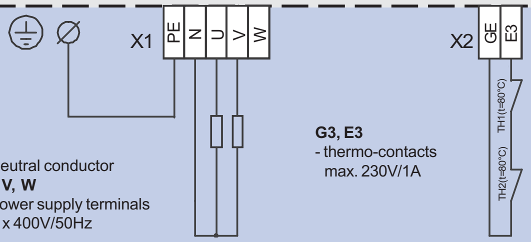
Figure 14 - Wiring box after removing the cover

The EOS 70-40/30 heater's wiring box - protecting cover removed

1. Power supply
2. Control and signalling of emergency failure
3. Adjustable limiting thermostat
4. Protective conductor terminal
5. SSR switching relay with varistors
6. Neutral bus bar
7. Ground screw
8. Interconnecting bus bar of heating blocks



Wiring diagrams

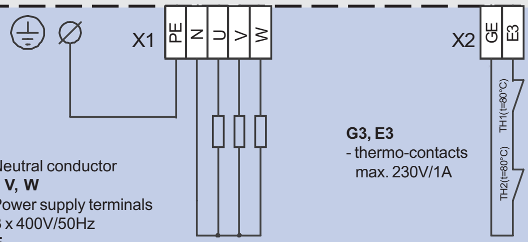


G3, E3
- thermo-contacts max. 230V/1A

N
- Neutral conductor
U, V, W
- Power supply terminals 3 x 400V/50Hz
PE
- Protective conductor terminal

Typ	Rozměrová řada	Výkon [kW]								
		3	4	6	7	12	15	22	30	45
EO	30 - 15	●								
	40 - 20									
	50 - 25									
	50 - 30									
	60 - 30									
	60 - 35									
	70 - 40									
	80 - 50									
	90 - 50									

El. heater EO

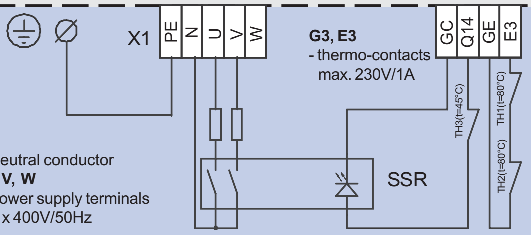


G3, E3
- thermo-contacts max. 230V/1A

N
- Neutral conductor
U, V, W
- Power supply terminals 3 x 400V/50Hz
PE
- Protective conductor terminal

Typ	Rozměrová řada	Výkon [kW]								
		3	4	6	7	12	15	22	30	45
EO	30 - 15		●							
	40 - 20			●		●				
	50 - 25				●		●	●		
	50 - 30				●		●	●		
	60 - 30						●	●	●	
	60 - 35						●	●	●	
	70 - 40						●		●	●
	80 - 50						●		●	●
	90 - 50								●	●

El. heater EO



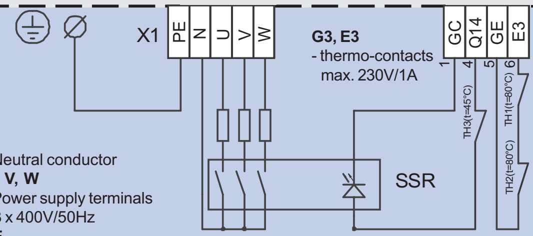
G3, E3
- thermo-contacts max. 230V/1A

N
- Neutral conductor
U, V, W
- Power supply terminals 3 x 400V/50Hz
PE
- Protective conductor terminal

Typ	Rozměrová řada	Výkon [kW]								
		3	4	6	7	12	15	22	30	45
EOS	30 - 15	●								
	40 - 20									
	50 - 25									
	50 - 30									
	60 - 30									
	60 - 35									
	70 - 40									
	80 - 50									
	90 - 50									

GC, Q14
- control signal 10-40V/DC (+ Q14)

El. heater EOS



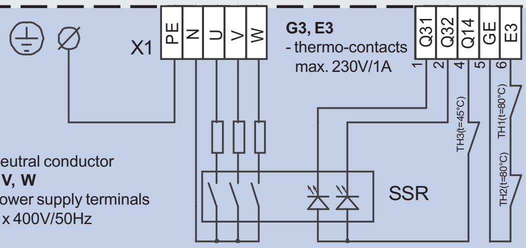
G3, E3
- thermo-contacts max. 230V/1A

N
- Neutral conductor
U, V, W
- Power supply terminals 3 x 400V/50Hz
PE
- Protective conductor terminal

Typ	Rozměrová řada	Výkon [kW]								
		3	4	6	7	12	15	22	30	45
EOS	30 - 15		●							
	40 - 20			●		●				
	50 - 25				●		●	●		
	50 - 30				●		●	●		
	60 - 30						●	●	●	
	60 - 35						●	●	●	
	70 - 40						●		●	●
	80 - 50						●		●	●
	90 - 50								●	●

GC, Q14
- control signal 10-40V/DC (+ Q14)

El. heater EOS



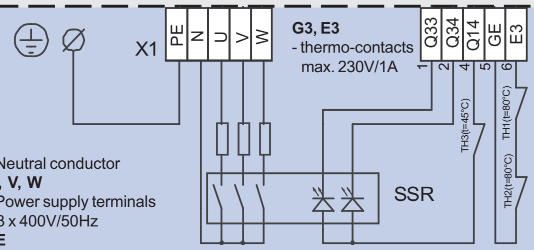
G3, E3
- thermo-contacts max. 230V/1A

N
- Neutral conductor
U, V, W
- Power supply terminals 3 x 400V/50Hz
PE
- Protective conductor terminal

Typ	Rozměrová řada	Výkon [kW]								
		3	4	6	7	12	15	22	30	45
EOSX	30 - 15									
	40 - 20					●				
	50 - 25						●			
	50 - 30						●			
	60 - 30						●			
	60 - 35						●			
	70 - 40						●			
	80 - 50						●			
	90 - 50									

GC, Q14
- control signal 10-40V/DC(+Q14)
Q31
- 1st section switching (-Q31)
Q32
- 2nd section switching (-Q32)

El. heater EOSX



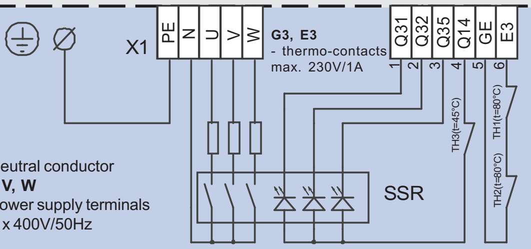
G3, E3
- thermo-contacts max. 230V/1A

N
- Neutral conductor
U, V, W
- Power supply terminals 3 x 400V/50Hz
PE
- Protective conductor terminal

Typ	Rozměrová řada	Výkon [kW]								
		3	4	6	7	12	15	22	30	45
EOSX	30 - 15									
	40 - 20									
	50 - 25							●		
	50 - 30							●		
	60 - 30							●		
	60 - 35							●		
	70 - 40									
	80 - 50									
	90 - 50									

GC, Q14
- control signal 10-40V/DC(+Q14)
Q31
- 1st section switching (-Q31)
Q32
- 2nd section switching (-Q32)

El. heater EOSX



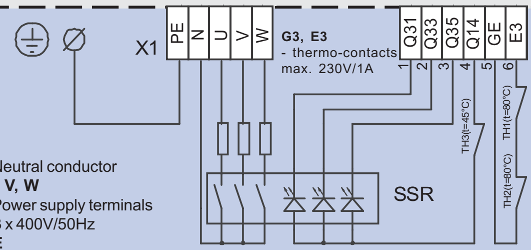
G3, E3
- thermo-contacts max. 230V/1A

N
- Neutral conductor
U, V, W
- Power supply terminals 3 x 400V/50Hz
PE
- Protective conductor terminal

Typ	Rozměrová řada	Výkon [kW]								
		3	4	6	7	12	15	22	30	45
EOSX	30 - 15									
	40 - 20									
	50 - 25									
	50 - 30									
	60 - 30								●	
	60 - 35								●	
	70 - 40								●	
	80 - 50								●	
	90 - 50								●	

GC, Q14
- control signal 10-40V/DC(+Q14)
Q31
- 1st section switching (-Q31)
Q32
- 2nd section switching (-Q32)

El. heater EOSX



G3, E3
- thermo-contacts max. 230V/1A

N
- Neutral conductor
U, V, W
- Power supply terminals 3 x 400V/50Hz
PE
- Protective conductor terminal

Typ	Rozměrová řada	Výkon [kW]								
		3	4	6	7	12	15	22	30	45
EOSX	30 - 15									
	40 - 20									
	50 - 25									
	50 - 30									
	60 - 30									
	60 - 35									
	70 - 40									●
	80 - 50									●
	90 - 50									●

GC, Q14
- control signal 10-40V/DC(+Q14)
Q31
- 1st section switching (-Q31)
Q32
- 2nd section switching (-Q32)

El. heater EOSX

Technical Information

Applications of water heaters

Hot-water heaters are intended for air heating, from simple venting installations to sophisticated air-handling systems. They are designed to be installed directly in square air ducts. Ideally, they can be used along with other components of the Vento modular system which ensure inter-compatibility and balanced parameters.

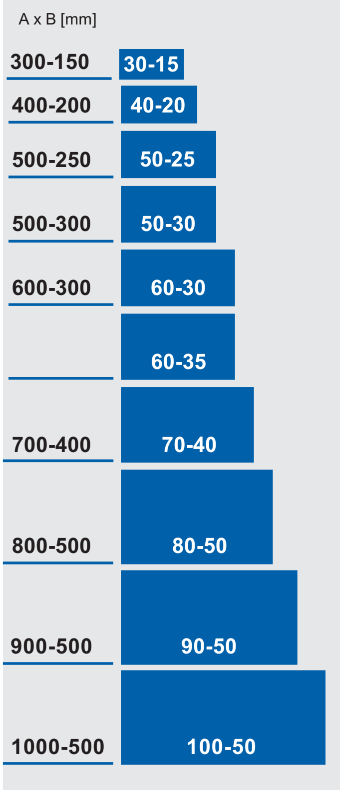
Operating conditions

The heated air must be free of solid, fibrous, sticky and aggressive impurities. The heated air must also be free of corrosive chemicals or chemicals aggressive to aluminium, copper and/or zinc.
Maximum allowed operating parameters of heating water:

- Max. allowed water temperature .... +130 °C
- Max. allowed water pressure ....1,6 MPa

Performance properties of water heaters for common values of water temperature gradients, various air flow rates and inlet air temperatures for water as a heat-transfer agent are included in nomograms in the data section of this catalogue.

Figure 1 - Dimensions



Dimensional Range

VO water heaters are manufactured in a range of ten sizes according to the A x B dimensions of the connecting flange (see figure # 1). Single, two and three-row heaters are available for all sizes (except for sizes 30-15 and 40-20 - only two and three-row heaters).
Water heaters can be connected to air ducts in the same way as any other Vento duct system component. Connections of all water heaters to the heating water supply are maximally standardized. These heaters enable designers to cover the full air flow range of Vento fans.

Poloha a umístění

When projecting the layout of the heater location, we recommend observing the following principles:

- If water is used as the heating medium, the heater can be situated only in an indoor environment where the temperature is maintained above freezing point (this does not apply to heated air during operation).
- Outdoor installation is allowed only if an antifreeze solution is used as the heating medium (mostly ethylene glycol solution). In this case, the actual heater's parameters must be calculated using AeroCAD software.
- Water heaters can work in any position in which air venting of the heater is possible. [1]
- Free access to the heater must be ensured to enable control and service.
- An air filter must be installed in front of the heater to avoid its fouling.
- The counter-current connection of the heater is needed to achieve maximum output.
- The heater can be situated either in front of or behind the fan. However, if the heater is in front of the fan, the heater output must be controlled so that the air temperature will not exceed the maximum allowed value for the given fan.
- If the heater is situated behind the fan, we recommend inserting between the fan and the heater a spacer (e.g. 1-1.5 m long straight duct) to steady the air flow.

Materials and Design

The external casing of the heaters is made of galvanized steel sheets. The headers are made of welded steel pipes and finished with a synthetic coating. The heat exchange surface is created by 0.1 mm thick aluminium overlapping fins pulled on copper pipes of Ć 9.52 mm (3/8"). As standard, VO heaters are manufactured in two-row versions with shifted geometry (ST 25 x 22 mm).
All used materials are carefully checked so they ensure long service life and reliability. All heaters are tested under water for leakage using pressurised air of 2 MPa for five minutes.

Figure 2 - Heater's design

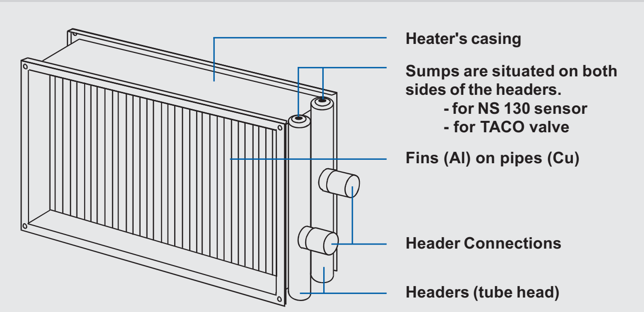
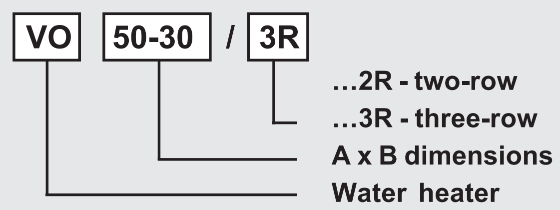


Figure 3 - Designation of Heaters



Designation of Heaters

The type designation of heaters in projects and orders is defined by the key in figure # 3.

[1] For instructions, refer to the section Installation, Maintenance and Service.

Technické informace

The heater's output is only valid for the selected operating conditions. Selected (i.e. nominal) operating conditions are specified by the air flow rate at air flow velocity of 3.7 m/s, inlet air temperature of -15 °C and heating water operating temperature gradient of +90 °C / +70 °C. Nominal operating conditions are included in the nomograms (according to the number) as an example.
Accessories like self-air venting TACO valve, SUMX mixing set and NS 130R anti-freeze sensor featuring short time constant (resp. other sensors) can be delivered. Accessories are not included in the heater delivery so must be ordered separately.

Air-Venting of the Heater

To ensure proper operation of the heater, it is necessary to install reliable air-venting, the best being automatic. The TACO automatic air-venting valve with outer G1/2" thread is designed to be screwed directly into the heater header pipe. It must be installed on the very top of both header pipes. [2]
Thanks to its small dimensions, it is suitable when using the heater just below the ceiling.

Antifreeze Protection

Antifreeze protection of the heater is created by comprehensive interconnected equipment preventing freezing of the heater in normal operating conditions. To ensure safety of the assembly, it is advisable to use proven Vento components, the choice of which depends on the particular device and the selected control unit.
As standard, the antifreeze protection consists of:

– Control unit
– NS 130R water temperature sensors, NS 120 air temperature sensors and optionally a capillary probe
– Inlet air damper controlled by the safety actuator
– Mixing Set

A particular configuration of the antifreeze protection can be specified using the catalogue of control units, respectively using AeroCAD software, available from REMAK or their distributors.

Dimensions and weights

For important dimensions and weights (without water filling) of heaters, refer to figure # 5 and table # 1.
The connection for the heating water is provided with G 1" outer thread which is used for all heater sizes. Connections for TACO valves and NS 130 sensor are provided with G1/2" inner thread.

.

Table 1 - Dimensions of water heaters

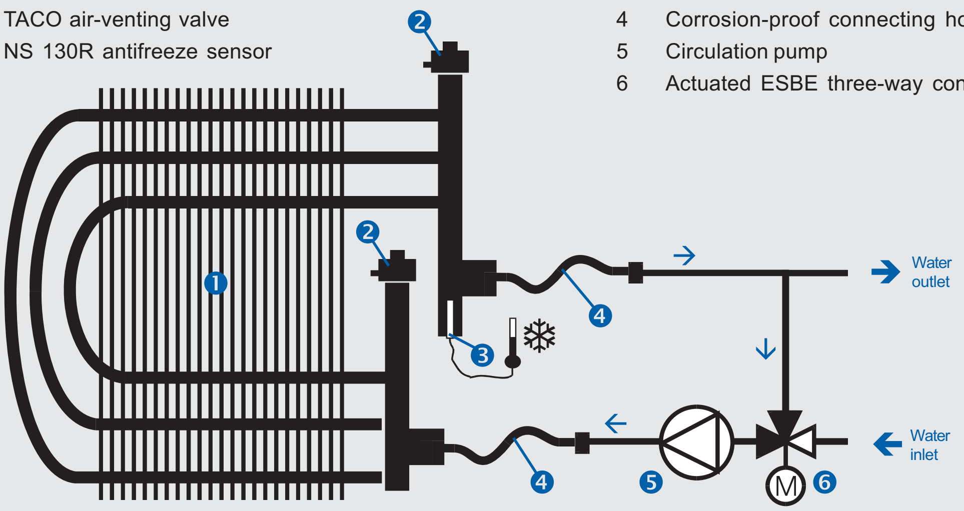
Heater	A	B	C	D	E	F	G	m (2R) ±10%
	mm	mm	mm	mm	mm	mm	mm	kg
VO 30-15	300	150	320	170	340	190	130	4,1
VO 40-20	400	200	420	220	440	240	180	5,6
VO 50-25	500	250	520	270	540	290	230	6,6
VO 50-30	500	300	520	320	540	340	280	7,1
VO 60-30	600	300	620	320	640	340	280	8,1
VO 60-35	600	350	620	370	640	390	330	8,8
VO 70-40	700	400	720	420	740	440	380	10,6
VO 80-50	800	500	820	520	840	540	480	13,5
VO 90-50	900	500	930	530	960	560	480	15,2
VO 100-50	1000	500	1030	530	1060	560	480	17,7

(2 For instructions, refer to the section Installation, Maintenance and Service

Figure 4 - Heater with a mixing set

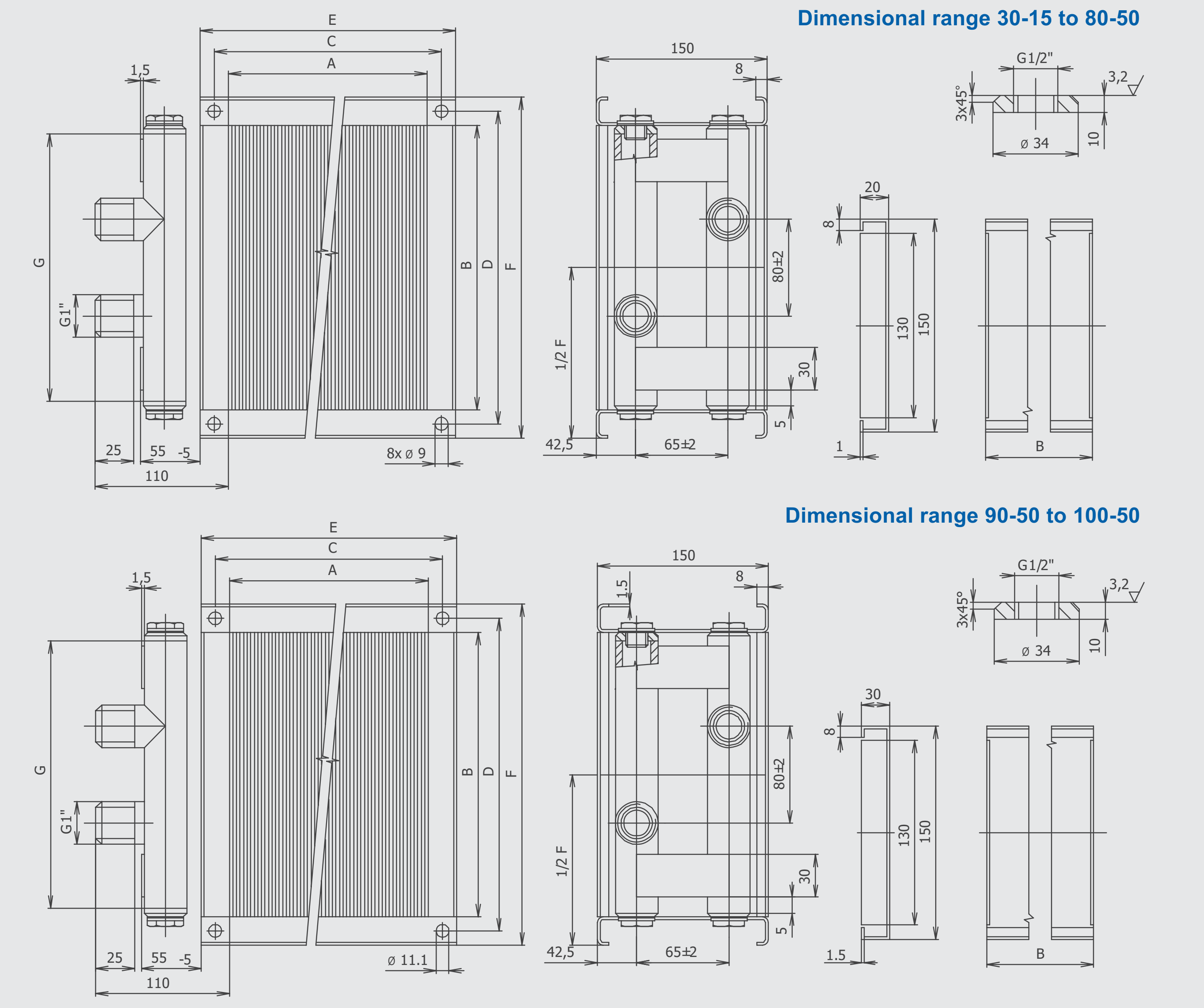
1 VO Water heater
2 TACO air-venting valve
3 NS 130R antifreeze sensor

SUMX Mixing Set Components::
4 Corrosion-proof connecting hoses
5 Circulation pump
6 Actuated ESBE three-way control valve



Parameters

Figure 5 - Dimensions of VO water heaters (type designation corresponds with table # 1)



Heater Dimensioning

For nomograms showing the thermodynamic correlation for each heater, refer to pages 157-174. All necessary final parameters of the heater corresponding to the performance job can be obtained from the nomograms.

- **Required default parameters**
  - Selected heater's size
  - Air flow rate (velocity in the cross-section)
  - Calculated inlet air temperature
  - Calculated water temperature gradient
- **Determined final parameters**
  - Outlet air temperature
  - Heater's output
  - Required water discharge
  - Water pressure loss
  - Air pressure loss [3]

[3] The air pressure loss for all heaters can be determined from the nomogram. As the design of the heaters is standardized, the pressure loss only depends on the air flow velocity through the heater. The nomogram also includes air flow rate - velocity conversion curves for all heater sizes.

Heater Dimensioning Procedure

- Outlet air temperature behind the heater ④ for required default parameters ①②③ can be determined from the nomograms.
- If the outlet air temperature ④ is the same or higher than the required temperature, the heater complies with the performance job.
- Maximum output of the heater ⑦, maximum water discharge ⑨ and water pressure loss ⑩ at maximum discharge for the required default parameters ①⑤⑥ can also be determined from the nomograms.[4]
- A suitable mixing set for water discharge and pressure loss at the given discharge can be determined following the procedure included in the section SUMX Mixing Sets.
- The heater's pressure loss at the given air flow rate for calculation of the assembly pressure loss balance needed for the fan selection can be obtained from the nomogram on page 174.

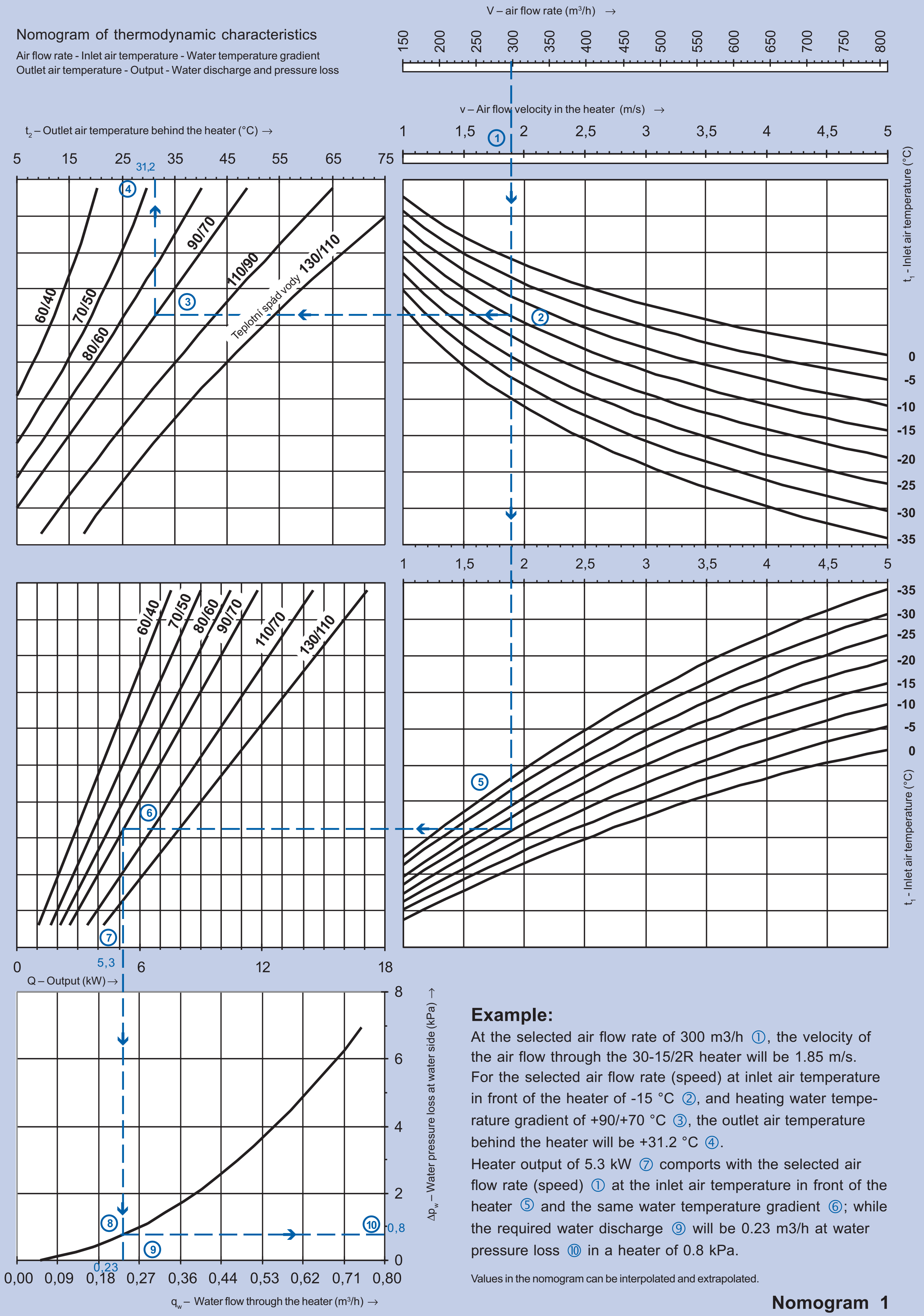
[4] The nomograms cannot be used to determine the maximum calculated output and water discharge because value $\Delta t_W = 20K$ is given for the fixed heating water temperature gradients.

VO 30-15/2R

Cu/Al water heater 300 x 150 mm

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss



Example:

At the selected air flow rate of 300 m3/h ①, the velocity of the air flow through the 30-15/2R heater will be 1.85 m/s.

For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +31.2 °C ④.

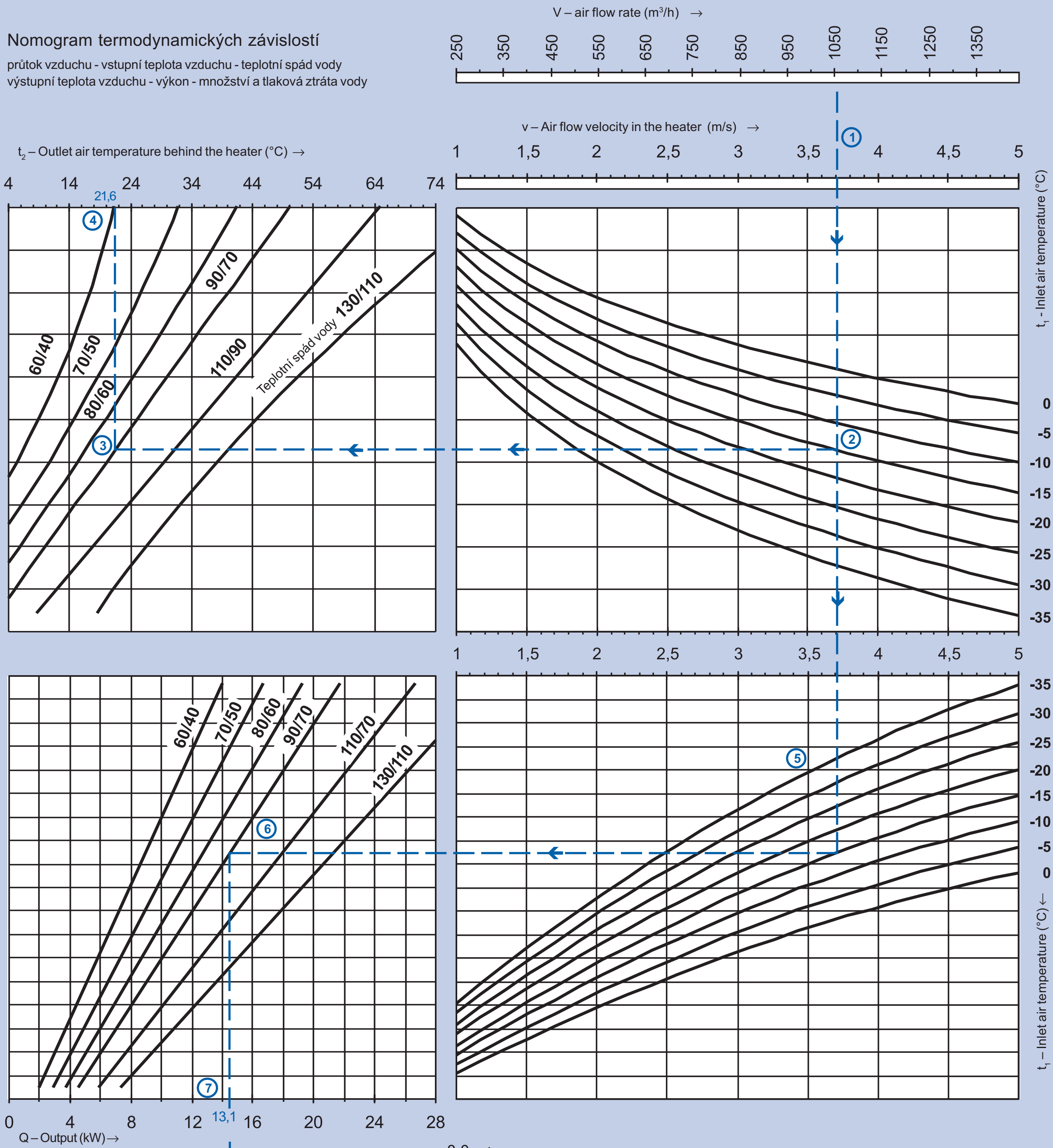
Heater output of 5.3 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 0.23 m3/h at water pressure loss ⑩ in a heater of 0.8 kPa.

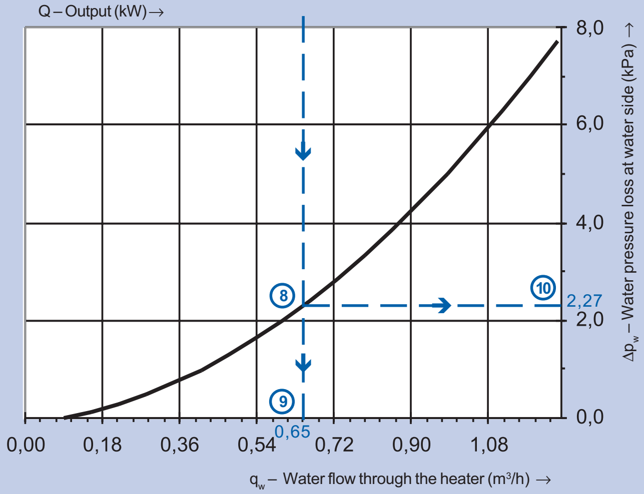
Values in the nomogram can be interpolated and extrapolated.

Nomogram 1

VO 40-20/2R

Cu/Al water heater 400 x 200 mm





Example:

At the selected air flow rate of 1066 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +21,6 °C ④.
Heater output of 13,1 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 0,65 m³/h at water pressure loss ⑩ in a heater of 2,27 kPa.

Values in the nomogram can be interpolated and extrapolated.

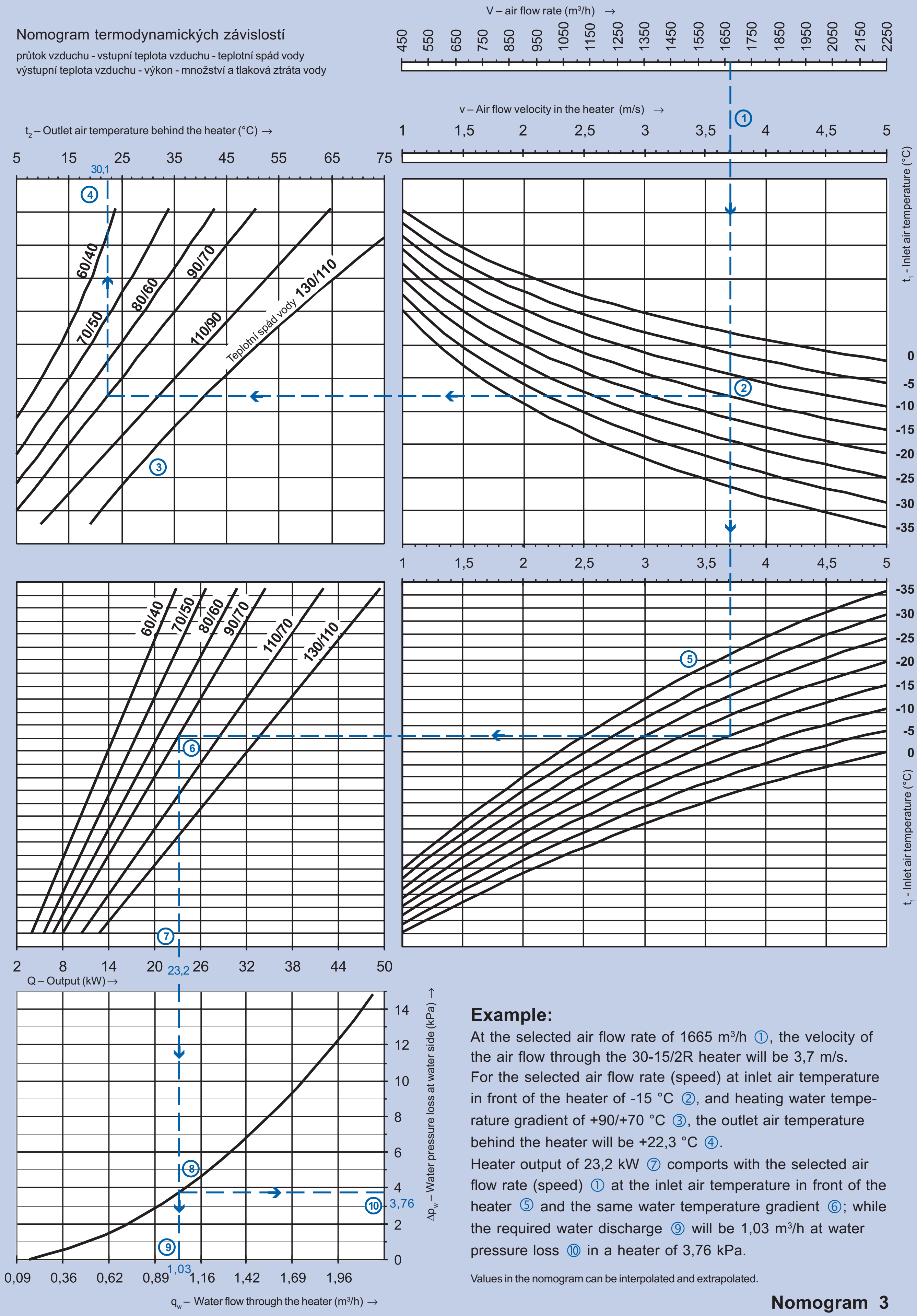
Nomogram 2

VO 50-25/2R

Cu/Al water heater 500 x 250 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody



Example:

At the selected air flow rate of 1665 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +22,3 °C ④.
Heater output of 23,2 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 1,03 m³/h at water pressure loss ⑩ in a heater of 3,76 kPa.

Values in the nomogram can be interpolated and extrapolated.

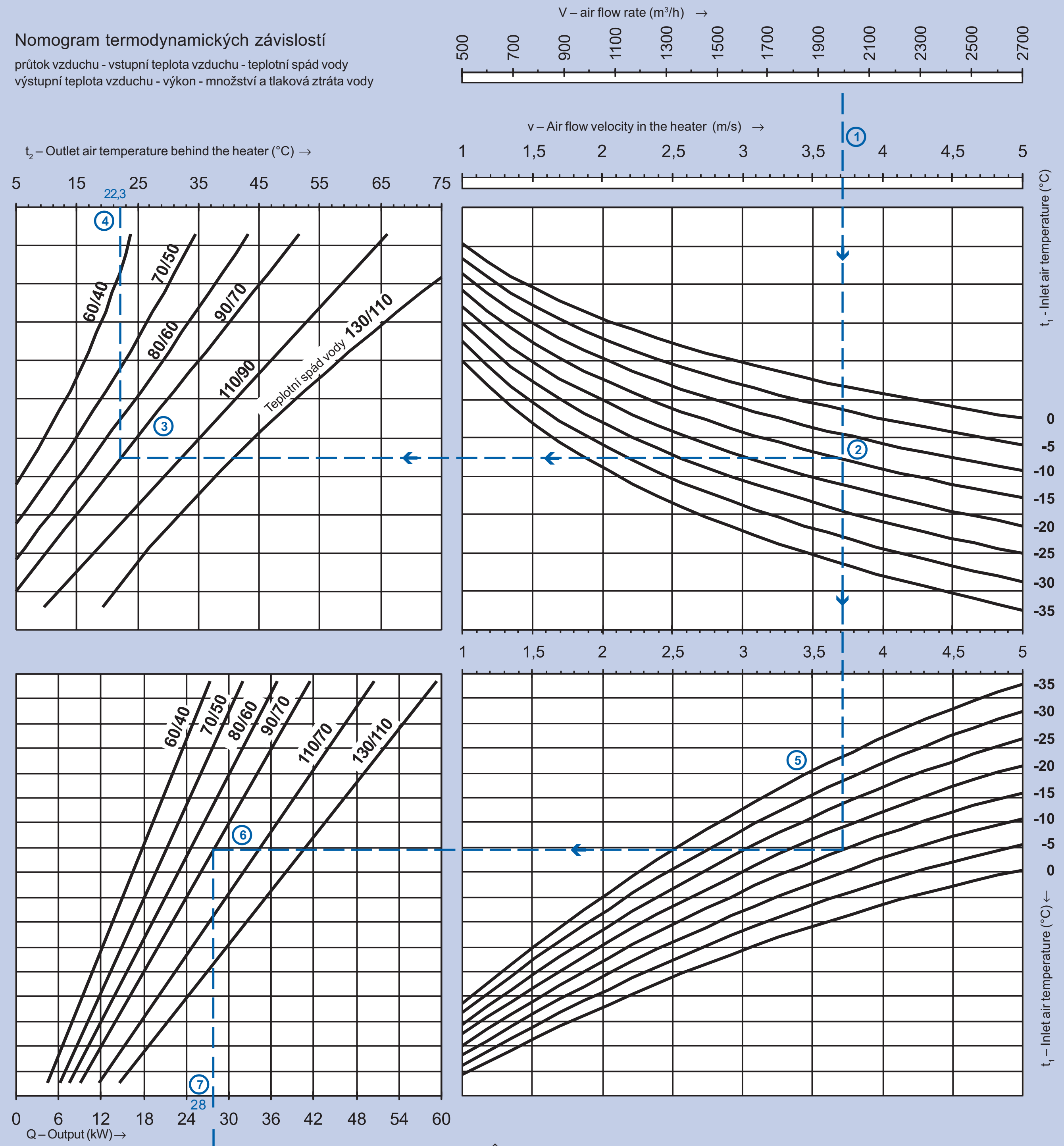
Nomogram 3

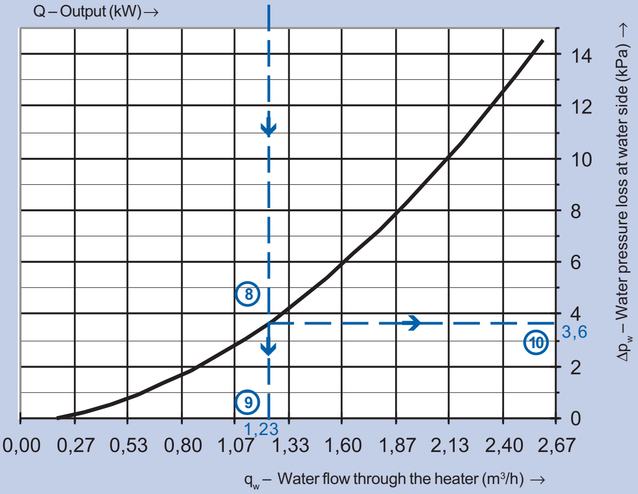
VO 50-30/2R

Cu/Al water heater 500 x 300 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

At the selected air flow rate of 1998 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +22,3 °C ④.
Heater output of 28 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 1,23 m³/h at water pressure loss ⑩ in a heater of 3,6 kPa.

Values in the nomogram can be interpolated and extrapolated.

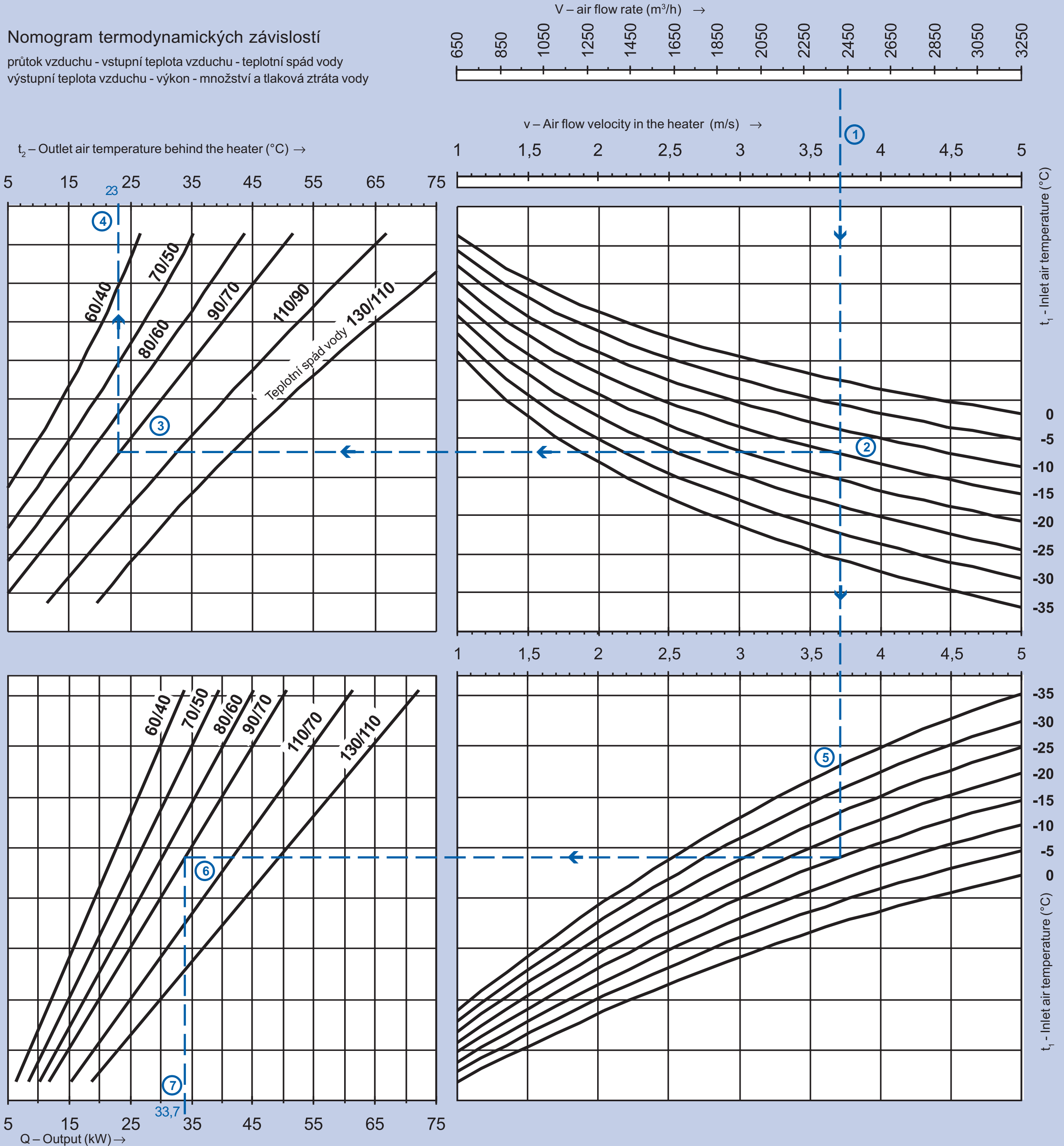
Nomogram 4

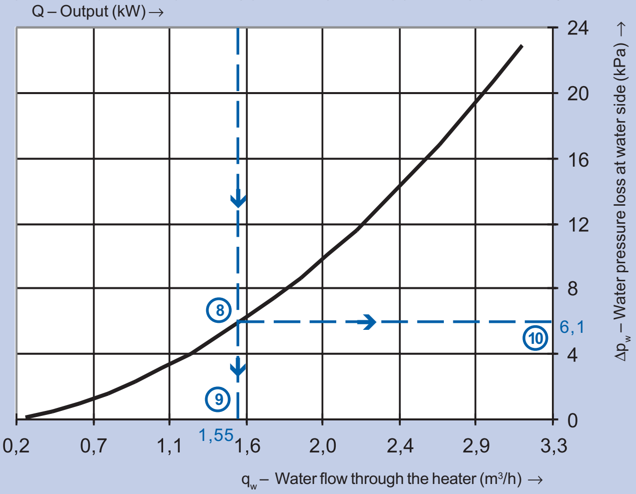
VO 60-30/2R

Cu/Al water heater 600 x 300 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

At the selected air flow rate of 2398 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +23 °C ④.
Heater output of 33,7 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 1,55 m³/h at water pressure loss ⑩ in a heater of 0.8 kPa.

Values in the nomogram can be interpolated and extrapolated.

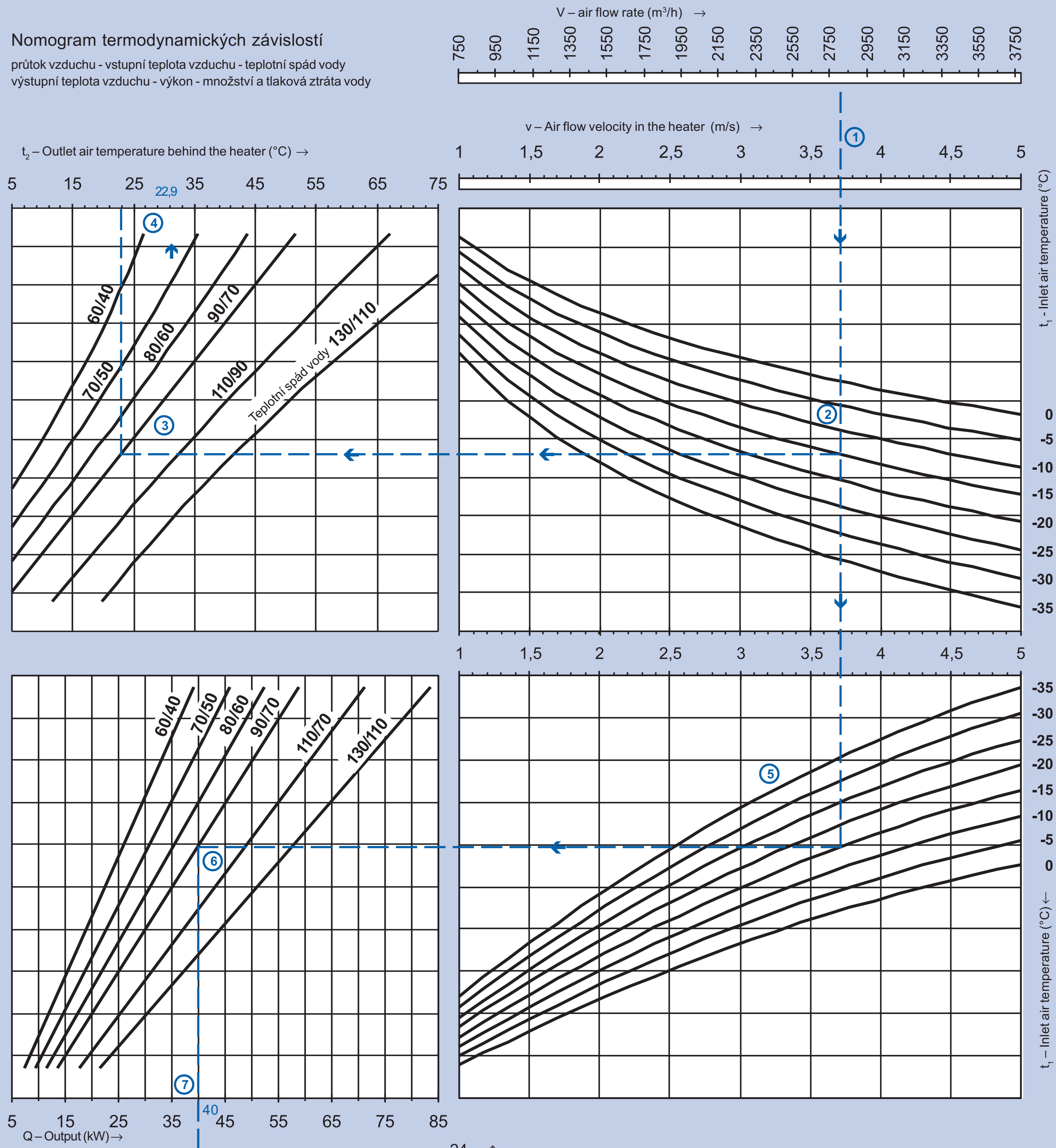
Nomogram 5

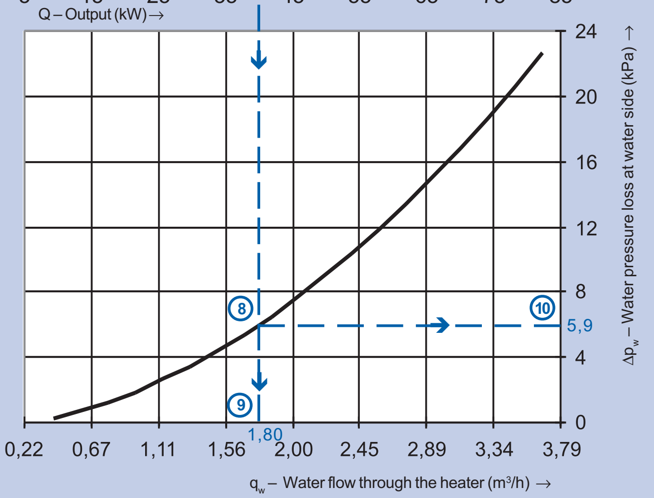
VO 60-35/2R

Cu/Al water heater 600 x 350 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

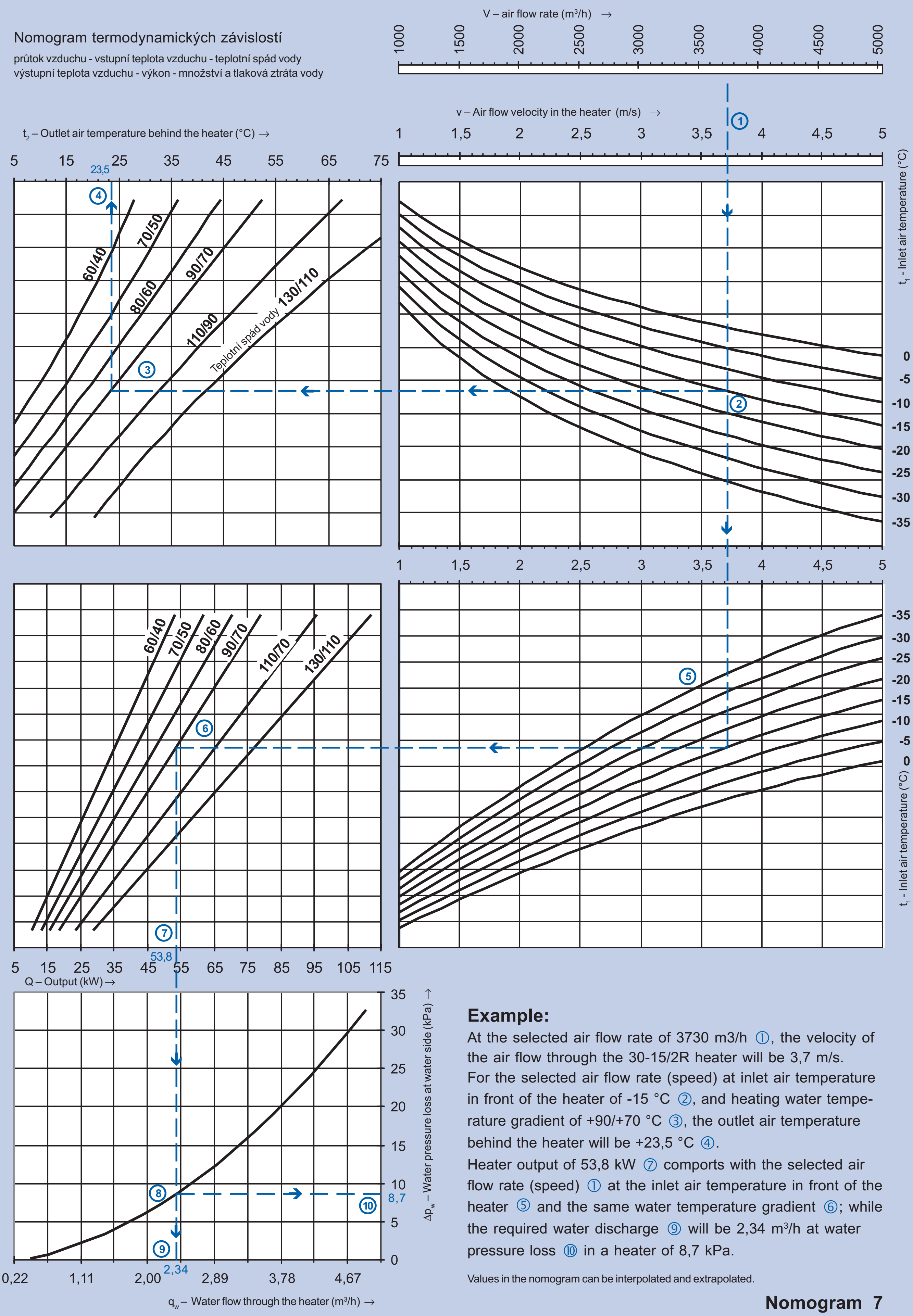
At the selected air flow rate of 2797 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s. For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +22,9 °C ④. Heater output of 40 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 1,80 m³/h at water pressure loss ⑩ in a heater of 5,9 kPa.

Values in the nomogram can be interpolated and extrapolated.

Nomogram 6

VO 70-40/2R

Cu/Al water heater 700 x 400 mm



Example:

At the selected air flow rate of 3730 m3/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +23,5 °C ④.
Heater output of 53,8 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 2,34 m³/h at water pressure loss ⑩ in a heater of 8,7 kPa.

Values in the nomogram can be interpolated and extrapolated.

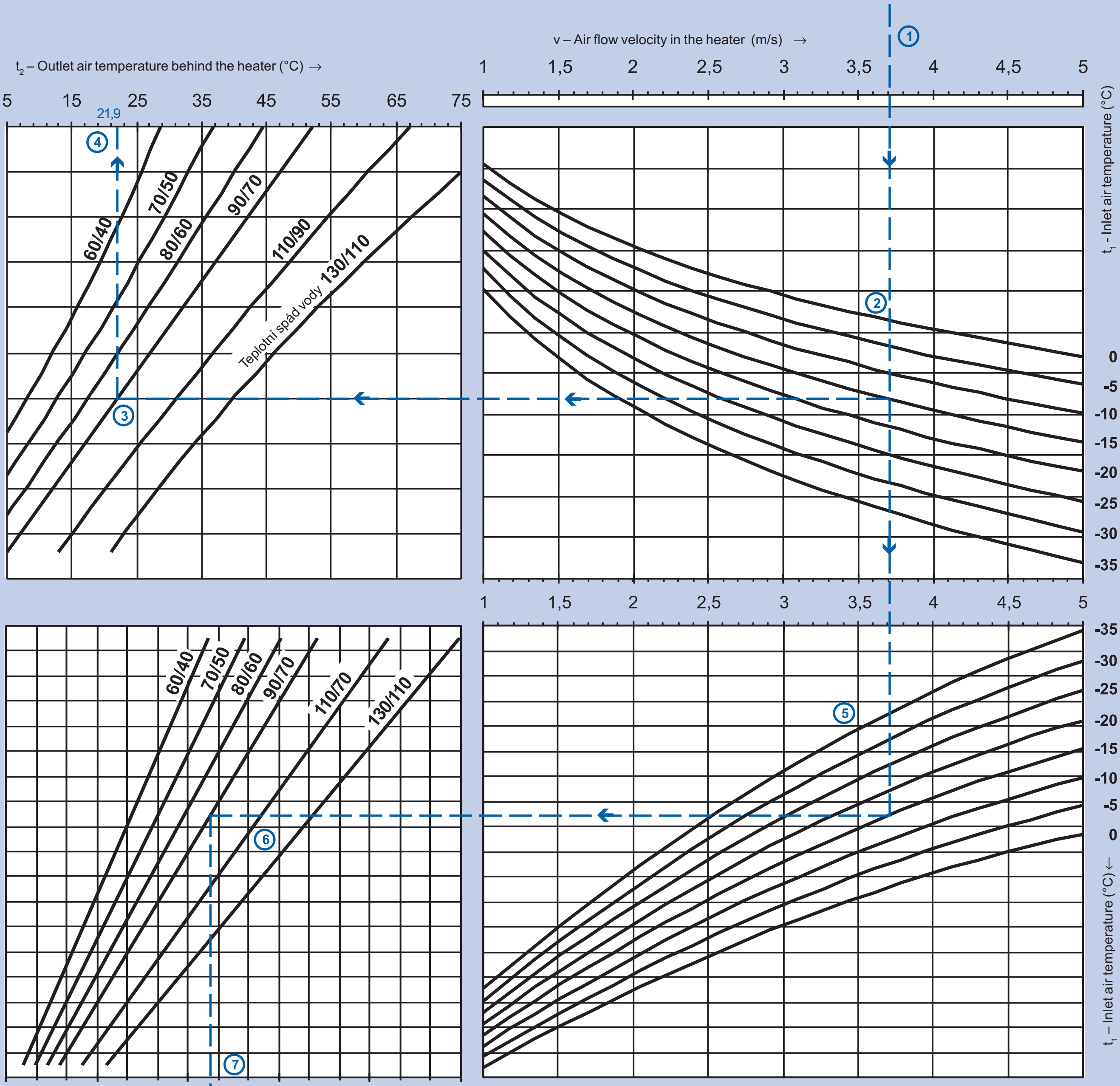
Nomogram 7

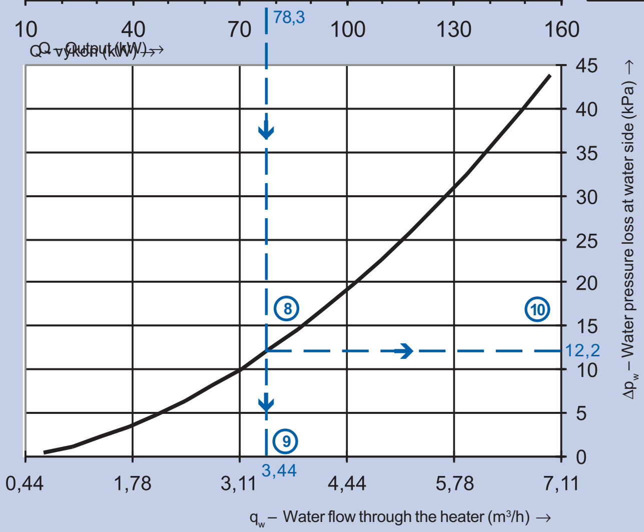
VO 80-50/2R

Cu/Al water heater 800 x 500 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

At the selected air flow rate of 5328 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +21,9 °C ④.
Heater output of 78,3 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 3,44 m³/h at water pressure loss ⑩ in a heater of 12,2 kPa.

Values in the nomogram can be interpolated and extrapolated.

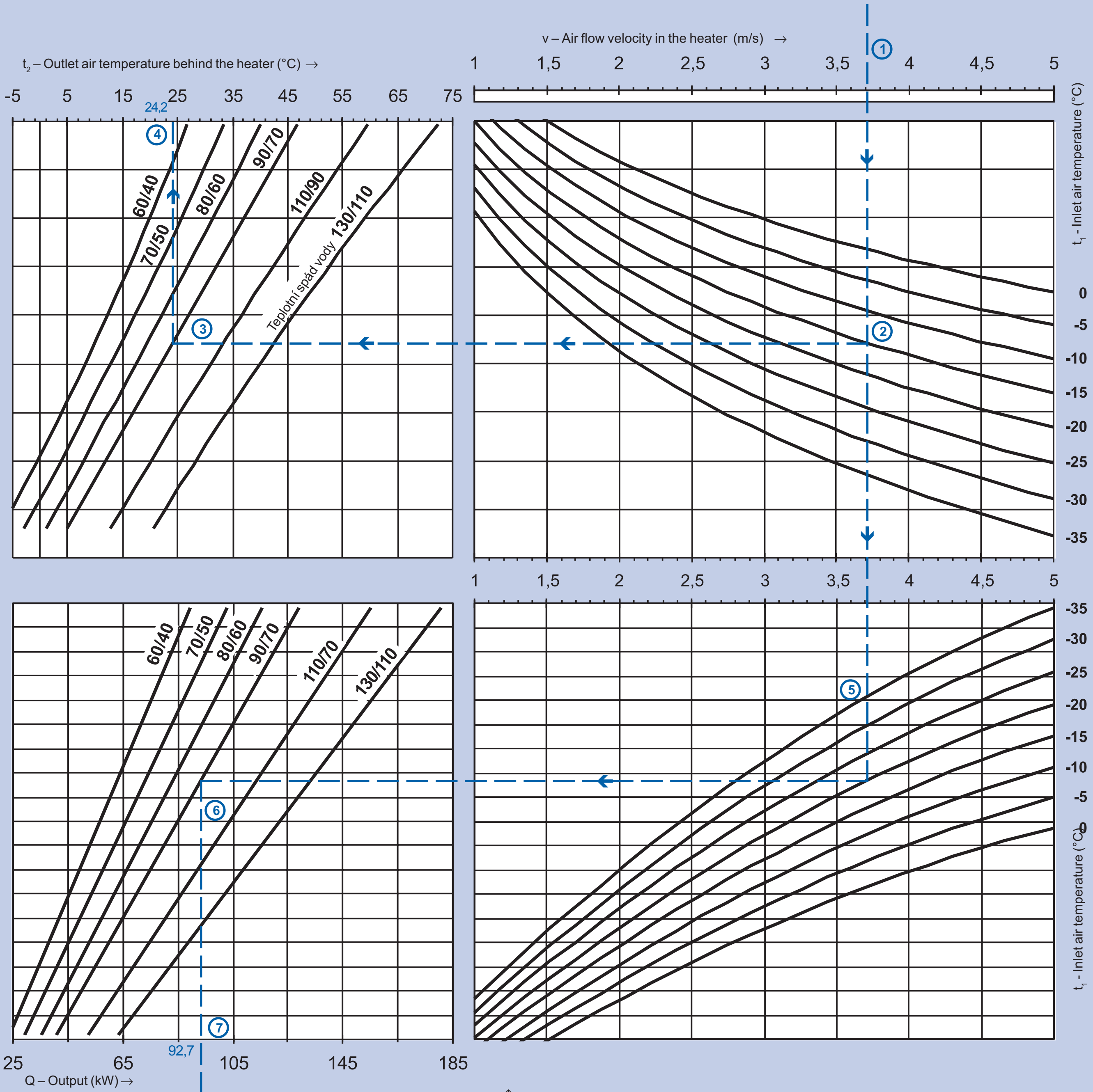
Nomogram 8

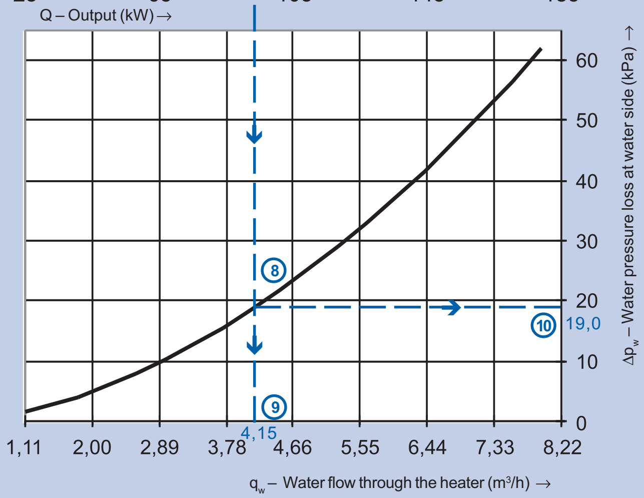
VO 90-50/2R

Cu/Al water heater 900 x 500 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

At the selected air flow rate of 3730 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +24,2 °C ④.
Heater output of 92,7 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 4,19 m³/h at water pressure loss ⑩ in a heater of 19 kPa.

Values in the nomogram can be interpolated and extrapolated.

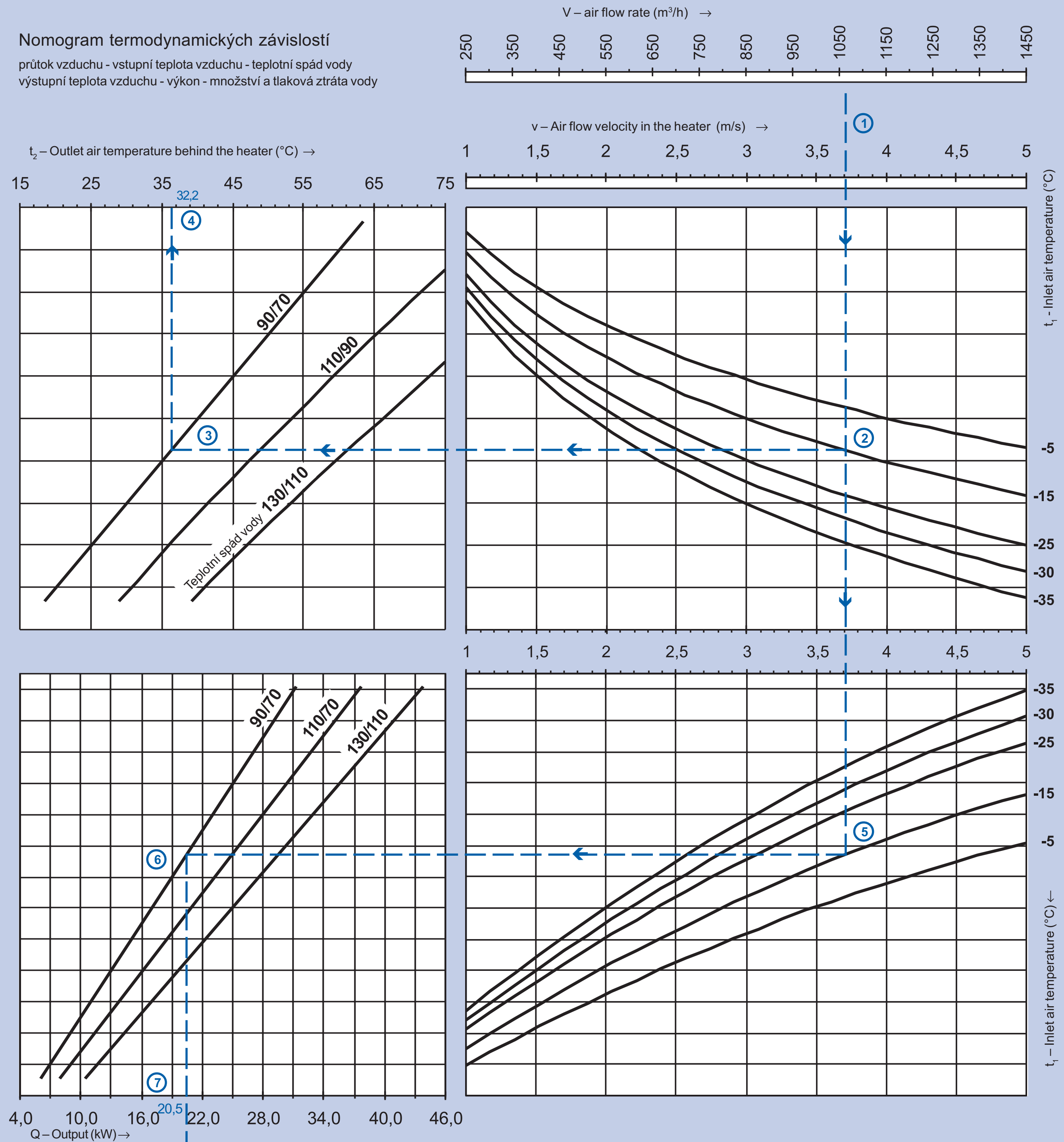
Nomogram 9

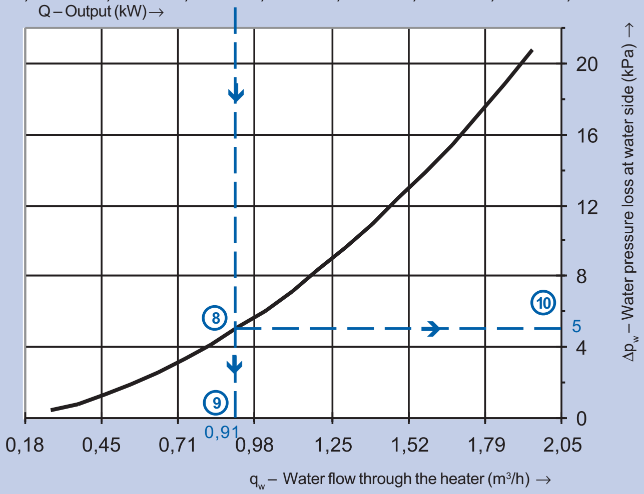
VO 40-20/3R

Cu/Al water heater 400 x 200 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

At the selected air flow rate of 5328 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +36,4 °C ④.
Heater output of 20,5 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 0,91 m³/h at water pressure loss ⑩ in a heater of 5 kPa.

Values in the nomogram can be interpolated and extrapolated.

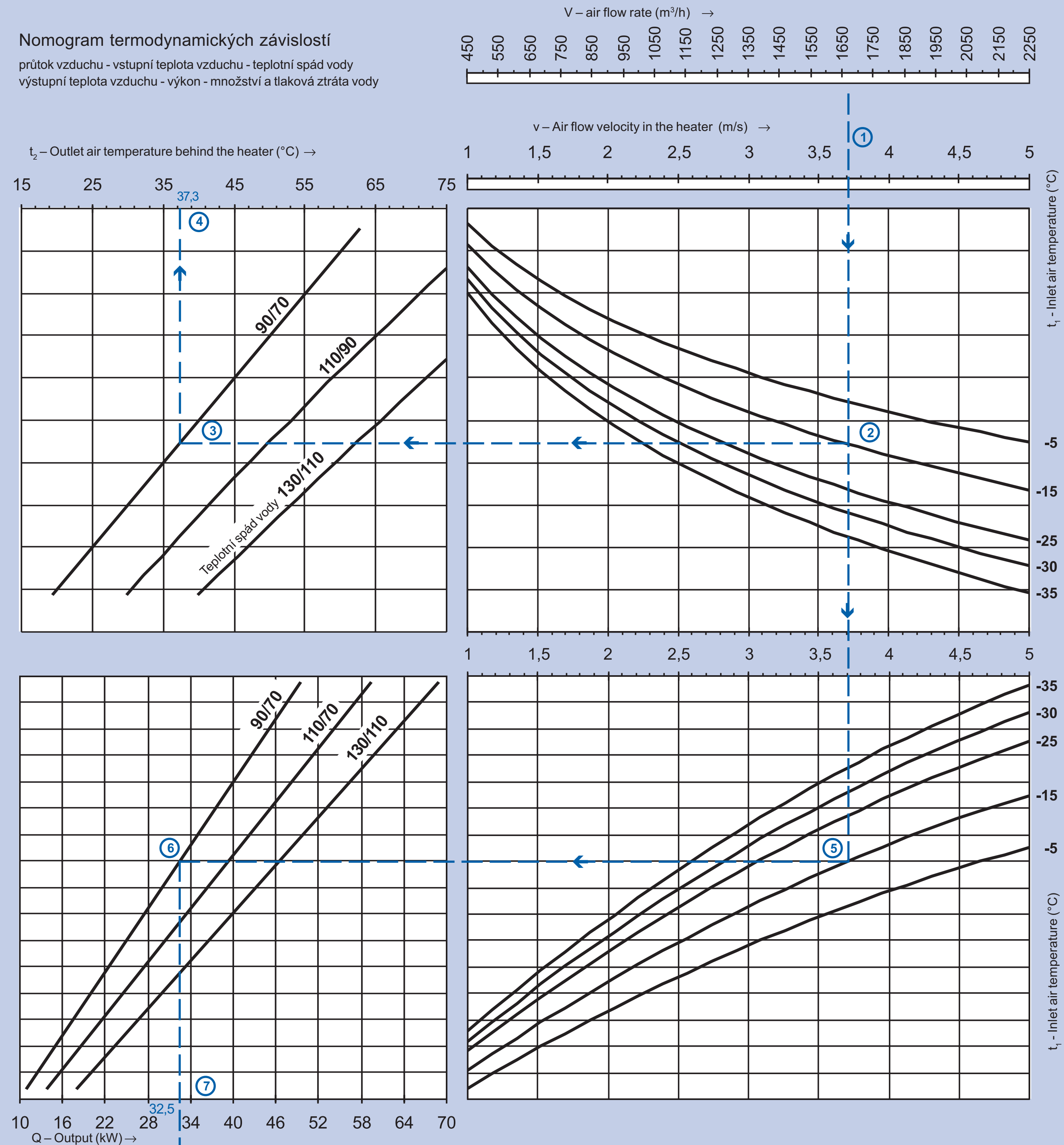
Nomogram 10

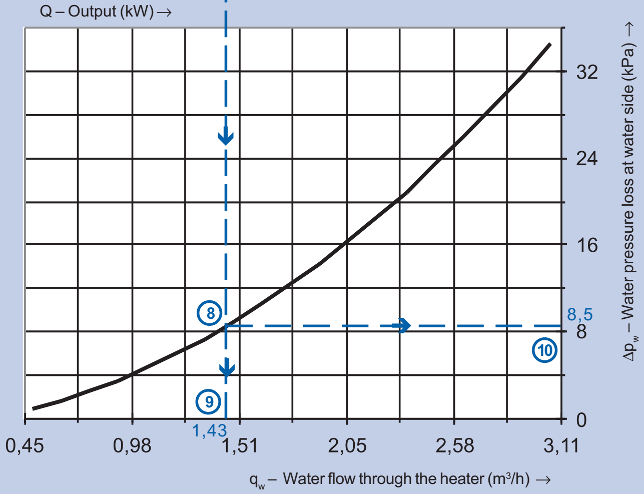
VO 50-25/3R

Cu/Al water heater 500 x 250 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

At the selected air flow rate of 3730 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +37,3 °C ④.
Heater output of 32,5 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 1,43 m³/h at water pressure loss ⑩ in a heater of 8,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

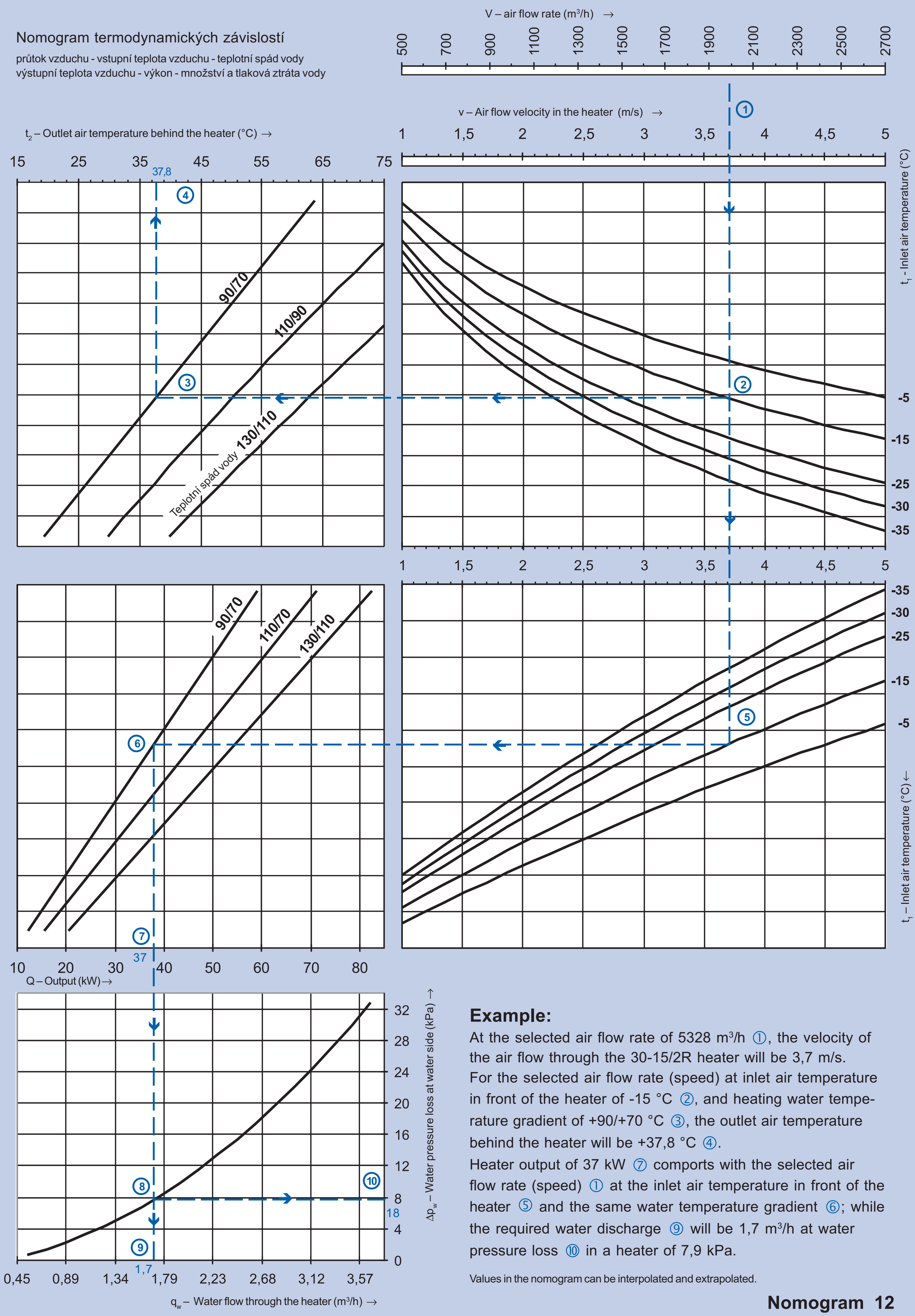
Nomogram 11

VO 50-30/3R

Cu/Al water heater 500 x 300 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody



Example:

At the selected air flow rate of 5328 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +37,8 °C ④.
Heater output of 37 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 1,7 m³/h at water pressure loss ⑩ in a heater of 7,9 kPa.

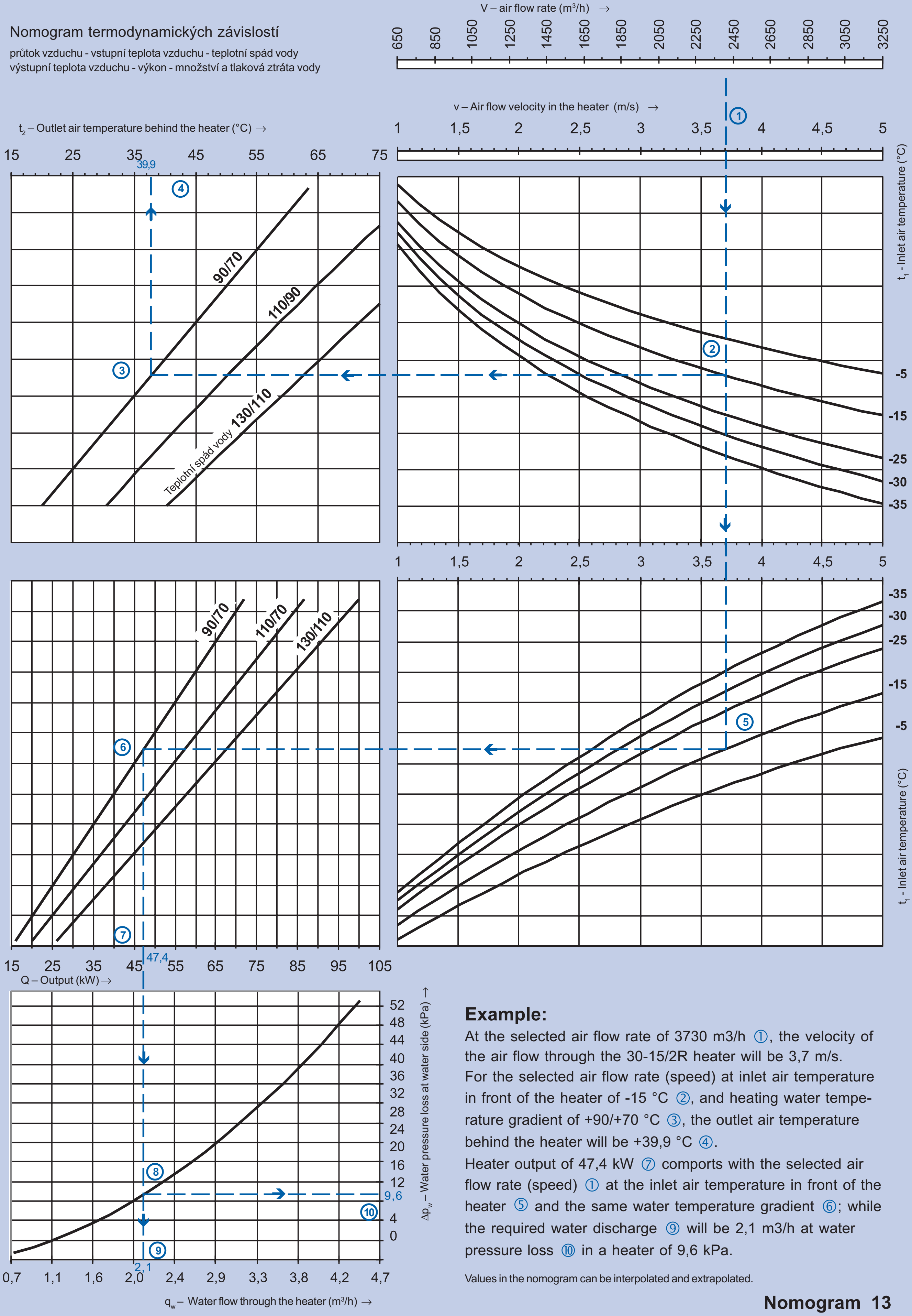
Values in the nomogram can be interpolated and extrapolated.

Nomogram 12

VO 60-30/3R

Cu/Al water heater 600 x 300 mm

Nomogram termodynamických závislostí
průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody



Example:

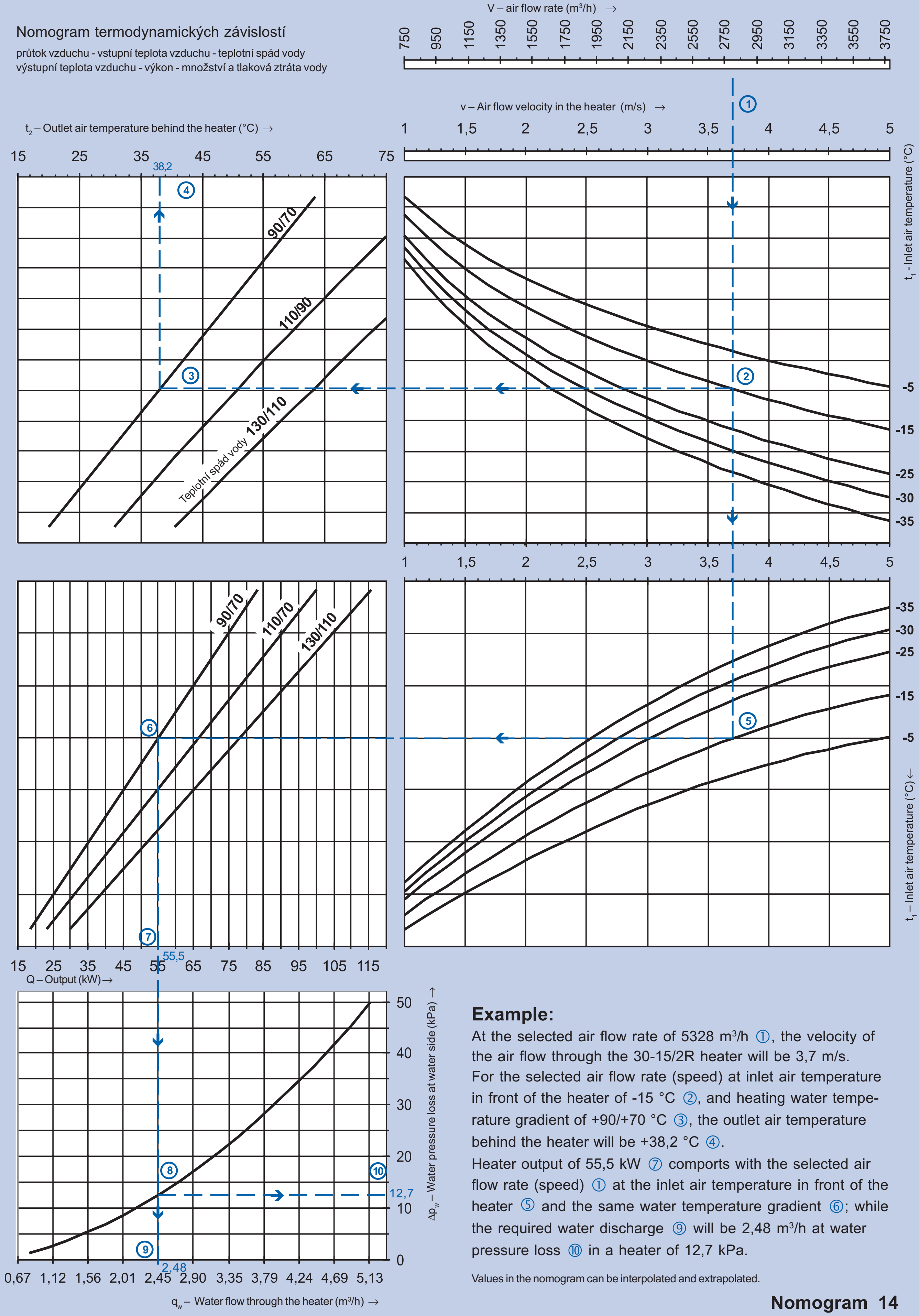
At the selected air flow rate of 3730 m3/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +39,9 °C ④.
Heater output of 47,4 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 2,1 m3/h at water pressure loss ⑩ in a heater of 9,6 kPa.

Values in the nomogram can be interpolated and extrapolated.

Nomogram 13

VO 60-35/3R

Cu/Al water heater 600 x 350 mm



Example:

At the selected air flow rate of 5328 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +38,2 °C ④.
Heater output of 55,5 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 2,48 m³/h at water pressure loss ⑩ in a heater of 12,7 kPa.

Values in the nomogram can be interpolated and extrapolated.

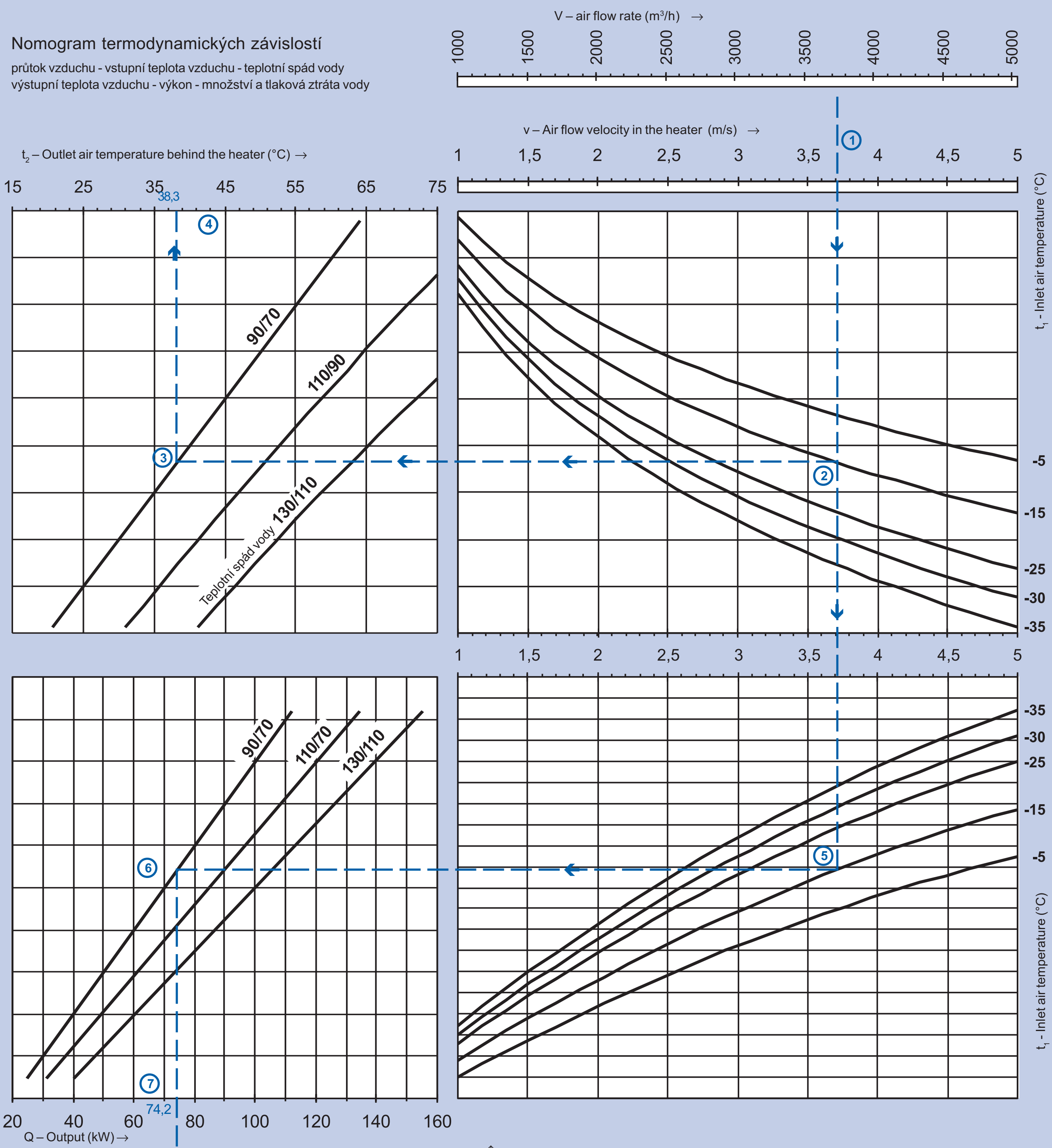
Nomogram 14

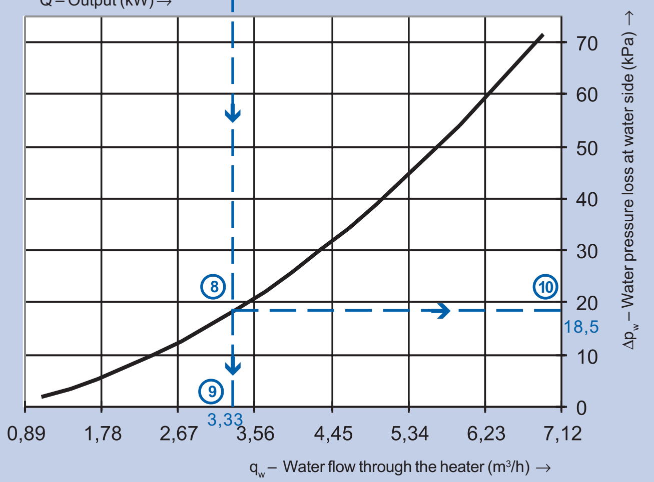
VO 70-40/3R

Cu/Al water heater 700 x 400 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

At the selected air flow rate of 3730 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s. For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +38,3 °C ④. Heater output of 74,2 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 3,33 m³/h at water pressure loss ⑩ in a heater of 18,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

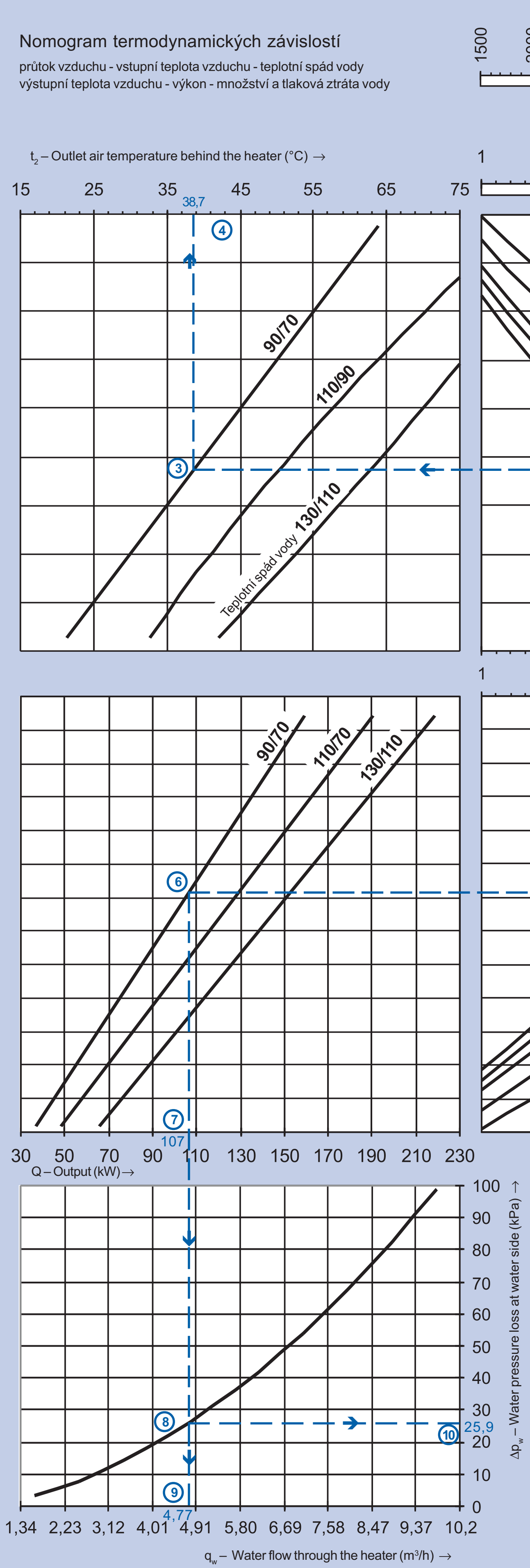
Nomogram 15

VO 80-50/3R

Cu/Al water heater 800 x 500 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody



Example:

At the selected air flow rate of 5328 m³/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s.
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +38,7 °C ④.
Heater output of 107 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 4,77 m³/h at water pressure loss ⑩ in a heater of 25,9 kPa.

Values in the nomogram can be interpolated and extrapolated.

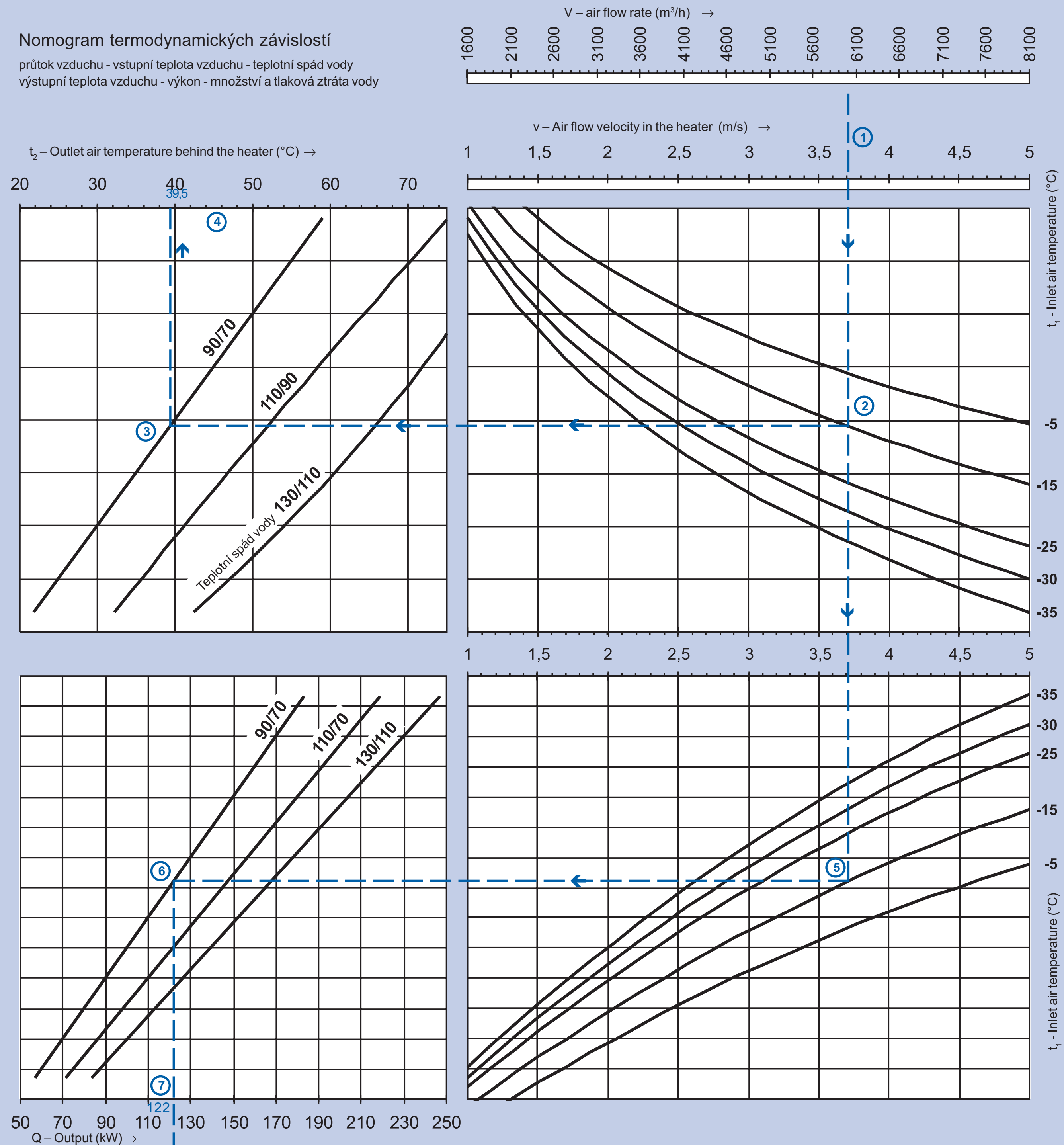
Nomogram 16

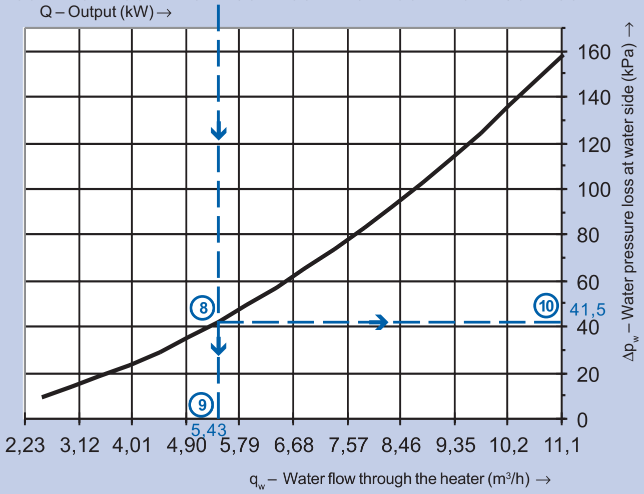
VO 90-50/3R

Cu/Al water heater 900 x 500 mm

Nomogram termodynamických závislostí

průtok vzduchu - vstupní teplota vzduchu - teplotní spád vody
výstupní teplota vzduchu - výkon - množství a tlaková ztráta vody





Example:

At the selected air flow rate of 3730 m^3/h ①, the velocity of the air flow through the 30-15/2R heater will be 3,7 m/s. For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 °C ②, and heating water temperature gradient of +90/+70 °C ③, the outlet air temperature behind the heater will be +39,5 °C ④. Heater output of 122 kW ⑦ comports with the selected air flow rate (speed) ① at the inlet air temperature in front of the heater ⑤ and the same water temperature gradient ⑥; while the required water discharge ⑨ will be 5,43 m^3/h at water pressure loss ⑩ in a heater of 41,5 kPa.

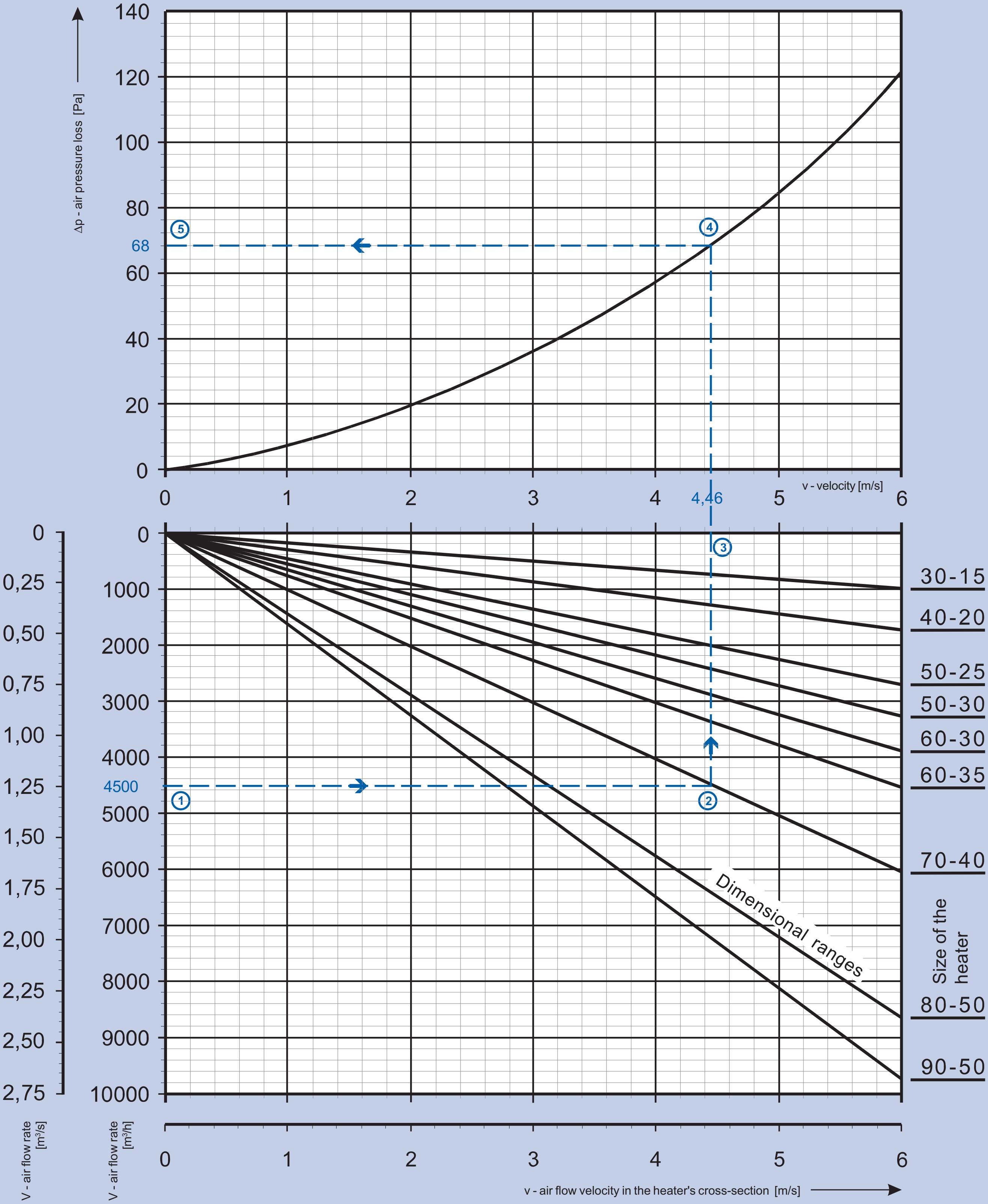
Values in the nomogram can be interpolated and extrapolated.

Nomogram 12

Air Pressure Losses in VO Heaters

Nomogram of air pressure losses for all VO heaters

The curve of pressure losses is valid for all VO heaters. The air pressure loss depends on the air flow velocity, and it is calculated for the air velocity in a free cross section of all Vento system dimensional ranges.



The nomogram of pressure losses is valid for all VO heaters. For the selected air flow rate ①, the air flow velocity ③ in the free heater's cross-section ②, can be read in the lower graph, and then the corresponding heater's air pressure loss ④ at the known velocity can be determined in the upper part ⑤.

Example:

At an air flow rate of 4,500 m3/h, the velocity of the air flow in the VO 70-40 heater will be 4.46 m/s. The heater's air pressure loss for VO 70-40/2R at the above-mentioned air flow rate will be 68 kPa.

Accessories

Heater Accessories

Water heaters in air-handling systems are reliable only if completed with accessories which ensure the following essential functions:

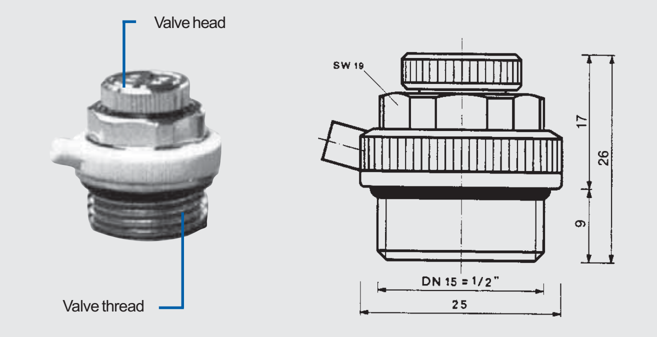
- Air-venting
- Antifreeze protection
- Output control

Ideally, they should always be used along with accessories of the Vento system, which ensure inter-compatibility and balanced parameters.

Air-Venting of the Heater

The heater can be vented either manually or automatically. With regard to the fact that the heater is mostly installed in places difficult to access, at height or on ceilings, automatic air-venting is a necessity. The TACO automatic air-venting valve with outer G1/2" thread (see fig. #10) is designed to be screwed directly into the heater header pipe. It is installed on the very top of the headers.[5]

Figure 10 - TACO air-venting valve



Max. allowed operating parameters of heating water:

- Max. water operating temperature .. 115 °C [6]
- Max. water operating pressure .... 0.85 MPa
- Min. water operating pressure .... 20 kPa

The valve must be installed in the vertical position or aslant with its head upwards, respectively horizontally; in no case downwards!

Minimum water pressure in the system ensures that even if the pressure in the intake part of the mixing set drops, the air-venting valve will not take up air into the outlet heater header pipe.

Warning!

The following antifreeze solutions can be used as heating media:

- vody a ethylenglykolu (Antifrogen N)
- vody a 1,2-propylenglykolu (Antifrogen L)

They enable the freezing temperature of the heating media to be dropped depending on the solution concentration.

Other antifreeze agents can be used only upon presenting confirmation from the manufacturer on their compatibility with swelling materials (inserts).

Antifreeze Protection Accessories

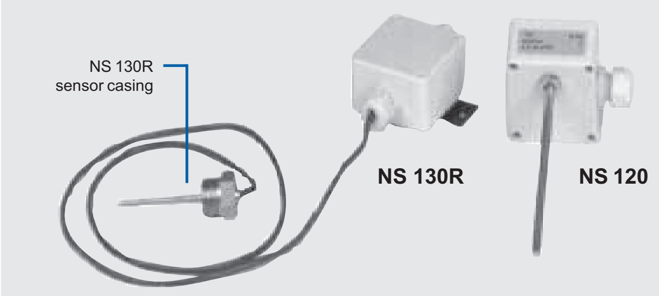
Antifreeze protection of the heater is created by comprehensive interconnected equipment preventing freezing of the heater in normal operating conditions. The section only includes devices which are directly connected to or associated with the heater.

Temperature Sensors for Control Units

The temperature of the water flowing through the heater must be continuously measured and evaluated by the control unit. The NS 130R sensor (resistance Ni 1000), which is equipped with an action reading element situated in the casing made of stainless steel - class 17 248, is used to measure the water temperature.

The casing is provided with G1/2" outer thread, and it is intended for direct mounting into the bottom hole in the heater's header for return water (after removing the blinding plug from the header).

Figure 11 - Types of temperature sensors



[5] For detailed instructions, refer to the section Installation, Maintenance and Service.

[6] If the heating water temperature for the water heater operation is +116 °C or higher, it will be necessary to ensure air-venting by a float valve.

Installation, Service and Maintenance

Installation

- VO heaters and mixing sets, as well as other Vento elements and equipment, are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the heater and accessories. The installation and commissioning can be performed only by a specialized installer company licensed in accordance with valid regulations (if wiring is needed, specialized also in wiring).
- The heater must be checked carefully before its installation, especially if it has been stored for a longer time. It is necessary to check parts for damage, and in particular whether the pipes, heater vanes and header pipes, insulation of conductors of the mixing set pump and actuator are in good condition.
- If water is used as the heating medium, the heater can then be situated only in an indoor environment where the temperature is maintained above freezing point (this does not apply for heated air).
- Outdoor use is not recommended. It is allowed only if antifreeze solution is used as the heating medium (mostly ethylene glycol solution at a concentration corresponding to the temperatures).

VO Water Heaters

- There is no need for individual suspensions to install the water heaters. The heater can be inserted into the duct line, but it must not be exposed to any strain or torsion caused by the connected duct line.
- Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento system, use galvanized M8 screws and nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection, or use Cu conductor wiring.
- To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping.
- Water heaters can work in any position in which air venting of the heater is possible. The most common heater positions are shown in figure #12. Positions A, B and C show the most suitable places for the TACO air-venting valve mounting (marked with arrows). Position D shows impermissible installation of the heater as it does not allow air venting.

Figure 12 - Heater's positions

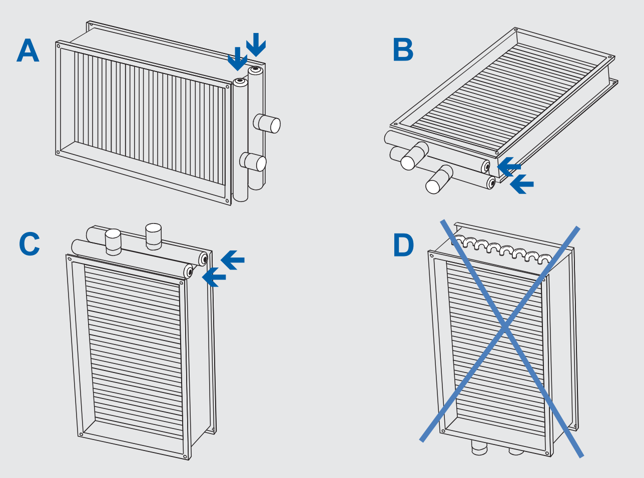
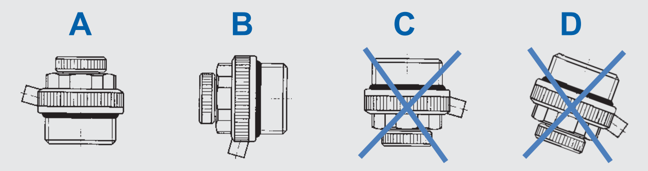
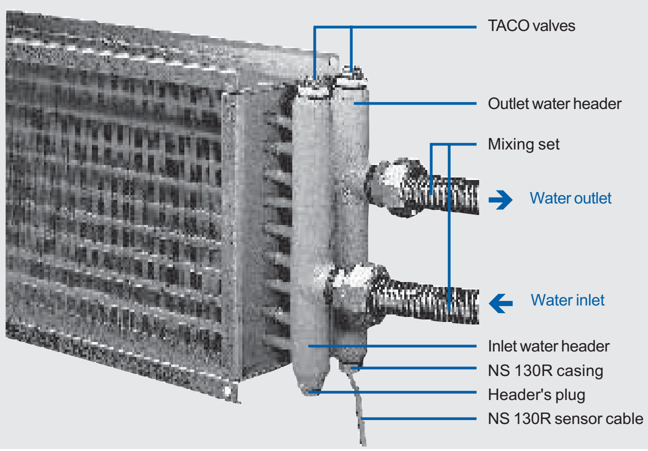


Figure 13 - TACO valve positions



- The TACO air-venting valves must be installed as shown in figure #13, i.e. vertically (upright) with their heads up - view A, or horizontally - view - B; in no case downwards or slanted with their heads down - C, D.
- The TACO air-venting valves must be mounted onto the highest point of the inlet/outlet header pipe (see fig. # 14). The openings in the header pipes have G1/2" inner thread and were closed with plugs in the plant.

Figure 14 - TACO valve installation

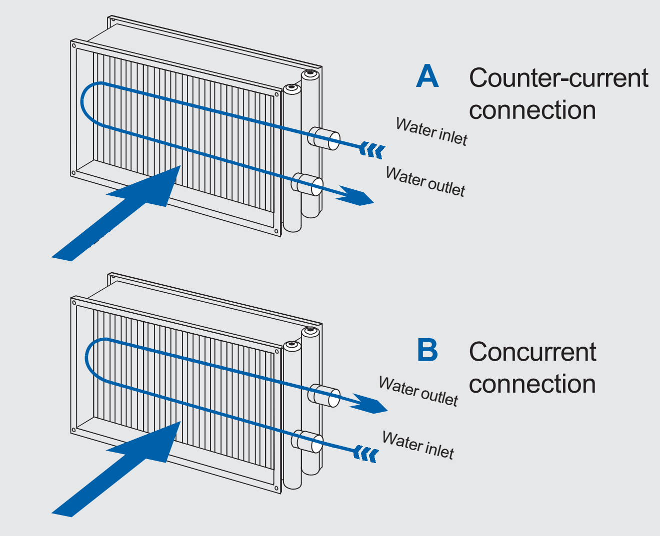


- The casing of the antifreeze protection NS 130 sensor can be mounted on the bottom side of the header pipe.
- To allow faster air venting while filling the system with water, loosen the knurled screw on the TACO valve by one or two turns. After finishing the filling of the system, tighten the knurled screw firmly. The valve will then work automatically.
- During the first air venting, a couple of water drops can leak through the air-venting valve. This will not happen again during normal operating conditions.
- When cleaning the TACO valve inside, it is necessary to replace the swelling rings (valve inserts). The TACO valve is equipped with a back valve so there is no need to drain the heater.
- When connecting the mixing set hoses, thermal sensor NS 130 casing, or air-venting valve, be careful. Do not use excessive force, otherwise the pipes situated between the header pipes and sidewall of the heater could be damaged.
- An air filter must always be placed in front of the heater to avoid heater fouling.

Installation, Service and Maintenance

■ The heater can be situated either in front of or behind the fan. However, if the heater is in front of the fan, the heater output must be controlled so that the air temperature will not exceed the maximum allowed value for the given fan.
■ If the heater is situated behind the fan, we recommend inserting a 1-1.5 m long straight duct between the fan and the heater to calm the air flow down.
■ The counter-current connection of the heater is needed to achieve maximum output (see fig. # 15).
All calculations and nomograms included in the section "Water Heaters" are valid for the counter-current connection of the heaters. Such concurrent connection provides lower output, but it is more frost resistant. [7]
■ The sophisticated design of the heaters enables you to turn on one heater arbitrarily, and you will always be able to arrange counter-current connection and install the valves and thermal sensor in the right place. [8]
■ If the heater is covered by a ceiling, it is necessary to ensure access to the entire heater to enable checking and service; especially air-venting valves need checking and maintenance.

Figure 15 - Water heater connection



Operation, Maintenance and Service

The water heater requires regular maintenance at least at the beginning and end of the heating season. During operation, it is necessary to check proper air venting and water leakages, respectively increasing pressure losses in the water piping or air duct (due to fouling). It is necessary to supervise pump and actuator operation, and keep the mixing set's filters clean. If the air-handling system is stopped due to the action of the antifreeze protection, the reason must be found and removed following the procedure included in the Installation Manual, in the section "Troubleshooting".
All important system protection functions, including antifreeze protection of the mixing sets and heaters, must be permanently controlled by the control unit.
Attention! During the winter season, the control unit must not be disconnected from the power supply for too long! Power supply failure during air-handling system operation is especially dangerous!

[7] If the anti-freeze protection is correctly designed, the above-mentioned feature of the concurrent connection is insignificant.
[8] Therefore, only one version of the heaters is used in the Vento system (no right or left versions).

Technical Information

Application of Mixing Sets

SUMX mixing sets ensure continuous output control (proportional control using analogue voltage signal of 0-10 V) and protection of the water heater. Output control is ensured by the change in the water output temperature at constant water discharge. A mixing set connected to the control unit and antifreeze protection system components can effectively protect the heater against freezing followed by its destruction. Below-mentioned information can also be suitably used for integration of the mixing sets into the cooling system equipped with a water cooler.

Operating Conditions

The water running through the mixing set must not contain impurities, solids or chemicals aggressive to copper, brass, stainless steel, zinc, plastics, rubber and cast iron.The feed line of the heating system must always be provided with **sludge and cleaning filters**. The mixing set is not allowed to be operated without these filters.
Max.allowed operating parameters of heating water:

- Max. allowed water temperature +110 °C
- Max. allowed water pressure SUMX 1-12 .... 0.8 MPa
- Maxi. allowed water pressure SUMX 18 ...... 0.3 MPa
- Max. allowed water pressure SUMX 28-90 .. 0.6 MPa

In installations with water temperature up to 130°C it is possible to place the pump in the return pipe, the so-called "inverse mixing set arrangement", while ensuring the maximum allowed temperature of hot water in the outlet of the heater is not exceeded. It is advisable to consult this option with the manufacturer.

- If water is used as the heat carrying medium, then the mixing set can be situated only in an indoor environment where the temperature never falls below freezing point.
- Outdoor use is acceptable only if antifreeze solution is used as the heat carrying medium.
- In cases where chilling of the primary circuit or interference of primary and secondary circuit pumps (unwanted change of heating water flow through the heater) must be avoided, we recommend connecting the bypass (respectively the thermo-hydraulic splitter) to the primary circuit. The bypass should be situated as close as possible to the connection point of the mixing set.

The heating water bypass increases the temperature of the return water; therefore, the bypass (respectively the thermo-hydraulic splitter) may not be used when connected to modern condkensing boilers. The same applies if the supplier of the heating water does not allow the uncooled water to be returned.
Since the mixing set pump overcomes just the head losses in the secondary circuit (i.e. of the heater circuit) the primary circuit pump must be dimensioned to cover all head losses up to the mixing set at the nominal water flow projected for the heater. No other heat consumers should be connected to the heater circuit. Furthermore, it is necessary to equip the primary circuit (both inlet and outlet) with closing ball valves, and the feeding line with sludge and cleaning filters (again, it is advisable to use a closing valve).

- **The mixing set must not be operated without sludge and cleaning filters**.
- Components of the primary circuit are not the subject of the delivery from REMAK a.s.

Position and Location

When designing the layout of the mixing set location, we recommend observing the following principles:

- The mixing set must be positioned so that the shaft of the pump will always be in the horizontal position.
- The mixing set must be situated in a position in which its air venting is possible.
- If the mixing set is covered by a ceiling, it is necessary to ensure access to the whole mixing set.
- The mixing set is connected to the heater via corrosion-proof hoses (resp. pipes). It is advisable to minimize the length of connecting hoses/pipes; the longer the hoses, the later the control response.
- The mixing set can be mounted using an integrated holder or clamps while the weight of the mixing set may never be transferred onto the heater.
- The flange versions of mixing sets are delivered disassembled. The connecting piping is not the subject of the delivery from REMAK a.s.

Materials

The mixing sets are made of materials and components commonly used in heating engineering, i.e. brass, stainless steel or cast iron, and to a minor degree galvanized steel or steel. The sealing components are made of rubber or plastics.
The construction materials are thoroughly checked to ensure high reliability and long service life.

Dimensional Range and Design

The mixing sets are delivered in 12 output types. Eight of them are equipped with screw couplings including connecting hoses, and four of them are equipped with

Table 1 – mixing sets overview

Type	Pump	3-way valve	Delivery head	Actuator
A design with screwed components				
SUMX 1	UPS 25-40	3MG 15-1	4 m	LMC24A-SR
SUMX 1,6	UPS 25-40	3MG 15-1,6	4 m	LMC24A-SR
SUMX 2,5	UPS 25-40	3MG 15-2,5	4 m	LMC24A-SR
SUMX 4	UPS 25-60	3MG 20-4	6 m	LMC24A-SR
SUMX 6,3	UPS 25-60	3MG 20-6,3	6 m	LMC24A-SR
SUMX 8	UPS 25-80	3MG 25-8	8 m	LMC24A-SR
SUMX 12	UPS 25-80	3MG 25-12	8 m	LMC24A-SR
SUMX 18	UPS 32-80	3MG 32-18	8 m	LMC24A-SR
A design with flanged components				
SUMX 28	UPS 40-60	3F 32	6 m	LMC24A-SR
SUMX 44	UPS 40-60	3F 40	6 m	LMC24A-SR
SUMX 60	UPS 65-60	3F 50	6 m	NM24A-SR
SUMX 90	UPS 65-60	3F 65	6 m	NM24A-SR

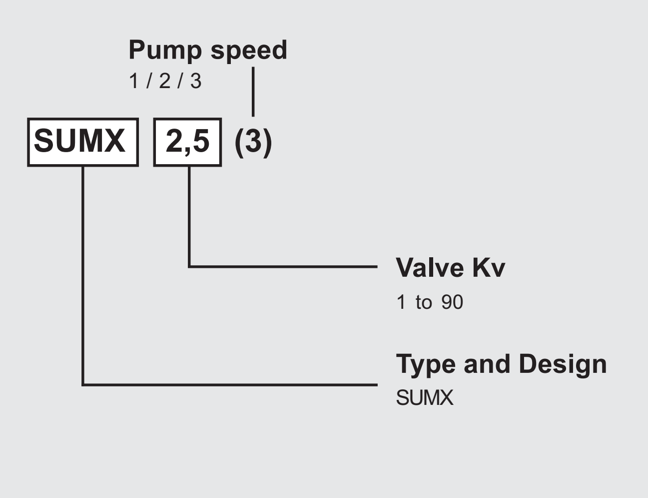
Technical Information

flange connections without connecting hoses. The flange-connected mixing sets are delivered disassembled. The connecting hoses are not included in the delivery.

Mixing Set Type

The rate of flow and pressure of heating respectively cooling medium in the mixing set is given by the size of the pump and three-way mixing valve with Kv value from 1.0 to 90 according to table # 1. The mixing set type selection and allocation to the heater is performed automatically by the AeroCAD design software.

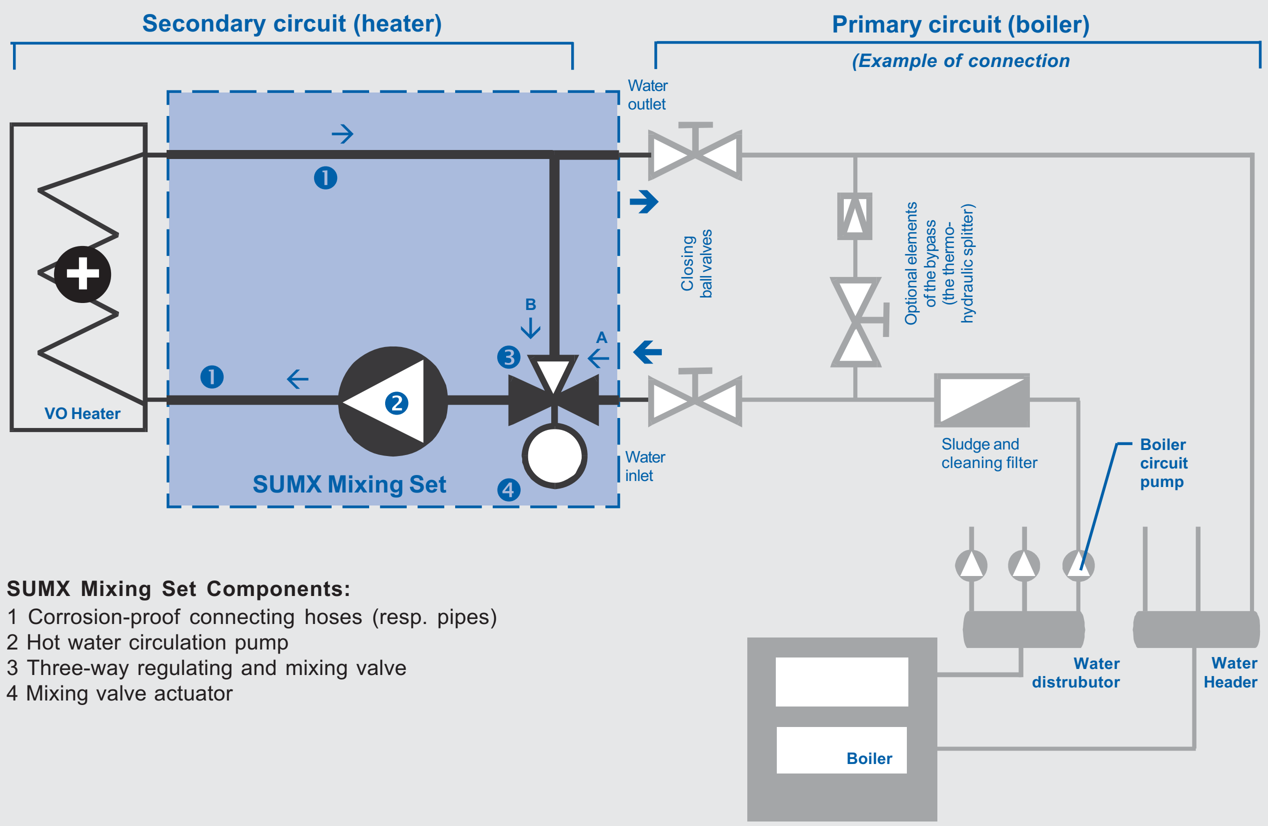
Figure 1 - Type designation



Mixing Set Designation

The type designation of mixing sets in projects and orders is defined by the key in figure # 1.
The project must also include the pump speed, which is set during the course of installation. The pump speed is indicated in the parenthesis behind the mixing set type code.

Figure 2 - Connecting scheme of the heater and mixing set in a heating system



SUMX Mixing Set Components:
1 Corrosion-proof connecting hoses (resp. pipes)
2 Hot water circulation pump
3 Three-way regulating and mixing valve
4 Mixing valve actuator

Technical Information

For basic layouts of mixing sets, refer to figures #3a to #4b and table #4. Connection dimensions are in table #1. Technical and electrical parameters of pumps and actuators are in tables #2 and #3.

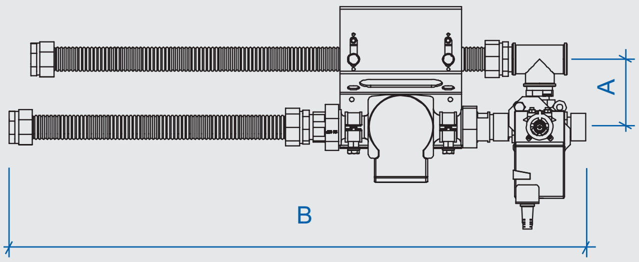
Table 2 – pump parameters

Pump	Input power	Current max.	Supply voltage	Protection
	W	A	V	IP
25-40	60	0,3	1 x 230 AC	44
25-60	90	0,3		
25-80	245	1		
32-80	245	1,1		
40-60/4F	340	1,3		
65-60/4F	640	3,2		

Table 3 – actuator parameters

		LMC24A-SR	NM24A-SR
Supply voltage	V	24 AC / DC	24 AC / DC
Degree of protection	IP	54	54
Input power	W	1	2
Dimensioning	VA	2	4
Rotation angle	°	max. 95	max. 95
Rotation time	sec	35	150
Torque	Nm	5	10
Control signal	V	DC 0-10	DC 0-10

Figure 3a – Basic layout of mixing sets



❶ Connecting hose ❷ Circulation pump
❸ Three-way regulating valve ❹ Valve actuator
❺ Integrated holder

Figure 3b – Basic layout of mixing sets

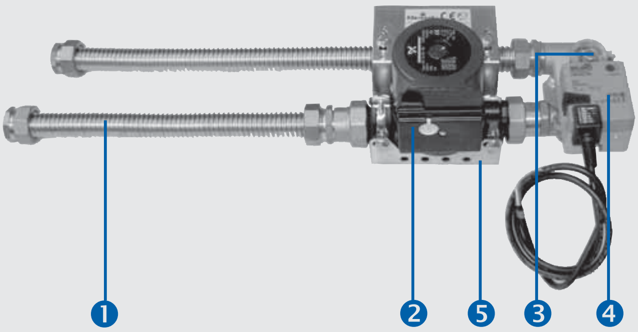
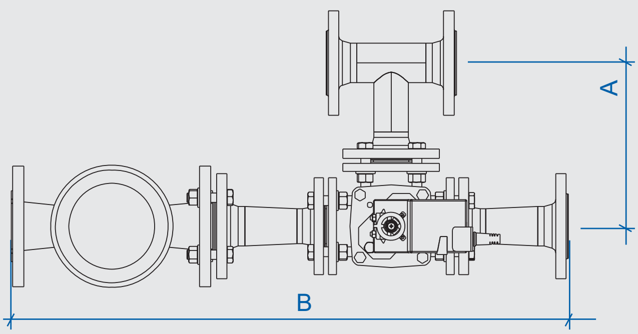
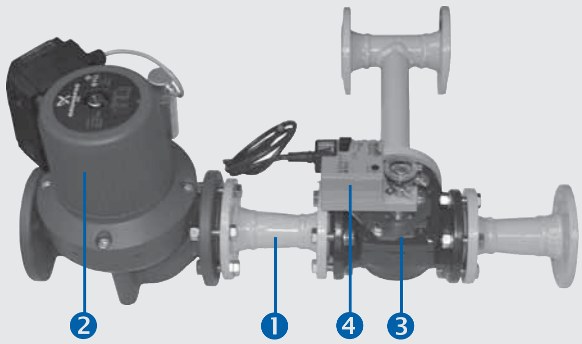


Figure 4a – Basic layout of mixing sets



❶ Connecting fittings ❷ Circulation pump
❸ Three-way regulating valve ❹ Valve actuator

Figure 4b – Basic layout of mixing sets



One or two connecting fittings are used depending on the diameter of the mixing set

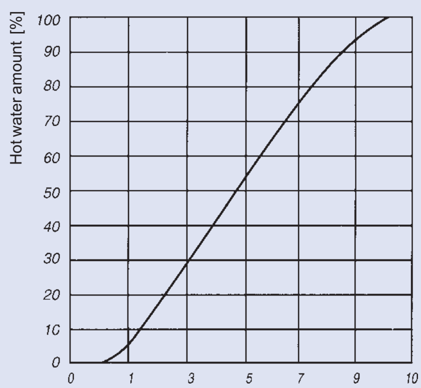
The mixing characteristic of three-way valve related to the actuator shaft position angle is marked in graph #1. Numbers 0-10 indicate positions marked on the three valve's plate.
The 0 position corresponds to 0% heating output, and the 10 position corresponds to 100% heating output.
ESBE valves feature excellent tightness. Thanks to minimum clearance, the maximum leakiness is 1% of the flow-rate

Table 4 – Dimensions

Type	Width A* (mm)	Length B* (mm)	Mixing set connection	Weight (kg)
SUMX 1	90	860	G1	7
SUMX 1,6	90	860	G1	7,5
SUMX 2,5	90	860	G1	7,5
SUMX 4	90	860	G1	7,5
SUMX 6,3	90	860	G1	7,5
SUMX 8	90	810	G1	8,5
SUMX 12	100	830	G1	8,5
SUMX 18	110	830	G1 1/4	11,5
SUMX 28	350	690	DN 40	41
SUMX 44	350	570	DN 40	39
SUMX 60	350	875	DN 65	62
SUMX 90	350	710	DN 65	59

* ± 20 mm

Graph 1 - Mixing characteristics



The valve setting on the valve's scale-plate
(0 - closed, 10 - fully open)

Operating Characteristics

Mixing Set Characteristics and Dimensioning

The proper dimensioning of the mixing set is essential for stepless control of the water heater. The mixing set selection is critical for optimal operation of the heating system.

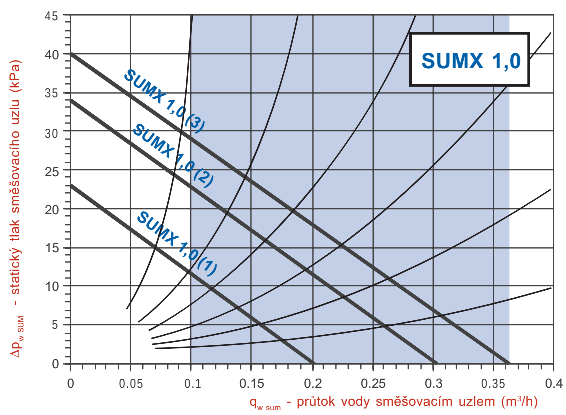
The graph of each mixing set includes three characteristics related to the pump speed (1), (2), (3). The mixing set working characteristic is given by the correlation of the mixing set water discharge (qw sum) and pressure (Dpw sum) at the selected speed (revolutions) of the pump.

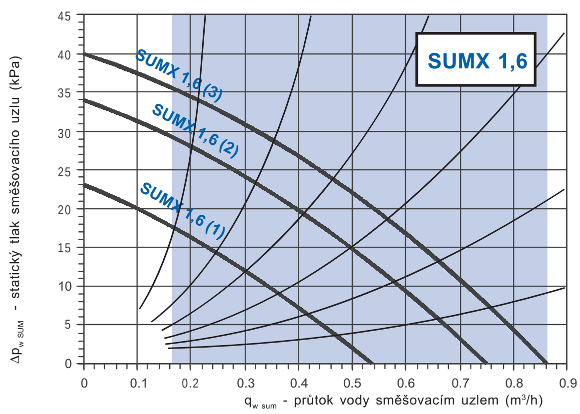
The mixing set calculation and dimensioning is performed automatically by the AeroCAD design software. The below-mentioned procedure is recommended if the air-handling device is completely designed using the AeroCAD design software.

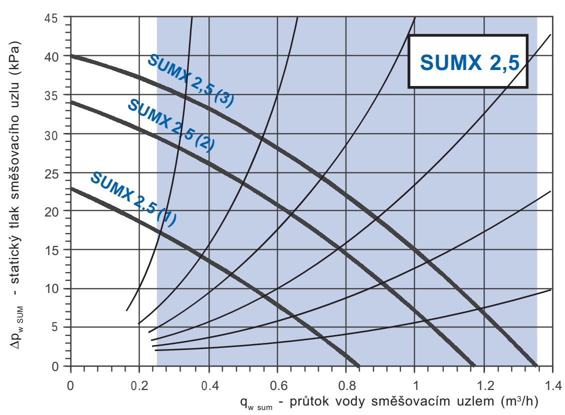
Design of the VO and SUMX Assembly - Example
Input variables:
VO 60-35 water heater, Air flow rate 2.800 m3/h, Water temperature gradient +90/+70 °C, Design outdoor air temperature -15 °C, Required outlet air temperature +22 °C.

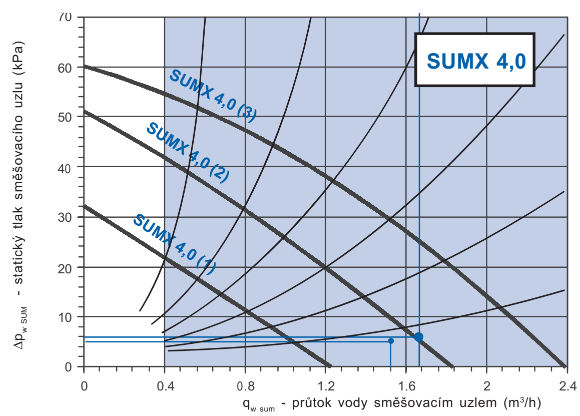
Design and calculation:

- Maximum outlet air temperature of +39 °C at output of 40 kW and water discharge of 1.80 m3/h for pre-assigned air flow rate of 2.800 m^3/h, heater input air temperature of -15 °C and water temperature gradient of +90/+70 °C can be determined in the VO 60-35 heater nomogram (the chapter Water heaters).
- As the maximum outlet air temperature is higher than the required temperature, the heater meets the output condition with a margin.
- To get the pre-assigned (lower) outlet air temperature, it is necessary to decrease the heater's output. The adjusted output results from the output calculation for the pre-assigned air temperature gradient -15/+22 °C: $Q = m*c*\Delta t = (2800/3600*1.2)*1010*(22-(-15)) =$ 34.9kW
- Water discharge of 1.56 m^3/h needed for output of 35 kW (rounded 34.9 kW) can be determined in the VO 60-35 / 2R heater nomogram on page # 162 or in the aggregate graph valid for all heaters on page 143, and the water pressure loss in the VO 60-35 / 2R heater will be Dpw = 5 kPa.
- The SUMX 4,0 (2) mixing set suits best for water discharge of 1.56 m3/h at pressure loss of 5 kPa, see the graph on page # 181.
- The heater-mixing assembly effective working point will lie on the SUMX 4,0 (2) curve with qw sum = 1.65 m^3/h and Δpw sum = 6 kPa.

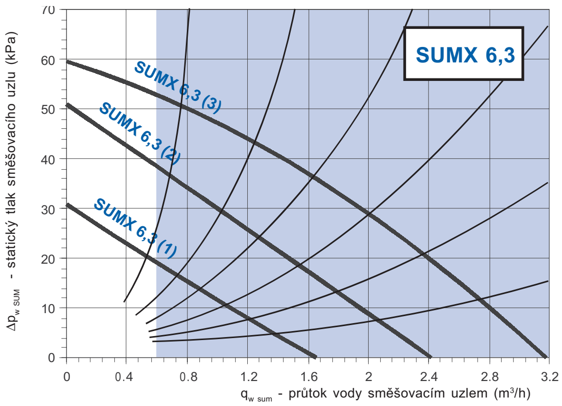


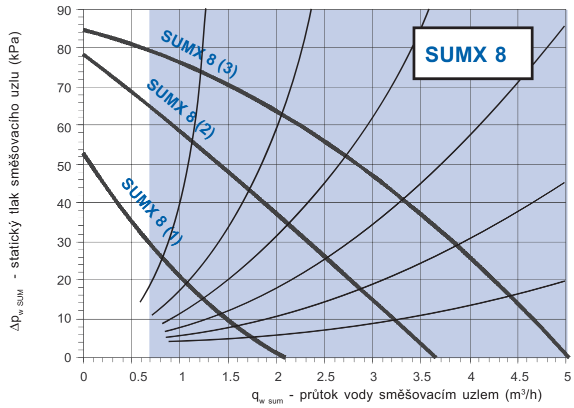


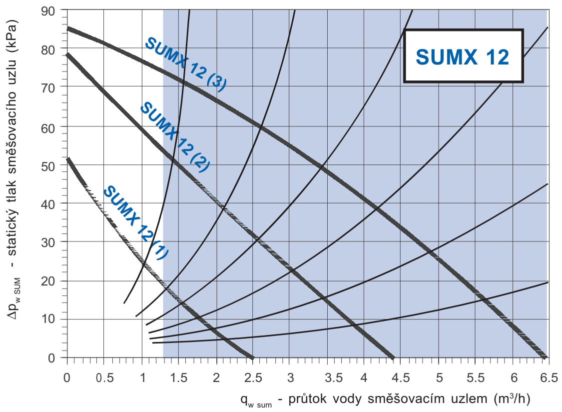


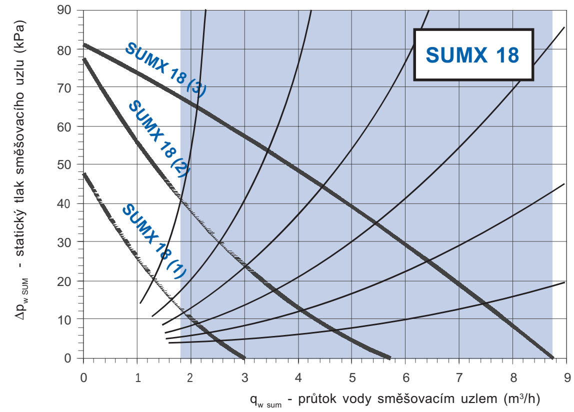


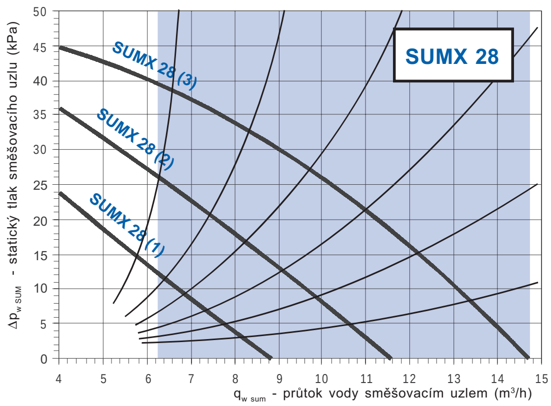
Operating Characteristics

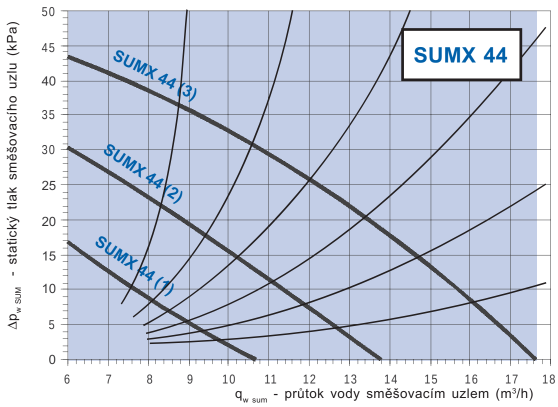


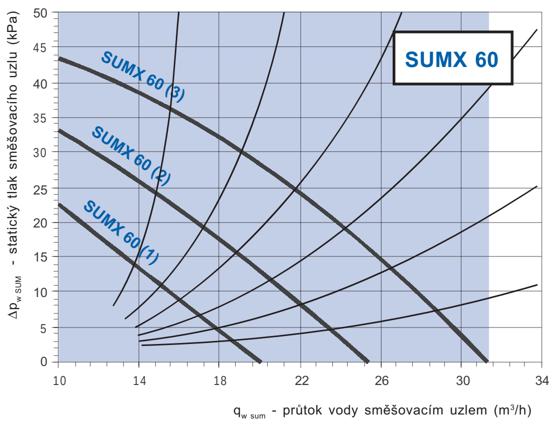


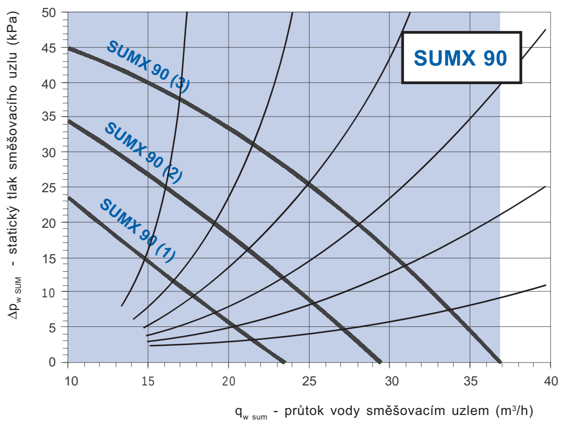












Installation, maintenance, service

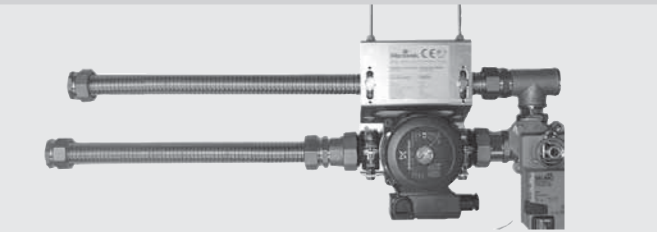
Heater Output Control

Pump ❷ ensures the constant water flow (circulation) through the water heater. Three-way mixing valve ❸ controlled by actuator ❹ controls the heater's output by mixing the return water from the heater and heating water from the boiler. If the control system requires full output of the heater, the water will flow in the so-called big circuit, i.e. from the boiler through the heating water distributor, sludge and cleaning filter, service and closing valve, SUMX intake, three-way mixing valve ❸ (only A direction), pump ❷, water heater, SUMX water outlet, service and closing valve in to the heating water header. If full output of the is not required, three-way valve ❸ will start letting through some quantity of the water from the B direction, and thus decreasing the water temperature flowing through the heater. If no heating output is required, the water will only circulate within the heater circuit, i.e. three-way mixing valve ❸ will only let the water through in the B direction..

Installation

■ SUMX 1-18 mixing sets are connected directly to the heater via corrosion-proof hoses. If needed, the hoses can be cut to the desired length before installation.
■ The mixing set must not be exposed to any strain or torsion caused by the connected pipe line.

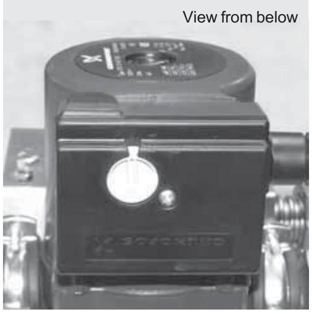
Figure 5 - Installation using suspension rods



■ The mixing sets can be mounted on separate suspensions using an integrated holder, or using clamps (see figure # 5).
■ If the mixing set is covered by a ceiling, it is necessary to ensure access to the whole mixing set to enable electric cable connections, checking and maintenance.

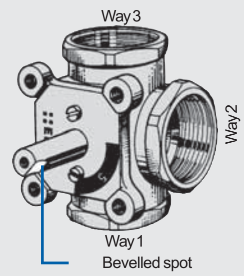
■ SUMX 28 - 90 flange-connected mixing sets can be connected to the heat exchangers using standard heating engineering procedures; among others it is necessary to ensure adaptation to threaded connections of the heat exchangers - refer to the heat exchanger technical details. It is advisable to use clamps to connect the flange-connected mixing sets to the suspensions or supporting brackets.

Figure 6



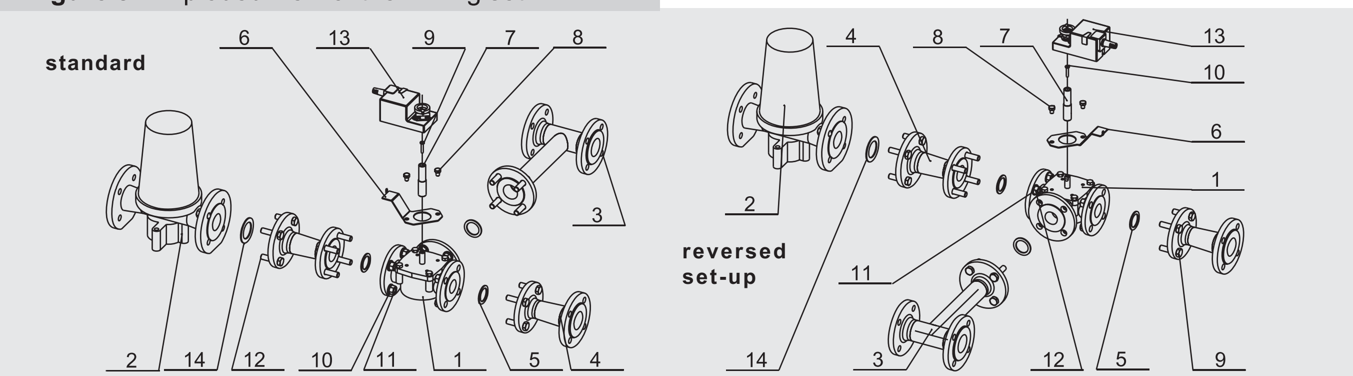
■ The mixing set must be installed in such a way that the air in the piping will be able to run to the air-venting valves of the heater or boiler piping. Especially the connecting corrosion-proof hoses must be shaped after installation so as not to create an air trap.
■ The mixing set must be positioned so that the shaft of the circular pump motor will always be in the horizontal position!

Figure 7



■ The circular pump must be vented after the system has been filled with water in accordance with the manufacturer's instructions.
■ The speed of the circular pump is indicated in the project behind the type code of the mixing set. For example, the mixing set SUM 6,3 (3) is equipped with the pump UPS 25-60 which is set to speed 3, the number in parentheses (3). The speed of the pump can be adjusted by the plastic wheel on the pump during installation (see figure # 6).
■ When connecting the mixing set, it is necessary to check the correctness of the adjustment of the three-way valve and actuator. One way of the three-way valve, to which the bevelled spot on the valve shaft is directed, is always closed (see fig. # 7).

Figure 8 - Exploded view of the mixing set



(1) valve, (2) pump, (3) T joint, (4) making-up piece, (5) sealing, (6) actuator holder, (7) D18/81 adaptor, (8), M8x10 screw, (9), M5x25 screw, (10) washer 13, (11) M12 nut, (12) M12x45 screw, (13) actuator, (14) sealing

(1) valve, (2) pump, (3) T joint, (4) making-up piece, (5) sealing, (6) actu ator holder, (7) D18/81 adaptor, (8), M8x10 screw, (9), M12x45 screw, (10) M12x45 screw, (11) washer 13, (12) M12 nut , (13) actuator, (14) sealing

Installation, maintenance, service

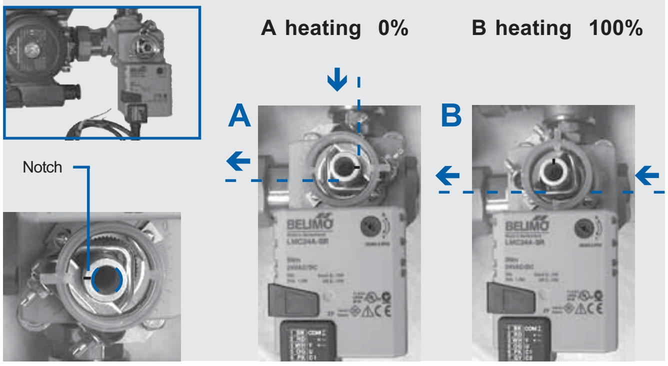
If the mixing set is assembled then the valve adjustment is indicated by the position of the notch on the shaft adaptor face.
This adaptor serves as a coupling which is fixed to the actuator sleeve (see fig. #9).
This notch is always directed to the closed way.
Warning! The position of the notch is always relevant, not the position of the plastic ring, which can be freely turned.

- The mixing sets are delivered disassembled, the mixing set must be assembled following figure # 8.
- The A and B positions are the extreme positions of the actuator (see fig. #9). If the actuator works incorrectly, just change the direction of rotation turning the switch to the other position.

Warning! The position of the notch is always relevant, not the position of the plastic ring, which can be freely turned.

- The mixing sets are delivered disassembled, the mixing set must be assembled following figure # 8.
- The A and B positions are the extreme positions of the actuator (see fig. #9). If the actuator works incorrectly, just change the direction of rotation turning the switch to the other position

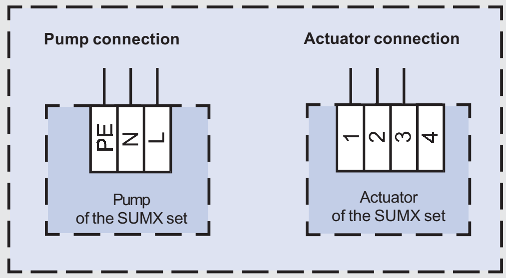
Figure 9 - Extreme positions of the actuator



The Wiring

- The wiring can be performed only by a qualified worker licensed in accordance with generally valid regulations.
- The pump must be connected via the terminal box in accordance with its manual. The actuator is provided with a cable which must be connected in a wiring box (not included in the delivery).
- The mixing set pump and actuator are supplied and controlled by the control unit.
- The Mixing set wiring diagram is shown in figure #10.
- The principle diagram of the connection to the control unit is shown in figure #11.
- After connecting the mixing set, it is necessary to check the correctness of the actuator function depending on the control signal (heating - no heating).
- After turning the pump on, it is necessary to measure the feed current, which must not exceed the allowed current $I_{max.}$ stated on the pump rating plate.

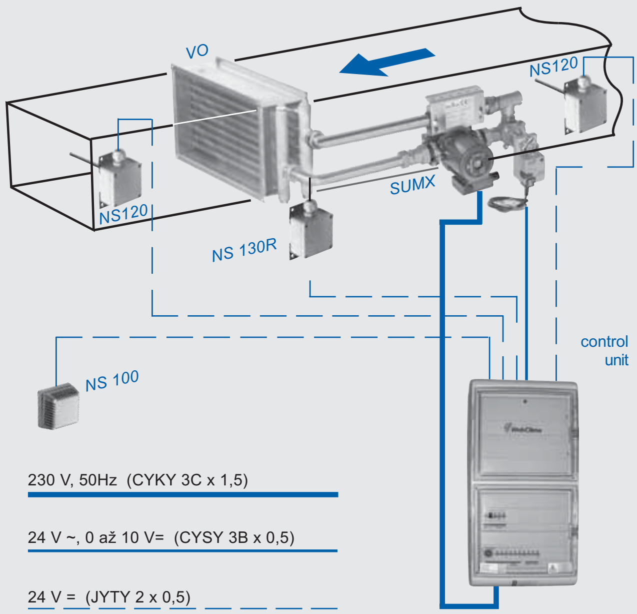
Figure 10 - Mixing set wiring diagram



1 x 230V + PE + N +I
PE . protective conductor terminal
N ... neutral conductor
L .... phase conductor

1....grounding terminal
2....24 V AC
3....control signal
4....measuring voltage

Figure 11 – diagram of the mixing set connection



Installation, maintenance, service

Operation, Maintenance and Service

- The water and mixing set requires regular maintenance at least at the beginning and end of the heating season.
- During operation, it is necessary to check proper air venting and water leaking. It is necessary to supervise pump and actuator operation, and keep the mixing set's filters clean. If the air-handling system is stopped due to the action of the antifreeze protection, the reason must be found and removed, refer to the chapter "Troubleshooting".

All important system protection functions, including antifreeze protection of the mixing sets and heaters, must be permanently controlled by the control unit.

Attention! During the winter season the control unit must not be disconnected from the power supply for too long! Power supply failure during the air-handling system operation is especially dangerous!

Troubleshooting

When activating the air-handling system, you can face some undesirable situations. The following text includes the most common problems and their removal:

- **Permanently low output air temperature**
  - Low hot water flow or pressure in the boiler piping
  - Low water temperature in the boiler piping
  - Low air temperature adjusted on the control unit
  - Low speed of the pump in the SUMX mixing set
  - Clogged screen in the SUMX mixing set
  - Wrong adjustment of the three-way valve and actuator
  - Aerated pump (resp. whole system)
  - Wrong design of the VO and SUMX assembly
- **Permanently high output air temperature**
  - Too high water flow and pressure in the boiler piping
  - Too high air temperature adjusted on the control unit
  - Wrong adjustment of the three-way valve and actuator
  - Wrong design of the VO and SUMX assembly
- **The output air temperature fluctuates**
  - Too high water flow and pressure in the boiler
  - Wrong adjustment of the three-way valve and actuator
  - Wrong design of the VO and SUMX assembly
- **Repeated activation of an antifreeze protection**
  - Low hot water flow or pressure in the boiler piping
  - Low water temperature in the boiler piping
  - Low air temperature adjusted on the control unit
  - Low speed of the pump in the SUMX mixing set
  - Clogged screen of the SUMX mixing set
  - Wrong adjustment of the three-way valve and actuator
  - Aerated pump (resp. whole system)
  - Wrong design of the VO and SUMX assembly

Repeated activation of the antifreeze protection can also be caused by too high temperature amplitudes. The reasons are listed in the paragraph above.

If the output water temperature is permanently above +30oC, the problem can be caused by failure of the control system or sensor.

Technical Information

Applications of Coolers

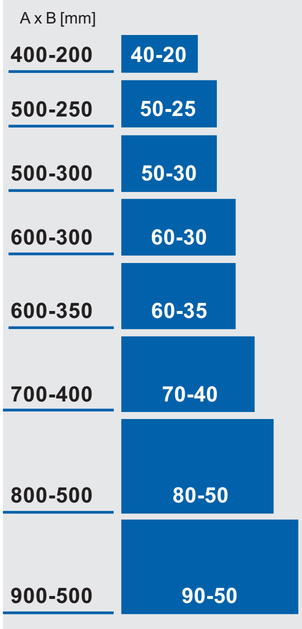
CHV water coolers are intended for air cooling, from simple venting installations to sophisticated air-handling systems. They are designed to be installed directly in square air ducts. Ideally, they can be used along with other components of the Vento modular system, which ensure inter-compatibility and balanced parameters.

Operating conditions

The cooled air must be free of solid, fibrous, sticky and aggressive impurities. The heated air must also be free of corrosive chemicals or chemicals aggressive to aluminium, copper and zinc.Maximum allowed operating parameters of cooling water:
Maximum water operating pressure: 1,5 MPa

Performance properties of water coolers for common values of water temperature gradients, various air flow rates and inlet air temperatures for water as a heat-transfer agent are included in nomograms in the data section of this catalogue.

Figure 1 - Dimensions



Dimensional Range

VCHV water coolers are manufactured in a range of eight sizes according to the A x B dimensions of the connecting flange (see figure # 1). Two and three-row versions of coolers are available for all sizes. As standard, CHV water coolers are manufactured in three-row versions with shifted geometry (ST 25 x 22 mm). Water coolers can be connected to air ducts in the same way as any other Vento duct system component. Connections of all water coolers to the cooling water supply are maximally standardized. These coolers enable designers to cover the full air flow range of Vento fans.

Position and Location

When projecting the layout of the cooler location in the air-handling system, we recommend observing the following principles:

■ If water is used as the cooling medium, the cooler can then be situated only in an indoor environment where the temperature is maintained above freezing point (the main condition is to maintain the temperature of the transported air).

■ Outdoor installation is allowed only if antifreeze solution is used as the cooling medium (mostly ethylene-glycol solution). However, the temperature limit of the used actuating mechanism of the mixing set must be taken into account; and in this case, the below-mentioned nomograms cannot be used when determining the cooler's parameters. The calculation must be performed using AeroCAD software.

■ Water coolers can work only in the horizontal position, in which condensate draining and air venting of the cooler is possible.

■ Access to the cooler must be ensured to enable checking and service.

■ An air filter must be installed in front of the cooler to avoid its fouling (providing it has not already been installed, e.g. in front of the heater).

■ The counter-current connection of the cooler is essential to achieve maximum output.

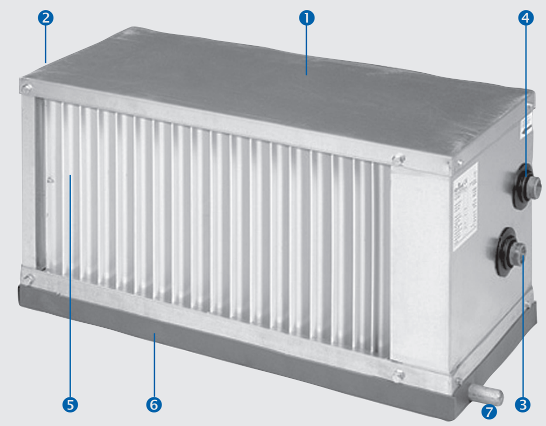
■ The cooler can be situated either in front of or behind the fan.

■ If the cooler is situated behind the fan, we recommend inserting between the fan and the cooler a spacer (e.g. 1-1.5 m long straight duct) to steady the air flow.

Materials and Design

The external casing of the coolers is made of galvanized steel sheets. The headers are made of welded steel pipes and finished with a synthetic coating. The heat exchange surface is created by 0.1 mm thick aluminium overlapping fins pulled on copper pipes of ϕ10 mm.

Figure 2 - Standard design of the cooler



❶ External casing, ❷ Cooler, ❸ Coolant inlet, ❹ Coolant outlet, ❺ Drop eliminator, ❻ Tray for condensate, ❼ Condensate drainage (G $^1/_2$")

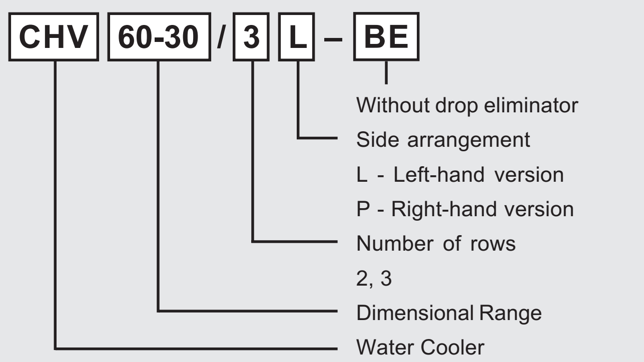
All used materials are carefully checked so they ensure long service life and reliability. All coolers are tested under water for leakage using pressurised air at 2 MPa for five minutes.
As standard, the water coolers are delivered in a left-hand version, looking at the air flow direction, and are equipped with a drop eliminator and an insulated condensate drainage tray.
In case of two-stage cooling, it is advisable to exclude the drop eliminator (order the water cooler without a drop eliminator).
The water cooler is equipped with a TACO automatic air-venting valve situated at the top of the headers, which ensures progressive air-venting of the cooler.

Parameters

Designation of Coolers

The type designation of coolers in projects and orders is defined by the key in figure # 3.

Figure 3 - Type designation



The above-mentioned specification without an ordering code corresponds to the stock configuration of the product, i.e. the three-row left-hand arrangement with a drop eliminator. Any other configuration (e.g. without a drop eliminator) must be specified by the ordering code. The cooler is a configured product which should be preferably ordered using AeroCAD software, which will generate its ordering code.

Dimensions and Weights

For important dimensions and weights (without water filling) of coolers, refer to figure # 4 and table # 1.
The connection for the heating water is provided with a G1" outer thread.

Figure 4 - Dimensions of CHV Water Coolers

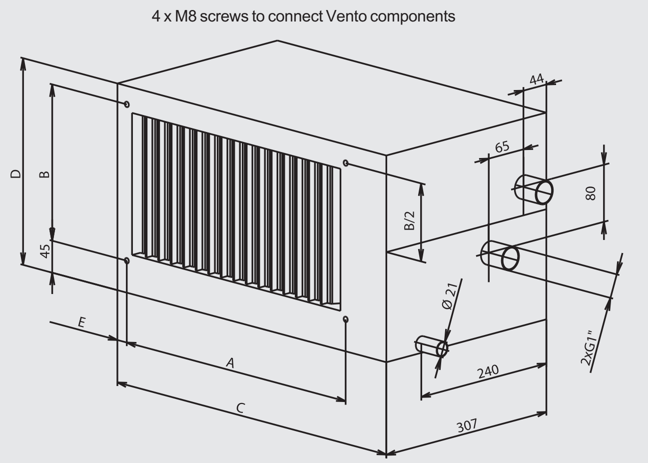


Table 1 - Dimensions of water coolers

Size	Dimensions in mm				
	A	B	C	D	E
CHV 40-20	420	220	516	280	18
CHV 50-25	520	270	616	330	18
CHV 50-30	520	320	616	380	18
CHV 60-30	620	320	716	380	18
CHV 60-35	620	370	716	430	18
CHV 70-40	720	420	816	480	18
CHV 80-50	820	520	916	580	18
CHV 90-50	930	530	1036	597	22

Cooler Accessories

Accessories like the TACO automatic air-venting valve and SUMX mixing set can be delivered as an internal part of the cooler. Accessories are not included in the cooler delivery so must be specified and ordered separately. Water coolers can be completed with accessories which ensure the following essential functions:

- **Output control**

CHV water coolers can be controlled using mixing sets, refer to the section "Mixing Sets".

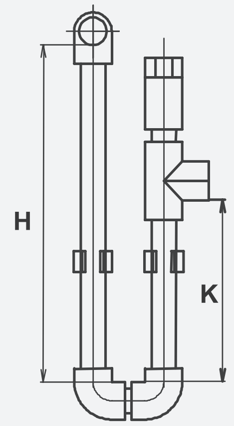
- **Condensate drainage (siphon)**

The cooler must always be equipped with a siphon to drain the condensate. Without the siphon, condensate drainage from the collecting tray is not ensured. The siphon can be replaced by a pump intended for condensate drainage.

Condensate Drainage

The cooler is equipped with a tray to collect condensate; the tray is terminated with an outlet to connect the condensate draining kit. The condensate draining kits are available as optional accessories. The siphon height depends on the total pressure of the fan, and ensures its proper functioning. The siphon must be designed depending on the fan pressure (see fig # 5).

Figure 5 - Example of condensate drainage siphon



H (mm)	K (mm)	P (Pa)
100	55	600
200	105	1100
260	140	1400

H... Siphon height
K... Siphon drain height
P... Total pressure of the fan

Cooler Dimensioning

Cooler Dimensioning

For nomograms showing the thermodynamic correlation for each cooler, refer to pages 189-196. All necessary final parameters of the cooler corresponding to the performance job can be obtained from the nomograms. The nomograms have been developed for three-row coolers and the most common water temperature gradient: +6 °C/+12 °C:

- **Required default parameters**
  - Selected cooler's size
  - Air flow rate (velocity in the cross-section)
  - Calculated inlet air temperature (25 °C, 30 °C, 35 °C)
  - Relative air humidity (40 %, 50 %, 60 %)
- **Determined final parameters**
  - Outlet air temperature
  - Output of the cooler
  - Required water discharge
  - Water pressure loss
  - Air pressure loss

Warning: If other coolant is used, the calculation of the cooler's parameters must be performed using AeroCAD software.

Cooler Dimensioning Procedure

- Outlet air temperature behind the cooler ④ for required default parameters ①②③ can be determined from the nomograms.
- If the outlet air temperature ④ is the same or higher than the required temperature, the cooler complies with the performance job.
- Maximum output of the cooler ⑦, maximum water discharge ⑨ and water pressure loss ⑩ at maximum discharge for the required default parameters ①⑤⑥ can also be determined from the nomograms.[1]
- A suitable mixing set for water discharge ⑨ and pressure loss ⑩ at the given discharge can be determined following the procedure and characteristics of SUMX mixing sets included in the section "SUMX Mixing Sets", refer to pages 181-182.

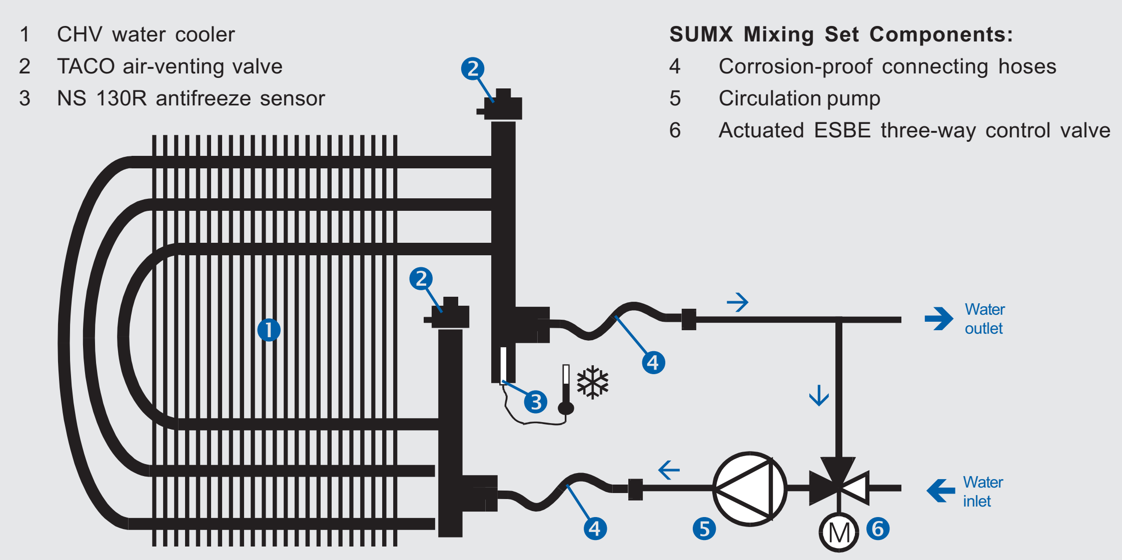
Nominal operating conditions are included in the nomograms; i.e. the air flow rate at air flow velocity of 2.7 m/s, inlet air temperature of +30 °C, inlet relative air humidity of 40 %, water temperature gradient of +6 °C/+12 °C (i.e. water cooling by 6 K) and maximum output at these conditions at corresponding water discharge and water pressure loss. A mixing set can be connected to the water cooler in these conditions.

The air pressure loss for all coolers can be determined from the nomogram on page 197.

Cooler Control

SUMX mixing sets are designed as compact fixtures. They are dimensioned using the same principles applied when used with VO water heaters. For allocation of mixing sets to the corresponding water coolers, refer to table 5 in the section "Mixing Sets".

Figure 6 - Cooler equipped with a mixing set

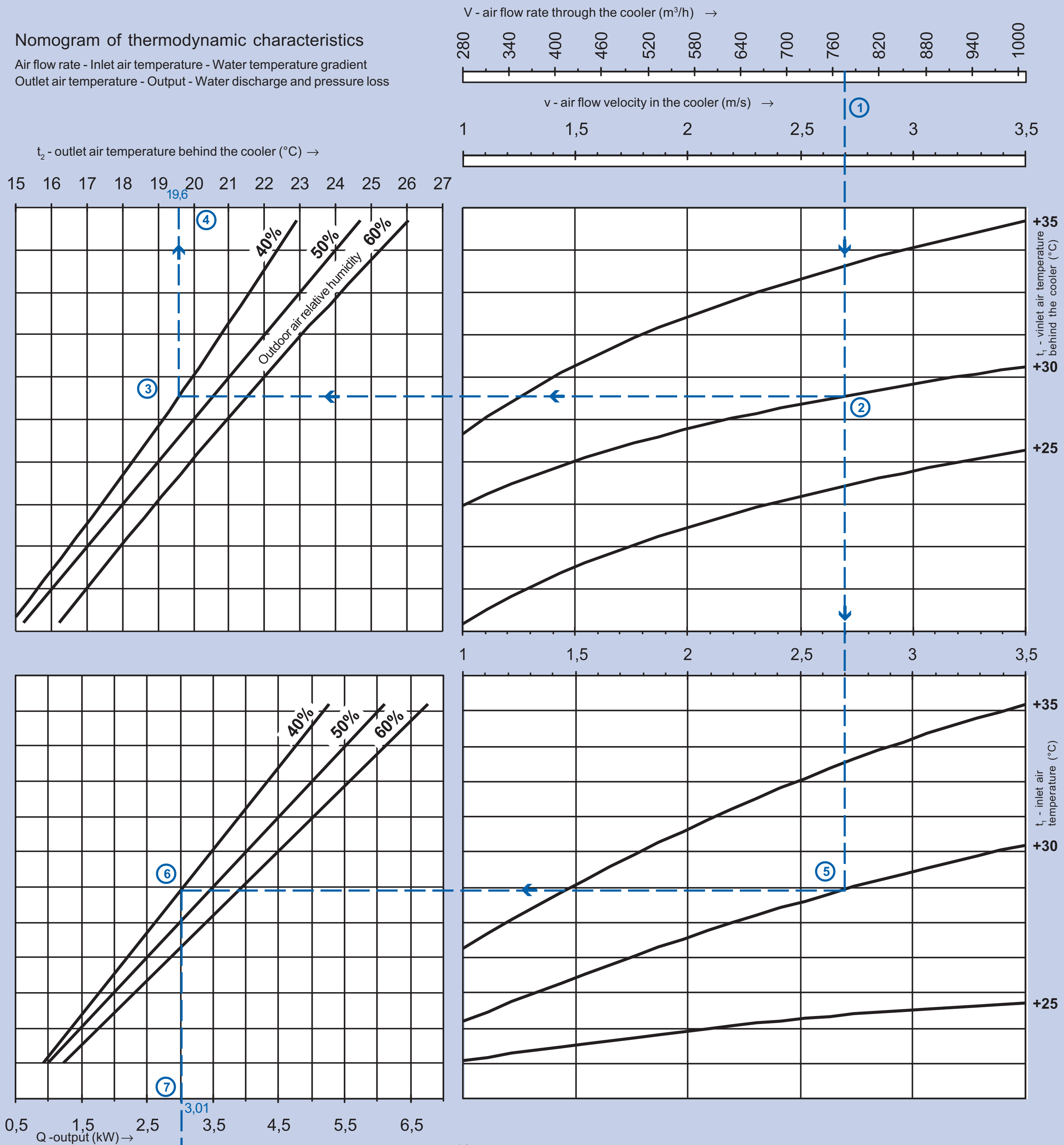


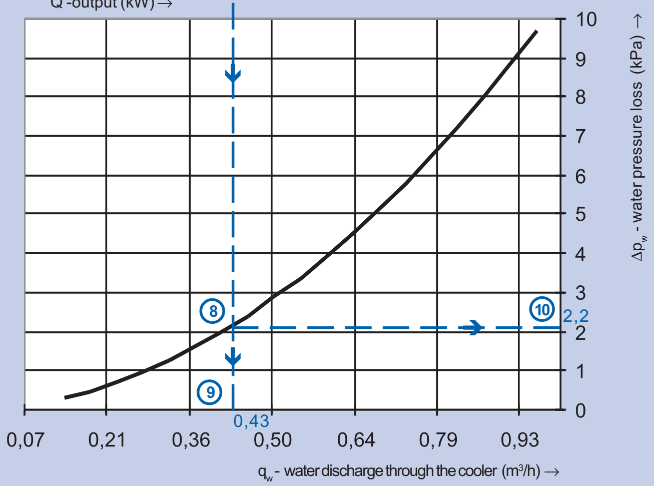
[1] The nomograms on pages 190 to 196 can be used to determine the maximum calculated output and water discharge because they are given for the fixed water temperature gradient $\Delta t_W = 6$ K.

CHV 40-20 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss





Example:

At the selected air flow rate of 775 m^3/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +19.6 °C ④.
Cooling output of the cooler of 3.01 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 0.43 m3/h at water pressure loss ⑩ in a heater of 2.2 kPa.

Values in the nomogram can be interpolated and extrapolated.

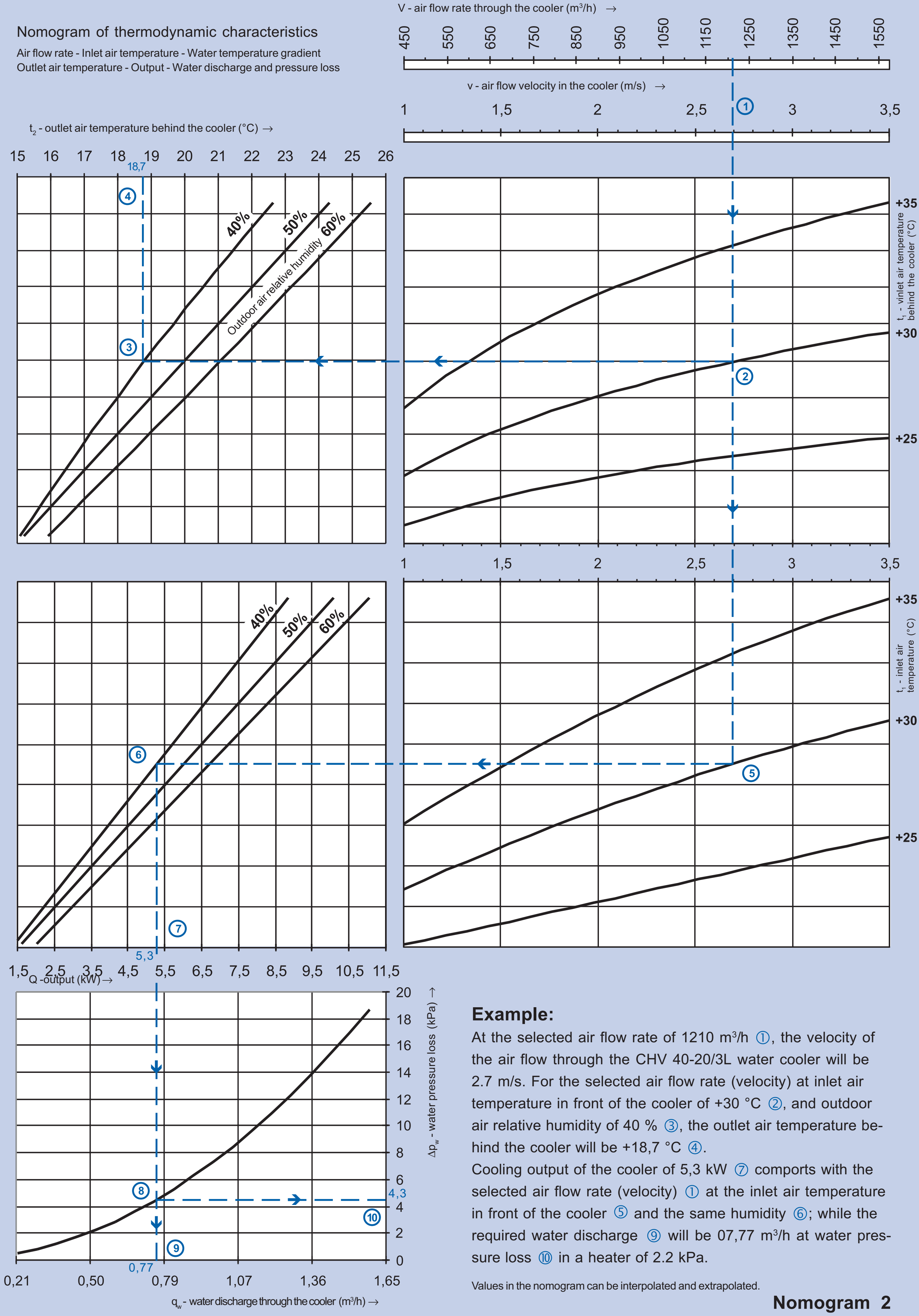
Nomogram 1

REMAK

CHV 50-25 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss



Example:

At the selected air flow rate of 1210 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,7 °C ④.

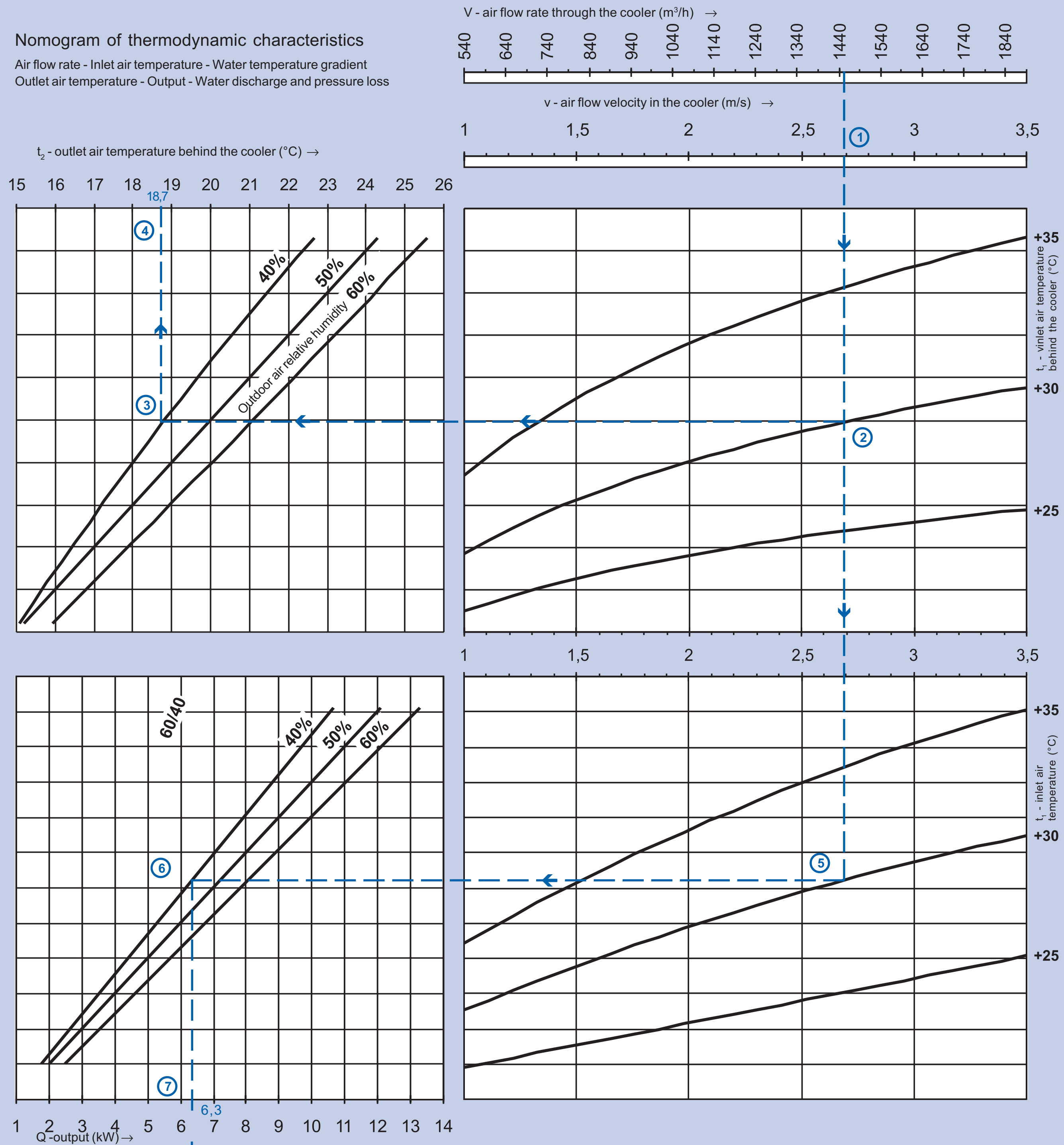
Cooling output of the cooler of 5,3 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 07,77 m³/h at water pressure loss ⑩ in a heater of 2.2 kPa.

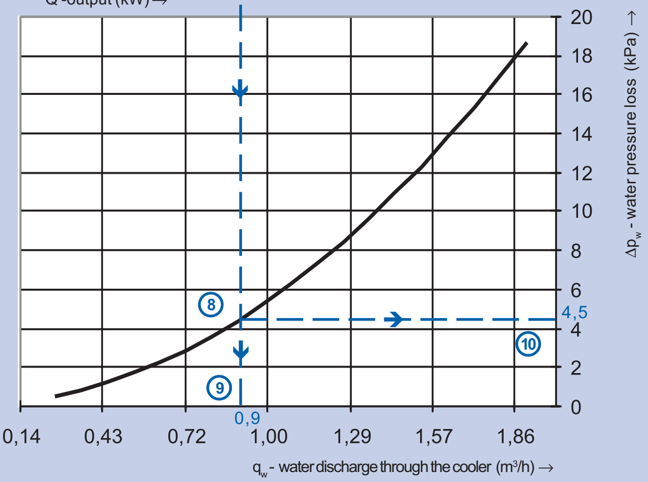
Values in the nomogram can be interpolated and extrapolated.

Nomogram 2

CHV 50-30 / 3L

Nomogram of thermodynamic characteristics
Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss





Example:

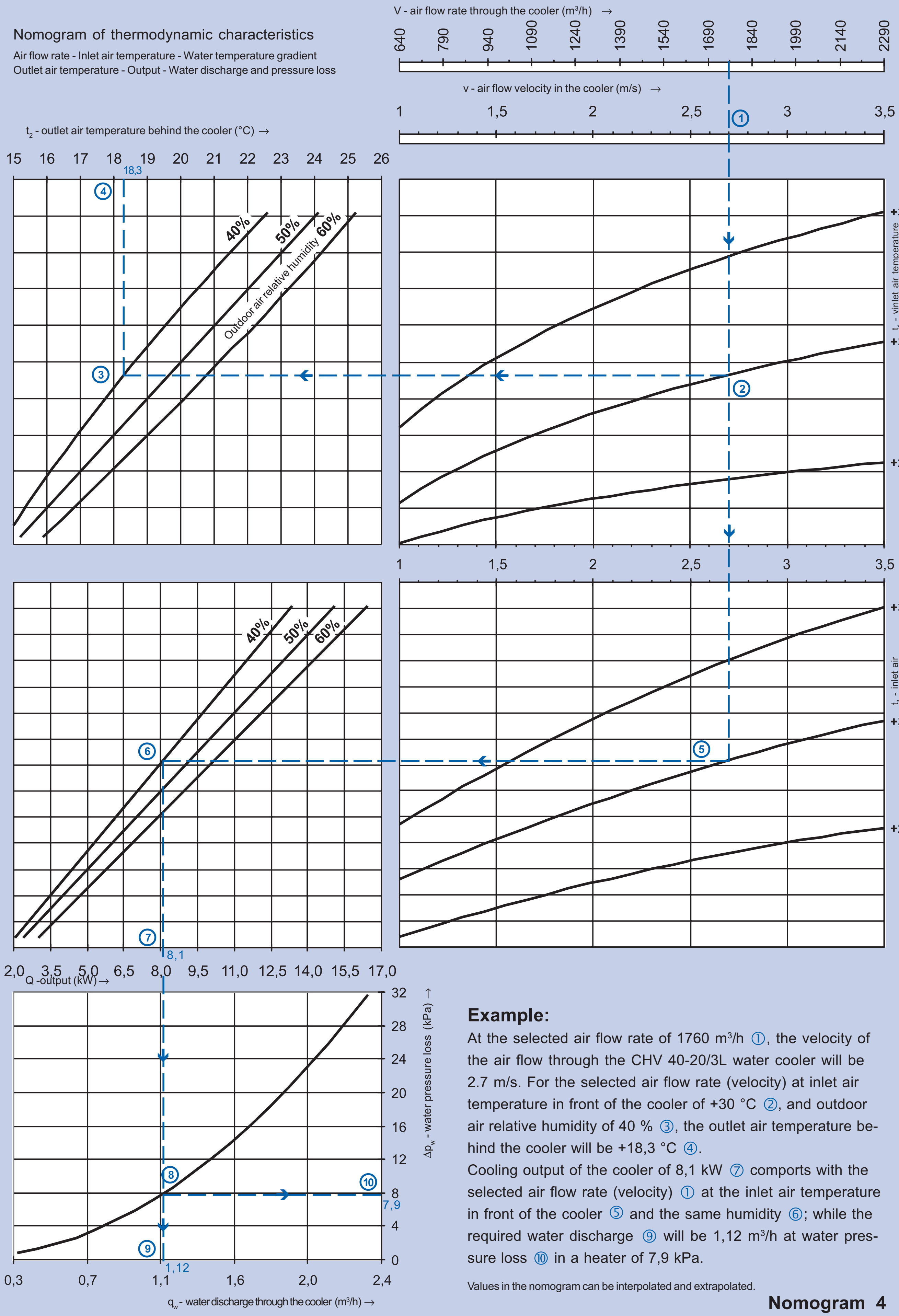
At the selected air flow rate of 1450 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,7 °C ④.
Cooling output of the cooler of 6,3 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 0,9 m³/h at water pressure loss ⑩ in a heater of 4,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

Nomogram 3

Ventilátory RP
Ventilátory RQ
Ventilátory RO
Ventilátory RS
Regulátory ...
El. ohřívače EO..
Vodní ohřívače VO
Směšovací uzly SUMX
Vodní chladiče CHV
Přímé chladiče CHF
Rekuperátory HRV
Příslušenství ...

CHV 60-30 / 3L



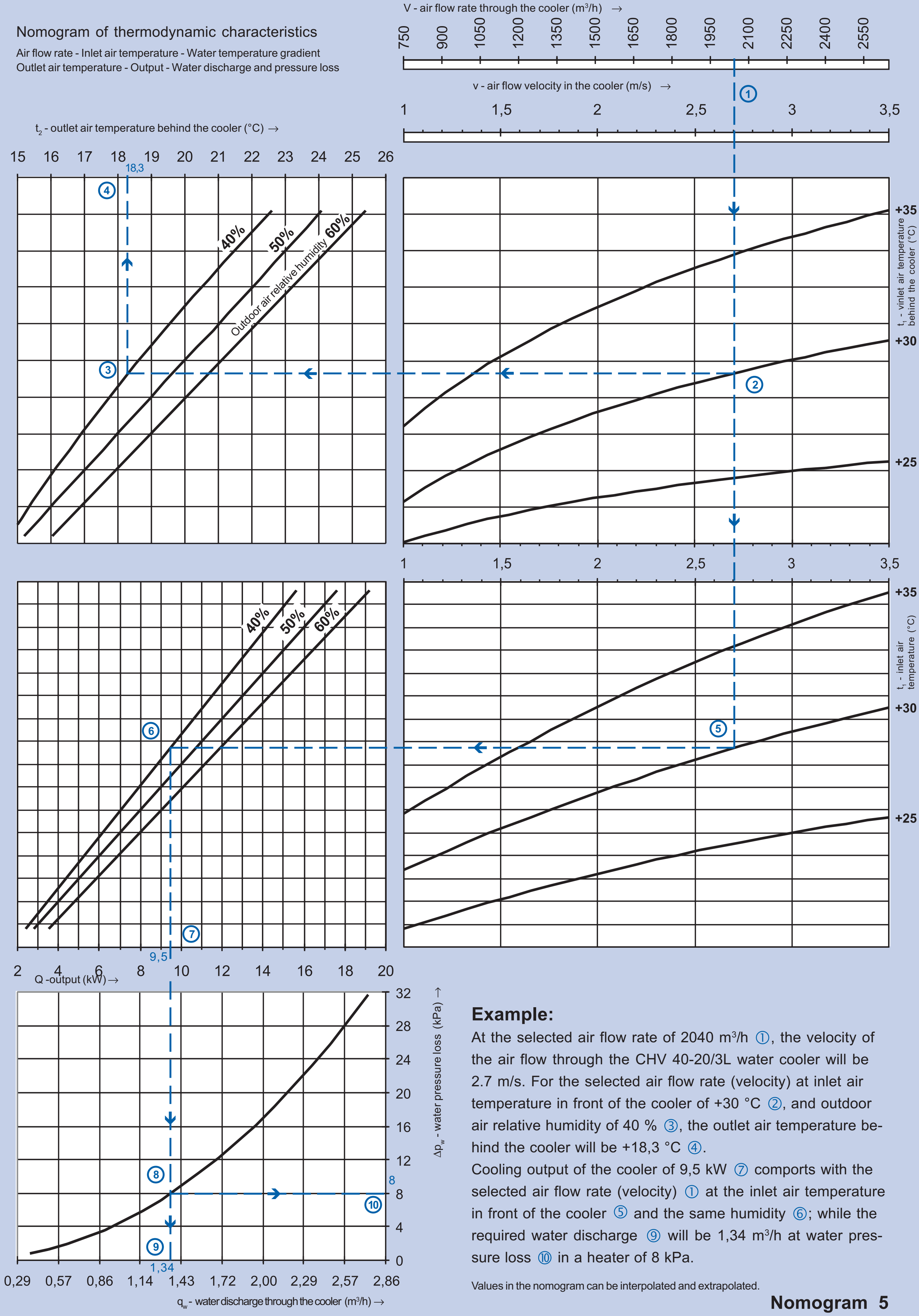
Example:

At the selected air flow rate of 1760 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,3 °C ④.
Cooling output of the cooler of 8,1 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 1,12 m³/h at water pressure loss ⑩ in a heater of 7,9 kPa.

Values in the nomogram can be interpolated and extrapolated.

Nomogram 4

CHV 60-35 / 3L



Example:

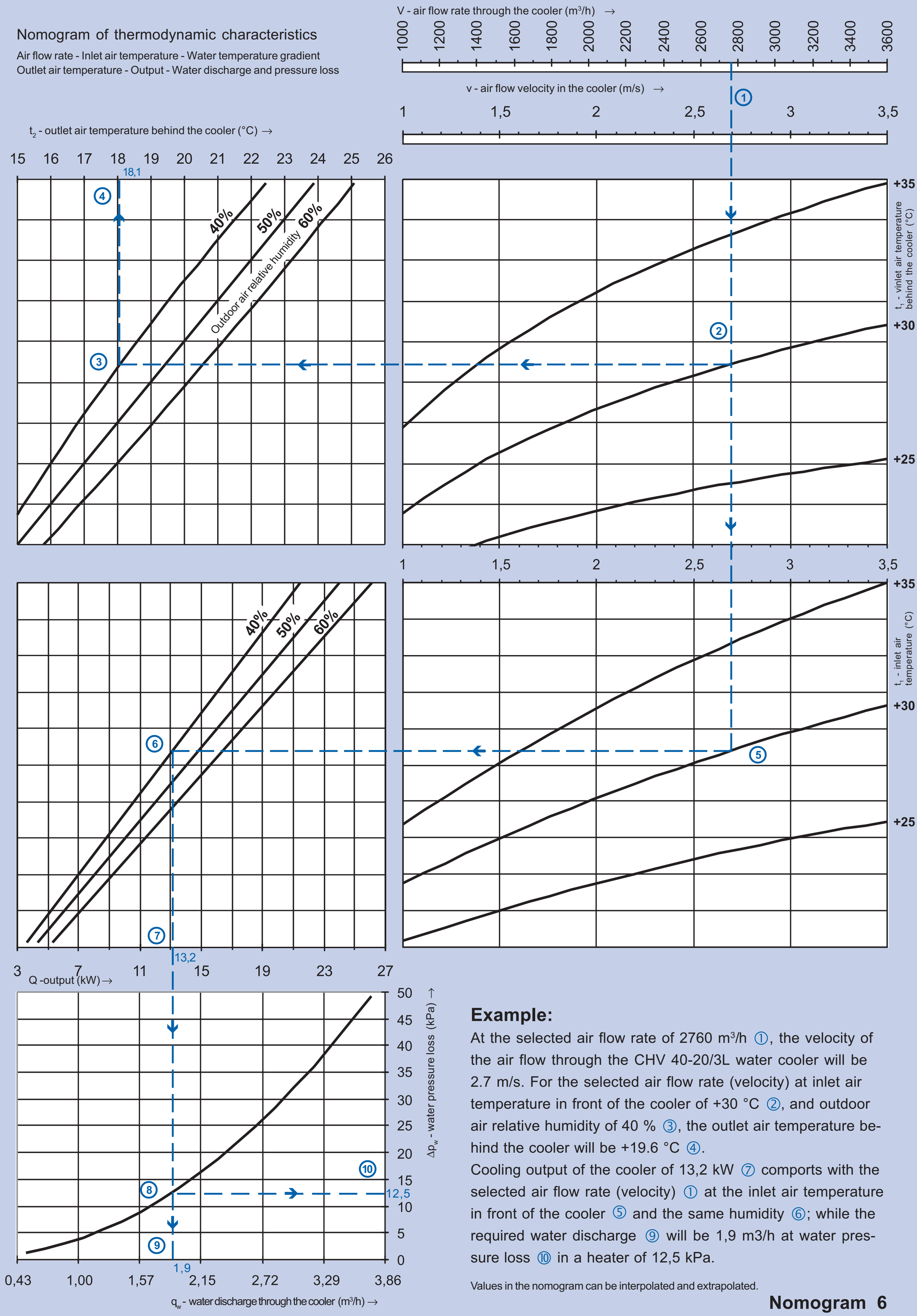
At the selected air flow rate of 2040 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,3 °C ④.

Cooling output of the cooler of 9,5 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 1,34 m³/h at water pressure loss ⑩ in a heater of 8 kPa.

Values in the nomogram can be interpolated and extrapolated.

Nomogram 5

CHV 70-40 / 3L



Example:

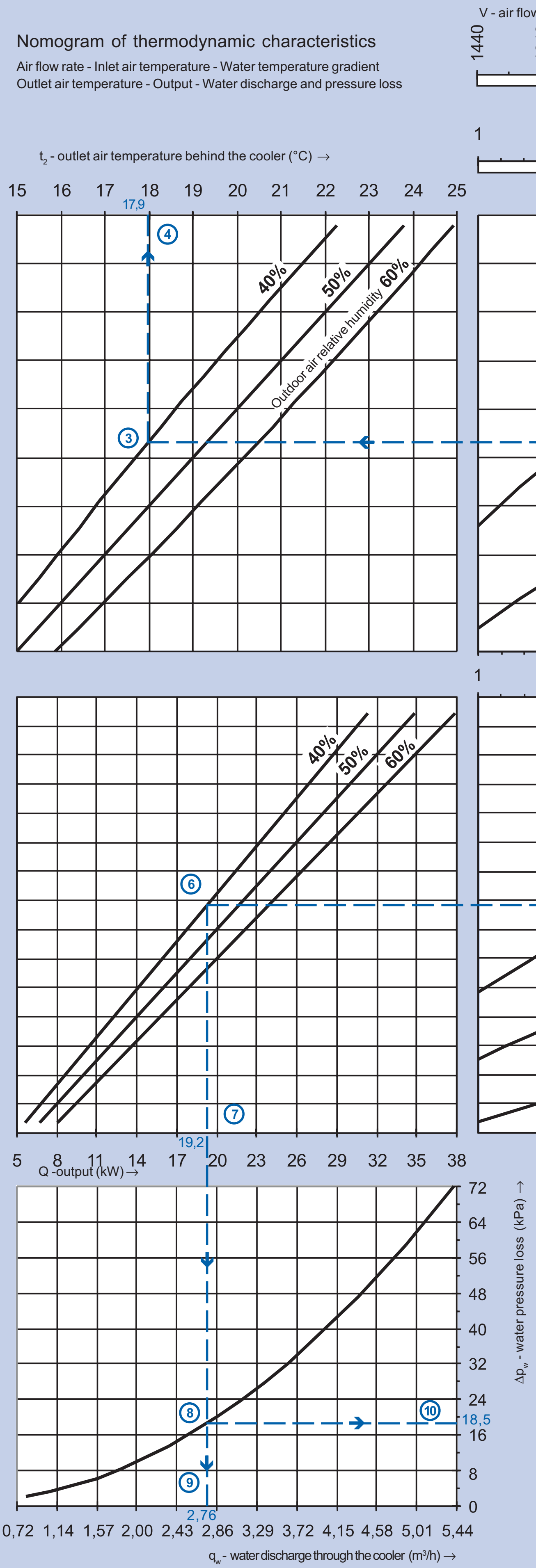
At the selected air flow rate of 2760 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +19.6 °C ④.

Cooling output of the cooler of 13,2 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 1,9 m3/h at water pressure loss ⑩ in a heater of 12,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

Nomogram 6

CHV 80-50 / 3L



Example:

At the selected air flow rate of 3880 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +17,9 °C ④.
Cooling output of the cooler of 19,2 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 2,76 m³/h at water pressure loss ⑩ in a heater of 18,5 kPa.

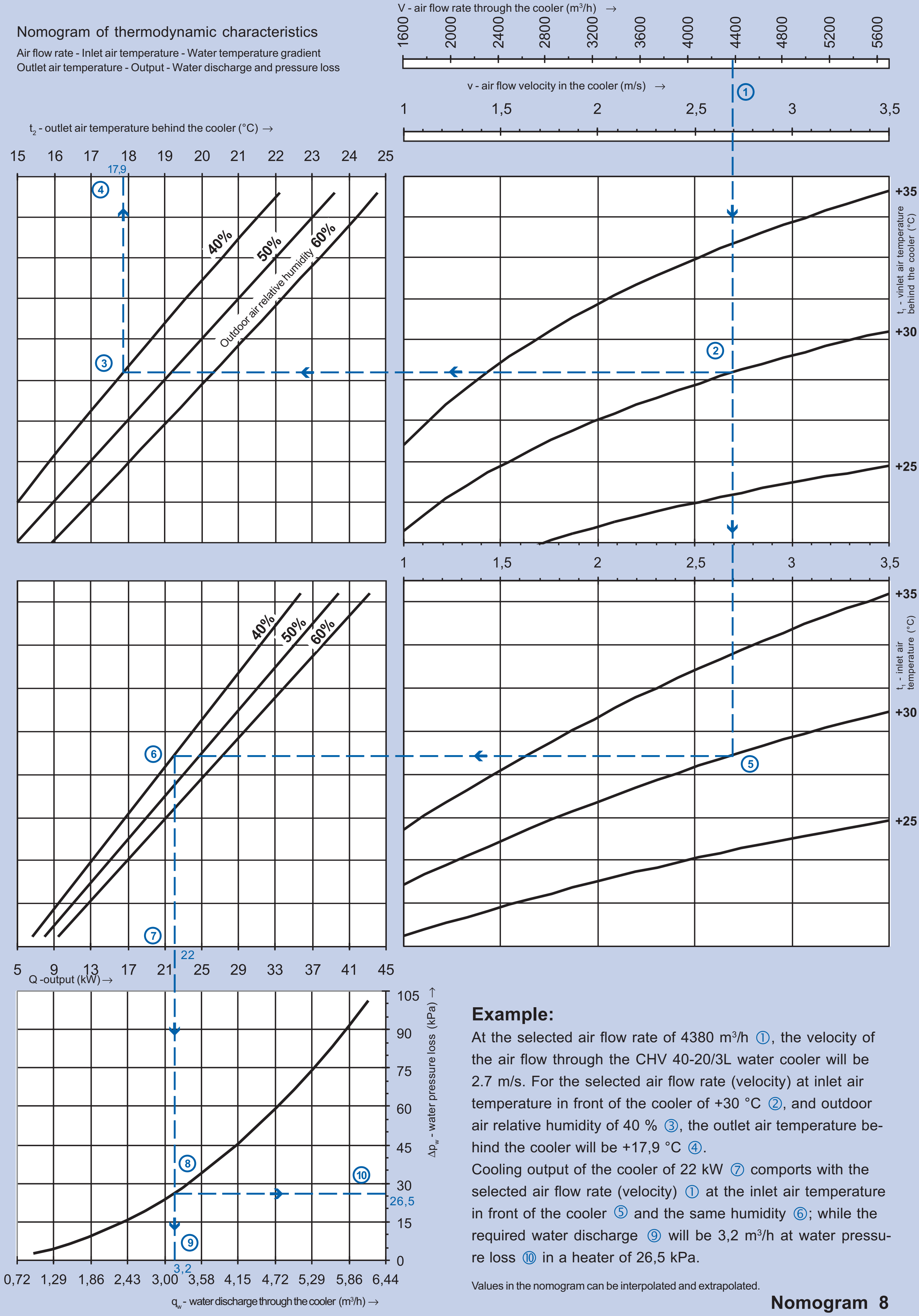
Values in the nomogram can be interpolated and extrapolated.

Nomogram 7

CHV 90-50 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss



Example:

At the selected air flow rate of 4380 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +17,9 °C ④.
Cooling output of the cooler of 22 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 3,2 m³/h at water pressure loss ⑩ in a heater of 26,5 kPa.

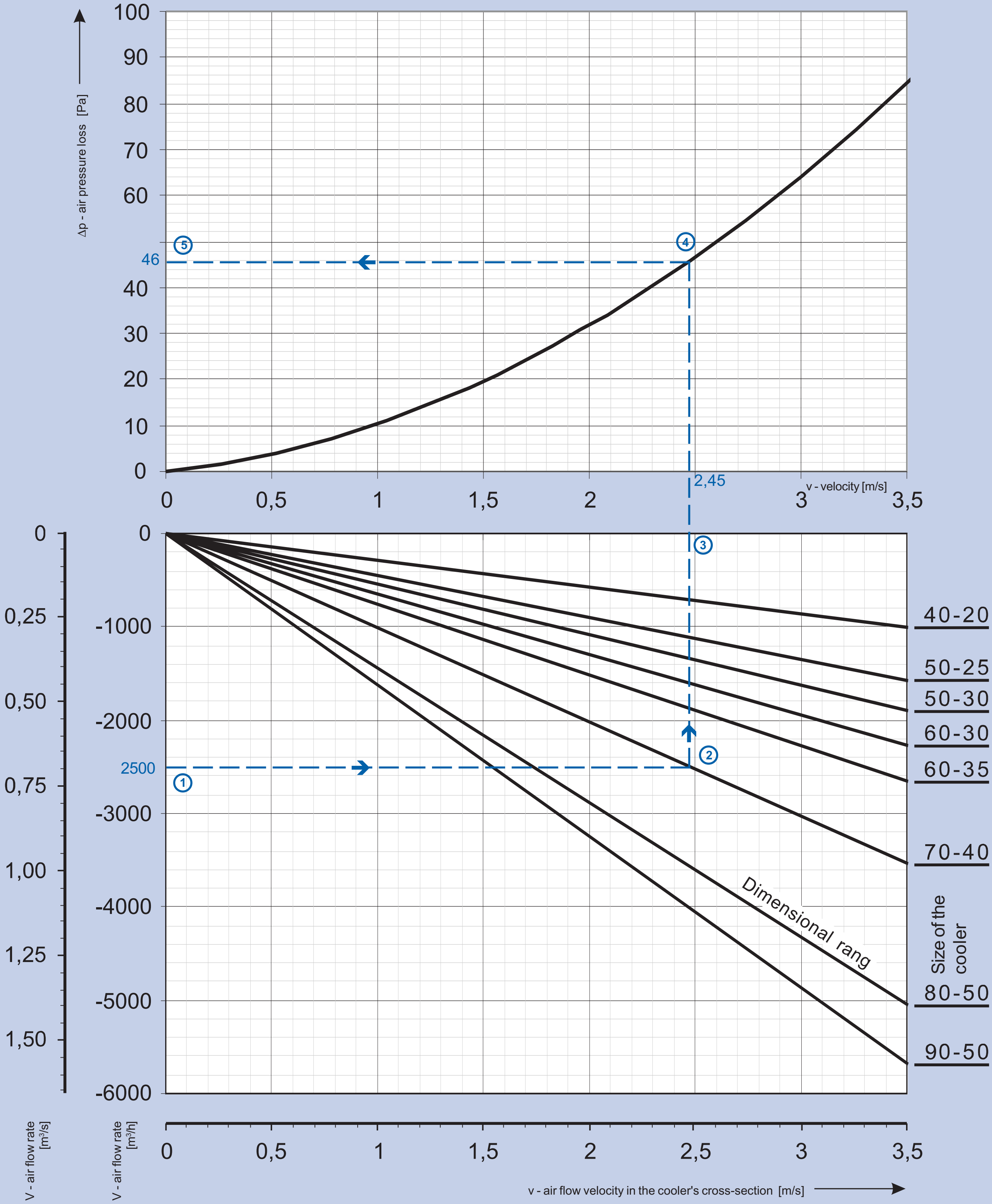
Values in the nomogram can be interpolated and extrapolated.

Nomogram 8

Air Pressure Losses in CHV Water Coolers

Nomogram of air pressure losses for all CHV water coolers

The nomogram of pressure losses is valid for all CHV water coolers. The air pressure loss depends on the air flow velocity, and it is calculated for the air velocity in a free cross section of all dimensional ranges.



The nomogram of pressure losses is valid for all CHV water coolers. For the selected air flow rate ①, the air flow velocity ③ in the free cooler's cross-section ②, can be read in the lower graph, and then the corresponding cooler's air pressure loss ⑤ at the known velocity can be determined in the upper part ④.

Example:

At an air flow rate of 2,500 m³/h, the velocity of the air flow in the CHV 70-40 3L water cooler will be 2.45 m/s. The cooler's air pressure loss for the above-mentioned air flow rate will be 46 Pa.

Installation, Service and Maintenance

Installation

■ CHV water coolers and mixing sets, as well as other Vento elements and equipment, are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the cooler and accessories. The installation and commissioning may only be performed by a specialized assembling company licensed in accordance with generally valid regulations.

■ The cooler must be checked carefully before its installation, especially if it was stored for a longer time. It is necessary to check parts for damage, and in particular whether the pipes, cooler vanes and header pipes, insulation of conductors of the mixing set pump and actuator are in good condition.

■ If water is used as the cooling medium, the cooler can then be situated only in an indoor environment where the temperature is maintained above freezing point.

■ Outdoor use is not recommended. It is allowed only if antifreeze solution is used as the cooling medium (mostly ethylene glycol solution concentrated depending on the temperature). However, the temperature limit of the used actuating mechanism of the mixing set must be taken into account.

CHV Water Coolers

■ There is no need for individual suspensions to install the water coolers. The cooler can be inserted into the duct line, it must not be exposed to any strain or torsion caused by the connected duct line.

■ Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento system, use galvanized M8 screws and nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection, or use Cu conductor wiring.

■ Water coolers can work only in the horizontal position, in which condensate draining and air venting of the cooler are possible.

■ To allow faster air venting while filling the system with water, remove the upper cover of the cooler, and loosen the knurled screw on the TACO valve by one or two turns. After finishing the filling of the system, tighten the knurled screw firmly. The valve will then work automatically.

■ During the first air venting, a couple of water drops can leak through the air-venting valve. This will not happen again during normal operating conditions.

■ When cleaning the TACO valve inside, it is necessary to replace the swelling parts (rings and inserts). The TACO valve is equipped with a back valve so there is no need to drain the heater.

■ **Warning:** The following antifreeze solutions can be used as heating media:
- water and ethylene glycol (Antifrogen N)
- water and 1.2 - ethylene glycol (Antifrogen L)
However, the cooler's parameters must be calculated using AeroCAD software

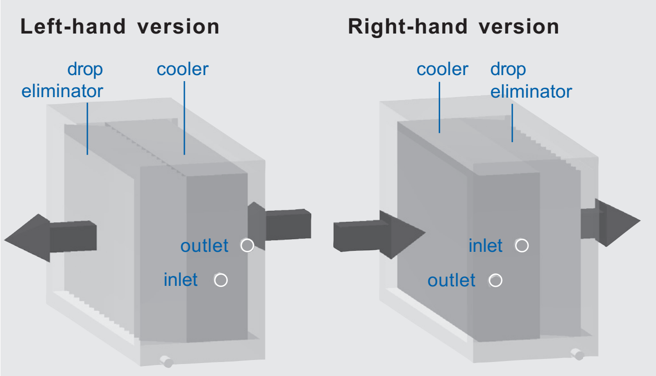
■ When connecting the mixing set hoses or air-venting valve, be careful. Do not use excessive force, otherwise the pipes situated between the header pipes and the sidewall of the cooler could be damaged.

■ The counter-current connection of the cooler is needed to achieve maximum output.
All calculations and nomograms are valid for the counter-current connection of the coolers.

■ An air filter must be installed in front of the cooler to protect it from fouling.

■ If the cooler is covered by a ceiling, it is necessary to ensure access to the entire cooler to enable checking and service; especially air-venting valves need regular checking.

Figure 7 - Side arrangement of the cooler



Before operating the air-handling unit or after being out of operation for a longer period, it is necessary to fill the siphon via the plastic plug with water. The air-handling unit can also be equipped with a siphon with a disconnecting trap and a ball valve (only negative pressure sections). This type of siphon need not be filled with water before putting it into operation.

Mixing Sets

Installation instructions included in the section "Mixing Sets" on page 182 (except the anti-freeze correlations) are fully valid for installation of the mixing sets with CHV coolers.

Installation, Service and Maintenance

Troubleshooting

When activating the air-handling system, you could face some undesirable situations. The following text includes the most common problems and their possible causes:

Permanently high output air temperature

- Low cooling water discharge rate or pressure in the cooling circuit
- High temperature of the water in the cooling circuit
- High air temperature adjusted in the control system
- Low speed of the pump in the SUMX mixing set
- Clogged screen in the SUMX mixing set
- The three-way valve and SUMX mixing set actuator are incorrectly adjusted.
- Aerated pump (resp. entire system)
- Incorrect design of the CHV and SUMX assembly

Permanently low output air temperature

- High cooling water discharge rate and pressure in the cooling circuit
- Low air temperature adjusted in the control system
- The three-way valve and SUMX mixing set actuator are incorrectly adjusted.
- Incorrect design of the CHV and SUMX assembly

The output air temperature fluctuates

- High cooling water discharge rate and pressure in the cooling circuit
- The three-way valve and SUMX mixing set actuator are incorrectly adjusted.
- Incorrect design of the CHV and SUMX assembly

Operation, Maintenance and Service

The water cooler and mixing set require regular maintenance at least at the beginning and end of the heating season. During operation, it is necessary to check proper air venting and water leakage, respectively rising pressure losses in the water piping or air duct (due to fouling). It is necessary to supervise pump and actuator operation, and keep the mixing set's filters clean.

Technical Information

Applications of Direct Coolers

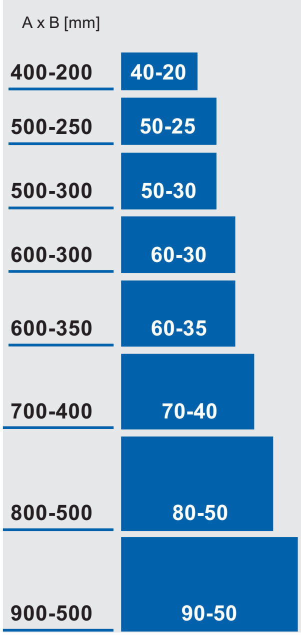
CHF direct coolers are intended for air cooling, from simple venting installations to sophisticated air-handling systems. They are designed to be installed directly in square air ducts. Ideally, they can be used along with other components of the Vento modular system, which ensure inter-compatibility and balanced parameters.

Operating conditions

The cooled air must be free of solid, fibrous, sticky and aggressive impurities. The air must also be free of corrosive chemicals or chemicals aggressive to aluminium, copper and/or zinc.
The cooler evaporator is filled with protective gas which is discharged after the evaporator is connected to the cooling circuit. The following operating coolants can be used: R123, R134a, R152a, R404a, R407c, R410a, R507, R12, and R22 (ASHRAE Number).

Dimensional Range

Figure 1 - Dimensions



CHF direct coolers are manufactured in a range of eight sizes according to the A x B dimensions of the connecting flange (see figure # 1). Three-row versions of coolers are available for all sizes. Non-standard versions of direct coolers can be delivered on the customer's request based on calculations performed using the AeroCAD design program. Direct coolers can be connected to air ducts in the same way as any other Vento duct system component. Direct coolers enable designers to cover the full air flow range of Vento fans.

Position and Location

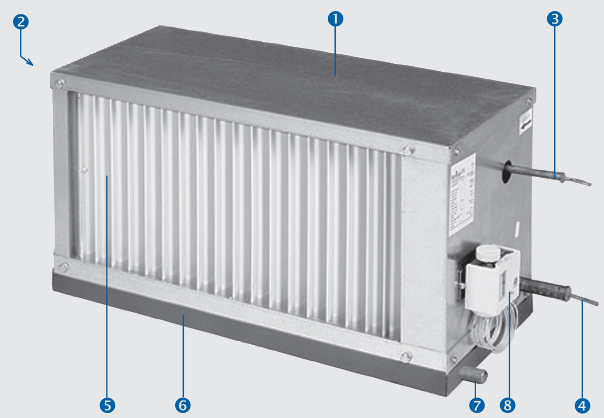
When projecting the layout of the direct cooler location in the air-handling system, we recommend observing the following principles:

- Direct coolers can work only in any position in which condensate draining is possible.
- Access to the cooler must always be ensured to enable checking and service.
- An air filter must be installed in front of the cooler to avoid its fouling (providing it has not already been installed, e.g. in front of the heater).
- The counter-current connection of the direct cooler is needed to achieve maximum output.
- The cooler can be situated either in front of or behind the fan.
- If the cooler is situated behind the fan, we recommend inserting between the fan and the evaporator a spacer (e.g. 1-1.5 m long straight duct) to steady the air flow.

Materials and Design

The external casing of the coolers is made of galvanized steel sheets insulated against moisture condensation. The heat exchange surface is created by 0.1 mm thick aluminium overlapping fins pulled on copper pipes of ø10 mm diameter. Standard CHF coolers are manufactured in two-row versions with shifted geometry (ST 25 x 22 mm). All used materials are carefully checked so they ensure long service life and reliability. Direct coolers are pre-filled with nitrogen in the production factory. As standard, direct coolers are delivered in a left-hand version, looking at the air flow direction, and are equipped with a drop eliminator, an insulated condensate drainage tray and an optional integrated anti-frost sensor. The cooler can also be ordered without the drop eliminator.

Figure 2 - Description of direct cooler parts

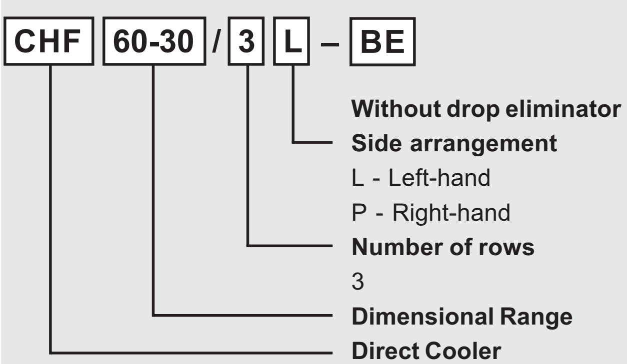


❶ External casing, ❷ Evaporator, ❸ Coolant inlet, ❹ Coolant outlet, ❺ Drop eliminator, ❻ Tray for condensate, ❼ Condensate drainage ❽ Capillary sensor (optional accessories, separate order necessary)

Designation of Direct Coolers

The type designation of coolers in projects and orders is defined by the key in figure # 3.

Figure 3 - Type designation



The above-mentioned specification without an ordering code corresponds to the stock configuration of the product, i.e. the three-row left-hand arrangement with a drop eliminator. Any other configuration (e.g. without a drop eliminator) must be specified by the ordering code. The cooler is a configured product which should be preferably ordered using AeroCAD software, which will generate its ordering code

Parameters

Dimensions and Weights

For important dimensions and weights (without water filling) of direct coolers, refer to figure # 4 and table # 1. The connection of the direct cooler depends on the selected dimensional range.

Direct Cooler Dimensioning

For nomograms showing the thermodynamic correlation for each direct cooler, refer to pages 202-209. All necessary final parameters of the direct cooler corresponding to the performance job can be obtained from the nomograms. The nomograms have been developed for direct coolers and most frequently used evaporating temperature: + 5 °C:

■ **Required default parameters**

- Selected cooler's size
- Air flow rate (velocity in the cross-section)
- Design inlet air temperature (+25 °C, +30 °C, +35 °C)
- Relative air humidity (40 %, 50 %, or 60 %).

■ **Determined final parameters**

- Outlet air temperature
- Output of the cooler
- Air pressure loss

Direct Cooler Dimensioning Procedure

■ Outlet air temperature behind the cooler ④ for required default parameters ①②③ can be determined from the nomograms.

■ If the outlet air temperature ④ is the same or higher than the required temperature, the cooler complies with the performance job. [4]

■ Maximum output of the direct cooler at maximum required air flow for the required default parameters ①⑤⑥ can also be determined from the nomograms.

■ The direct cooler's pressure loss at the given air flow rate for calculation of the assembly pressure loss balance needed for the fan selection can be obtained from the nomograms on pages 202-209.

The air pressure loss for all coolers can be determined from the nomogram on page 210. As the design of the direct coolers is standardized, the pressure loss only depends on the air flow velocity through the cooler. The nomogram also includes air flow rate - velocity conversion curves for all cooler sizes.

Figure 4 - Dimensions of CHF Direct Coolers

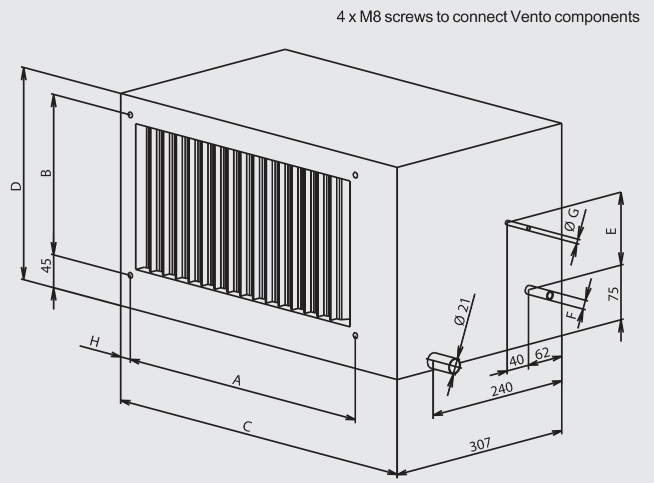


Table 1 - Dimensions of CHF Direct Coolers

Size	Dimensions in mm							
	A	B	C	D	E	F	G	H
CHV 40-20	420	220	506	280	100	16	12	23
CHV 50-25	520	270	606	330	150	16	12	23
CHV 50-30	520	320	606	380	150	16	12	23
CHV 60-30	620	320	706	380	200	22	12	23
CHV 60-35	620	370	706	430	200	22	12	23
CHV 70-40	720	420	806	480	200	28	12	23
CHV 80-50	820	520	906	580	250	28	16	23
CHV 90-50	930	530	1013	597	250	28	16	20

Installation, Service and Maintenance

Installation, servicing and maintenance can be performed only by a specialized company licensed in accordance with valid regulations and possessing the appropriate tools.

■ There is no need for individual suspensions when installing the CHF direct coolers. The cooler can be inserted into the duct line, it must not be exposed to any strain or torsion caused by the connected duct line.

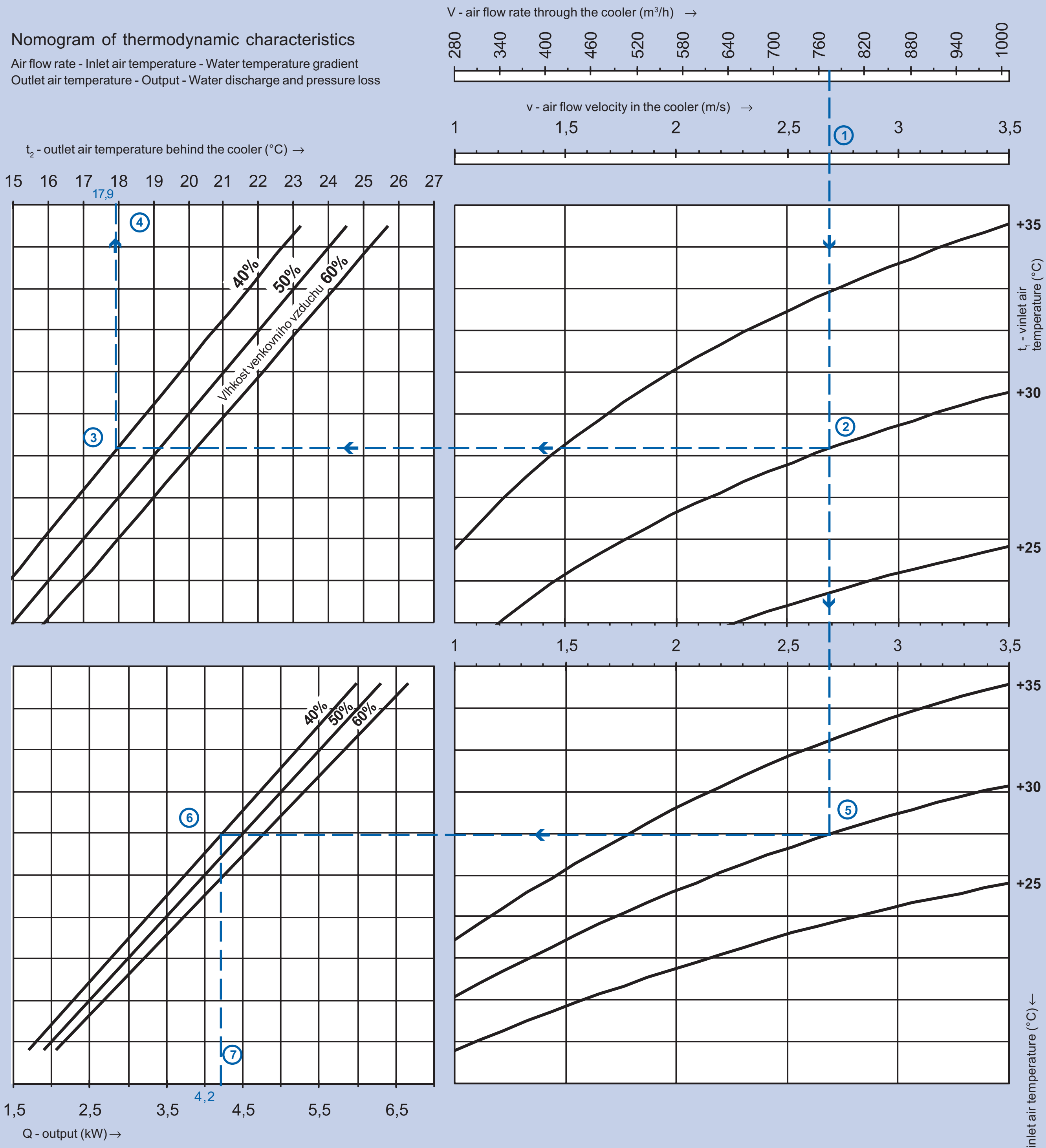
■ Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento system, use galvanized M8 screws and nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection, or use Cu conductor wiring.

[4] It the outlet air temperature from the direct cooler in the given default conditions is higher than required, it is necessary to select a larger cooler, or ask REMAK or their distributor to calculate the CHF cooler's parameters for the required conditions.

CHF 40-20 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss



Example:

At the selected air flow rate of 775 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s.
For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 °C ④.
Cooling output of the cooler of 4.2 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

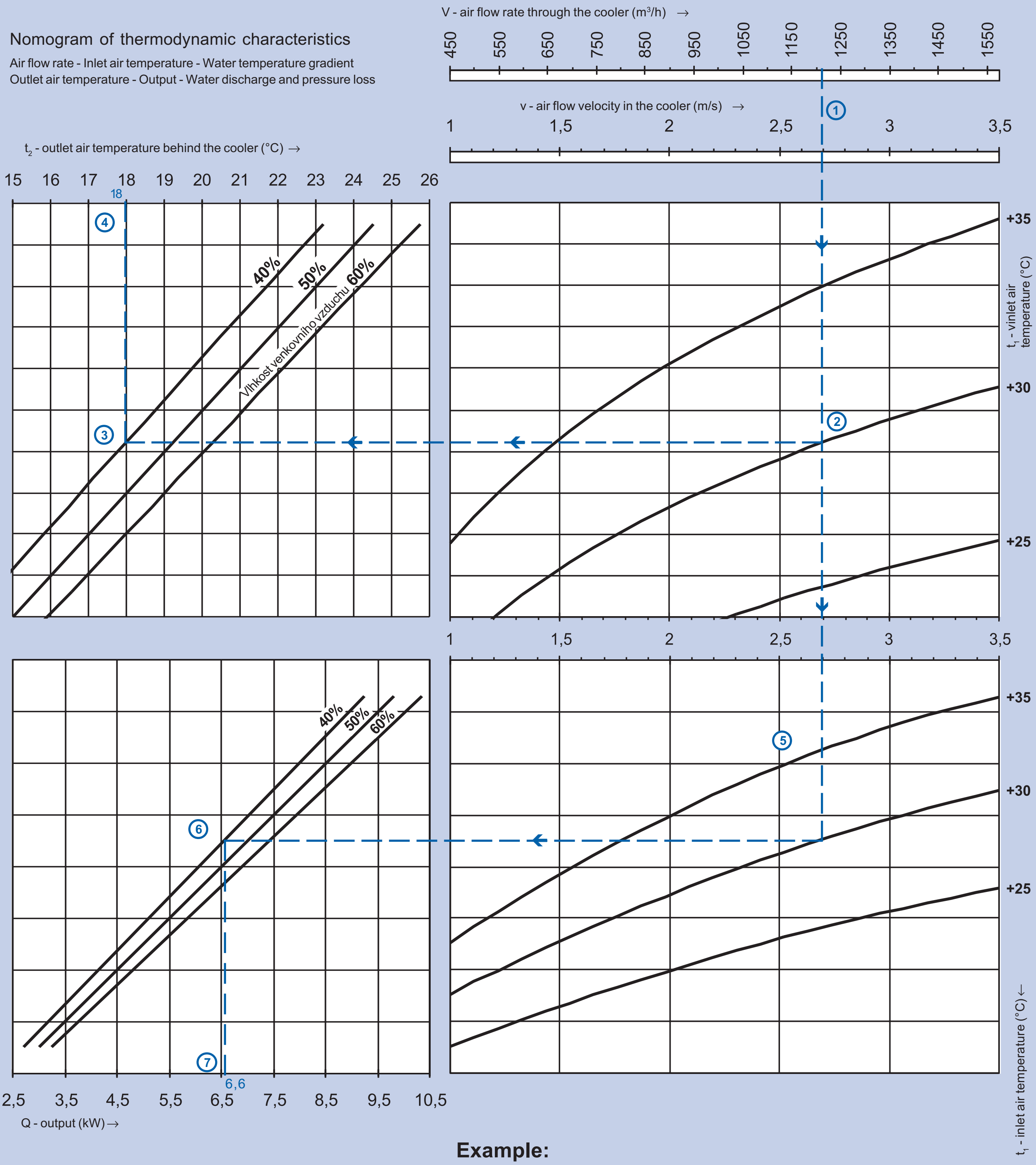
Values in the nomogram can be interpolated and extrapolated

Nomogram 1

CHF 50-25 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss



Example:

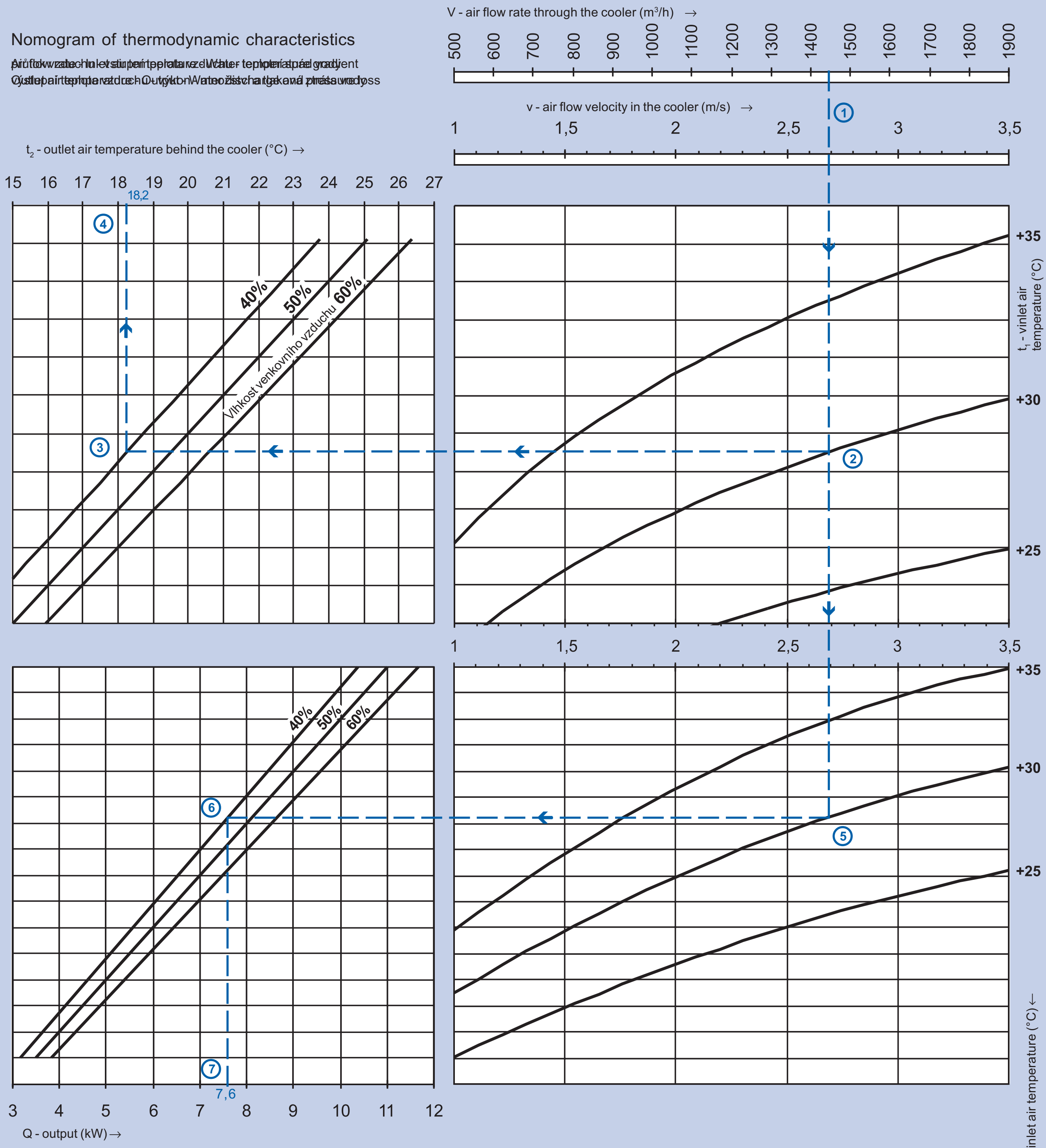
At the selected air flow rate of 1210 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +18 °C ④.
Cooling output of the cooler of 6,6 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 2

CHF 50-30 / 3L

Nomogram of thermodynamic characteristics



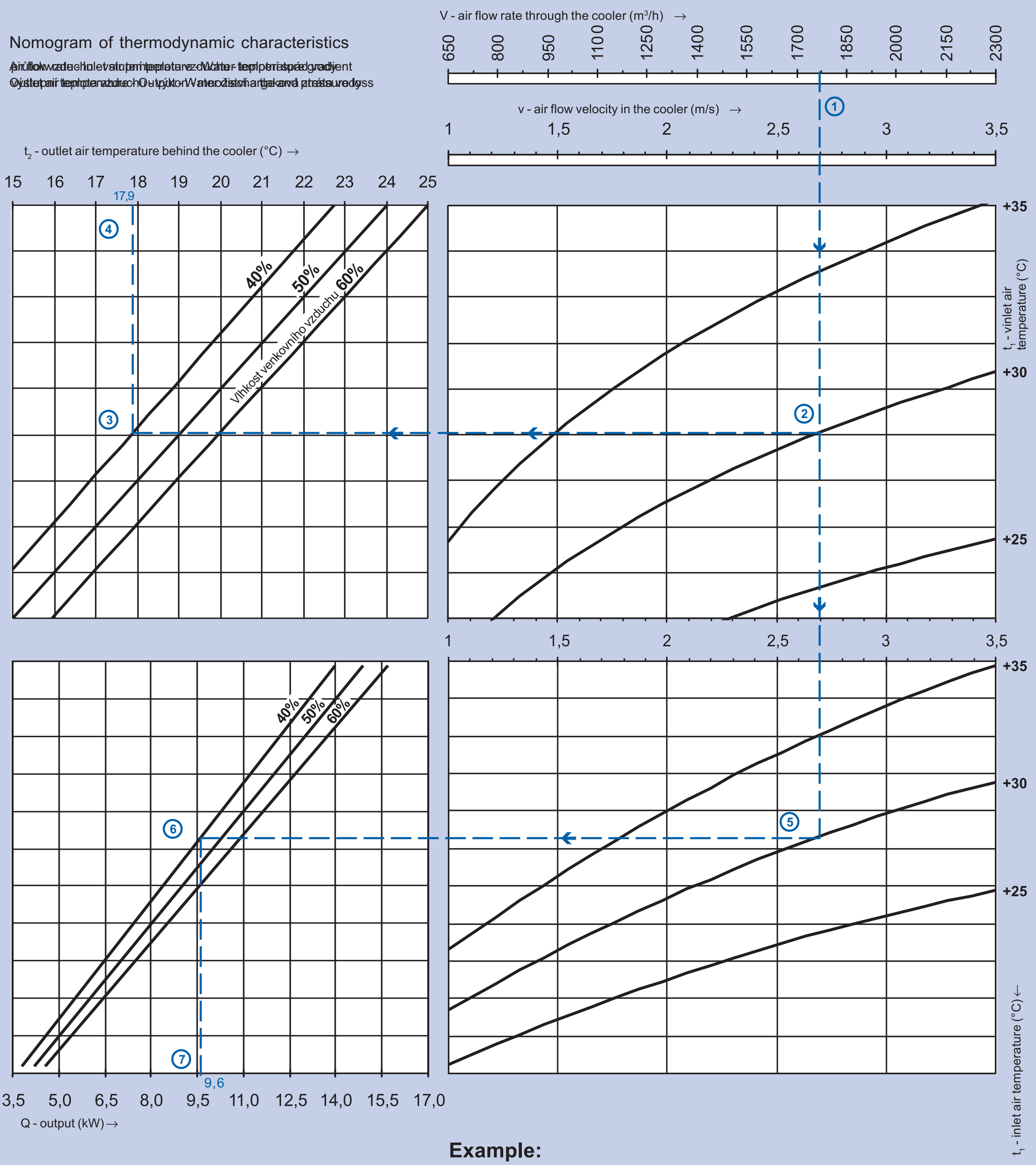
Example:

At the selected air flow rate of 1450 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +18,2 °C ④.
Cooling output of the cooler of 7,6 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 3

CHF 60-30 / 3L



Example:

At the selected air flow rate of 1760 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 °C ④.

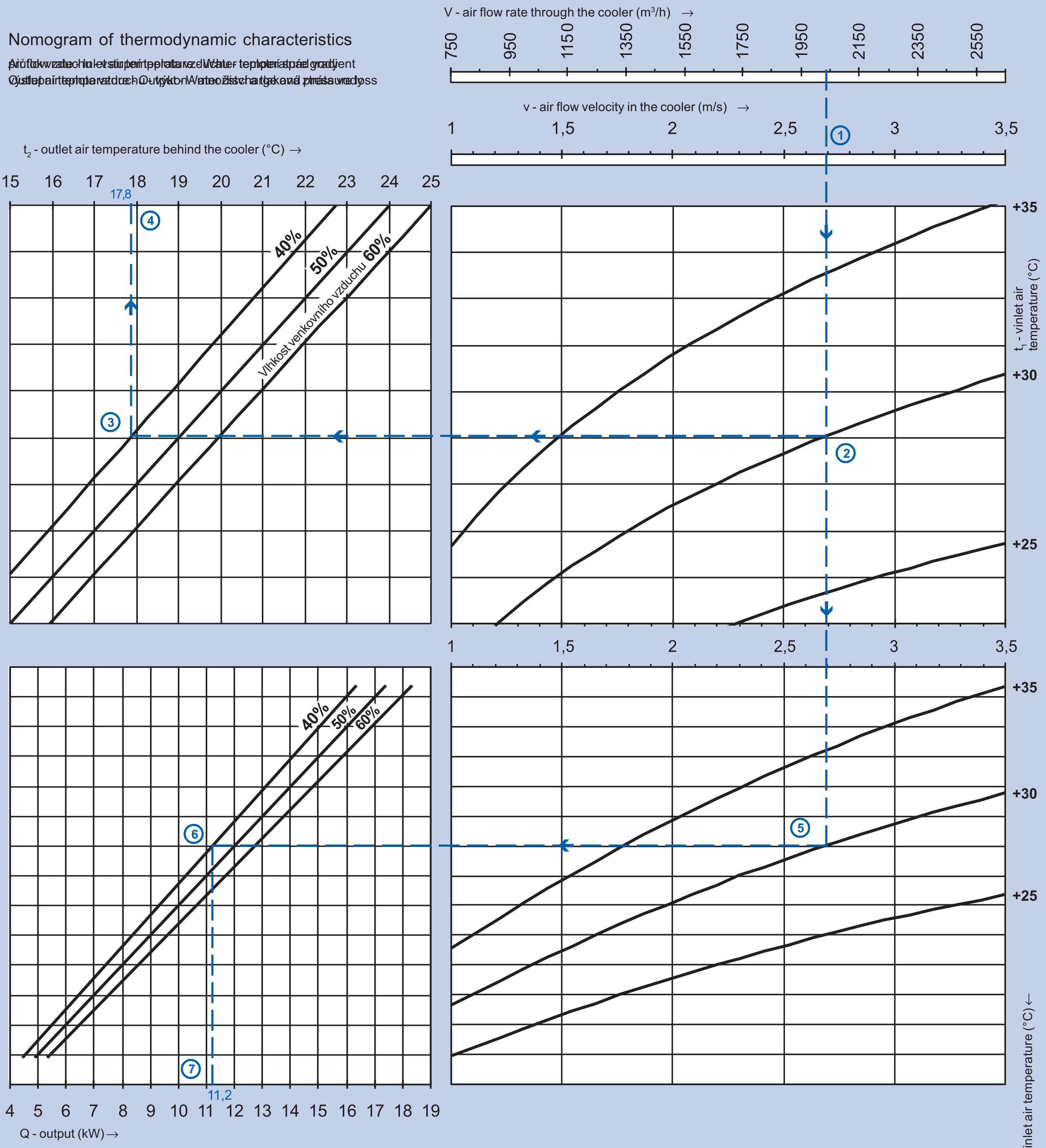
Cooling output of the cooler of 9,6 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 4

CHF 60-35 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 2040 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17,8 °C ④.

Cooling output of the cooler of 11,2 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

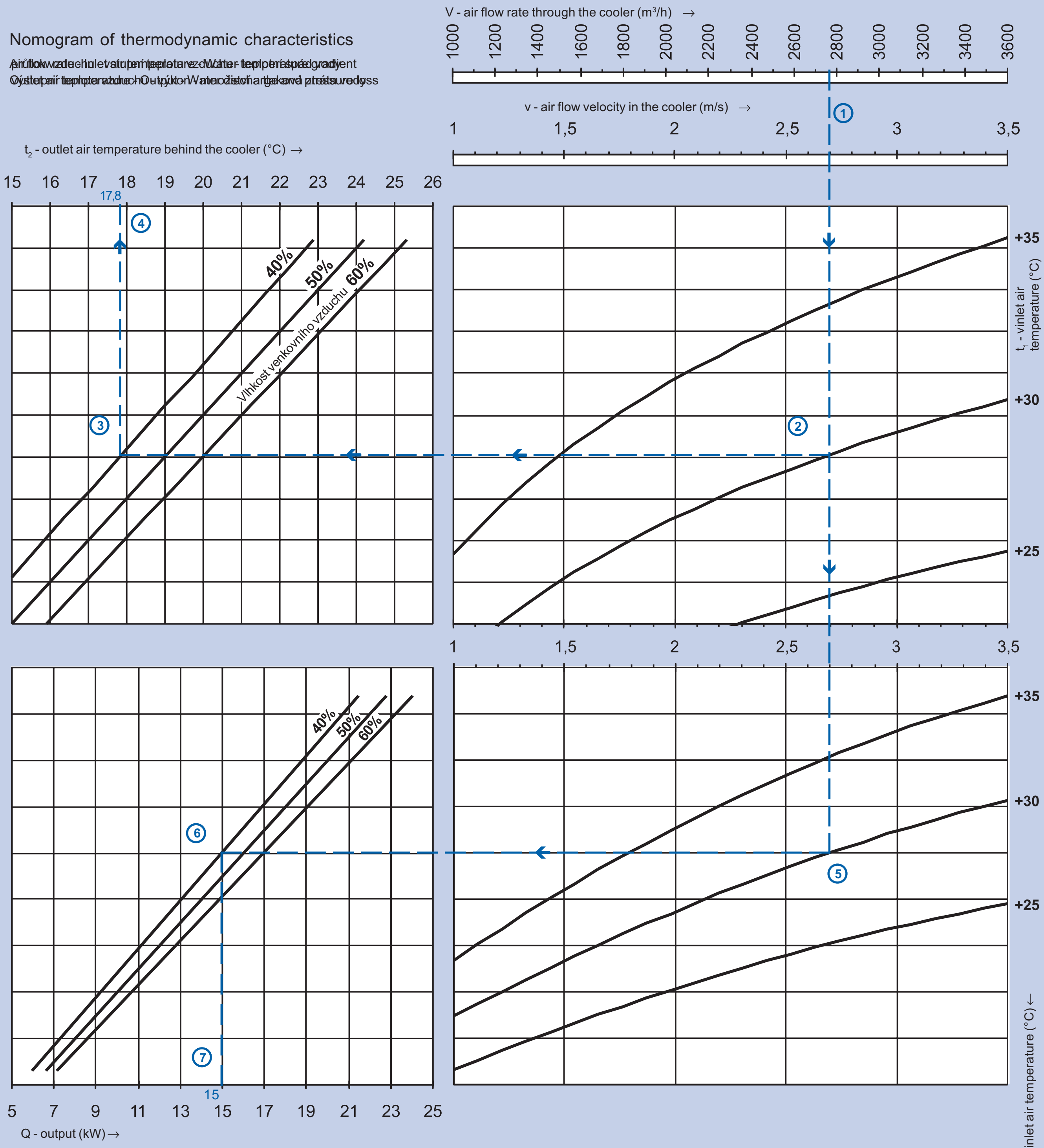
Values in the nomogram can be interpolated and extrapolated

Nomogram 5

CHF 70-40 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Průtok vzduchu - Vstupní teplota vzduchu - Teplotní spád vody
Outlet air temperature - Output - Water flow rate and pressure loss
Výstupní teplota vzduchu - Výkon - Množství a tlaková ztráta vody



Example:

At the selected air flow rate of 2760 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17,8 °C ④.

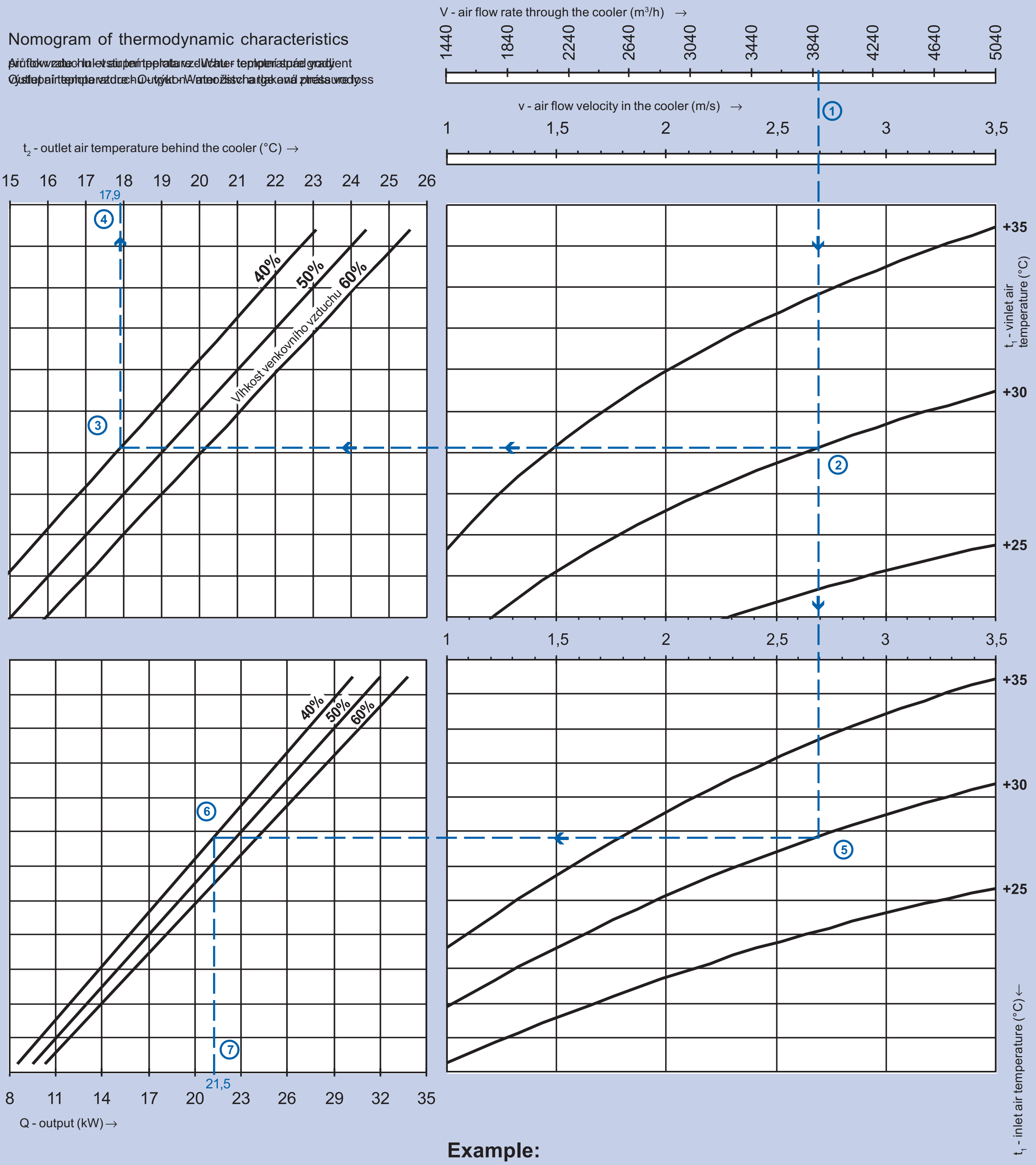
Cooling output of the cooler of 15 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 6

CHF 80-50 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 3880 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 °C ④.

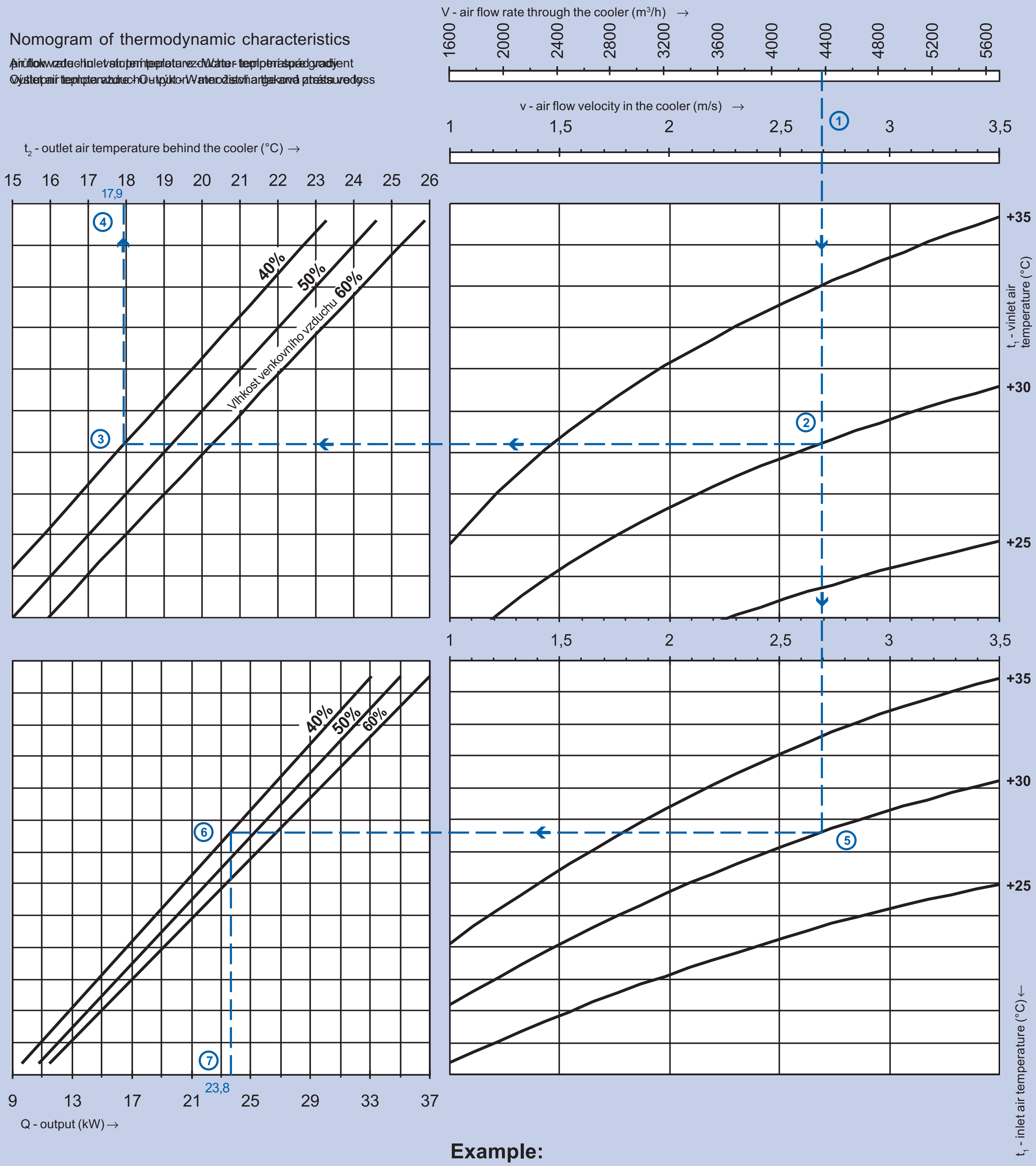
Cooling output of the cooler of 21,5 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 7

CHF 90-50 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 4380 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 °C ④.

Cooling output of the cooler of 23,8 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

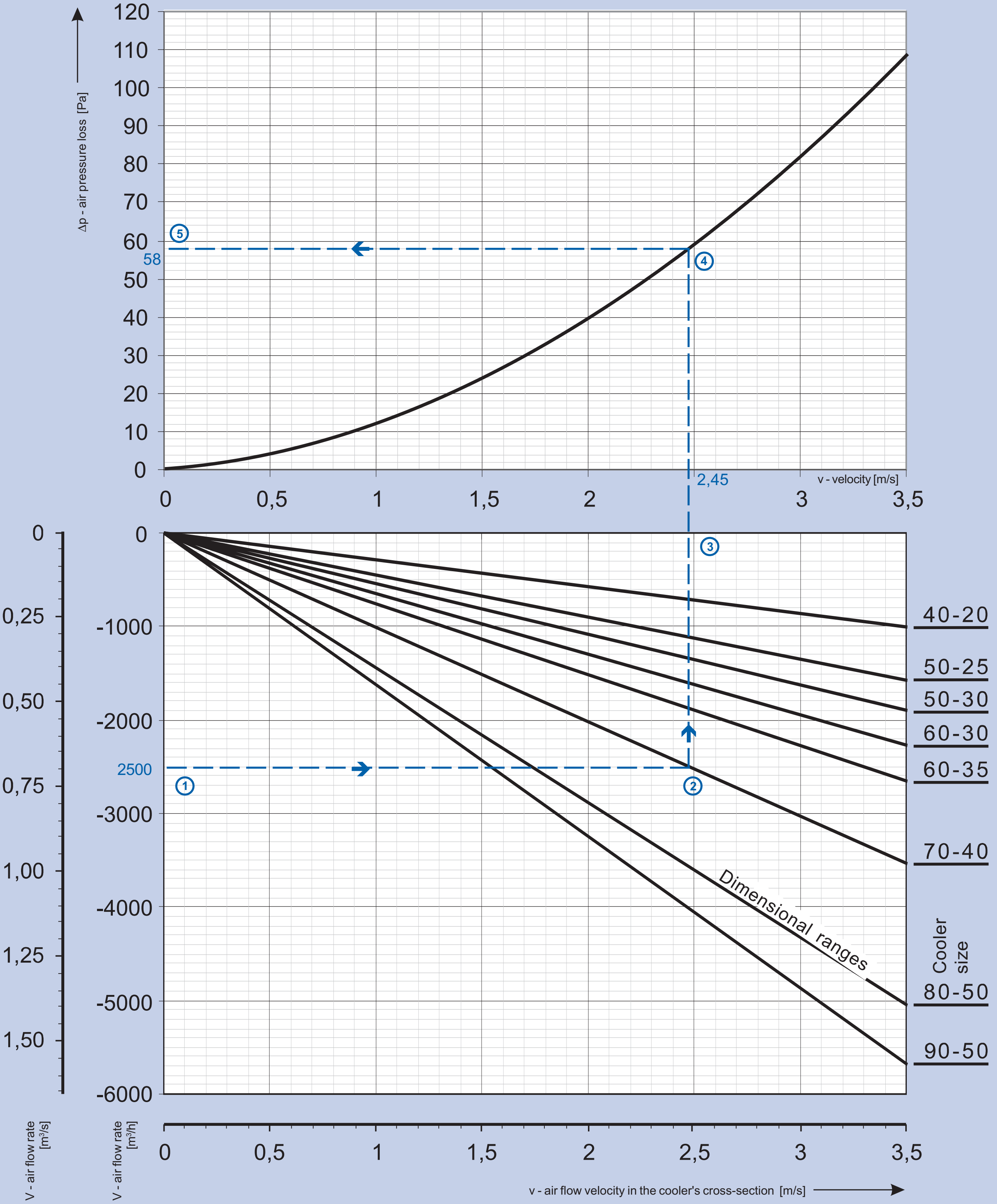
Values in the nomogram can be interpolated and extrapolated

Nomogram 8

Air Pressure Losses in CHF Direct Coolers

Nomogram of air pressure losses for all CHF direct coolers

The curve of pressure losses is valid for all CHF direct coolers. The air pressure loss depends on the air flow velocity, and it is calculated for the air velocity in a free cross section of all Vento system dimensional ranges.



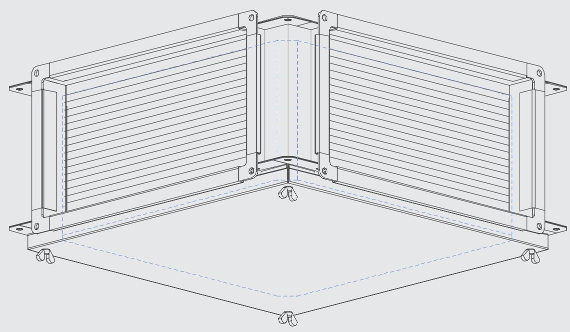
The nomogram of pressure losses is valid for all CHF direct coolers. For the selected air flow rate ①, the air flow velocity ③ in the free cooler's cross-section ②, can be read in the lower graph, and then the corresponding cooler's air pressure loss ⑤ at the known velocity can be determined in the upper part ④.

Example:

At an air flow rate of 2,500 m3/h, the velocity of the air flow in the CHF 70-40 / 3L direct cooler will be 2.45 m/s. The direct cooler's air pressure loss for the above-mentioned air flow rate will be 58 Pa.

Technical Information

Figure 1 - Cross-airflow heat exchanger



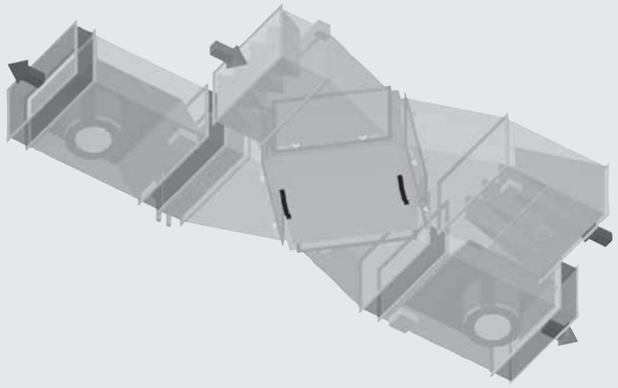
Application

HRV cross-airflow plate heat exchangers are used to recover heat energy from the outlet air coming from an air-conditioned room, especially in applications which are highly demanding for heating or cooling of the inlet air.

Operating Conditions and Position

Inlet and outlet air must be without solid, fibrous, sticky, aggressive and explosive impurities.
The heat exchanger is designed to be installed into the air-handling system, into a parallel, perpendicular or 45° aslant air inlet/outlet duct line, or their various combinations.
The layout variability of the heat exchanger is provided by special connecting elbows OBL.../45. The number of elbows must be specified in the project, depending on the intended layout.
The SKX mixing section can be connected directly to the heat exchanger via elbows for the parallel air outlet. The HRV heat exchanger even without elbows has the standard connecting dimensions of the Vento System. The HRV heat exchanger can be operated either in the horizontal or vertical position. However, condensate draining from the outlet air duct behind the heat exchanger must be ensured. When planning the air-handling system, it is necessary to consider requirements for the servicing space to enable the replacement of heat-exchange inserts

Figure 2 – location in the air-handling assembly



Materials and Design

The external casing and connecting flanges of HRV plate heat exchangers are made of galvanized steel sheets. The heat exchanger is equipped with a heat-exchange insert made of thin aluminium fins (sheets). The air-tightness of the inlet and outlet air separation within the heat-exchange insert is ensured by capping the fins and sheets and sealing the connections with polyester resins.

Dimensional and Type Range

HRV plate heat exchangers are a part of the Vento air-handling modular system. They are manufactured in eight dimensional rages, from HRV 40-20 to HRV 90-50. In these eight dimensional rages, corresponding OBL…/45 elbows are also manufactured.

Figure 3 - Heat exchanger designation

HRV 60 - 30

- 30 – Flange connection B dimension (cm)
- 60 – Flange connection A dimension (cm)
- HRV – Heat exchanger designation

Figure 4

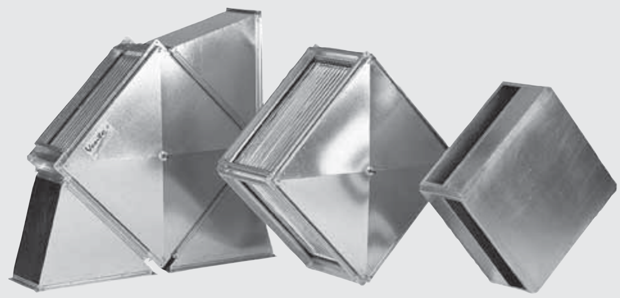
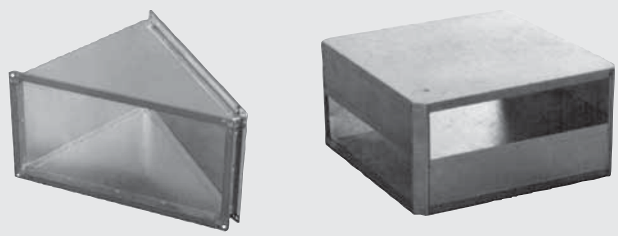


Figure 5 - Heat exchanger accessories



OBL elbow   LV summer insert

Technical Information

Figure 6 - Important dimensions of heat exchangers

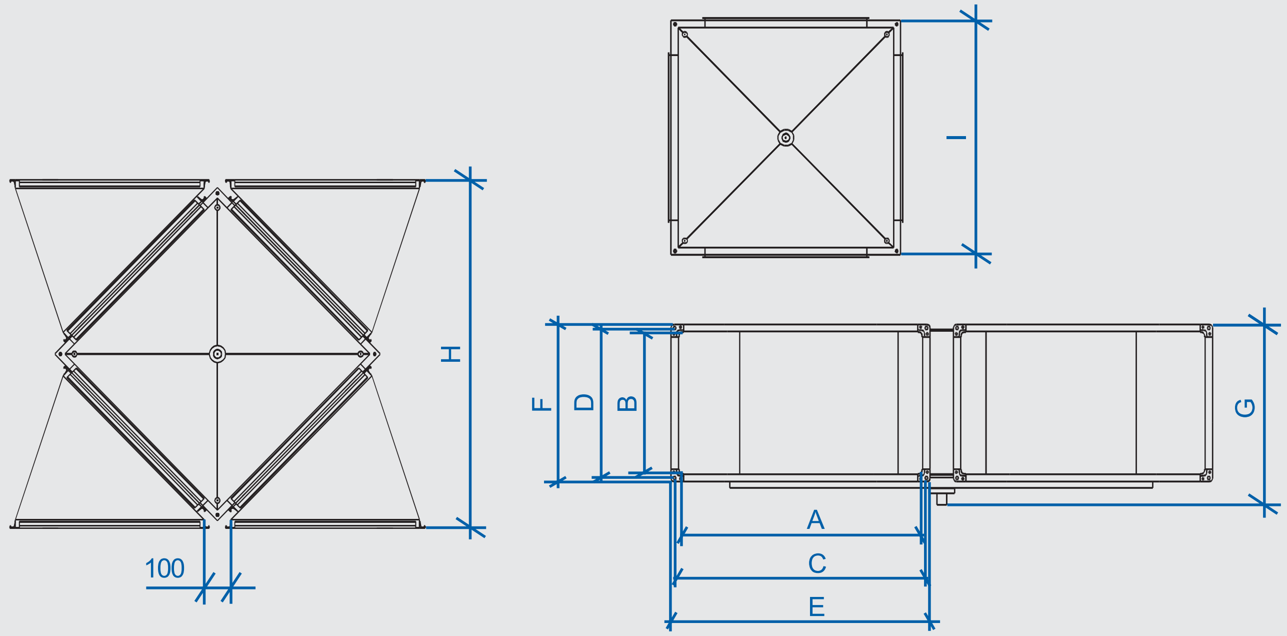


Table 1 - Dimensions and weights of heat exchangers

Heat Exchanger	Dimensions (mm)									Weight
	A	B	C	D	E	F	G	H	I	m [kg]
HRV 40-20	400	200	420	220	440	240	250	845	561	19
HRV 50-25	500	250	520	270	540	290	300	985	661	21
HRV 50-30	500	300	520	320	540	340	350	985	661	23
HRV 60-30	600	300	620	320	640	340	400	1130	761	36
HRV 60-35	600	350	620	370	640	390	450	1130	761	37
HRV 70-40	700	400	720	420	740	440	500	1270	861	39
HRV 80-50	800	500	820	520	840	540	550	1410	961	53
HRV 90-50	900	500	930	530	960	560	600	1590	1107	94

Figure 7 - Example of elbow designation

OBL 60 - 30 / 45

Angle between the elbow inlet and outlet flanges (45°)*
Flange connection B dimension (cm)
Flange connection A dimension (cm)
Type designation OBL

* REMAK a.s. does not deliver elbows with other angles

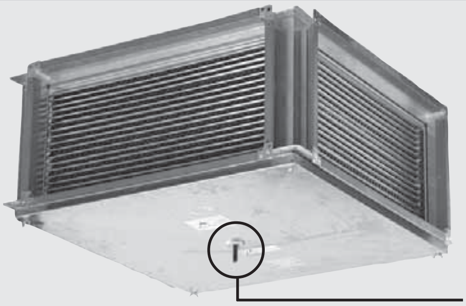
Figure 8 - Example of the summer insert designation

LV 60 - 30

Flange connection B dimension (cm)
Flange connection A dimension (cm)
Type designation LV

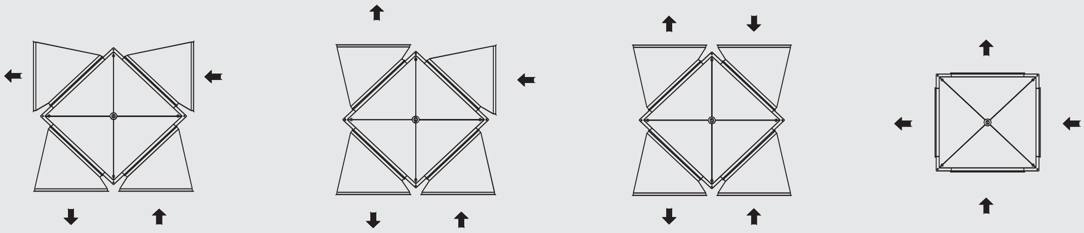
A PVC outlet is included in the delivery of the heat exchanger to drain condensate which may be created in the heat-exchange insert. It must be connected to the lowest point of the heat exchanger lid, which serves as a tray, to drain the condensate from the heat exchanger (if the heat exchanger is suspended under the ceiling with the lid directed downwards), see figures #9 and # 11 on page 216.

Figure 9 - PVC outlet



Condensate drainage outlet

Figure 10 - heat exchanger layout arrangements in the ducting depending on the orientation OBL elbows. /45



Heat Exchanger Dimensioning

Accessories

The following optional accessories can be ordered with HRV heat exchangers:

- OBL …/45 elbows to make the heat exchanger's installation in different layouts of ducting easy.
- LV summer insert (built-in assembly) .... For summer operation of the heat exchanger, the heat-exchange insert can be replaced with so-the called "summer insert". The summer insert avoids unwanted heat exchange, while the pressure loss is decreased by approximately 10% (this is advisable if a heat exchanger without a bypass is used in the inlet branch, respectively for air-handling systems without cooling).

Heat Exchanger Dimensioning, Parameters

On page 215 you will find correlation graphs of efficiency and pressure losses related to the air flow rate for each heat exchanger. The heat exchanger's efficiency is defined by the following relationship:

$$\Phi = (t_{p2} - t_{p1}) / (t_{o1} - t_{p1})$$

kde

t_{o1} is the outlet air temperature in the entry to the heat exchanger.

t_{p1} is the inlet air temperature in the entry to the heat exchanger.

t_{p2} is the inlet air temperature in the exit from the heat exchanger.

From this relationship and the known heat exchanger's efficiency, the required inlet air temperature tp2 in the heat exchanger's exit can be determined using the following relationship:

$$t_{p2} = \Phi \cdot (t_{o1} - t_{p1}) + t_{p1}$$

As the heat exchanger's efficiency is significantly dependent on the relative humidity of the outlet air (i.e. the higher the relative humidity, the higher the heat exchanger's efficiency), two curves, the so-called "dry" (minimum) and "wet" (maximum) efficiency, are included in each graph. The value of relative humidity at which a significant change in the heat exchanger's efficiency was manifested was always selected as the relative humidity for the "dry" efficiency. The value of the "wet" efficiency was determined at 100% air relative humidity.

The temperature of the outlet air exhausted from the ventilated room and the temperature of the inlet (outdoor) air are further parameters selected for the structure of the graphs. The outlet air temperature was selected as t_{o1} = 25°C, and the inlet air temperature was in all cases selected as t_{p1} = -10°C. However, the dependency of the heat exchanger's efficiency on these values is not too significant; therefore, if needed, the outlet air temperature behind the heat exchanger for other t_{o1} and t_{p1} temperatures can also be determined with decent accuracy using the following graphs and above-mentioned relationship. If the calculated outdoor air temperature is lower than -10°C it is advisable, in relation to the outdoor air humidity, to consider installation of an air preheater situated in front of the heat exchanger which would raise the air temperature at the entrance to the heat exchanger, or consider installation of active antifreeze protection. Otherwise, there is the risk of the heat exchanger freezing, which would cause malfunction of the entire air-handling system (for details, refer to the section "Heat Exchanger Bypass and Antifreeze Protection"). Conditions in which the risk of frosting exists can be precisely determined by the calculation using AeroCAD program

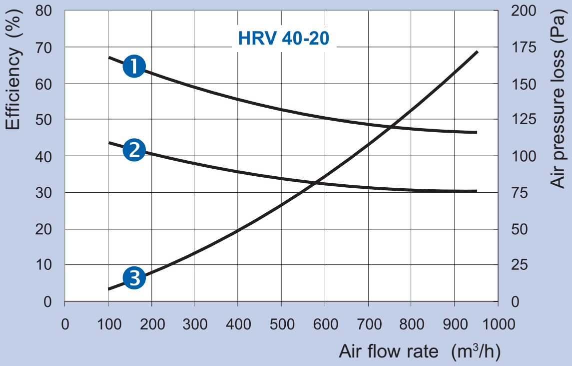
On the basis of these data or relationships, all necessary final parameters of the heat exchangers can be obtained from the required default data:

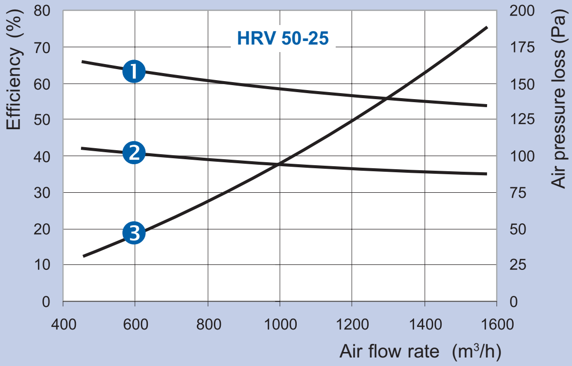
- **Required default parameters**
  - Selected heat exchanger's size
  - Air flow rate (velocity in the cross-section)
  - Relative outlet air humidity
- **Determined final parameters**
  - Outlet air temperature behind the heat exchanger
  - Heat exchanger's pressure loss

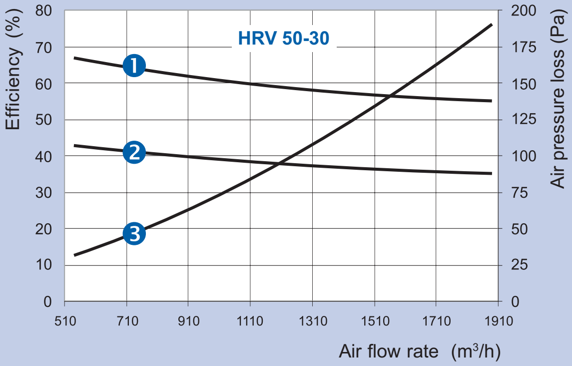
Heat Exchanger Dimensioning Procedure

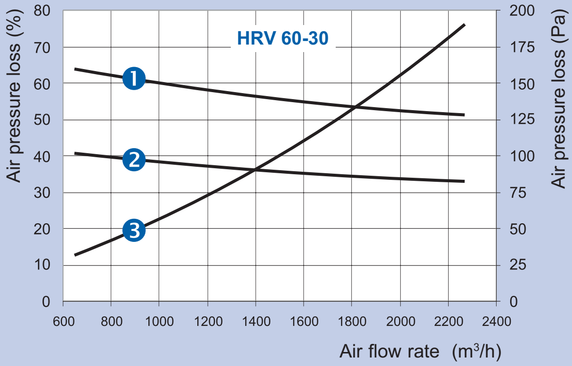
- Dry" or "wet" efficiency of the heat exchanger for the required values of the air flow rate can be determined from the graph. If the expected relative humidity value of the outlet air lies in the area between the "dry" and "wet" efficiency curves, the efficiency can be estimated within the range between these limit curves.
- The observed efficiency of the heat exchanger and expected air temperatures, i.e. the inlet air temperature behind the heat exchanger and the temperature of the air exhausted from the room, are put into the following relationship $t_{p2} = \Phi . (t_{o1} - t_{p1}) + t_{p1}$
- The heat exchanger's pressure loss at the given air flow rate for calculation of the assembly pressure loss balance needed for the fan selection can be obtained from the graph. Condensation of the air humidity can significantly increase the heat exchanger's pressure loss; it can be in the range from 20% to 50%. If the outlet air humidity value lies within the range above the "dry" efficiency curve, it is advisable for pressure loss balance purposes to increase the value derived from the graph by at least 30%.
- The calculated air temperature tp2 will be used to dimension the water heater as the inlet air temperature.

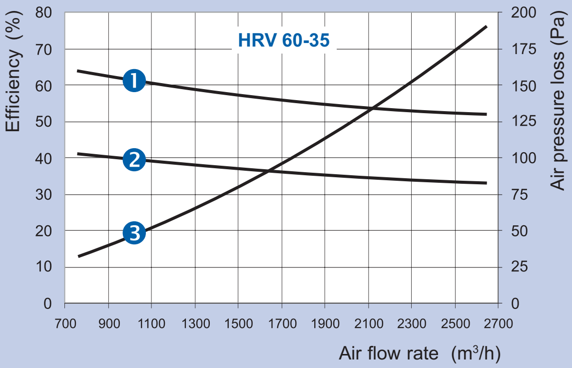
Heat Exchanger Working Characteristics

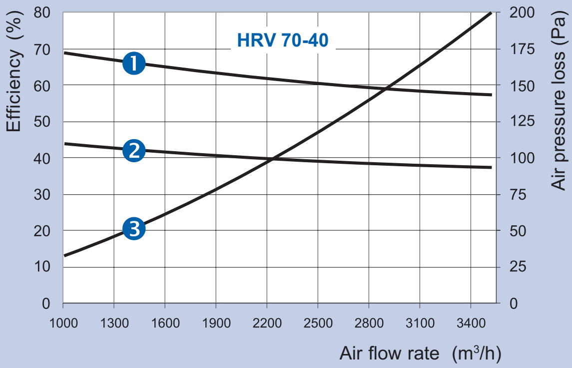


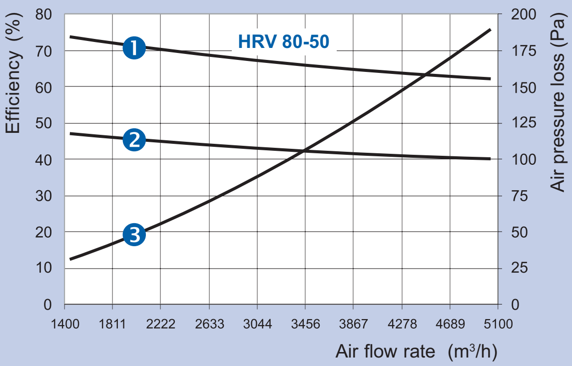












1. Correlation of "wet" efficiency [%] and pressure loss [Pa] related to the air flow rate [m³/h] through the heat exchanger
2. Correlation of "dry" efficiency [%] related to the air flow rate [m³/h] through the heat exchanger without condensation (applicable for outlet air relative humidity from 0 % to 25 %)
3. Correlation of pressure loss [Pa] related to the air flow rate [m³/h] through the heat exchanger

Efficiency of heat exchangers

		Inlet (outdoor air)	Outlet (indoor air)
Temperature	°C	**-15**	**20**
Relative air humidity for "dry" efficiency [1]	%	It does not affect the result	**max. 25**
Relative air humidity for "wet" efficiency [1]	%		**min. 65**
Air flow	m³/h	**1400 – 5100** (Ratio inlet/outlet = 1:1)	
Altitude	m	**250**	

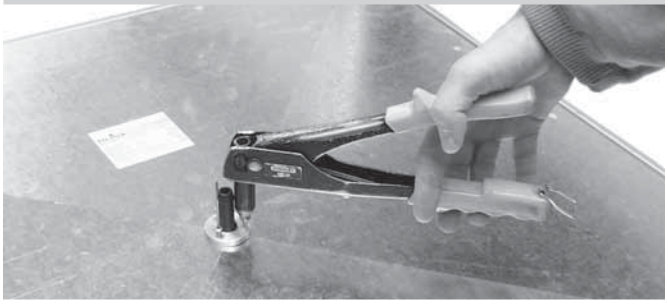
[1] If the outlet air relative humidity is within the range from 25% to 65%, the efficiency curve will lie proportionally between the "dry" and "wet" efficiency curves. The precise values for any operating conditions can be calculated using the AeroCAD design program.

Installation, Service and Maintenance

Mounting and Installation

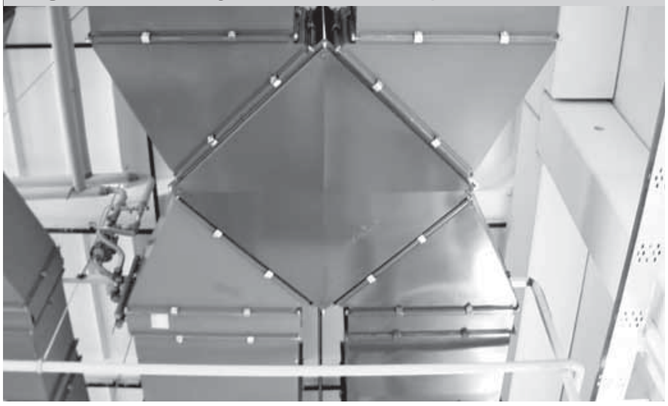
■ Installation of the heat exchanger can be performed in a way similar to installation of other Vento components. The flange dimensions are compatible with Vento components. The casing of the heat exchanger is provided with holes in its corners. These holes can be used to suspend the heat exchanger on M8 threaded rods.
■ Before installation, paste self-adhesive sealing onto the connecting flange faces.
■ It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides, at least on one flange connection.
■ Condensate can form on individual vanes (heat exchange surfaces); therefore, the heat-exchange insert is always situated inside the heat exchanger casing with the side marked with the VRCH (TOP) label up. This along with the shape of the vane surfaces minimizes the possibility of accumulation of condensate on individual layers, and thus continuous draining of condensate drops from the vane surfaces is ensured.

Figure 11 - PVC outlet



As the inlet and outlet air line branches intersect within the heat exchanger, the actual air flow cross-section is approx. half of its entire cross-section, and the air flow speed is doubled. Due to the actual air flow speed, condensate drops can be carried from the vanes down the air duct. In installations where this can happen, it is necessary to slope the duct behind the heat exchanger down, solder the joints, and provide the lowest duct point with a condensate draining outlet. The distance the condensate drops fall extends with increasing air flow speed. Depending on the air flow speed, this distance can be 1-3 m behind the heat exchanger.
A PVC outlet is included in the delivery of the heat exchanger to drain condensate which may form in the heat-exchange insert. It must be connected to the lowest point of the heat exchanger, which serves as a collecting tray (if the heat exchanger is suspended with the lid directed downwards) - see figures #9 and # 11.
If the HRV heat exchanger is installed on the floor with its lid up, the condensate draining outlet is installed only in the following air duct. Therefore, all condensate runs out from the heat exchanger into the duct.

Figure 12 - Flange bar screw clamps



Recommendations:
■ Air filters must be installed in front of the cold and hot air inlets to avoid fouling of the heat-exchange surfaces, gradual reduction of the heat exchange effectiveness, and increasing pressure losses.
■ To brace flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping (see figures # 15 and # 13).

Bypass and Antifreeze Protection

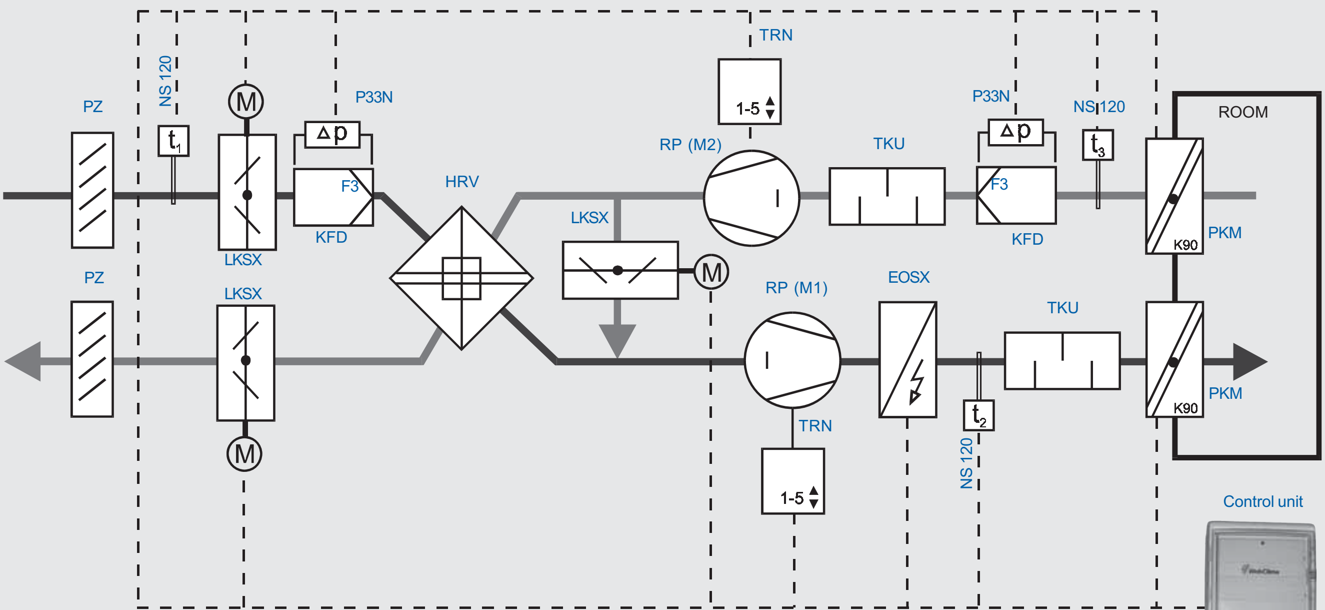
Installation of the plate heat exchanger without the bypass is advisable only for applications where condensate ice accretion on the heat exchanger fins cannot form and the heat exchanger location and operating and maintenance schedule enable easy access and prompt operator intervention. In air-handling systems without cooling, this installation requires seasonal replacement of the heat-exchange insert by the "summer insert" to avoid unwanted heat exchange during the summer season. If the air-handling system is equipped with cooling (respectively, if the room is cooled in another way) it is possible and convenient to use the heat-exchange insert during both winter and summer seasons.
The heat exchanger's bypass can be installed using dampers and a duct bypass connected to the inlet branch to provide the heat exchanger with antifreeze protection, or to enable automatic cut out of the heat exchanger in air-handling systems without cooling. The bypass control depends on the bypass's function (antifreeze protection, summer bypass, or both), and using a suitable sensor (a surface temperature sensor or a differential pressure sensor - best equipped with an adjustable hysteresis) the bypass control can be autonomous or ensured in cooperation with a control unit. The cross-section of the bypass duct should be dimensioned at 40% of the cross-section1) of the heat exchanger connecting flanges.

Figure 13 - Flange bar screw clamps

1) The bypass duct must be dimensioned, respectively regulated, so that the air pressure loss in the duct bypass will be approximately the same as the air pressure loss in the heat exchanger. Otherwise, the parameters of the air-handling system could be changed; respectively the working point of the supply fan could be shifted into the non-working (forbidden) area. Therefore, the supply current of the fan must be checked during heat exchange mode as well as during bypass mode.

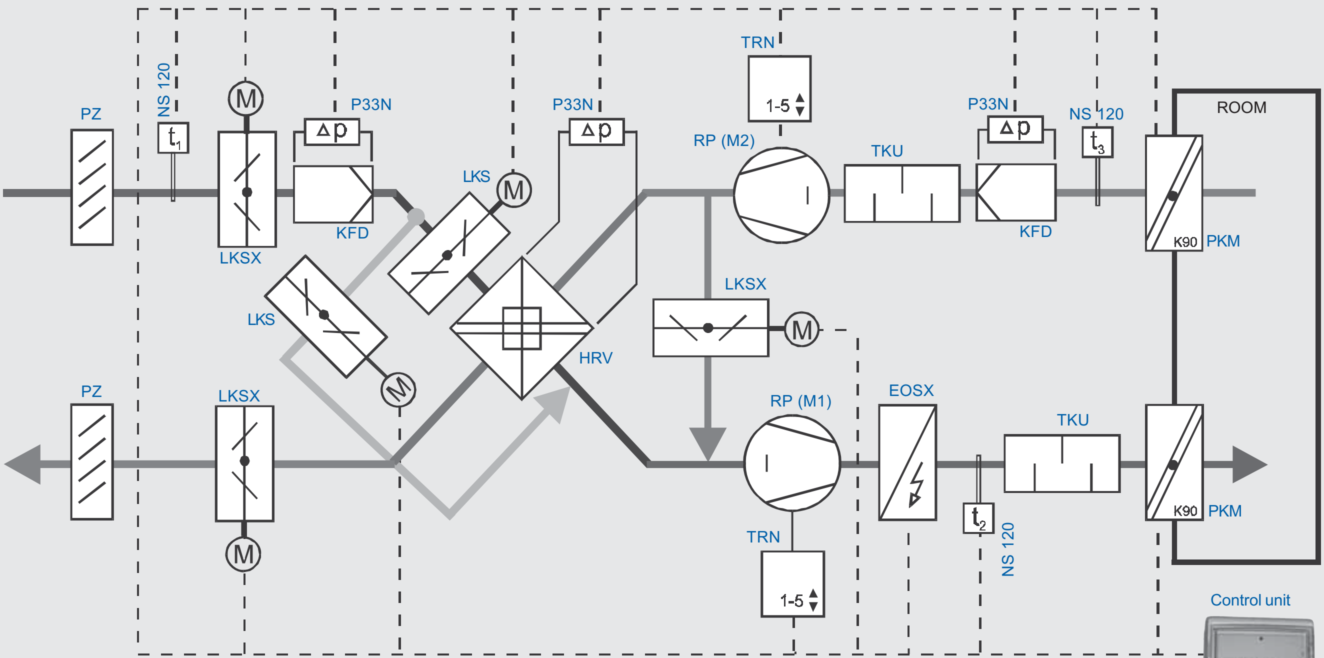
Installation Examples

Figure 14 - Heat exchanger without a bypass



Installation without the heat exchanger's bypass
An example of the heat exchanger installation in an air-handling system without a bypass. This figure shows an example of the ventilation system including air heating using an electric heater, a heat exchanger and a mixing section. If exclusion of the heat exchange during the summer season is required, it is necessary to install the LV summer insert.

Figure 15 - Heat exchanger with a bypass



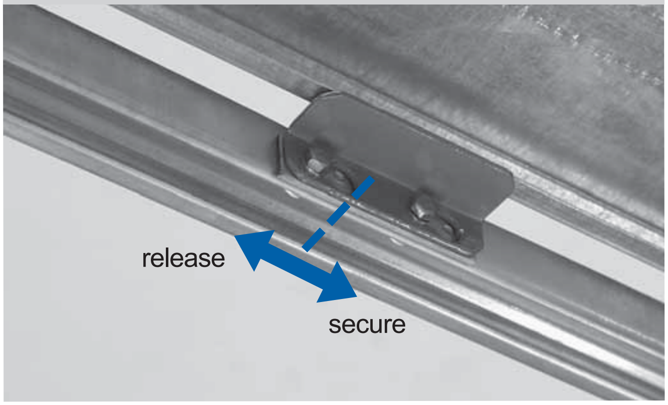
Installation with the heat exchanger's bypass
An example of the heat exchanger installation in an air-handling system with a bypass. This figure shows the same example as the previous figure completed with a heat exchanger bypass and two inversely working (one closes - the second opens) LKS dampers as a part of the antifreeze protection.This application does not require replacement of the heat-exchange insert by the summer insert. Unwanted air heat exchange can be eliminated by the control of dampers.

Installation, Service and Maintenance

Operation and Maintenance

HRV heat exchangers, when used in accordance with the chapter "Operating Conditions and Position", do not require special maintenance. Recommended checks (e.g. cleaning and checking the insert for damage) are included in the service manual, and are usually performed when changing the winter assembly for the summer one, and vice-versa. To avoid condensation problems, it is necessary to keep the condensate drainage free. The replacement of the block shaped heat-exchange insert (resp. summer insert) can be performed after removing the four wing screws from the bottom lid of the heat exchanger. The block is secured inside the heat exchanger by movable locking pieces. After loosening the securing screws, the locking pieces can be shifted aside (see fig. #16) and the heat exchange insert can be removed from the casing. If the heat exchanger is installed using suspensions, first it will be necessary to push (lift) the heat-exchange insert to release the locking pieces.
Fouling can be carefully removed from the fins of the heat-exchange insert by washing it out with a detergent solution.

Figure 16 - Securing screw



Technical information

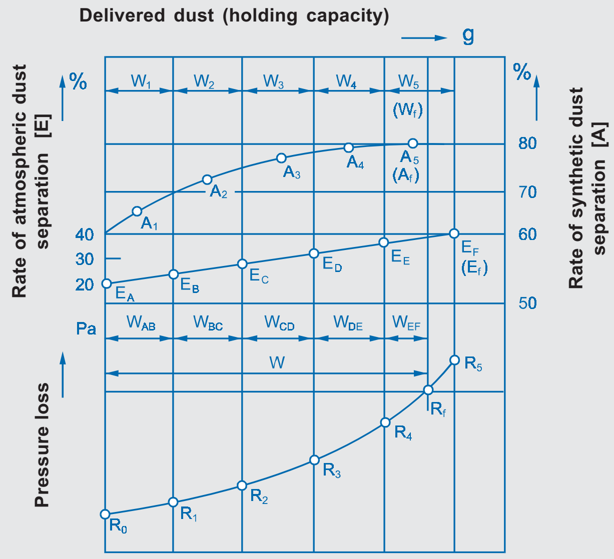
Filtration Classes

Air filters are classified depending on the results of tests made in accordance with the ČSN EN 779 standard, and classed into three groups and classes according to the achieved filtration parameters (mean rate of synthetic dust separation or mean rate of atmospheric dust separation). Group G (Grobstaubfilter - coarse filter) is divided into the following classes: G1, G2, G3, G4.
Group F (Feinstaubfilter - fine filter) is divided into the following classes: F5, F6, F7, F8, F9.
Classification of individual classes is specified by the mean rate of separation, and it is included in the table, which also contains classes pursuant to the DIN 24 185 standard to enable comparison.

Table 1 - Filtration Classes

Filtration Classes – ČSN EN 779			Filtration Classes - DIN 24 185		
Filtration Class	Mean rate of synthetic dust separation A_m [%]	Mean rate of atmospheric dust separation E_m [%]	Filtration Class	Mean rate of synthetic dust separation A_m [%]	Mean rate of atmospheric dust separation E_m [%]
G1	$A_m < 65$	-	EU 1	$A_m < 65$	-
G2	$65 < A_m < 80$	-	EU 2	$65 < A_m < 80$	-
G3	$80 < A_m < 90$	-	EU 3	$80 < A_m < 90$	-
G4	$90 < A_m$	-	EU 4	$90 < A_m$	-
F5	-	$40 < E_m < 60$	EU 5	-	$40 < E_m < 60$
F6	-	$60 < E_m < 80$	EU 6	-	$60 < E_m < 80$
F7	-	$80 < E_m < 90$	EU 7	-	$80 < E_m < 90$
F8	-	$90 < E_m < 95$	EU 8	-	$90 < E_m < 95$
F9	-	$95 < E_m$	EU 9	-	$95 < E_m$

Figure 1 - Chart of filtration parameters



Explanatory notes:

A_m	Mean rate of synthetic dust separation [%]
$A_1 \ldots A_n$	Values of the rate of synthetic dust separation in each measuring cycle [%]
A_f	Values of the rate of synthetic dust separation in each measuring cycle* [%]
W	Total weight of the delivered dust until the reaching the final point of the test [g]
$W_1 \ldots W_n$	Weight of the delivered dust in each measuring cycle [g]
W_f	Weight of the delivered dust in the last batch until the moment of reaching the final point of the test* [g]
$E_A \ldots E_n$	Values of the rate of synthetic dust separation in each measuring cycle [%]
E_f	Last included value of the rate of atmospheric dust separation [%]
R_0	Initial pressure loss of the clean filter at the nominal air flow [Pa]
$R_1 \ldots R_n$	Values of the pressure loss of the filter at the nominal air flow in each measuring cycle [Pa]
R_f	Last included value of the pressure loss at the nominal air flow* [Pa]

* In the course of the last testing dust batch, the value of final pressure loss was reached or surpassed.

Examples of calculation of the mean rate of synthetic dust separation

$$A_m = \frac{1}{W} (W_1A_1 + W_2A_2 + W_3A_3 + W_4A_4 + W_5A_5)$$

Glossary

Each table of filter parameters contains basic values which are defined by the ČSN EN 779 standard.
These values and some of their dependencies (correlations) are demonstrated in the figure "Chart of filtration parameters".

Nominal air flow volume rate – V [m³/s]

The nominal air flow volume rate is a testing parameter determined by the manufacturer for which the filter is designed (for a reference air density of 1.2 kg/m3). Deviations from the nominal air flow during filter operation are common, and do not mean an error in the design. It is only necessary to consider air flow optimization related to the filter pressure loss.

Face area – S_0 [m²]

The face area is a cross-sectional area of the test duct just in front of the filter (without transition pieces).

Face velocity – v_0 [m/s]

The face velocity is the air flow velocity in the face area (i.e. the air flow volume rate divided by the face area).

Effective filtration area – S [m²]

The effective filtration area is the total area of the filter surface area through which testing air flows.

Filtration velocity – v [m/s]

The filtration velocity is the air flow velocity in the face area (i.e. the air flow volume rate divided by the effective filtration area).

Initial pressure loss – R_0 [Pa]

Initial pressure loss is the pressure loss of the clean filter at the nominal air flow volume rate; it is often marked as Δp_0.

Final pressure loss – R_f [Pa]

Final pressure loss is a value related to the nominal air flow and nominal testing conditions. It is often marked as Δp_f. During operation, pressure loss gradually rises due to the filter fouling with dust. Therefore, the final pressure loss represents an economical pressure loss at which the filter should be replaced. Recommended value for G Group filters is 250 Pa and for F Group filters 400 Pa.
If the actual air flow rate differs from the nominal air flow rate, the final pressure loss will also be different.

Rate of atmospheric dust separation – E [%]

The rate of atmospheric dust separation, also known as opacitometric rate of separation, is the filter capability to separate atmospheric dust from the testing air. The rate of atmospheric dust separation is determined by measuring the diffuse-transmission factor.

Initial rate of atmospheric dust separation – E_A [%]

Initial rate of atmospheric dust separation is the first value of the rate of atmospheric dust (opacitometric) separation before delivering the dust into the filter.

Technical information

Mean rate of atmospheric dust separation – E_m [%]
The mean rate of atmospheric dust separation is the average value of result values of atmospheric dust (opacitometric) separation.

Rate of synthetic dust separation – A [%]
The rate of synthetic dust separation is the filter capability to separate synthetic dust from the testing air, and it is gravimetrically determined. It represents the ratio of the testing dust weight separated by the filter and the total dust weight delivered into the filter.

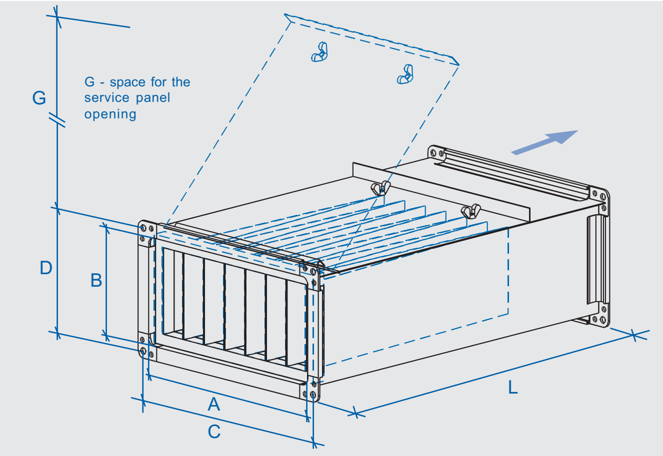
Initial rate of synthetic dust separation – A_1 [%]
Initial rate of atmospheric dust separation is the first value of the rate of synthetic dust separation got from the first testing dust batch of 30 g.

Mean rate of synthetic dust separation – A_m [%]
The mean rate of synthetic dust separation is the average value of result values of synthetic dust separation.

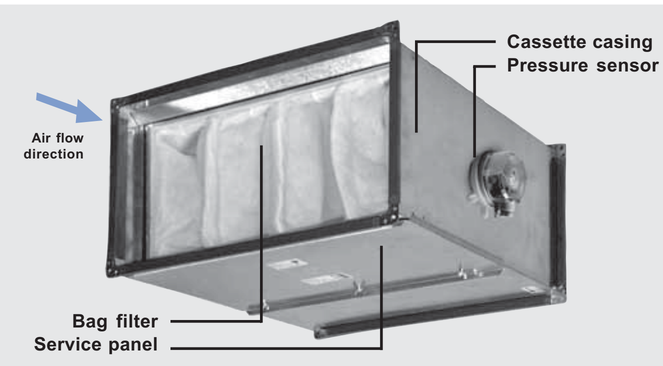
Filter holding capacity (static) – W [g]
The filter holding capacity represents the amount of trapped dust in the course of the test until the final pressure loss is reached. For the purposes of the static test, it is expressed in grams [g], and for the purposes of the dynamic test, in grams per square meter [g/m^2].

Testing synthetic dust
Testing synthetic dust consists of 72 % of fine "Air Cleaner Test Dust", 23 % of "Molocco Black", and 5 % of No.7 cotton linters. This testing dust compound must be delivered by the manufacturer in the above-mentioned composition.

KFD Bag Filter Cassette



	A (mm)	B (mm)	C (mm)	D (mm)	G (mm)	L (mm)	m ±10% (kg)
KFD 30-15	300	150	320	170	310	550	6,5
KFD 40-20	400	200	420	220	410	550	8
KFD 50-25	500	250	520	270	410	650	11
KFD 50-30	500	300	520	320	410	650	12
KFD 60-30	600	300	620	320	410	650	13
KFD 60-35	600	350	620	370	410	650	14
KFD 70-40	700	400	720	420	410	720	18
KFD 80-50	800	500	820	520	410	800	21
KFD 90-50	900	500	930	530	405	800	24
KFD 100-50	1000	500	1030	530	410	800	27



Filtration Bag Replacement

1. Loosen the service panel wing screws.
2. Release the service panel from hinges.
3. Remove the filter in the following way: First push its frame back (in the air flow direction), and then pull it out of the guiding rails

Example of designation

KFD 60 - 35

Flange connection B dimension (cm)
Flange connection A dimension (cm)
Type designation of the filter cassette

Application

After inserting the required filter insert, the bag filter cassette is intended for trapping solid and fibre particles from the transported (outdoor or circulating) air. The bag filter protects the environment of the ventilated rooms and air-handling components (fans, heaters, coolers, and heat exchangers).

Operating Conditions and Position

The KFD bag filter cassette should be installed in the air-handling duct at the beginning of the assembly (always in front of the exchangers, heat exchanger, and fan). The horizontal or vertical (the air flow direction downward) positions are recommended. The filters are designed for indoor use. When installed outside, they must be protected against water by a cover. Transported air must be free of corrosive substances or chemicals aggressive to zinc and rubber. Acceptable temperature of transported air can range from -30 °C to +70 °C.

Dimensional and Type Range

The back filter cassettes are manufactured in all ten dimensional ranges, from 30-15 to 100-50.

Materials

The external casing and connecting flanges are made of galvanized steel sheets. The connecting bar flanges are 20 mm (KFD 30-15 to KFD 80-50) or 30 mm (KFD 90-50 and 100-50) high. Perfect tightness of the filter insert and service panel is ensured by rubber sealing.

Installation, Maintenance and Service

The KFD bag filter cassettes must be installed in the air-handling duct so that the air-flow direction through the filter will follow the arrow on the casing. Before installation, paste self-adhesive sealing onto the connecting flange face. To connect the filter flanges, use galvanized M8 screws and nuts (M10 only for KFD 100-50). It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping. The removable inspection panel must be easily accessible. If installed into a ceiling, space for the service panel opening and filter replacement must be taken into account. This service space is specified by the G dimension, see the table

Accessories

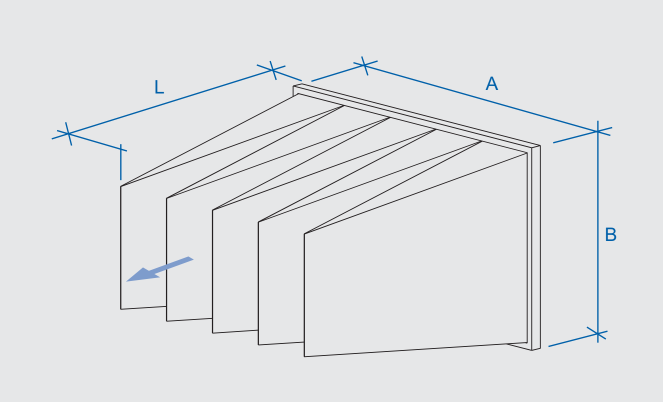
A bag filter of the corresponding size and required filtration class is an essential accessory of the KFD filter cassette, while the P33N differential pressure sensor is a recommended accessory

- KF3 – G3 class bag filter
- KF5 – F5 class bag filter
- KF7 – F7 class bag filter
- P33N – differential pressure sensor

Service

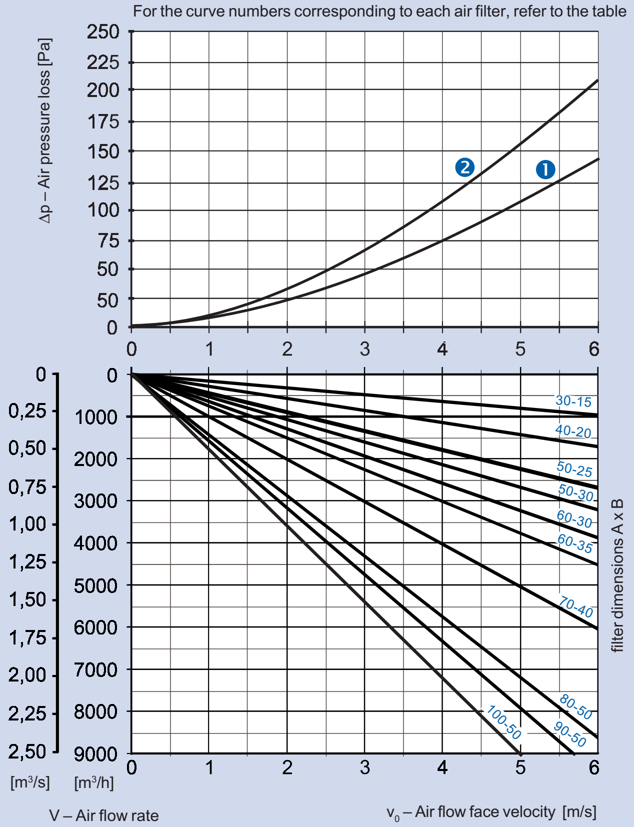
The filters require regular inspection for fouling and replacement, if necessary. Inspection and filter replacement can be performed after loosening the wing screws and removing the service panel from the cassette casing. The filter can be removed in the following way: First push its frame back (in the air flow direction), and then pull it out of the guiding rails. Install the new filter following the reverse way.

KF3 Bag Filters



Air Pressure Loss of KF3 Bag Filters
Clean filter inserts

For the curve numbers corresponding to each air filter, refer to the table



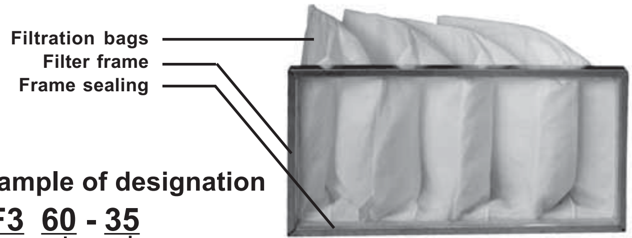
Application
KF3 bag filters are designed to be used in KFD filter cassettes. They are used for single-stage air filtration in simpler air-handling systems or as pre-filters for the first filtration stage to separate coarser dust particles.

Operating Conditions and Position
Maximum temperature of the transported air can be up to +100 °C while air relative humidity is not limited (it can be up to 100 %).

Dimensional and Type Range
KF3 bag filters are manufactured in all ten dimensional ranges, from 30-15 to 100-50.

Materials
Filtration bags are made of unwoven, thermally and mechanically reinforced 100 % polyether textile of 150 g/m2 surface density. After inflating, the geometric shape of the filter bags is maintained by plastic braces which enable maximum utilization of the bag filtration surface. The fixing frame is made of galvanized sheets. The filter bags are fixed to the frame and sealed with a PE strip.

Installation, Maintenance and Service
The filters require regular inspections for fouling. During operation, pressure loss gradually rises due to the filter fouling with dust. Final air pressure loss at the nominal air flow is 250 [Pa]. At air flow rates different from the nominal air flow rate we recommend replacing the filter if the actual air pressure loss is double that of the clean filter pressure loss. After reaching the final pressure loss, replace the filter with a new one [1].



Example of designation

KF3 60 - 35

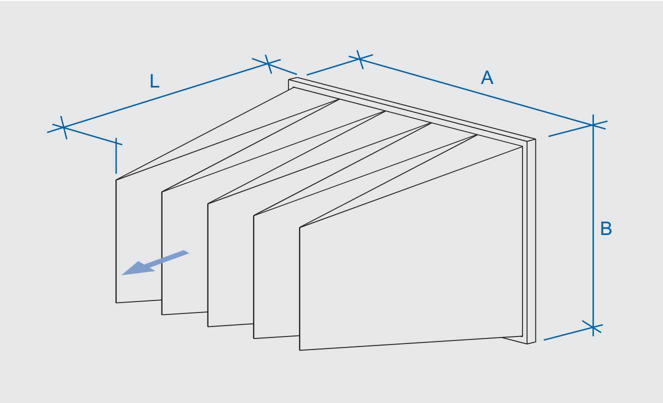
- 35 – Cassette flange connection B dimension (cm)
- 60 – Cassette flange connection A dimension (cm)
- KF3 – G3 class bag filter

Filter Type		KF3									
A-B dimensions	[cm]	30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50	100-50
L dimension	[cm]	42	42	52	52	52	52	60	68	68	68
Filtration Class - ČSN EN 779	[-]	G 3									
Mean rate of synthetic dust separation A_m	[%]	83,3									
Filtration area	[m^2]	0,49	0,66	1,28	1,49	1,54	1,75	2,79	3,91	3,98	4,15
Number of bags	[ks]	3	3	4	4	4	4	5	5	5	5
Weight	[kg]	1,5	1,5	2	2,5	2,5	3	3	3,5	3,5	4
Rated (nominal) air flow	[m^3/h]	670	900	1740	2030	2090	2380	3790	5320	5410	5644
Initial pressure loss [2]	[Pa]	114	71	101	68	54	52	68	67	57	61
Clean state pressure loss	Curve No.	2	2	2	1	1	1	1	1	1	1
Final pressure loss [2]	[Pa]	250	250	250	250	250	250	250	250	250	250
Holding capacity	[g]	216	291	565	657	679	772	1231	1725	1756	1830
Thermal resistance	[°C]	max. + 100									
Combustibility class	[-]	F1 (according to DIN 53 438)									
Recoverability	[-]	Limited via a dry process (impaired filter properties can be expected)									

[1] Fouled filter can only be partly recovered via a dry process (dusted or vacuumed); however, impaired filter properties can be expected after the filter recovery.

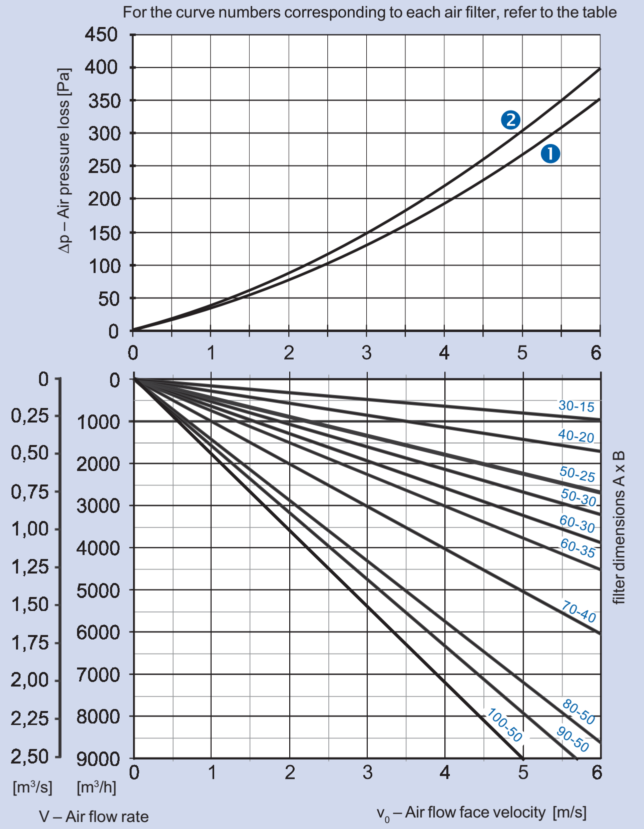
[2] At the nominal air flow

KF5 Bag Filters



Air Pressure Loss of KF5 Bag Filters

Clean filter inserts



Application

KF5 bag filters are designed to be used in KFD filter cassettes. They are used for the second stage or single air filtration in more sophisticated air-handling systems to separate fine dust particles.

Operating Conditions and Position

Maximum temperature of the transported air can be up to +100 °C while air relative humidity is not limited (it can be up to 100 %).

Dimensional and Type Range

KF5 bag filters are manufactured in all ten dimensional ranges, from 30-15 to 100-50.

Materials

Filtration bags are made of progressively designed, unwoven 100 % synthetic textile of 185 g/m2 surface density. After inflating, the geometric shape of the filter bags is maintained by plastic braces which enable maximum utilization of the bag filtration surface. The fixing frame is made of galvanized sheet. The filter bags are fixed to the frame and sealed with a PE strip.

Installation, Maintenance and Service

The filters require regular inspections for fouling. During operation, pressure loss gradually rises due to the filter fouling with dust. Final air pressure loss at the nominal air flow is 400 Pa. At other air flow rates we recommend replacing the filter if the actual air pressure loss is double that of the clean filter pressure loss. This filter cannot be recovered; after reaching the final pressure loss, replace the filter with a new one.

Filtration bags
Filter frame
Frame sealing

Example of designation

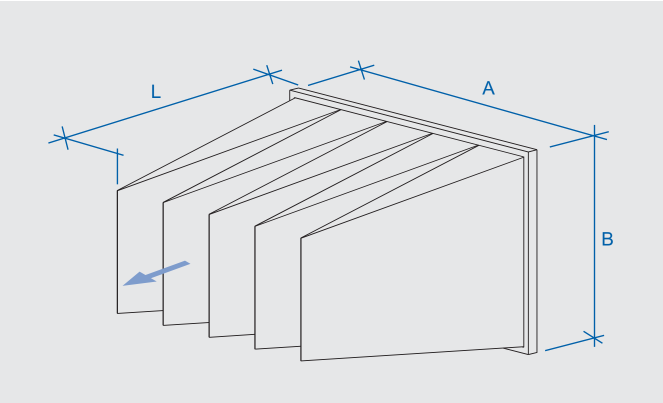
KF5 60 - 35

Cassette flange connection B dimension (cm)
Cassette flange connection A dimension (cm)
F5 class bag filter

Filter Type		KF5									
A-B dimensions	[cm]	30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50	100-50
L dimension	[cm]	42	42	52	52	52	52	60	68	68	68
Filtration Class - ČSN EN 779	[-]	F5									
Mean rate of synthetic dust separation A_m	[%]	97,2									
Mean rate of atmosph. dust separation E_m	[%]	60,1									
Filtration area	[m^2]	0,49	0,66	1,28	1,49	1,54	1,75	2,79	3,91	3,98	4,15
Number of bags	[ks]	3	3	4	4	4	4	5	5	5	5
Weight	[kg]	1,5	1,5	2	2,5	2,5	3	3	3,5	3,5	4,5
Rated (nominal) air flow	[m^3/h]	310	420	837	975	1010	1145	1825	2560	2600	2711
Initial pressure loss (2	[Pa]	82	59	68	65	54	59	73	72	63	70
Clean state pressure loss		2	2	1	1	1	2	2	2	2	2
Final pressure loss (2	[Pa]	450	450	450	450	450	450	450	450	450	450
Holding capacity	[g]	19	25	48	56	58	66	105	147	150	156
Thermal resistance	[°C]	max. + 100									
Combustibility class	[-]	F1 (according to DIN 53 438)									
Recoverability	[-]	Unrecoverable									

(1 At nominal air flow

KF7 Bag Filters



Application

KF7 bag filters are designed to be used in KFD filter cassettes. They are mostly used for second-stage air filtration in highly sophisticated and clean air-handling systems to separate fine dust particles.

Operating Conditions and Position

Maximum temperature of the transported air can be up to +100 °C while air relative humidity is not limited (it can be up to 100 %).

Dimensional and Type Range

KF7 back filters are only manufactured in eight dimensional ranges, from 50-25 to 100-50.

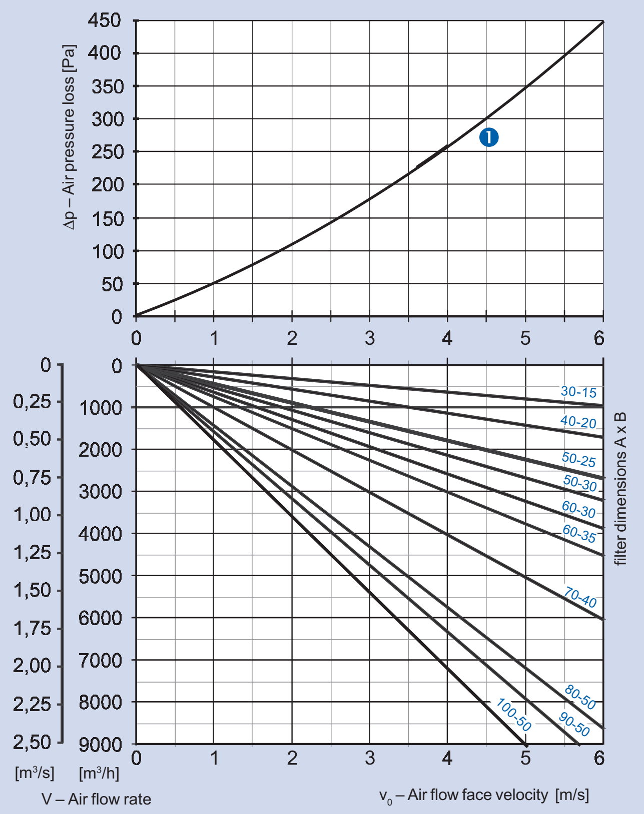
Materials

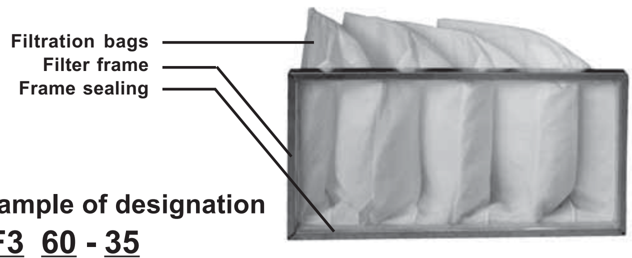
Filtration bags are made of progressively designed, unwoven 100 % synthetic textile of 205 g/m2 surface density. After inflating, the geometric shape of the filter bags is maintained by plastic braces which enable maximum utilization of the bag filtration surface. The fixing frame is made of galvanized sheet. The filter bags are fixed to the frame and sealed with a PE strip.

Installation, Maintenance and Service

The filters require regular inspections for fouling. During operation, pressure loss gradually rises due to the filter fouling with dust. Final air pressure loss at the nominal air flow is 400 Pa. At other air flow rates, we recommend replacing the filter if the actual air pressure loss is double that of the clean filter pressure loss. This filter cannot be recovered; after reaching the final pressure loss, replace the filter with a new one.

Air Pressure Loss of KF5 Bag Filters
Clean filter inserts





Example of designation

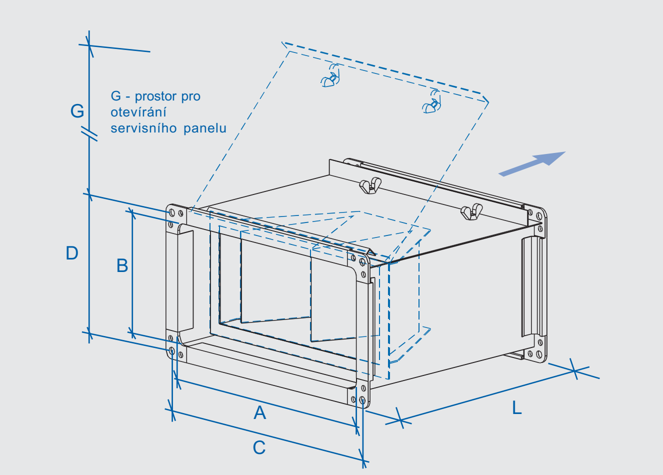
KF3 60 - 35

- 35 – Cassette flange connection B dimension (cm)
- 60 – Cassette flange connection A dimension (cm)
- KF3 – F7 class bag filter

Filter Type		KF7							
A-B dimensions	[cm]	50-25	50-30	60-30	60-35	70-40	80-50	90-50	100-50
L dimension	[cm]	52	52	52	52	60	68	68	68
Filtration Class - ČSN EN 779	[-]	F7							
Mean rate of synthetic dust separation A_m	[%]	98,11							
Mean rate of atmosph. dust separation E_m	[%]	80,46							
Filtration area	[m²]	1,28	1,49	1,54	1,75	2,79	3,91	3,98	4,15
Number of bags	[ks]	4	4	4	4	5	5	5	5
Weight	[kg]	2	2,5	2,5	3	3	3,5	3,5	4,5
Rated (nominal) air flow	[m³/h]	837	975	1010	1145	1825	2560	2600	2711
Initial pressure loss [2]	[Pa]	100	96	81	94	97	94	84	88
Clean state pressure loss		1	1	1	1	1	1	1	1
Final pressure loss [2]	[Pa]	450	450	450	450	450	450	450	450
Holding capacity	[g]	98	115	119	135	215	302	308	321
Thermal resistance	[°C]	max. + 100							
Combustibility class	[-]	F1 (according to DIN 53 438)							
Recoverability	[-]	Unrecoverable							

(1 At nominal air flow

VFK Insert Air Filter Cassette

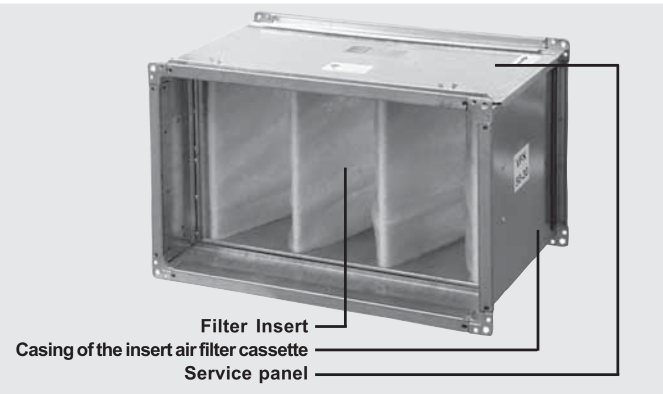


	A (mm)	B (mm)	C (mm)	D (mm)	G (mm)	L (mm)	m ±10% (kg)
VFK 30-15	300	150	320	170	230	300	5
VFK 40-20	400	200	420	220	230	300	6
VFK 50-25	500	250	520	270	230	300	7
VFK 50-30	500	300	520	320	230	300	7
VFK 60-30	600	300	620	320	230	300	8
VFK 60-35	600	350	620	370	230	300	8
VFK 70-40	700	400	720	420	230	300	10
VFK 80-50	800	500	820	520	230	300	12
VFK 90-50	900	500	930	530	225	300	13
VFK 100-50	1000	500	1030	530	230	300	14

Example of designation

VFK 60 - 35

- 35 – Flange connection B dimension (cm)
- 60 – Flange connection A dimension (cm)
- VFK – Type designation of the insert air filter cassette



Filter Insert Removal

1. Loosen the service panel wing screws
2. Release the service panel from hinges
3. Remove the filter by pulling its frame out of the guiding rails

Application

After inserting the required filter insert, the filter cassette is intended for trapping solid and fibre particles from the transported (outdoor or circulating) air. The insert air filter protects the environment of the ventilated rooms and air-handling components (fans, heaters, coolers, and heat exchangers).

Operating Conditions and Position

The filter cassette should be installed in the air-handling duct at the beginning of the assembly (always in front of the exchangers, heat exchanger, and fan). It can work in any position. The filters are designed for indoor use. When installed outside, they must be protected against water by a cover. Transported air must be free of corrosive substances or chemicals aggressive to zinc and rubber. Acceptable temperature of transported air can range from -30 °C to +70 °C.

Dimensional and Type Range

VFK filter cassettes are part of the Vento air-handling modular system. They are manufactured in nine dimensional ranges, from 30-15 to 90-50.

Materials

The external casing and connecting flanges are made of galvanized steel sheets. The connecting bar flanges are 20 mm (VFK 30-15 to VFK 80-50) or 30 mm (VFK 90-50) high. Perfect tightness of the filter insert and service panel is ensured by rubber sealing.

Installation, Maintenance and Service

The filter cassettes must be installed in the air-handling duct so that the air-flow direction through the filter will follow the arrow on the casing. Before installation, paste self-adhesive sealing onto the connecting flange face. To connect the filter flanges, use galvanized M8 screws and nuts (M10 only for VKF 90-50). It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping.
The removable inspection panel must be easily accessible. If installed into a ceiling, space for the inspection panel opening and filter insert replacement must be taken into account. This service space is specified by the G dimension, see the table.

Accessories

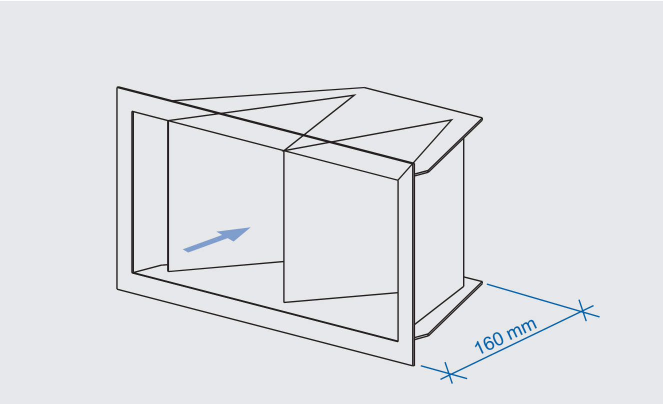
A bag filter of corresponding size and required filtration class is an essential accessory of the VFK filter cassette, while the P33N differential pressure sensor is a recommended accessory.

- VF3 – G3 filter insert (page 198)
- VF3N – Filter insert spare filtration textile
- P33N – differential pressure sensor

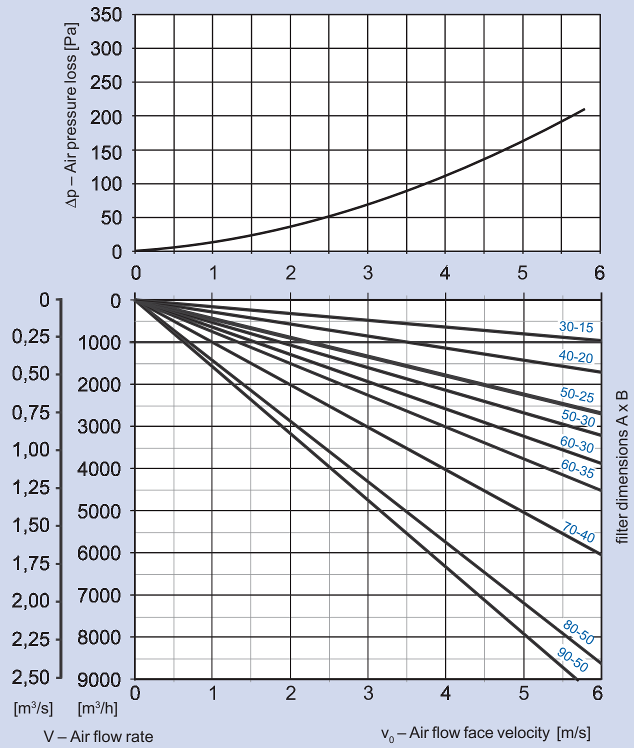
Service

The filter inserts require regular inspection for fouling and replacement of the filtration textile, if necessary. Inspection and filter insert replacement can be performed after loosening the wing screws and removing the service panel from the cassette casing. The filter can be removed by pulling its frame out of the guiding rails. Install the new filter insert following the reverse way.

VF3 Spare Filter Inserts



Air Pressure Loss of VFK Insert Filters
Clean filter inserts



Application

VF3 filter inserts are designed to be used in VFK filter cassettes. They are used for single-stage air filtration in simpler air-handling systems to separate coarser dust particles.

Operating Conditions and Position

Maximum temperature of the transported air can be up to +100 °C while air relative humidity is not limited (it can be up to 100 %).

Dimensional and Type Range

VF3 insert filters are manufactured in all nine dimensional ranges, from 30-15 to 90-50.

Materials

Filtration insert contains unwoven, thermally reinforced 100 % polyether textile of 220 g/m2 surface density. Filtration textile is stretched between aluminium braces in a precise lightweight frame made of galvanized sheets, creating a predefined geometric shape. Filtration textile is fixed to the frame edges by grip bars.

Accessories

Spare filtration textile is an accessory
- VF3N – Filter insert spare filtration textile

Installation, Maintenance and Service

The filter insert requires regular inspection for fouling and replacement of the filtration textile, if necessary. During operation, pressure loss gradually rises due to the filter fouling with dust. Final air pressure loss at the nominal air flow is 250 Pa. At other air flow rates we recommend replacing the filter if the actual air pressure loss is double that of the clean filter pressure loss. Fouled filtration textile can only be partly recovered via a wet process (washing in detergent solution); however, impaired filter properties, compared with the original state of the filter, can be expected after the filtration textile recovery.

Example of designation

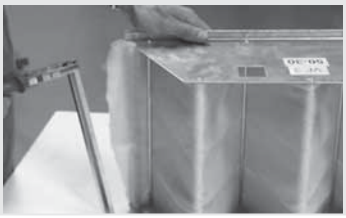
VF3 80 - 50

- 50 – Flange connection B dimension (cm)
- 80 – Flange connection A dimension (cm)
- VF3 – G3 (class 3) filter insert

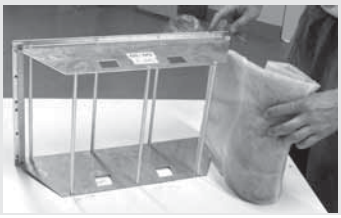
Filter insert textile replacement

Using pliers, pull off the grip bar of the filtration textile.

Remove the filtration textile from the braces, and replace it with a new one.

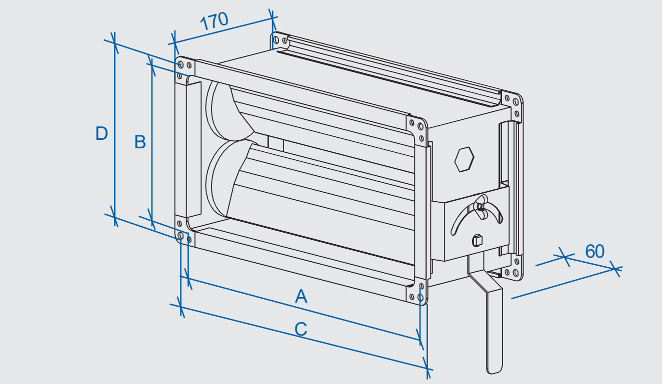


Release the filtration textile edge.



Filter Type		VF3								
A-B dimensions	[cm]	30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50
Mean rate of synthetic dust separation Am	[%]	80 - 85								
Filtration area	[m²]	0,07	0,11	0,21	0,25	0,33	0,4	0,6	0,86	1
Weight	[kg]	2	2	2,5	3	3	4	4	5	5
Rated (nominal) air flow	[m³/h]	380	600	1130	1350	1780	2160	3240	4640	5400
Initial pressure loss	[Pa]	47	39	52	52	60	64	77	78	82
Final pressure loss	[Pa]	250								
Holding capacity	[g]	35	56	106	126	167	202	303	434	505
Recoverability	[-]	Limited via a wet process (impaired filter properties can be expected)								

LKR Manual Blade Dampers



	A	B	C	D	m	graph
	(mm)	(mm)	(mm)	(mm)	(kg)	(curve no.)
LKR 30-15	300	150	320	170	4	1
LKR 40-20	400	200	420	220	4	1
LKR 50-25	500	250	520	270	5	2
LKR 50-30	500	300	520	320	6	1
LKR 60-30	600	300	620	320	7	1
LKR 60-35	600	350	620	370	7	2
LKR 70-40	700	400	720	420	8	1
LKR 80-50	800	500	820	520	10	1
LKR 90-50	900	500	930	530	11	1
LKR 100-50	1000	500	1030	530	13	1

Application

The LKR tight blade damper for the square duct is mostly used to regulate an air-handling system or manually close individual duct branches.

Operating Conditions and Position

This damper is intended for indoor and outdoor 1) applications in air flow free of solid, fibrous, sticky, or aggressive impurities. Operating position is arbitrary, and the range of operating temperatures can be from -30 °C to +70 °C. Pressure loss-air flow rate-opening angle correlation is shown in the graph "Blade damper pressure losses".

Dimensional and Type Range

LKR blade dampers are manufactured in ten Vento dimensional ranges, refer to the table.

Materials and Design

The LKR blade damper is equipped with a hand lever and plastic grip which can be arrested in any position using a wing screw. The external casing and connecting flanges are made of galvanized steel sheets. The connecting bar flanges are 20 mm (for sizes from 30-15 to 80-50) or 30 mm (for sizes 90-50 and 100-50) high. Contra-rotating vanes (blades) are made of galvanized, hollow sectional steel. Individual blades are equipped with elastic plastic sealing so that the edge of one blade fits in the sealed groove of the other. Side sealing is ensured by plastic toth-wheels seated in the bearings, which are also made of plastic.

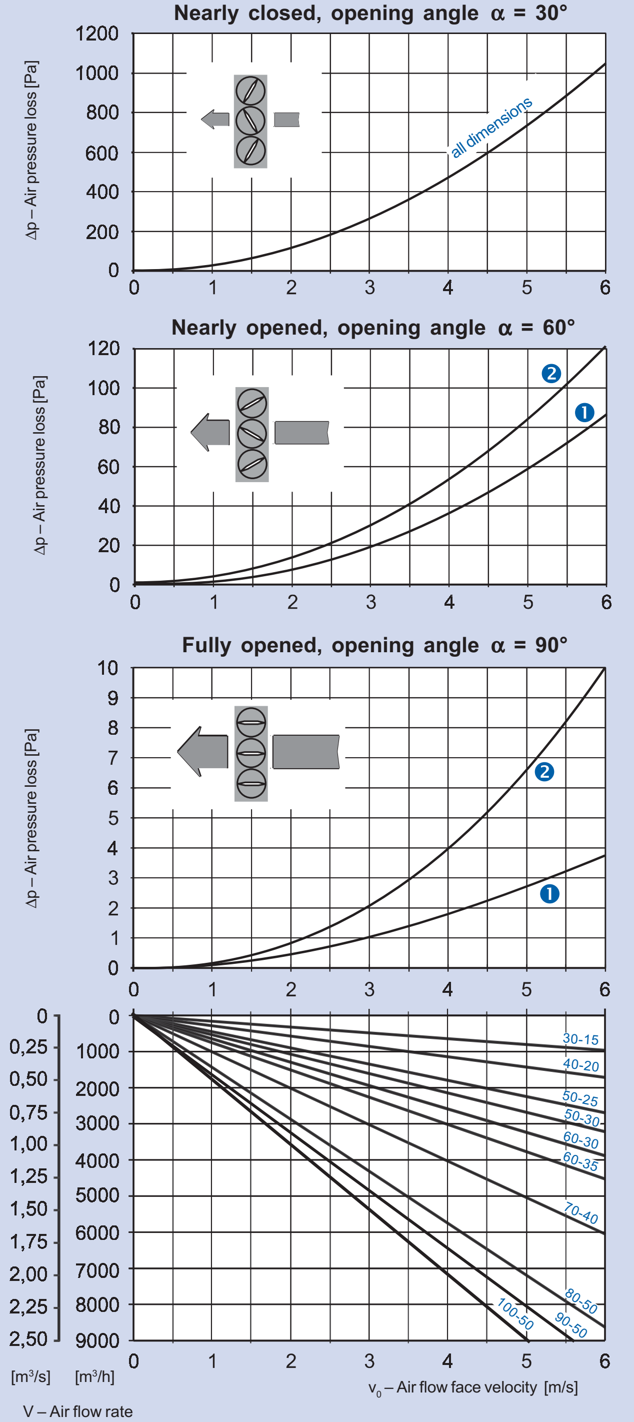
Example of designation

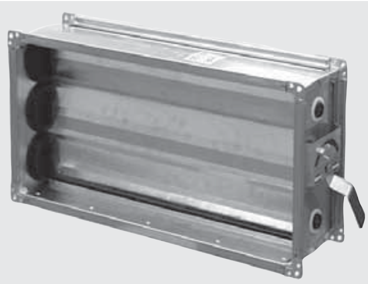
LKR 60 - 50

- 50 — Flange connection B dimension (cm)
- 60 — Flange connection A dimension (cm)
- LKR — Type - Manual Blade Damper

(1 If exposed to intensive moisture condensation or weather conditions, it is necessary to coat the dampers with anticorrosive paint, provide the actuator and movable elements with protective shielding against direct effect of precipitation.

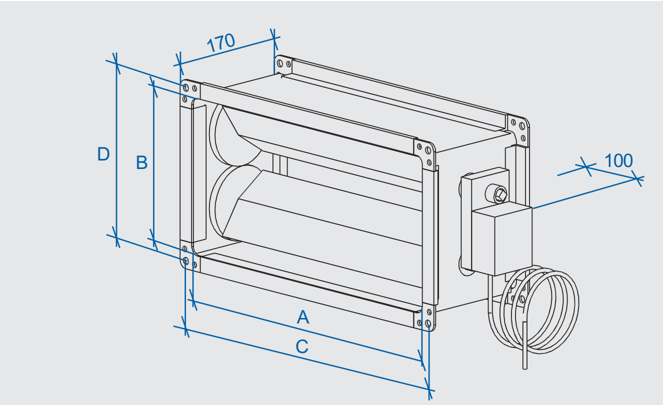
Air Pressure Loss of Blade Dampers LKR, LKS, LKSX, LKSF





LKR blade damper equipped with a hand lever and a mechanical position arresting device

LKS Driven Blade Dampers



	A	B	C	D	m ±10%	graph
	(mm)	(mm)	(mm)	(mm)	(kg)	(curve no.)
LKS 30-15/..	300	150	320	170	5	1
LKS 40-20/..	400	200	420	220	5	1
LKS 50-25/..	500	250	520	270	6	2
LKS 50-30/..	500	300	520	320	7	1
LKS 60-30/..	600	300	620	320	8	1
LKS 60-35/..	600	350	620	370	8	2
LKS 70-40/..	700	400	720	420	9	1
LKS 80-50/..	800	500	820	520	11	1
LKS 90-50/..	900	500	930	530	12	1
LKS 100-50/..	1000	500	1030	530	14	1

Application

The LKS tight blade damper is mostly used to close square air-handling ducting. After being connected to the control system, the damper's actuator ensures automatic closing, respectively opening of the air inlet (outlet). The damper can also be used for actuated closing of individual duct branches.

Operating Conditions and Position

The damper is designed for indoor (1 and outdoor use in air flow free of solid, fibrous, sticky, aggressive, respectively explosive impurities. Operating position is arbitrary, and the range of operating temperatures can be from -30 °C to +50 °C. Pressure loss-air flow rate-blade opening angle correlation is shown in the graph "Blade damper pressure losses".

Dimensional and Type Range

These blade dampers are manufactured in ten Vento dimensional ranges, refer to the table.

Materials and Design

The LKS closing damper is equipped with the LM 24 actuator (24 V voltage) or LM 230 actuator (230 V voltage). The external casing and connecting flanges are made of galvanized steel sheets. The connecting bar flanges are 20 mm (for sizes from 30-15 to 80-50) or 30 mm (for sizes 90-50 and 100-50) high. Contra-rotating vanes (blades) are made of galvanized, hollow sectional steel. Individual blades are equipped with elastic plastic sealing so that the edge of one blade fits in the sealed groove of the other. Side sealing is ensured by plastic tooth-wheels and bearings, which are also made of plastic.

Actuator

A single or two-conductor two-stage control is used. Manual adjustment can be performed using the release button (the gear is taken out of operation as long as this button is pressed). After releasing this button, the actuator will return to the default position. Working angle can be limited by mechanical stops. The actuator is protected against overloading; there are no end limit switches (it automatically stops on the stop).

Installation, Maintenance and Service

Before installation, paste self-adhesive sealing onto the connecting flange face. To connect the damper flanges, use galvanized M8 screws and nuts (M10 only for dimensions 90-50 and 100-50). It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping.

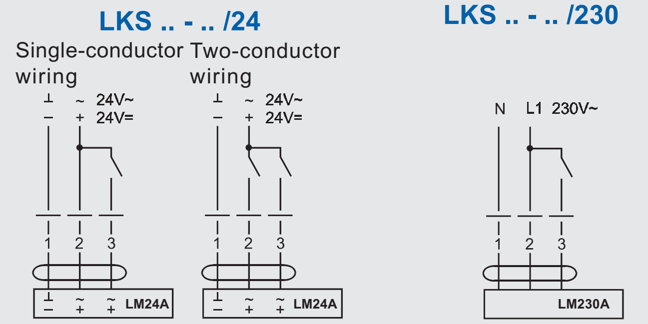
If installed into a ceiling, space for the opening enabling inspection of the actuator must be taken into account. The damper must not be exposed during installation or operation to any torsion. After installation, it is necessary to check free movement of the blades by pressing the release button on the actuator. Deformed blades can cause increased resistance, and the actuator will be automatically stopped.

Example of designation

LKS 60 - 30 / 24

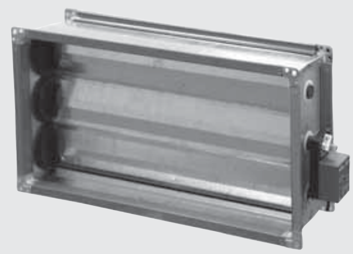
- 24 – Supply voltage 24 V or 230 V
- 30 – Flange connection B dimension (cm)
- 60 – Flange connection A dimension (cm)
- LKS – Type - Driven Blade Damper

Wiring diagram of damper actuators



Technical Data - LM 24A and LM 230A Actuators

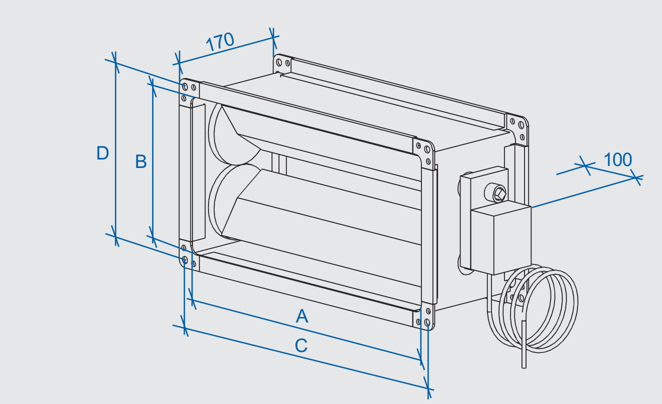
Power supply voltage	**LM 24A** : 24V~ ±20%, 50/60Hz or 24V=, ± 20% **LM 230A** : 230V~, 50/60Hz), ± 5%
Dimensioning	**LM 24A** : 2 VA / **LM 230A** : 4 VA
Input power	**LM 24A** : 1 W / **LM 230A** : 2 W
Direction of rotation	can be selected by the left/right (L/R) selector
Manual adjustment	using the button, automatic return to the default position
Torque	min. 5 Nm (at the rated voltage)
Working angle	max. 95° (mechanical stops, adjustable 0...100%)
Adjustment time	150 s
Noise level	max. 35 dB (A)
Position indicator	mechanical
Protection Class	**LM 24A** : III (low voltage) **LM 230** : II (double insulation)
Degree of protection	IP54



LKS Blade Damper with LM24A or LM230A Actuator

(1 If exposed to intensive moisture condensation or weather conditions, it is necessary to coat the dampers with anticorrosive paint, and provide the actuator and movable elements with protective shielding against direct effect of precipitation.

LKSX Driven Blade Dampers



	A	B	C	D	m ±10%	graf
	(mm)	(mm)	(mm)	(mm)	(kg)	(curve no)
LKSX 30-15/24	300	150	320	170	5	1
LKSX 40-20/24	400	200	420	220	5	1
LKSX 50-25/24	500	250	520	270	6	2
LKSX 50-30/24	500	300	520	320	7	1
LKSX 60-30/24	600	300	620	320	8	1
LKSX 60-35/24	600	350	620	370	8	2
LKSX 70-40/24	700	400	720	420	9	1
LKSX 80-50/24	800	500	820	520	11	1
LKSX 90-50/24	900	500	930	530	12	1
LKSX 100-50/24	1000	500	1030	530	14	1

Application

The LKSX tight blade regulating damper is mostly used to mix air, respectively to close square air-handling ducting. The accurate position of the damper is set by the actuator controlled by the control system.

Operating Conditions and Position

LKSX blade dampers are designed for indoor and outdoor (1 use in air flow free of solid, fibrous, sticky, aggressive or explosive impurities. Operating position is arbitrary, and the range of operating temperatures can be from -30 °C to +50 °C. Pressure loss - air flow rate - blade opening angle correlation is shown in the graph "Blade damper pressure losses".

Dimensional and Type Range

These blade dampers are manufactured in ten Vento dimensional ranges, refer to the table.

Materiály a provedení

As standard, the LKSX regulating damper is equipped with an LM 24X actuator (for details, refer to the table). The external casing and connecting flanges are made of galvanized steel sheets. The connecting bar flanges are 20 mm (for sizes from 30-15 to 80-50) or 30 mm (for size 100-50) high. Contra-rotating vanes (blades) are made of galvanized, hollow sectional steel. Individual blades are equipped with elastic plastic sealing so that the edge of one blade fits in the sealed groove of the other. Side sealing is ensured by plastic tooth-wheels and bearings, which are also made of plastic.

Actuator

The actuator is proportionally set to the position given by the unified control signal of 0 to 10V. Measuring voltage signal U serves as a feedback signal for an electrical representation of the damper position 0...100%. The angle of the damper shift can be gradually adjusted by an integrated potentiometer. Measuring voltage signal U is automatically adapted in the actuator. Manual adjustment can be performed using the release button (the gear is taken out of operation as long as this button is pressed). After releasing this button, the actuator will return to the default position.

Installation, Maintenance and Service

Before installation, paste self-adhesive sealing onto the connecting flange face. To connect the damper flanges, use galvanized M8 screws and nuts, for dimensions 90-50 and 100-50 use M10 screws. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping. If installed into a ceiling, space for the opening enabling inspection of the actuator must be taken into account. The damper must not be exposed during installation or operation to any torsion. After installation, it is necessary to check free movement of the blades by pressing the release button on the actuator. Deformed blades can cause increased resistance, and the actuator will be automatically stopped. The wiring connection can be performed via the wiring terminal box. The actuator is equipped with a 1m-long 3 x 0.75 mm2 cable.

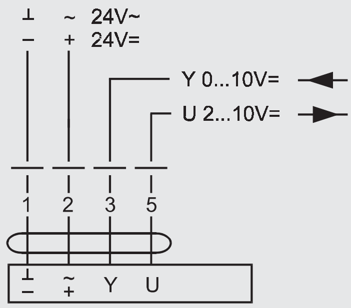
Example of designation

LKSX 60 - 30 / 24

- 24 — Supply voltage (24 V)
- 30 — Flange connection B dimension (cm)
- 60 — Flange connection A dimension (cm)
- LKSX — Type designation LKSX

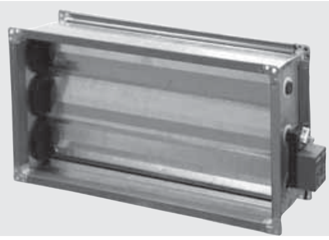
Damper actuator wiring diagram

LKSX ..-.. /24



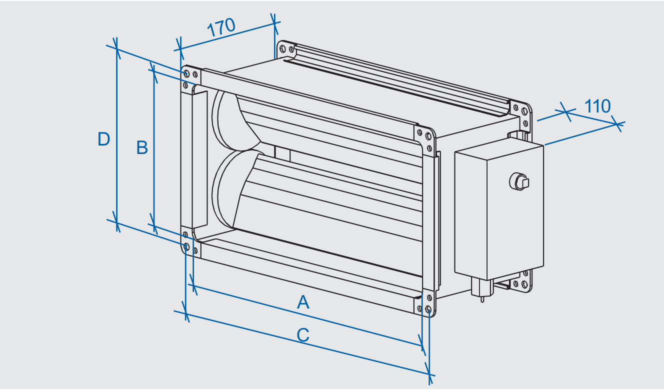
Technical Data - LM 24A-SR Actuator

Power supply voltage	24V~ ±20%, 50/60Hz, 24V= ±10%
Dimensioning, input power	2 VA, 1 W
Control signal Y	0...10V=, input impedance 100kΩ
Working range	2...10V= (for the set working angle)
Measuring voltage signal U	2...10V=, ≤ 0,5mA (for the set working angle)
Direction of rotation	can be selected by the left/right (L/R) selector (L/R)
Manual adjustment	using the button, automatic return to the default position
Torque	min. 5 Nm (at the rated voltage)
Working angle	max. 95° (adjustable by the potentiometer within the range 20...100%)
Adjustment time	35 s
Noise and Noise Level	max. 35dB (A)
Position indicator	mechanical
Protection class	III (low voltage)
Degree of protection	IP54



LKSX Blade Damper with actuator LM 24A-SR

LKSF Driven Blade Dampers



	A	B	C	D	m ±10%	graf
	(mm)	(mm)	(mm)	(mm)	(kg)	(curve no)
LKSF 30-15/230	300	150	320	170	6	❶
LKSF 40-20/230	400	200	420	220	6	❶
LKSF 50-25/230	500	250	520	270	7	❷
LKSF 50-30/230	500	300	520	320	8	❶
LKSF 60-30/230	600	300	620	320	9	❶
LKSF 60-35/230	600	350	620	370	9	❷
LKSF 70-40/230	700	400	720	420	10	❶
LKSF 80-50/230	800	500	820	520	12	❶
LKSF 90-50/230	900	500	930	530	13	❶
LKSF 100-50/230	1000	500	1030	530	15	❶

Application

The LKSF tight blade damper with an emergency function is mostly used to close square air-handling ducting. If the power supply fails, the actuator will ensure quick closure of the damper; therefore, the LKSF damper is recommended as one of the elements of antifreeze protection in systems equipped with a water heater.

Operating Conditions and Position

The damper is designed for indoor (1 and outdoor use in air flow free of solid, fibrous, sticky, aggressive, respectively explosive impurities. Operating position is arbitrary, and the range of operating temperatures can be from -30 °C to +50 °C. Pressure loss - air flow rate - blade opening angle correlation is shown in the graph "Blade damper pressure losses".

Dimensional and Type Range

These blade dampers are manufactured in ten Vento dimensional ranges, refer to the table.

Materials

As standard, the LKSF regulating damper is equipped with an LF 230 actuator (for details, refer to the table). The external casing and connecting flanges are made of galvanized steel sheets. The connecting bar flanges are 20 mm (for sizes from 30-15 to 80-50) or 30 mm (for sizes 90-50 and 100-50) high.
Contra-rotating vanes (blades) are made of galvanized, hollow sectional steel. Individual blades are equipped with elastic plastic sealing so that the edge of one blade fits in the sealed groove of the other. Side sealing is ensured by plastic tooth-wheels and bearings, which are also made of plastic.

Actuator

The actuator opens the damper and simultaneously takes up the return spring. If the power supply is interrupted, the damper is moved by the spring energy back to the closed (safety) position. The damper's angle of shift can be set by the integrated adjustable stop. The actuator is protected against overloading; there are no end limit switches (it automatically stops on the stop).

Installation, Maintenance and Service

Before installation, paste self-adhesive sealing onto the connecting flange face. To connect the damper flanges, use galvanized M8 screws and nuts (for dimensions 90-50 and 100-50 use M10 screws). It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping. If installed into a ceiling, space for the opening enabling inspection of the actuator must be taken into account. The damper must not be exposed during installation or operation to any torsion. After installation, it is necessary to check free movement of the blades. Deformed blades can cause increased resistance, and the actuator will be automatically stopped. The wiring connection can be performed via the wiring terminal box. The actuator is equipped with a 1m-long 2 x 0.75 mm^2 cable.

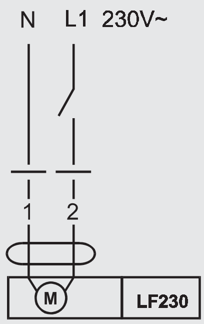
Example of designation

LKSF 60 - 30 / 230

- 230 — Supply voltage (230 V)
- 30 — Flange connection B dimension (cm)
- 60 — Flange connection A dimension (cm)
- LKSF — Type designation LKSF

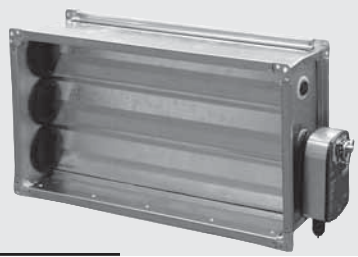
Damper actuator wiring diagram

LKSF ..-.. /230



Damper actuator wiring diagram

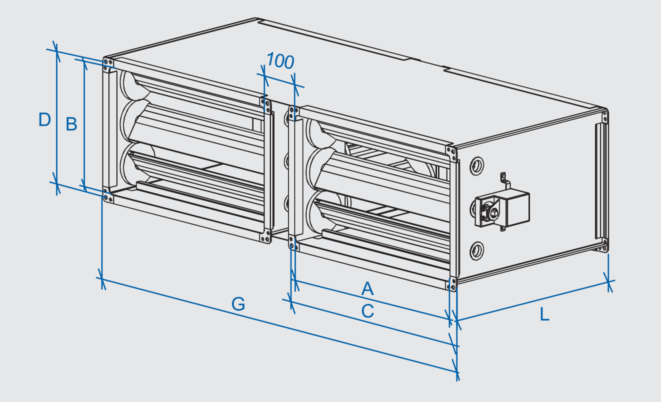
Power supply voltage	230V~ ±15%, 50/60Hz
Dimensioning	7 VA (I_{max} 150mA, t=10ms)
Input power	5 W when taking up the spring 4W in resting position
Direction of rotation	optional left/right installation
Torque	min. 4Nm (at the rated voltage)
Working angle	max. 95° (adjustable within the range 37...100%, integrated mechanical limiters of the working angle)
Adjustment time	motor 40...75 s, return spring 5 s
Noise Level	motor max. 50 dB (A), spring 62 dB (A)
Position indicator	mechanical
Protection Class	II (double insulation)
Degree of protection	IP54



LKSF Blade Damper with emergency actuator LF 230

[1] If exposed to intensive moisture condensation or weather conditions, it is necessary to coat the dampers with anticorrosive paint and provide the actuator and movable elements with protective shielding against direct effect of precipitation.

SKX Mixing Sections



	A	B	C	D	G	L	m ±10%	graph
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(kg)	(curve no)
SKX 40-20/24	400	200	420	220	940	390	19	❷ ❶
SKX 50-25/24	500	250	520	270	1140	440	25	❷ ❷
SKX 50-30/24	500	300	520	320	1140	490	33	❶ ❶
SKX 60-30/24	600	300	620	320	1340	490	36	❷ ❶
SKX 60-35/24	600	350	620	370	1340	540	41	❷ ❷
SKX 70-40/24	700	400	720	420	1540	590	45	❶ ❶
SKX 80-50/24	800	500	820	520	1740	690	56	❶ ❶
SKX 90-50/24	900	500	930	530	1960	790	68	❶ ❶

Application

SKX air mixing sections are intended for continuous mixing of fresh and circulating air. The mixing ratio can be adjusted by three tight blade dampers which are mechanically interconnected. The dampers are handled by an actuator controlled by the control unit. Two parallel dampers in the SKX section can also ensure the closing function.

Operating Conditions and Position

Mixing sections are designed for indoor and outdoor 1) applications in air flow free of solid, fibrous, sticky, aggressive, respectively explosive impurities. Operating position is arbitrary, and the range of operating temperatures can be from -20 °C to +50 °C. Pressure loss - air flow rate - mixing mode correlation is shown in the graph "Blade damper pressure losses".

Dimensional and Type Range

The air mixing sections are manufactured in eight dimensional ranges, from 40-20 to 90-50.

Materials

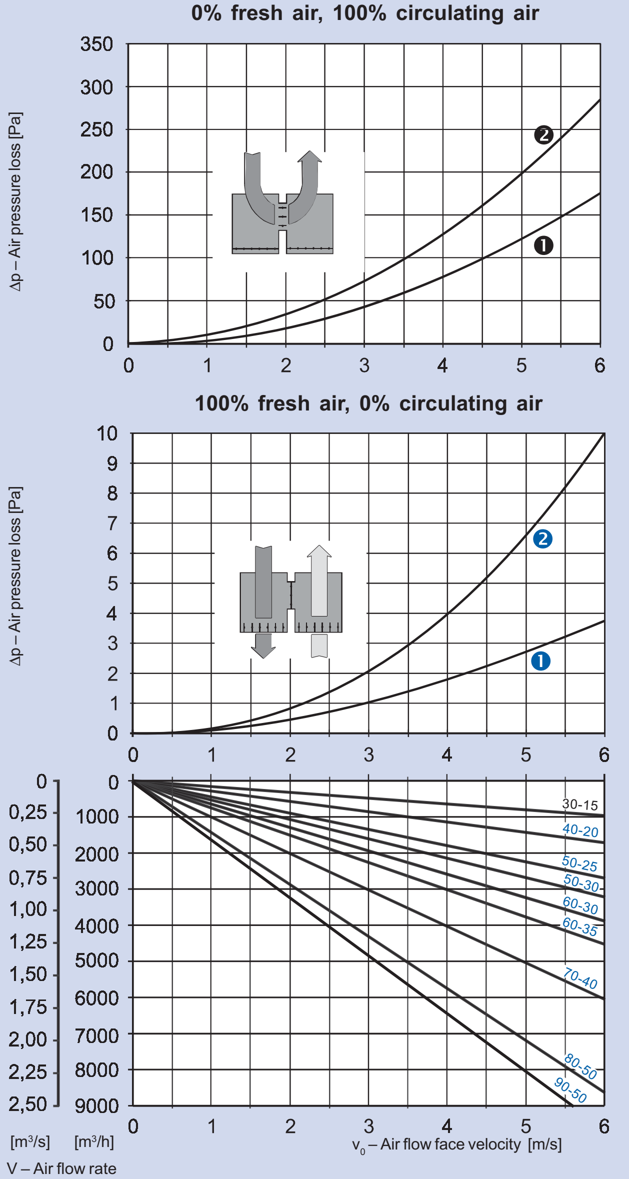
The external casing and connecting flanges are made of galvanized steel sheets. The connecting bar flanges are 20 mm or 30 mm (for size 90-50) high. Contra-rotating vanes (blades) are made of galvanized, hollow sectional steel. Individual blades are equipped with elastic plastic sealing so that the edge of one blade fits in the sealed groove of the other. Side sealing is ensured by plastic tooth-wheels and their bearings, which are also made of plastic.

As standard, the SKX air mixing section is equipped with an NM 24A-SR actuator.

Actuator

The actuator is proportionally set to the position given by the unified control signal of 0 to 10V. Measuring voltage signal U serves as a feedback signal for an electrical representation of the damper position 0...100 %. The angle of the damper shift can be gradually adjusted by an integrated potentiometer. Measuring voltage signal U is automatically adapted in the actuator.

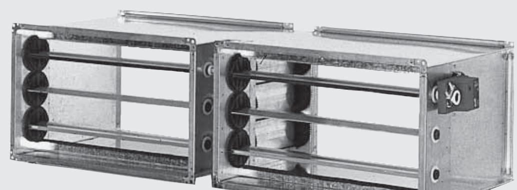
SKX Mixing Section Pressure Loss Chart



Example of designation

SKX 60 - 30 / 24

- Supply voltage (24 V)
- Flange connection B dimension (cm)
- Flange connection A dimension (cm)
- Type designation



SKX air mixing section
equipped with an NM 24A-SR actuator

Manual adjustment can be performed using the release button (the gear is taken out of operation as long as this button is pressed). After releasing this button, the actuator will return to the default position.

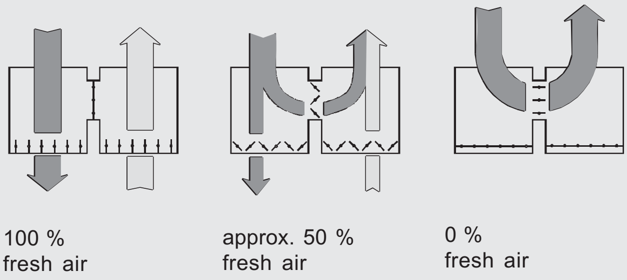
[1] If exposed to intensive moisture condensation or weather conditions, it is necessary to coat the dampers with anticorrosive paint and provide the actuator and movable elements with protective shielding against direct effect of precipitation.

SKX Mixing Sections

Installation, Maintenance and Service

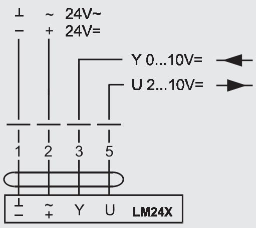
Before installation, paste self-adhesive sealing onto the connecting flange face. To connect the flanges, use galvanized M8 screws and nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping. If installed into a ceiling, space for the opening enabling inspection of the actuator must be taken into account. The mixing section must not be exposed during installation or operation to any torsion. After installation, it is necessary to check free movement of the blades by pressing the release button on the actuator. Deformed blades can cause increased resistance, and the actuator will be automatically stopped. The wiring connection can be performed via the wiring terminal box. The actuator is equipped with a 1m-long 3 x 0.75 mm2 cable.

Function of SKX Mixing Sections



Actuator wiring diagram

SKX ..-.. /24



Technical Data - LM 24 X Actuator

Power supply voltage	24V~ ±20%, 50/60Hz, 24V= ±10%
Dimensioning, input power	4VA, 2W
Control signal Y	0...10V=, impedance 100kΩ
Working range	2...10V= (for the set working angle)
Measuring voltage signal	U2...10V=, ≤ 0,5mA (for the set working angle)
Direction of rotation	can be selected by the left/right (L/R) selector
Manual adjustment	using the button, automatic return to the default position
Torque	min. 4Nm (at the rated voltage)
Working angle	max. 95° (adjustable by the potentiometer within the range 20...100%)
Adjustment time	80...110s (0...4Nm)
Noise level	max. 35dB (A)
Position indicator	mechanical
Protection Class	III (low voltage)
Degree of protection	IP54

Recommended Connections of LKS(F), LKSX, SKX Mixing Sections in Vento System Assemblies

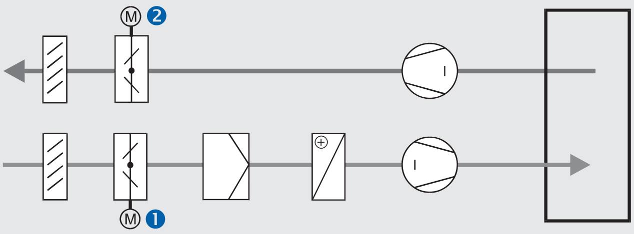


Figure A

Figure A shows an air-handling system equipped with an inlet ❶ and an outlet ❷ damper. LKS ..-.. /24 (or LKS ..-.. / 230) mixing sections are mostly used in this or similar situations. If the air-handling assembly is equipped with a water heater, it is recommended to use the LKSF ..-.. /230 mixing section type as an inlet damper ❶.
With a simpler air-handling assembly without heating or with electric heating, the outlet damper ❷ and PZ louver can be replaced with a PK pressure damper.

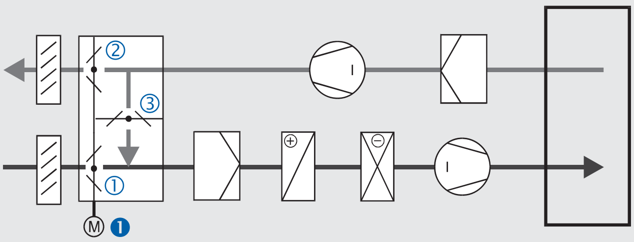


Figure B

Figure B shows an air-handling system with air mixing using the SKX ..-.. /24 air mixing section ❶. This section is consistently equipped with three integrated dampers from which dampers ①②, also provide inlet and outlet closing functions. The contra-rotating damper ③ is a mixing damper. If the air mixing section cannot be used, it is possible to ensure the same functions using three individual LKSX ..-../24 dampers in a similar arrangement ①②③. The dampers are controlled by the common control signal from the control unit. The contra-rotating damper ③ operation can be set by the selector on the actuator.

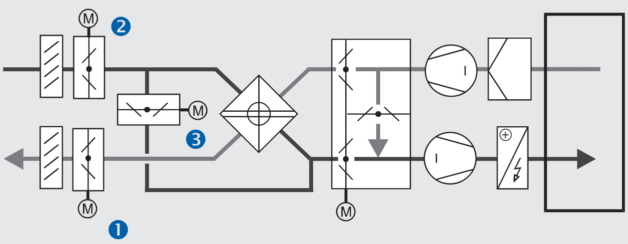
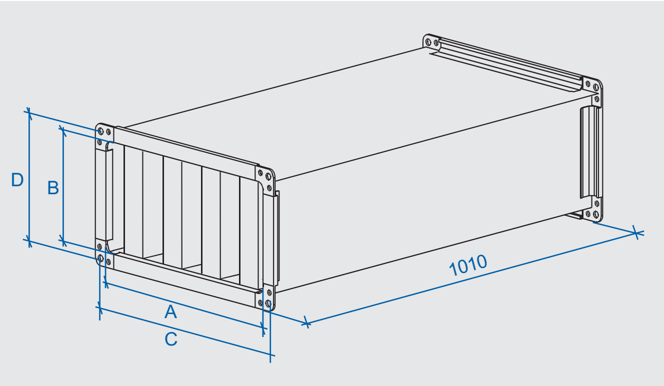


Figure C

Figure C shows an air-handling system with a heat exchanger and an air mixing section. If a heat exchanger is used in the assembly, it is possible to use the SKX air mixing section; however, air mixing must be situated between the heat exchanger and the room. In this case, the fans cannot be situated arbitrarily. Inlet and outlet closing must be ensured using the LKS ..-../24 (or LKS ..-../230) dampers ❶ and ❷. The air-handling assembly can also be equipped with a heat exchanger bypass which is controlled by the LKS ..-.. /24 (or LKS ..../230) closing damper ❸. The heat exchanger's bypass can be used especially to protect the heat exchanger against ice build-up, or as a seasonal bypass.

TKU Attenuators



	A	B	C	D	m ±10%	graph
	(mm)	(mm)	(mm)	(mm)	(kg)	(curve no.)
TKU 30-15	300	150	320	170	13	3
TKU 40-20	400	200	420	220	14	1
TKU 50-25	500	250	520	270	19	3
TKU 50-30	500	300	520	320	21	3
TKU 60-30	600	300	620	320	23	1
TKU 60-35	600	350	620	370	24	1
TKU 70-40	700	400	720	420	31	2
TKU 80-50	800	500	820	520	40	1
TKU 90-50	900	500	930	530	44	2
TKU 100-50	1000	500	1030	530	50	1

Application

TKU splitter attenuators are intended for attenuation of the noise transmitted through the air-handling duct both, in the inlet and outlet.

Operating Conditions and Position

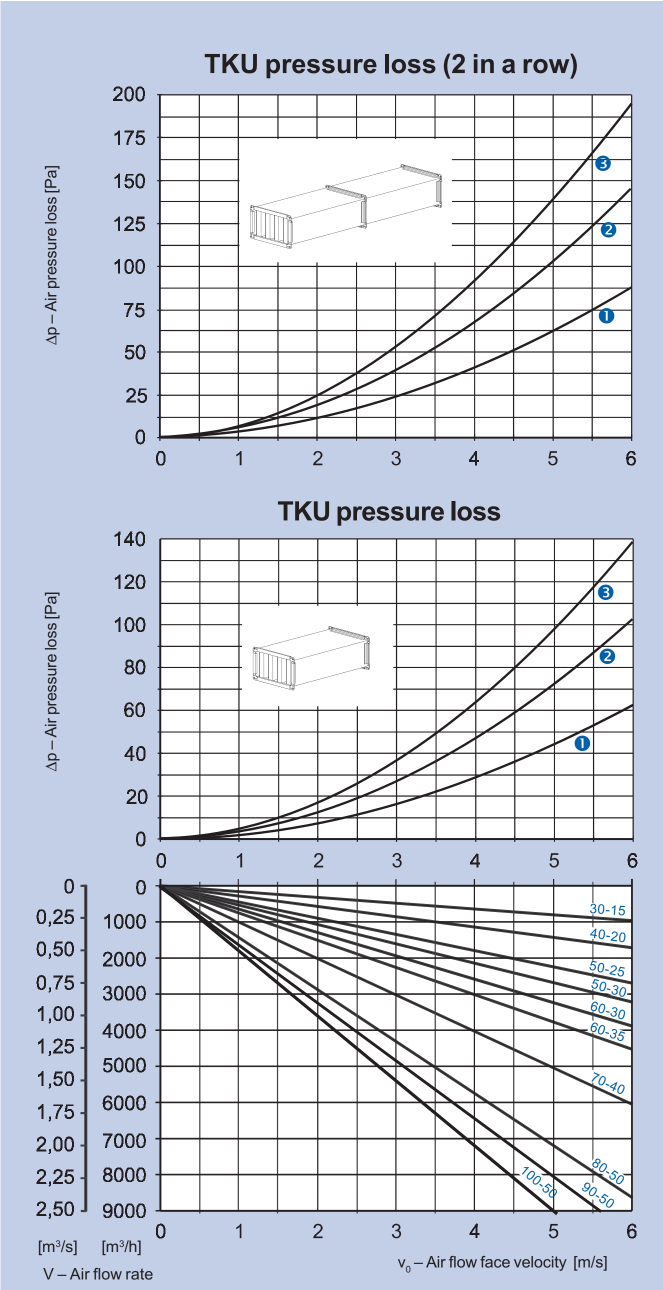
TKU attenuators are designed for direct installation into square air ducts. They are intended for indoor use (when installed outside, they must be protected against water by a cover). Transported air must be free of solid, fibrous, sticky, aggressive impurities. Maximum air flow speed between splitters can be 20 m/s. Operating position is arbitrary, and the range of operating temperatures can be from -40 °C to +70 °C. If possible, we recommend putting a 1-1.5 m long duct in front of the attenuator to partly balance the speed profile of the air flow. Two successive attenuators can be installed in series to increase insertion loss. Pressure loss - air flow rate correlation is shown in the graph "TKU attenuator pressure losses" (two successive attenuators in series).

Dimensional and Type Range

As standard, the splitter attenuators are manufactured in ten Vento dimensional ranges, refer to the table. Non-standard dimensions or sizes can be manufactured according to the customer's requirement. As the attenuator's own noisiness increases with increased air flow velocity, in some cases it is advisable to combine the duct system with an attenuator from a higher (larger) dimensional range. The interconnection must be performed using a 500mm-long transition piece.

Materials

The attenuator consists of the casing and hard installed splitters. The external casing is made of galvanized steel sheets (Zn 275 g/m2) reinforced by "Z" profiles. The splitters are created by the profiled frame, made of galvanized steel sheets and non-combustible sound-absorbing lining. The splitters are mould-resistant and impregnated with water-repellent coating. The splitter surface is backed with a special glass textile. The material complies with A2 Combustibility Class (non-combustible) in accordance with the DIN 4102 standard.



Installation, Maintenance and Service

Before installation, check the surface condition of attenuation splitters and paste self-adhesive sealing onto the connecting flange face. To connect the flanges, use galvanized M8 screws and nuts, for dimensions 90-50 and 100-50 use M10 screws. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping.

If two successive attenuators are installed in series, they must be interconnected by the sides where the faces of the splitters match with the flange edge!

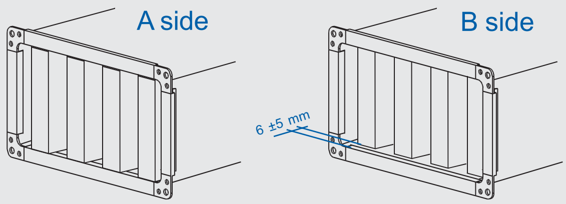
Example of designation

TKU 60 - 30

- Flange connection B dimension (cm)
- Flange connection B dimension (cm)
- Type designation

TKU Attenuators

Alignment of attenuators, when connected together

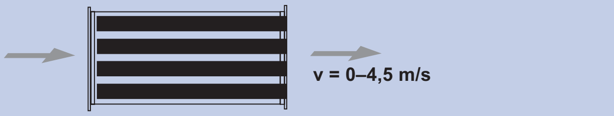


If two successive attenuators are installed in series, they must be interconnected by the A sides (i.e. A-A connection), where the faces of the splitters match with the flange edge. If incorrectly connected (B-B, A-B, or B-A), the splitters do not bear on each other, and do not create continuous 2m-long splitters.

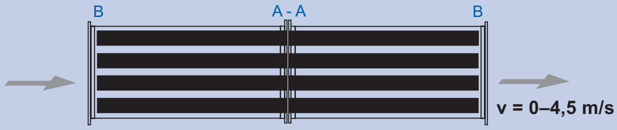
Operating Characteristics

Absorbent TKU splitter attenuators feature excellent attenuation characteristics within the frequency range 500 to 4,000 Hz. Graphs contain the noise attenuation (insertion loss) of attenuators and their own noisiness. Insertion loss is a reduction of sound coming through the duct after the attenuator has been inserted. Attenuation of the attenuator depends on the width, pitch, and total length of the splitters. Pressure loss and own noisiness of the attenuator depend on the pitch of the splitters and the air flow velocity. The attenuation is expressed by the differential of sound power levels [dB] within mean frequencies of octave bands from 63 Hz to 8 kHz. All values in the graphs are related to standard attenuators without leading sheets. This version is suitable for easy assembly of two attenuators in series and for increased attenuation utilizing reflection of sound from the splitter faces back to the sound source. If the leading sheets, made of galvanized steel sheets, are prescribed in the project (and installed) according to the figure, air pressure loss lowered by 15 % and lower own noisiness of the attenuator can be expected; however, at the cost of attenuation decreased by 3 dB in the whole frequency band. Therefore, use of the leading sheets only makes sense at air flow velocities above 4.5 m/s.

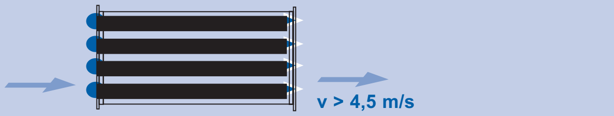
Examples of attenuator arrangements and installation of leading sheets



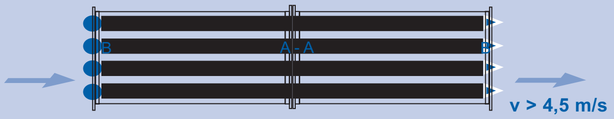
One standard attenuator, total effective length 1 m; installation of leading sheets is not recommended for air flow velocities below 4 m/s.



Two successive standard attenuators in series, total effective length 2 m; installation of leading sheets on the faces of opposite splitters is not recommended for air flow velocities below 4 m/s. The attenuators must be interconnected by the sides where the faces of the splitters match with the flange edge.



One standard attenuator completed with leading sheets, total effective length 1 m. Leading sheets on the inlet side are shaped in radius R = approx. 50 mm while the leading sheets on the outlet side are shaped in an equilateral triangle.

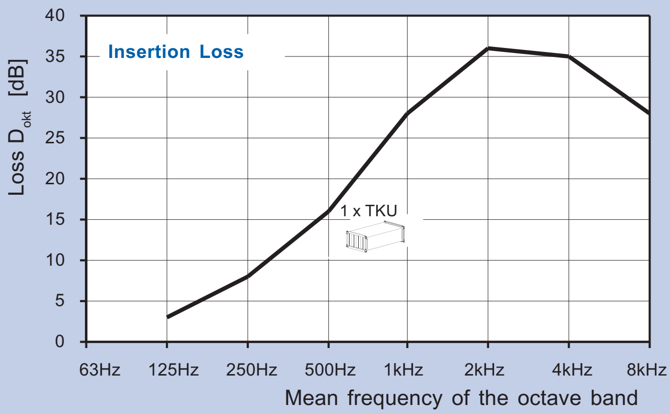


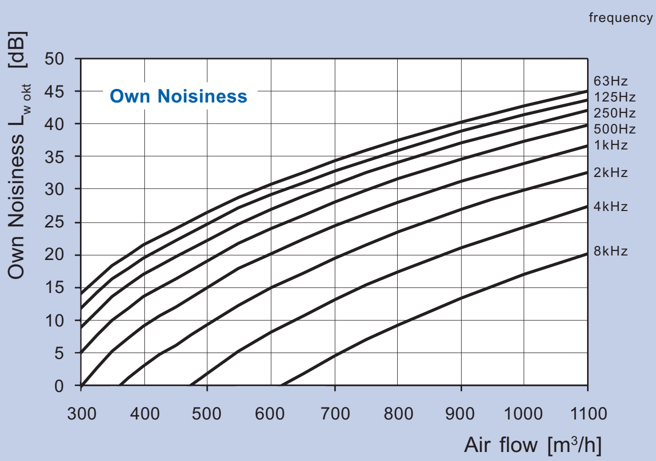
Two successive standard attenuators in series, total effective length 2 m. Leading sheets on the inlet side are shaped in radius R = approx. 50 mm while the leading sheets on the outlet side are shaped in an equilateral triangle. The attenuators must be interconnected by the sides where the faces of the splitters match with the flange edge.

Insertion Losses of Attenuators

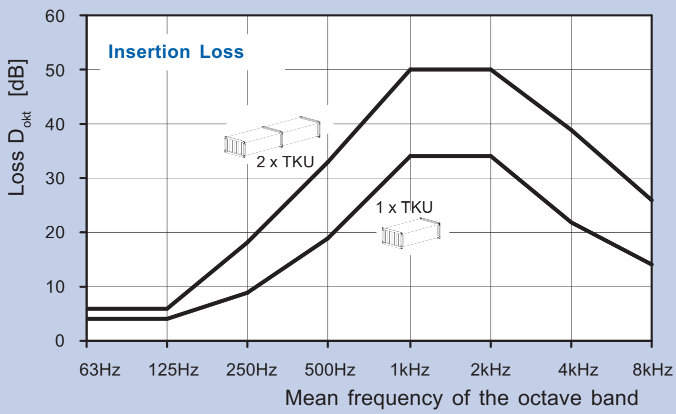
Own Noisiness of Attenuators

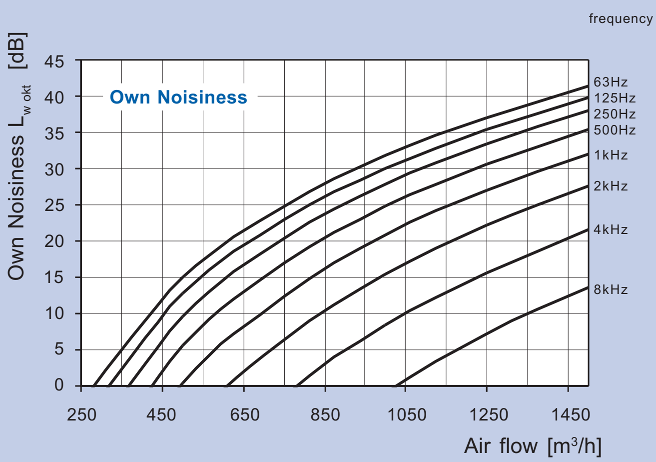
TKU 30-15



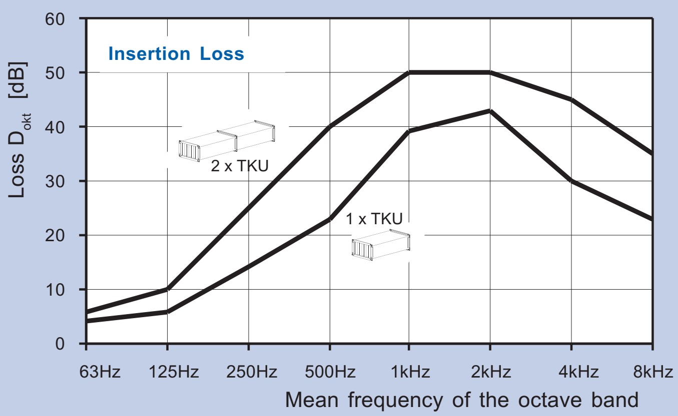


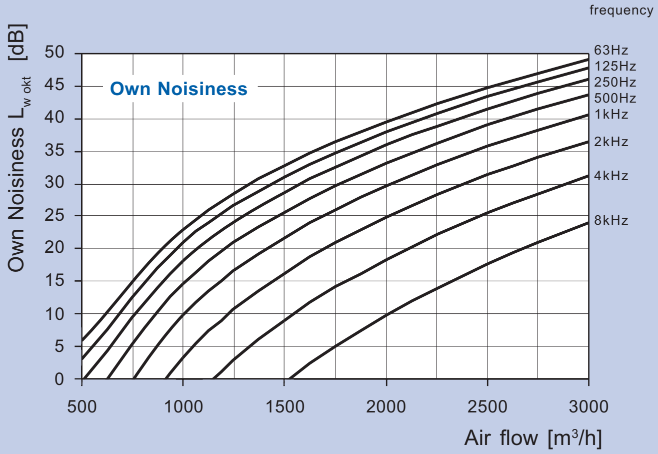
TKU 40-20



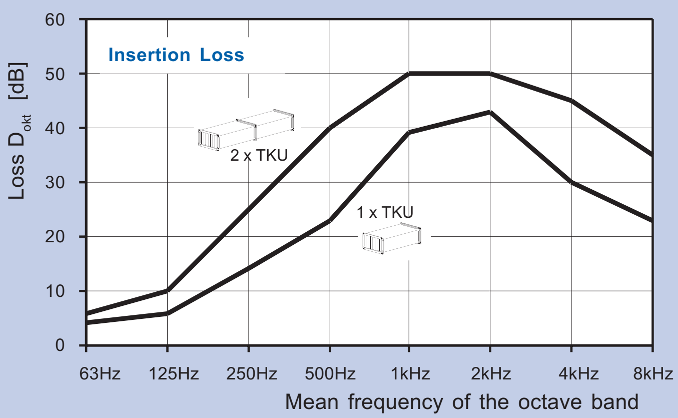


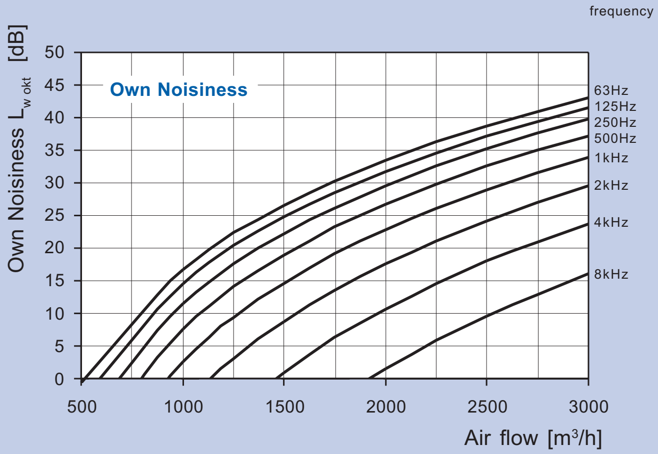
TKU 50-25



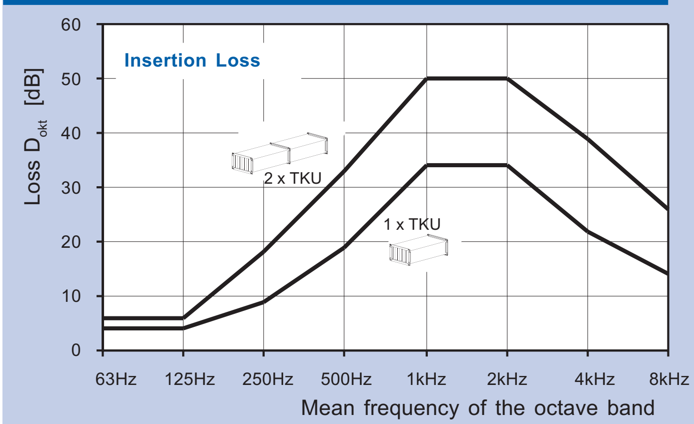


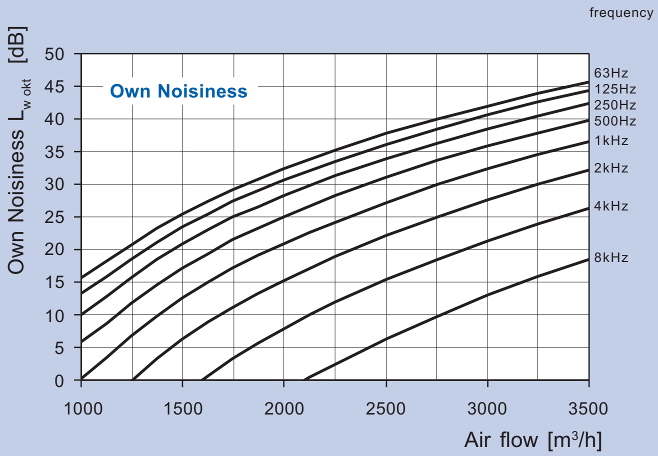
TKU 50-30



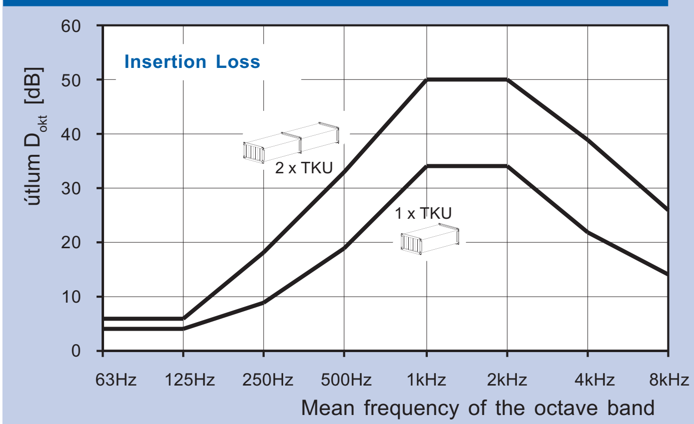


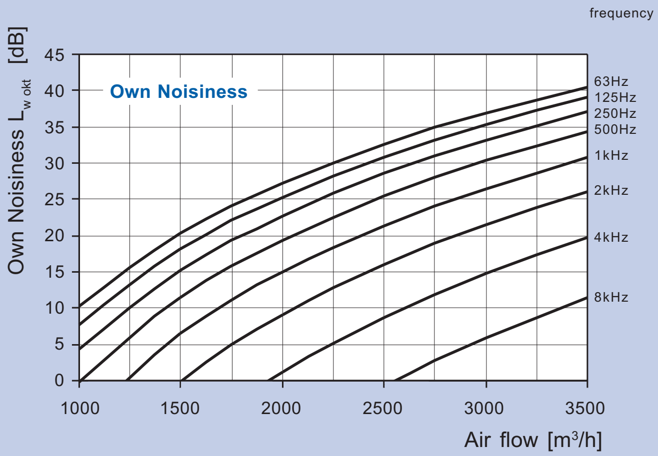
TKU 60-30



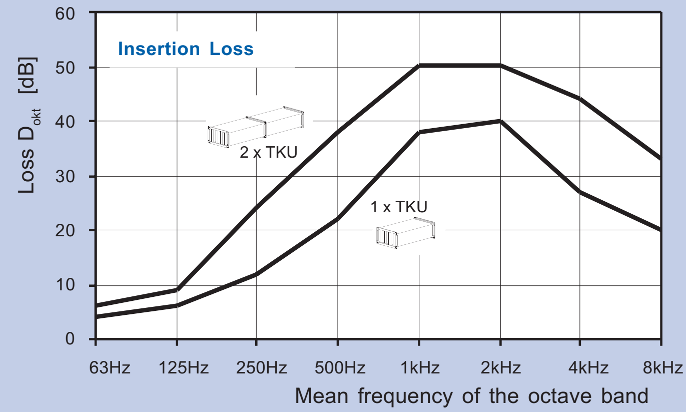


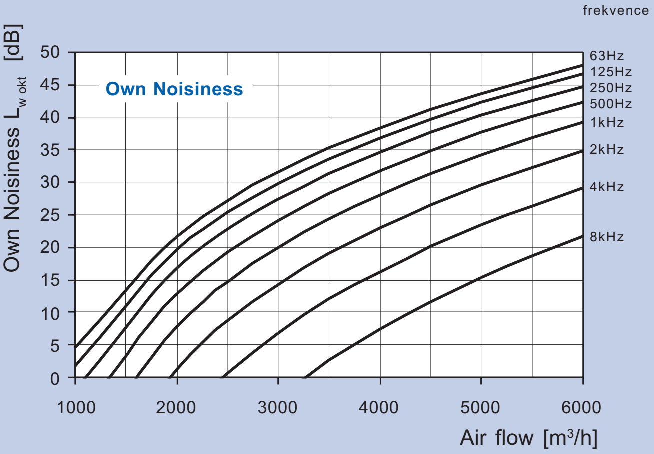
TKU 60-35



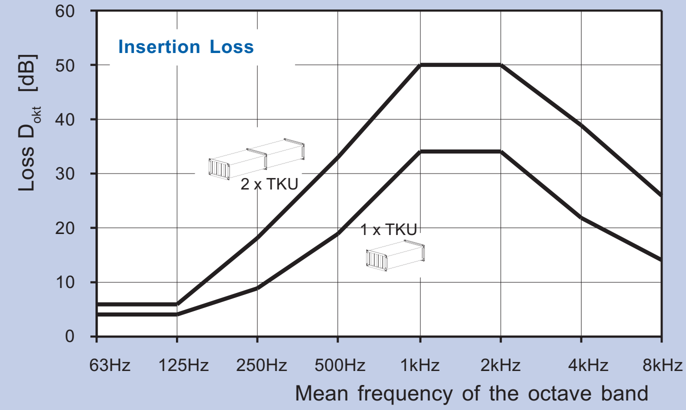


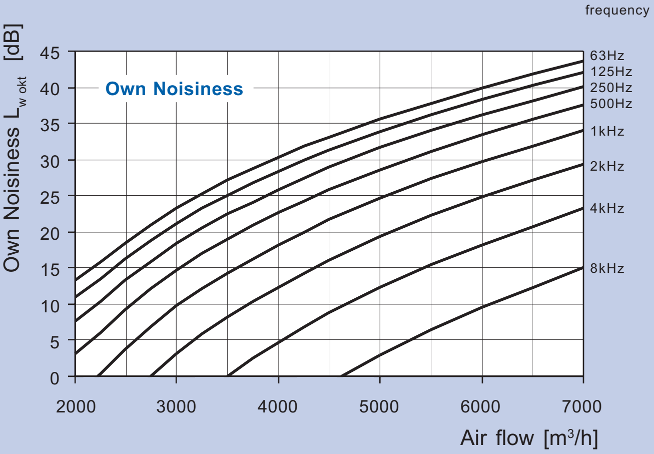
TKU 70-40



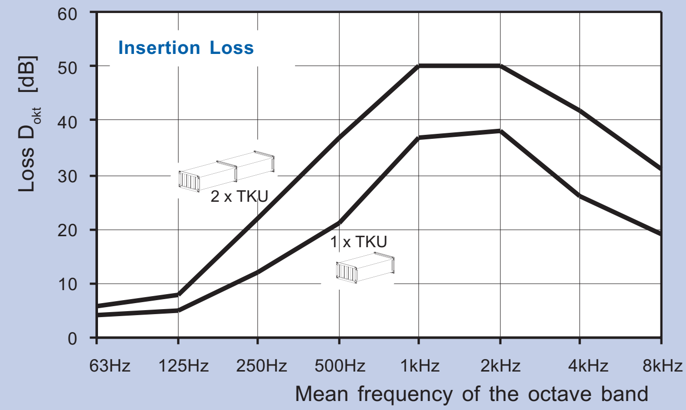


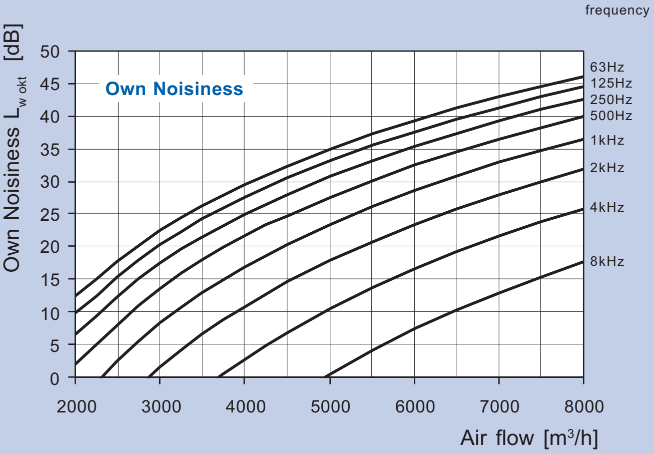
TKU 80-50



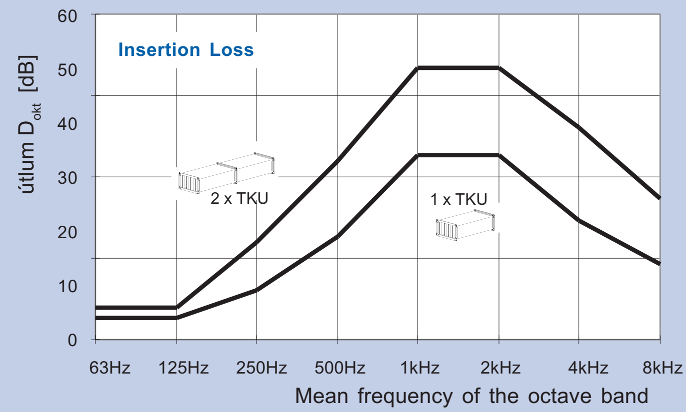


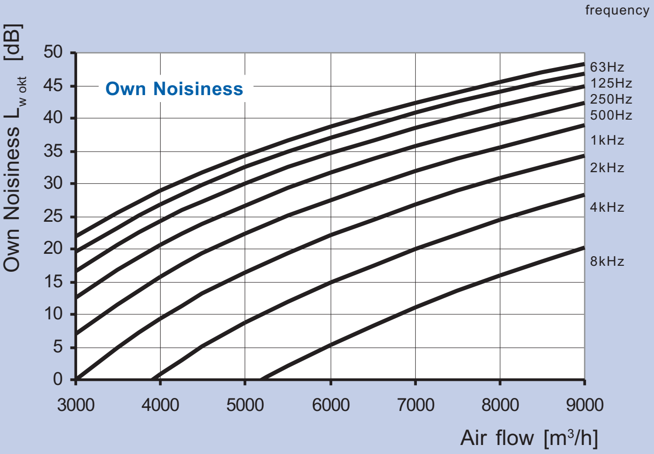
TKU 90-50



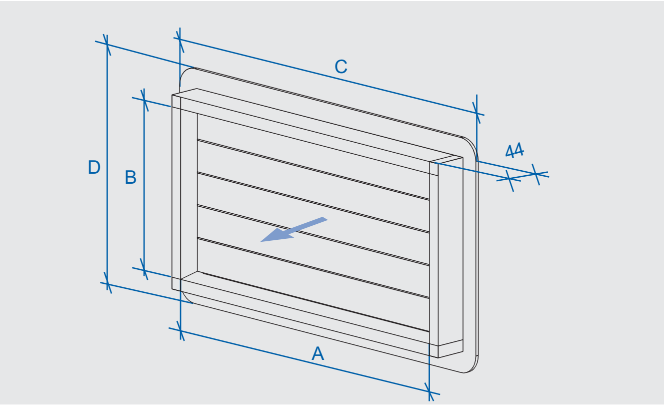


TKU 100-50

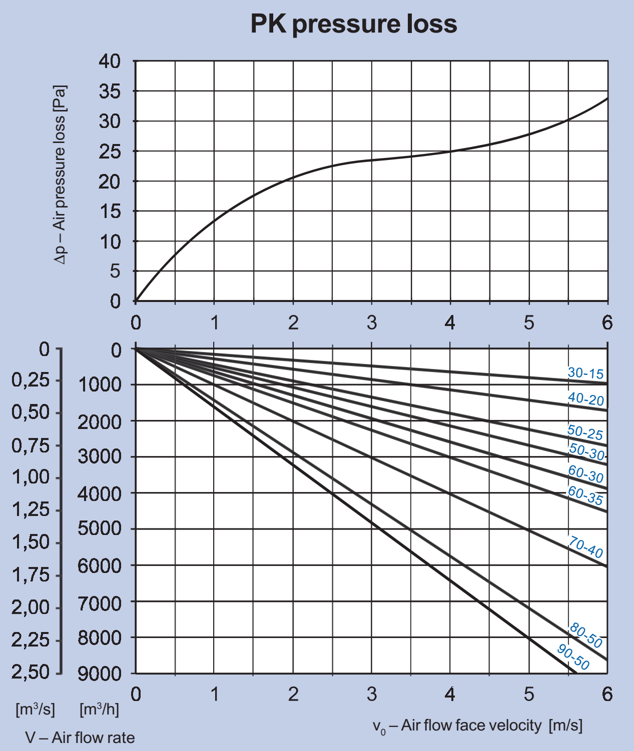




PK Pressure Dampers



	A	B	C	D	m ±10%
	(mm)	(mm)	(mm)	(mm)	(kg)
PK 30-15	300	150	376	226	0,5
PK 40-20	400	200	476	276	1
PK 50-25	500	250	576	326	1
PK 50-30	500	300	576	376	1
PK 60-30	600	300	676	376	1
PK 60-35	600	350	676	426	1
PK 70-40	700	400	776	476	2
PK 80-50	800	500	876	576	2
PK 90-50	900	500	976	576	2



Application

PK pressure damper (louver) is an end element used to automatically close the square outlet of an air-handling unit. If the fans stop, the damper will automatically close the outlet and prevent air backdraught to the duct, respectively penetration of water, dust, insects, etc.

Operating Conditions and Position

The PK pressure damper is intended to be situated vertically on the air exhaust. Transported air must be free of solid, fibrous, sticky, or aggressive impurities. PK pressure damper is designed for outdoor use. The range of operating temperatures can be from -30 °C to +60 °C. Maximum air flow speed can be 6 m/s. Correlation of pressure loss related to the air flow rate is included in the graph "PK pressure loss".

Dimensional and Type Range

The dampers are manufactured in ten Vento dimensional ranges, from 30-15 to 100-50. Larger sizes are equipped with a vertical brace to enhance the damper's rigidity and endurance.

Materials

The pressure damper is made of plastics resistant to UV radiation and weather effects; grey RAL 7040 colour.
The damper's frame is glued from plastic profiles with a closed air gap. Extremely light and aerodynamic plastic vanes are hinged on plastic pivots, which are inserted into the external frame. The lowest vane covers the inner frame jut, and thus creates a weather moulding.

Installation

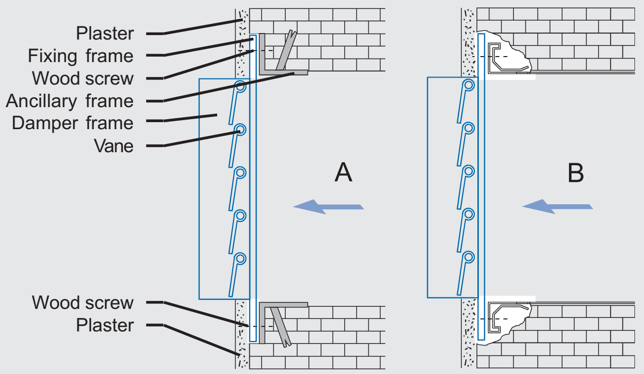
The pressure dampers can work in any position. The standard version of the PK pressure damper must be installed with the longer side in the horizontal position while the blades are closed automatically (by gravity). The acceptable air flow direction is indicated in the figure. The pressure damper can be fixed with wood or self-tapping screws to an ancillary wooden or steel frame, respectively to the flange of the air-handling unit. If used on a façade, it must be embedded 2 cm into the façade to cover its fixing frame.

Example of designation

PK 60 - 30

- 30 – Flange connection B dimension (cm)
- 60 – Flange connection A dimension (cm)
- PK – Pressure damper type designation

PK Pressure Dampers - Installation Diagram

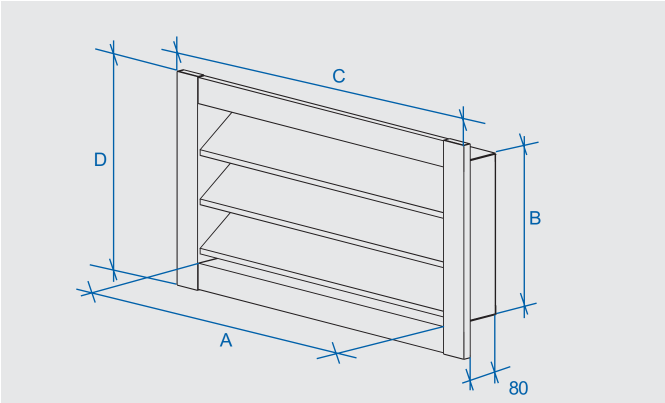


A - Installation on ancillary frame
B - Installation on flange of air-handling duct

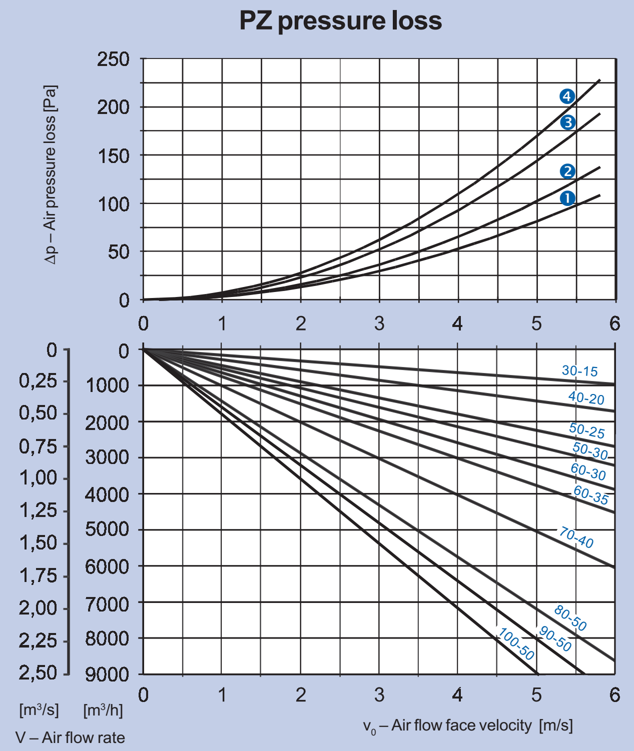

PK pressure damper without a brace up to size 50-30, incl.


PK pressure damper with a brace, sizes from 60-30 to 90-50

PZ Louvers



	A	B	C	D	m ±10%	graph
	(mm)	(mm)	(mm)	(mm)	(kg)	(curve no)
PZ 30-15	285	135	345	195	2	4
PZ 40-20	385	185	445	245	2	3
PZ 50-25	485	235	545	295	3	2
PZ 50-30	485	285	545	345	4	2
PZ 60-30	585	285	645	345	5	2
PZ 60-35	585	335	645	395	5	1
PZ 70-40	685	385	745	445	6	1
PZ 80-50	785	485	845	545	8	1
PZ 90-50	885	485	945	545	10	1
PZ 100-50	985	485	1045	545	12	1



Application

PZ louvers are intended for covering square inlets or outlets. The louvers prevent penetration of rainwater and small animals into air-handling ducting.

Operating Conditions and Position

PZ louvers are designed for outdoor use. The range of operating temperatures can be from -40 °C to +80 °C. The louver must be installed vertically on the façade, on the exhaust or intake of the air-handling duct. Transported air must be free of solid, fibrous, sticky, or aggressive impurities. Maximum air flow speed can be 6 m/s. Correlation of pressure loss related to the air flow rate is shown in the graph "PZ pressure loss".

Dimensional and Type Range

The louvers are manufactured in ten Vento dimensional ranges, from 30-15 to 100-50.

Materials

The louvers are made of galvanized steel sheets (Zn 275 g/m2). Aerodynamically shaped vanes are firmly fixed with their sides to the louver's profile frame. The vanes are specially shaped to ensure high rigidity and rate of water separation at low pressure loss. A galvanized protective screen with a 10x10 mm mesh is situated behind the vanes, to protect the duct against small animals and birds. As standard, the louvers are finished in grey baking enamel, RAL 7040 colour shade. On customer request, the louvers can also be made of stainless steel, copper or aluminium.

Installation

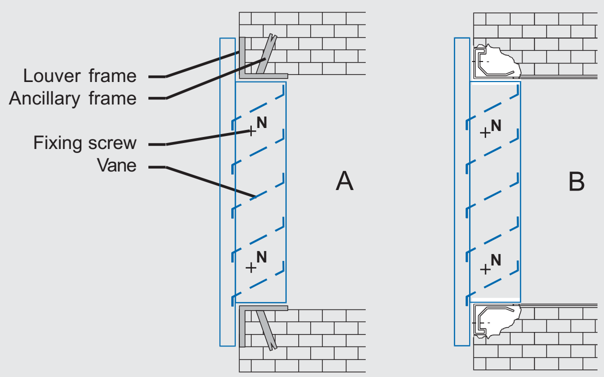
The standard version of the PZ louver must be installed with the longer side (vanes) in the horizontal position, and it can be fixed with wood or self-tapping screws to an ancillary wooden or steel frame, respectively riveted to the air-handling duct wall. Holes for fixing elements (wood or self-tapping screws, rivets) must be drilled into the louver side (see the figure "PZ louver installation").

Example of designation

PZ 60 - 30

- 30 – Flange connection B dimension (cm)
- 60 – Flange connection A dimension (cm)
- PZ – Louver type designation

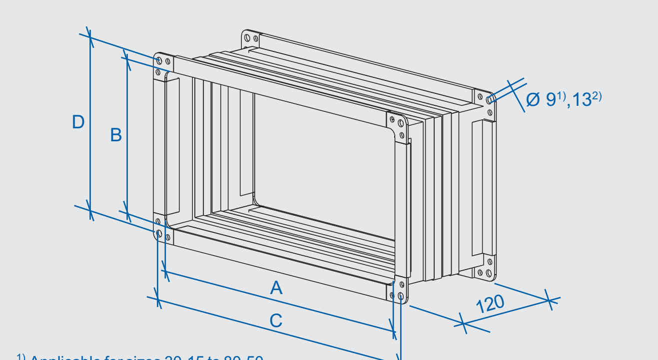
PZ louver installation



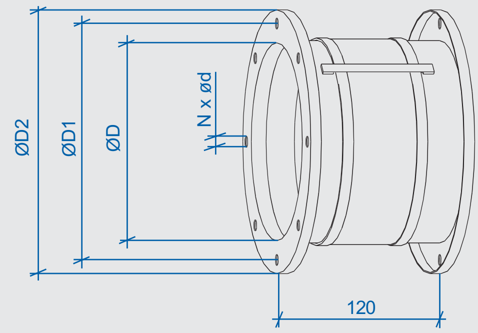
A - Installation on ancillary frame
B - Installation on flange of air-handling duct
N - Fixing wood screw or rivet (holes must be drilled)

PZ louver

DV, DK Elastic Connections



1) Applicable for sizes 30-15 to 80-50
2) Applicable for sizes 90-50 to 100-50



	A (mm)	B (mm)	C (mm)	D (mm)	m ±10% (kg)
DV 30-15	300	150	320	170	1,6
DV 40-20	400	200	420	220	2
DV 50-25	500	250	520	270	2,5
DV 50-30	500	300	520	320	2,6
DV 60-30	600	300	620	320	2,9
DV 60-35	600	350	620	370	3
DV 70-40	700	400	720	420	3,5
DV 80-50	800	500	820	520	4
DV 90-50	900	500	930	530	4,3
DV 100-50	1000	500	1030	530	4,7

Application
DV square elastic connections are designed to eliminate the transfer of fan or air-handling unit vibrations to ducting. They also partly eliminate strain and loading caused by thermal dilatation in air-handling ducting.

Operating Conditions and Position
The range of operating temperatures can be from -30 °C to +80 °C, while the maximum allowed temperature is + 100 °C. Elastic connections can be used up to a pressure of 3,000 Pa. They are not designed for mechanical loading, and cannot be used as a supporting part of the assembly. The construction length is 155 mm, while the usable mounting (planning) length is 120 mm.

Dimensional and Type Range
The DV elastic connections are manufactured in all Vento dimensional ranges, from 30-15 to 100-50.

Materials
The elastic connection is made of galvanized steel sheets and a PVC sleeve which is reinforced with a polyamide textile. The elastic connection's flanges are interconnected with a copper girdle of 6 mm diameter, to ensure conductive connection of the flanges.

Installation, Maintenance and Service
Before installation, paste self-adhesive sealing onto the connecting flange face. To connect the elastic connection flanges, use galvanized M8 screws and nuts for dimensions from 90-50, and for 100-50 use M10 screws. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. To brace the flanges with a side longer than 40 cm, it is advisable to connect them in the middle with another screw clamp which prevents flange bar gapping. The elastic connection must not be mechanically loaded during installation or operation.
If installed into a ceiling, space for inspection must be taken into account. Usually once a year, the elastic connections must be checked for tightness of the elastic insert and flexibility of the PVC band.

	D (mm)	D1 (mm)	D2 (mm)	d (mm)	N	m ±10% (kg)
DK 180	180	215	240	10	8	0,40
DK 200	200	235	260	10	8	0,45
DK 225	225	260	285	10	8	0,50
DK 250	250	285	310	10	8	0,55
DK 280	280	315	340	10	8	0,61
DK 315	315	350	375	10	12	0,69
DK 355	355	390	415	10	12	0,77
DK 400	400	445	480	12	12	1,18
DK 560	560	605	640	12	16	1,62

Application
DK square elastic connections are designed to eliminate the transfer of fan (RQ or RS inlet) vibrations to ducting. They also eliminate strain and loading caused by thermal dilatation in air-handling ducting.

Operating Conditions and Position
The same as DV elastic connections.

Dimensional and Type Range
DK elastic connections are manufactured in nine dimensional ranges, from a diameter of 180 mm to 560 mm.

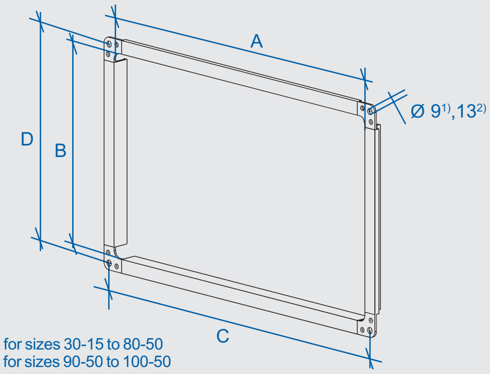
Materials
The same as DV elastic connections.

Installation, Maintenance and Service
Before installation, paste self-adhesive sealing onto the round connecting flange face. To connect the flanges, use galvanized M8 screws and nuts for dimensions up to 355, for dimensions from 400 up use M10 screws. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection. The elastic connection must not be mechanically loaded during installation or operation.
If installed into a ceiling, space for inspection must be taken into account. Usually once a year, the elastic connections must be checked for tightness of the elastic insert and flexibility of the PVC band.

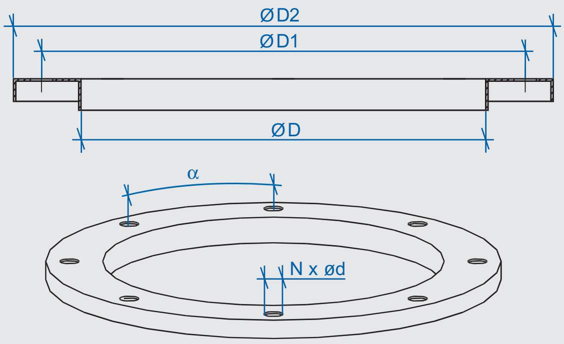

DV elastic connection


DK elastic connection

EP, GK Counter-Flanges



[1] Applicable for sizes 30-15 to 80-50
[2] Applicable for sizes 90-50 to 100-50



	A	B	C	D	m ±10%
	(mm)	(mm)	(mm)	(mm)	(kg)
EP 20/30-15	300	150	320	170	0,51
EP 20/40-20	400	200	420	220	0,65
EP 20/50-25	500	250	520	270	0,80
EP 20/50-30	500	300	520	320	0,85
EP 20/60-30	600	300	620	320	0,95
EP 20/60-35	600	350	620	370	1,02
EP 20/70-40	700	400	720	420	1,15
EP 20/80-50	800	500	820	520	1,35
EP 30 90-50	900	500	930	530	1,65
EP 30/100-50	1000	500	1030	530	1,95

Application

EP counter-flanges are used to terminate the air-handling duct, and thus to enable its connection to Vento system standard elements.

Dimensional and Type Range

EP flanges are manufactured in all Vento dimensional ranges, from 30-15 to 100-50.

Materials

EP counter-flanges are made of standard 20 mm or 30 mm high bar flange profiles, which are rolled from galvanized steel sheets (min. Zn layer of 275 g/m2). Galvanized corner irons are pressed from 11 373 steel sheets.

Installation

These flanges can be mounted on the free ends of a square duct of corresponding dimensions using self-tapping screws or rivets. They must be sealed with permanently flexible cement.

	D	D1	D2	d	N	α	m ±10%
	(mm)	(mm)	(mm)	(mm)			(kg)
GK 180	180	215	240	10	8	45°	0,40
GK 200	200	235	260	10	8	45°	0,45
GK 225	225	260	285	10	8	45°	0,50
GK 250	250	285	310	10	8	45°	0,55
GK 280	280	315	340	10	8	45°	0,61
GK 315	315	350	375	10	12	30°	0,69
GK 355	355	390	415	10	12	30°	0,77
GK 400	400	445	480	12	12	30°	1,18
GK 560	560	605	640	12	16	22,5°	1,62

Application

GK counter-flanges can be used to terminate the round air-handling duct at the place of connection to the inlets of RQ, RQ Ex, RS fans (not used if the RS fan is connected to a roof adaptor).

Dimensional and Type Range

GK counter-flanges are manufactured in nine dimensional ranges, from a diameter of 180 mm to 560 mm.

Materials

GK counter-flanges are made of galvanized steel sheets (min. Zn layer of 275 g/m^2).

Installation

These flanges can be mounted on the free ends of a round duct of corresponding diameter using self-tapping screws or rivets. They must be sealed with permanently flexible cement.

Protipříruba EP

Protipříruba GK

EKP Drop Eliminators

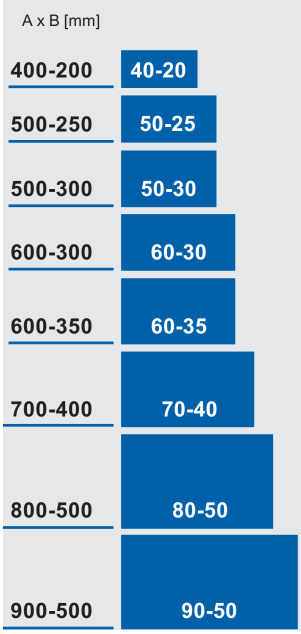
Application

Drop eliminators are intended for the separation of condensate drops from the air, from simple venting installations to sophisticated air-handling systems. They are designed to be installed directly in square air ducts. Ideally, they can be used along with other components of the Vento modular system, which ensure inter-compatibility and balanced parameters.

Operating Conditions

Eliminated air must be free of solid, fibrous, sticky, or aggressive impurities, and without corrosive chemicals or chemicals aggressive to zinc. The air must be free of corrosive chemicals or chemicals aggressive to zinc.

Fig. 1 – dimensions



Dimensional Range

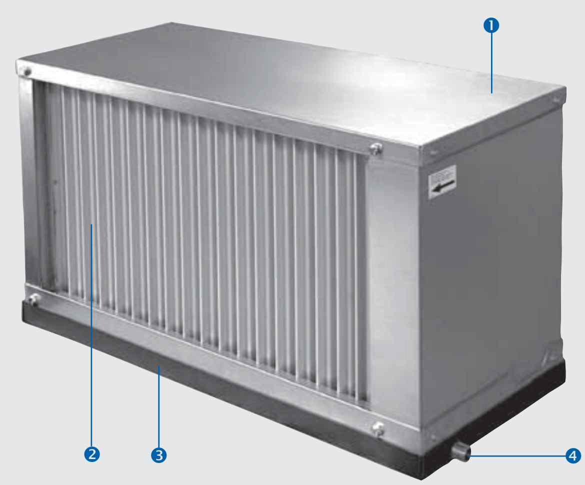
EKP drop eliminators are manufactured in a range of eight sizes according to the A x B dimensions of the connecting flange (see fig. #1). Drop eliminators can be connected to air ducts in the same way as any other Vento duct system component. Drop eliminators enable designers to cover the full air flow range of Vento fans.

Position and Location

When projecting the layout of the drop eliminator in the air-handling system, we recommend observing the following principles:

- Drop eliminators can work only in any position in which condensate draining is possible (tray at the bottom).

Fig. 2 – Description of Drop Eliminator Components



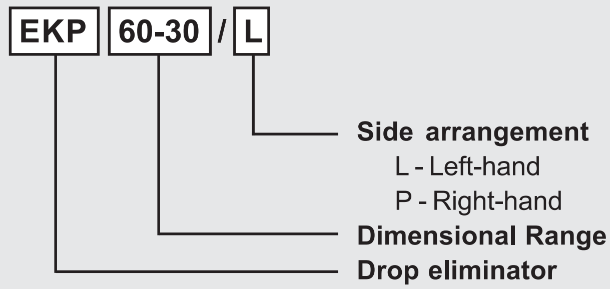
❶ External casing, ❷ Drop eliminator, ❸ Condensate tray, ❹ Condensate Drainage

- It is necessary to keep easy access to the drop eliminator, especially to the condensate drainage, to enable inspections and service.
- It is advisable to situate the drop eliminator behind the cooler (providing it is not a part of it) or heat exchanger.
- The connections between the cooler (heat exchanger) and drop eliminator should be watertight.

Materials and design

The external casing of the drop eliminators is made of galvanized steel sheets insulated against moisture condensation.

Fig. 3 – type designation



All used materials are carefully checked so they ensure long service life and reliability. As standard, drop eliminators are delivered in a left-hand version, looking at the air flow direction, and are equipped with an insulated condensate drainage tray.

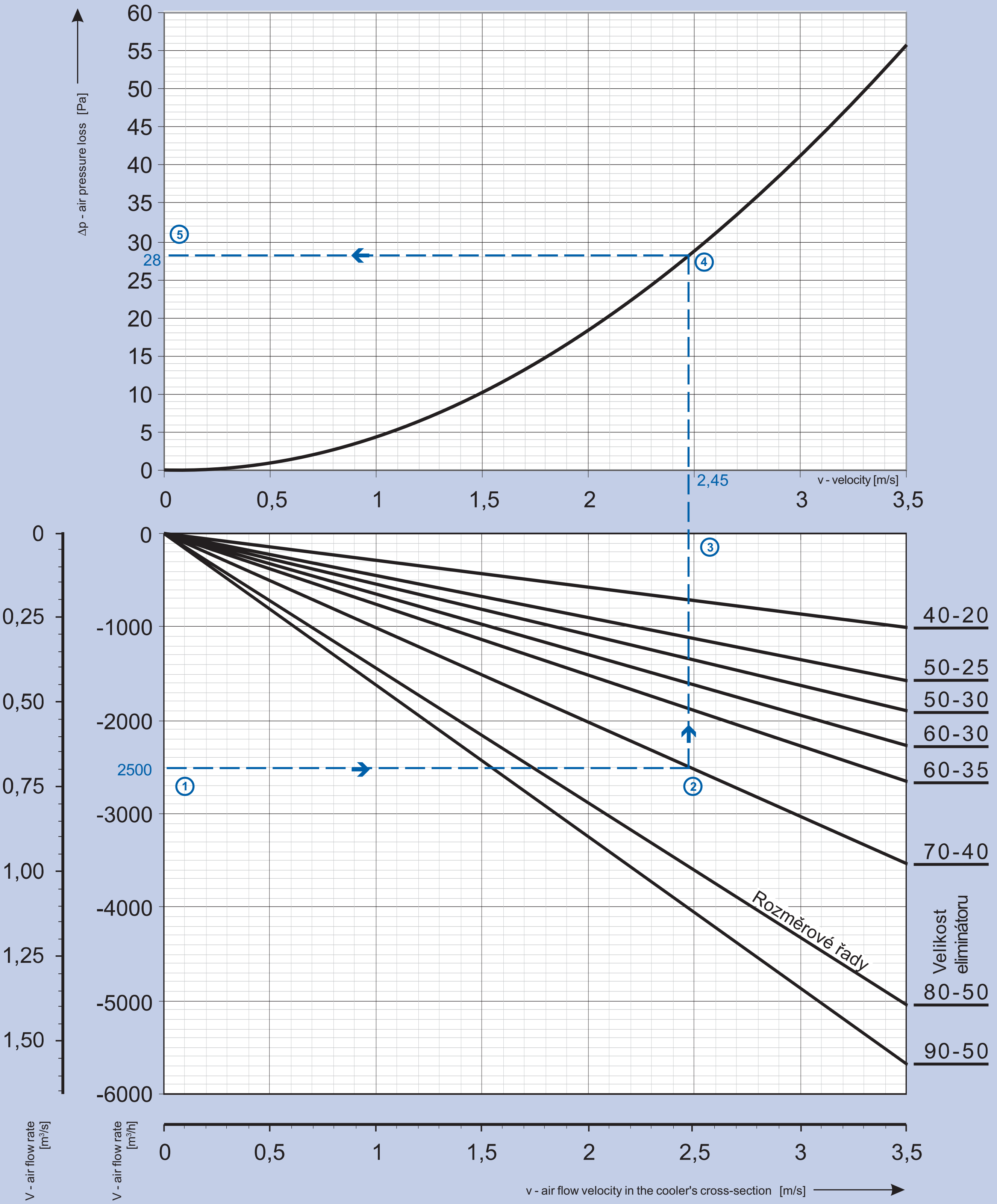
Drop Eliminator Designation

The type designation of coolers in projects and orders is defined by the key in figure # 3.
The above-mentioned specification without an ordering code corresponds to the stock configuration of the product, i.e. the left-hand arrangement. The drop eliminator is a configured product which should be preferably ordered using AeroCAD software, which will generate its ordering code.

Air Pressure Losses in a Drop Eliminator

Nomogram of air pressure losses for all drop eliminators

The curve of pressure losses is valid for all drop eliminators. The air pressure loss depends on the air flow velocity, and it is calculated for the air velocity in a free cross section of all Vento system dimensional ranges.



The nomogram of pressure losses is valid for all VO drop eliminators. For the selected air flow rate ①, the air flow velocity ③ in the free drop eliminator's cross-section ②, can be read in the lower graph, and then the drop eliminator's corresponding air pressure loss ⑤ at the known velocity can be determined in the upper part ④.

Example:

At an air flow rate of 2,500 m3/h, the velocity of the air flow in the EKP 70-40 drop eliminator will be 2.45 m/s.
The drop eliminator's air pressure loss for the above-mentioned air flow rate will be 28 Pa

Drop Eliminator Parameters

Dimensions and Weights

For important dimensions and weights of drop eliminators, refer to figure # 4 and table # 1.
The connection of the drop eliminator depends on the selected dimensional range.

Figure 4 - Drop eliminator dimensions

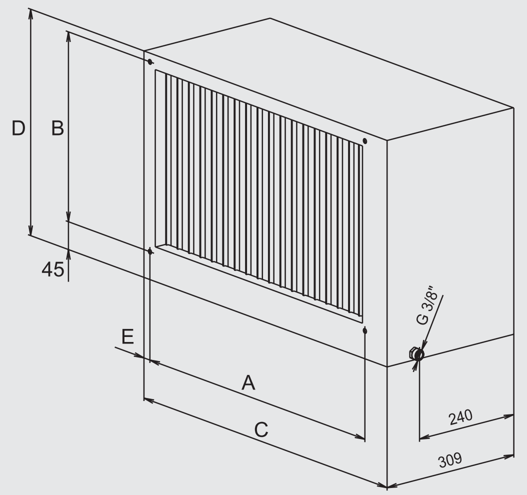


Table 1 - Drop eliminator dimensions

Size	Dimensions (mm)				
	A	B	C	D	E
EKP 40-20	420	220	508	281	100
EKP 50-25	520	270	608	331	150
EKP 50-30	520	320	608	381	150
EKP 60-30	620	320	708	381	200
EKP 60-35	620	370	708	431	200
EKP 70-40	720	420	808	481	200
EKP 80-50	820	520	908	581	250
EKP 90-50	930	530	1014	597	250

Installation, Service and Maintenance

Installation, servicing and maintenance can be performed only by a specialized company possessing the appropriate tools.

- There is no need for individual suspensions when installing the EKP drop eliminator. The drop eliminator can be inserted into the duct line, but it must not be exposed to any strain or torsion caused by the connected duct line.
- Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento units, use galvanized M8 screws and nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection, or use Cu conductor wiring.

Drop Eliminator Dimensioning

To dimension the drop eliminator, select the corresponding size of the drop eliminator from the dimensional range of Vento duct units.
The air pressure loss for all drop eliminators can be determined from the nomogram on page 243.
As the design of the drop eliminators is standardized, the pressure loss only depends on the air flow velocity through the drop eliminator. The nomogram also includes air flow rate - velocity conversion curves for all drop eliminator sizes.

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