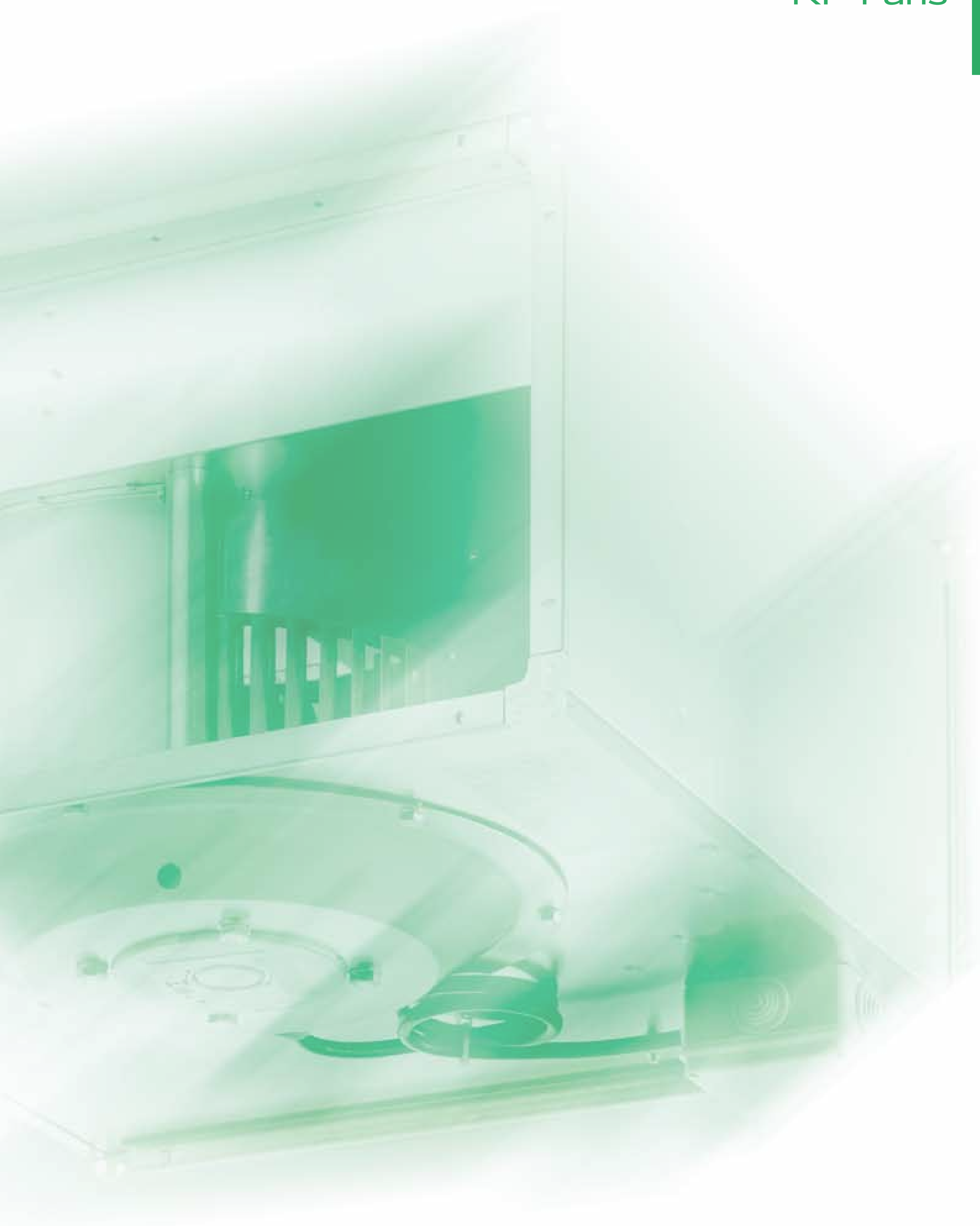
VENTO SYSTEM

REMAK

contents

RP Fans



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 ºC to +40 ºC, and with certain types up to +70 ºC. 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

P 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 9,200 m^3 per hour.

FIG. 1 – DIMENSIONS

A × B [mm]	
400-200	40-20
500-250	50-25
500-300	50-30
600-300	60-30
600-350	60-35
700-400	70-40
800-500	80-50
900-500	90-50
1000-500	100-50

MATERIALS

The external casing and connecting flanges of RP fans are made of galvanized steel sheets (Zn 275 g/m^2). Impeller blades – with forward curved blades are made of galvanized sheet steel, diffusers are made of aluminium. Motors are made of aluminium alloys, copper and plastics.

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. 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".

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!
Maximum thermo-contact permanent loading is 1.2 A at 250V / 50 Hz (cos φ 0,6) je 1,2 A (resp. 2 A respectively 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
0–10 V from the OSX control unit) is a significant feature of this product line.
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..

TABLE 1 – THE INPUT VOLTAGE AND CONTROLLER'S STAGE

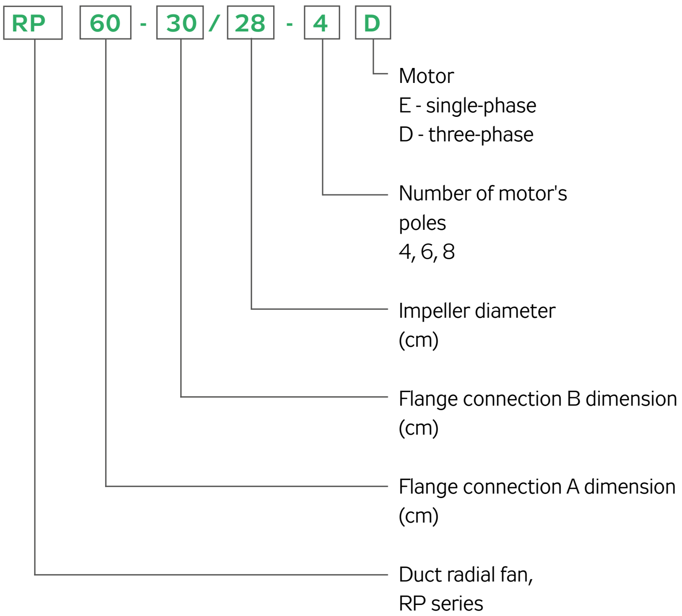
MOTOR TYPE	CURVE CHARACTERISTICS – CONTROLLER'S STAGE				
	5	4	3	2	1
1 – phase	230 V	180 V	160 V	130 V	105 V
3 – phase	400 V	280 V	230 V	180 V	140 V

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
- → VFT metal grease filters and spare VT3 cells
- → 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
- → VLH humidification chambers and steam humidifiers
- → řídicí jednotky a čidla
- → TRN Controllers, ORe 5 controllers, TRRE, TRRD Controllers, respectively PE controllers
- → STE, STD Protecting Relays

FIGURE 2 – TYPE DESIGNATION OF RP FANS

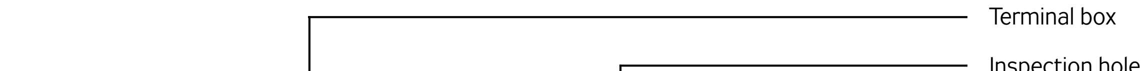


FAN DESCRIPTION AND DESIGNATION

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.

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



OPERATING CHARACTERISTICS

The output characteristics of RP fans are measured in REMAK 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.

Output characteristics in the "Data Section" starting on page 17 determine the relationship curve of the air flow rate V (m^3/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.

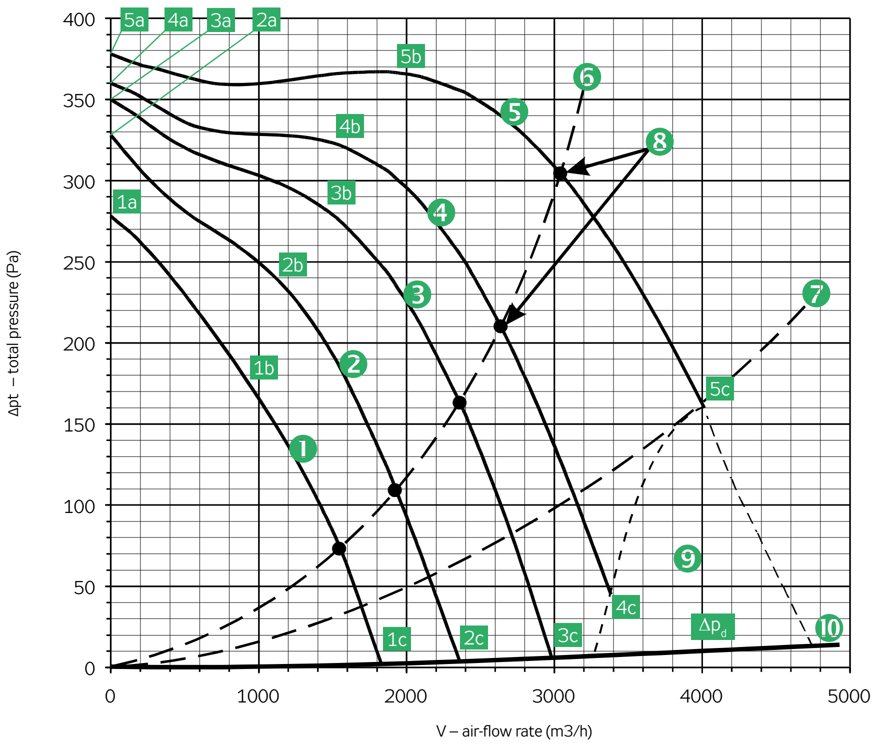
Some RP fans have a so-called forbidden area. The forbidden (non--working) area ❾ is defined by the dashed lines, and it is marked in the graph when any characteristic ends with point "c", e.g. 5c, which does not lie on the dynamic pressure curve "p_d".

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 ❿ (representing pd value) when the fan works with free inlet and free outlet, i.e. $\Delta p_s = 0$ Pa.

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.

GRAPH 1



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 ČSN EN ISO 3743-2.
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.
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.

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.

Noise and Noise 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.

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

where 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 ČSN EN 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).
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 $L_{pA\,okt}$.
The total sound level L_{pA} can be calculated from the known values of the sound level in octave bands $L_{pA\,okt}$

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

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

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 LWA value - A-scale sound power level and values L_{WAokt} for individual mean frequencies of octave bands.

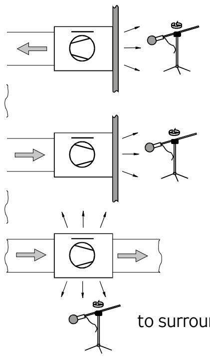
Measuring Method Used

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 EN ISO 3743-2 Standard, i.e. technical methodology for reverberant chambers, was used to determine the noise parameters of fans, i.e. sound power level LWA, presented in this catalogue. In accordance with this Standard, the sound pressure levels in octave bands LPAokt were measured, from which the sound power levels in these octave bands LWAokt 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 LWA [dB(A)] and LWAokt [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).
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).

TABLE 4 – SOUND POWER VALUES

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	68	74	61
Sound power level LWAokt [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

FIGURE 4 – ORIENTATION OF MEASURED FAN



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)
- → 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:

- → Specify the maximum permissible sound level in the given location.
- → 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.
- → 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.
- → 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.
- → 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).
- → 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.
- → 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.

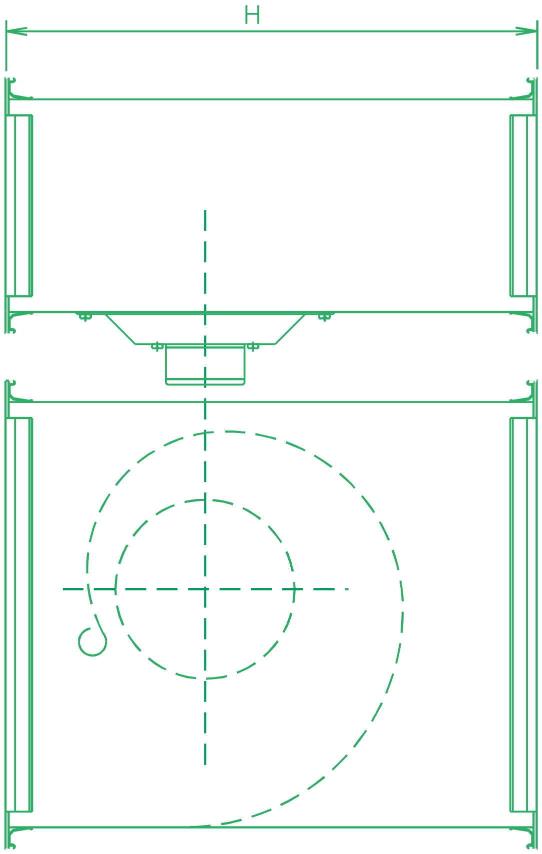
DIMENSIONS, WEIGHTS AND PERFORMANCE

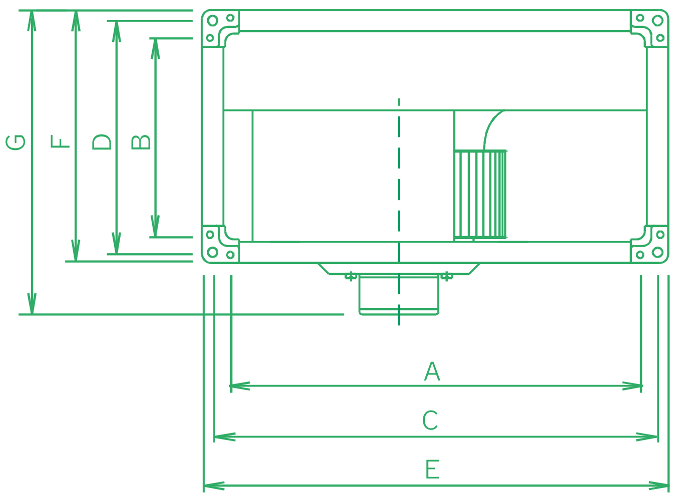
For important dimensions of RP fans, refer to Figure # 5 and Table # 5. For basic parametrs refer to table # 6.

TABLE 5 – FAN DIMENSIONS

Fan Type	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

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_{nom}	U_{nom}	P_{max}	I_{max}	t_{max}	C	Controller	m	ErP2015	
	m^3/h	Pa	W	min^{-1}	V	W	A	°C	µF	type	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	✓	η=32.2% (statA) N=44.0 (N44)
RP 50 - 25/22 - 6D	1376	137	0	940	400	222	0,46	55	-	TRN 2D	16	✓	N/A (P1 < 125 W)
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	✓	η=39.2% (statA) N=47.1 (N44)
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	✓	η=38.8% (statA) N=45.9 (N44)
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 2D	43,5	✓	η=36.6% (statA) N=44.0 (N44)
RP 70 - 40/35 - 4D	5981	806	340	1440	400	3527	6	40	-	TRN 7D	62	✓	η=41.2% (statA) N=46.3 (N44)
RP 80 - 50/40 - 8D	4720	298	0	700	400	1230	2,29	55	-	TRN 4D	57,1	✓	η=37.3% (statA) N=45.6 (N44)
RP 80 - 50/40 - 6D	7357	496	0	960	400	2824	5,11	50	-	TRN 7D	71	✓	η=42.2% (statA) N=48.2 (N44)
RP 80 - 50/40 - 4D	6831	1040	683	1410	400	4919	8,1	40	-	TRN 9D	78	✓	η=44.4% (statA) N=47.9 (N44)
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	✓	η=42.3% (statA) N=47.3 (N44)
RP 90 - 50/45 - 8D	7810	386	0	690	400	1892	3,88	55	-	TRN 4D	93	✓	η=38.7% (statA) N=45.7 (N44)
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	✓	η=42.3% (statA) N=47.3 (N44)
RP 100 - 50/45 - 8D	7810	386	0	690	400	1892	3,88	55	-	TRN 4D	93	✓	η=38.7% (statA) N=45.7 (N44)

SYMBOLS USED IN TABLE 6:

V_{max} maximum air flow rate
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)
$P_{max.}$ electric motor maximal power output
$I_{max.}$ maximum phase current at voltage **U** (this value must be checked)
$t_{max.}$ maximum permissible transported air temperature at air flow **$V_{max.}$**
C capacitor capacity with single-phase fans
FM. frequency inverter
m weight of the fan (±10%)

ErP2015 Fan compliance with the requirements of Regulation 2009/125/EC (NOT compliant fans must not be used within EU region)

DATA SECTION

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.

EXAMPLE AND EXPLANATIONS OF FAN DATA

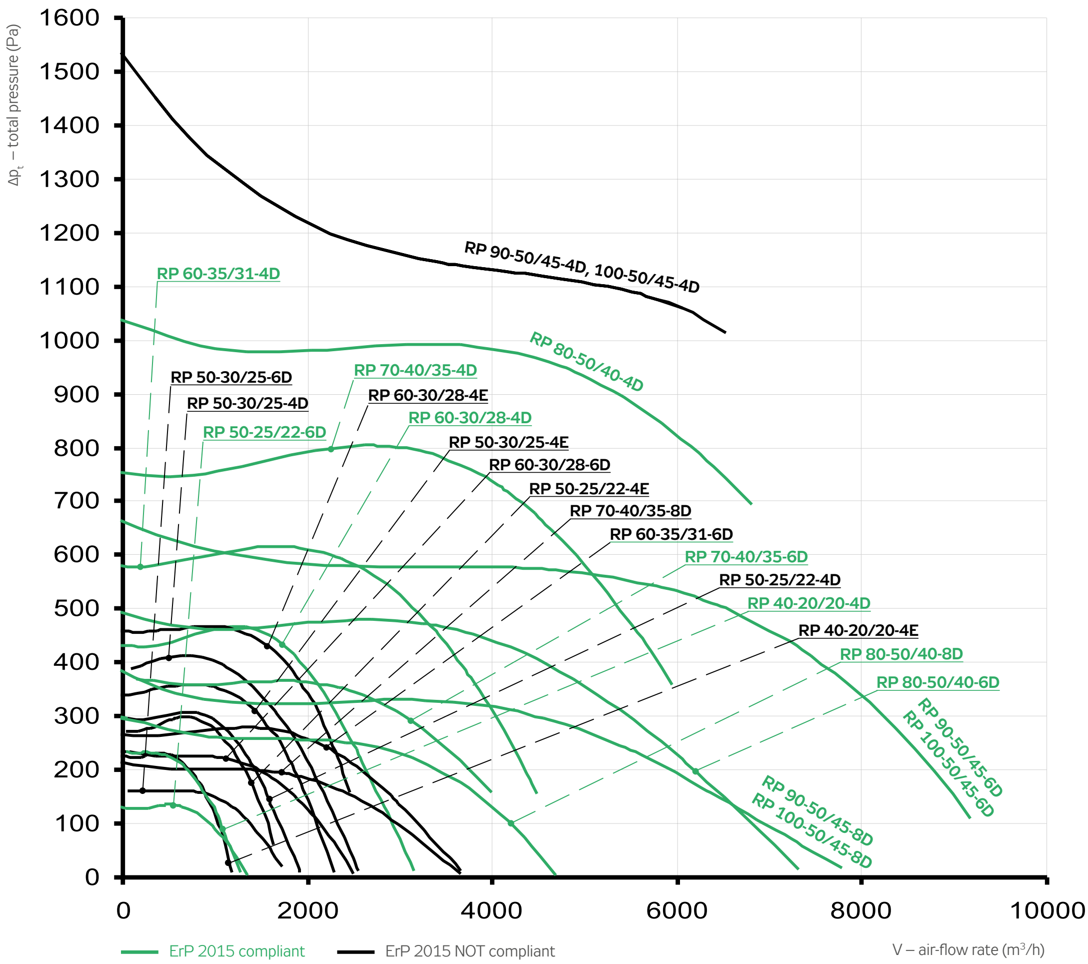
RP 40-20/20-4D

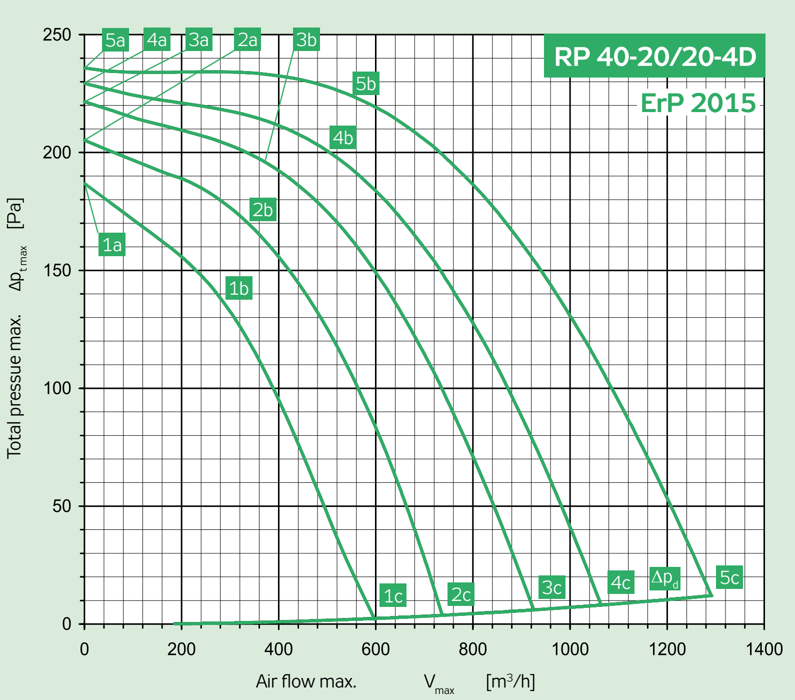
Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	291
Max. current (5c)	I_{max}	[A]	0.50
Mean speed	n	[min^{-1}]	1420
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	70
Air flow max.	V_{max}	[m^3/h]	1292
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	236
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	12.8
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

The meaning of individual lines is as follows:

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.

GRAPH 2 – RP FAN CHARACTERISTICS QUICK SELECTION

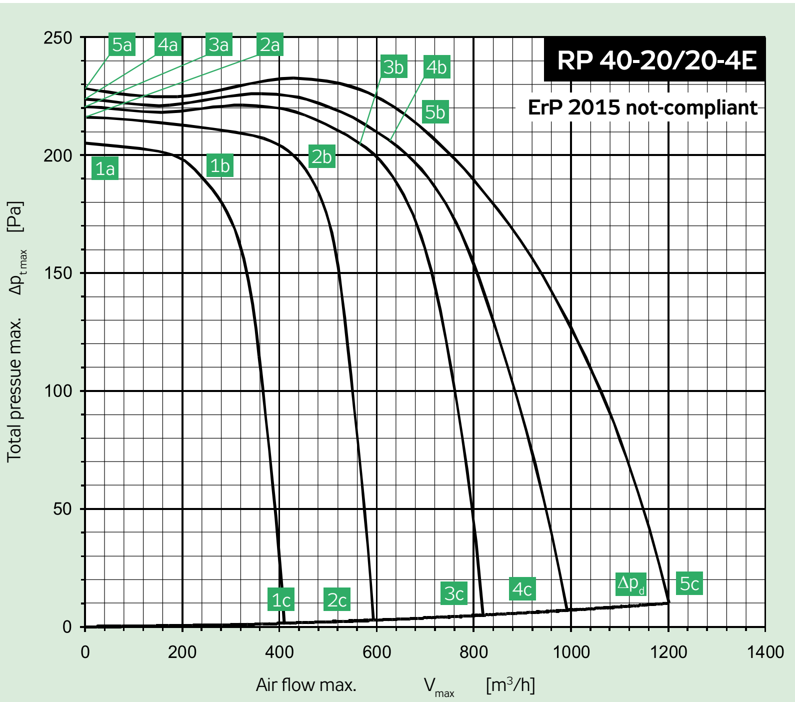




Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	291
Max. current (5c)	I_{max}	[A]	0.50
Mean speed	n	[min⁻¹]	1420
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	70
Air flow max.	V_{max}	[m³/h]	1292
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	236
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	12.8
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	68	74	61
Sound power level LWAokt [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
Input power 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 [m³/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



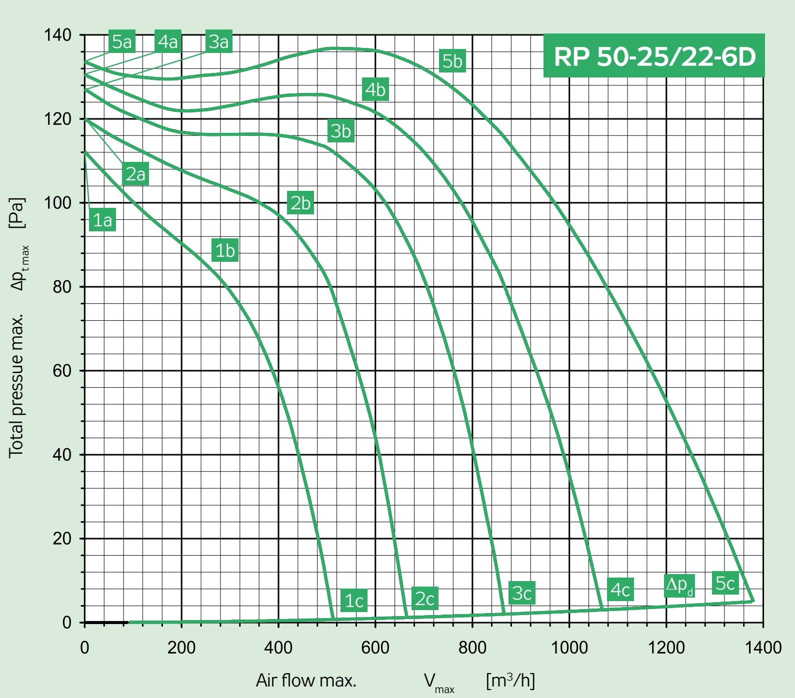
Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	322
Max. current (5c)	I_{max}	[A]	1.60
Mean speed	n	[min⁻¹]	1420
Capacitor	C	[F]	5
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	1200
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	233
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	13.4
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	71	78	66
Sound power level LWAokt [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	1.6	0.56	0.81	1.58	0.49	0.78	1.46	0.46	0.72	1.17	0.48	0.57	0.95
Input power 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 [m³/h]	0	692	1200	0	629	851	0	576	607	0	459	470	0	254	358
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
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

RP 50-25/22-6D



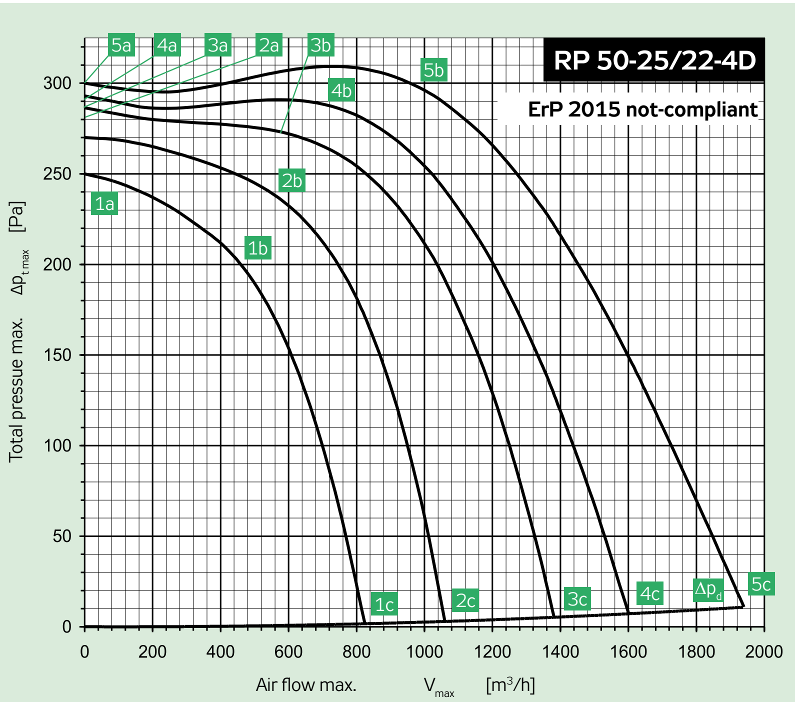
Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	222
Max. current (5c)	I_{max}	[A]	0.46
Mean speed	n	$[min^{-1}]$	940
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	$[m^3/h]$	1376
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	137
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	16
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	66	66	57
Sound power level LWAokt [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
Input power 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

RP 50-25/22-4D

ErP 2015 not-compliant



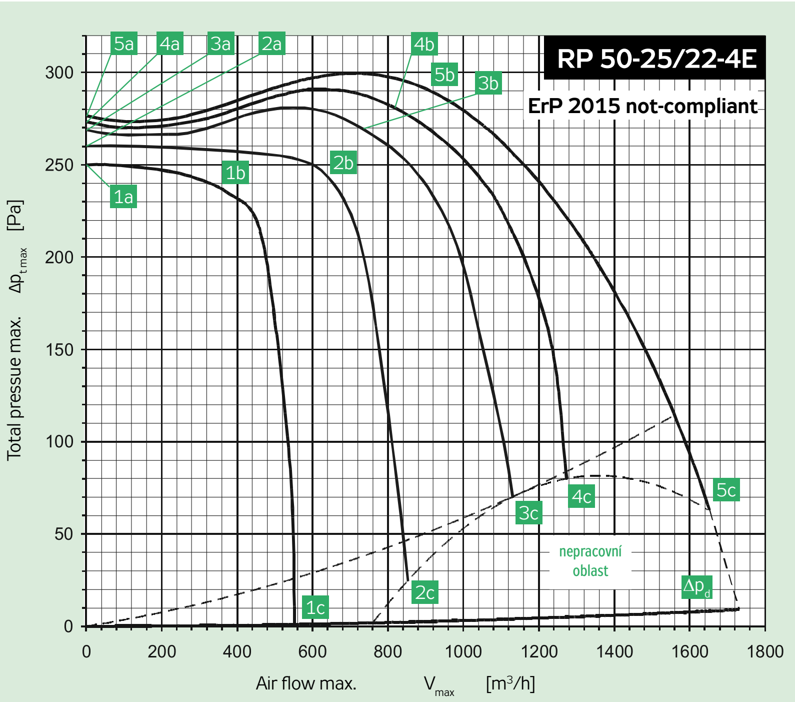
Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	590
Max. current (5c)	I_{max}	[A]	1.00
Mean speed	n	$[min^{-1}]$	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	$[m^3/h]$	1937
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	309
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	18.1
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	72	78	64
Sound power level LWAokt [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
Input power 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

RP 50-25/22-4E

ErP 2015 not-compliant



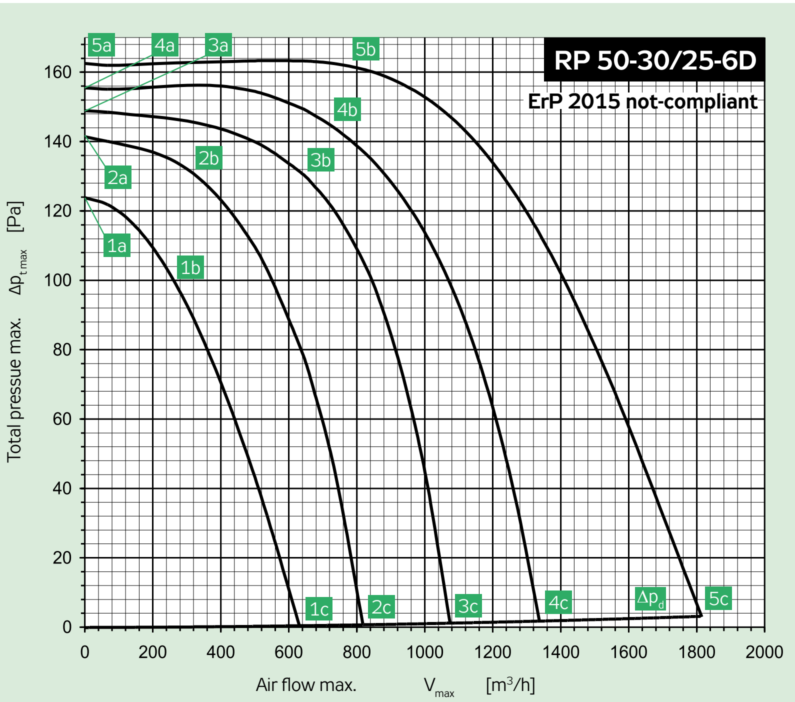
Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	499
Max. current (5c)	I_{max}	[A]	2.30
Mean speed	n	$[min^{-1}]$	1420
Capacitor	C	[F]	8
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	$[m^3/h]$	1648
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	299
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	55
Weight	m	[kg]	18.1
Five-stage controller	type		TRN 4E
Protecting relay	type		STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	73	77	65
Sound power level LWAokt [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
Input power 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

RP 50-30/25-6D

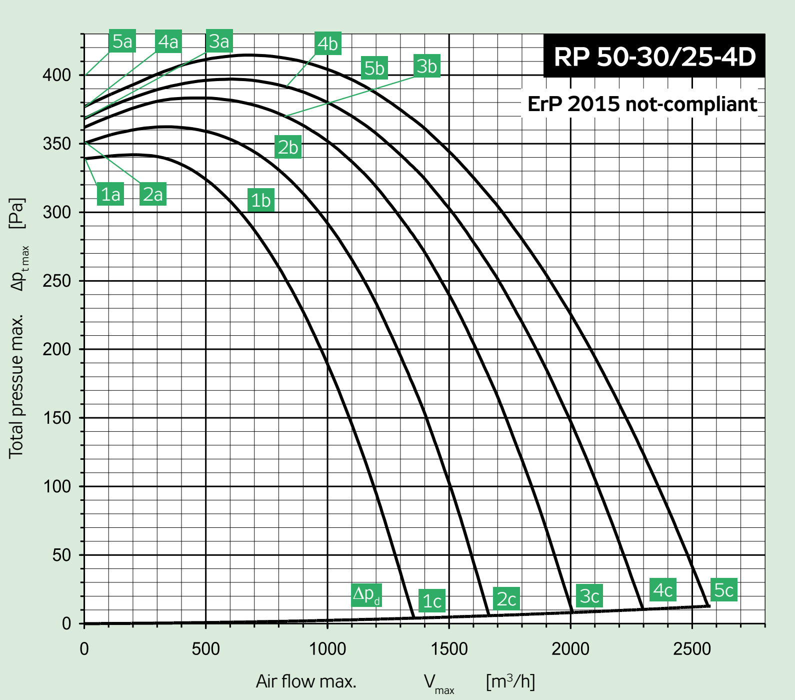
ErP 2015 not-compliant



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	356
Max. current (5c)	I_{max}	[A]	0.69
Mean speed	n	$[min^{-1}]$	940
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	50
Air flow max.	V_{max}	$[m^3/h]$	1811
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	163
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	18.8
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	65	68	58
Sound power level LWAokt [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

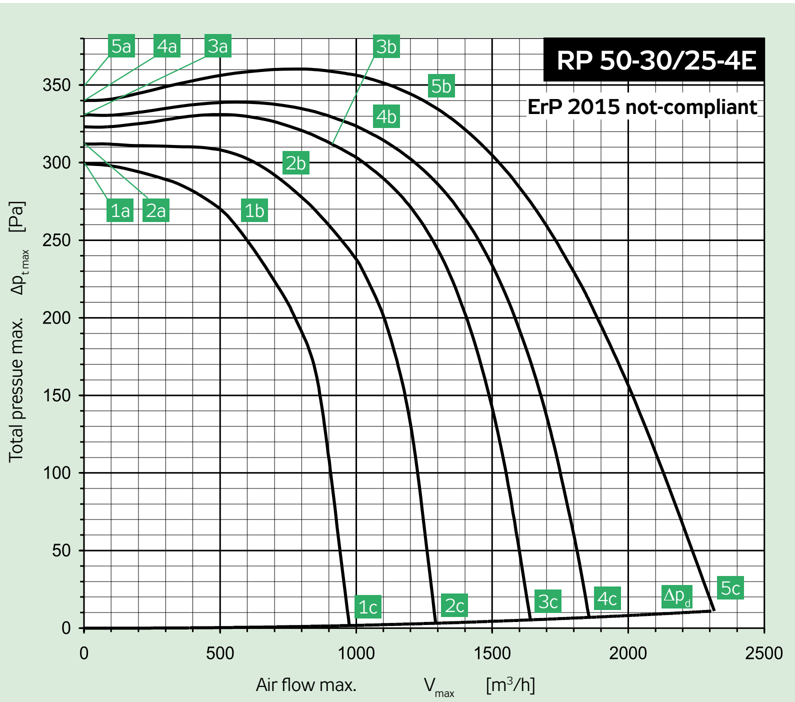
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.42	0.45	0.69	0.30	0.36	0.65	0.25	0.33	0.57	0.21	0.25	0.47	0.21	0.24	0.38
Input power P [W]	76	133	356	49	104	223	42	88	157	37	51	98	33	41	59
Speed n $[min^{-1}]$	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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1004
Max. current (5c)	I_{max}	[A]	1.97
Mean speed	n	[min⁻¹]	1450
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	50
Air flow max.	V_{max}	[m³/h]	2576
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	414
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	22.5
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	74	79	69
Sound power level LWAokt [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

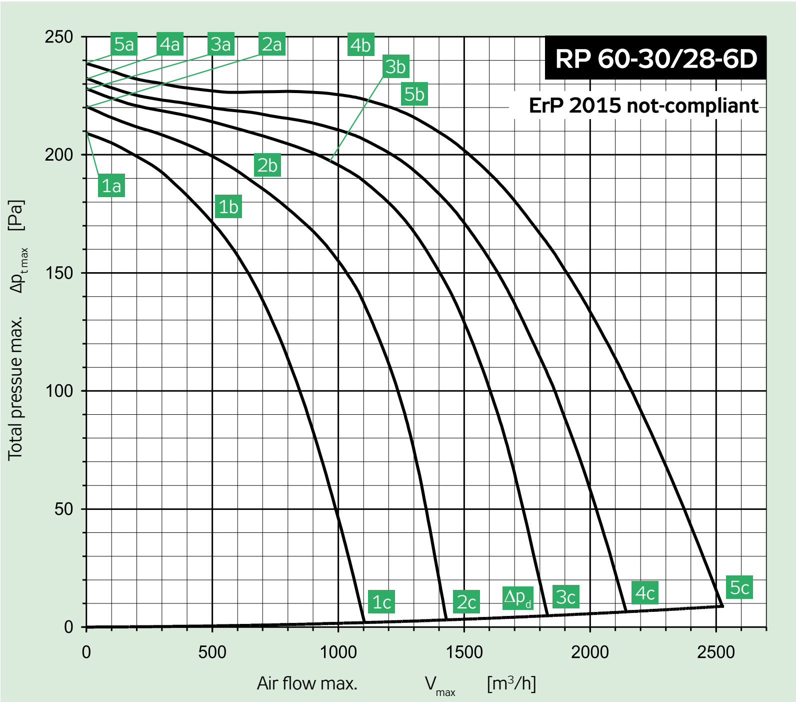
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.30	1.37	1.97	0.72	0.88	1.92	0.60	0.89	2.10	0.52	0.90	1.99	0.49	0.93	1.77
Input power P [W]	223	441	1004	133	271	803	120	268	700	114	246	519	97	205	358
Speed n [min⁻¹]	1479	1454	1362	1469	1417	1216	1457	1387	1096	1434	1336	904	1390	1277	731
Air flow V [m³/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



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	831
Max. current (5c)	I_{max}	[A]	3.68
Mean speed	n	[min⁻¹]	1380
Capacitor	C	[F]	14
Max. working temp.	t_{max}	[ºC]	50
Air flow max.	V_{max}	[m³/h]	2305
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	360
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	22.8
Five-stage controller	type		TRN 4E
Protecting relay	type		STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	75	81	68
Sound power level LWAokt [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

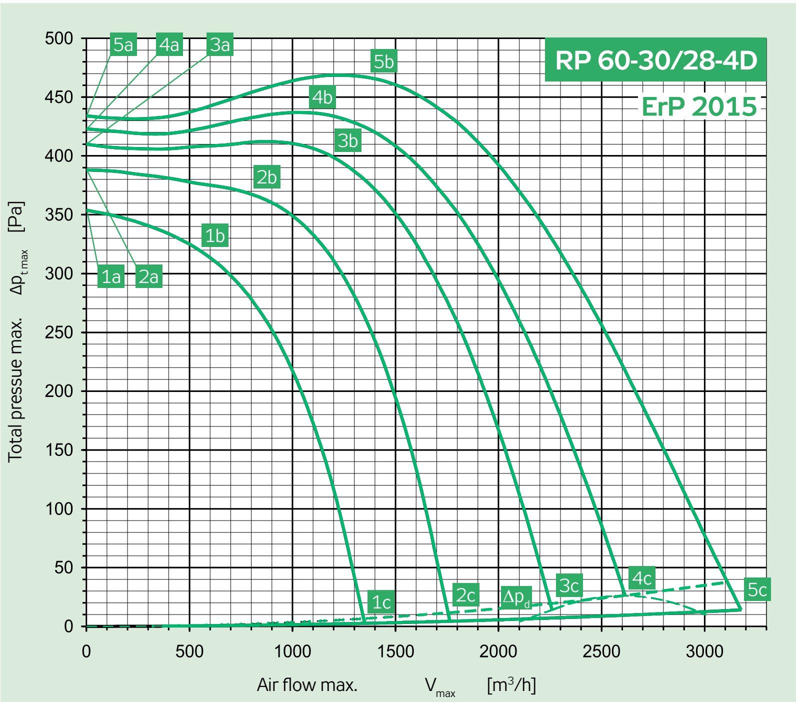
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	1.23	1.94	3.68	1.11	1.87	3.64	1.09	1.76	3.51	1.02	1.62	3.07	0.98	1.55	2.64
Input power P [W]	270	444	831	199	339	632	174	286	539	135	215	381	107	167	262
Speed n [min⁻¹]	1453	1382	1162	1436	1336	943	1424	1319	830	1402	1276	664	1368	1205	508
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	575
Max. current (5c)	I_{max}	[A]	1.28
Mean speed	n	[min⁻¹]	960
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	2531
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	239
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	25.8
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	69	73	63
Sound power level LWAokt [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]	0.30	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
Input power 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 [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1397
Max. current (5c)	I_{max}	[A]	2.38
Mean speed	n	[min⁻¹]	1450
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	3178
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	469
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	31.5
Five-stage controller	type		TRN 4 D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	78	83	70
Sound power level LWAokt [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
Input power 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 [m³/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

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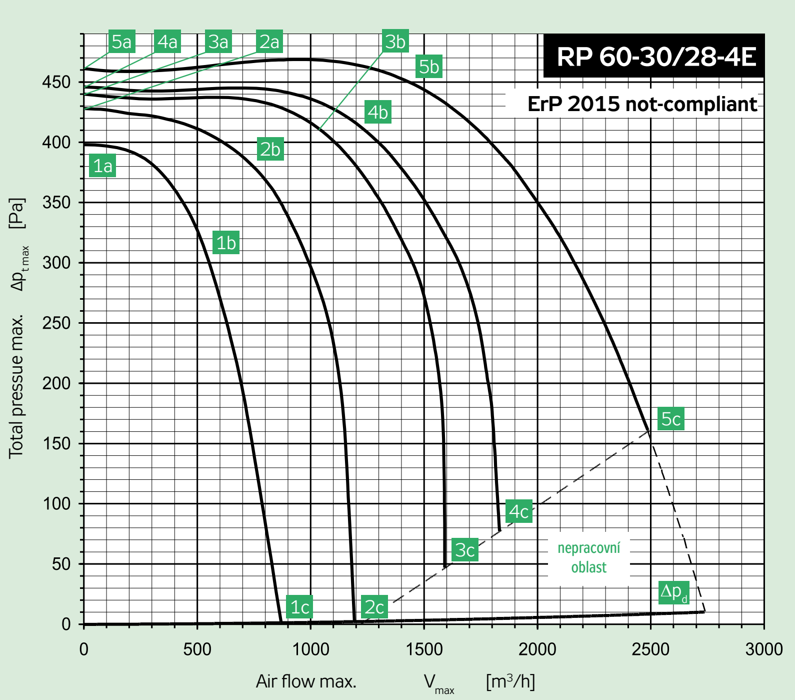
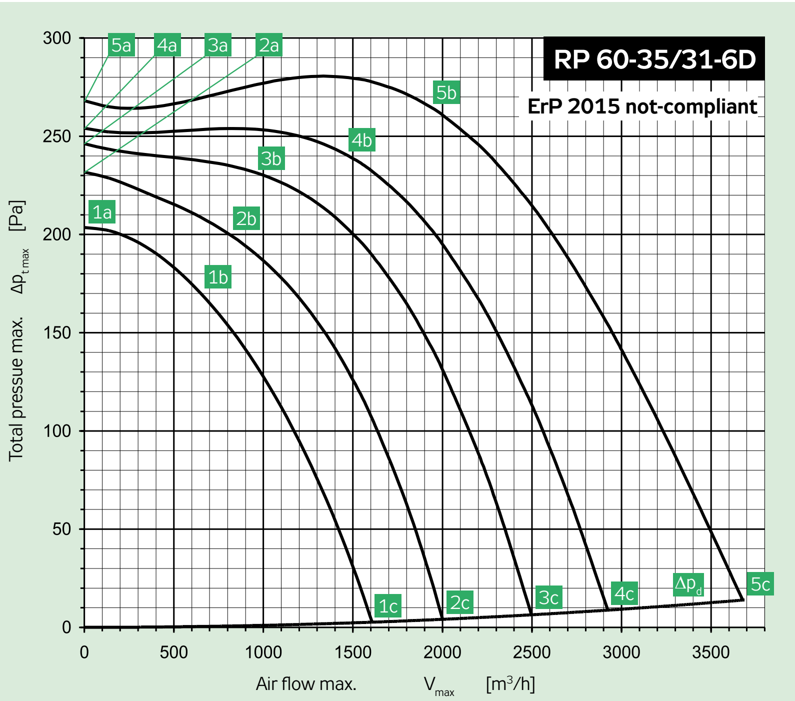


Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	1046
Max. current (5c)	I_{max}	[A]	5.10
Mean speed	n	[min⁻¹]	1400
Capacitor	C	[F]	16
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	2496
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	469
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	152
Weight	m	[kg]	31.7
Five-stage controller	type		TRN 7E
Protecting relay	type		STE

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	77	83	70
Sound power level LWAokt [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
Input power 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 [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	948
Max. current (5c)	I_{max}	[A]	1.86
Mean speed	n	[min⁻¹]	910
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	3687
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	281
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	31.2
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	70	75	64
Sound power level LWAokt [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
Input power 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 [m³/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

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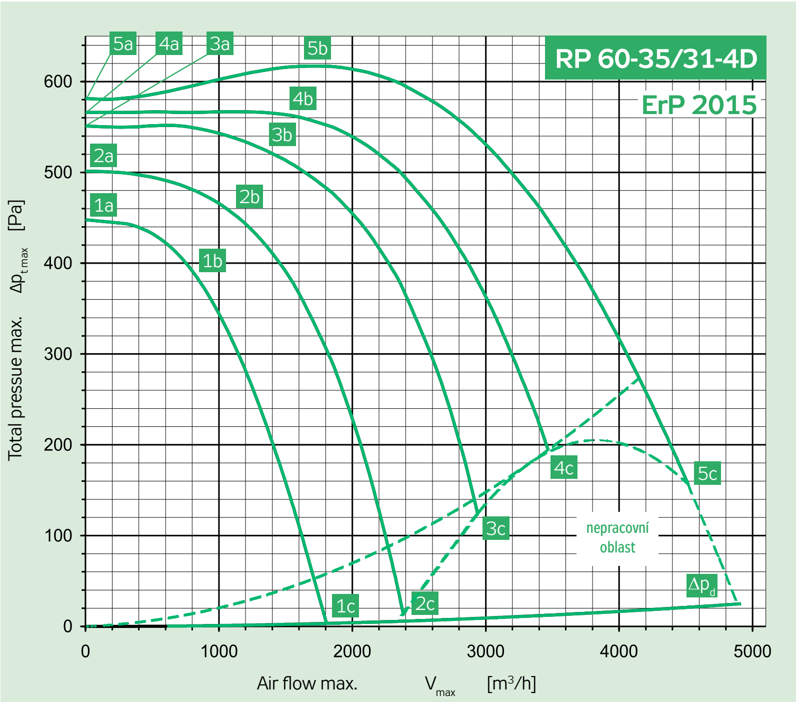
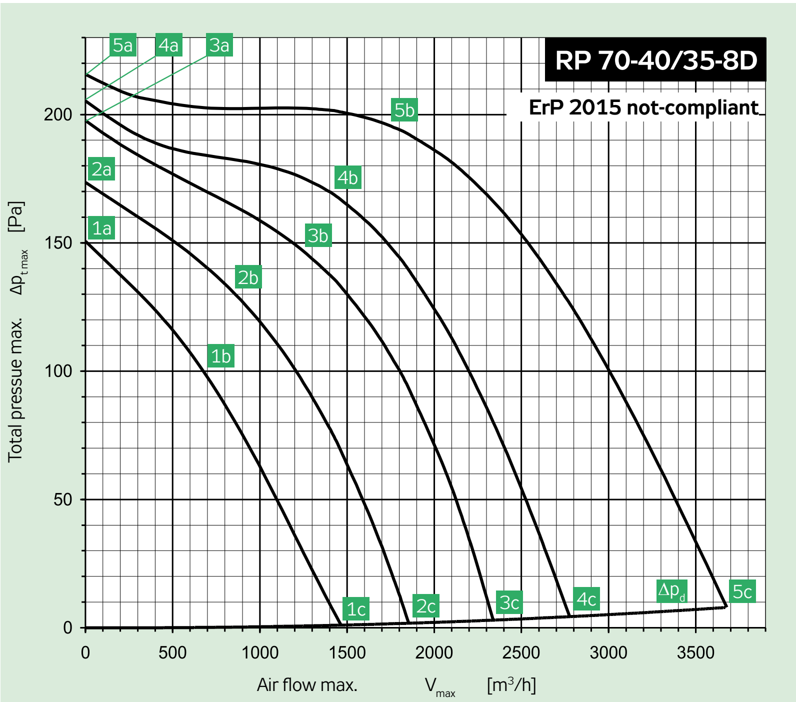


Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	2464
Max. current (5c)	I_{max}	[A]	4.10
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	4512
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	617
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	136
Weight	m	[kg]	38.9
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	78	83	72
Sound power level LWAokt [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

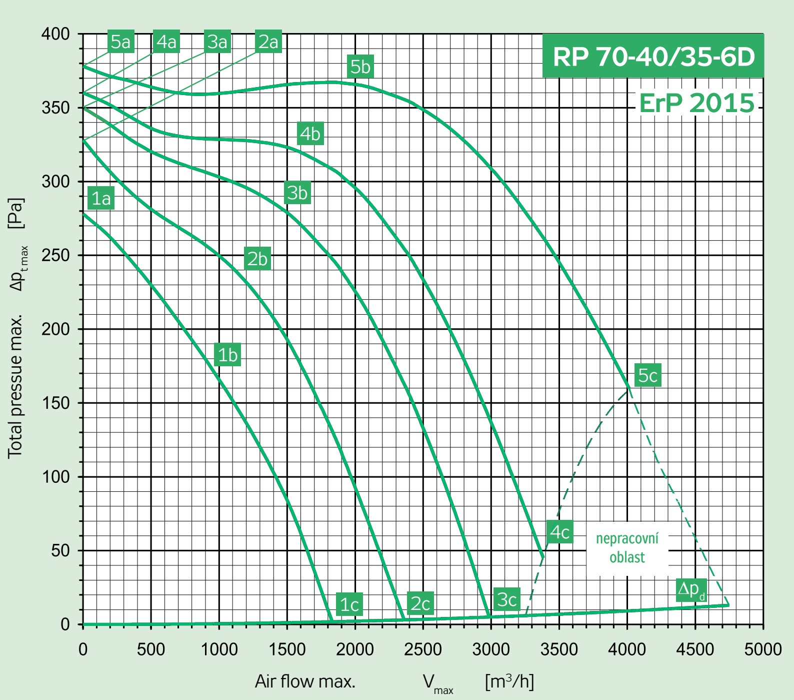
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.41	1.72	4.10	1.04	1.62	4.10	1.06	1.62	4.10	1.07	1.73	4.10	1.13	1.77	3.39
Input power P [W]	503	832	2464	351	666	1730	343	563	1374	295	484	1007	252	382	629
Speed n [min^{-1}]	1474	1440	1252	1445	1383	1083	1418	1346	912	1381	1270	603	1321	1164	461
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	642
Max. current (5c)	I_{max}	[A]	1.38
Mean speed	n	[min^{-1}]	670
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	3669
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	216
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	44.5
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	68	72	62
Sound power level LWAokt [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

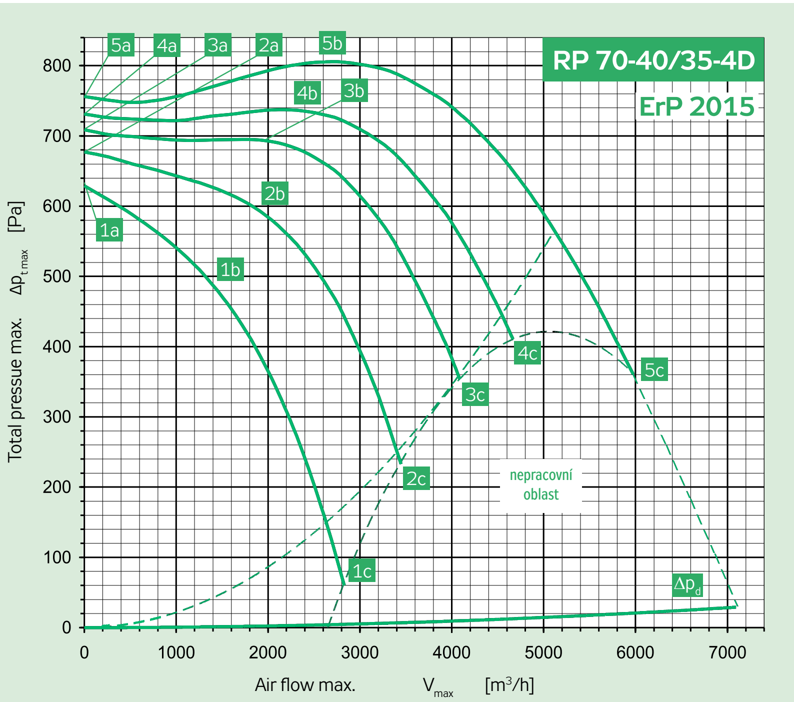
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.90	0.97	1.38	0.57	0.71	1.15	0.48	0.64	1.00	0.41	0.53	0.83	0.37	0.49	0.68
Input power P [W]	166	318	642	100	205	390	84	167	277	71	111	179	60	84	113
Speed n [min^{-1}]	725	673	532	706	631	406	689	592	351	657	573	278	605	495	223
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1096
Max. current (5c)	I_{max}	[A]	2.00
Mean speed	n	[min⁻¹]	920
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	4032
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	378
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	151
Weight	m	[kg]	43.5
Five-stage controller	type		TRN 4D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	74	79	69
Sound power level LWAokt [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

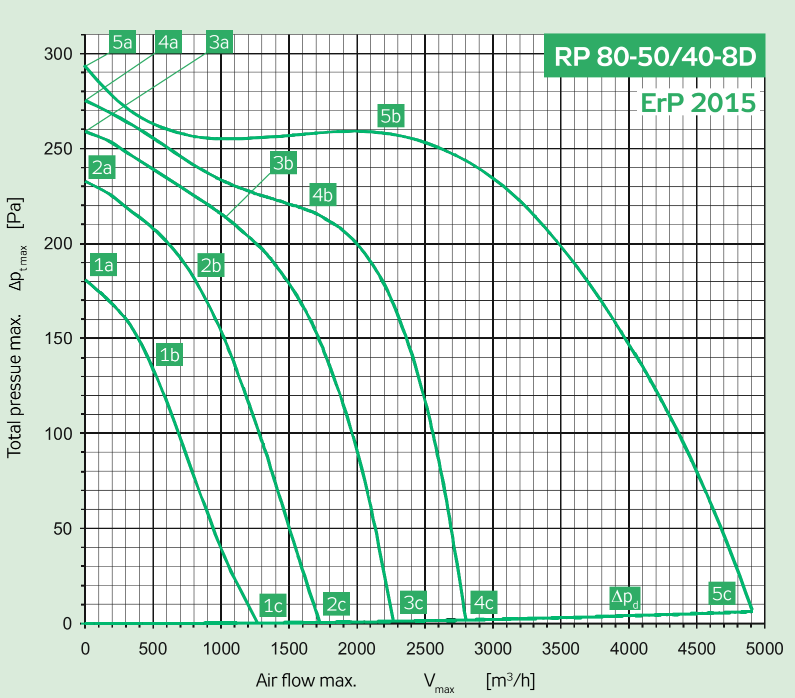
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.98	1.19	2.00	0.67	0.97	2.00	0.60	0.99	1.92	0.56	0.93	1.60	0.57	0.91	1.29
Input power P [W]	206	500	1096	153	350	784	138	316	600	127	239	392	112	182	243
Speed n [min⁻¹]	977	922	779	954	872	566	935	813	424	896	756	354	835	644	285
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	3527
Max. current (5c)	I_{max}	[A]	6.00
Mean speed	n	[min⁻¹]	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	5981
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	806
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	340
Weight	m	[kg]	62
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	84	90	77
Sound power level LWAokt [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

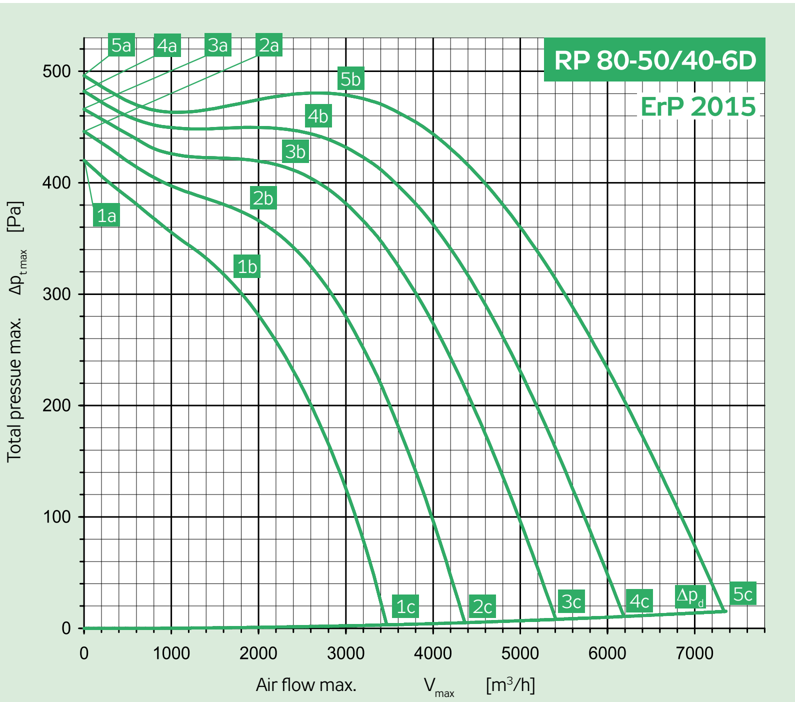
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.98	2.67	6.00	1.54	2.61	6.00	1.41	2.68	6.00	1.84	3.34	6.00	1.98	3.27	5.73
Input power P [W]	442	1231	3527	483	1065	2522	410	931	2028	503	924	1520	437	697	1055
Speed n [min⁻¹]	1478	1442	1312	1457	1397	1189	1441	1355	1083	1387	1244	891	1327	1157	598
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1230
Max. current (5c)	I_{max}	[A]	2.29
Mean speed	n	[min⁻¹]	700
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	4720
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	298
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	57.1
Five-stage controller	type		TRN 4D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	69	74	63
Sound power level LWAokt [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

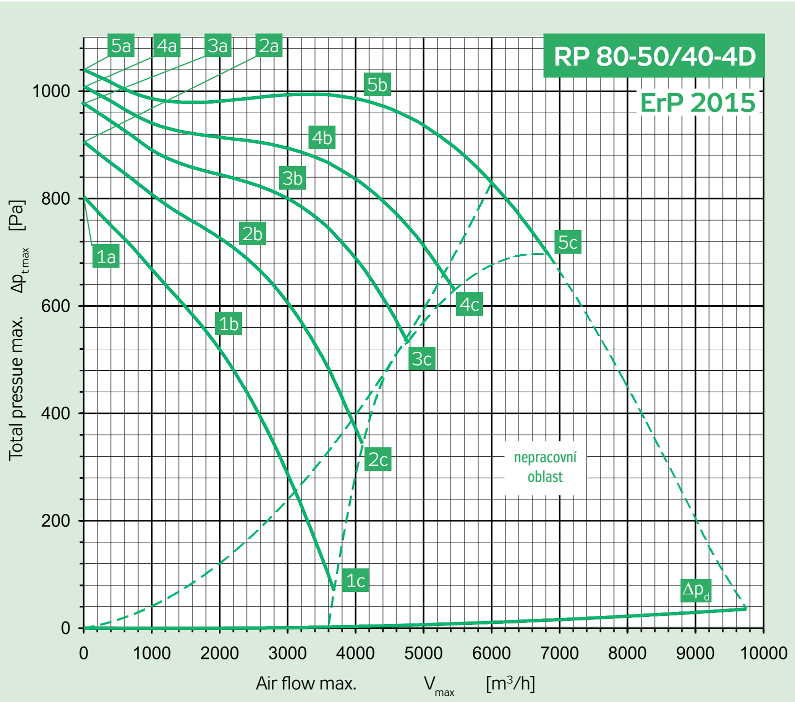
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.88	1.05	2.29	0.56	0.85	1.80	0.53	0.72	1.52	0.54	0.70	1.24	0.62	0.72	1.00
Input power P [W]	239	476	1230	159	321	646	147	226	438	136	180	271	115	132	158
Speed n [min⁻¹]	736	698	478	713	646	291	696	646	234	658	604	183	578	510	147
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	2824
Max. current (5c)	I_{max}	[A]	5.11
Mean speed	n	[min⁻¹]	960
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	50
Air flow max.	V_{max}	[m³/h]	7357
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	496
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	71
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	77	81	68
Sound power level LWAokt [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

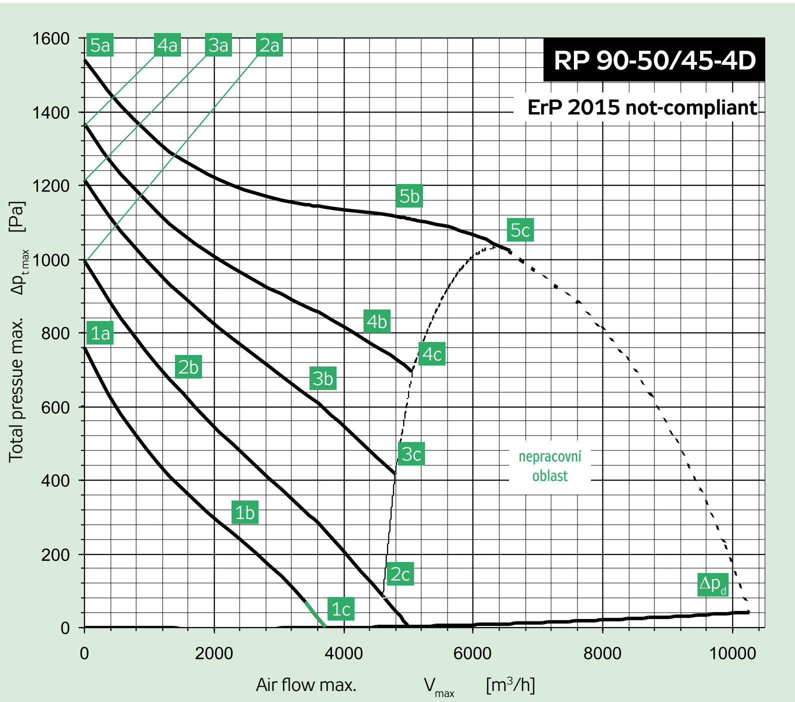
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	2.17	2.58	5.11	1.43	2.08	4.99	1.22	2.03	4.90	1.11	2.00	4.40	1.08	2.10	3.80
Input power P [W]	441	1013	2824	276	724	1957	264	633	1556	229	512	1044	201	421	678
Speed n [min⁻¹]	992	960	835	980	928	710	967	899	621	948	853	507	917	774	409
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8.10
Mean speed	n	[min^{-1}]	1410
Capacitor	C	[F]	-
Max. working temp.	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. (5c)	$\Delta p_{s\,min}$	[Pa]	683
Weight	m	[kg]	78
Five-stage controller	type		TRN 9D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	88	92	77
Sound power level LWAokt [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

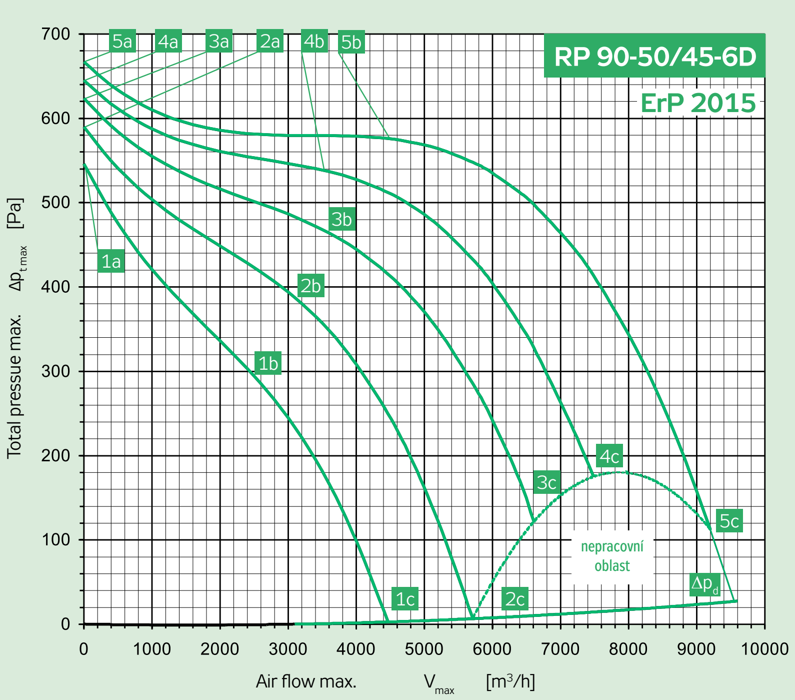
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	3.00	5.01	8.10	2.38	4.91	8.10	2.33	4.93	8.10	2.54	4.88	8.10	2.96	5.21	8.10
Input power P [W]	1217	2915	4919	903	2143	3498	782	1770	2800	721	1379	2117	671	1110	1516
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



Power supply	D	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8.30
Mean speed	n	[min^{-1}]	1260
Capacitor	C	[F]	-
Max. working temp.	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. (5c)	$\Delta p_{s\,min}$	[Pa]	1014
Weight	m	[kg]	96
Five-stage controller	type		TRN 9D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	88	95	79
Sound power level LWAokt [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

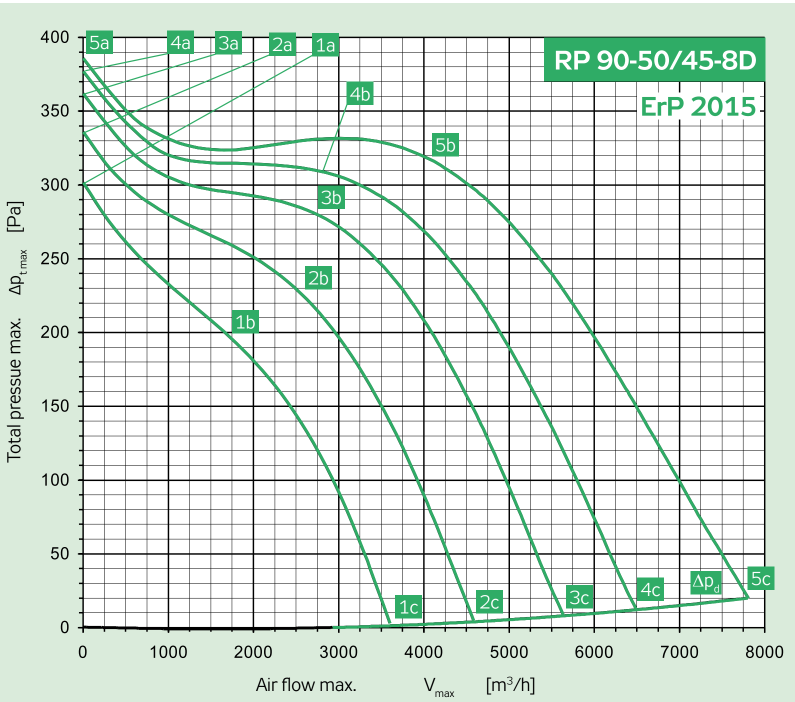
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	3.74	7.20	8.30	3.44	7.41	8.30	3.65	6.97	8.30	4.07	5.07	8.17	4.11	5.50	6.32
Input power P [W]	1993	4269	4919	1402	3055	3367	1259	2318	2718	1073	1330	1927	829	1041	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	1111	1014	1367	777	693	1216	617	435	994	652	0	758	267	0
Total pressure Δp_t [Pa]	1541	1118	1023	1367	781	699	1216	619	440	994	652	5	758	268	3



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	3780
Max. current (5c)	I_{max}	[A]	6.80
Mean speed	n	[min^{-1}]	930
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Air flow max.	V_{max}	[m³/h]	9200
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	667
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	90
Weight	m	[kg]	96
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	81	88	68
Sound power level LWAokt [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

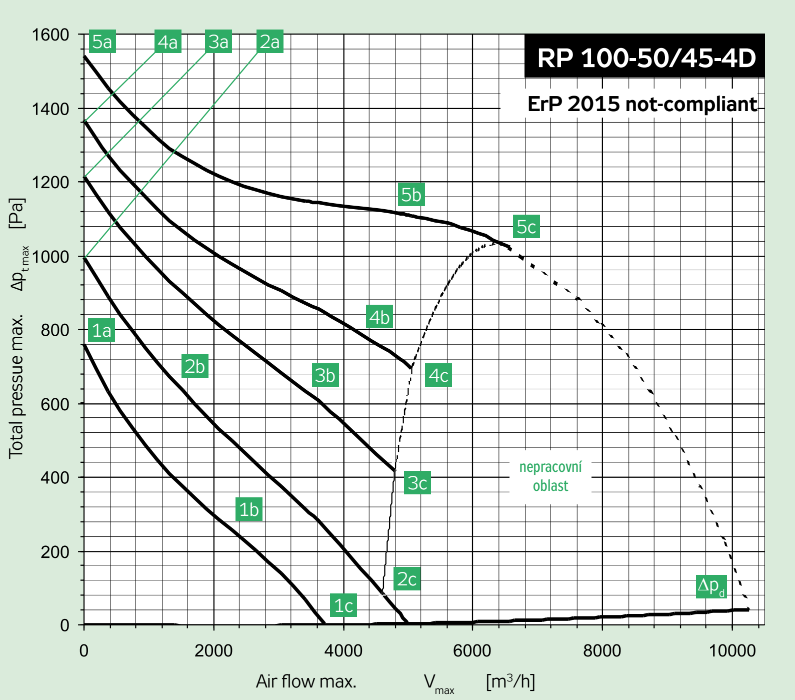
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	2.96	3.87	6.80	2.15	3.45	6.80	1.99	3.75	6.80	1.98	3.86	6.66	2.03	3.74	5.59
Input power P [W]	665	1757	3780	564	1315	2785	518	1242	2271	476	1025	1640	415	760	1040
Speed n [min^{-1}]	968	926	832	948	879	713	931	825	621	899	749	443	846	659	351
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1892
Max. current (5c)	I_{max}	[A]	3.88
Mean speed	n	[min^{-1}]	690
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Air flow max.	V_{max}	[m³/h]	7810
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	386
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	93
Five-stage controller	type		TRN 4D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	74	81	62
Sound power level LWAokt [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

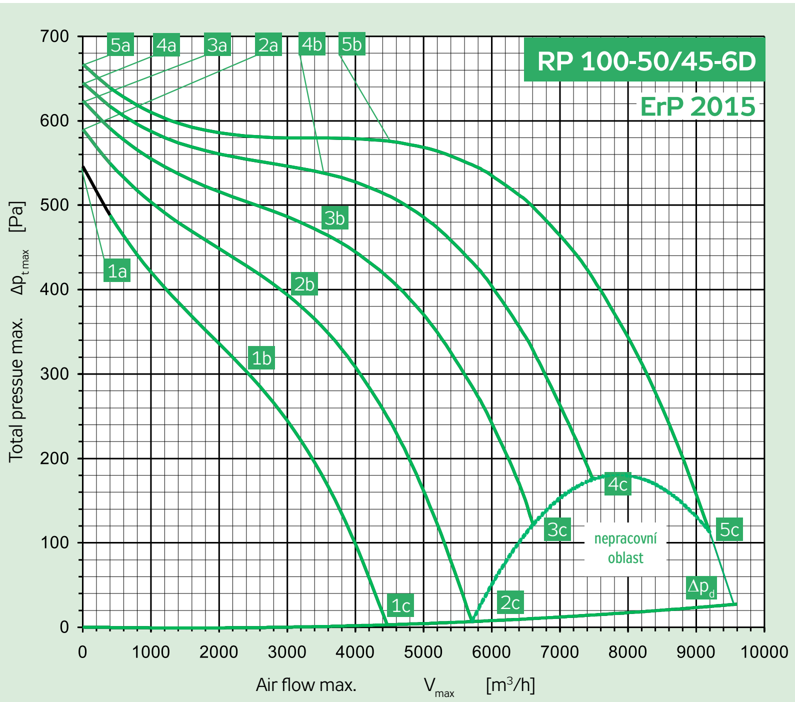
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	2.20	2.49	3.88	1.54	2.03	3.78	1.32	1.87	3.61	1.14	1.92	3.20	1.08	1.67	2.73
Input power P [W]	350	813	1892	264	624	1398	222	518	1081	196	455	733	178	311	477
Speed n [min^{-1}]	725	694	610	715	661	505	704	641	434	683	577	349	646	543	277
Air flow V [m³/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



Power supply	D	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8.30
Mean speed	n	[min⁻¹]	1260
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Air flow max.	V_{max}	[m³/h]	6558
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	1541
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	1014
Weight	m	[kg]	96
Five-stage controller	type		TRN 9D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	88	95	79
Sound power level LWAokt [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

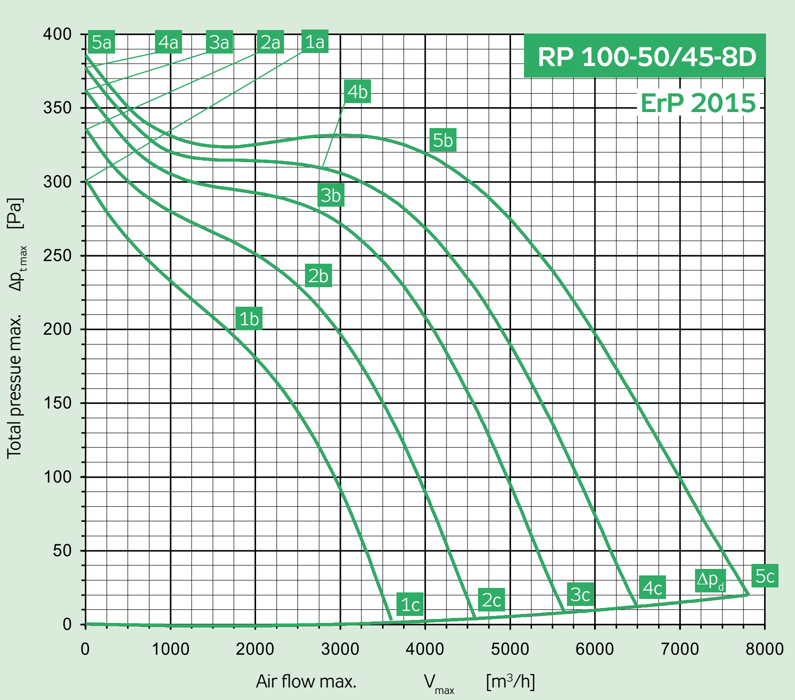
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	3.74	7.20	8.30	3.44	7.41	8.30	3.65	6.97	8.30	4.07	5.07	8.17	4.11	5.50	6.32
Input power P [W]	1993	4269	4919	1402	3055	3367	1259	2318	2718	1073	1330	1927	829	1041	1119
Speed n [min⁻¹]	1396	1259	1211	1343	1069	997	1280	957	800	1137	1009	376	978	623	285
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	3780
Max. current (5c)	I_{max}	[A]	6.80
Mean speed	n	[min⁻¹]	930
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Air flow max.	V_{max}	[m³/h]	9200
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	667
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	90
Weight	m	[kg]	96
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	81	88	68
Sound power level LWAokt [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
Input power 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 [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1892
Max. current (5c)	I_{max}	[A]	3.88
Mean speed	n	[min⁻¹]	690
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Air flow max.	V_{max}	[m³/h]	7810
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	386
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	93
Five-stage controller	type		TRN 4D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	74	81	62
Sound power level LWAokt [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
Input power 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 [m³/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

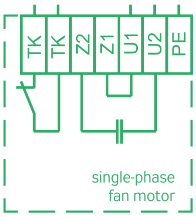
INSTALLATION

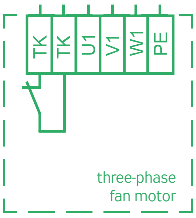
- RP fans (including other Vento elements and equipment) are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for the proper selection of fan. The installation and commissioning may be performed only by an authorized company licensed in accordance with generally valid regulations.
- It is recommended to insert the DV elastic connections in front of and behind the fan.
- It is advisable to always place the KFD or VFK air filters, respectively VFT metal grease filter in front of the fan to protect the fan and duct against dirtying and dust fouling,
- 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 # 3 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. 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 [1].
  On the inlet side, the DV elastic connection will be sufficient as a distance piece in most cases.

WIRING

- The wiring can be performed only by a qualified worker licensed in accordance with national regulations.
- An all-plastic terminal box fixed with screws to the fan casing is equipped with WAGO terminals; max. cross-section of connecting conductors 1.5 mm^2
- 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.

FIGURE 6 – WIRING DIAGRAM





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

TK
– motor thermo-contact terminals
U1, V1, W1
– three-phase motor power supply terminals 400 V / 50 Hz
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.

On 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.

[1] That recommendation applies to all duct fans.

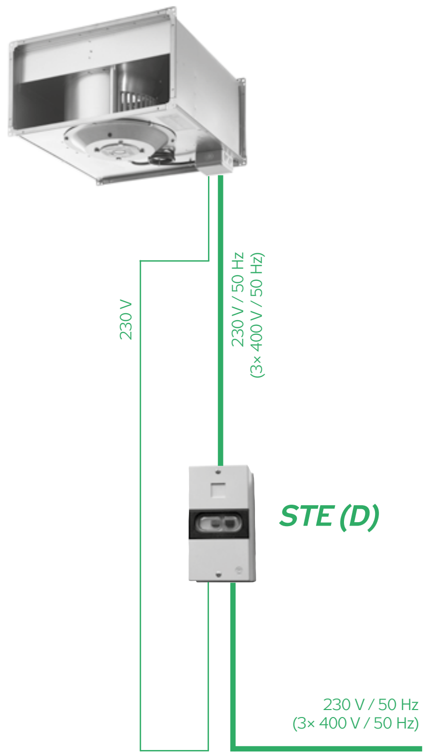
EXAMPLE A
RP FANS WITHOUT OUTPUT CONTROL AND WITH STE(D) PROTECTING RELAY

The RP fan connection in a simple venting system without output control is shown in figure # 7.
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 7 – FAN CONNECTION



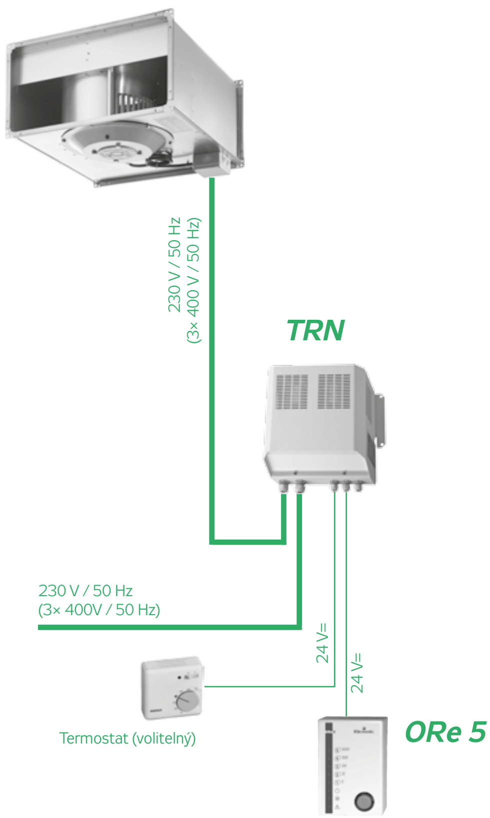
EXAMPLE B
RP FANS WITH OUTPUT CONTROL AND TRN CONTROLLER

The RP fan connection in a venting system with output control using TRN controller with ORe5 controller is shown in figure # 8.
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 8 – FAN CONNECTION



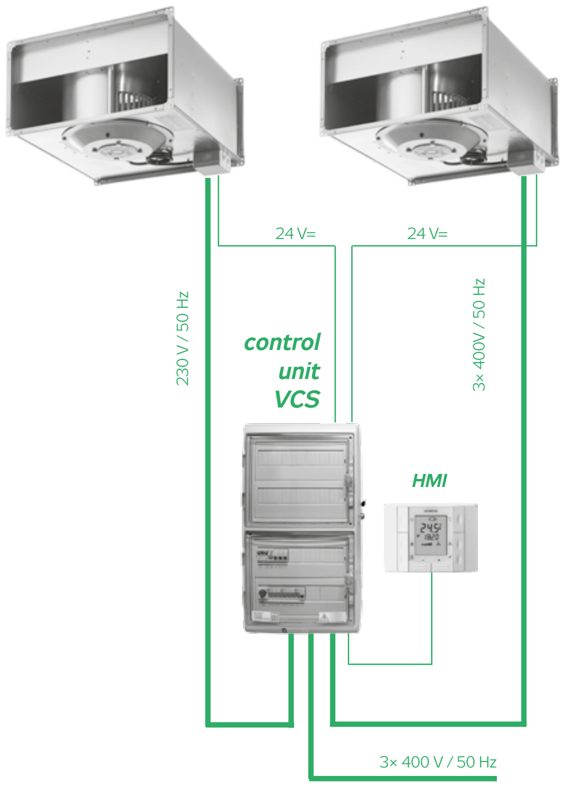
EXAMPLE C
RP FANS WITHOUT OUTPUT CONTROL AND WITH CONTROL UNIT

The RP fan without output control connection in more sophisticated venting systems using the control unit is shown in figure # 9.
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 9 – FAN CONNECTION



EXAMPLE D
RP FANS WITH TRN CONTROLLERS AND CONTROL UNIT

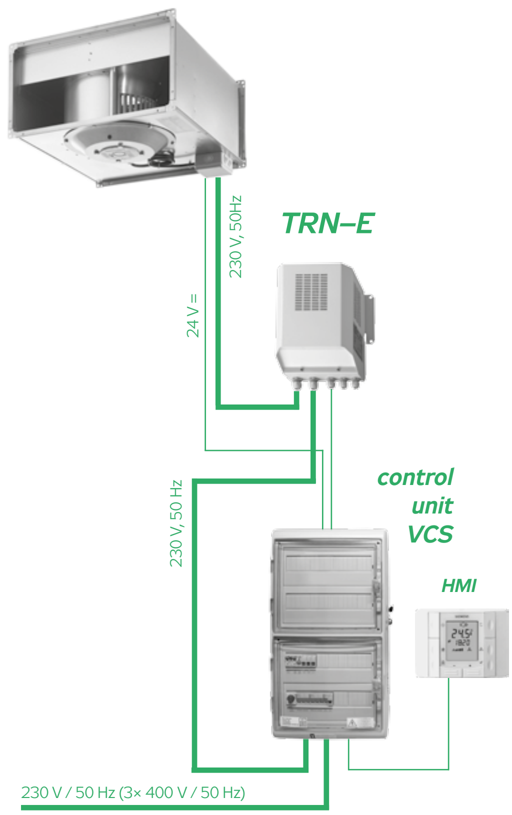
The RP fan with TRN output controllers and a common internal controller in more sophisticated venting systems using the control unit is shown in figure # 10. The internal control is installed in the control unit during production.
This connection ensures:

- → 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.
- → Fan output control within the stage range 1-5 manually via HMI controller or using time schedule function of the control unit.

In the connection with control unit, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the TRN-D 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 10 – FAN CONNECTION



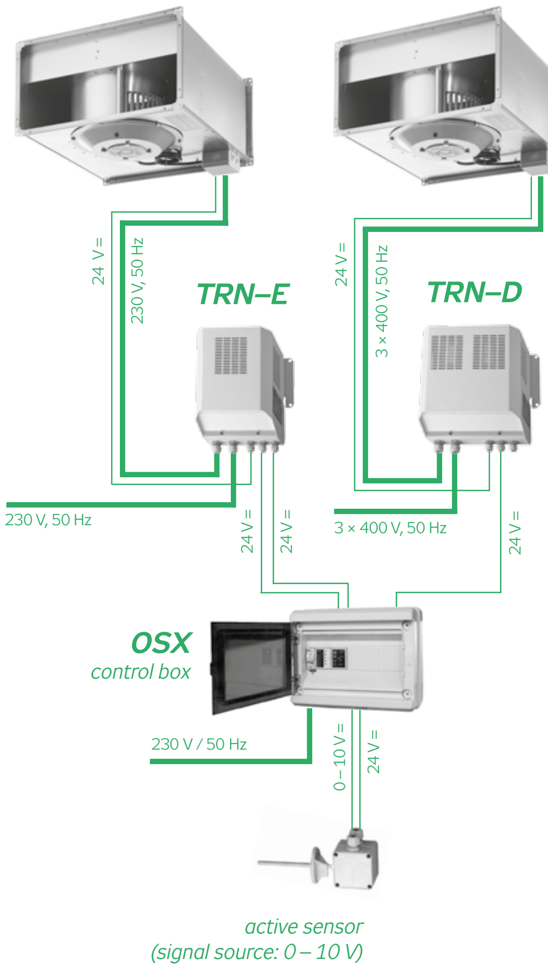
EXAMPLE E
RP FANS WITH AUTOMATIC OUTPUT CONTROL, TRN CONTROLLER AND OSX CONTROL UNIT

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.
Tento způsob zapojení zabezpečuje:

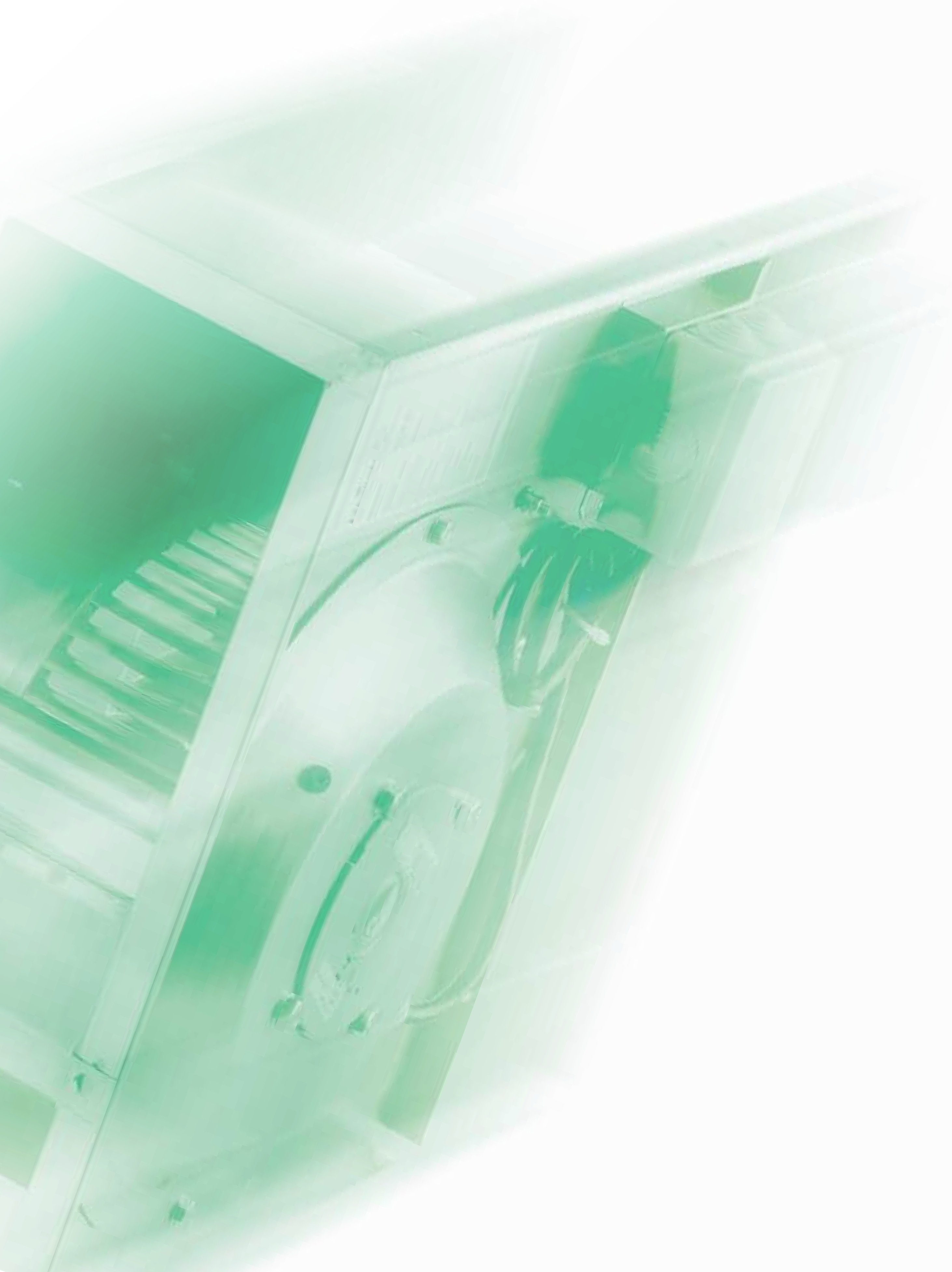
- Automatic selection of the fan output within the stage range 0 - 5 as well as its protection via thermo-contacts and the protection integrated into the TRN controller. Automatic selection of the controller output stage is ensured by the OX controller integrated into the OSX control unit in relation 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 11 – FAN CONNECTION



RQ Fans



FAN USE

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 ºC to +40 ºC, and with certain types up to +70 ºC. The maximum nominal values for each fan are included in table # 3. 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 m^3 per hour.

MATERIALS

The external casing of RQ fans is made of galvanized steel sheets (Zn 275 g/m2). Impeller blades – with forward curved blades are made of galvanized sheet steel, with aluminium diffusers. 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.

MOTO RS

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 all RQ fans except of
RQ 20 and RQ 25 fans (IP 44).

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.

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 A at 250V / 50V (cos φ 0.6), (respectively 2 A 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.[1)]
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.
Refer to table # 1 2) showing the correlation between the input voltage and selected stage of the controller for single-phase and three-phase motors. RQ fan motors can be operated within a range of approx. from 25 % to 110 % of the rated voltage.
The recommended product line includes single-phase and three-phase TRN controllers (simplified TRRE and TRRD controllers can also be used to control RQ fans; however, they do not provide a protection function.

TABLE 1 – THE INPUT VOLTAGE AND CONTROLLER'S STAGE

MOTOR TYPE	CURVE CHARACTERISTICS – CONTROLLER'S STAGE				
	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

1) Refer to chapter „Stepless Electronic Control" of RP fans .
2) For detailed information, refer to the chapter "Fan Output controllers".

MEASURING THE PARAMETERS

The output characteristics of RQ fans are measured in 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 Standards. Noise parameters of RQ fans are measured in REMAK's acoustic testing laboratory in accordance with the ČSN EN ISO 3743-2 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" 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). For an explanation of the correlations and relations of important data, refer to the section "RP 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 L_{WA} [dB (A)], i.e. the total level of the radiated A-scale sound power, is always given. Further, the octave value L_{WAokt} of the A-scale sound power level for octave bands from 125 Hz to 8 kHz is also given. [3)]

ACCESSORIES

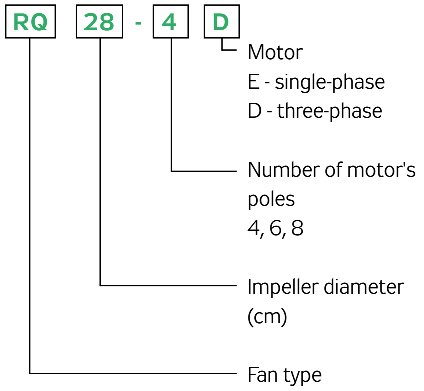
RQ fans belong in the wide range of Vento modular venting and air-handling system components. Any air-handling set-up, from simple venting to sophisticated comfortable air-conditioning, can be created by selecting suitable elements. The following accessories can be ordered along with RQ fans:

- → Elastic connections DV, DK, counter-flanges
- → TRN Controllers and ORe 5 controllers
- → TRRE, TRRD Controllers
- → STE, STD Protecting Relays

FAN DESCRIPTION AND DESIGNATION

The key for type designation of RP fans in projects and orders is defined in figure # 1). For example, type designation RQ 28-4D specifies the type of fan, impeller and motor.

FIGURE 1 – TYPE DESIGNATION OF RQ FANS



DIMENSIONS, WEIGHTS AND PERFORMANCE

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

FIGURE 2 – FAN DIMENSIONAL DIAGRAM

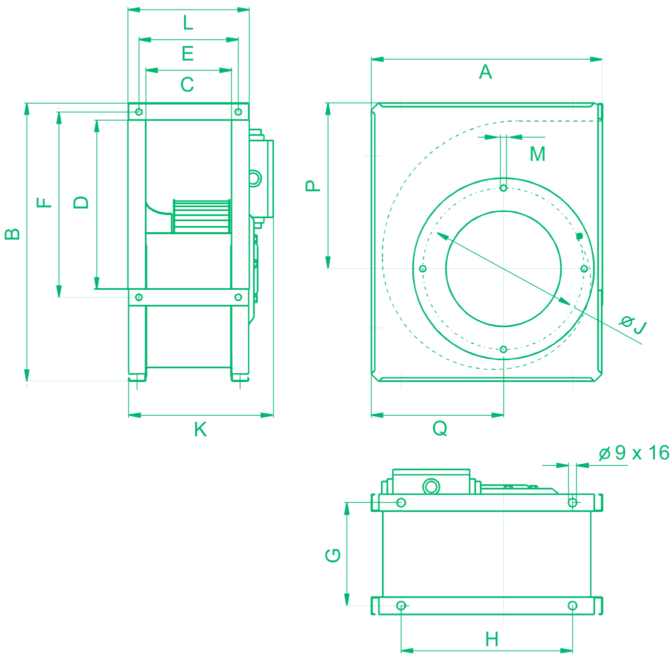


TABLE 2 - FAN DIMENSIONS

Type	Dimensions in mm															
	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)] circular damping insert on the fan / [2)] square damping insert on the fan outlet

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

TABLE 3 – FAN BASIC PARAMETERS AND NOMINAL VALUES

Fan Type	V_{max}	$\Delta p_{t\ max}$	n_{nom}	U_{nom}	I_{max}	t_{max}	C	Regul.	m	ErP2015	
	m^3/h	Pa	min^{-1}	V	A	ºC	µF	typ	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	✓	η=32.2% (statA) N=44.0 (N44)
RQ 22-6D	1370	233	920	3x 400	0.46	55	-	TRN 2D	11	✓	does not apply (P1 < 125 W)
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	✓	η=39.2% (statA) N=47.1 (N44)
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	✓	η=38.8% (statA) N=45.9 (N44)
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	✓	η=36.6% (statA) N=44.0 (N44)
RQ 35-4D	5886	3534	1400	3x 400	6	40	-	TRN 7D	47	✓	η=41.2% (statA) N=46.3 (N44)
RQ 40-8D	4700	1274	670	3x 400	2.41	55	-	TRN 4D	48	✓	η=37.3% (statA) N=45.6 (N44)
RQ 40-6D	7800	2770	940	3x 400	5.1	50	-	TRN 7D	51	✓	η=42.2% (statA) N=48.2 (N44)
RQ 40-4D	6768	4873	1390	3x 400	8.1	40	-	TRN 9D	58	✓	η=44.4% (statA) N=47.9 (N44)

LEGENDA K SYMBOLŮM V TABULCE 3:

V_{max} maximum air flow rate
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)
$P_{max.}$ electric motor maximal power output
$I_{max.}$ maximum phase current at voltage **U** (this value must be checked)
$t_{max.}$ maximum permissible transported air temperature at air flow $V_{max.}$.
C capacitor capacity with single-phase fans
FM. frequency inverter
m weight of the fan (±10%)
ErP2015 Fan compliance with the requirements of Regulation 2009/125/EC (NOT compliant fans must not be used within EU region)

DATA SECTION

In the data section of the catalog, in addition to the characteristics of each fan, there is a table of the most important values. The importance of individual lines is explained in Table 4. These values are also listed on the nameplate of each fan.
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 five stage, are included in this graph.

EXAMPLE AND EXPLANATION OF FAN DATA

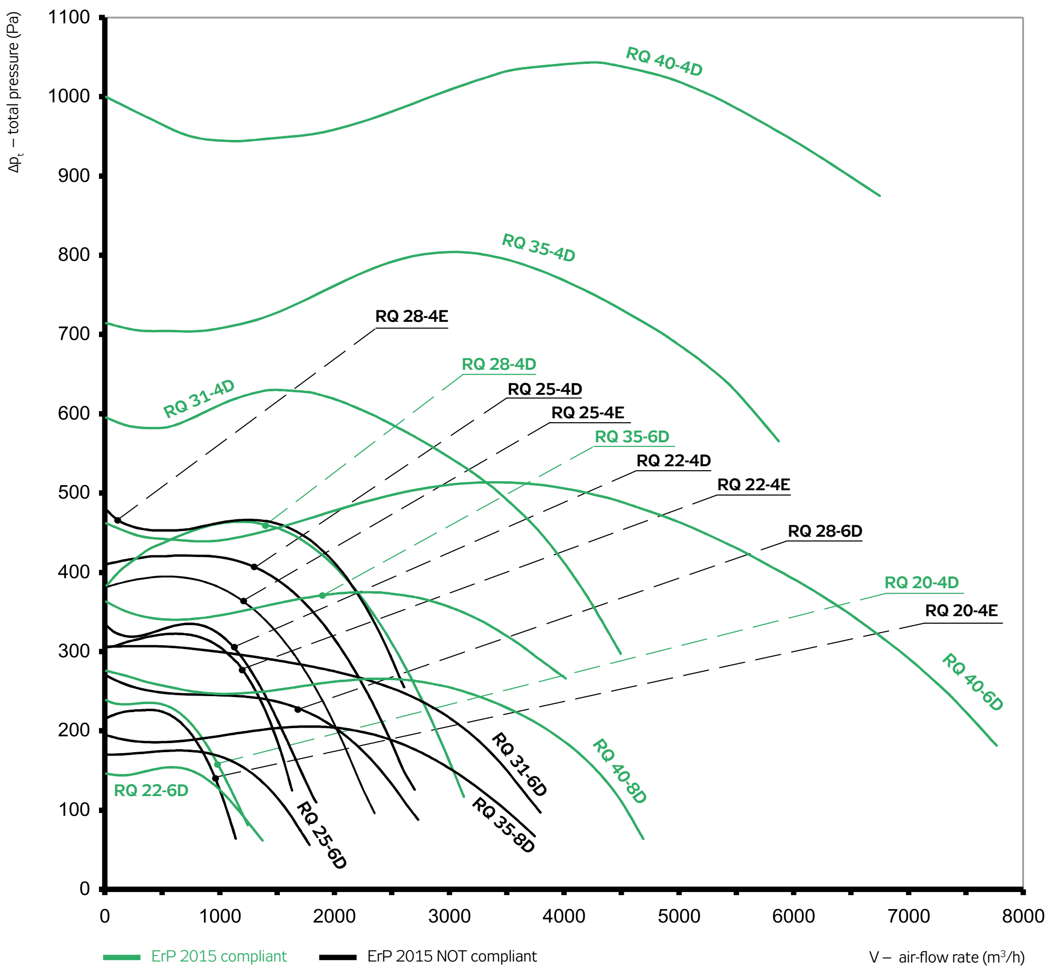
RQ 20-4E

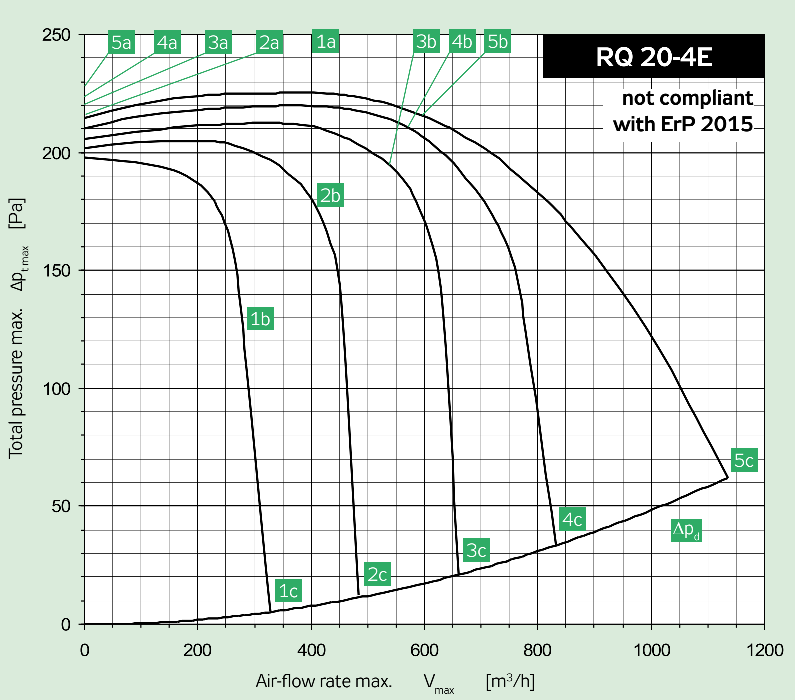
Power supply	Y	230 V	50 Hz
Max. electric input	P_{max}	[W]	303
Max. current (5c)	I_{max}	[A]	1.47
Mean speed	n	[min^{-1}]	1400
Capacitor	C	[F]	5
Max. working temp.	t_{max}	[ºC]	40
Max. air-flow rate	V_{max}	[m^3/h]	1135
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	225
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	9
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

The meaning of individual lines is as follows:

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.

GRAPH 1 – RQ FAN CHARACTERISTICS QUICK SELECTION

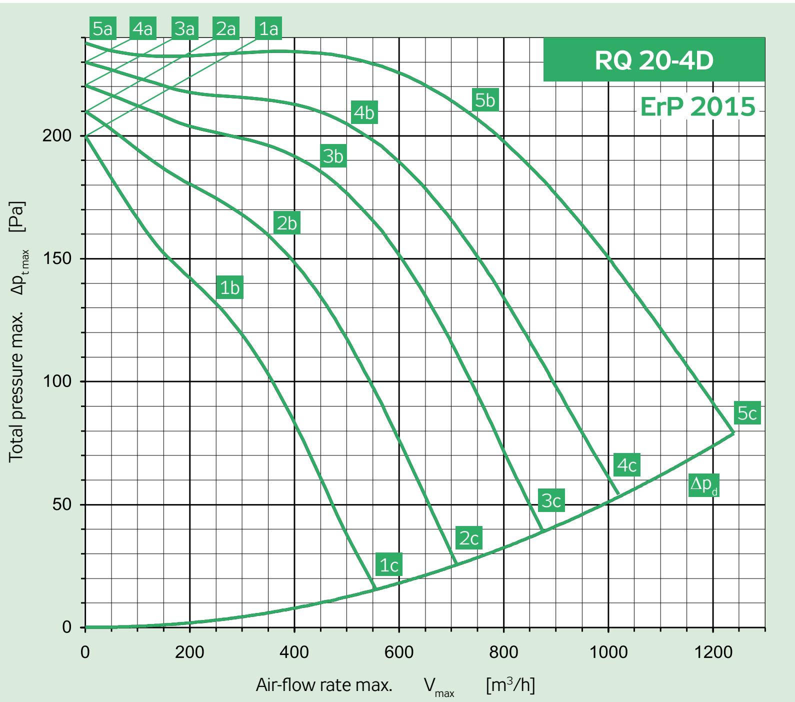




Power supply	Y	230 V	50 Hz
Max. electric input	P_{max}	[W]	303
Max. current (5c)	I_{max}	[A]	1.47
Mean speed	n	[min⁻¹]	1400
Capacitor	C	[F]	5
Max. working temp.	t_{max}	[°C]	40
Max. air-flow rate	V_{max}	[m³/h]	1135
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	225
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	9
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
	Total sound power level L_{MAX} [dB(A)]		
L_{WA}	72	76	64
	Sound power level L_{WAKokt} [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 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]	0.89	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 [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	290
Max. current (5c)	I_{max}	[A]	0.49
Mean speed	n	[min⁻¹]	1350
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	70
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
	Total sound power level L_{MAX} [dB(A)]		
L_{WA}	71	74	62
	Sound power level L_{WAKokt} [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 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 [m³/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

RP
RQ
RO
RE
RF
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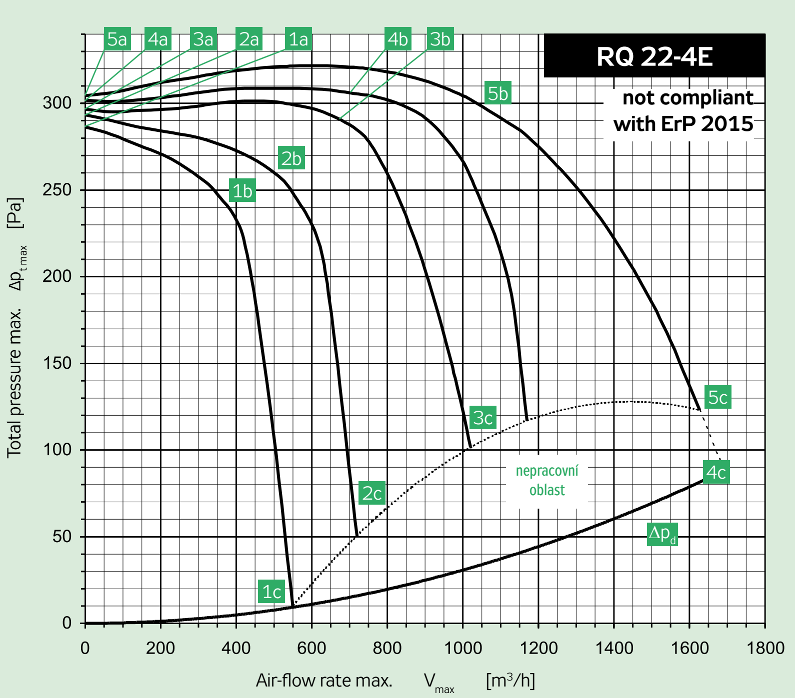
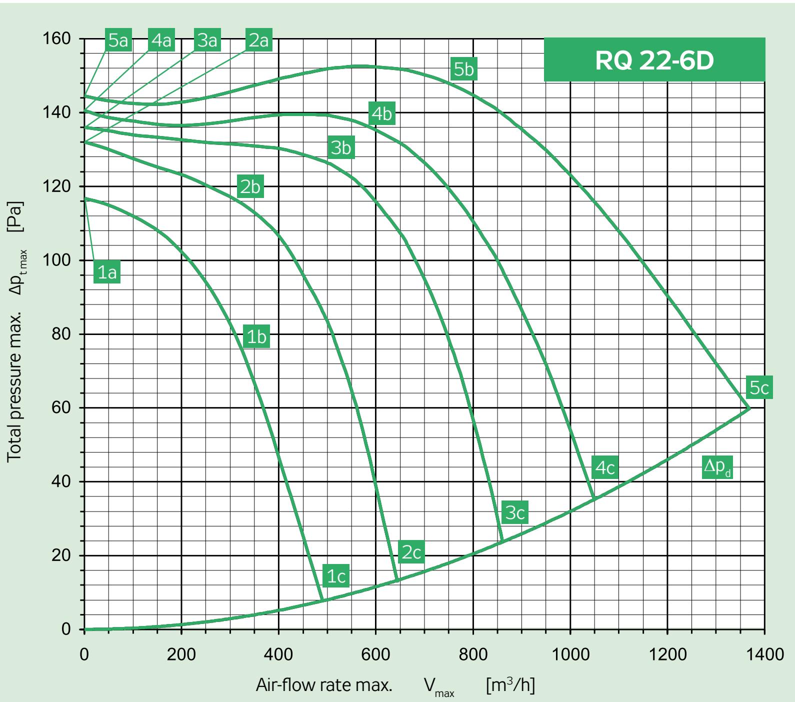
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI



Power supply	Y	230 V	50 Hz
Max. electric input	P_{max}	[W]	508
Max. current (5c)	I_{max}	[A]	2.30
Mean speed	n	[min⁻¹]	1380
Capacitor	C	[F]	8
Max. working temp.	t_{max}	[ºC]	40
Max. air-flow rate	V_{max}	[m³/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	type		TRN 4E
Protecting relay	type		STE

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	77	79	67
Sound power level L_{WAKokt} [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

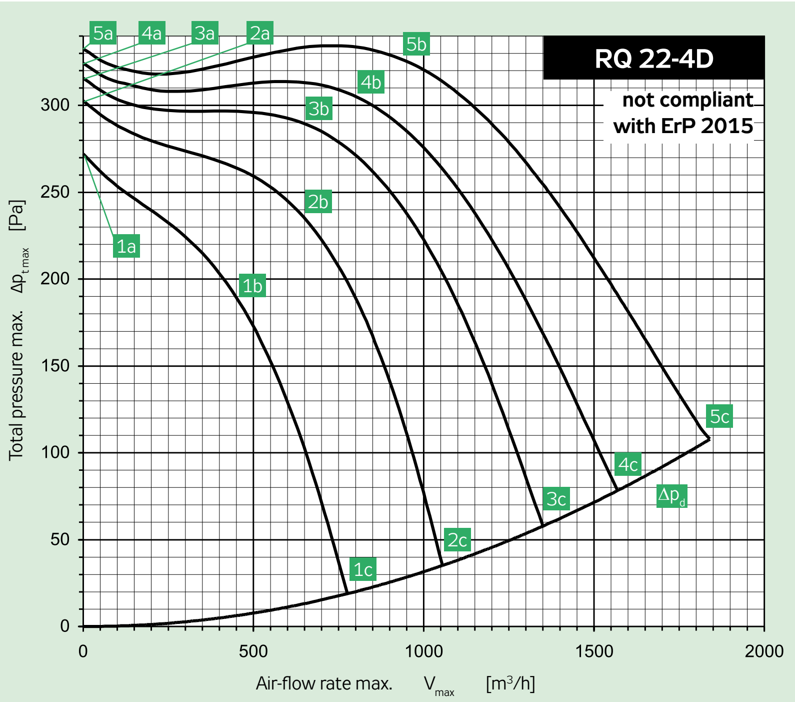
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	1.07	1.47	2.30	0.73	1.11	2.25	0.69	1.12	2.20	0.71	1.05	2.10	0.71	1.02	1.74
Electric input P [W]	192	320	508	128	202	380	115	182	324	90	136	239	78	108	157
Speed n [min⁻¹]	1446	1379	1244	1435	1376	1057	1425	1349	931	1401	1318	603	1365	1255	420
Air-flow rate V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	233
Max. current (5c)	I_{max}	[A]	0.46
Mean speed	n	[min⁻¹]	920
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	66	68	57
Sound power level L_{WAKokt} [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

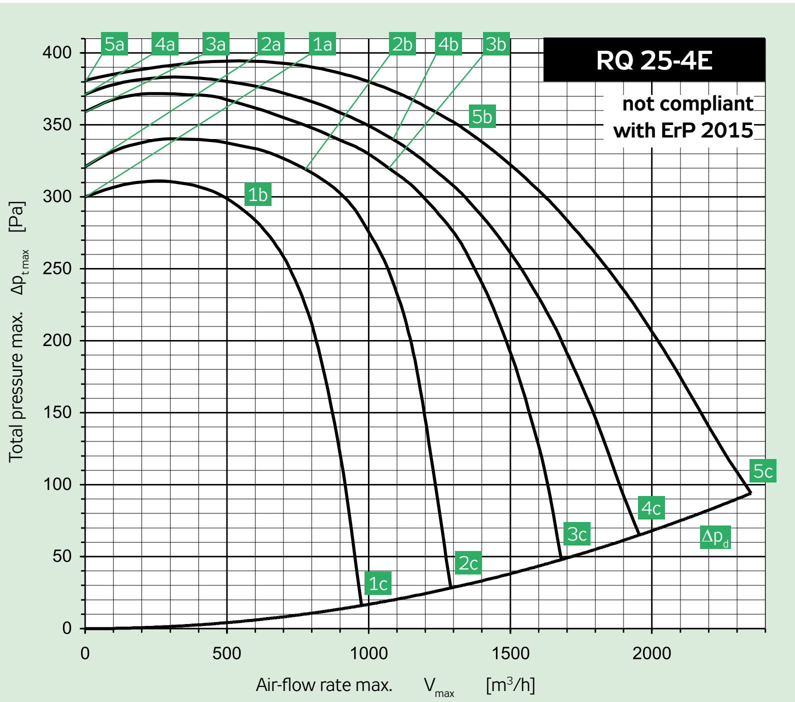
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.30	0.32	0.46	0.20	0.24	0.44	0.17	0.22	0.41	0.14	0.18	0.34	0.13	0.17	0.28
Electric input P [W]	56	114	233	37	76	162	30	61	121	26	41	76	22	32	47
Speed n [min⁻¹]	964	924	809	953	885	617	945	865	533	920	844	415	872	778	313
Air-flow rate V [m³/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



Power supply	Y		3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	535	
Max. current (5c)	I_{max}	[A]	0.94	
Mean speed	n	[min^{-1}]	1410	
Capacitor	C	[F]	-	
Max. working temp.	t_{max}	[ºC]	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	type		TRN 2D	
Protecting relay	type		STD	

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	66	68	57
Sound power level L_{WAKokt} [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

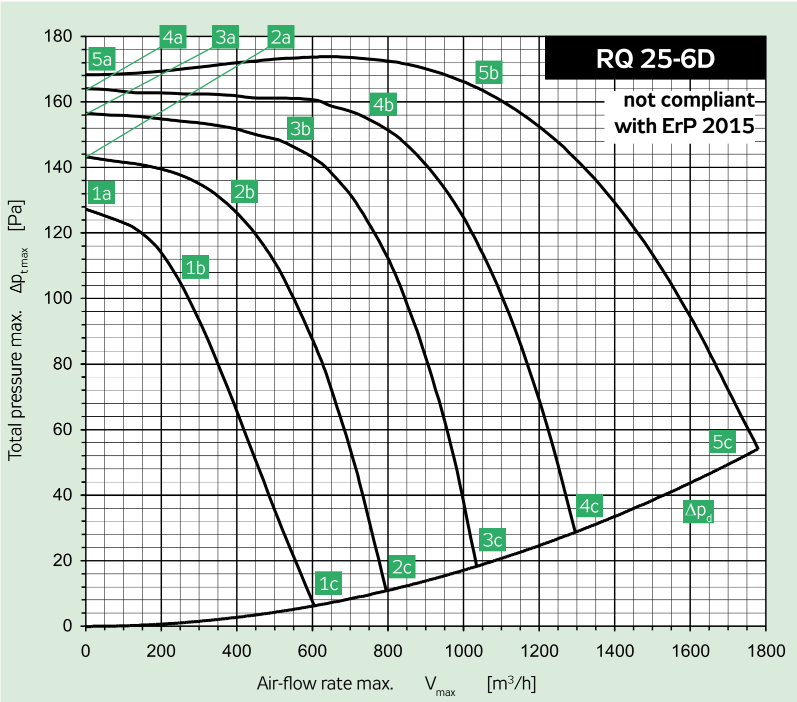
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.58	0.63	0.94	0.32	0.48	1.00	0.27	0.46	1.02	0.26	0.53	0.97	0.28	0.52	0.81
Electric input P [W]	111	249	535	76	190	438	67	156	373	63	146	260	59	111	166
Speed n [min^{-1}]	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



Power supply	Y		230 V	50 Hz
Max. electric input	P_{max}	[W]	861	
Max. current (5c)	I_{max}	[A]	3.85	
Mean speed	n	[min^{-1}]	1370	
Capacitor	C	[F]	14	
Max. working temp.	t_{max}	[ºC]	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	type		TRN 4E	
Protecting relay	type		STE	

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	82	81	71
Sound power level L_{WAKokt} [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

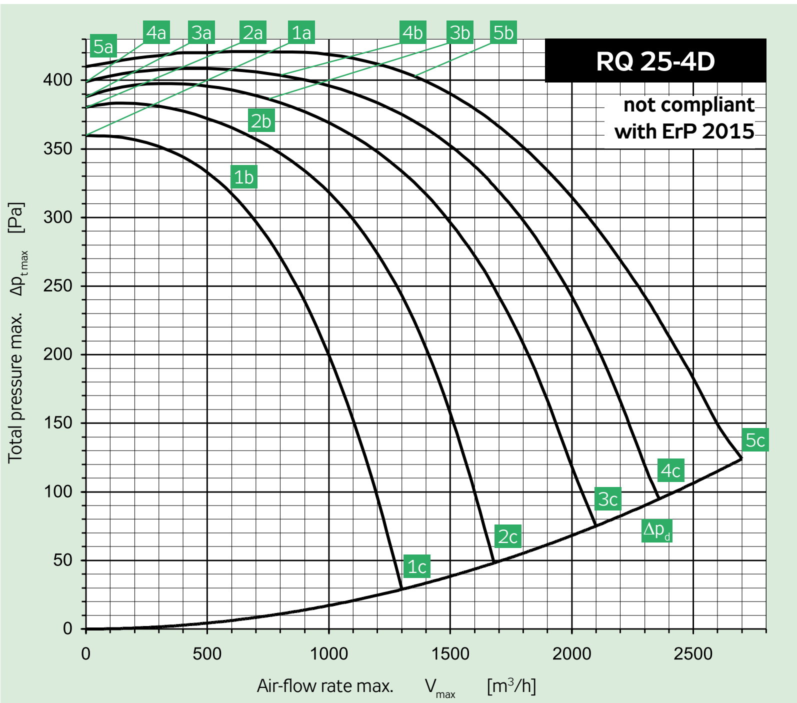
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			140			105	
Current I [A]	1.56	2.26	3.85	1.14	1.97	4.08	1.12	2.09	3.92	1.13	1.82	3.66	1.13	1.61	3.08
Electric input P [W]	320	503	861	209	354	702	180	335	591	148	241	448	122	170	298
Speed n [min^{-1}]	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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	337
Max. current (5c)	I_{max}	[A]	0.70
Mean speed	n	[min⁻¹]	910
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
	Total sound power level L_{MAX} [dB(A)]		
L_{WA}	67	69	60
	Sound power level L_{WAKokt} [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

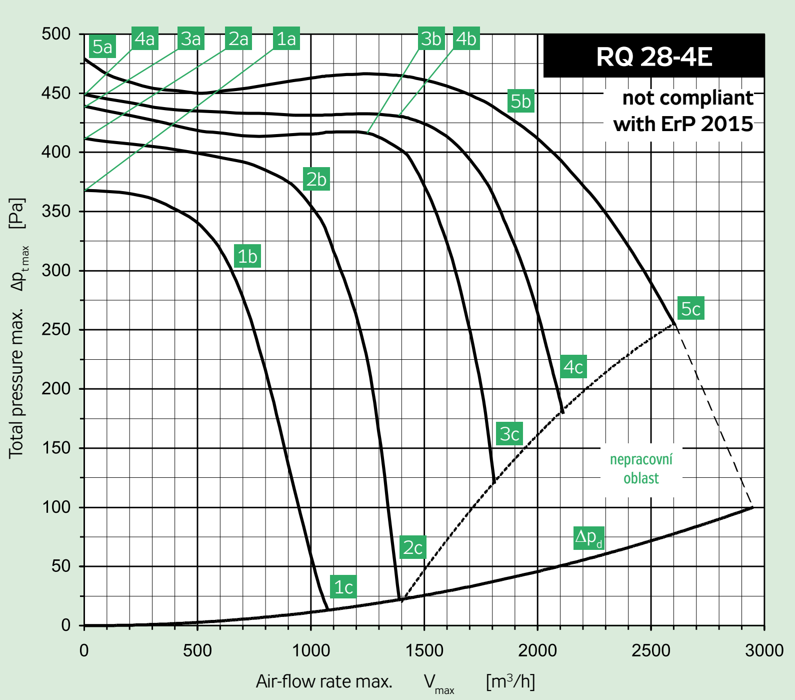
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.44	0.49	0.70	0.29	0.38	0.65	0.25	0.31	0.57	0.23	0.27	0.47	0.21	0.24	0.37
Electric input P [W]	83	173	337	56	113	227	47	78	155	43	56	98	35	41	59
Speed n [min⁻¹]	969	913	786	950	870	568	933	865	464	887	829	351	823	771	279
Air-flow rate V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1058
Max. current (5c)	I_{max}	[A]	1.98
Mean speed	n	[min⁻¹]	1430
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	50
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
	Total sound power level L_{MAX} [dB(A)]		
L_{WA}	80	83	70
	Sound power level L_{WAKokt} [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

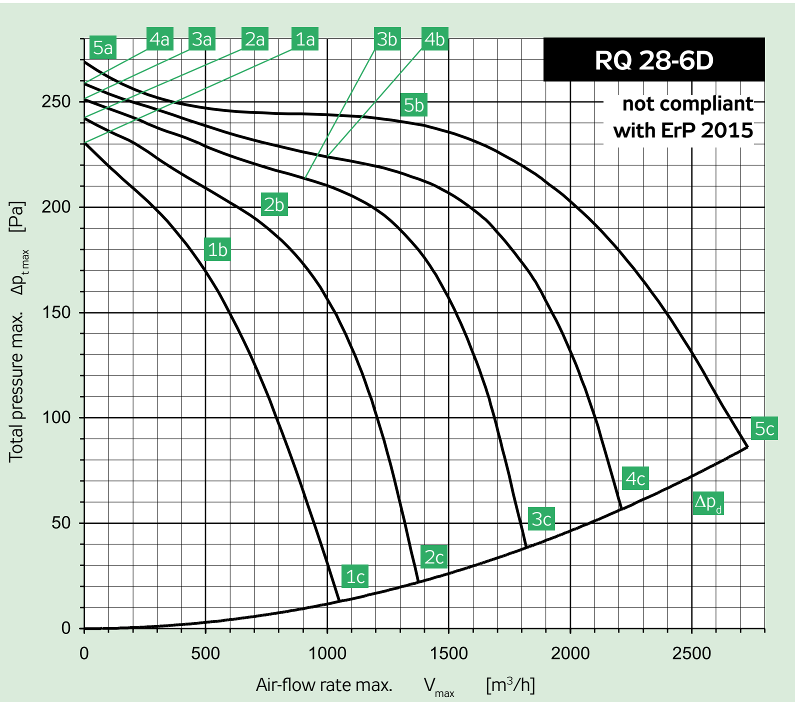
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.28	1.37	1.98	0.69	0.83	2.10	0.57	0.77	2.20	0.53	0.77	2.10	0.50	0.84	1.83
Electric input P [W]	211	484	1058	134	263	872	121	234	757	109	200	542	99	180	357
Speed n [min⁻¹]	1466	1428	1344	1454	1420	1197	1444	1395	1060	1419	1350	849	1381	1265	679
Air-flow rate V [m³/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



Power supply	Y	230 V	50 Hz
Max. electric input	P_{max}	[W]	1079
Max. current (5c)	I_{max}	[A]	5.10
Mean speed	n	[min⁻¹]	1370
Capacitor	C	[F]	16
Max. working temp.	t_{max}	[ºC]	40
Max. air-flow rate	V_{max}	[m³/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	type		TRN 7E
Protecting relay	type		STE

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	82	84	72
Sound power level L_{WAKokt} [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

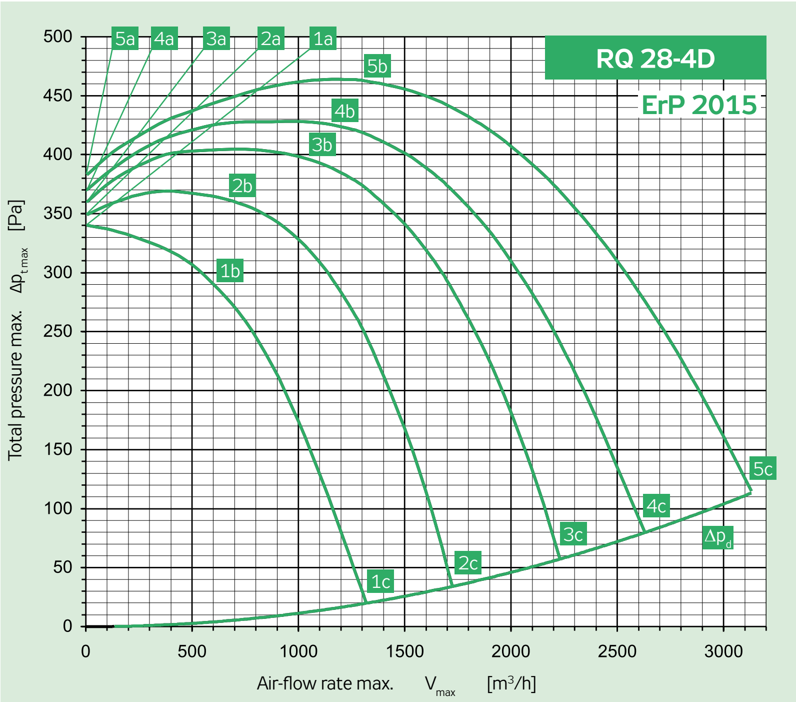
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	2.48	3.70	5.10	1.88	3.04	5.10	1.88	2.97	5.10	1.83	2.80	4.49	1.83	2.61	3.62
Electric input P [W]	448	783	1079	335	544	843	300	471	718	240	360	495	194	262	316
Speed n [min⁻¹]	1447	1371	1271	1430	1342	1062	1417	1310	845	1389	1249	560	1338	1146	434
Air-flow rate V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	643
Max. current (5c)	I_{max}	[A]	1.37
Mean speed	n	[min⁻¹]	950
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	71	74	62
Sound power level L_{WAKokt} [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

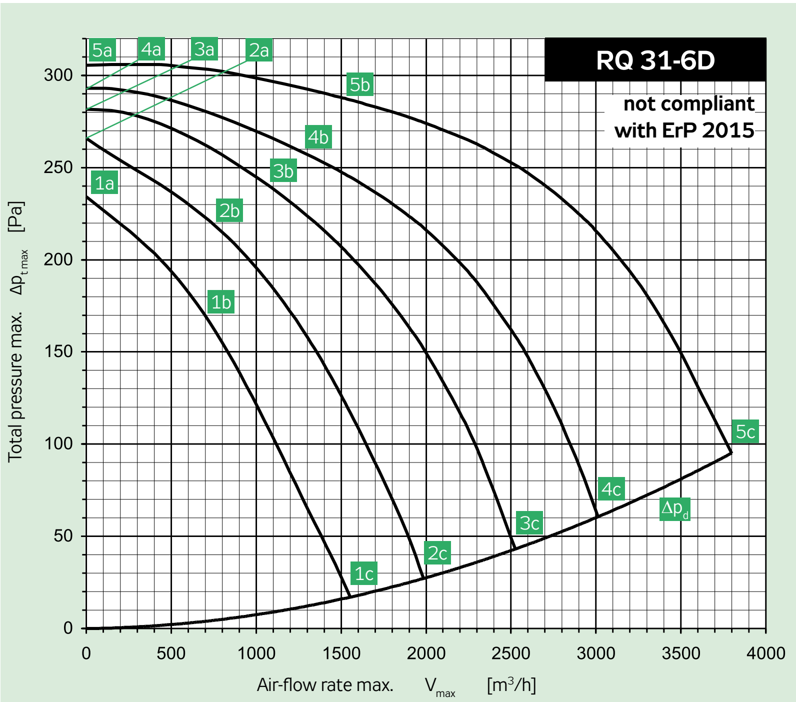
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.88	0.96	1.37	0.59	0.71	1.38	0.49	0.65	1.32	0.43	0.61	1.12	0.39	0.56	0.92
Electric input P [W]	130	271	643	90	187	487	73	162	366	69	130	230	59	94	136
Speed n [min⁻¹]	975	946	866	966	924	713	957	900	581	937	861	440	903	805	343
Air-flow rate V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1278
Max. current (5c)	I_{max}	[A]	2.22
Mean speed	n	[min⁻¹]	1420
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Max. air-flow rate	V_{max}	[m³/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	type		TRN 4D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	80	82	69
Sound power level L_{WAKokt} [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

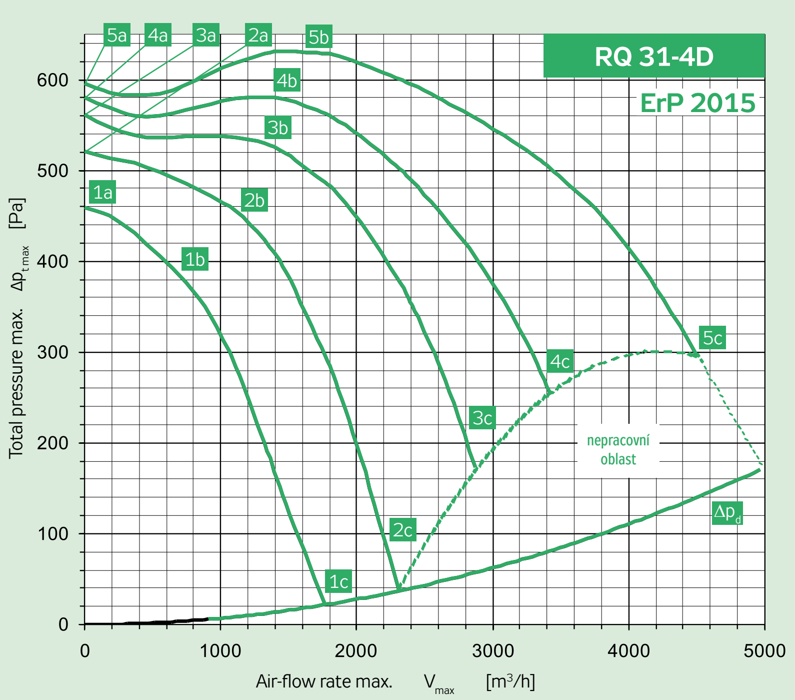
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.01	1.16	2.22	0.72	1.01	2.50	0.63	1.03	2.48	0.69	0.89	2.26	0.76	1.05	1.92
Electric input P [W]	252	484	1278	205	393	1044	193	361	833	176	247	567	157	226	364
Speed n [min⁻¹]	1452	1418	1286	1426	1365	1076	1406	1320	917	1357	1301	720	1281	1152	544
Air-flow rate V [m³/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	299	357	0	340	284	0
Total pressure Δp_t [Pa]	382	462	113	370	425	80	360	397	58	300	362	34	340	288	20



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	946
Max. current (5c)	I_{max}	[A]	1.82
Mean speed	n	[min⁻¹]	920
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	74	76	63
Sound power level L_{WAKokt} [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

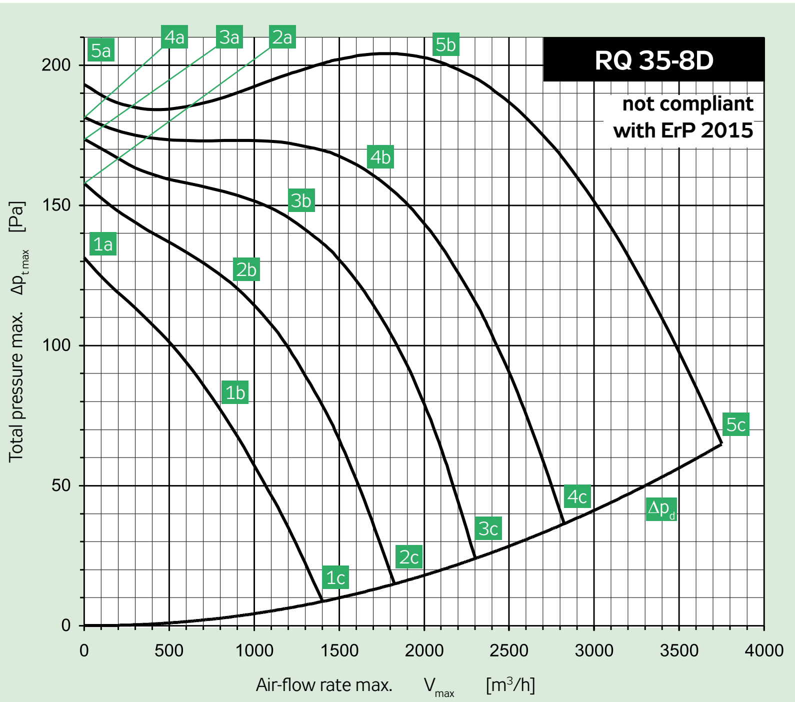
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.11	1.17	1.82	0.63	0.79	1.64	0.54	0.73	1.49	0.48	0.64	1.29	0.47	0.66	1.06
Electric input P [W]	189	373	946	117	261	639	105	205	471	99	156	310	80	124	201
Speed n [min⁻¹]	968	924	766	949	878	601	931	852	510	896	817	410	845	728	323
Air-flow rate V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	2494
Max. current (5c)	I_{max}	[A]	4.10
Mean speed	n	[min⁻¹]	1410
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Max. air-flow rate	V_{max}	[m³/h]	4482
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	596
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	157
Weight	m	[kg]	30
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	68	72	62
Sound power level L_{WAKokt} [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

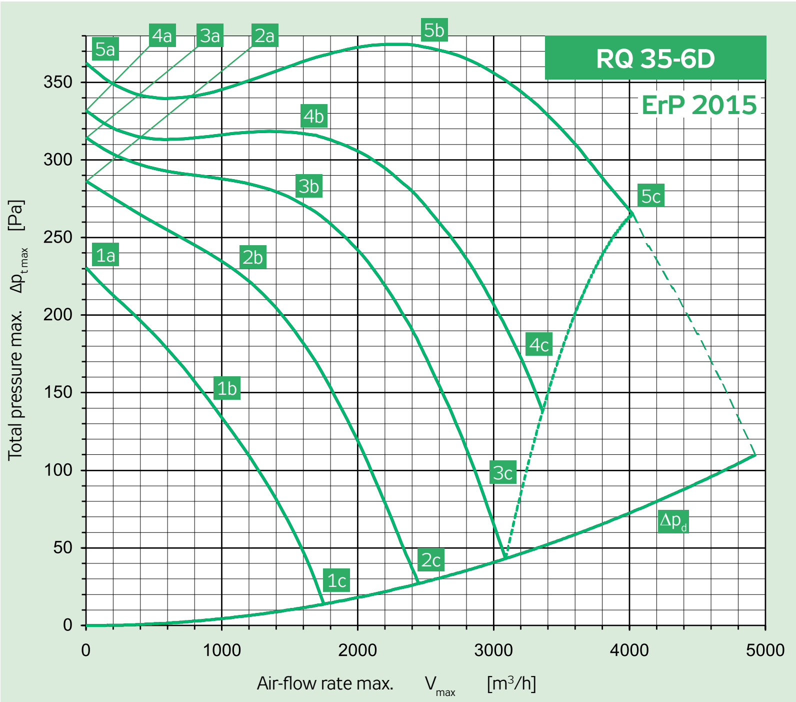
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.22	1.71	4.10	0.91	1.53	4.10	0.86	1.61	4.10	0.94	1.87	3.96	1.08	1.65	3.25
Electric input P [W]	327	852	2494	300	642	1746	265	572	1389	255	528	983	237	360	603
Speed n [min⁻¹]	1457	1408	1231	1433	1364	1039	1412	1315	865	1372	1205	567	1296	1152	437
Air-flow rate V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	672
Max. current (5c)	I_{max}	[A]	1.40
Mean speed	n	[min⁻¹]	650
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	69	72	62
Sound power level L_{WAKokt} [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

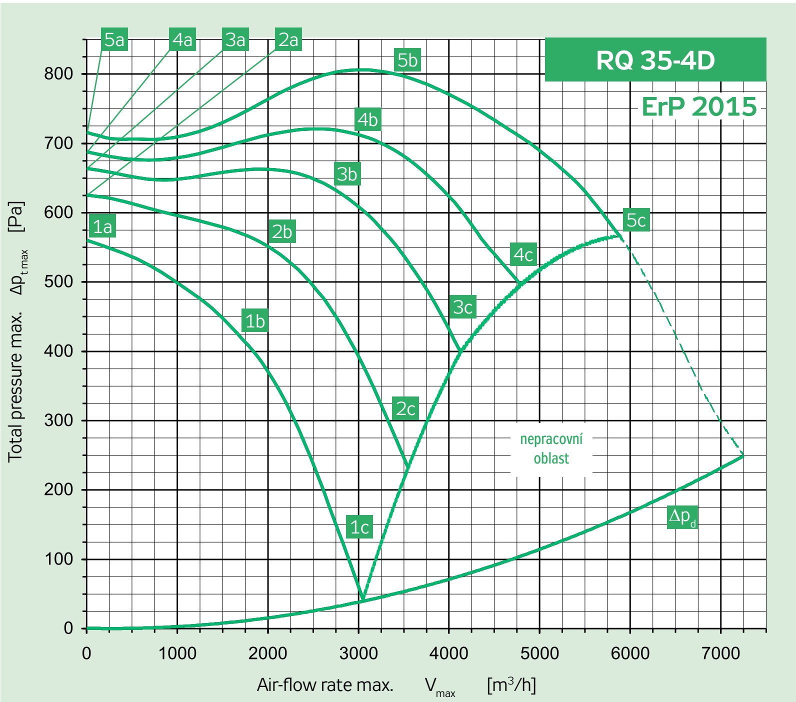
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.83	0.94	1.40	0.54	0.75	1.19	0.46	0.62	1.02	0.42	0.55	0.86	0.40	0.54	0.69
Electric input P [W]	159	336	672	109	237	407	92	166	284	75	114	177	61	89	107
Speed n [min⁻¹]	714	654	514	698	605	386	678	589	316	644	556	252	581	435	201
Air-flow rate V [m³/h]	0	2022	3723	0	1637	2825	0	1177	2300	0	842	1823	0	792	1400
Static pressure Δp_s [Pa]	193	182	5	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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1084
Max. current (5c)	I_{max}	[A]	2.00
Mean speed	n	[min⁻¹]	890
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	76	78	65
Sound power level L_{WAKokt} [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

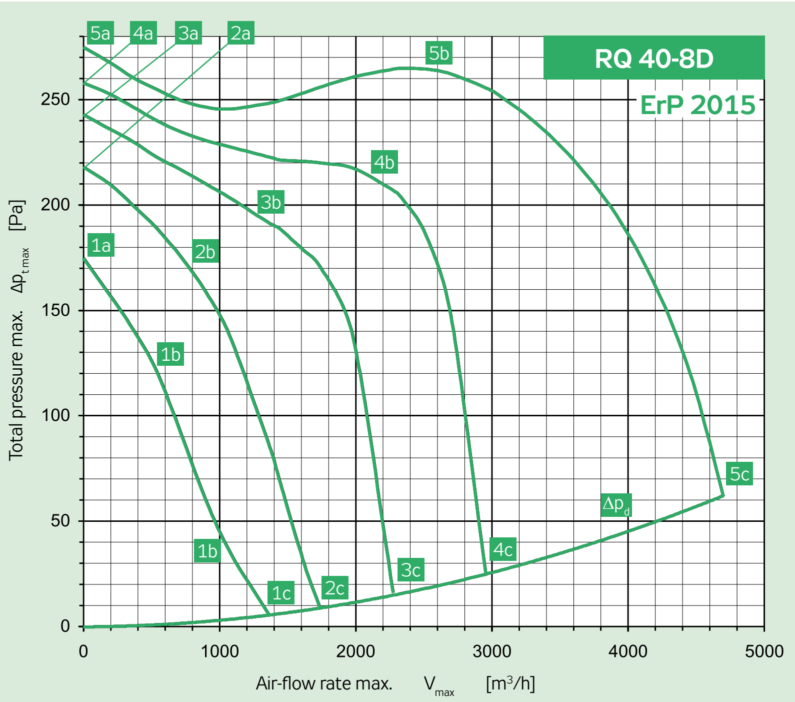
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.07	1.38	2.00	0.73	1.03	2.00	0.66	1.07	1.98	0.64	0.96	1.65	0.64	0.90	1.24
Electric input P [W]	241	629	1084	186	372	791	167	343	636	151	247	407	121	168	215
Speed n [min⁻¹]	965	893	789	940	862	602	915	798	431	868	746	339	772	609	250
Air-flow rate V [m³/h]	0	2497	4022	0	1573	3360	0	1553	3088	0	1138	2450	0	881	1751
Static pressure Δp_s [Pa]	352	344	192	331	308	87	313	262	0	286	219	0	230	142	0
Total pressure Δp_t [Pa]	352	372	265	331	319	138	313	272	43	286	224	27	230	146	14



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	3534
Max. current (5c)	I_{max}	[A]	6.00
Mean speed	n	[min⁻¹]	1400
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Max. air-flow rate	V_{max}	[m³/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	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	87	90	76
Sound power level L_{WAKokt} [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

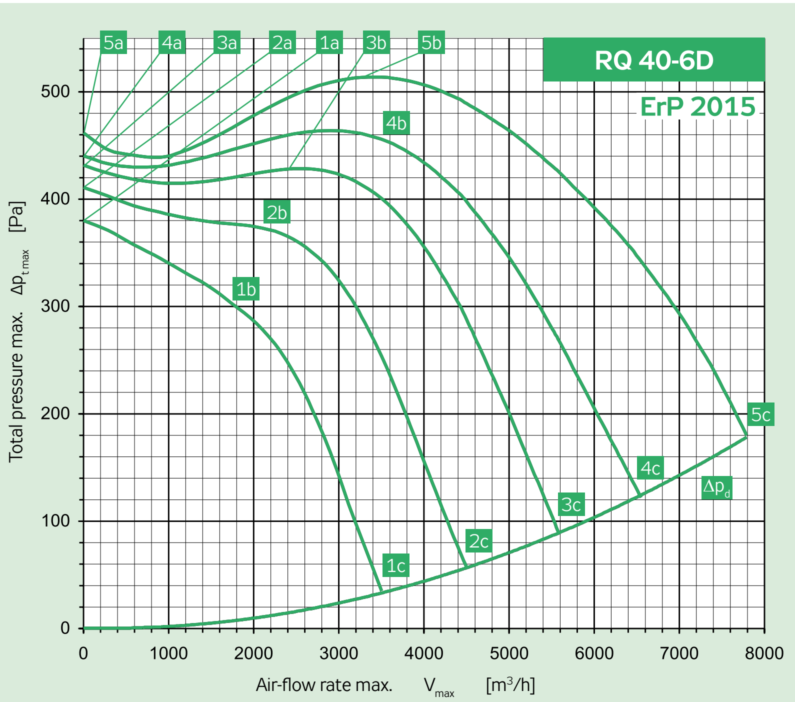
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	2.07	3.24	6.00	1.50	3.15	6.00	1.46	3.43	6.00	1.57	3.36	6.00	1.82	3.44	5.74
Electric input P [W]	564	1724	3534	478	1343	2563	454	1218	2063	425	939	1575	397	728	1089
Speed n [min⁻¹]	1330	1400	1292	1325	1340	1158	1321	1276	1036	1362	1204	829	1307	1073	526
Air-flow rate V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	303
Max. current (5c)	I_{max}	[A]	1.47
Mean speed	n	[min⁻¹]	1400
Capacitor	C	[F]	5
Max. working temp.	t_{max}	[°C]	40
Max. air-flow rate	V_{max}	[m³/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	type		TRN 2E
Protecting relay	type		STE

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	72	75	65
Sound power level L_{WAKokt} [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

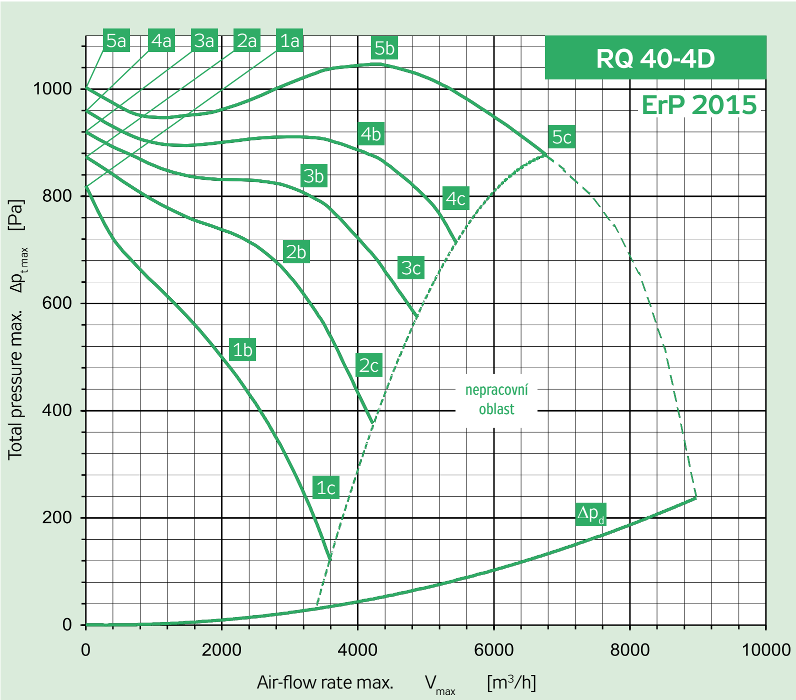
Parameters in selected points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.87	1.07	2.41	0.62	1.03	1.94	0.56	0.81	1.60	0.58	0.71	1.27	0.63	0.72	1.00
Electric input P [W]	221	495	1274	164	396	673	154	257	449	134	170	271	117	131	166
Speed n [min⁻¹]	715	669	427	697	610	279	679	616	227	639	594	168	560	508	139
Air-flow rate V [m³/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	164	124	0
Total pressure Δp_t [Pa]	274	267	62	258	215	25	242	194	18	218	173	9	164	125	6



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	2770
Max. current (5c)	I_{max}	[A]	5.10
Mean speed	n	[min⁻¹]	940
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	50
Max. air-flow rate	V_{max}	[m³/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	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	80	83	69
Sound power level L_{WAKokt} [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 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 [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	4873
Max. current (5c)	I_{max}	[A]	8.10
Mean speed	n	[min⁻¹]	1390
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Max. air-flow rate	V_{max}	[m³/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	type		TRN 9D
Protecting relay	type		STD

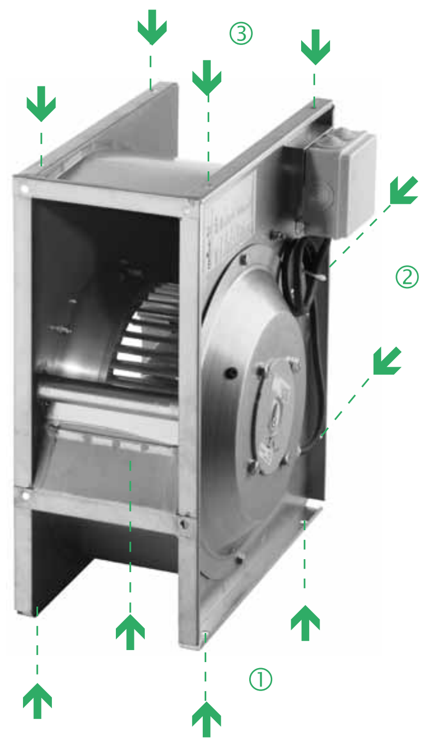
	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	91	94	78
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	76	73	49
250 Hz	77	79	62
500 Hz	81	86	68
1000 Hz	87	90	73
2000 Hz	85	89	74
4000 Hz	82	85	68
8000 Hz	73	76	58

Parameters in selected 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 [m³/h]	0	4125	6768	0	3937	5447	0	3053	4764	0	2852	4200	0	2098	3602
Static pressure Δp_s [Pa]	1003	1009	746	960	865	629	920	783	515	874	647	330	818	472	83
Total pressure Δp_t [Pa]	1003	1058	877	960	909	714	920	810	580	874	670	372	818	485	120

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.
- 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.
- 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).

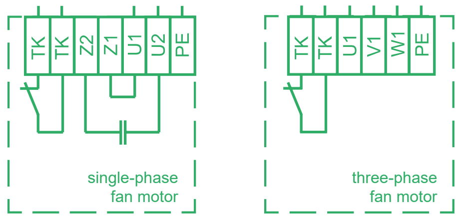
FIGURE 3 – ANCHORING HOLES



WIRING

- The wiring can be performed only by a qualified worker licensed in accordance with national regulations.
- 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 mm^2
- 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.

FIGURE 4 – WIRING DIAGRAM



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

TK
– motor thermo-contact terminals
U1, V1, W1
– three-phase motor power supply terminals 400 V / 50 Hz
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.

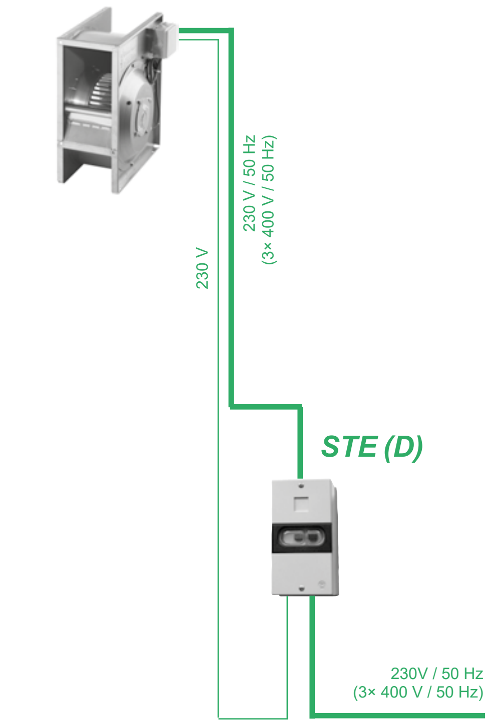
On the following pages you will find some basic examples of the fan connection to output controllers and control units.
AeroCAD software is available for precise design of the wiring.

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 # 5.
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 ºC 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 black "I" button..

FIGURE 5 – FAN CONNECTION

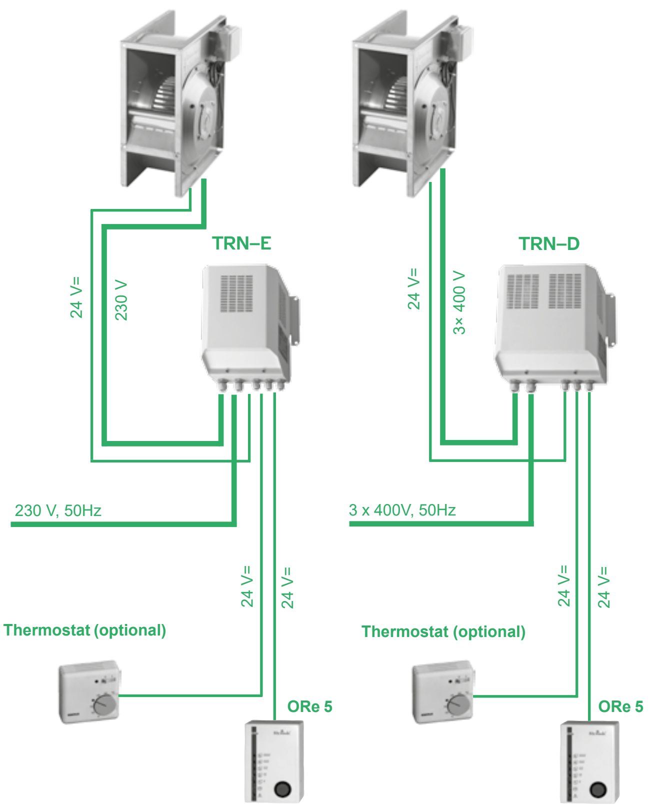


EXAMPLE B
RQ FANS WITH OUTPUT CONTROL AND TRN CONTROL

The RQ fan connection in a simple venting system with one or more fans which must be controlled independently using the TRN controller with ORe 5 controller
is shown in figure # 6.
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 ORe 5 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 ORe 5 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 6 – FAN CONNECTION



EXAMPLE C

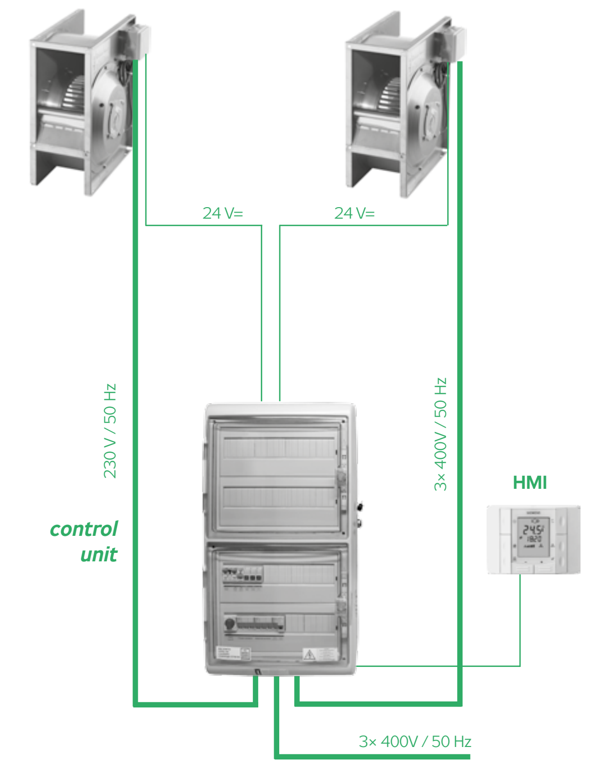
RQ FANS WITHOUT OUTPUT CONTROL AND WITH CONTROL UNIT

The RQ fan without output control connection in more sophisticated venting systems using the control unit is shown in figure # 7. 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 7 – FAN CONNECTION



EXAMPLE D

RQ FANS WITH TRN CONTROLLERS AND CONTROL UNIT

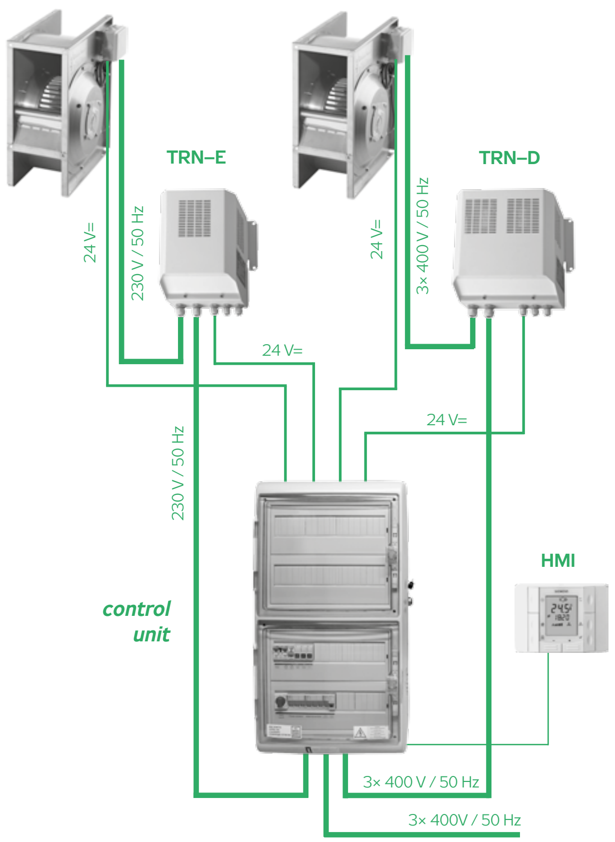
Connection of RQ fans equipped with an output control with two TRN controllers and an independent internal control for each controller is shown in figure # 8. The internal control is installed in the control unit during production. Among others, this connection ensures:

- → Manual selection of the fan output within the stage range 1-5 via HMI controller and/or using time schedule function of control unit, separate or 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 TRN controller.

The air-handling system is started by the control unit. 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 8 – FAN CONNECTION



RO Fans

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

FAN USE

Fully controlled, low-pressure RO radial fans are intended to be installed directly in square air ducts. They are very convenient when used especially for simple venting installations. With small fan types equipped with a hinged panel (an impeller), the service panel can be easily loosened and opened by loosening two screws so these fans are ideal, e.g., for kitchen exhaust hoods, where higher levels of grease and the need for periodical cleaning of the impeller can be expected. 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 according to fan type can range from -25 °C to -40 °C up to +55 °C 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 nine sizes according to the A x B dimensions of the connecting outlet flange and enable to realize devices with flow rates up to approximately 11.000 m^3/h.
Fans of the 30-15, 40-20 and 50-25 dimensional ranges are manufactured with a hinged impeller, larger types as solid.

MATERIALS

The external casing and connecting flanges of RO fans are made of galvanized steel sheets (Zn 275 g/m2). Impeller blades – with backward curved blades are made of plastics, diffusers are made of aluminium. 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.

MOTORS

Compact single-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 IP 44, respectively IP 54 with certain types.

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" at the end of the chapter.

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 to the supply circuit for impellers up to 250 mm in diameter (single-phase), and to the control circuit of the protective contractor for impellers from 310 mm in diameter (three-phase). They automatically protect the motor against overloading due to excessive temperature of transported air, etc.

FAN OUTPUT 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. Following voltage controllers can be used with fans:

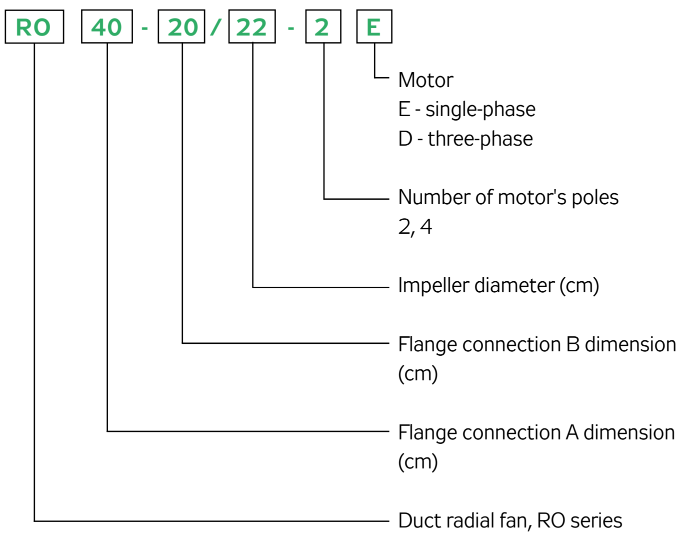
- PE for stepless control (single-phase fans only)
- TRN or TRR for the five-stage control

From the application and financial point of view – the initial costs (respectively price/performance ratio) and the operating costs – it is not suitable to use the RO fans with speed control. If output control is required, it is better to use RE fans equipped with EC motors..

FAN DESCRIPTION AND DESIGNATION

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

FIGURE 1 – TYPE DESIGNATION OF RP FANS



The most commonly used names of parts and fan assemblies defines a figure # 2.

ACCESSORIES

RO 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.

DIMENSIONS, WEIGHTS AND PERFORMANCE

For important dimensions of RP fans, refer to Figure # 3 and Table # 1.
For basic parameters refer to table # 2.

FIGURE 2 – RO FAN DESCRIPTION (HINGED TYPE)

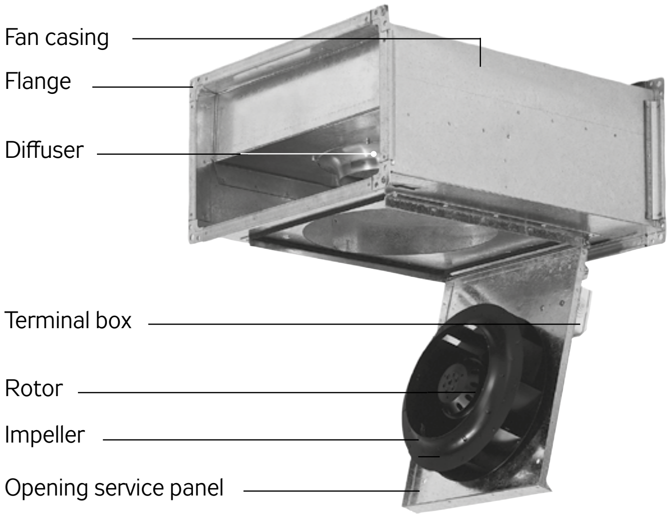


FIGURE 3 – FAN DIMENSIONAL DIAGRAM

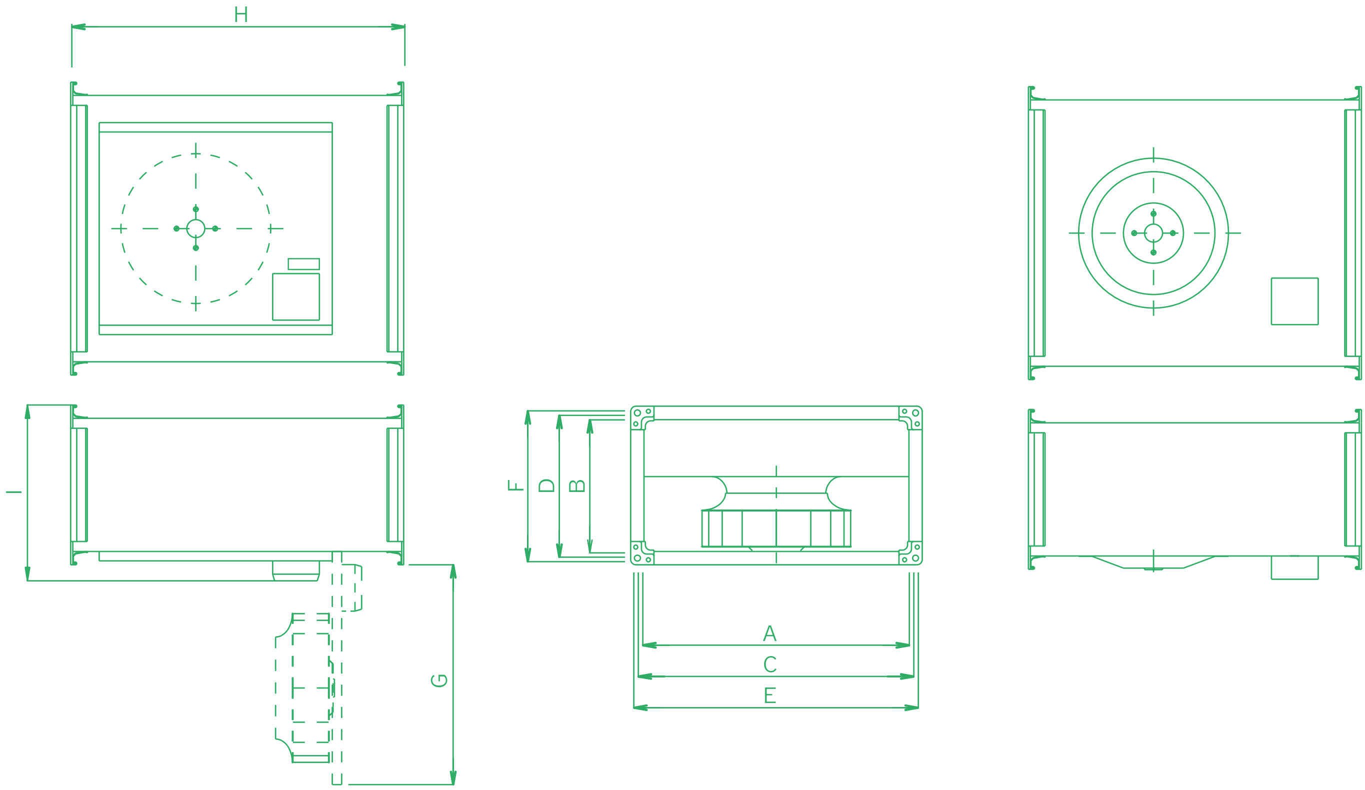


TABLE 1 – FAN DIMENSIONS

Fan Type	Dimensions in mm								
	A	B	C	D	E	F	G	H	I
RO 30-15/19-2E	300	150	320	170	340	190	258	400	215
RO 40-20/22-2E	400	200	420	220	440	240	280	500	265
RO 50-25/25-2E	500	250	520	270	540	290	355	530	315
RO 50-30/31-4D	500	300	520	320	540	340	-	565	380
RO 60-35/35-4D	600	350	620	370	640	390	-	720	430
RO 70-40/40-4D	700	400	720	420	740	440	-	780	480

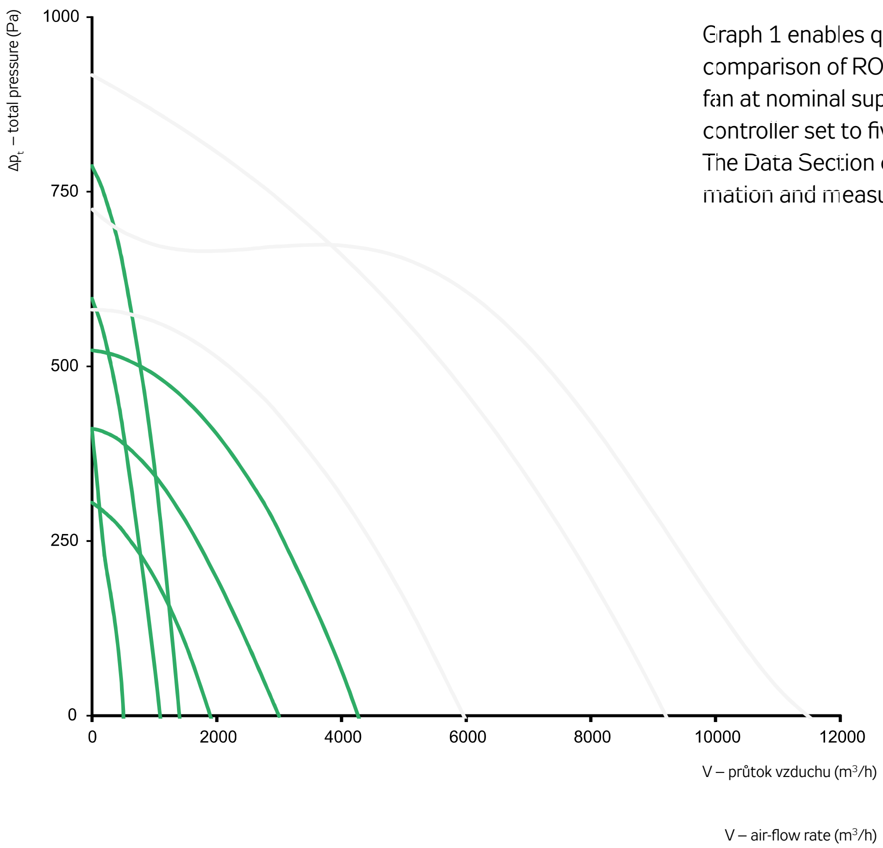
TABLE 2 – FAN BASIC PARAMETERS AND NOMINAL VALUES

Fan type	V_{max}	$\Delta p_{t\ max}$	$\Delta p_{t\ min}$	n_{nom}	U_{nom}	P_{max}	I_{max}	t_{min}	t_{max}	C	m	ErP2015
	m^3/h	Pa	Pa	min^{-1}	V	W	A	ºC	ºC	mF	kg	
SINGLE-PHASE FANS												
RO 30-15/19-2E	502	409	0	2345	230	52	0.23	-25	65	1.5	10	✓
RO 40-20/22-2E	1095	597	0	2601	230	155	0.7	-25	70	3.5	16	✓
RO 50-25/25-2E	1416	787	0	2772	230	250	1.1	-25	70	5	15	✓
THREE-PHASE FANS												
RO 50-30/31-4D	1901	305	0	1356	400	145	0.35	-25	55	-	21	✓
RO 60-35/35-4D	2971	411	0	1387	400	280	0.72	-25	60	-	25	✓
RO 70-40/40-4D	4218	526	0	1401	400	515	1.2	-40	60	-	32	✓

SYMBOLS USED IN TABLE 2:

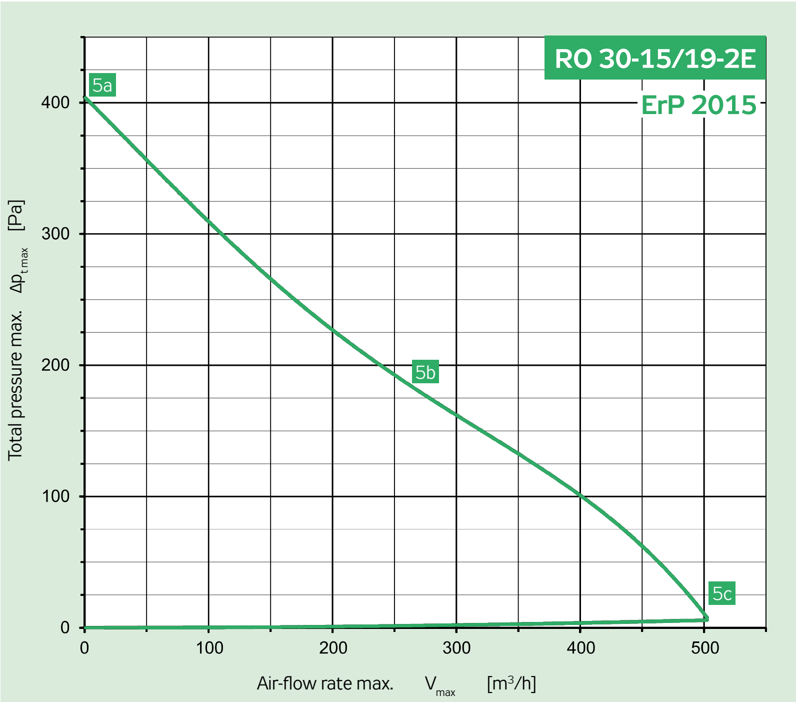
V_{max} maximum air flow rate
n fan speed measured at the highest efficiency working point (5b), rounded to tens
U nominal power supply voltage of the motor without control (all values in the table are to this voltage)
$P_{max.}$ electric motor maximal power output
$I_{max.}$ maximum phase current at voltage **U**
(this value must be checked)
$t_{max.}$ maximum permissible transported air temperature at air flow $\mathbf{V}_{max..}$
C capacitor capacity with single-phase fans
FM. frequency inverter
m weight of the fan (±10%)
ErP2015 Fan compliance with the requirements of Regulation 2009/125/EC (NOT compliant fans must not be used within EU region)

GRAPH 1 – RO FAN CHARACTERISTICS QUICK SELECTION



DATA SECTION

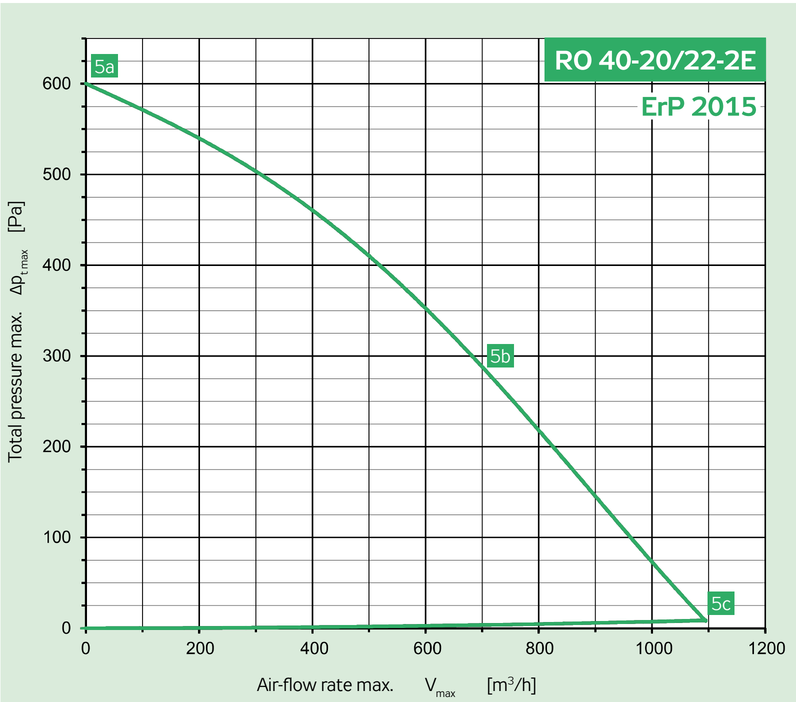
Graph 1 enables quick selection of a suitable fan and alternate comparison of RO fans. Only the highest characteristics of each fan at nominal supply voltage, i.e. without a controller or with a controller set to five stage, are included in this graph.
The Data Section of the catalogue contains all important information and measured data of RO fans.



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	52
Max. current (5c)	I_{max}	[A]	0.23
Mean speed	n	[min⁻¹]	2345
Capacitor	C	[F]	1.5
Max. working temp.	t_{max}	[°C]	65
Max. air-flow rate	V_{max}	[m³/h]	502
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	409
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	10
Five-stage controller	type		TRN 2E
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	66	69	50
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	44	48	33
250 Hz	56	59	41
500 Hz	63	66	48
1000 Hz	56	60	37
2000 Hz	59	62	39
4000 Hz	52	55	30
8000 Hz	41	41	19

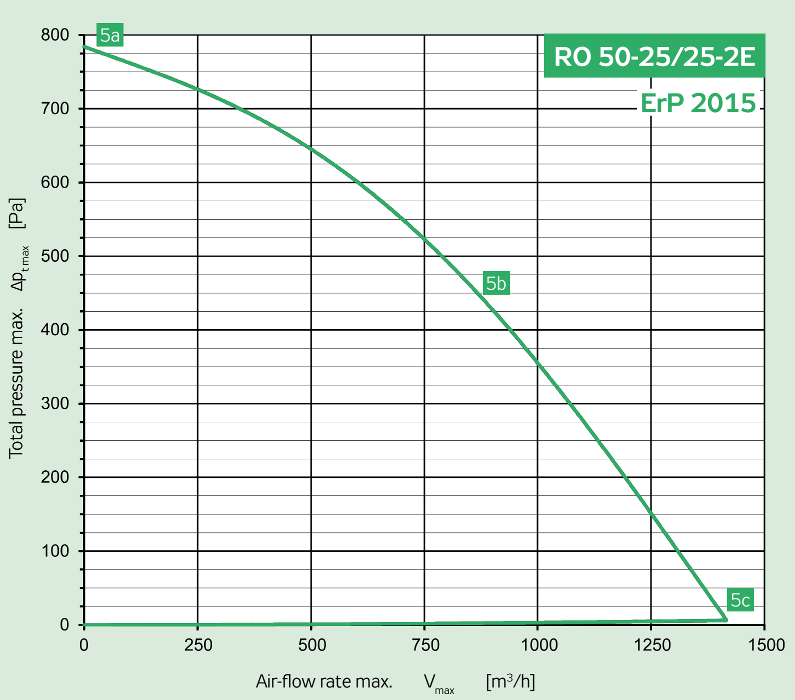
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.2	0.2	0.2
Electric input P [W]	49	48	48
Speed n [min⁻¹]	2950	2345	2457
Air-flow rate V [m³/h]	0	267	502
Static pressure Δp_s [Pa]	409	186	0
Total pressure Δp_t [Pa]	409	187	6



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	155
Max. current (5c)	I_{max}	[A]	0.70
Mean speed	n	[min⁻¹]	2601
Capacitor	C	[F]	3.5
Max. working temp.	t_{max}	[°C]	70
Max. air-flow rate	V_{max}	[m³/h]	1095
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	597
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	16
Five-stage controller	type		TRN 2E
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	72	75	55
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	57	60	46
250 Hz	64	68	49
500 Hz	63	66	48
1000 Hz	67	71	48
2000 Hz	66	69	46
4000 Hz	61	64	39
8000 Hz	51	54	29

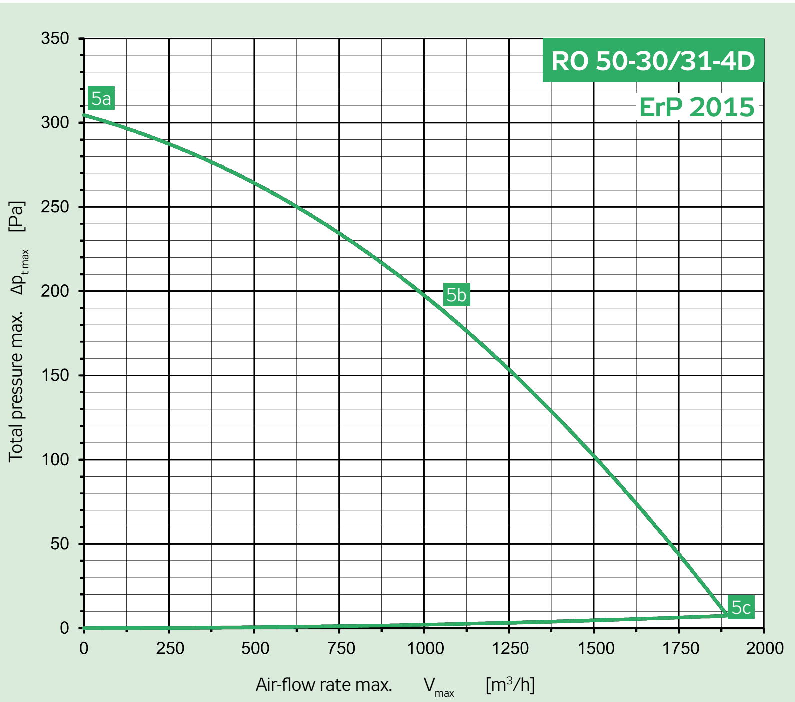
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.4	0.6	0.6
Electric input P [W]	94	148	133
Speed n [min⁻¹]	2880	2601	2671
Air-flow rate V [m³/h]	0	604	1095
Static pressure Δp_s [Pa]	597	347	0
Total pressure Δp_t [Pa]	597	350	9



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	250
Max. current (5c)	I_{max}	[A]	1.10
Mean speed	n	[min^{-1}]	2772
Capacitor	C	[F]	5
Max. working temp.	t_{max}	[°C]	70
Max. air-flow rate	V_{max}	[m³/h]	1416
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	787
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	15
Five-stage controller	type		TRN 2E
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	72	74	54
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	58	54	47
250 Hz	64	62	49
500 Hz	59	66	45
1000 Hz	67	70	48
2000 Hz	66	68	46
4000 Hz	62	66	40
8000 Hz	58	59	36

Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.6	1.1	0.9
Electric input P [W]	141	246	204
Speed n [min^{-1}]	2910	2772	2831
Air-flow rate V [m³/h]	0	803	1416
Static pressure Δp_s [Pa]	787	488	0
Total pressure Δp_t [Pa]	787	490	6

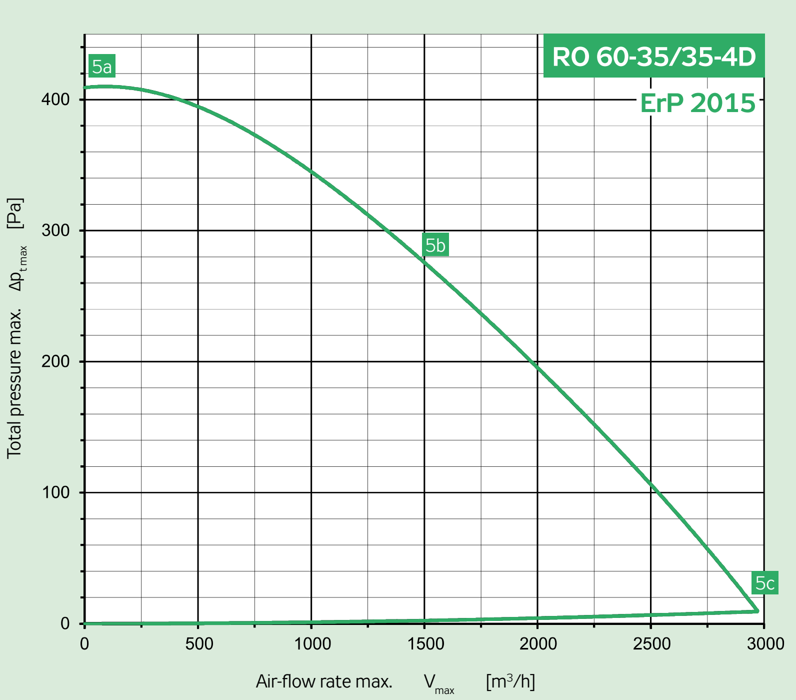


Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	145
Max. current (5c)	I_{max}	[A]	0.35
Mean speed	n	[min^{-1}]	1356
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Max. air-flow rate	V_{max}	[m³/h]	1901
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	305
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	21
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	62	66	51
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	62	66	51
250 Hz	57	60	41
500 Hz	53	56	39
1000 Hz	57	60	38
2000 Hz	52	55	32
4000 Hz	47	50	25
8000 Hz	39	42	17

Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	0.3	0.3	0.3
Electric input P [W]	67	136	121
Speed n [min^{-1}]	1450	1356	1380
Air-flow rate V [m³/h]	0	1053	1901
Static pressure Δp_s [Pa]	305	189	0
Total pressure Δp_t [Pa]	305	192	7

RO 60-35/35-4D

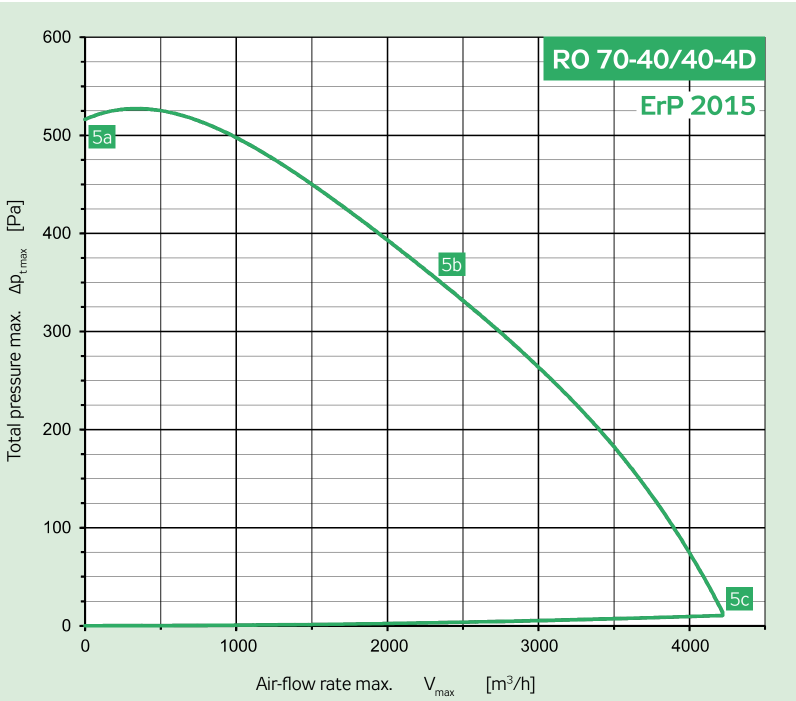


Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	280
Max. current (5c)	I_{max}	[A]	0.72
Mean speed	n	[min^{-1}]	1387
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	60
Max. air-flow rate	V_{max}	[m^3/h]	2971
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	411
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	25
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	64	70	50
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	58	61	47
250 Hz	55	64	40
500 Hz	59	65	44
1000 Hz	58	64	39
2000 Hz	55	61	35
4000 Hz	48	54	26
8000 Hz	39	43	17

Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	0.7	0.7	0.7
Electric input P [W]	145	278	222
Speed n [min^{-1}]	1470	1387	1359
Air-flow rate V [m^3/h]	0	1498	2971
Static pressure Δp_s [Pa]	411	279	0
Total pressure Δp_t [Pa]	411	281	9

RO 70-40/40-4D



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	515
Max. current (5c)	I_{max}	[A]	1.20
Mean speed	n	[min^{-1}]	1401
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	60
Max. air-flow rate	V_{max}	[m^3/h]	4218
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	526
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	32
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	68	73	55
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	65	65	54
250 Hz	59	65	44
500 Hz	59	63	44
1000 Hz	59	68	40
2000 Hz	58	64	38
4000 Hz	54	59	32
8000 Hz	53	57	31

Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.0	1.1	1.1
Electric input P [W]	269	505	424
Speed n [min^{-1}]	1470	1401	1387
Air-flow rate V [m^3/h]	0	2341	4218
Static pressure Δp_s [Pa]	522	362	0
Total pressure Δp_t [Pa]	522	365	11

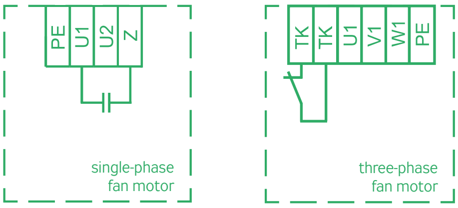
INSTALLATION

- 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 the proper selection of fan. The installation and commissioning may be performed only by an authorized company licensed in accordance with generally valid regulations.
- It is recommended to insert the DV elastic connections in front of and behind the fan.
- It is advisable to always place the KFD or VFK air filters, respectively VFT metal grease filter in front of the fan to protect the fan and duct against dirtying and dust fouling,
- 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 # 2 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. 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. On the inlet side, the DV elastic connection will be sufficient as a distance piece in most cases.
- When positioned under the ceiling, it is advisable to situate the fan with its opening service panel directed downwards to ease access to the motor terminal box.

WIRING

- The wiring can be performed only by a qualified worker licensed in accordance with national regulations.
- Terminal box f is equipped with WAGO terminals; max. cross-section of connecting conductors 1.5 mm^2
- For wiring diagrams refer to figure # 4.

FIGURE 4 – WIRING DIAGRAM



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

TK
– motor thermo-contact terminals
U1, V1, W1
– three-phase motor power supply terminals 400 V / 50 Hz
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.

On 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.

EXAMPLE A
RO FANS WITHOUT OUTPUT CONTROL

a) An RO fan's single-phase connection in a simple venting system is shown in figure # 5 a).
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 ºC 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.

b) An RO fan's three-phase connection in a simple venting system is shown in figure # 5 b).
This connection ensures:

- Full thermal protection of the fan via built-in thermo-contacts and STD protecting relay.
- Manual switching on/off of the fan using STD protecting relay buttons

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 winding is overheated above 130 ºC 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 STD protecting relay circuit TK, TK will be disconnected. As a reaction to this state, the STD 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 black "I" button..

EXAMPLE B
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 # 6.
This connection ensures:

- Thermal protection of the fans against overheating. This protection is ensured via built-in thermo-contacts, which are connected in series with the motor winding in the case of single-phase RO fans and automatically interrupt the fan power supply, while in the case of three-phase fans the thermo-contacts are brought out into the control unit, which ensures switching off of the fans (the entire assembly, respectively).
- 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 5 – FAN CONNECTION

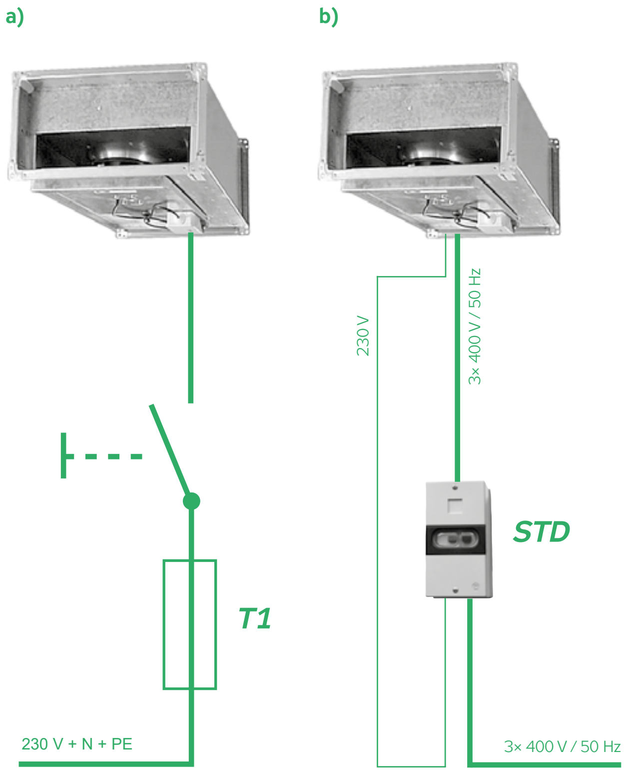
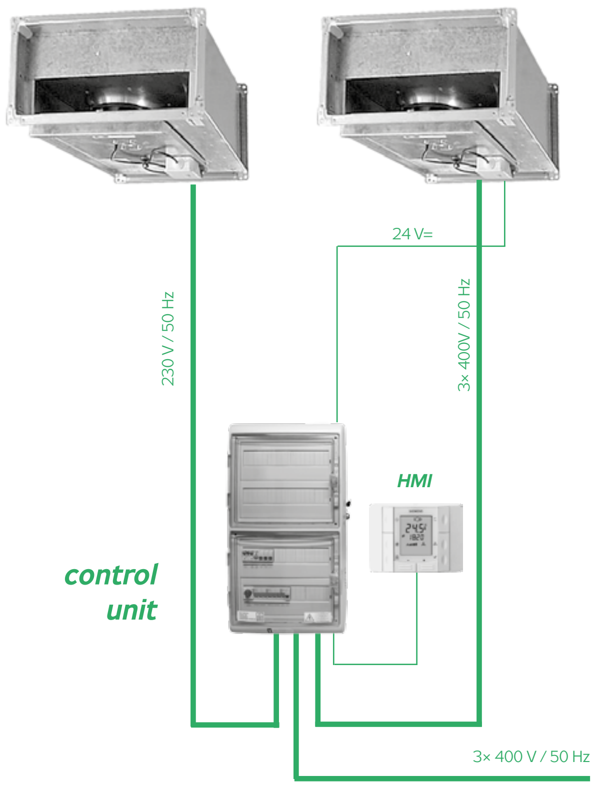
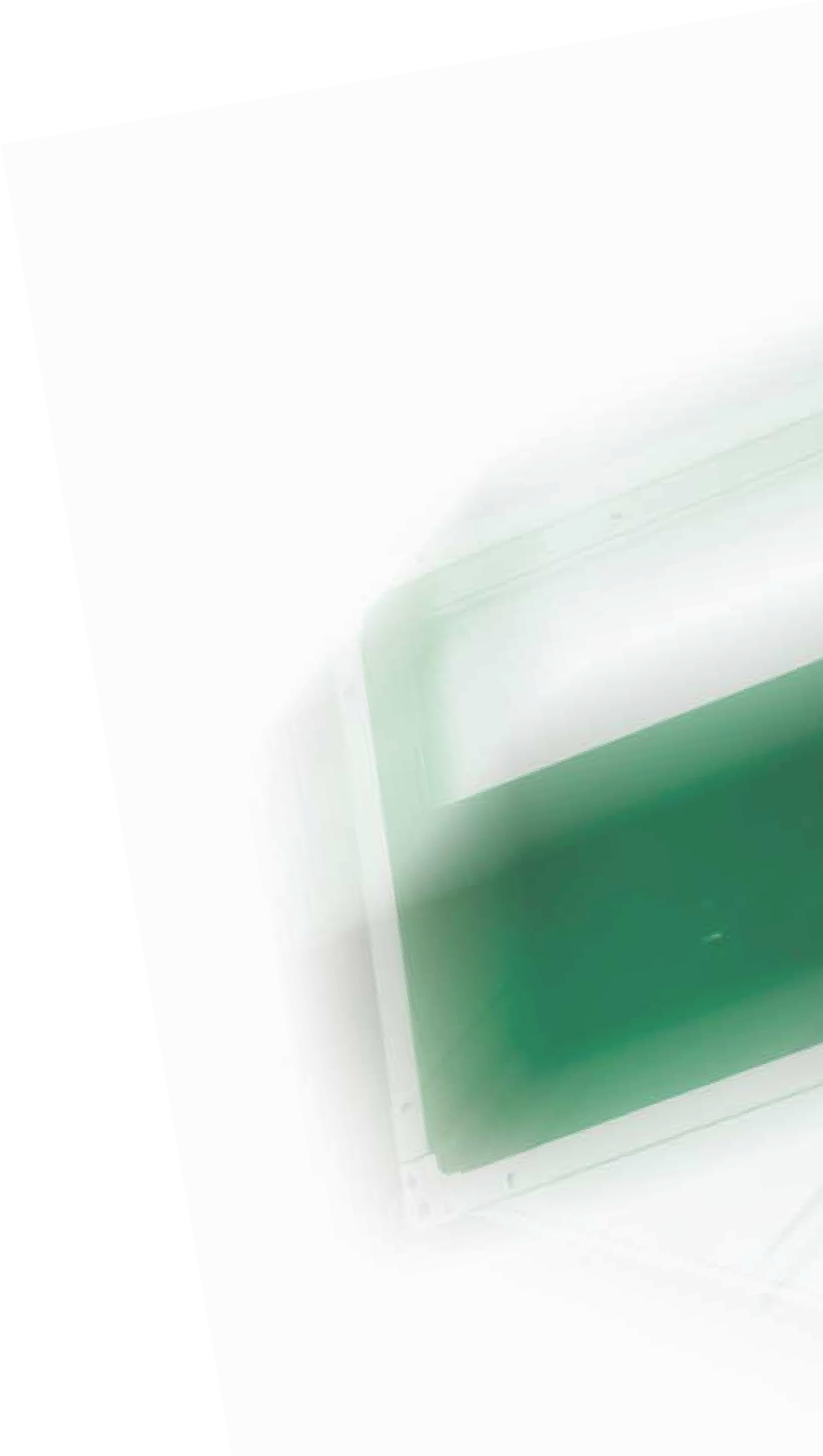
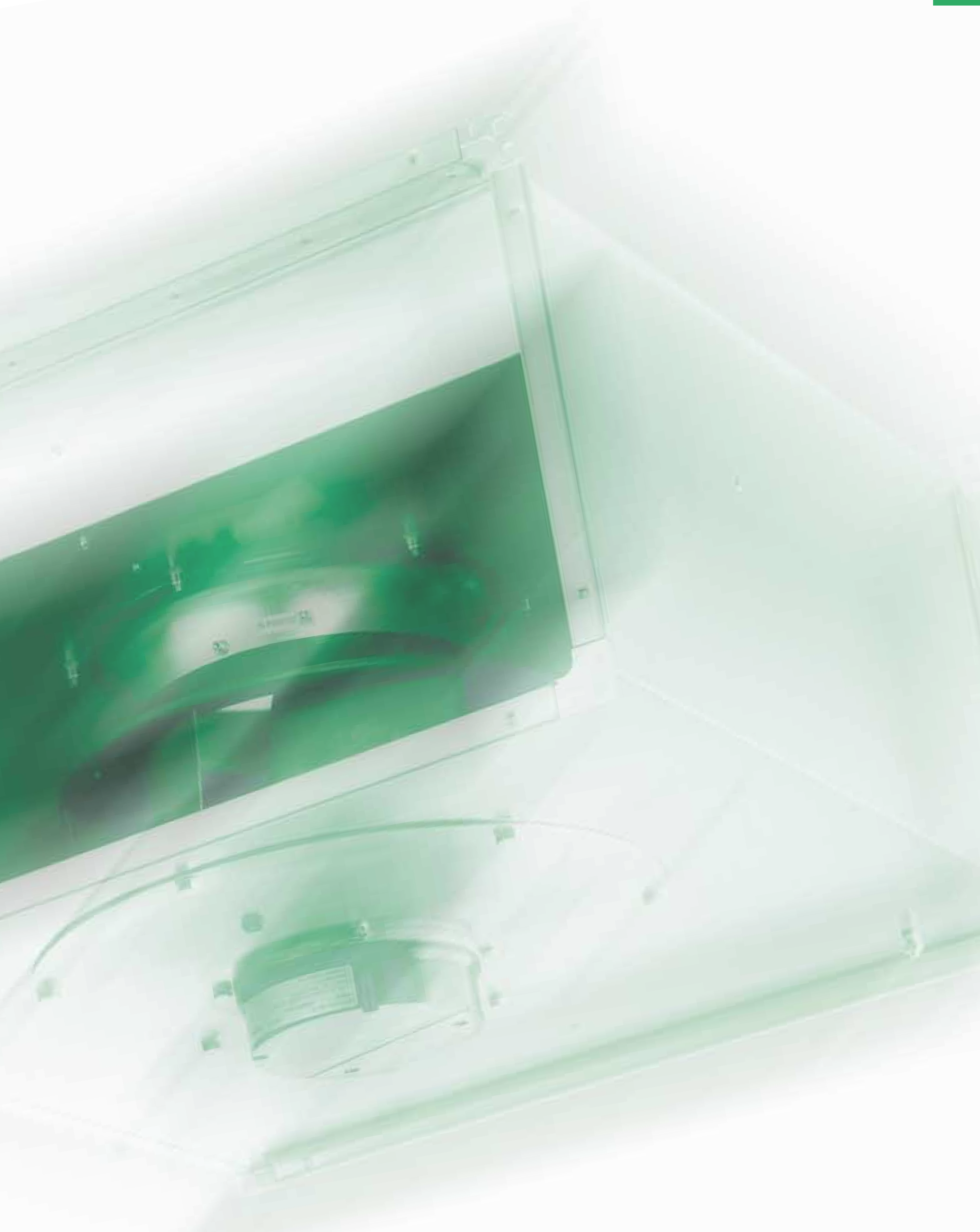


FIGURE 6 – FAN CONNECTION





RE Fans



FAN USE

Fully controlled, low-pressure, highly efficient RE radial fans intended for square ducts can be universally used for complex air-conditioning, from simple venting installations to sophisticated air-handling installations. They can be very conveniently used in systems with a large range of output control during operation – important areas of the plant operating at lower than maximum output, when the features of the used EC motors are utilised in the most efficient way. The integrated control electronics also simplify installation and maintenance (there is no need for an external output controller). Modern impellers feature excellent noise parameters and are suitable for use in duct systems with greater requirements regarding the sound level. With small fan types equipped with a hinged panel (an impeller), the service panel can be easily loosened and opened by loosening two screws. These fans are ideal, e.g., for kitchen exhaust hoods, where higher levels of grease and the need for periodical cleaning of the impeller can be expected.
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 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 provide the fans with a protective coating (except for the rating plates).
The transported air must be free of corrosive chemicals or chemicals aggressive to zinc, aluminium or plastics.
The permissible operating temperature of the environment and transported air ranges from -25 or -30 °C up to +40 or +60 °C, according to the type. The maximum nominal values for each fan are included in table # 3.
For safe operation of the fan down to the minimum permitted external temperature, it is necessary to provide a continuous electrical power supply, which ensures automatic maintaining of the operating temperature and functionality of the electronic components, even if ventilation (impeller rotation) is not required. The fan must be stopped (except service activities) using a control signal. At the same time, this procedure ensures the long service life of the fan (frequent forced switching decreases the service life).
Warning: As EC motors with permanent magnets are used, it's not possible to operate, store or transport RE fans at ambient temperatures lower than -40 °C!
The fan's EC motors, respectively their integrated electronic components, are as far as their function and design similar in principle to frequency inverters, which are generally used for standard ISO motors (with a brought-out shaft) and are equipped with built-in interference filters for higher harmonic frequencies. Nevertheless, it is necessary to evaluate the area of electromagnetic interference (EMC compatibility) according to the situation at the installation site (it is affected by the final installation and interaction of devices).
RE fans can work in any position, which enables free access to the terminal box and motor. We recommend adding a 1–1.5 m long piece of straight duct to the fan's outlet to reduce pressure losses in the assembly.

DIMENSIONAL RANGE

RE fans are manufactured in a range of ten sizes according to the A × B dimensions of the connecting flange.
The standard dimensional and performance range of single-phase and three-phase RE fans enables designers to optimize all parameters for air flows up to 12,000 m^3 per hour. Fans of the dimensional ranges 30-15, 40-20 and 50-25 are manufactured with a hinged impeller, larger types as solid.

MATERIALS

The casing of RE fans, connecting flanges and diffusers are made of galvanized sheet steel (Zn 275 g/m^2). Impeller blades – with backward-curved blades - are made of plastic.
Motors are made of aluminium alloys, copper and plastics.

MOTORS

Electronically switched (so-called EC) compact single-phase and three-phase motors with external rotor are used to drive the fans. The motors are situated inside the impeller, and during operation are optimally cooled by the flowing air.
The motors' high quality enclosed ball bearings with permanent lubricating filling enable the fans to achieve a service life above 40,000 operating hours without maintenance. Motor degree of protection is IP 54.

ELECTRICAL EQUIPMENT

According to the fan type, the wiring can be terminated in a special independent box of IP 54 protection degree for the power connection and in a box of IP 44 protection degree for the control connection or using a two-segment terminal box integrated under the cover directly on the motor body (IP 54).
For wiring diagrams, refer to the separate section "Wiring Diagram". Small types of fans contain a so-called draught output which enables fan operation (rotation) to be monitored. Larger types are equipped with an output non-potential relay contact for failure indication. See Wiring Diagrams.

MOTOR PROTECTION

As standard, permanent automatic monitoring of the internal motor temperature is used in all motors. The electronics of the EC motor control the fan's operation so that it will not be damaged. In case of adverse operating conditions (blocking, repeated overheating, phase failure), the fan is switched off [1)] or the failure is signalled (in types equipped with a failure relay). Once the protective functions have been activated, the fans can restart themselves again after subsequent problem removal, cooling, etc. [2)]

FAN OUTPUT CONTROL

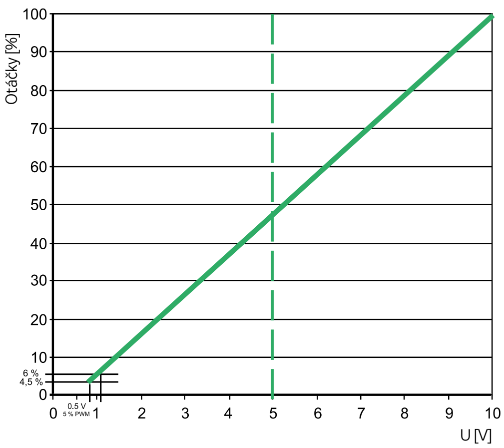
The output of all RE fans can be fully controlled by changing the speed. The fan's speed is changed by the analogue input using control voltage (0-10 V DC) and the fan (electronics of the motor) provides a constant exciting voltage of 10 V DC for control, or it is possible to control it by an external signal of 0-10 V from a complex control system.

- A potentiometric ORP controller for manual control is available as an accessory.
- It is possible to control two or more fans connected together in parallel to the control signal (max. number - depends on max. possible power supply source load of 10 V) using a power supply of 0-10 V, respectively the potentiometric ORP controller. However, an "exciting" voltage of 10 V must always be used only from one source, respectively a fan (it must never be connected to the 10 V outputs of the remaining fans).
- Simultaneously, the control voltage must be used for operating stoppage of the fan (the power supply must not be disconnected in the standard way) – see "Operating Conditions" above.
- For fan speed (flow) control depending on the input signal level, see figure # 1 and table # 1.

TABLE 1

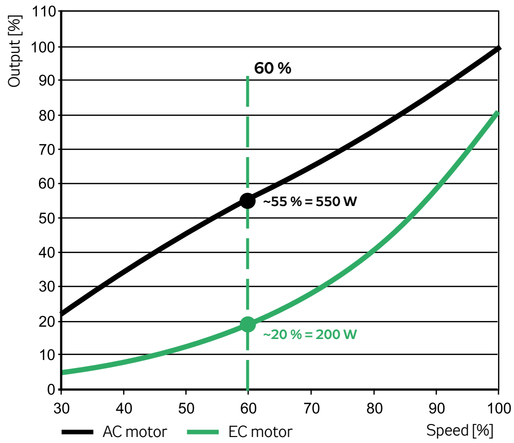
Control DC voltage [V]	Operation Mode	Fan speed (%)
0-1	STOP	0
>1	RUN	see fig. **1**
10	RUN	100

FIGURE 1



The motor will be started with a control signal of 1 V – at approx. 6 % of the rated (maximum) speed.
RE fans equipped with EC motors are significantly more effective than voltage-controlled fans equipped with AC motors (RO, RP types, etc.), see figure # 2.
Figure # 2 graphically compares the energy consumption of AC and EC fans for nominal output (100 % fan speed) as well as for output control (speed). In comparison with voltage-controlled fans, EC fans can have a lower power input for nominal output (flow) and even lower for the lowered (controlled) output.
For example, during operation at 60 % of maximum speed (flow), the input of the highly efficient EC motor is approximately at 20 % of the power input in comparison with 55 % with the AC motor.

FIGURE 2 – COMPARISON OF ENERGY DEMANDS FOR VOLTAGE AND EC CONTROL



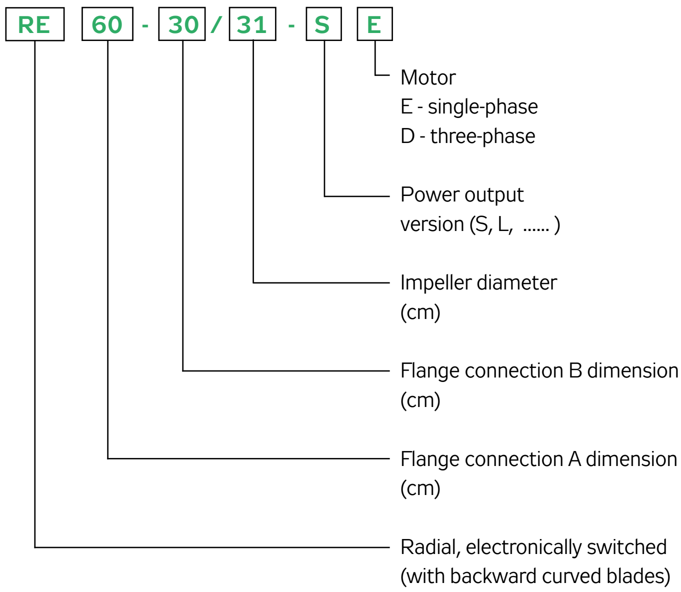
ACCESSORIES

RE 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.
ORP IP 40 or ORP IP 54 controllers are intended for manual start--up and control of the fan output (without using the control unit).

FAN DESCRIPTION AND DESIGNATION

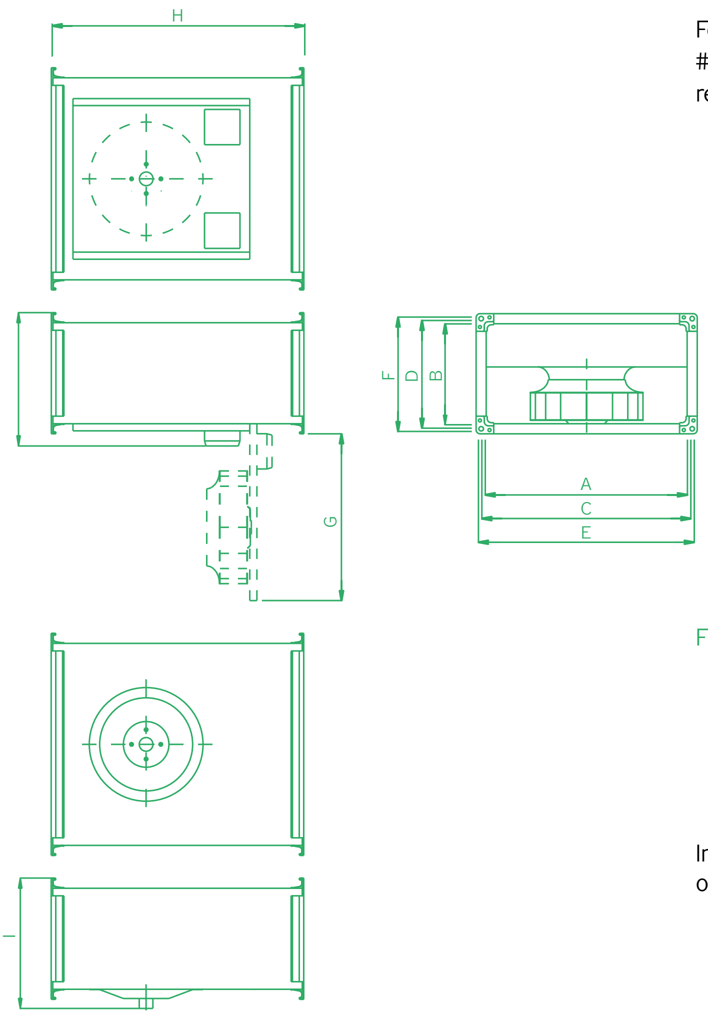
The type designation of RE fans is defined by the key shown in figure # 3. For example, type designation RE 70-40/40-SD specifies the type of fan, impeller and motor. The most frequently used names of the fan's individual parts and structure assemblies are defined in figures # 4 and # 5.

FIGURE 3 – TYPE DESIGNATION OF RP FANS



[1] Application of this operational behaviour (non-signalled shutdown) must be evaluated within the scope of the air-handling device and control system project.
[2] Beware of possible automatic fan start when handling the fan!

FIGURE 5 – FAN DIMENSIONAL DIAGRAM



DIMENSIONS, WEIGHTS AND PERFORMANCE

For important dimensions of RE fans, refer to Figure # 5 and Table # 2. For basic parameters and nominal fan values refer to table # 2.

FIGURE 4 – RE FAN DESCRIPTION (SOLID TYPE)

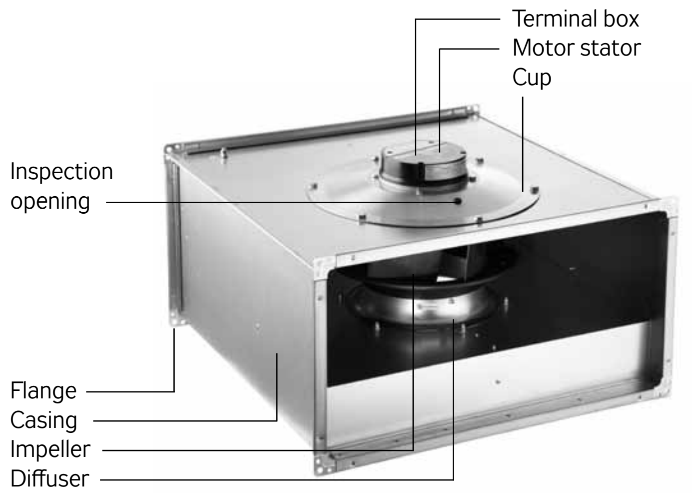


TABLE 2 – FAN DIMENSIONS

Fan type	Dimensions mm								
	A	B	C	D	E	F	G	H	I
RE 30-15/19-SE	300	150	320	170	340	190	258	400	215
RE 40-20/22-SE	400	200	420	220	440	240	280	500	265
RE 50-25/28-SE	500	250	520	270	540	290	395	530	315
RE 50-30/28-SE	500	300	520	320	540	340	-	565	380
RE 60-30/31-SE	600	300	620	320	640	340	-	642	390
RE 60-35/35-SD	600	350	620	370	640	390	-	720	445
RE 60-35/35-SE	600	350	620	370	640	390	-	720	430
RE 70-40/40-SD	700	400	720	420	740	440	-	780	495
RE 70-40/40-SE	700	400	720	420	740	440	-	780	480
RE 80-50/50-SD	800	500	820	520	840	540	-	885	625
RE 80-50/50-LD	800	500	820	520	840	540	-	885	595
RE 90-50/45-SD	900	500	930	530	960	560	-	985	620
RE 90-50/50-SD	900	500	930	530	960	560	-	985	590
RE 100-50/45-SD	1000	500	1030	530	1060	560	-	985	620
RE 100-50/50-SD	1000	500	1030	530	1060	560	-	985	590
RE 100-50/56-SD	1000	500	1030	530	1060	560	-	985	590

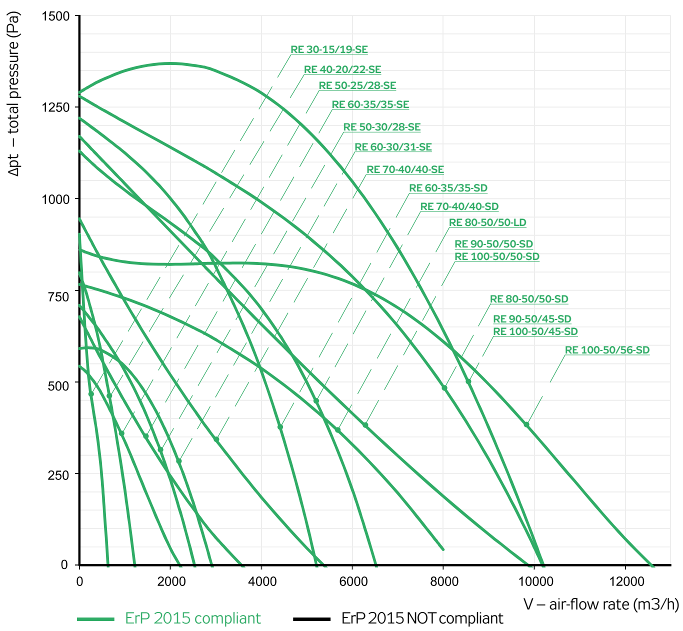
TABLE 3 – FAN BASIC PARAMETERS AND NOMINAL VALUES

Typ ventilátoru	V_{max}	$\Delta p_{t\ max}$	$\Delta p_{t\ min}$	n_{nom}	U_{nom}	P_{max}	I_{max}	t_{min}	t_{max}	m	ErP2015
	m³/h	Pa	Pa	min⁻¹	V	W	A	°C	°C	kg	
SINGLE-PHASE FANS											
RE 30-15/19-SE	709	906	0	3132	230	83	0.75	-25	60	10	✓
RE 40-20/22-SE	1219	800	0	2897	230	170	1.4	-25	60	14	✓
RE 50-25/28-SE	2144	538	0	1842	230	168	1.4	-25	60	18	✓
RE 50-30/28-SE	2531	703	0	2222	230	310	2.1	-25	60	20	✓
RE 60-30/31-SE	2911	591	0	2023	230	370	1.65	-15	60	24	✓
RE 60-35/35-SE	3490	672	0	1482	230	260	1.1	-25	60	29	✓
RE 70-40/40-SE	5314	927	0	1510	230	530	2.3	-25	50	36	✓
THREE-PHASE FANS											
RE 60-35/35-SD	5219	1220	0	2499	400	1270	2.1	-15	60	30	✓
RE 70-40/40-SD	6553	1130	0	2108	400	1450	2.4	-15	60	36	✓
RE 80-50/50-SD	10246	1280	0	1806	400	2600	4.3	-15	60	56	✓
RE 80-50/50-LD	8185	766	0	1397	400	1250	2.1	-15	60	48	✓
RE 90-50/45-SD	10228	1370	0	2122	400	2900	4.8	-20	40	63	✓
RE 90-50/50-SD	9821	1170	0	1335	400	1320	2.1	-25	50	61	✓
RE 100-50/45-SD	10228	1370	0	2122	400	2900	4.8	-20	40	67	✓
RE 100-50/50-SD	9821	1170	0	1335	400	1320	2.1	-25	50	65	✓
RE 100-50/56-SD	12655	864	0	1530	400	2360	3.7	-25	60	73	✓

SYMBOLS USED IN TABLE 3:

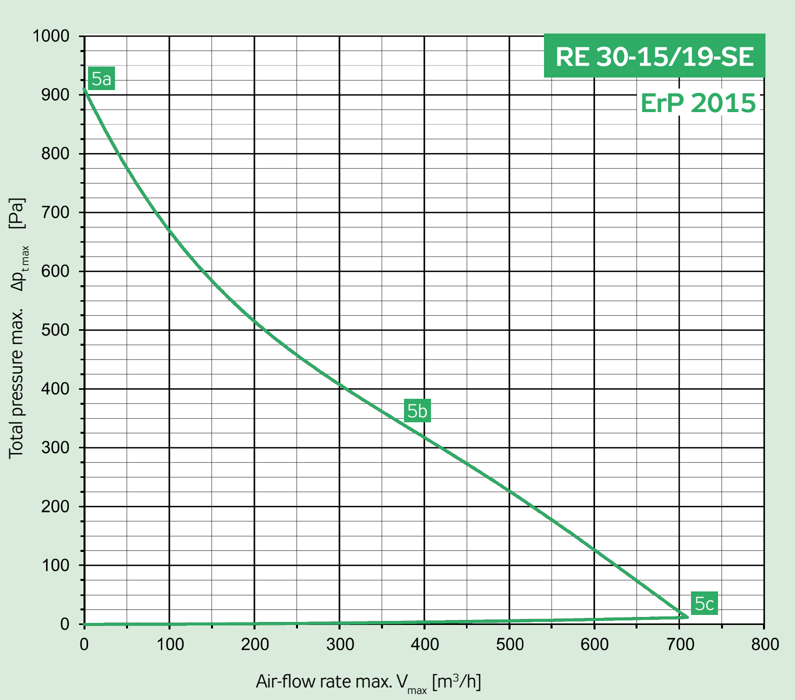
V_{max} maximum air flow rate
n fan speed measured at the highest efficiency working point (5b), rounded to tens
U nominal power supply voltage of the motor without control (all values in the table are to this voltage)
$P_{max.}$ electric motor maximal power output
$I_{max.}$ maximum phase current at voltage **U** (this value must be checked)
$t_{max.}$ maximum permissible transported air temperature at air flow $V_{max.}$.
C capacitor capacity with single-phase fans
FM. frequency inverter
m weight of the fan (±10%)
ErP2015 Fan compliance with the requirements of Regulation 2009/125/EC (NOT compliant fans must not be used within EU region)

GRAPH 1 – RE FAN CHARACTERISTICSQUICK SELECTION



DATOVÁ ČÁST

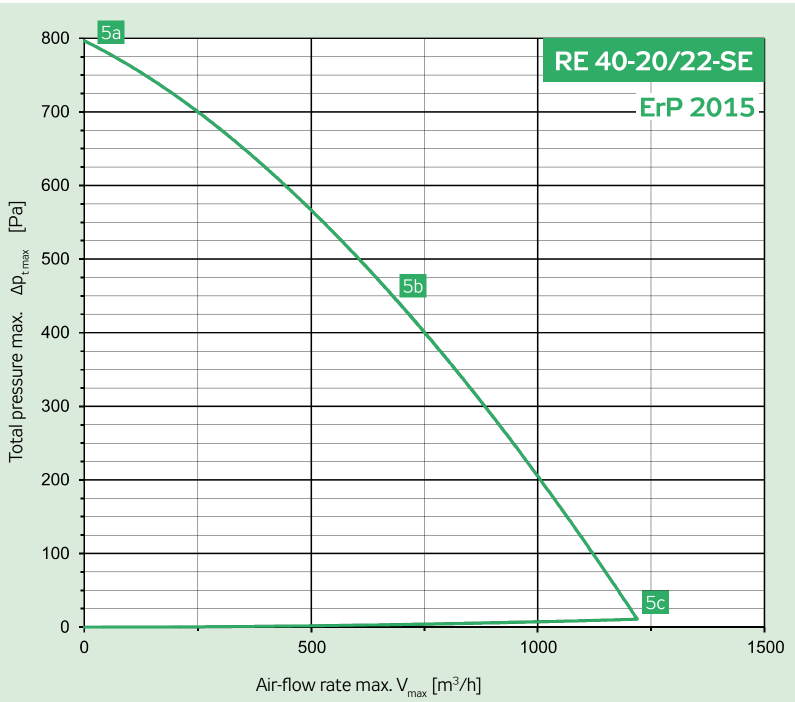
K rychlému výběru vhodného ventilátoru a ke vzájemnému porovnání ventilátorů RO slouží graf 1.
V něm jsou, stejně jako u grafů ve specifikacích každého jednotlivého typu, zaznamenány pouze nejvyšší charakteristiky každého ventilátoru při řídicím signálu 10 V.
V datové části katalogu jsou uvedeny všechny důležité informace a naměřená data ventilátorů RE.



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	83
Max. current (5c)	I_{max}	[A]	0.75
Mean speed	n	[min^{-1}]	3132
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	60
Max. air-flow rate	V_{max}	[m³/h]	709
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	906
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	10
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	72	75	56
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	49	53	38
250 Hz	61	64	46
500 Hz	70	73	55
1000 Hz	62	65	43
2000 Hz	64	67	44
4000 Hz	59	62	37
8000 Hz	53	53	31

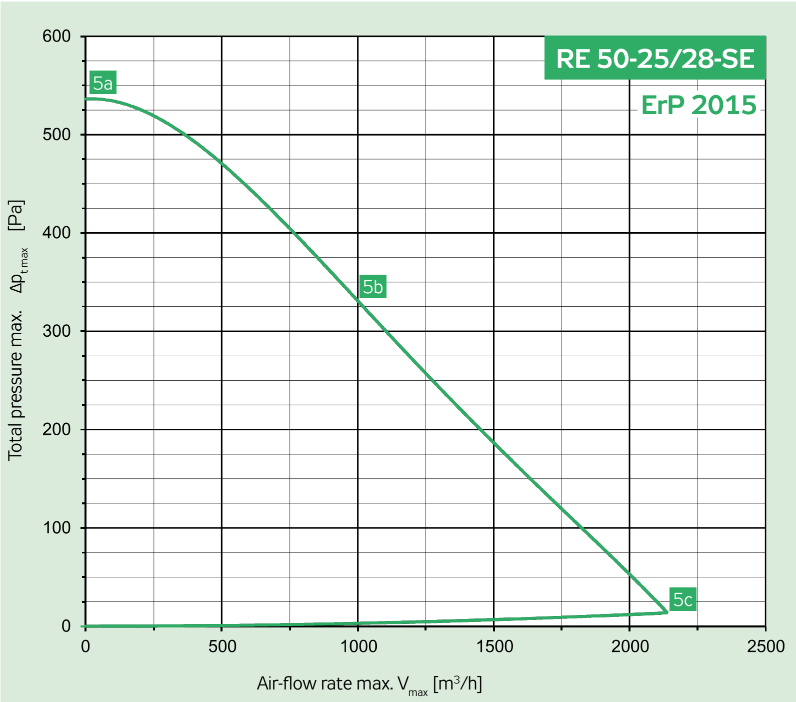
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.7	0.7	0.7
Electric input P [W]	81	84	83
Speed n [min^{-1}]	4200	3132	3423
Air-flow rate V [m³/h]	0	374	709
Static pressure Δp_s [Pa]	906	334	0
Total pressure Δp_t [Pa]	906	337	12



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	170
Max. current (5c)	I_{max}	[A]	1.40
Mean speed	n	[min^{-1}]	2897
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	60
Max. air-flow rate	V_{max}	[m³/h]	1219
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	800
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	14
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	65	76	47
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	46	60	35
250 Hz	57	69	42
500 Hz	56	66	41
1000 Hz	62	71	43
2000 Hz	55	69	35
4000 Hz	51	64	29
8000 Hz	43	56	21

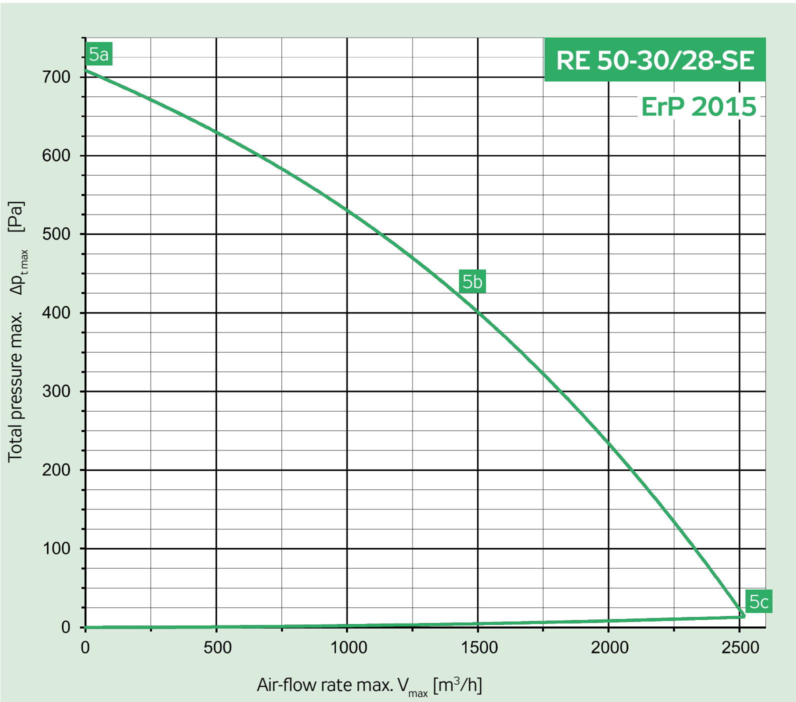
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.8	1.4	1.3
Electric input P [W]	94	170	151
Speed n [min^{-1}]	3270	2897	2996
Air-flow rate V [m³/h]	0	714	1219
Static pressure Δp_s [Pa]	800	428	0
Total pressure Δp_t [Pa]	800	432	11



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	168
Max. current (5c)	I_{max}	[A]	1.40
Mean speed	n	[min^{-1}]	1842
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	60
Max. air-flow rate	V_{max}	[m^3/h]	2144
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	538
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	18
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	70	73	55
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	58	62	47
250 Hz	68	71	53
500 Hz	58	61	43
1000 Hz	62	65	43
2000 Hz	59	62	39
4000 Hz	55	58	33
8000 Hz	46	49	24

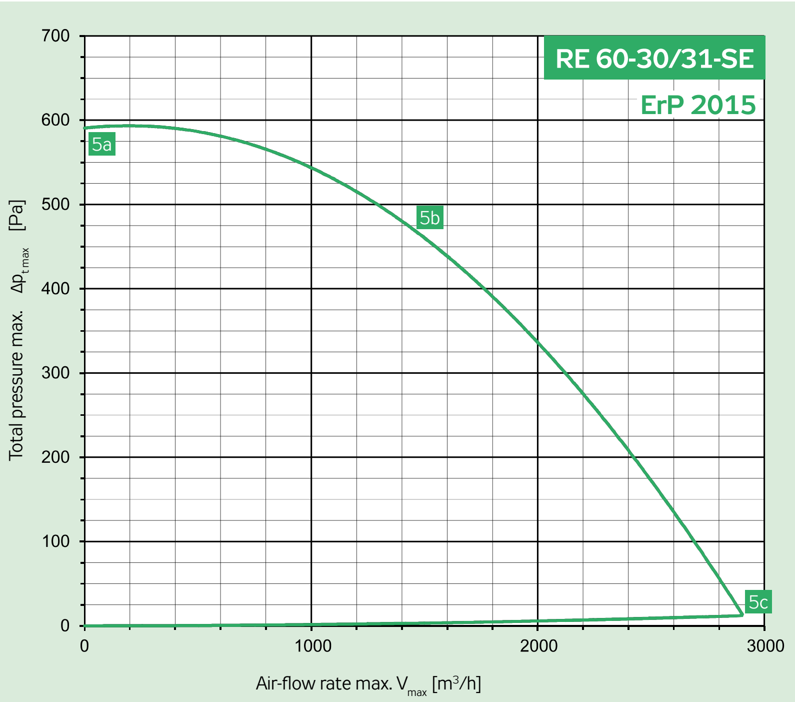
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.9	1.4	1.3
Electric input P [W]	103	168	162
Speed n [min^{-1}]	2160	1842	1895
Air-flow rate V [m^3/h]	0	1010	2144
Static pressure Δp_s [Pa]	538	334	0
Total pressure Δp_t [Pa]	538	337	14



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	310
Max. current (5c)	I_{max}	[A]	2.1
Mean speed	n	[min^{-1}]	2222
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Max. air-flow rate	V_{max}	[m^3/h]	2531
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	703
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	20
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	77	81	61
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	61	65	50
250 Hz	75	79	60
500 Hz	62	65	47
1000 Hz	68	72	49
2000 Hz	66	69	46
4000 Hz	62	65	40
8000 Hz	58	61	36

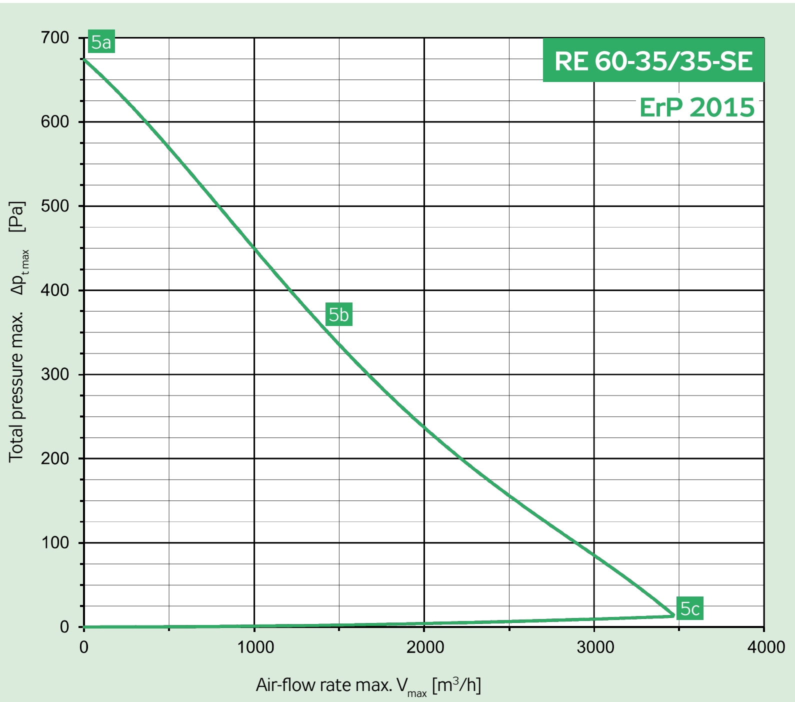
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.9	2.0	1.7
Electric input P [W]	128	296	259
Speed n [min^{-1}]	2400	2222	2255
Air-flow rate V [m^3/h]	0	1406	2531
Static pressure Δp_s [Pa]	703	428	0
Total pressure Δp_t [Pa]	703	432	13



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	370
Max. current (5c)	I_{max}	[A]	1.65
Mean speed	n	[min⁻¹]	2023
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	60
Max. air-flow rate	V_{max}	[m³/h]	2911
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	591
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	24
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	72	76	57
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	62	64	51
250 Hz	69	70	54
500 Hz	64	72	50
1000 Hz	64	69	45
2000 Hz	59	66	39
4000 Hz	55	61	33
8000 Hz	48	54	26

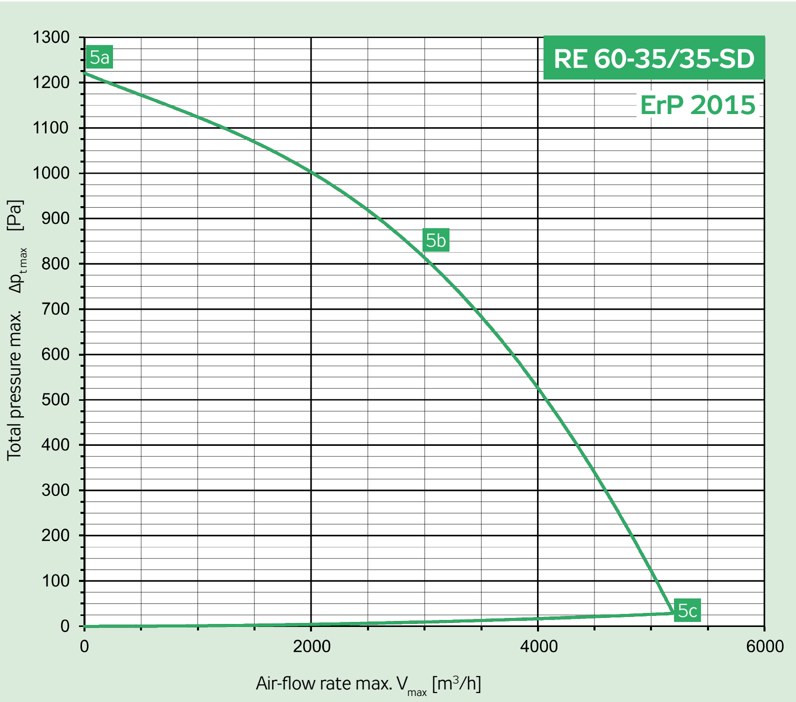
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.5	1.6	1.3
Electric input P [W]	115	359	306
Speed n [min⁻¹]	2020	2023	2026
Air-flow rate V [m³/h]	0	1470	2911
Static pressure Δp_s [Pa]	591	467	0
Total pressure Δp_t [Pa]	591	470	12



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	260
Max. current (5c)	I_{max}	[A]	1.10
Mean speed	n	[min⁻¹]	1482
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	60
Max. air-flow rate	V_{max}	[m³/h]	3490
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	672
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	29
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	65	70	52
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	61	64	50
250 Hz	58	64	43
500 Hz	57	62	42
1000 Hz	57	61	38
2000 Hz	56	61	36
4000 Hz	49	54	27
8000 Hz	40	44	18

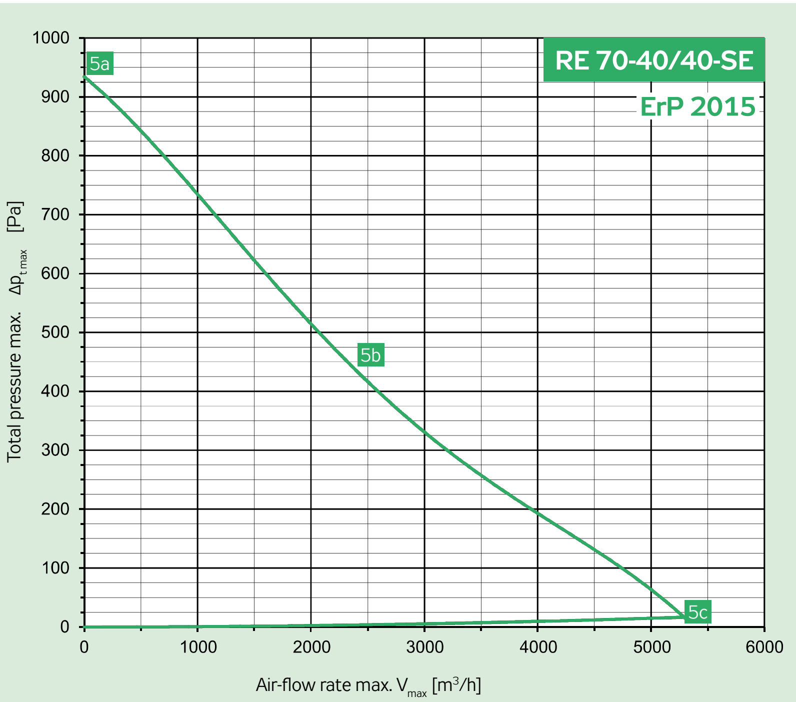
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.9	1.1	1.1
Electric input P [W]	210	259	248
Speed n [min⁻¹]	1880	1482	1570
Air-flow rate V [m³/h]	0	1425	3490
Static pressure Δp_s [Pa]	672	356	0
Total pressure Δp_t [Pa]	672	358	13



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1270
Max. current (5c)	I_{max}	[A]	2.10
Mean speed	n	[min⁻¹]	2499
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	60
Max. air-flow rate	V_{max}	[m³/h]	5219
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	1220
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	30
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	82	88	67
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	70	71	59
250 Hz	78	81	63
500 Hz	76	81	62
1000 Hz	73	82	54
2000 Hz	73	83	53
4000 Hz	68	75	45
8000 Hz	60	67	38

Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	0.8	2.0	1.7
Electric input P [W]	388	1261	1060
Speed n [min⁻¹]	2500	2499	2499
Air-flow rate V [m³/h]	0	2931	5219
Static pressure Δp_s [Pa]	1220	830	0
Total pressure Δp_t [Pa]	1220	839	29

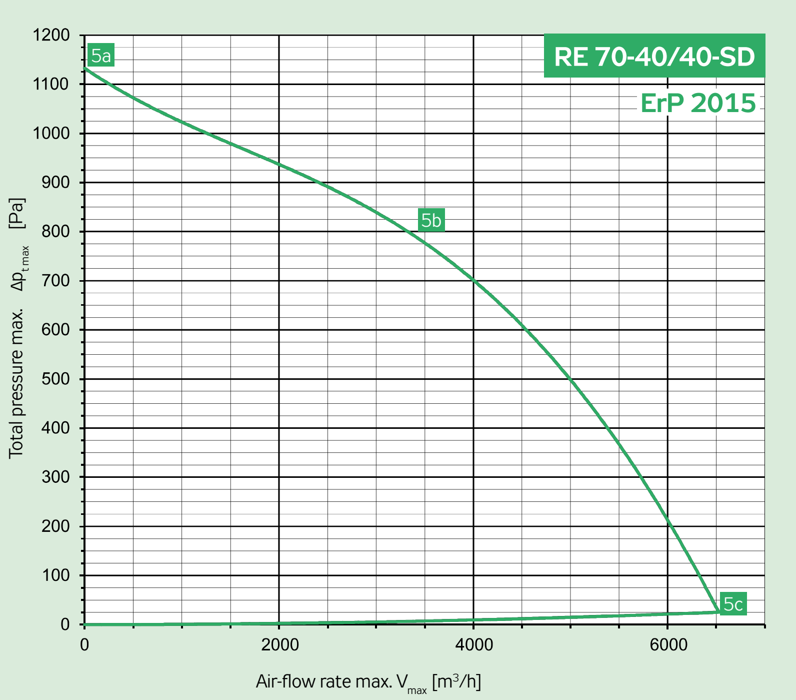


Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	530
Max. current (5c)	I_{max}	[A]	2.30
Mean speed	n	[min⁻¹]	1510
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	50
Max. air-flow rate	V_{max}	[m³/h]	5314
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	927
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	36
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	70	75	56
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	64	70	53
250 Hz	63	68	48
500 Hz	63	68	48
1000 Hz	63	68	44
2000 Hz	61	66	41
4000 Hz	56	60	34
8000 Hz	50	55	28

Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	1.8	2.3	2.2
Electric input P [W]	412	522	496
Speed n [min⁻¹]	1970	1510	1661
Air-flow rate V [m³/h]	0	2410	5314
Static pressure Δp_s [Pa]	927	444	0
Total pressure Δp_t [Pa]	927	447	17

RE 70-40/40-SD

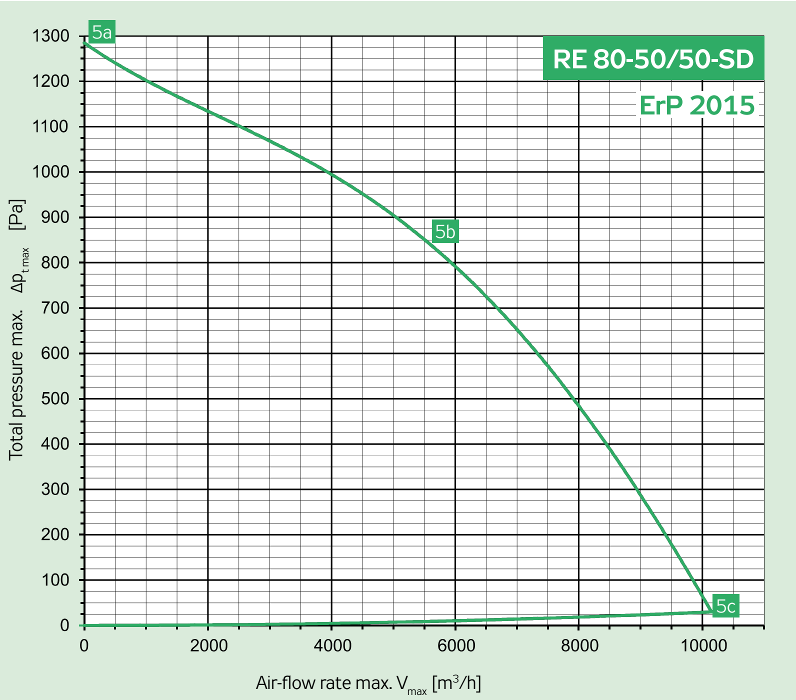


Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1450
Max. current (5c)	I_{max}	[A]	2.40
Mean speed	n	[min⁻¹]	2108
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	60
Max. air-flow rate	V_{max}	[m³/h]	6553
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	1130
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	36
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	80	87	65
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	71	72	60
250 Hz	74	81	59
500 Hz	76	81	61
1000 Hz	72	81	53
2000 Hz	71	78	52
4000 Hz	67	73	45
8000 Hz	59	66	37

Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	0.9	2.2	1.8
Electric input P [W]	444	1422	1173
Speed n [min⁻¹]	2110	2108	2107
Air-flow rate V [m³/h]	0	3970	6553
Static pressure Δp_s [Pa]	1130	704	0
Total pressure Δp_t [Pa]	1130	714	25

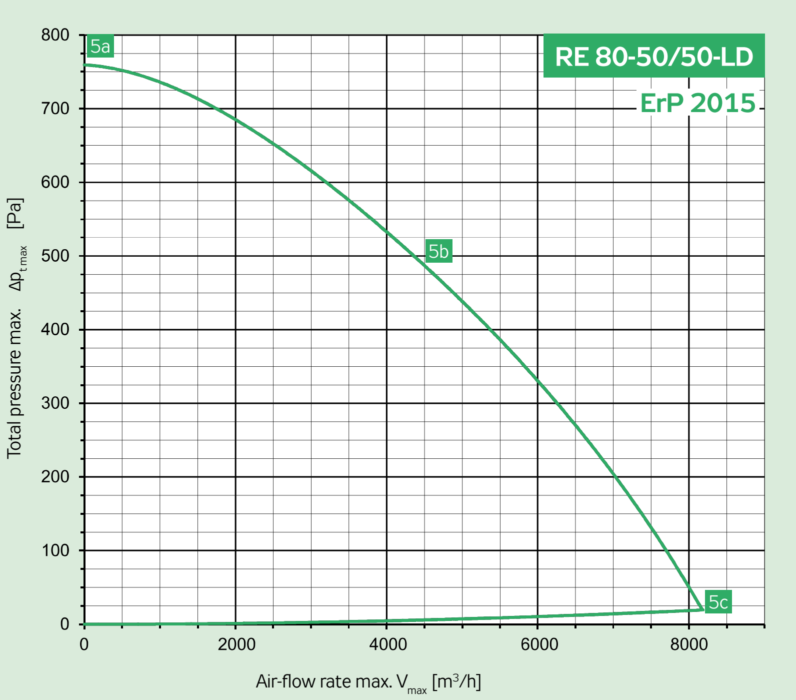
RE 80-50/50-SD



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	2600
Max. current (5c)	I_{max}	[A]	4.30
Mean speed	n	[min⁻¹]	1806
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	60
Max. air-flow rate	V_{max}	[m³/h]	10246
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	1280
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	56
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	83	88	68
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	74	75	63
250 Hz	77	82	61
500 Hz	78	83	63
1000 Hz	75	82	56
2000 Hz	73	78	53
4000 Hz	69	74	47
8000 Hz	65	68	43

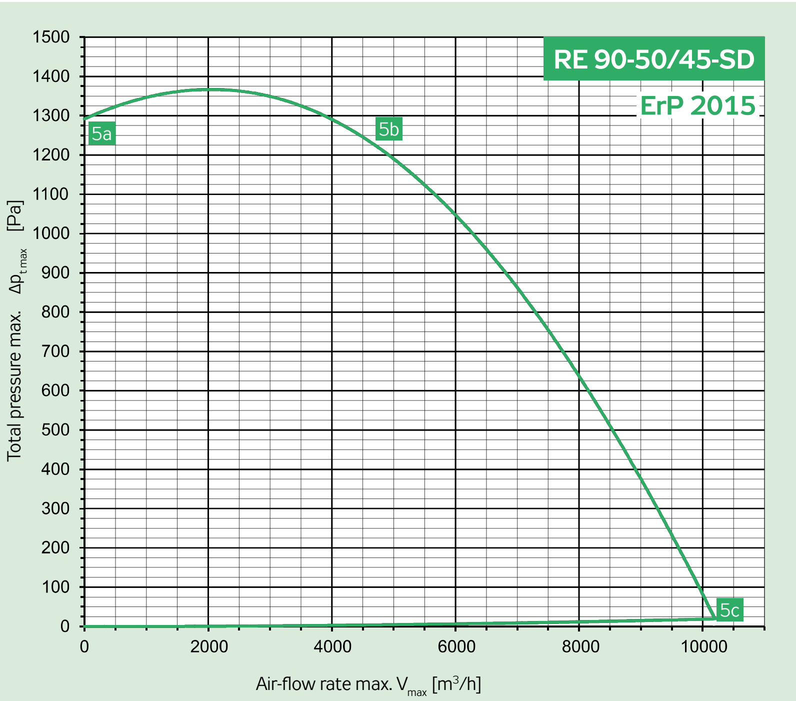
Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.7	3.6	3.1
Electric input P [W]	1060	2408	2004
Speed n [min⁻¹]	1810	1806	1803
Air-flow rate V [m³/h]	0	5595	10246
Static pressure Δp_s [Pa]	1280	835	0
Total pressure Δp_t [Pa]	1280	844	30



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1250
Max. current (5c)	I_{max}	[A]	2.10
Mean speed	n	[min⁻¹]	1397
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	60
Max. air-flow rate	V_{max}	[m³/h]	8185
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	766
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	48
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	77	81	64
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	73	73	62
250 Hz	66	74	51
500 Hz	70	75	55
1000 Hz	67	74	48
2000 Hz	65	70	45
4000 Hz	61	66	39
8000 Hz	56	60	34

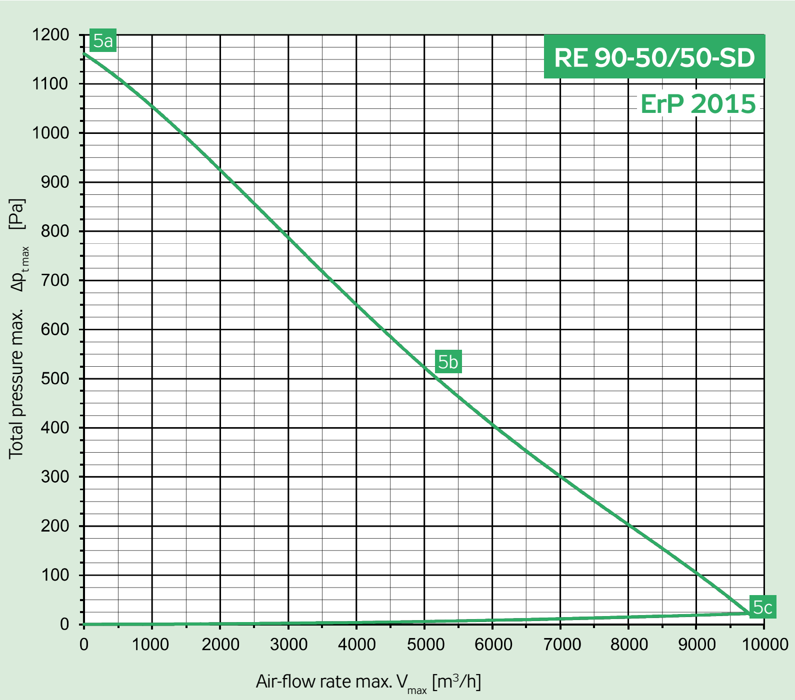
Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	0.8	1.9	1.6
Electric input P [W]	458	1228	997
Speed n [min⁻¹]	1400	1397	1395
Air-flow rate V [m³/h]	0	4490	8185
Static pressure Δp_s [Pa]	766	493	0
Total pressure Δp_t [Pa]	766	498	19



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	2900
Max. current (5c)	I_{max}	[A]	4.80
Mean speed	n	[min⁻¹]	2122
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Max. air-flow rate	V_{max}	[m³/h]	10228
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	1370
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	63
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX}[dB(A)]			
L_{WA}	83	90	67
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	73	72	62
250 Hz	74	84	59
500 Hz	77	83	62
1000 Hz	75	86	56
2000 Hz	76	83	56
4000 Hz	71	79	49
8000 Hz	65	71	43

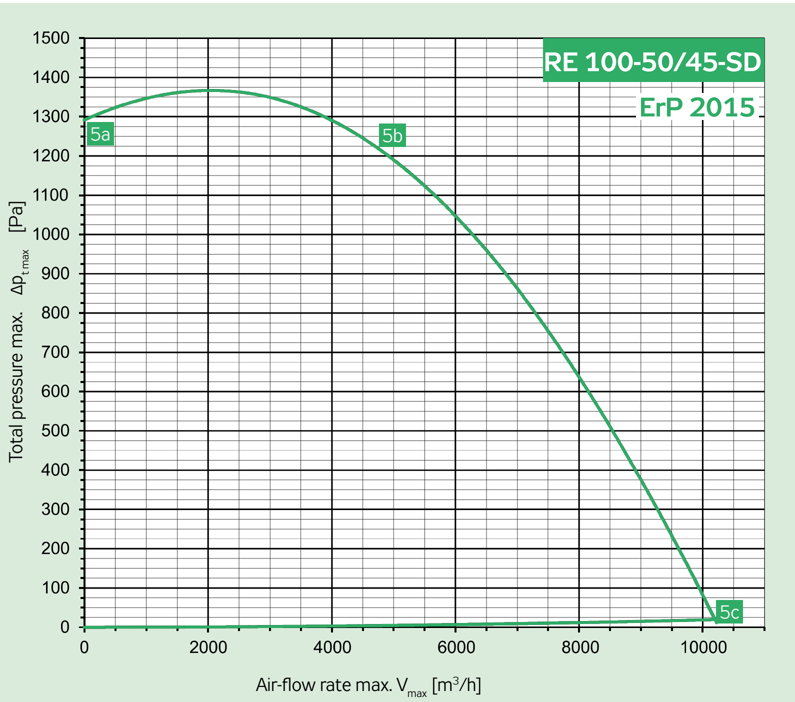
Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.1	4.3	3.2
Electric input P [W]	688	2795	2059
Speed n [min⁻¹]	2120	2122	2124
Air-flow rate V [m³/h]	0	4723	10228
Static pressure Δp_s [Pa]	1290	1220	0
Total pressure Δp_t [Pa]	1290	1224	19



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1320
Max. current (5c)	I_{max}	[A]	2.10
Mean speed	n	[min⁻¹]	1335
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	50
Max. air-flow rate	V_{max}	[m³/h]	9821
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	1170
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	61
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	78	82	63
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	71	73	60
250 Hz	67	68	52
500 Hz	71	76	56
1000 Hz	70	79	51
2000 Hz	71	73	51
4000 Hz	67	69	45
8000 Hz	61	63	39

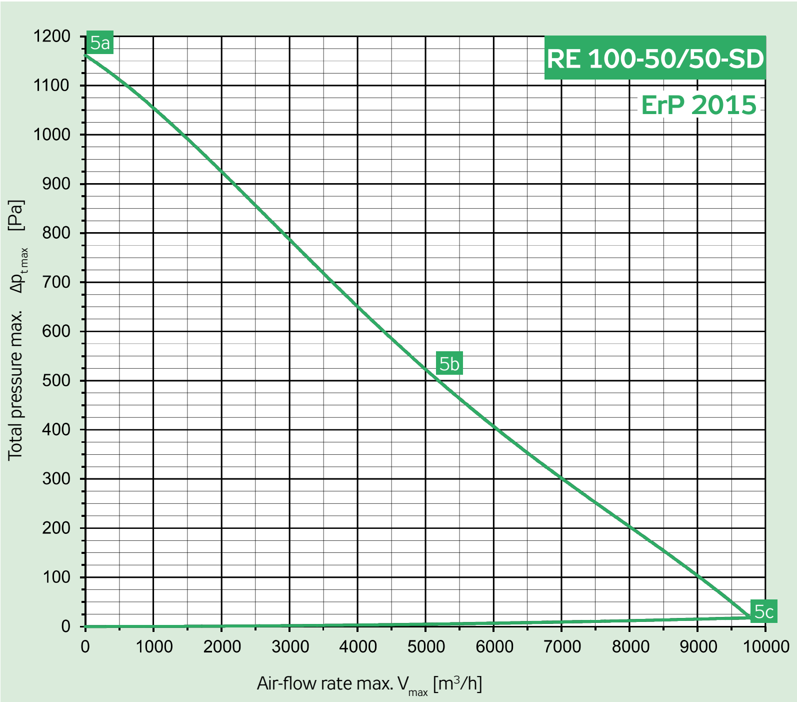
Parameters in selected points	5a	5b	5c
Voltage U [V]		230	
Current I [A]	1.3	2.0	1.9
Electric input P [W]	830	1284	1236
Speed n [min⁻¹]	1650	1335	1443
Air-flow rate V [m³/h]	0	5197	9821
Static pressure Δp_s [Pa]	1170	510	0
Total pressure Δp_t [Pa]	1170	516	22



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	2900
Max. current (5c)	I_{max}	[A]	4.80
Mean speed	n	[min⁻¹]	2122
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Max. air-flow rate	V_{max}	[m³/h]	10228
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	1370
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	67
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	83	90	67
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	73	72	62
250 Hz	74	84	59
500 Hz	77	83	62
1000 Hz	75	86	56
2000 Hz	76	83	56
4000 Hz	71	79	49
8000 Hz	65	71	43

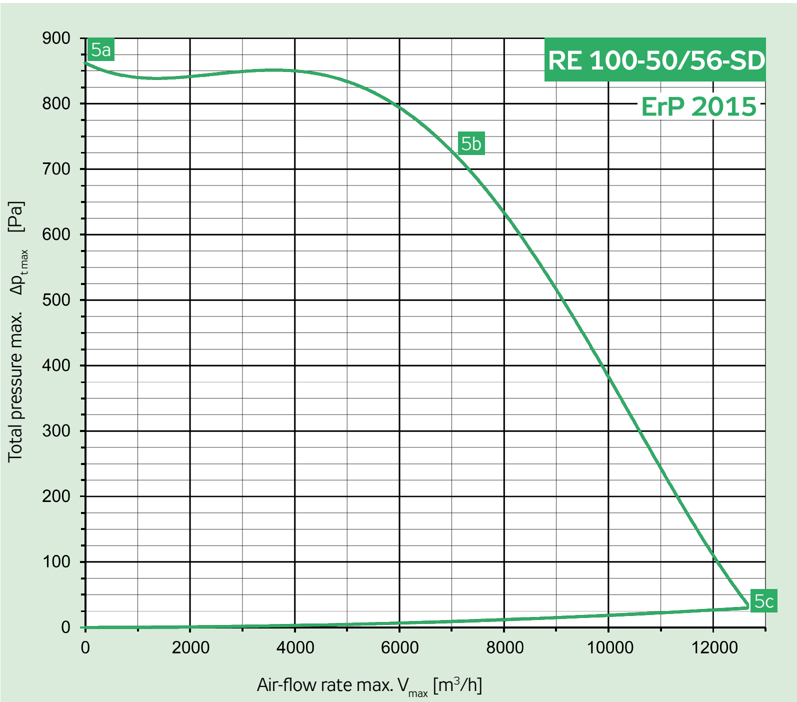
Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.1	4.3	3.2
Electric input P [W]	688	2795	2059
Speed n [min⁻¹]	2120	2122	2124
Air-flow rate V [m³/h]	0	4723	10228
Static pressure Δp_s [Pa]	1290	1220	0
Total pressure Δp_t [Pa]	1290	1224	19



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1320
Max. current (5c)	I_{max}	[A]	2.10
Mean speed	n	[min⁻¹]	1335
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	50
Max. air-flow rate	V_{max}	[m³/h]	9821
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	1170
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	65
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	78	82	63
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	71	73	60
250 Hz	67	68	52
500 Hz	71	76	56
1000 Hz	70	79	51
2000 Hz	71	73	51
4000 Hz	67	69	45
8000 Hz	61	63	39

Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.3	2.0	1.9
Electric input P [W]	830	1284	1236
Speed n [min⁻¹]	1650	1335	1443
Air-flow rate V [m³/h]	0	5197	9821
Static pressure Δp_s [Pa]	1170	510	0
Total pressure Δp_t [Pa]	1170	515	18



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	2360
Max. current (5c)	I_{max}	[A]	3.70
Mean speed	n	[min⁻¹]	1530
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	60
Max. air-flow rate	V_{max}	[m³/h]	12655
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	864
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	73
Five-stage controller	type		-
Protecting relay	type		-

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level L_{MAX} [dB(A)]			
L_{WA}	84	89	69
Sound power level L_{WAKokt} [dB(A)]			
125 Hz	75	75	64
250 Hz	75	75	60
500 Hz	79	83	64
1000 Hz	76	85	57
2000 Hz	75	81	55
4000 Hz	72	76	50
8000 Hz	66	66	44

Parameters in selected points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.8	3.7	3.1
Electric input P [W]	1050	2348	1960
Speed n [min⁻¹]	1540	1530	1537
Air-flow rate V [m³/h]	0	7078	12654
Static pressure Δp_s [Pa]	864	697	0
Total pressure Δp_t [Pa]	864	706	30

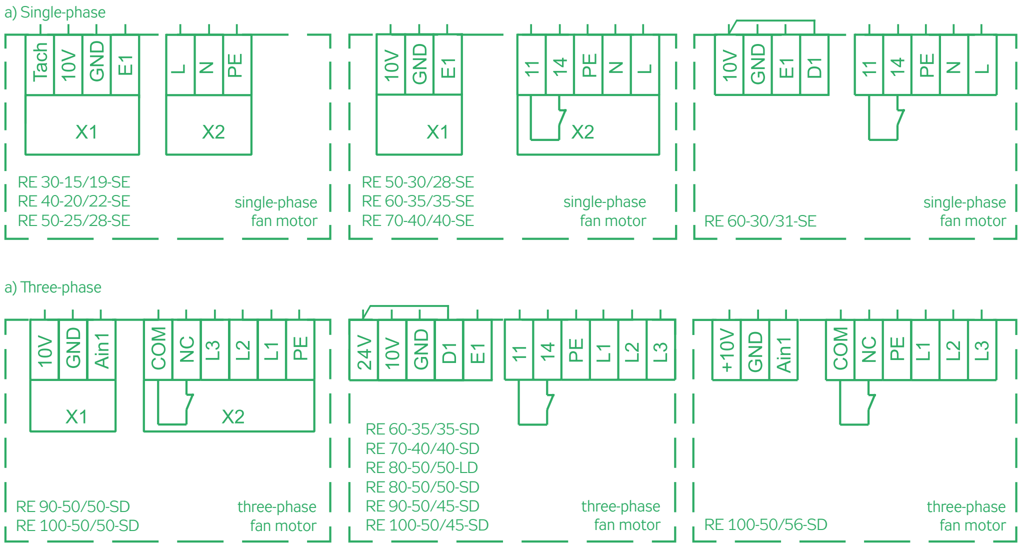
INSTALLATION

- RE fans (including other Vento system 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. Installation and commissioning may only be performed by an authorized company licensed in accordance with generally valid regulations.
- It is recommended to insert DV elastic connections in front of and behind the fan.
- It is advisable to always place KFD or VFK air filters, respectively a VFT grease filter, in front of the fan to protect the fan and duct against pollution and dust fouling.
- 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 # 4 shows the fan's outlet design and arrangement.
- It is obvious that from the entire cross-section (e.g. 500 x 250) only 1/2 of the 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 greater the distance of the attenuators (or other resistant elements) from the outlet, the better. On the inlet side a DV elastic connection will be sufficient as a distance piece in most cases.
- RE fans can work in any position. When positioned under the ceiling, it is advisable to situate the fan (especially those with a hinged panel) with its motor and terminal box directed downwards to make access to the motor and terminal box easy.

WIRING

- The wiring can be performed only by a qualified worker licensed in accordance with national regulations.
- The fans enable the power supply and control to be connected using cables with conductors of 1.5mm^2 cross-section in both types of terminal boxes (see Wiring).

FIGURE 6 – WIRING ACCORDING TO TYPES



Terminals description (summary):

L1, L2, L3 – power supply

N – neutral conductor

PE – protective conductor

11, 14 – Summary fan failure (loading of the 250 V AC, 2 A contact)

NC, COM – Summary fan failure (loading of the 250 V AC, 2 A contact)

D1 – digital input (on/off)

E1 – input 0–10 V DC

Ain1 – input 0–10 V DC

10V – voltage source 10 V DC

24V – voltage source 24 V DC

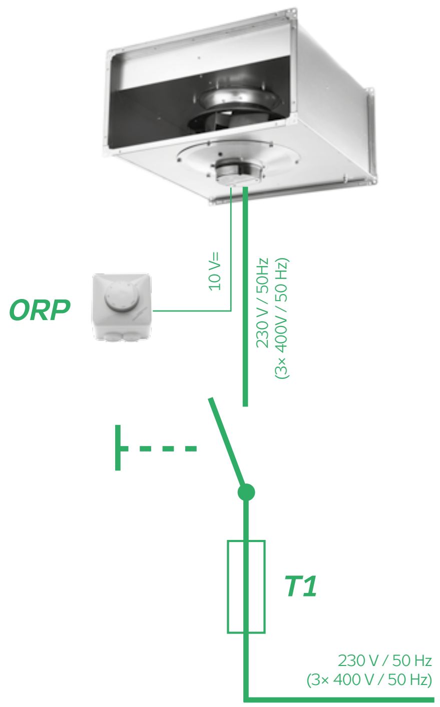
GND – ground

EXAMPLE A
WIRING WITH MANUAL POTENTIOMETRIC CONTROLLER (ORP)

An RE fan connection in a venting system with output control using the ORP controller is shown in figure # 8.

- This connection ensures:
- Start-up and step-less control of the RE fan's output using the ORP controller.
- The RE fan motor is protected by the integrated control electronics.
- Service switch-off is enabled by the switch situated in the power supply.

FIGURE 7 – FAN CONNECTION

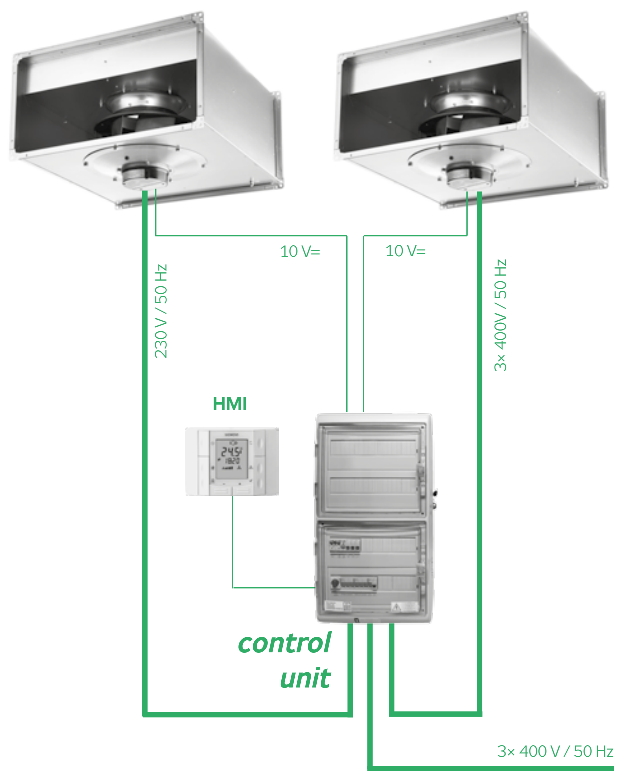


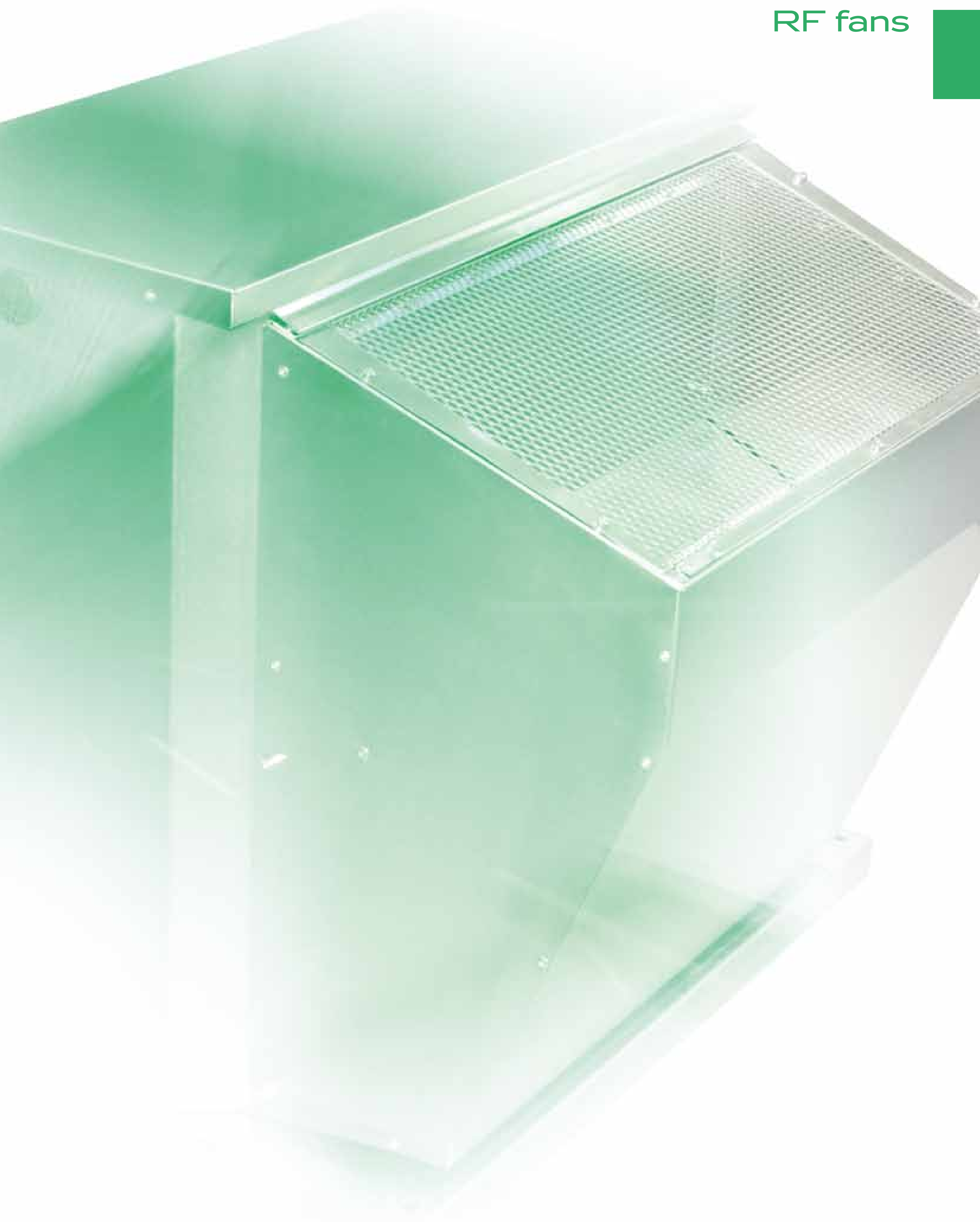
EXAMPLE B
WIRING OF TWO RE FANS AND CONTROL UNIT

This method of wiring enables start-up and control of the fan output in 5 degrees to be used via the control unit's functions – in manual operation mode or time program.

- The RE fan does not require an external output controller (it contains an integrated one).
- The control unit provides operation control and failure assessment.

FIGURE 8 – FAN CONNECTION





FAN USE

A roof fan with vertical outlet is intended for air exhaust from a room with normal environment in accordance with the chapter „Operating Conditions, Position". When selecting a fan for the required air flow and pressure, the following general rule is applied; fan motors with a greater number of poles reach the required parameters at lower RPM, which results in lower noise and longer service life. Fans equipped with a suitable roof adaptor (optional) can be situated on flat as well as sloping roofs.

OPERATING CONDITIONS, POSITION

The device can be used in normal rooms (IEC 60364-5-51, resp. ČSN 332000-5-51 ed.3, ČSN 33 2000-1 ed.2) extended for outdoor areas and in areas exposed to weather effects with ambient temperature ranging from -30 ºC to +40 ºC without additional measures.
The fan may only be used to transport air without solid, fibrous, sticky, aggressive or explosive impurities. The transported air must be free of corrosive chemicals or chemicals aggressive to zinc, aluminium and plastics. Maximum permissible temperature of the transported air must not exceed +40 ºC (three-phase fans), respectively +60 ºC (single-phase fans). RF fans can only be operated, transported or stored in the basic horizontal position (inlet situated from below).

DIMENSIONAL RANGE

RF fans are manufactured in a range of four sizes according to the dimensions of the base. Several fans, differing mainly in the number of poles of the used motor, 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 greater number of poles reach the required parameters at lower RPM, which results in lower noise and longer service life.
The standard dimensional and performance range of single-phase and three-phase RF fans enables designers to optimize all parameters for air flow rates from 300 m3/h up to 14,000 m^3/h.

MATERIALS

The external casing of RF fans is made of sheet aluminium, which provides very good resistance against corrosion in industrial and coastal areas. Basic support parts of the largest fan housing size RF 100/.. are made of sheet steel protected by backed powder coating. Removable outlet pockets are fitted with elements enabling quick water drainage and with gravity dampers protecting the fan's internal area against direct moisture penetration. A fine perforated protecting screen prevents dirt and foreign objects entering the fan impeller area. The fan impellers up to fan size RF100/63 are made of plastic; the RF100/71-6D fan impeller is made of aluminium. The motor armatures are made of aluminium, respectively grey cast iron. The motor's high quality enclosed ball bearings with permanent lubricant filling enable the fans to reach a service life of 20,000 operating hours (three-phase motors), respectively 40,000 operating hours (single-phase motors) without maintenance. Connection of the impeller to the three-phase motor shaft up to the RF 56 and RF 71 sizes is carried out using a fixed hub while with the RF100 size uses a Taper-Lock® bushing.

MOTORS

According to the type, roof fans can be equipped with one of two types of power units:

- **AC 1× 230 V/50 Hz:** Compact three-phase asynchronous fan motors with an external rotor and a resistance armature. The motors are situated inside the impeller (so-called motor impeller), and during operation are optimally cooled by the flowing air. They feature low build-up current, and enable voltage control. For the motor degree of protection, refer to Table #3 - Motor Thermal Protection, in the chapter „Motor Protection". Single-phase motors are equipped with a starting capacitor, degree of protection IP 54, which is mounted next to the terminal box (for capacity values, see Table #3).
- **AC 3× 400 V/230 V/50 Hz (Y/D):** Flange-mounted motors with a short-circuit armature.
  The terminal box is situated on the motor's body. These motors are situated out of the air flow, and thus they are protected against direct contact with the flowing air. The motors are cooled by a system of internal channels. Degree of protection is IP55. The motor thermal protection is ensured by a thermo-contact which is brought out to the cable; for details, refer to the chapter „Motor Protection"..

ELECTRICAL EQUIPMENT

For the wiring diagrams and description, please refer to page 162.

MOTOR PROTECTION

As standard, permanent monitoring of the internal motor temperature is used in all motors. The permissible limit temperature is monitored by thermo-contacts situated in the motor winding, 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.
Thermal protection by means of thermo-contacts is comprehensive and reliable providing they are correctly connected. This 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 ºC. After cooling down, the thermo-contact closes, and the fan will start. All RF 40/xx and RF 56/31-4E fans are equipped with serial thermo-contacts, see summary table of parameters. Beware of possible automatic fan start when servicing the fan! The fan must be disconnected from the power supply when working on it (outlet „pockets" removed)!
Application of this operational behaviour (non-signalled shutdown) must be evaluated within the scope of the air-handling device project..

Brought-Out Thermo-Contact (control)

Fans equipped with a thermo-contact brought out into the terminal box (TK- TK terminal) must be connected to the recommended 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. The motor restart must be conditioned by the operator's intervention, check and removal of the protective shutdown causes. Repeated restart of the motor without removing the cause of motor overheating results in shorter service life of the product, or can damage the motor.
All fans, except the RF 40/.. and RF 56/31-4E lines, are equipped with brought-out thermo-contacts, see summary table of parameters.

Maximum thermo-contact permanent loading is 1.2 A at 250V / 50 Hz (cos φ 0,6) is 1,2 A
(resp. 2 A respectively cos φ 1,0).

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-PHASE FANS OUTPUT CONTROL

Stepless Electronic Control

- Stepless thyristor fan output control is possible from about 25 % to 100 % fan power level; minimum supply voltage of the fan must be limited by controller so that reliable start-up of fan after a power outage is possible.
- This is very suitable for the smallest (RF 40/... a RF 56/31-4E) fans with a serial thermo-contact.

TABLE 1 – THE INPUT VOLTAGE AND CONTROLLER'S STAGE

MOTOR TYPE	CURVE CHARACTERISTICS – CONTROLLER'S STAGE				
	5	4	3	2	1
1 – phase	230 V	180 V	160 V	130 V	105 V

Five Stage Voltage Control

→ TRN–E: A single-phase five-stage transformer controller equipped with integrated fan motor protection. It is operated using the ORe5 remote controller; therefore, it can be situated out of the operator's reach.

→ TRRE: A simplified single-phase transformer controller motor protection without motor temperature protection; therefore, it must always be used in connection with control units or STE protecting relays. Output stages are selected by the rotary selector situated on the controller's front panel, and therefore, they must be within the operator's reach.

Mainly for fans with brought-out thermocontact, eventually for fans with serial thermocontact (deblocking of protection within TRN should be activated). For information, see the documentation for TRN regulators.

THREE-PHASE FAN OUTPUT CONTROL

As standard, three-phase fans are equipped with IEC asynchronous motors with a short-circuit armature. The motor speed can be controlled by changing the frequency using a frequency inverter. It is advisable to connect the frequency inverter to the fan using a shielded cable, and make it as short as possible in accordance with the frequency inverter documentation. Power and control cables must be led separately.

Warning:
If fans with frequency inverters 1× 230 V / 3× 230 V, REMAK standard up to output of 0.75 kW, are used, it is necessary to reconnect the motors for AC 3× 230 V D and verify, respectively adjust settings of motor nominal values in the frequency inverter.
The frequency inverter ensures over-current protection of the motor by disconnecting the power supply. Therefore, failure removal must be confirmed on the frequency converter to enable fan restart.

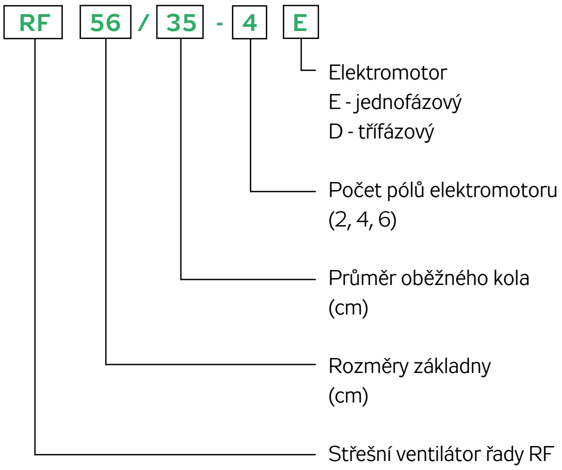
TABULKA 2 – PŘEHLED FREKVENČNÍCH MĚNIČŮ

Frequency inverter	Power output	Supply	Recommended for:
Frequency inverter equipped with protecting roof (IP 21)			
RFFMIM031A20	0.37 kW	1× 230 V/3× 230 V	RF56/31-4D, RF56/35-4D, RF71/50-6D
RFFMIM071A20	0.75 kW	1× 230 V/3× 230 V	RF56/40-4D, RF71/45-4D, RF100/56-6D
RFFMIM153B20	1.5 kW	3× 400 V/3× 400 V	RF71/50-4D, RF100/63-6D
RFFMIM223B20	2.2 kW	3× 400 V/3× 400 V	RF100/56-4D, RF100/71-6D
Frequency inverter (IP54)			
RFFMIB073B50	0.75 kW	3× 400 V/3× 400 V	RF56/31-4D, RF56/35-4D, RF71/50-6D RF56/40-4D, RF71/45-4D, RF100/56-6D
RFFMIB153B50	1.5 kW	3× 400 V/3× 400 V	RF71/50-4D, RF100/63-6D
RFFMIB223B50	2.2 kW	3× 400 V/3× 400 V	RF100/56-4D, RF100/71-6D

FAN DESCRIPTION AND DESIGNATION

The type designation of RF roof fans in projects is defined by the key shown in figure # 1. For example, type designation RF 56/35-4D specifies the type of fan, impeller and motor.

FIGURE 1 – FAN TYPE DESIGNATION



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 #3. These values are also listed on each fan's rating plate.

TABLE 3 – FAN PARAMETERS

RF 40/19-2E			
Power supply	Y	230 V	50 Hz
Max. electric input	P_{max}	[W]	59
Max. current (5c)	I_{max}	[A]	0.24
Mean speed	n	[min^{-1}]	2480
Capacitor	C	[μF]	2
Max. working temp.	t_{max}	[ºC]	60
Max. Air flow rate	V_{max}	[m^3/h]	559
Max. total pressure	$\Delta p_{t\,max}$	[Pa]	314
Min. static pressure (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	12
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

ACCESSORIES

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

- → SNK roof adaptor – short
- → NDH roof adaptor with an attenuator - long
- → VS low-pressure damper / DV elastic connection
- → STE and STD protecting relays
- → Electronic PE controller for single-phase fans
- → TRN five-stage controllers and ORe 5 controller
- → RFFM frequency inverter for three-phase motors, see table 3

The meaning of individual lines is as follows:

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

In this catalogue you can find values of noise levels radiated to the inlet and surroundings (i.e. also outlet), the total sound power level L_{WA} [dB (A)], i.e. the total level of radiated A-scale sound power is always provided. Further, value L_{WAokt}, i.e. sound power level, for octave bands from 125 Hz to 8 kHz is also provided. Knowledge of the octave levels is essential to assess the noisiness of the air--handling unit with a given fan.

MEASURING METHOD USED

Noise parameters of RF fans are measured in Remak's acoustic testing laboratory. The measurements are performed in accordance with the ČSN EN ISO 3743-2 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. For a recapitulation of technical acoustic terms, an explanation of measuring methodology and outline of noise attenuation, refer to the catalogue sections „„RP Fans".

NOISE LEVEL CALCULATION

The result of the calculation is sound level L_{pA} at a place within the personnel's reach or other places where the sound level limit must be observed. If it concerns a roof fan, then sound level L_{pA} in the selected outdoor area in its surroundings and sound level L_{pA} in the ventilated room are relevant. These tasks are quite different; therefore, the general calculation procedures for both cases are outlined below.

OUTDOOR SOUND LEVEL

When calculating the sound level at a selected distance within the roof fan's surroundings, we can consider the values of the reflected sound waves as insignificant; therefore, it is possible to use an equation for sound propagation in free space. For this case, the following relationship is applicable:

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

$L_{P(A)}$	sound level [dB]
$L_{W(A)}$	sound power level (A)[dB]
Q	Directional coefficient for the given direction (1–8) [-]
r	Distance (source – person) [m]

If the space angle of the fan's noise is 180º, which is applicable to most installations of RF fans, then the value of the directional coefficient

$$Q = 4\pi/\upsilon \qquad (2)$$

The directional coefficient Q specifies the influence of noise propagation limiting surfaces, and is a function of the space angle υ of the fan's noise radiation. It can be calculated using the following relationship

$$Q = 2$$

Using equation (1), the values of sound level $L_{p(A)}$ for different sound power levels $L_{W(A)}$ and selected distances **r** were calculated and transferred to Graph 1. This can be used for simple determination of the sound level (A-scale sound pressure level at distance **r** from the fan).

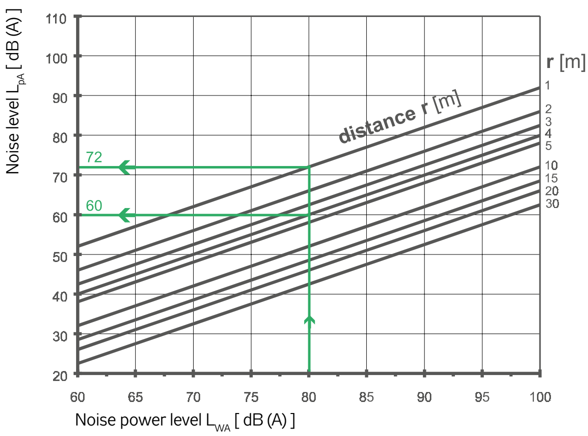
SOUND LEVEL IN VENTILATED ROOM

The noise radiated by the fan is transferred through the air ducting to the ventilated room. On the one hand, the noise is attenuated by the duct, attenuators, and other air-handling elements; on the other hand, it is increased by the inherent noise of some components, especially the inherent noise of ventilation grills. To determine the sound level in the ventilated room, first it is necessary to determine the total sound power level radiated to the ventilated room. As the sound transfer and attenuation depend on the frequency, the sound power level must be calculated for each octave band separately. Attenuation of attenuators and all other parts of the duct line leading to the ventilated room in which the noise level is being determined is subtracted from the sound power values:

$$L_{Wokt\,(i+1)} = L_{Wokt(i)} - D_{okt(i)} \qquad (3)$$

$L_{Wokt\,(i+1)}$ is the sound power level at the particular octave behind the „i-th" element of the duct line. $D_{okt(i)}$ is the value of attenuation at the particular octave behind the „i-th" element of the duct line. Inherent noise of individual components of the duct line depends mainly on the air flow velocity. However, the noise of many components is lower than the noise radiated by the fan so it can be ignored. However, the inherent noise level of the „i-th" component must be compared to value $L_{wokt(i+1)}$, i.e. the fan sound power level reduced by the attenuation of preceding components.

GRAPH 1 – L_{WA} TO L_{PA} CONVERSION AT DISTANCE „r"



This especially applies for ventilation grills, where the fan noise can be attenuated to such an extent that the inherent noise of the ventilation grill may be higher, especially at high air flow velocity.

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

Using general equation (2), which is valid for total sound pressure in a closed room, the octave sound pressure level L_{pokt} can be calculated from the values of sound power L_{wokt} radiated into the room.

$$L_P = L_W + 10 \log [Q / (4\pi r^2) + 4.(1 - \alpha_m) / (S.\alpha_m)] \qquad (4)$$

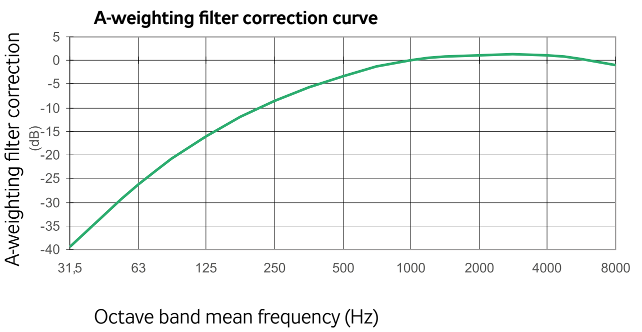
- L_P sound pressure level [dB]
- L_W sound power level [dB]
- Q directional coefficient for the given direction (1–8) [-]
- r Distance (source – person) [m]
- α_m mean coefficient of sound absorption capacity [-]
- S room enclosing area [m²]

Then, the total sound pressure level in the room can calculated using the following relationship

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

For the values of correction factor K_{Aokt} for particular octave bands, refer to table #4.
If the calculated sound level in the checked place is not satisfactory, it is necessary to take additional anti-noise measures, e.g. complete the air-handling assembly with an additional attenuator.

TABLE 4 – A-WEIGHTING FILTER CORRECTION VALUES



Octave band mean frequency	Hz	125	250	500	1000	2000	4000	8000
A-weighting filter correction K_{Ai}	dB	-16	-8,6	-3,2	0	1,2	1	-1,1

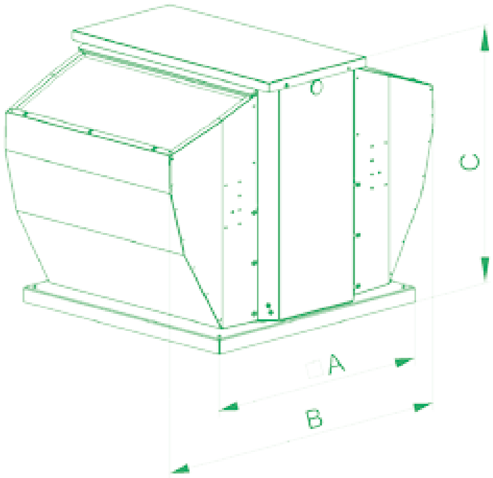
DIMENSIONS, WEIGHTS AND PERFORMANCE

For the most important data and dimensions of RF fans, refer to figure #2 and table #5.

TABLE 5 – BASIC DIMENSIONAL RANGE

Designation	Base dimensions A [mm]	Max. width [mm]	Height C [mm]
RF 40/ ..	408	560	400
RF 56/ ..	568	780	590
RF 71/ ..	718	960	690
RF 100/ ..	1008	1360	900

FIGURE 2 – BASIC DIMENSIONS OF THE FAN



FOR OPERATING FAN PARAMETERS AND THE ALLOCATION OF OUTPUT CONTROLLERS, REFER TO TABLE # 6.

SYMBOLS USED IN TABLE 6:

- V_{max} Maximum air flow rate
- 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)
- $P_{max.}$ Electric motor maximal power output
- $I_{max.}$ Maximum phase current at voltage **U** (this value must be checked)
- $t_{max.}$ Maximum permissible transported Air temperature at air flow $\mathbf{V}_{max}$
- C Capacitor capacity with single-phase fans
- FM. Frequency inverter
- m Weight of the fan (±10%)
- ErP2015 Fan compliance with the requirements of Regulation 2009/125/EC (NOT compliant fans must not be used within EU region)

TABLE 6 – BASIC PARAMETERS AND NOMINAL VALUES OF RF FANS

Fan type	Drive type (*)	V_{max}	p_{max}	P_{max}	U_{nom}	n_{nom}	t_{max}	Motor degree of protection	Sound power to the inlet L_{WA}	Sound power to the surroundings L_{WA}	m	Drive weight	ErP2015
		m³/h	Pa	W	V	min^{-1}	°C	IP	$dB_{(A)}$	$dB_{(A)}$	kg	kg	
SINGLE-PHASE FANS													
RF 40/19-2E	MOK	550	310	60	230	2500	60	IP 44	67	71	11,5	3,8	✓
RF 40/22-2E	MOK	950	370	100	230	2560	60	IP 44	70	74	12,0	4,2	✓
RF 40/25-2E	MOK	1 350	540	200	230	2420	60	IP 44	73	76	12,5	5,0	
RF 40/28-4E	MOK	1 250	220	110	230	1360	60	IP 44	62	68	12,5	4,7	✓
RF 56/31-4E	MOK	1 800	280	140	230	1240	60	IP 44	70	70	22	7,7	
RF 56/35-4E	MOK	2 500	330	310	230	1360	60	IP 54	71	72	25	10,5	
RF 56/40-4E	MOK	3 500	420	490	230	1350	60	IP 54	72	74	27	12,0	
THREE-PHASE FANS													
RF 56/31-4D	OK+M	2 000	320	120	400	1360	40	IP 55	68	71	25	10,5	✓
RF 56/35-4D	OK+M	2 600	330	250	400	1380	40	IP 55	71	74	26	11,5	✓
RF 56/40-4D	OK+M	4 000	470	550	400	1400	40	IP 55	74	77	30	15	✓
RF 71/45-4D	OK+M	5 700	500	750	400	1400	40	IP 55	80	80	40	21	✓
RF 71/50-4D	OK+M	7 400	750	1100	400	1400	40	IP 55	81	84	43	23	✓
RF 71/50-6D	OK+M	5 200	310	370	400	900	40	IP 55	72	72	40	20	
RF 100/56-4D	OK+M	13 000	900	2200	400	1420	40	IP 55	78	83	125	50	✓
RF 100/56-6D	OK+M	8 200	380	550	400	900	40	IP 55	66	66	115	41	
RF 100/63-6D	OK+M	11 500	500	1100	400	910	40	IP 55	74	80	117	45	✓
RF 100/71-6D	OK+M	14 000	600	2200	400	940	40	IP 55	84	87	135	60	✓

(*) Note: MOK ...Compact motors with an external rotor situated in the air flow, OK+M ...IEC asynchronous motor situated outside the air flow, impeller on the shaft

TABLE 7 – CONNECTION OF SINGLE-PHASE FANS, PROTECTION AND CONTROL

Fan type	Motor current (A)	Starting current (I_A/I_N)	Thermocontact motor protection (TK)	Capacitor (µF)	Ovládání bez regulace	Control without regulation
SINGLE-PHASE FANS (1× 230 V+N+PE / 50 HZ)						
RF 40/19-2E	0,3	0,5	TK serial	2	on/off switch	TRN 2E, TRRE 2, PE-4
RF 40/22-2E	0,5	0,8	TK serial	2,5	on/off switch	TRN 2E, TRRE 2, PE-4
RF 40/25-2E	0,9	1,7	TK serial	6	on/off switch	TRN 2E, TRRE 2, PE-4
RF 40/28-4E	0,5	1,2	TK serial	4	on/off switch	TRN 2E, TRRE 2, PE-4
RF 56/31-4E	0,6	1,2	TK serial	4	on/off switch	TRN 2E, TRRE 2, PE-4
RF 56/35-4E	1,5	3,7	TK brought-out	6	STE	TRN 2E, TRRE 2+STE, PE-4+STE
RF 56/40-4E	2,2	5	TK brought-out	10	STE	TRN 2E, TRRE 2+STE, PE-4+STE

TABLE 8 – CONNECTION OF THREE-PHASE FANS, PROTECTION AND CONTROL

Fan type	Motor current (A)	Starting current (I_A/I_N)	Thermocontact motor protection (TK)	Control without regulation
THREE-PHASE FANS - CONTROL WITHOUT REGULATION (Y 3× 400 V +PE / 50 HZ)				
RF 56/31-4D	0,4	4,4	TK brought-out	STD (Y 3 × 400 V)
RF 56/35-4D	0,7	5,2	TK brought-out	STD (Y 3 × 400 V)
RF 56/40-4D	1,3	5,2	TK brought-out	STD (Y 3 × 400 V)
RF 71/45-4D	1,9	6	TK brought-out	STD (Y 3 × 400 V)
RF 71/50-4D	2,7	6	TK brought-out	STD (Y 3 × 400 V)
RF 71/50-6D	1,2	4,7	TK brought-out	STD (Y 3 × 400 V)
RF 100/56-4D	4,8	7	TK brought-out	STD (Y 3 × 400 V)
RF 100/56-6D	1,7	4,7	TK brought-out	STD (Y 3 × 400 V)
RF 100/63-6D	3,1	5,5	TK brought-out	STD (Y 3 × 400 V)
RF 100/71-6D	4,5	6,5	TK brought-out	STD (Y 3 × 400 V)

TABLE 9 – THREE-PHASE MOTOR CONNECTION AND APPROPRIATE FREQUENCY INVERTERS

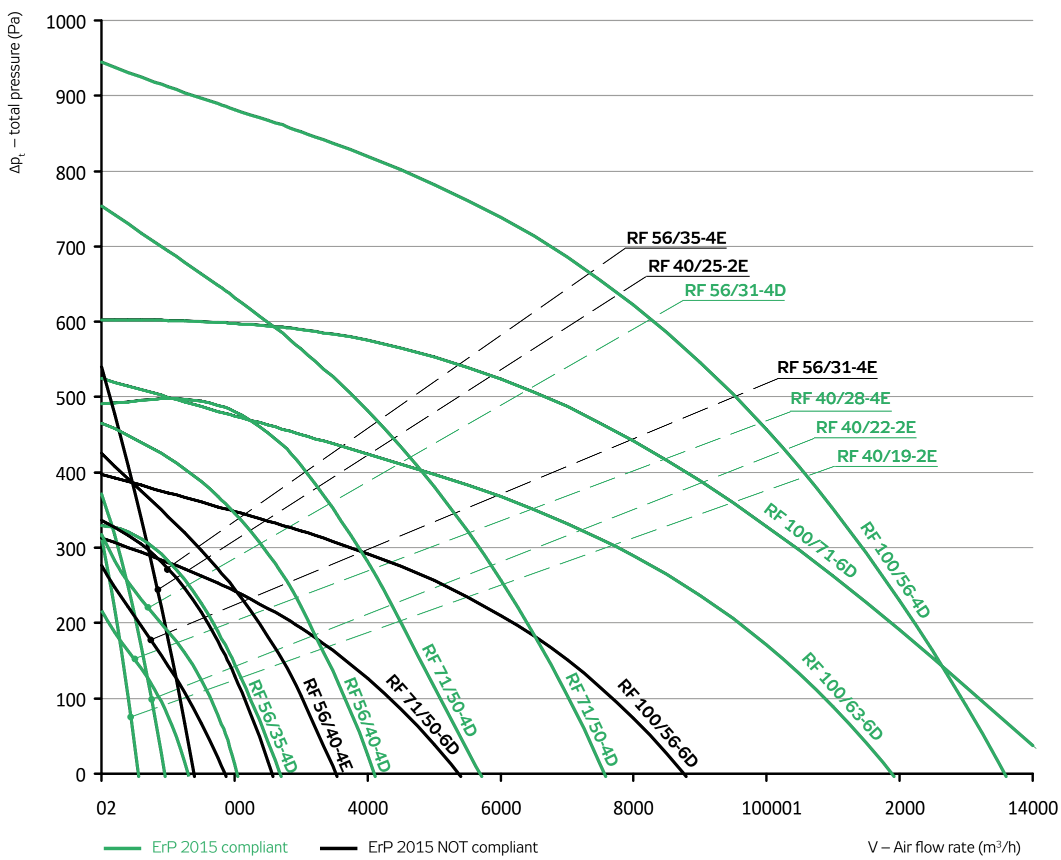
Fan type	Frequency inverter output kW	Frequency inverter IP21 (FC 051)					Frequency inverter IP54 (FC 101)				
		Connection with regulation **)		Frequency inverter			Connection with regulation **)		Frequency inverter		
		Voltage system *)	Current (A)	Frequency inverter marking	Supply	Max. input current (A)	Voltage system *)	Proud (A)	Frequency inverter marking	Supply	Max. input current (A)
THREE-PHASE FANS - CONTROL WITH REGULATION (Δ 3X230V +PE/50HZ OR Y 3X400V+PE/50HZ)											
RF 56/31-4D	0.37	Δ 3× 230 V	0,8	RFFMIM031A20	1x 230V	6,1	Y 3× 400 V	0,4	RFFMIB073B50	3× 400V	2,1
RF 56/35-4D	0.37	Δ 3× 230 V	1,3	RFFMIM031A20	1x 230V	6,1	Y 3× 400 V	0,7	RFFMIB073B50	3× 400V	2,1
RF 56/40-4D	0.75	Δ 3× 230 V	2,6	RFFMIM071A20	1x 230V	11,6	Y 3× 400 V	1,3	RFFMIB073B50	3× 400V	2,1
RF 71/45-4D	0.75	Δ 3× 230 V	3,3	RFFMIM071A20	1x 230V	11,6	Y 3× 400 V	1,9	RFFMIB073B50	3× 400V	2,1
RF 71/50-4D	1.5	Y 3× 400 V	2,7	RFFMIM153B20	3x 400V	5,9	Y 3× 400 V	2,7	RFFMIB153B50	3× 400V	3,5
RF 71/50-6D	0.37	Δ 3× 230 V	2,2	RFFMIM031A20	1x 230V	6,1	Y 3× 400 V	1,2	RFFMIB073B50	3× 400V	2,1
RF 100/56-4D	2.2	Y 3× 400 V	4,8	RFFMIM223B20	3x 400V	8,5	Y 3× 400 V	4,8	RFFMIB223B50	3× 400V	4,7
RF 100/56-6D	0.75	Δ 3× 230 V	2,9	RFFMIM071A20	1x 230V	11,6	Y 3× 400 V	1,7	RFFMIB073B50	3× 400V	2,1
RF 100/63-6D	1.5	Y 3× 400 V	3,1	RFFMIM153B20	3x 400V	5,9	Y 3× 400 V	3,1	RFFMIB153B50	3× 400V	3,5
RF 100/71-6D	2.2	Y 3× 400 V	4,5	RFFMIM223B20	3x 400V	8,5	Y 3× 400 V	4,5	RFFMIB223B50	3× 400V	4,7

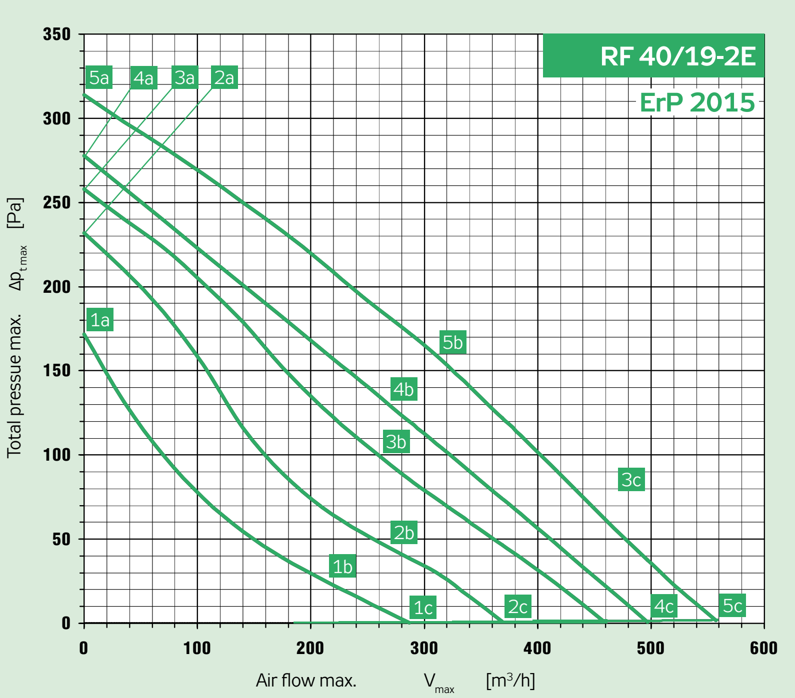
(*) Voltage system: 1× 230 V + N + PE / 50 Hz, 3× 230 V + PE / 50Hz, 3× 400 V + PE / 50 Hz.
(**) Connection of the motor to the control delivered as standard accessory.

DATA SECTION

Graph 2 enables quick selection of a suitable fan and alternate comparison of RF 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 RF fans.

GRAPH 2 – RF FAN CHARACTERISTICS QUICK SELECTION

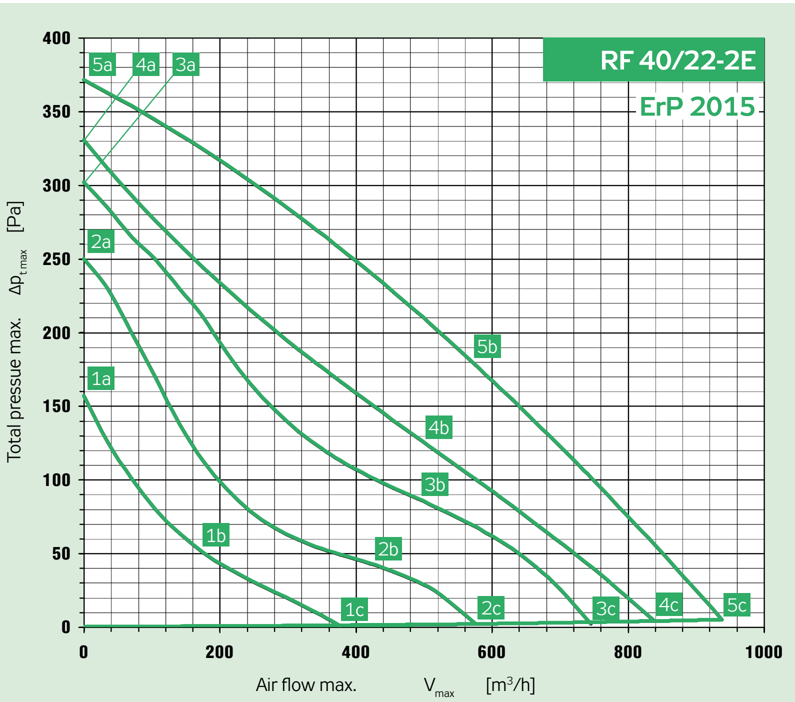




Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	59
Max. current (5c)	I_{max}	[A]	0.24
Mean speed	n	[min⁻¹]	2480
Capacitor	C	[F]	2
Max. working temp.	t_{max}	[°C]	60
Air flow max.	V_{max}	[m³/h]	559
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	314
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	12
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Inlet		Surronding	
Bod	5b	5c	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	67	67	71	71
Sound power level LWAokt [dB(A)]				
125 Hz	48	47	47	46
250 Hz	55	55	61	62
500 Hz	57	57	65	64
1000 Hz	61	61	66	66
2000 Hz	62	62	66	66
4000 Hz	58	58	62	62
8000 Hz	56	57	58	57

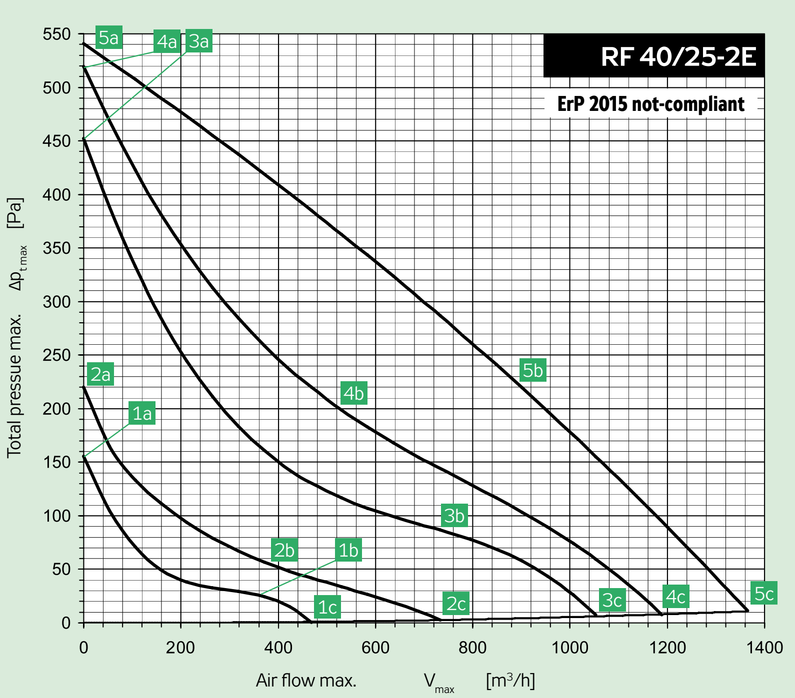
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	0.24	0.24	0.22	0.23	0.23	0.21	0.22	0.22	0.20	0.21	0.20	0.20	0.17	0.18	0.17
Input power P [W]	58	59	54	45	44	41	38	37	34	28	28	29	18	17	21
Speed n [min⁻¹]	2480	2483	2355	2190	2200	2319	1989	1999	2140	1604	1651	1738	1199	1231	1324
Air flow V [m³/h]	0	306	559	0	263	496	0	256	460	0	261	370	0	207	288
Static pressure Δp_s [Pa]	314	161	0	278	133	0	258	100	0	232	46	0	172	27	0
Total pressure Δp_t [Pa]	314	161	2	278	133	1	258	100	1	232	47	1	172	27	0



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	102
Max. current (5c)	I_{max}	[A]	0.42
Mean speed	n	[min⁻¹]	2450
Capacitor	C	[F]	2.5
Max. working temp.	t_{max}	[°C]	60
Air flow max.	V_{max}	[m³/h]	941
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	371
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	12
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Inlet		Surronding	
Bod	5b	5c	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	70	71	74	74
Sound power level LWAokt [dB(A)]				
125 Hz	48	47	50	48
250 Hz	61	60	63	64
500 Hz	61	61	68	67
1000 Hz	65	65	68	68
2000 Hz	63	64	67	69
4000 Hz	59	61	63	63
8000 Hz	64	65	63	64

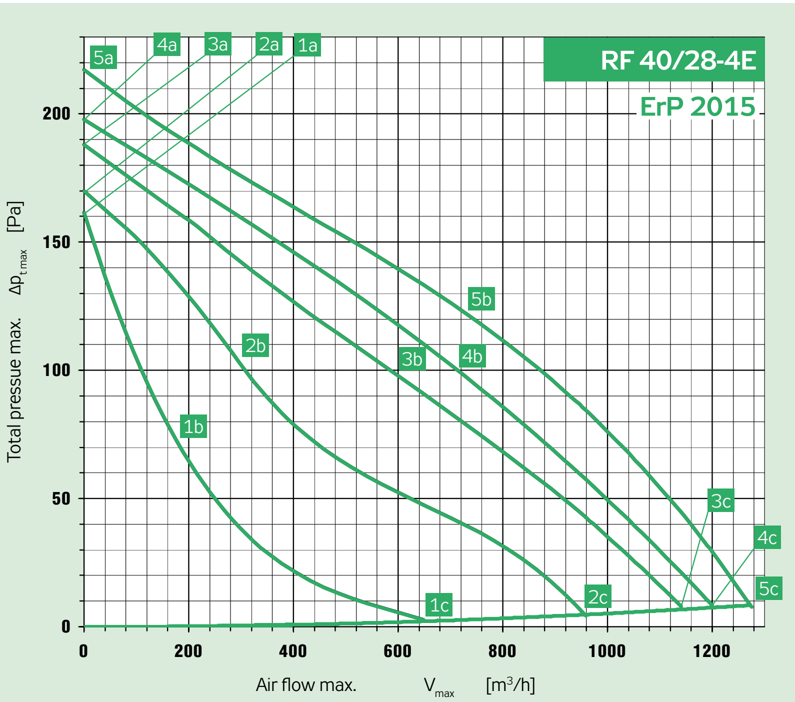
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	0.41	0.42	0.36	0.41	0.42	0.36	0.40	0.40	0.37	0.37	0.37	0.35	0.31	0.31	0.31
Input power P [W]	98	102	86	79	81	72	68	69	60	49	49	47	35	35	34
Speed n [min⁻¹]	2478	2445	2588	2113	2085	2317	1880	1903	2098	1442	1509	1640	1100	1100	1145
Air flow V [m³/h]	0	572	941	0	487	841	0	491	745	0	413	577	0	166	377
Static pressure Δp_s [Pa]	371	179	0	331	127	0	302	86	0	249	44	0	157	54	0
Total pressure Δp_t [Pa]	371	181	5	331	129	4	302	87	3	249	45	2	157	54	1



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	206
Max. current (5c)	I_{max}	[A]	0.87
Mean speed	n	[min⁻¹]	2430
Capacitor	C	[F]	6
Max. working temp.	t_{max}	[°C]	60
Air flow max.	V_{max}	[m³/h]	1393
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	541
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	13
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Inlet		Surronding	
Bod	5b	5c	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	73	75	76	79
Sound power level LWAokt [dB(A)]				
125 Hz	56	57	51	51
250 Hz	63	62	66	70
500 Hz	67	67	70	73
1000 Hz	70	72	71	73
2000 Hz	64	65	68	72
4000 Hz	59	60	64	66
8000 Hz	63	65	62	67

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]	0.83	0.87	0.71	0.89	0.94	0.78	0.89	0.87	0.80	0.81	0.82	0.79	0.66	0.66	0.66
Input power P [W]	199	206	169	166	174	147	147	143	133	109	110	108	72	72	72
Speed n [min⁻¹]	2471	2426	2570	2038	1943	2260	1730	1805	1992	1196	1122	1403	867	891	895
Air flow V [m³/h]	0	903	1393	0	513	1217	0	761	1072	0	368	747	0	351	469
Static pressure Δp_s [Pa]	541	221	0	519	204	0	452	90	0	219	58	0	156	27	0
Total pressure Δp_t [Pa]	541	225	11	519	205	8	452	93	6	219	59	3	156	27	1



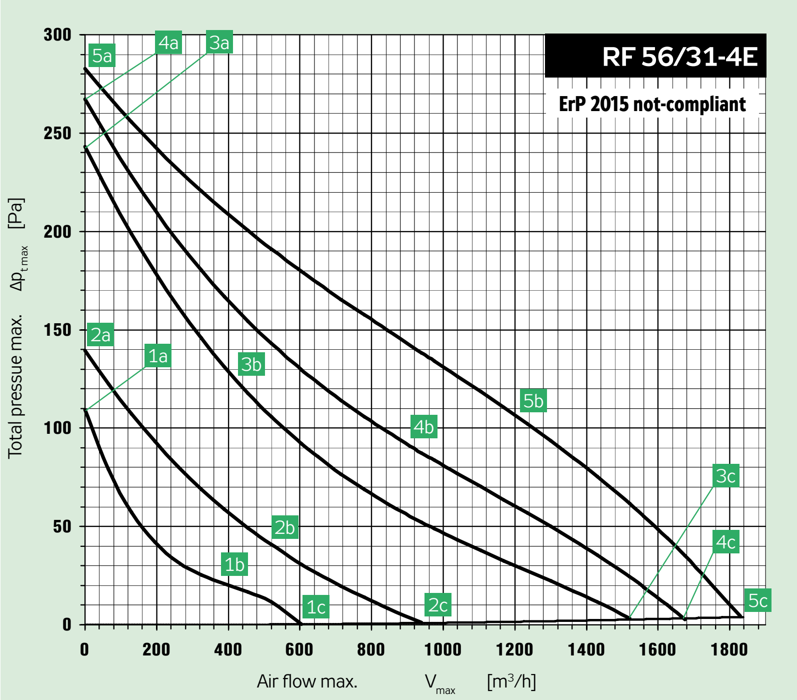
Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	112
Max. current (5c)	I_{max}	[A]	0.51
Mean speed	n	[min⁻¹]	1340
Capacitor	C	[F]	4
Max. working temp.	t_{max}	[°C]	60
Air flow max.	V_{max}	[m³/h]	1270
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	217
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	13
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Inlet		Surronding	
Bod	5b	5c	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	62	63	68	68
Sound power level LWAokt [dB(A)]				
125 Hz	56	57	61	53
250 Hz	53	53	60	59
500 Hz	56	55	63	63
1000 Hz	56	57	62	63
2000 Hz	52	51	57	59
4000 Hz	51	56	56	58
8000 Hz	44	45	44	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]	0.48	0.51	0.50	0.36	0.43	0.40	0.35	0.43	0.40	0.36	0.39	0.42	0.37	0.37	0.40
Input power P [W]	98	112	104	67	80	73	59	72	66	50	54	57	40	40	43
Speed n [min⁻¹]	1380	1341	1358	1324	1250	1290	1286	1188	1231	1156	1106	1042	897	897	728
Air flow V [m³/h]	0	712	1270	0	707	1203	0	609	1147	0	296	955	0	187	654
Static pressure Δp_s [Pa]	218	122	0	198	99	0	188	97	0	169	104	0	161	73	0
Total pressure Δp_t [Pa]	218	125	9	198	102	8	188	99	7	169	104	5	161	73	2

RF 56/31-4E

ErP 2015 not-compliant



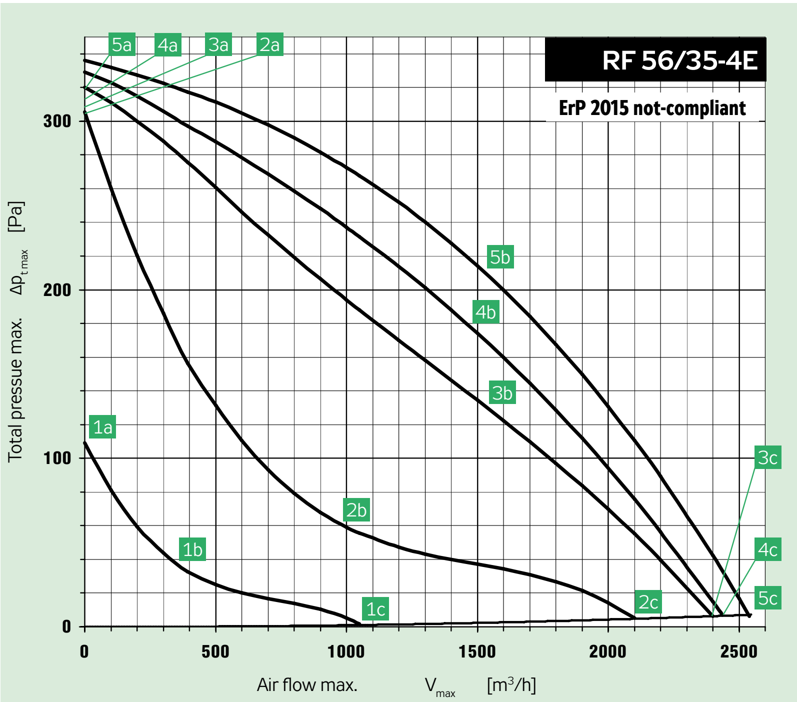
Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	138
Max. current (5c)	I_{max}	[A]	0.61
Mean speed	n	[min^{-1}]	1230
Capacitor	C	[F]	4
Max. working temp.	t_{max}	[ºC]	60
Air flow max.	V_{max}	[m³/h]	1837
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	283
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	22
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Inlet		Surronding	
Bod	5b	5c	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	70	73	70	74
Sound power level LWAokt [dB(A)]				
125 Hz	57	59	56	58
250 Hz	63	64	64	66
500 Hz	63	65	64	67
1000 Hz	62	63	64	67
2000 Hz	59	60	61	64
4000 Hz	64	70	62	68
8000 Hz	46	52	44	50

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]	0.54	0.61	0.54	0.46	0.56	0.47	0.47	0.51	0.48	0.47	0.50	0.49	0.41	0.42	0.42
Input power P [W]	116	138	119	85	105	90	77	84	81	60	66	65	42	45	44
Speed n [min^{-1}]	1315	1234	1305	1214	1083	1200	1112	1044	1097	850	704	762	630	514	536
Air flow V [m³/h]	0	1215	1837	0	956	1671	0	443	1518	0	505	935	0	362	604
Static pressure Δp_s [Pa]	283	107	0	267	94	0	243	126	0	139	43	0	109	23	0
Total pressure Δp_t [Pa]	283	108	4	267	95	3	243	126	3	139	44	1	109	23	0

RF 56/35-4E

ErP 2015 not-compliant



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	280
Max. current (5c)	I_{max}	[A]	1,66
Mean speed	n	[min^{-1}]	1370
Capacitor	C	[F]	6
Max. working temp.	t_{max}	[ºC]	60
Air flow max.	V_{max}	[m³/h]	2547
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	336
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	25
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Inlet		Surronding	
Bod	5b	5c	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	71	72	72	74
Sound power level LWAokt [dB(A)]				
125 Hz	54	55	55	56
250 Hz	64	65	65	66
500 Hz	65	65	67	68
1000 Hz	64	63	67	69
2000 Hz	63	61	64	66
4000 Hz	60	63	58	65
8000 Hz	59	65	55	64

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]	1.16	1.36	1.19	1.00	1.40	1.06	1.04	*1.53	1.11	1.33	*1.66	1.37	1.40	1.42	1.40
Input power P [W]	214	280	225	173	237	182	160	229	171	160	185	162	121	123	121
Speed n [min^{-1}]	1405	1368	1399	1362	1278	1350	1326	1180	1308	1123	836	1100	614	564	624
Air flow V [m³/h]	0	1516	2547	0	1463	2441	0	1482	2401	0	1041	2142	0	348	1038
Static pressure Δp_s [Pa]	336	213	0	329	179	0	320	134	0	306	61	0	109	39	0
Total pressure Δp_t [Pa]	336	216	7	329	181	7	320	136	6	306	62	5	109	39	1

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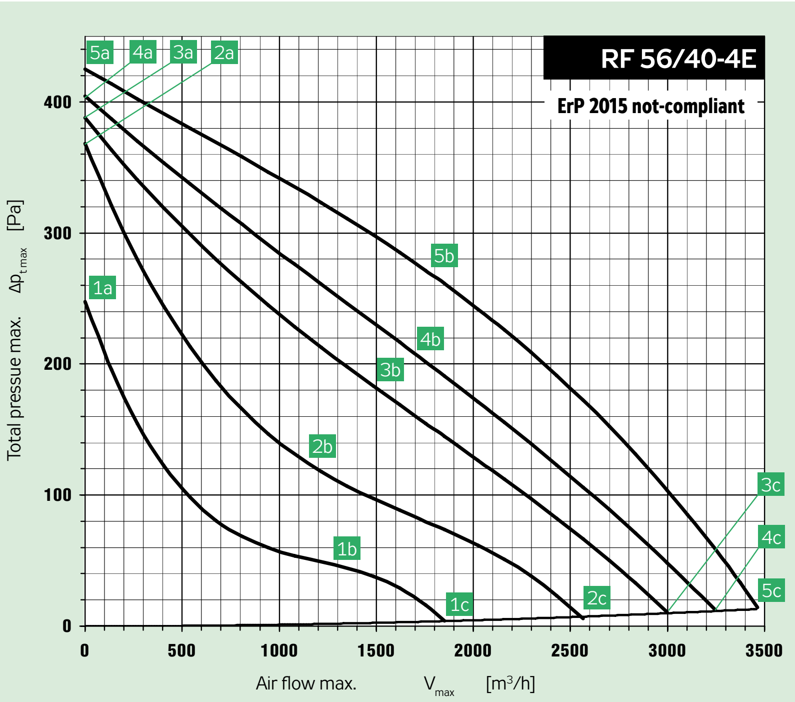
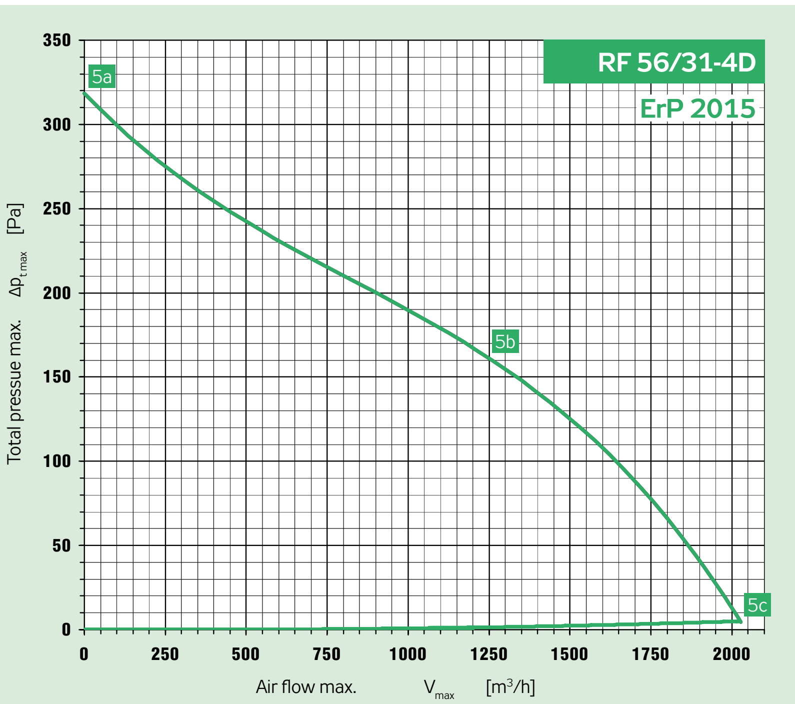


Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	415
Max. current (5c)	I_{max}	[A]	1.83
Mean speed	n	[min⁻¹]	1290
Capacitor	C	[F]	10
Max. working temp.	t_{max}	[ºC]	60
Air flow max.	V_{max}	[m³/h]	3458
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	425
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	27
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Inlet		Surronding	
Bod	5b	5c	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	72	74	74	77
Sound power level LWAokt [dB(A)]				
125 Hz	58	59	60	65
250 Hz	66	67	65	69
500 Hz	65	68	69	71
1000 Hz	65	65	69	70
2000 Hz	64	63	66	68
4000 Hz	60	64	61	65
8000 Hz	63	67	59	67

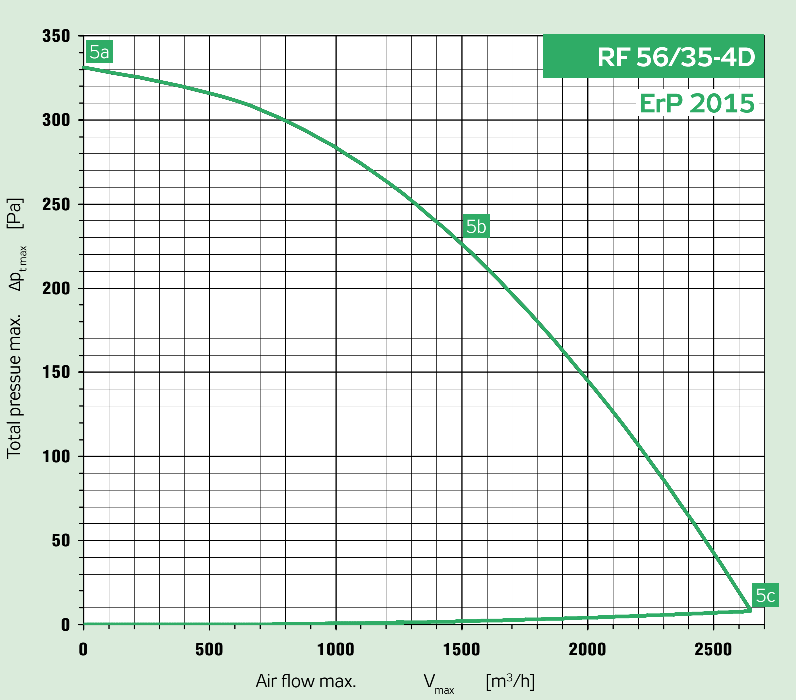
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	1.41	1.83	1.61	1.36	1.89	1.65	1.41	1.92	1.70	1.47	1.87	1.73	1.59	1.70	1.65
Input power P [W]	307	415	358	250	343	300	229	307	275	195	240	224	163	172	169
Speed n [min⁻¹]	1361	1289	1324	1292	1164	1226	1239	1068	1149	1116	891	983	788	682	734
Air flow V [m³/h]	0	1763	3458	0	1670	3248	0	1477	3003	0	1135	2565	0	1281	1852
Static pressure Δp_s [Pa]	425	268	0	404	209	0	388	180	0	368	127	0	248	47	0
Total pressure Δp_t [Pa]	425	272	13	404	212	12	388	183	10	368	129	7	248	48	4



Power supply		3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	177
Max. current (5c)	I_{max}	[A]	0.36
Mean speed	n	[min⁻¹]	1390
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	2044
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	318
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	25
Five-stage controller	type		FM 0,37 kW
Protecting relay	type		STD

	Inlet		Surronding	
Bod	5b	5c	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	68	69	71	72
Sound power level LWAokt [dB(A)]				
125 Hz	51	50	49	52
250 Hz	60	62	60	64
500 Hz	62	62	66	67
1000 Hz	60	59	65	65
2000 Hz	57	57	62	62
4000 Hz	62	64	62	65
8000 Hz	56	61	53	60

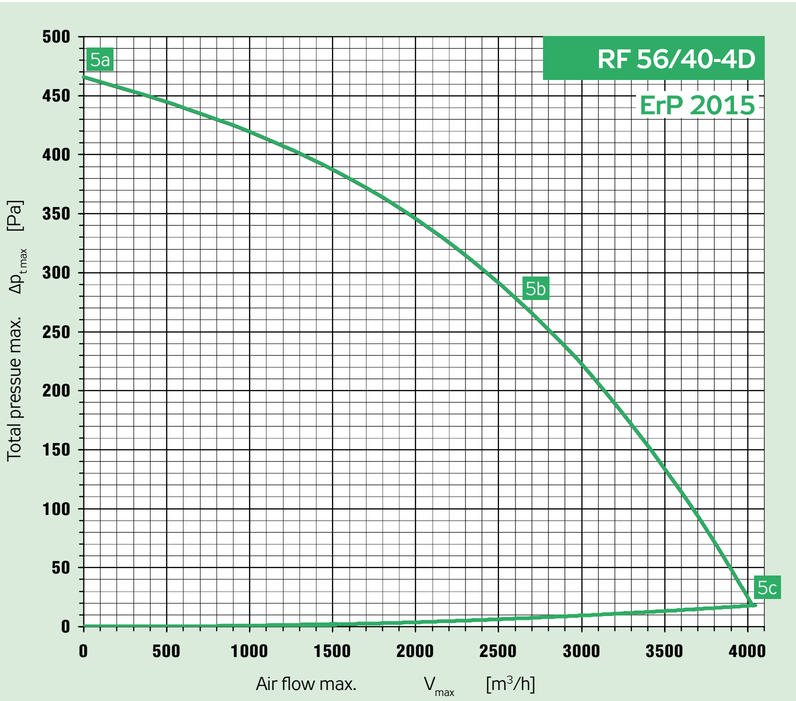
Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	0.34	0.36	0.33
Input power P [W]	159	177	135
Speed n [min⁻¹]	1404	1386	1415
Air flow V [m³/h]	0	1241	2044
Static pressure Δp_s [Pa]	318	164	0
Total pressure Δp_t [Pa]	318	166	5



Power supply		3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	288
Max. current (5c)	I_{max}	[A]	0.66
Mean speed	n	[min⁻¹]	1410
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	2681
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	331
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	26
Five-stage controller	type		FM 0,37 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	71	71	74	75
Sound power level LWAokt [dB(A)]				
125 Hz	56	59	60	59
250 Hz	64	65	65	65
500 Hz	66	66	70	70
1000 Hz	65	63	69	69
2000 Hz	63	61	65	66
4000 Hz	59	63	58	65
8000 Hz	56	61	50	59

Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	0.48	0.51	0.50
Input power P [W]	98	112	104
Speed n [min⁻¹]	1380	1341	1358
Air flow V [m³/h]	0	712	1270
Static pressure Δp_s [Pa]	218	122	0
Total pressure Δp_t [Pa]	218	125	9



Power supply		3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	592
Max. current (5c)	I_{max}	[A]	1.27
Mean speed	n	[min⁻¹]	1420
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	4047
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	466
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	30
Five-stage controller	type		FM 0,75 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	74	75	77	79
Sound power level LWAokt [dB(A)]				
125 Hz	61	60	64	61
250 Hz	64	68	68	71
500 Hz	69	70	72	73
1000 Hz	67	67	71	73
2000 Hz	67	64	69	70
4000 Hz	62	64	63	68
8000 Hz	63	68	62	70

Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.23	1.27	1.17
Input power P [W]	553	592	478
Speed n [min⁻¹]	1423	1418	1434
Air flow V [m³/h]	0	2591	4047
Static pressure Δp_s [Pa]	466	275	0
Total pressure Δp_t [Pa]	466	282	18

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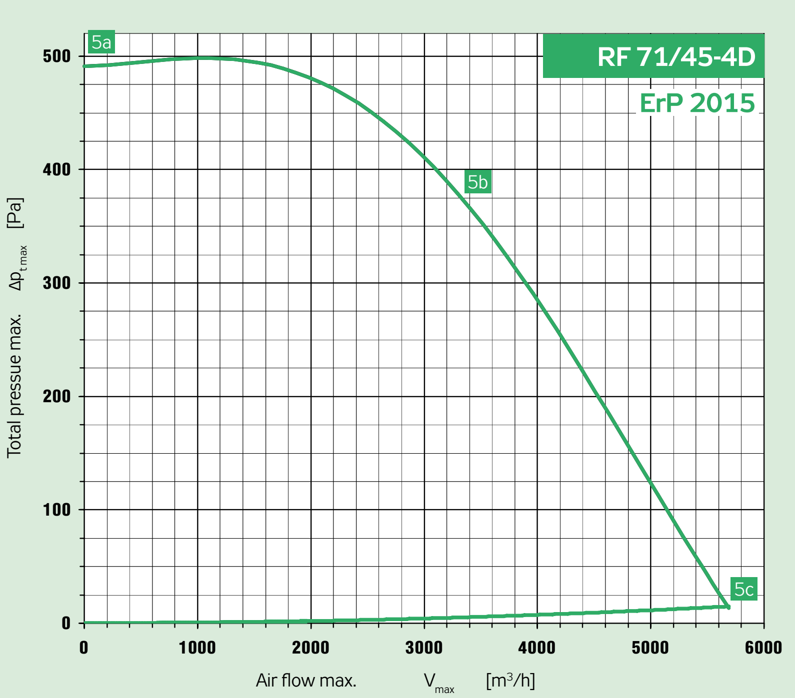
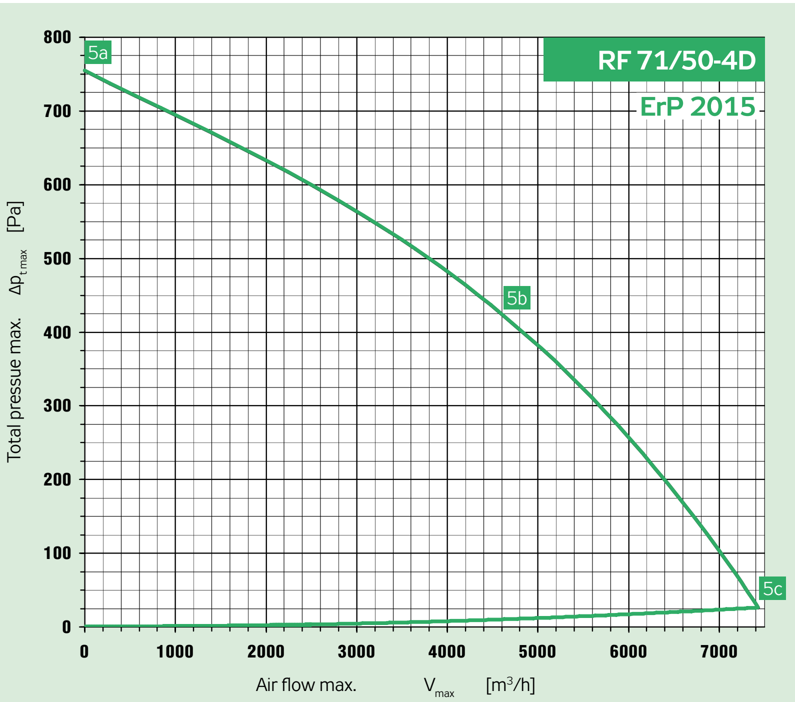


Power supply		3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	924
Max. current (5c)	I_{max}	[A]	1.87
Mean speed	n	[min⁻¹]	1410
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	5691
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	498
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	40
Five-stage controller	type		FM 0,75 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	80	82	80	84
Sound power level LWAokt [dB(A)]				
125 Hz	67	67	64	66
250 Hz	72	75	72	76
500 Hz	74	77	75	79
1000 Hz	74	74	75	78
2000 Hz	73	72	71	74
4000 Hz	68	69	67	72
8000 Hz	68	75	63	71

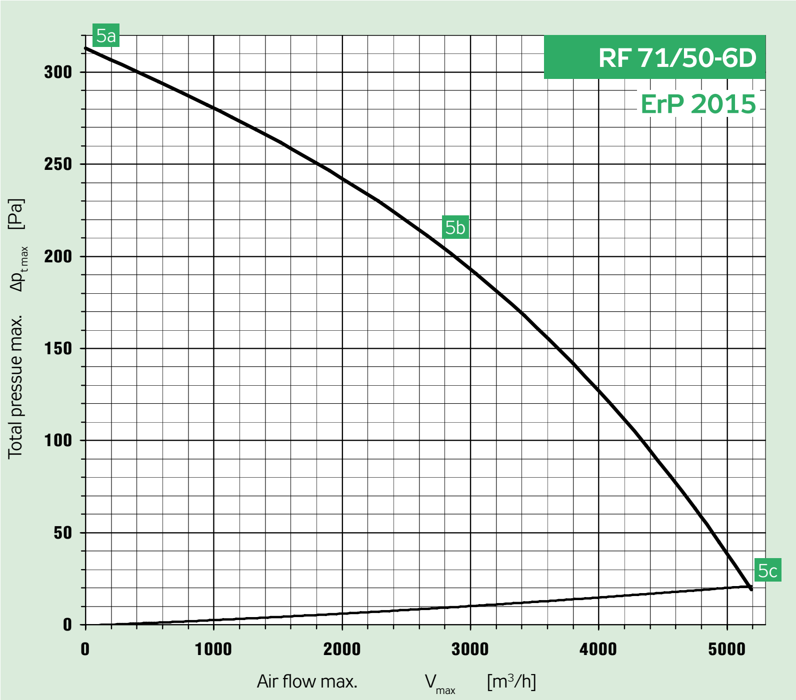
Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.58	1.87	1.67
Input power P [W]	606	924	711
Speed n [min⁻¹]	1434	1405	1425
Air flow V [m³/h]	0	3233	5691
Static pressure Δp_s [Pa]	491	380	0
Total pressure Δp_t [Pa]	491	385	15



Power supply		3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1399
Max. current (5c)	I_{max}	[A]	2.73
Mean speed	n	[min⁻¹]	1390
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	7431
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	754
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	43
Five-stage controller	type		FM 1,5 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	81	82	84	86
Sound power level LWAokt [dB(A)]				
125 Hz	66	70	69	71
250 Hz	76	77	76	79
500 Hz	75	76	79	81
1000 Hz	75	74	79	81
2000 Hz	72	71	76	78
4000 Hz	68	70	72	76
8000 Hz	64	69	64	69

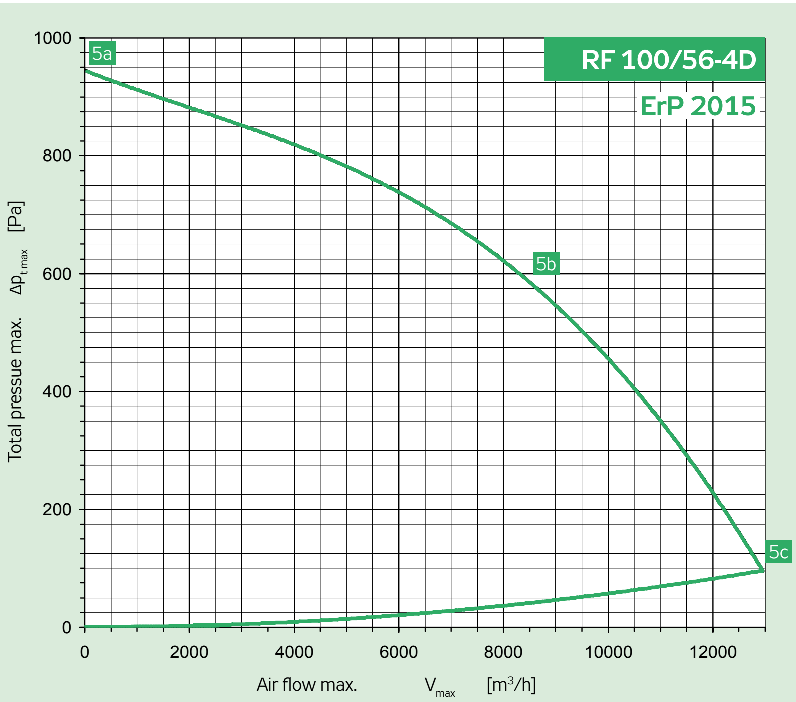
Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	2.25	2.73	2.57
Input power P [W]	889	1399	1244
Speed n [min⁻¹]	1427	1387	1400
Air flow V [m³/h]	0	4454	7431
Static pressure Δp_s [Pa]	754	426	0
Total pressure Δp_t [Pa]	754	435	26



Power supply		3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	475
Max. current (5c)	I_{max}	[A]	1.15
Mean speed	n	[min^{-1}]	930
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	5125
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	313
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	40
Five-stage controller	type		FM 0,37 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	72	75	72	75
Sound power level LWAokt [dB(A)]				
125 Hz	62	57	55	64
250 Hz	65	63	64	66
500 Hz	65	66	66	69
1000 Hz	61	69	67	68
2000 Hz	62	70	64	67
4000 Hz	66	65	58	67
8000 Hz	55	56	49	56

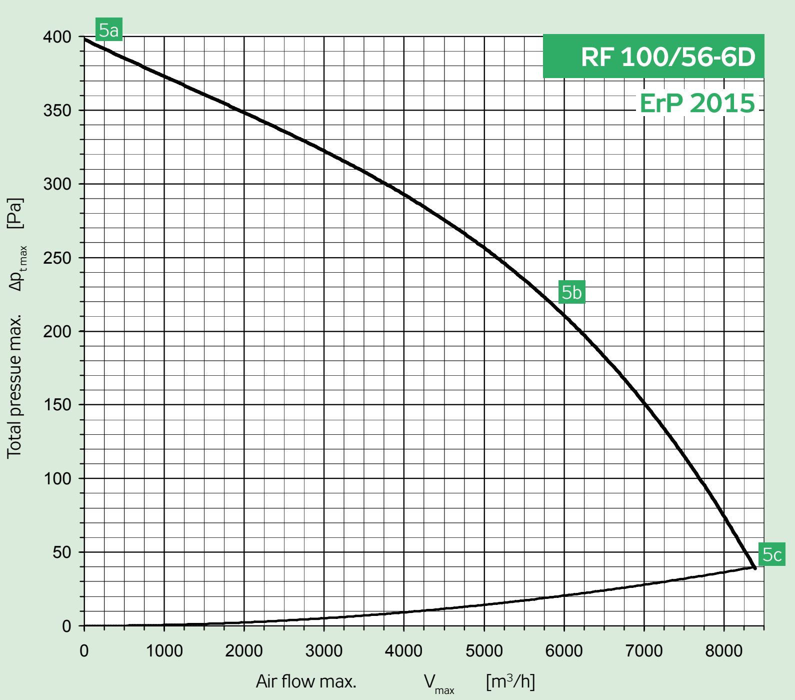
Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.05	1.15	1.08
Input power P [W]	323	475	399
Speed n [min^{-1}]	953	929	941
Air flow V [m³/h]	0	2823	5125
Static pressure Δp_s [Pa]	313	201	0
Total pressure Δp_t [Pa]	313	210	19



Power supply		3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	2568
Max. current (5c)	I_{max}	[A]	4.80
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	12956
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	945
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	125
Five-stage controller	type		FM 2,2 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	78	84	83	89
Sound power level LWAokt [dB(A)]				
125 Hz	69	68	72	76
250 Hz	72	79	72	79
500 Hz	72	77	78	83
1000 Hz	71	76	77	82
2000 Hz	70	76	74	81
4000 Hz	68	77	72	81
8000 Hz	63	72	65	72

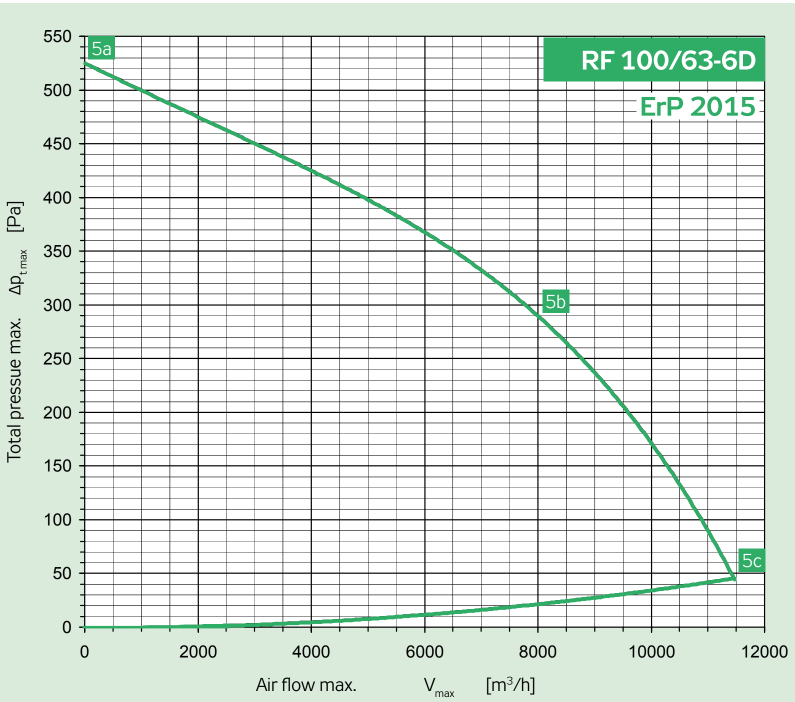
Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	3.60	4.80	4.00
Input power P [W]	1526	2568	1845
Speed n [min^{-1}]	1461	1435	1459
Air flow V [m³/h]	0	8480	12956
Static pressure Δp_s [Pa]	945	550	0
Total pressure Δp_t [Pa]	945	591	96



Power supply		3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	781
Max. current (5c)	I_{max}	[A]	1.70
Mean speed	n	[min⁻¹]	910
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	8387
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	398
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	115
Five-stage controller	type		FM 0,75 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	66	74	66	74
Sound power level LWAokt [dB(A)]				
125 Hz	52	59	52	59
250 Hz	57	67	57	67
500 Hz	64	66	64	66
1000 Hz	55	64	55	64
2000 Hz	54	66	54	66
4000 Hz	53	62	53	62
8000 Hz	35	69	35	69

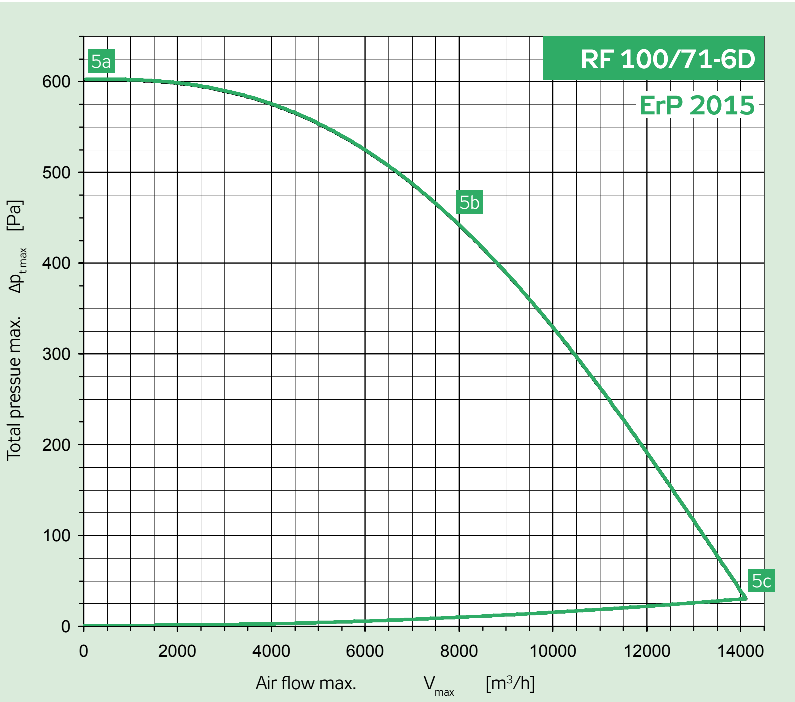
Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	1.40	1.70	1.50
Input power P [W]	524	778	585
Speed n [min⁻¹]	947	911	942
Air flow V [m³/h]	0	5830	8387
Static pressure Δp_s [Pa]	398	201	0
Total pressure Δp_t [Pa]	398	221	40



Power supply		3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1400
Max. current (5c)	I_{max}	[A]	3.10
Mean speed	n	[min⁻¹]	930
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	11469
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	525
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	117
Five-stage controller	type		FM 1,5 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	74	78	80	82
Sound power level LWAokt [dB(A)]				
125 Hz	60	63	64	67
250 Hz	64	72	66	72
500 Hz	72	71	78	77
1000 Hz	66	69	71	74
2000 Hz	64	71	69	75
4000 Hz	58	64	63	70
8000 Hz	61	71	61	70

Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	2.60	3.10	2.80
Input power P [W]	831	1400	1081
Speed n [min⁻¹]	964	932	952
Air flow V [m³/h]	0	7643	11469
Static pressure Δp_s [Pa]	525	279	0
Total pressure Δp_t [Pa]	525	290	46



Power supply		3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	2239
Max. current (5c)	I_{max}	[A]	4.50
Mean speed	n	[min⁻¹]	950
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	14112
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	602
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	135
Five-stage controller	type		FM 2,2 kW
Protecting relay	type		STD

	Inlet		Surrounding	
Point	5b	5b	5b	5c
Total sound power level LWA [dB(A)]				
L_{WA}	83	87	87	90
Sound power level LWAokt [dB(A)]				
125 Hz	67	70	70	72
250 Hz	72	76	75	78
500 Hz	78	77	83	82
1000 Hz	75	78	80	81
2000 Hz	75	83	80	87
4000 Hz	75	77	78	78
8000 Hz	67	79	71	77

Parameters in selected working points	5a	5b	5c
Voltage U [V]		400	
Current I [A]	3.40	4.50	4.10
Input power P [W]	1273	2212	1910
Speed n [min⁻¹]	977	953	960
Air flow V [m³/h]	0	7643	14112
Static pressure Δp_s [Pa]	602	453	0
Total pressure Δp_t [Pa]	602	462	17

INSTALACE

- Ventilátory RF (včetně dalších prvků a zařízení systému Vento) nejsou svou koncepcí určeny k přímému prodeji koncovému uživateli. Každá instalace musí být provedena na základě odborného projektu kvalifikovaného projektanta vzduchotechniky, který přebírá odpovědnost za správný výběr ventilátoru. Instalaci a spouštění zařízení smí provádět pouze odborná montážní firma s oprávněním dle obecně platných předpisů.
- Ventilátory RF mohou pracovat pouze ve vodorovné poloze (tzn. osa otáčení je ve vertikální poloze). Dopravovány mohou být také pouze ve vodorovné poloze.
- Ventilátor doporučujeme montovat na střešní nástavce. Pro zamezení samotížného proudění se na sání ventilátoru připojuje samočinná přetlaková klapka.
- Volné proudění může na chladných částech ventilátoru vyvolávat kondenzaci a její stékání dolů.
- Střešní ventilátory smí být umístěny pouze na pevné konstrukci, vhodné k přenosu hmotnosti ventilátoru a odolné povětrnostním vlivům, které lze předpokládat v místě instalace.
- Odváděnou vzdušinu může ventilátor volně nasávat z prostoru nebo může být napojen na vzduchotechnické potrubí. Připojené potrubí nesmí být zavěšeno za ventilátor, jinak může dojít k deformacím ventilátorové základny. Pro připojení potrubí k ventilátoru použijte tlumící vložku.

ELEKTRICKÉ ZAPOJENÍ

- Elektrickou instalaci může provádět pouze pracovník s oprávněním podle platných předpisů.
- **Svorkovnice:**
  a) u jednofázových motorů je připojení ukončeno připojovací svorkovnicí s krytím IP 54. Připojovací svorky jednofázových motorů jsou typu Wago.
  b) Třífázové provedení má svorkovnici řešenou na těle motoru. Připojení na šroubové svorníky.
- Všechny svorkovnicové skříně jsou osazeny plastovými kabelovými vývodkami (průchodkami).
- Schéma připojení motorů znázorňuje obrázek 3.
- Třífázový motor může být regulován frekvenčním měničem. Tabulka 2 uvádí, zda je zapojení mezi frekvenčním měničem, který je dodáván jako příslušenství, a ventilátorem 3× 400 V–Y nebo 3× 230 V– Δ. Třífázové motory jsou ve výrobě vždy zapojeny na napětí 3× 400 V–Y, v případě ovládání ventilátoru přes frekvenční měnič se zapojením 3× 230 V–Δ (výkon motoru do 0,75 kW), je nutno provést přepojení ve svorkovnici na motoru do trojúhelníku!
  Kabely elektroinstalace se ke svorkovnici přivádí kabelovou chráničkou vedoucí vnitřním prostorem ventilátoru a dále volně střešním nástavcem do větraného prostoru. Přívodní kabel a kabel tepelné ochrany se musí vést samostatně.
- Pokud se ventilátor reguluje pomocí elektronických komponentů (např. ovládače PE nebo frekvenční měnič), je nutno zabránit elektromagnetickým rušivým vlivům (EMC). Pro propojení ventilátoru s frekvenčním měničem použijte předepsaný stíněný kabel.

The inverters are equipped with a built-in EMI filters, however, if used it is necessary to assess the area of electromagnetic interference (EMC compatibility) in a complex situation at the injection site (affects the final installation, co-devices).

FIGURE 3 – Y/Δ CONNECTION IN THE THREE-PHASE MOTOR TERMINAL BOX WITH FREQUENCY INVERTER, IP 21 (RFFMIMXXXX20)

*) frequency converter is delivered as a standard accessory, see Table # 3.

FIGURE 4 – Y/Δ CONNECTION IN THE THREE-PHASE MOTOR TERMINAL BOX WITH FREQUENCY INVERTER, P54 (RFFMIBXXXX50)

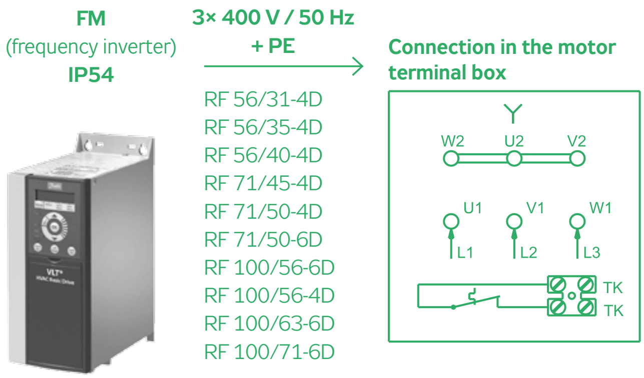
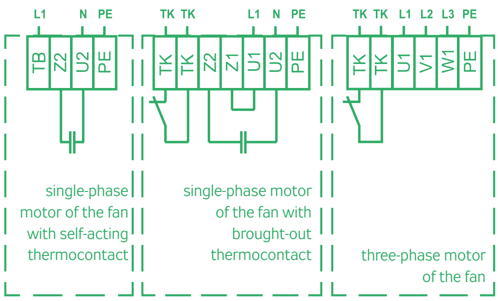


FIGURE 5 – RF FAN WIRING DIAGRAM



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

TK
– motor thermo-contact terminals
U1, V1, W1
– three-phase motor power supply terminals 400 V / 50 Hz
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
RF FANS WITHOUT OUTPUT CONTROL

Application of the RF fan in a simple air-handling assembly (separately) without output control, operation ON/OFF. This connection ensures:

- Internal ❶ or standard ❷ thermal protection of the fan
- Manual switching on/off of the fan using the switch or STE(D) protecting relay.

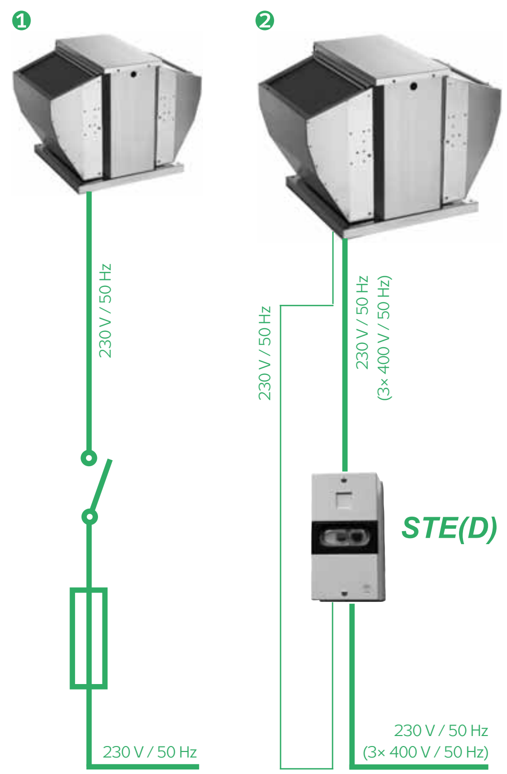
❶

RF 40/19-2E, RF 40/22-2E, RF 40/25-2E, RF 40/28-4E, RF 56/31-4E

❷

RF 56/31-4D, RF 56/35-4E, RF 56/35-4D, RF 56/40-4E, RF 56/40-4D, RF 71/xx, RF 100/xx

FIGURE 6 – FAN CONNECTION



EXAMPLE B
RF FANS WITH SINGLE-PHASE MOTOR AND OUTPUT CONTROL USING PE CONTROLLERS

It is same as the previous example plus electronic controller inserted into the power supply. The PE controller enables the fan to be switched off.
This connection ensures:

- Internal ❶ or standard ❷ thermal protection of the fan
- Manual switching on/off of the fan using the PE controller or STE(D) protecting relay.

The number behind the PE controller indicates the value of max. permissible current load, which must be lower than the value of the fan motor current.

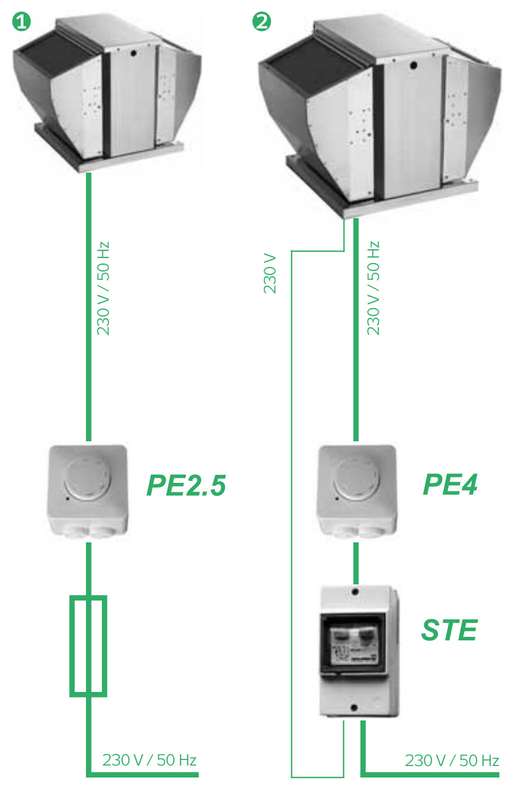
❶

RF 40/19-2E, RF 40/22-2E, RF 40/25-2E, RF 40/28-4E, RF 56/31-4E

❷

RF 56/35-4E, RF 56/40-4E

FIGURE 7 – FAN CONNECTION



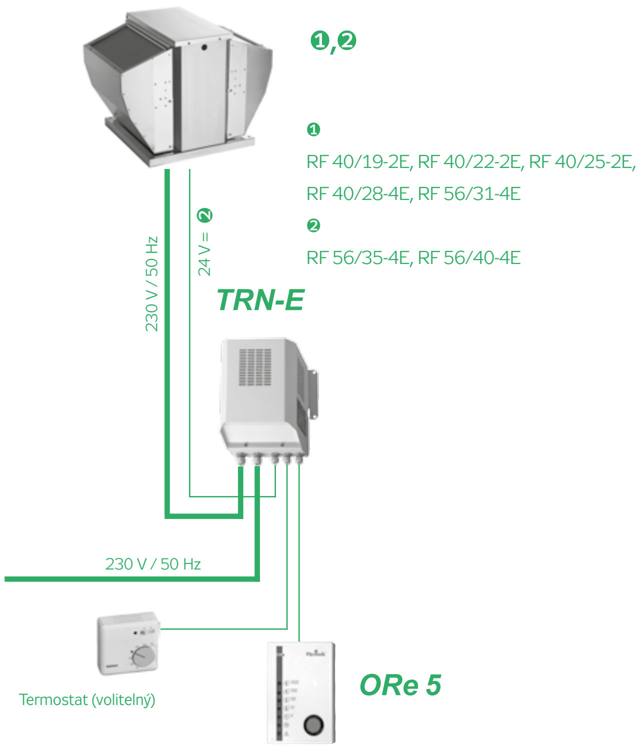
EXAMPLE C
RF FANS WITH SINGLE-PHASE MOTOR AND OUTPUT CONTROLLER

An RF fan connection in more sophisticated venting systems using the control unit is shown in figure # 8.
This connection ensures:

→ The possibility of fan output selection within the stage range 1–5.
→ Internal ❶ or standard ❷ thermal protection
→ 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, hygrostat, etc.) on terminals PT1, PT2 (for more information, refer to the separate TRN controller operating instructions)

When controlled by the ORe 5 controller along with an external switch, the operation signalling on the ORe5 controller may not correspond to the actual status of the fan. The fan operation, respectively corresponding speed stage indicator will always come on upon the fan operation request. The fan operation is conditioned by this option and the simultaneously switched external switch. If the function of the external switch is not used, it will be necessary to interconnect terminals PT1 and PT2. If the fan is overloaded, the fan circuit will be disconnected due to overheating of the motor winding, and the failure will be signalled by the red indicator on the ORe 5 controller. After cooling down, the motor is not automatically restarted. To restart the fan, it is first necessary to set the „STOP" position using the selecting button, 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. The TRN and ORe 5 controllers can be replaced by the TRR controller with a front-end STE controller. TRR controllers are equipped with motor protection.

FIGURE 8 – FAN CONNECTION



EXAMPLE D
RF FANS WITH A THREE-PHASE MOTOR AND A FREQUENCY INVERTER

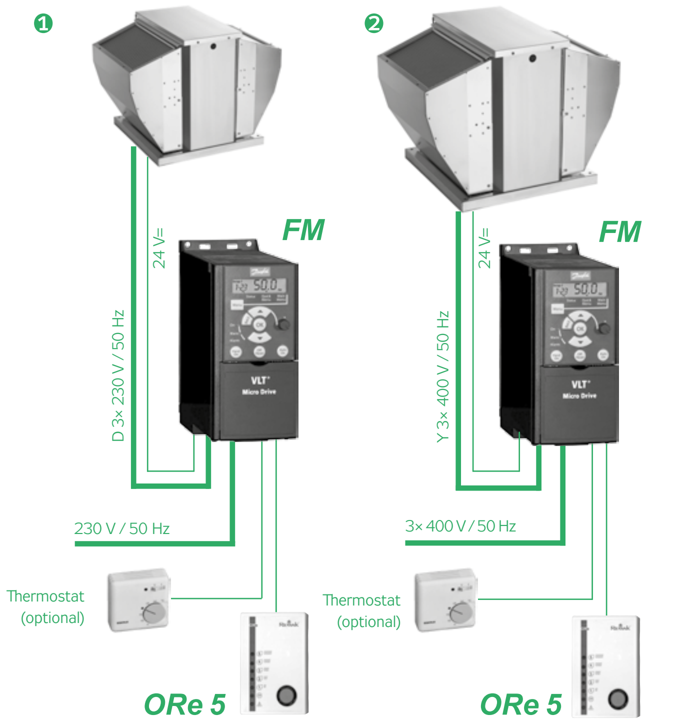
An assembly of the RF fan with frequency inverter is shown in figure # 9. An internal controller is installed in the control unit during production. This connection ensures:

→ The possibility of fan output selection within 1–5 range.
→ Over-current 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, hygrostat, etc.)

❶ Single-phase frequency converter with the 3× 230V/50Hz output.
❷ Three-phase frequency converter with the 3× 400V/50Hz output

When controlled by the ORe 5 controller along with an external switch, the operation signalling on the ORe 5 controller may not correspond to the actual status of the fan. The fan operation, respectively corresponding speed stage indicator will always come on upon the fan operation request. The fan operation is conditioned by this option and the simultaneously switched external switch. If the fan is overloaded, the frequency converter will disconnect the fan supply circuit due to change in the current uptake, and the failure will be signalled on the frequency converter. The failure will also be signalled by the red indicator on the ORe 5 controller. After cooling down, the motor is not automatically started. The failure removal must be confirmed on the frequency converter to enable fan restart.

FIGURE 9 – FAN CONNECTION



❶
RF 56/31-4D, RF 56/35-4D, RF 56/40-4D, RF 71/45-4D, RF 71/50-6D, RF 100/56-6D
❷
RF 100/56-4D, RF 100/71-6D, RF 71/50-4D, RF 100/63-6D

EXAMPLE E

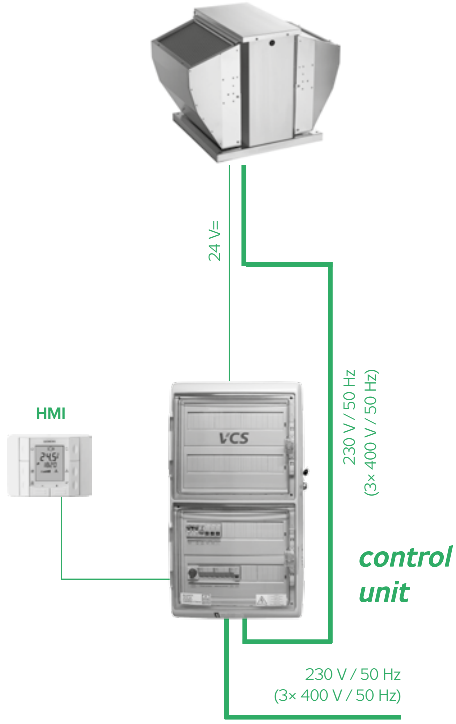
RF FAN WITHOUT OUTPUT CONTROL
AND WITH CONTROL UNIT

Application of the RF fan as an exhaust fan in a sophisticated air--handling assembly. The inlet branch is not displayed.
This connection ensures:

- Full thermal protection of the fan
- Fan switching on/off manually/automatically by the control unit (or its external switch) in conjunction with the inlet fan.

The air-handling assembly can be started by the control unit, manually or automatically following the program.
The protection of motors equipped with TK contacts must always be ensured by the control unit while TK, TK thermo-contact terminals are connected to terminals in the control unit.
Fans of smaller size are protected against overloading by thermo--contacts connected in series with the power supply. If the motor overheats, the thermo-contacts automatically disconnect the power supply circuit of the motor winding. After cooling down, the contacts will close and the fan starts up automatically.

FIGURE 10 – FAN CONNECTION



EXAMPLE F

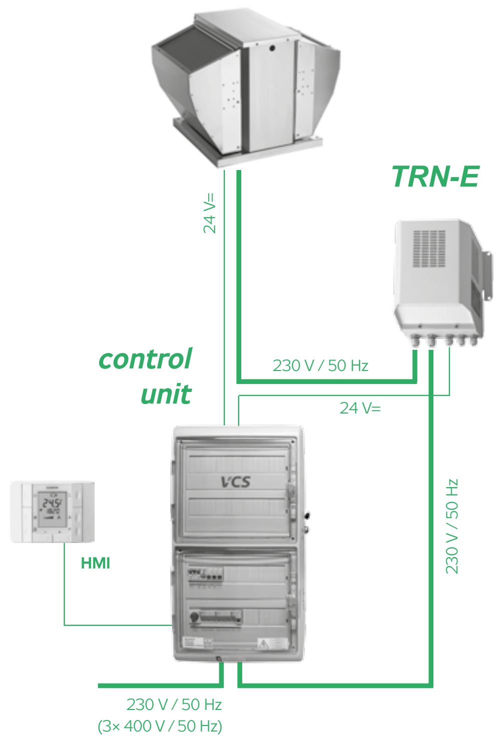
RF FAN WITH SINGLE-PHASE MOTOR,
OUTPUT CONTROLLER AND CONTROL UNIT

Application of the RF fan as an exhaust fan in a sophisticated air--handling assembly. The inlet branch is not displayed.
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).
- Fan switching on/off manually or automatically, and switching on of the entire assembly by the control unit (or its external switch) in conjunction with the inlet fan.

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

FIGURE 11 – FAN CONNECTION



EXAMPLE G

RF FAN WITH THREE-PHASE MOTOR, OUTPUT CONTROLLER AND CONTROL UNIT

Application of the RF fan as an exhaust fan in a sophisticated air-handling assembly. The inlet branch is not displayed. 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).
- Fan switching on/off manually or automatically, and switching on of the entire assembly by the control unit.

All protection and safety functions of the fans as well as the entire system are ensured by the control unit.

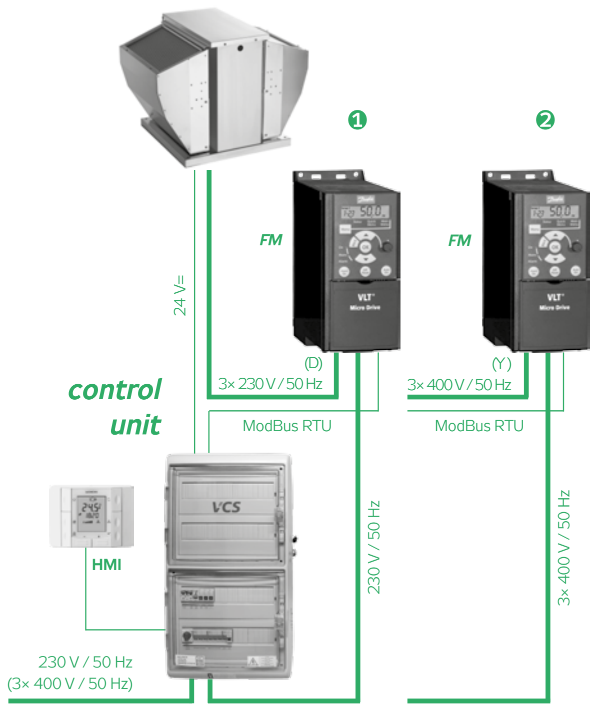
❶

RF 56/31-4D, RF 56/35-4D, RF 56/40-4D, RF 71/45-4D, RF 71/50-6D, RF 100/56-6D

❷

RF 100/56-4D, RF 100/71-6D, RF 71/50-4D, RF 100/63-6D

FIGURE 12 – FAN CONNECTION



EXAMPLE H

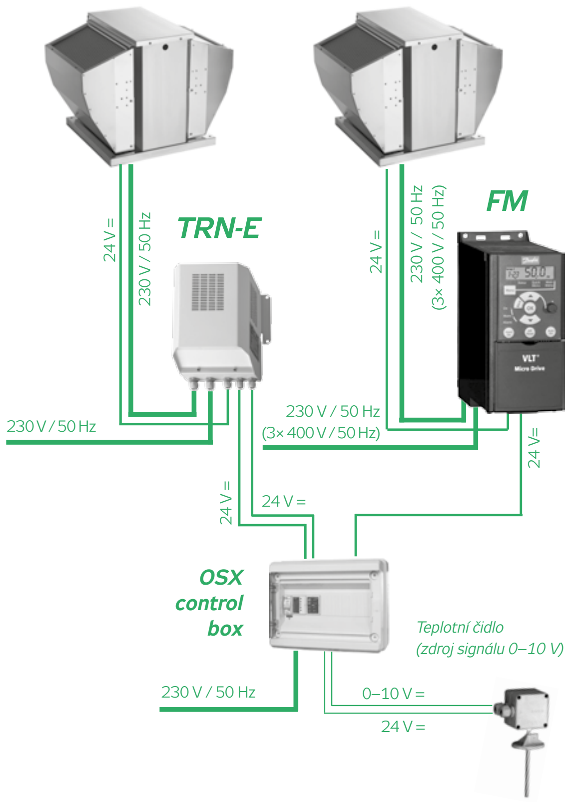
RF FAN WITH AUTOMATIC OUTPUT CONTROL, TRN CONTROLLER AND OSX CONTROL UNIT

An assembly of RF fans with TRN controllers and a common OSX unit is shown in figure # 13. The fans are controlled always at the same power level. This connection ensures:

- Automatic switching on/off of the fan at the selected value of input control voltage (some OSX types only).
- Manual switching on/off of the fan from the OSX unit.
- Fan switching on/off by the „external switching“ function (not included in the figure).
- Automatic selection of the fan output stage 1–5 depending on a 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 setting of the OSX controller enables start of the assembly at full output using the „MANUAL“ button.
- Thermal protection of the fans (ensured by the TK contacts and controllers)

The OSX unit evaluates signal coming from a converter (signal source), and automatically switches stages 0--5 of the controller. Thermal or pressure converter(s), converters for the measurement of relative or absolute humidity, concentration of gases or vapours, sensors of air quality and many other converters of different physical quantities which provide output signal 0–10 V can be used as sources of the control signal.
For detailed information on the OSX unit, refer to the applicable documentation.

OBRÁZEK 13 – ZAPOJENÍ VENTILÁTORU



NK AND NDH ROOF ADAPTORS

NK (see figure # 14) and NDH (see figure # 15) universal roof adaptors serve to fit RF fans on the roof, and they can also be used to connect square air ducting. 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 G × G, situated on the bottom side of the base, enable the square air duct flange to be connected. The adaptors are made of galvanized sheet steel, and sealed with waterproof sealing. Inner anti-condensate insulation is made of 20 mm thick, flame--retardant polyethylene foam plate which is glued and mechanically secured by pins. Four M8 threads, spacing A2 × A2, situated on the top side of the adaptor, enable the RF fan to be mounted.
Both types of adaptors in their upper part provide enough room for the VS back-flow damper. The NDH roof adaptor is equipped with an additional attenuator.
For pressure losses of NDH roof adaptors, refer to page 176. For attenuation capacity in octave bands D_{okt} of NDH roof adaptors and inherent noise $L_{WA\ okt}$, refer to page 177. Shown values do not include weighting filter corrections.

FIGURE 14 – DIMENSIONS OF NK ROOF ADAPTORS

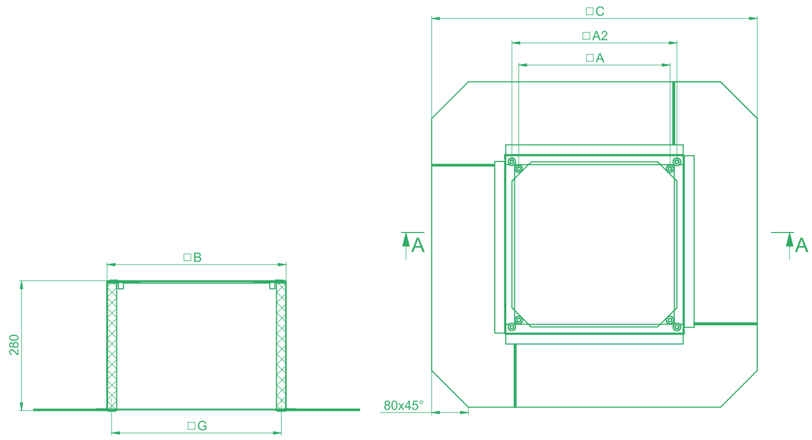


FIGURE 15 – DIMENSIONS OF NDH ROOF ADAPTORS

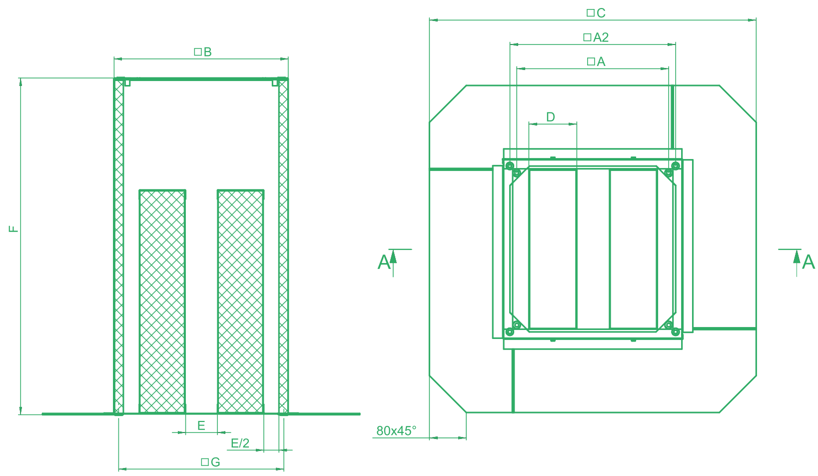
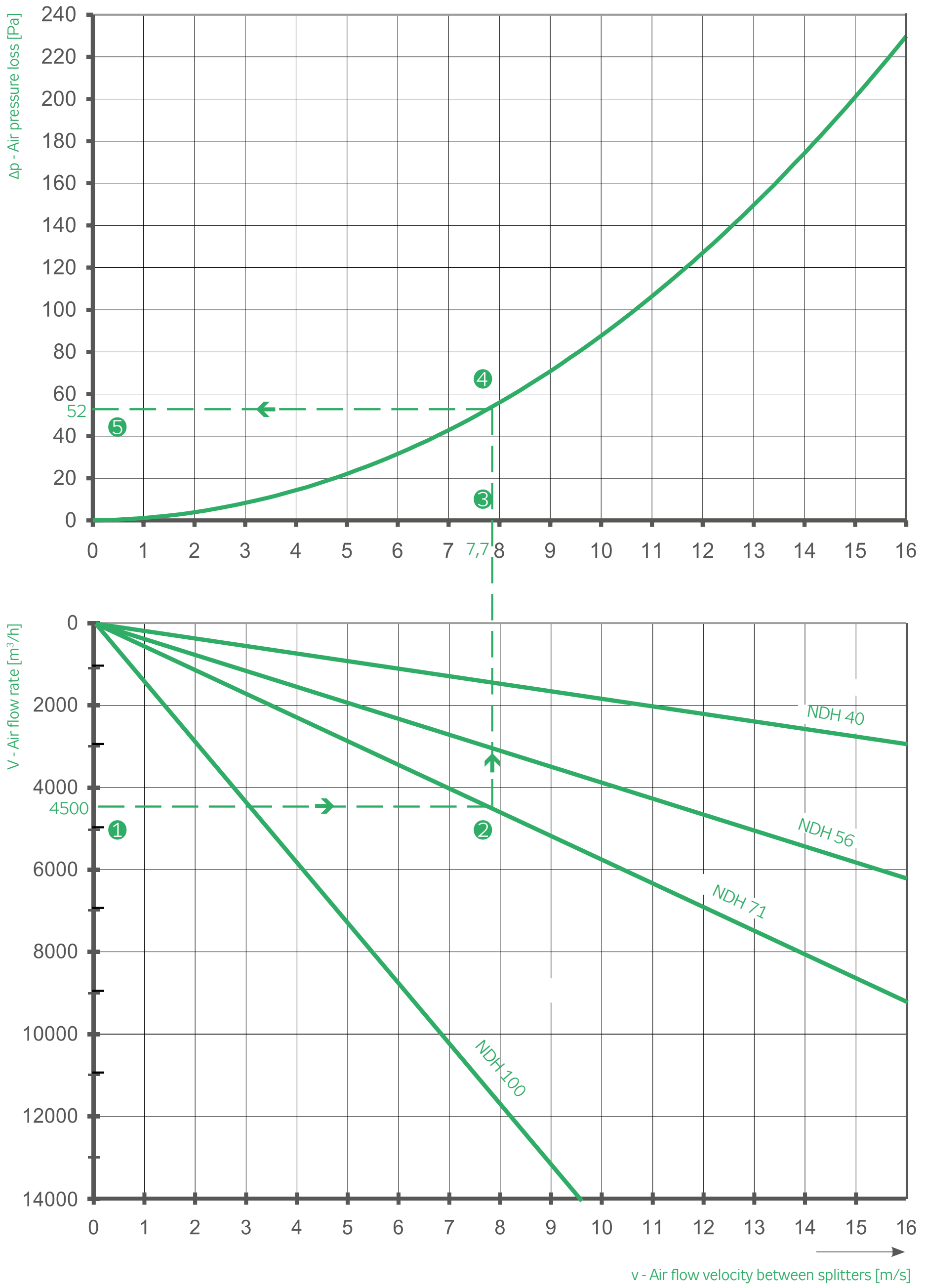


TABLE 11 – DIMENSIONS/WEIGHTS OF ROOF ADAPTORS

Type/size	A (RS)	A2 (RF)	B	C	D	E	F	G	m (kg)
NK 40	330	360	390	710				370	9,5
NDH 40	330	360	390	710	104	71	750	370	20
NK 56	450	520	550	870				530	12,5
NDH 56	450	520	550	870	104	66	750	530	29
NK 71		670	700	1020				680	15
NDH 71		670	700	1020	104	61	800	680	41
NK 100		960	990	1310				970	22
NDH 100		960	990	1310	104	86	900	970	69

AIR PRESSURE LOSSES OF ALL NDH ROOF ADAPTORS



The nomogram of pressure losses is valid for all NDH roof adaptors. For the selected air flow rate ➊, the air flow velocity ➌ between the splitters of the NDH roof adaptor ➋ can be read in the lower graph, and then the corresponding air pressure loss of the NDH roof adaptor ➎ at the known velocity can be determined in the upper part ➍.

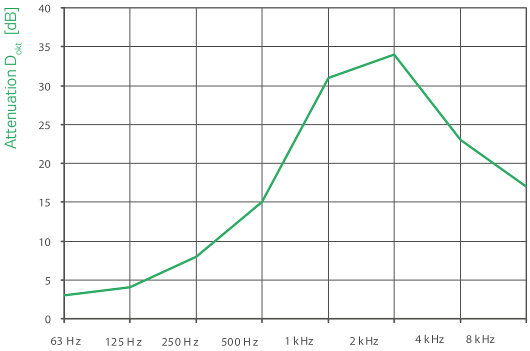
Example: At an air flow rate of 4,500 m³/h, the velocity of the air flow between the splitters of the NDH 60 roof adaptor will be 7.7 m/s. The air pressure loss for the above-mentioned air flow rate will be 52 Pa.

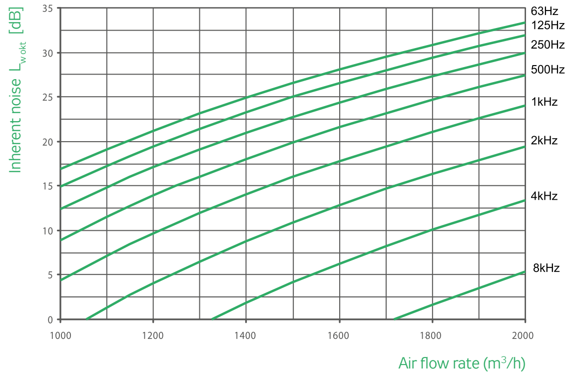
ATTENUATION AND INHERENT NOISE OF NDH ROOF ADAPTORS

ATTENUATION

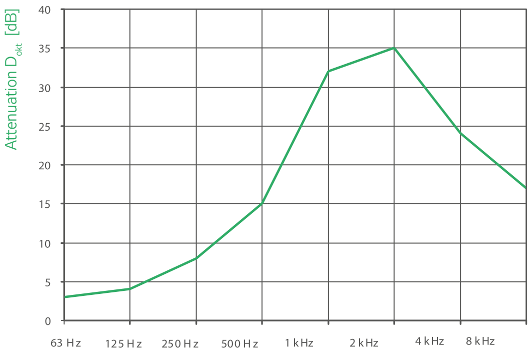
INHERENT NOISE

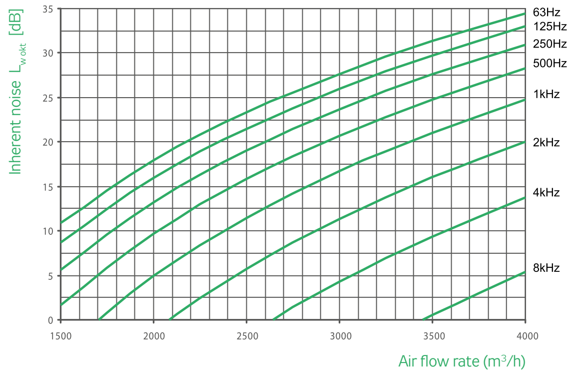
NDH 40



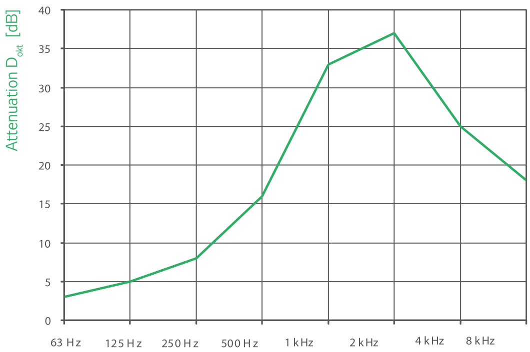


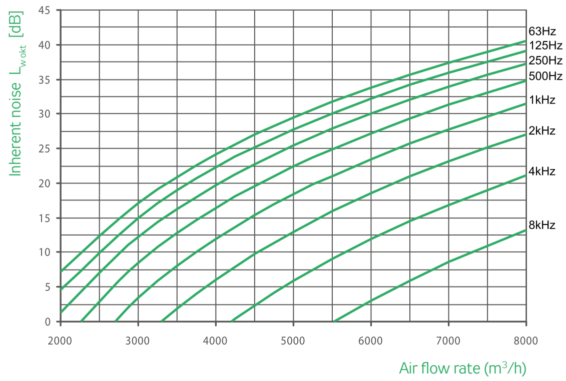
NDH 56



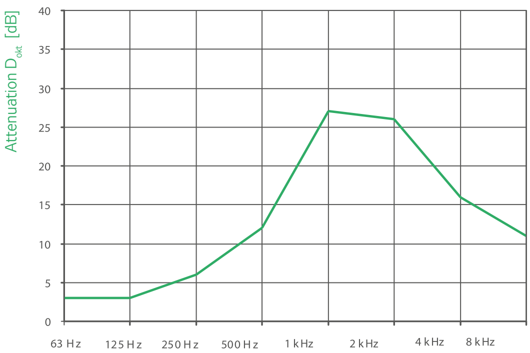


NDH 71





NDH 100



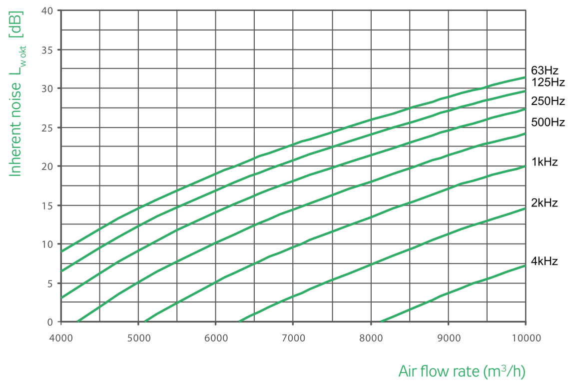
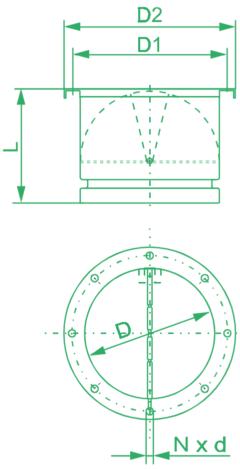


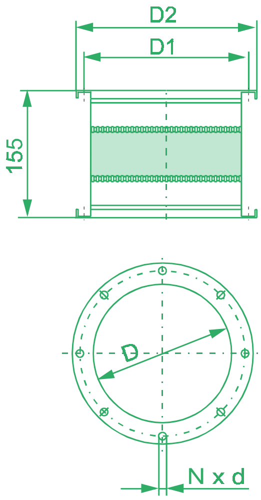
FIGURE 16



VS LOW-PRESSURE DAMPERS

The VS low-pressure back-flow damper is designed to block back-airflow into the 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 the 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 (figure # 16).

FIGURE 17



DK ELASTIC CONNECTIONS

The DK round elastic connection serves to eliminate the transfer of vibrations to the connected air ducting. 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 the prepared threads. It is made of an elastic slee-ve resistant to temperatures up to
+70 °C. At both ends, it is terminated in flanges made of galvani-zed steel sheets. The flanges are conductively interconnected by a copper girdle.
(figure # 17).

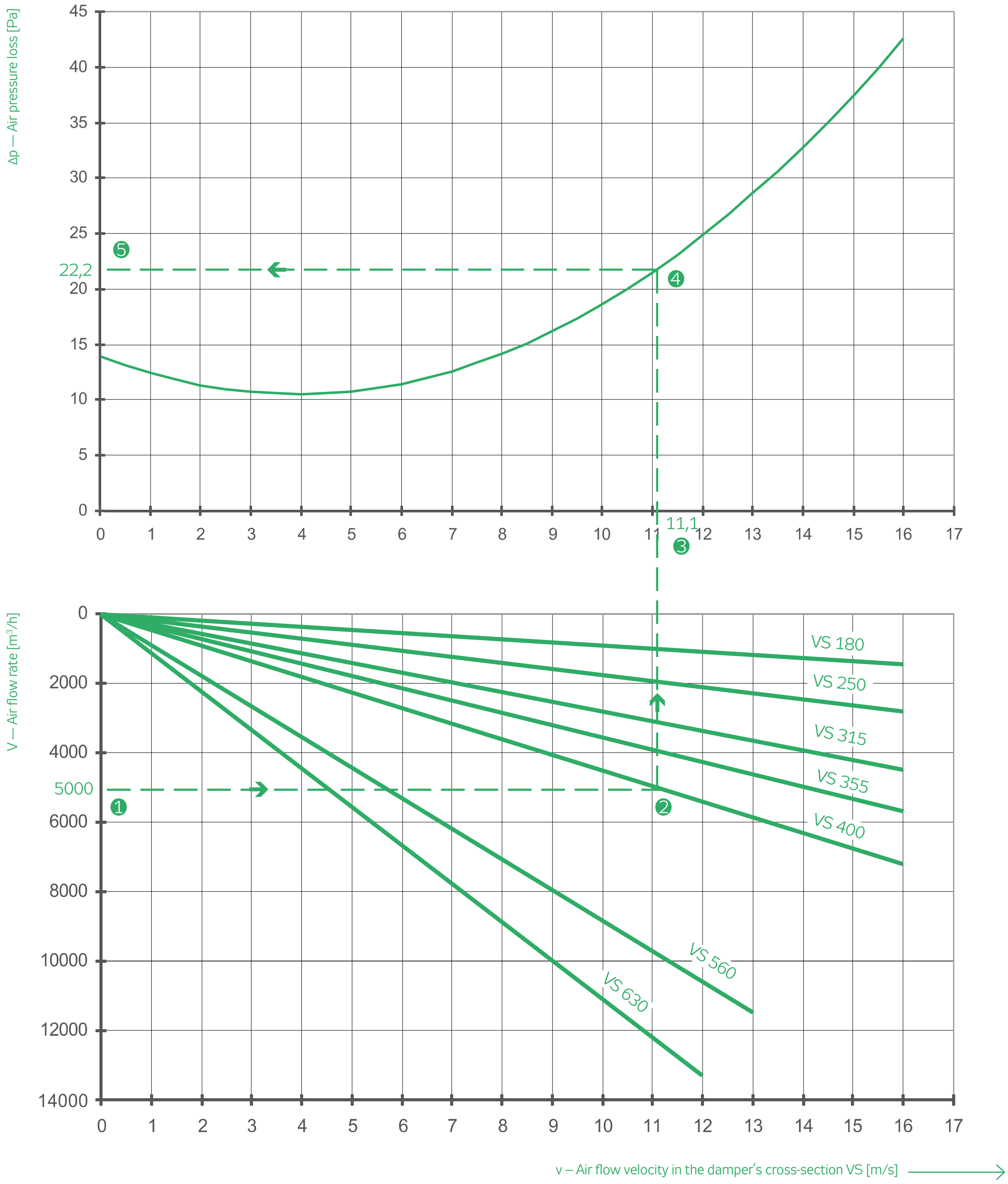
TABLE 12 – DIMENSIONS OF DAMPERS (USED WITH RF FANS) IN MM

RF / Size	VS	D	D1	D2	d	N	L
RF 40/19-2E	180	180	215	240	10	8	150
RF 40/22-2E							
RF 40/25-2E	250	250	285	310	10	8	150
RF 40/28-4E							
RF 56/31-4D							
RF 56/31-4E							
RF 56/35-4D	315	315	350	375	10	12	150
RF 56/35-4E							
RF 56/40-4D	355	355	390	415	10	12	150
RF 56/40-4E							
RF 71/45-4D	400	400	445	480	12	12	185
RF 71/50-4D							
RF 71/50-6D							
RF 100/56-4D	630	630	680	720	12	16	300
RF 100/56-6D							
RF 100/63-6D							
RF 100/71-6D							

TABLE 13 – DIMENSIONS OF ELASTIC CONNECTIONS (USED WITH RF FANS) IN MM

RF / Size	DK	D	D1	D2	d	N
RF 40/19-2E	180	180	215	240	10	8
RF 40/22-2E						
RF 40/25-2E	250	250	285	310	10	8
RF 40/28-4E						
RF 56/31-4D						
RF 56/31-4E						
RF 56/35-4D	315	315	350	375	10	12
RF 56/35-4E						
RF 56/40-4D	355	355	390	415	10	12
RF 56/40-4E						
RF 71/45-4D	400	400	445	480	12	12
RF 71/50-4D						
RF 71/50-6D						
RF 100/56-4D	630	630	680	720	12	16
RF 100/56-6D						
RF 100/63-6D						
RF 100/71-6D						

AIR PRESSURE LOSS OF VS LOW-PRESSURE DAMPERS



The nomogram of pressure losses is valid for all VS dampers. For the selected air flow rate ❶, the air flow velocity ❸ in the free damper's cross-section ❷ can be read in the lower graph, and then the corresponding VS damper's air pressure loss ❺ at the known velocity can be determined in the upper part ❹.

Example: At an air flow rate of 5,000 m^3/h, the velocity of the air flow in the damper will be 11.1 m/s. The air pressure loss of the VS 400 damper for the above-mentioned air flow rate will be 22 Pa.

FIGURE 18 – ROOF ADAPTOR ON A FLAT ROOF

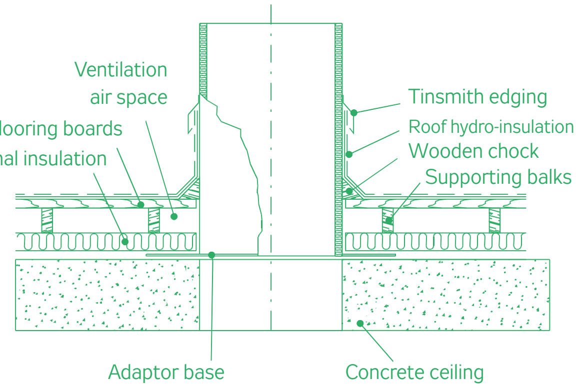


FIGURE 19 – ROOF ADAPTOR ON A SLOPING ROOF

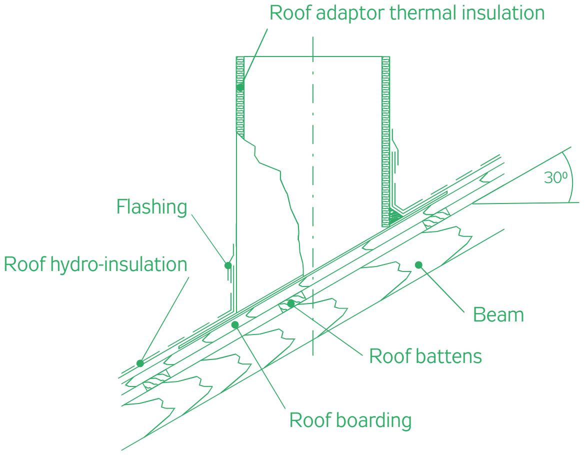
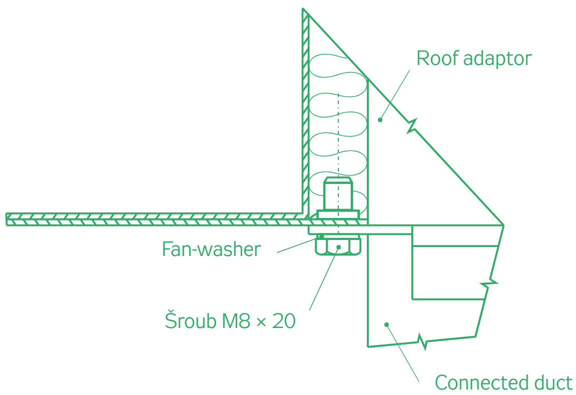


FIGURE 20 – CONNECTION OF THE AIR-HANDLING DUCT



FAN ACCESSORIES INSTALLATION

→ NK or NDH roof adaptors make the installation of RF fans significantly easier and faster. 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 should be of a precise square shape.

→ 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 the RF fan supporting stud into the terminal box.

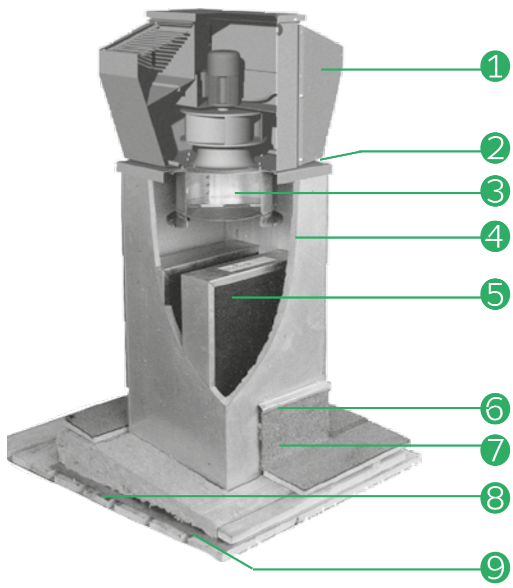
→ Roof hydro-insulation must always be applied on the roof adaptor up to a height of 30 cm above the roof. The end of the roof hydro-insulation must be completed with flashing to prevent water penetration
(figure # 18).

→ After installation, the roof adaptors need to be finished in a protective coating matching the building's colour according to the architect's choice.

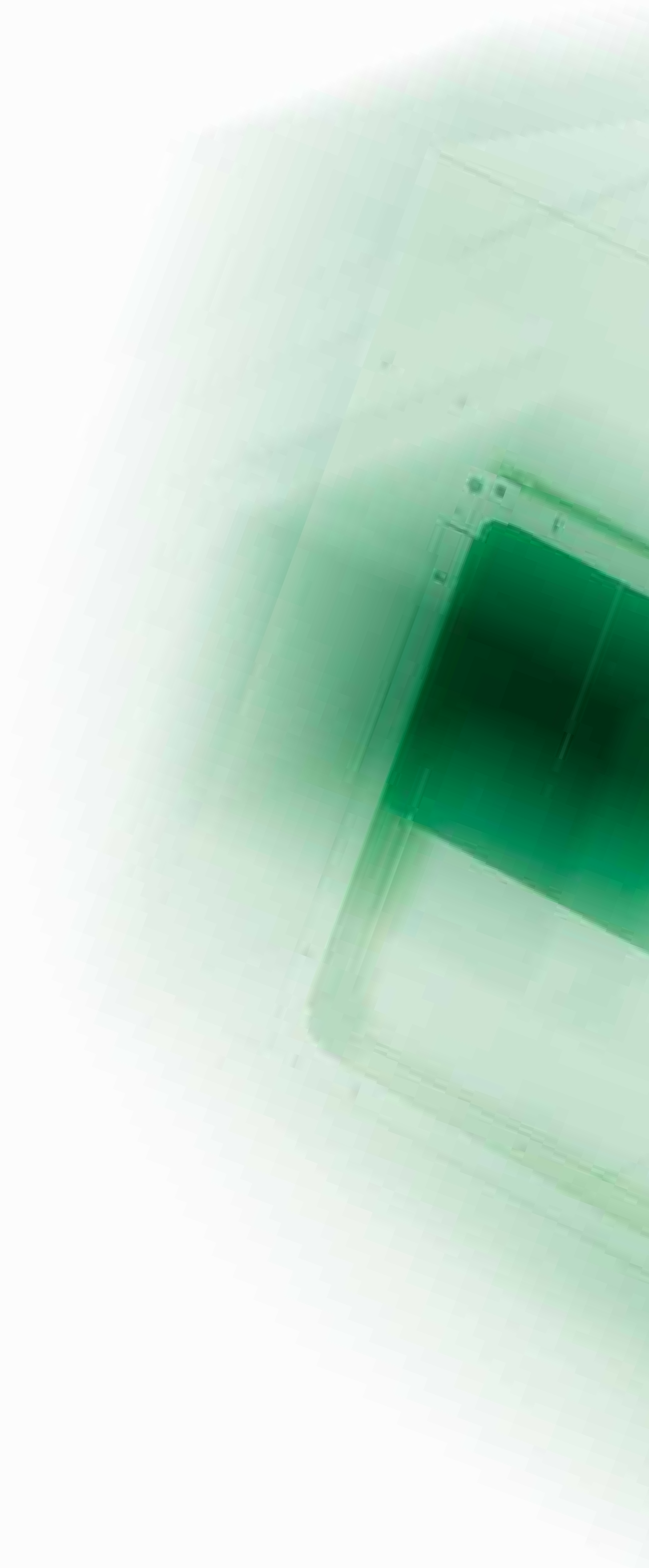
→ Roof adaptors for applications on sloping roofs can be delivered with their platforms modified to the roof slope. The roof sloping angle must be specified in your order (figure # 19).

→ Standard roof adaptors (without slope) can also be connected to the air-handling ducting. The details of the connection are shown in figure # 20. 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.

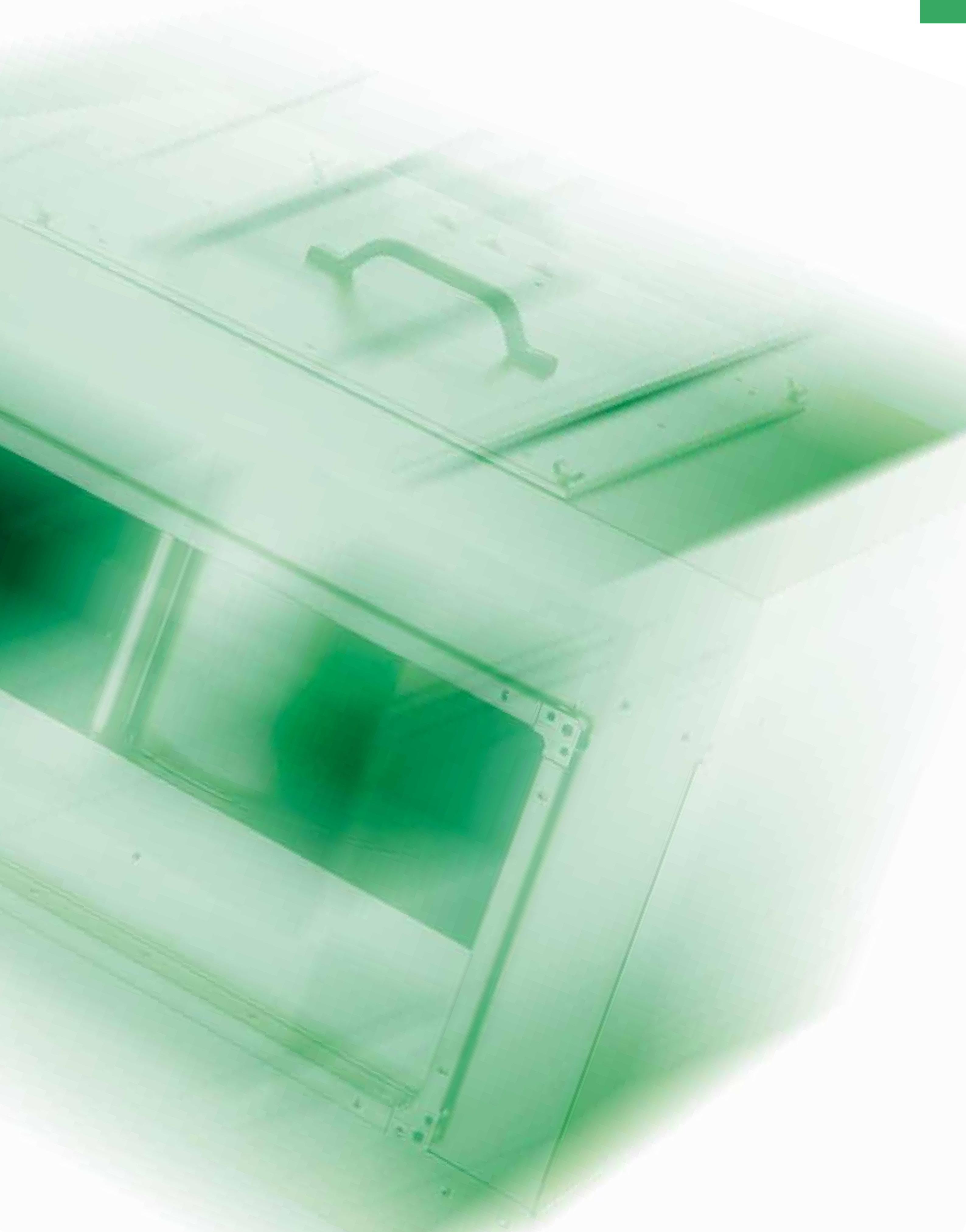
FIGURE 21 – FAN BASE INSTALLATION



1. RF Roof Fan
2. Fan base
3. Self-acting VS low-pressure damper
4. Thermally-insulated NDH roof adaptor
5. Attenuator in the NDH roof adaptor
6. Flashing
7. Roof hydro-insulation
8. Roof beams and boards (respectively concrete)
9. Roof adaptor base



RPH Fans



FAN USE

Fully controlled, low-pressure RPH sound-insulated radial fans intended for the square duct can be universally used for complex air-conditioning, from simple venting installations to sophisticated air-handling systems. 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. 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 ºC to +40 ºC, and with certain types up to +70 ºC. The maximum nominal values for each fan are included in table 4. The RPH 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 easy 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.

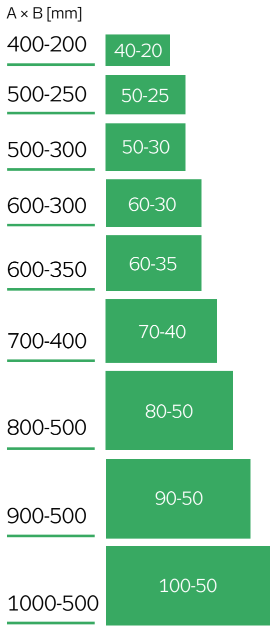
ROZMĚROVÁ ŘADA

RPH fans are manufactured in a range of nine sizes according to the A × 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 RPH fans enables the designers to optimize all parameters for air flow up to 11,700 m^3 per hour.

MATERIALS

The external casing and connecting flanges of RPH fans are made of galvanized steel sheets (Zn 275 g/m^2). Impeller blades – with forward curved blades (all fan types excluding 100-50/56-4D) are made of galvanized steel sheets, 100-50/56-4D has impeller blades with backward curved blades and it is made of painted steel. Diffusers are made of aluminium, motors are made of aluminium alloys, copper and plastic. The noise insulation is made of non--combustible, rot-resistant, waterproof mineral wool.

FIG. 1 – DIMENSIONS



MOTORS

The external casing and connecting flanges of RPH fans are made of galvanized steel sheets
(Zn 275 g/m^2). Impeller blades – with forward curved blades (all fan types excluding 100-50/56-4D) are made of galvanized steel sheets, 100-50/56-4D has impeller blades with backward curved blades and it is made of painted steel. Diffusers are made of aluminium, motors are made of aluminium alloys, copper and plastic. The noise insulation is made of non-combustible, rot-resistant, waterproof mineral wool.

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 40 protection degree under covering panel. For wiring diagrams, refer to the section "The Wiring".

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!
Maximum thermo-contact permanent loading is 1.2 A at 250V / 50 Hz (cos φ 0,6) je 1,2 A (resp. 2 A respectively cos φ 1,0).

FAN OUTPUT CONTROL

The output of all RPH 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 RPH fans.

Five Stage Voltage Control (transformer type)

Voltage control of single-phase and three-phase RPH fans is the most suitable, technically as well as operationally. There is no interference, humming, squeaking or vibration of the motor.
RPH 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.
RPH 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 0–10 V from the OSX control unit) is a significant feature of this product line.
This product line includes three single-phase and four 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.

TABLE 1 – THE INPUT VOLTAGE AND CONTROLLER'S STAGE

MOTOR TYPE	CURVE CHARACTERISTICS – CONTROLLER'S STAGE				
	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

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 4 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 must be fitted with a sine wave filters at the the output side. Appropriate inverter with sinusoidal filter can be supplied according to customer requirements.

PŘÍSLUŠENSTVÍ

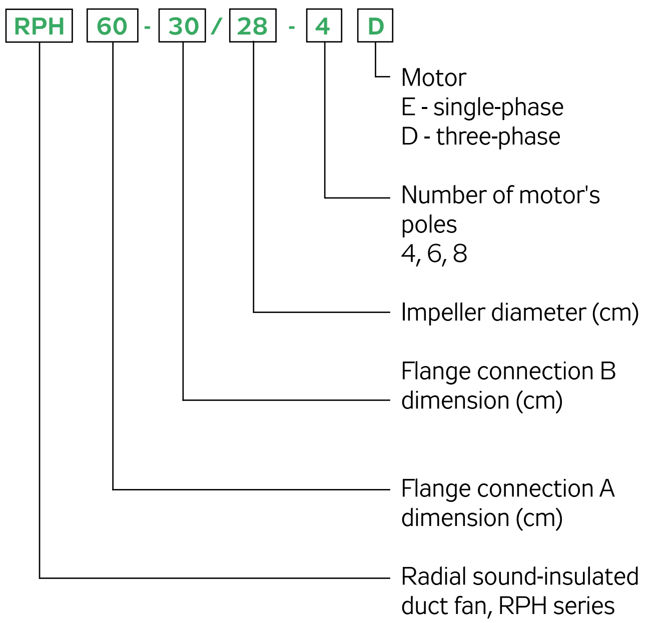
RPH fans belong in the wide range of Vento modular venting and air-handling system components. Any air-handling set-up, from simple venting to sophisticated comfortable air-conditioning, can be created by selecting suitable elements. Universal duct RPH fans can be used along with a wide range of elements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

- → KFD Bag Filters and KF3, KF5, KF7 Filter Inserts
- → VFK Insert Air Filters and VF3 Filter Inserts
- → VFT metal grease filters and spare VT3 cells
- → 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
- → VLH humidification chambers and steam humidifiers
- → Control units and sensors
- → TRN Controllers, ORe 5 controllers, TRRE, TRRD Controllers, or PE controllers
- → STE, STD Protecting Relays

FAN DESCRIPTION AND DESIGNATION

The key for type designation of RPH fans in projects and orders is defined in figure # 2.
For example, type designation RPH 60-30/28-4D specifies the type of fan, impeller and motor.

FIGURE 2 – TYPE DESIGNATION OF RPH FANS



The most used names of the fan's individual parts and structure assemblies are shown on figure # 3.

DIMENSIONS, WEIGHTS AND PERFORMANCE

For important dimensions of RPH fans, refer to Figure #4 and Table #3. For basic parameters refer to table #4.

FIGURE 3 – RPH FAN DESCRIPTION

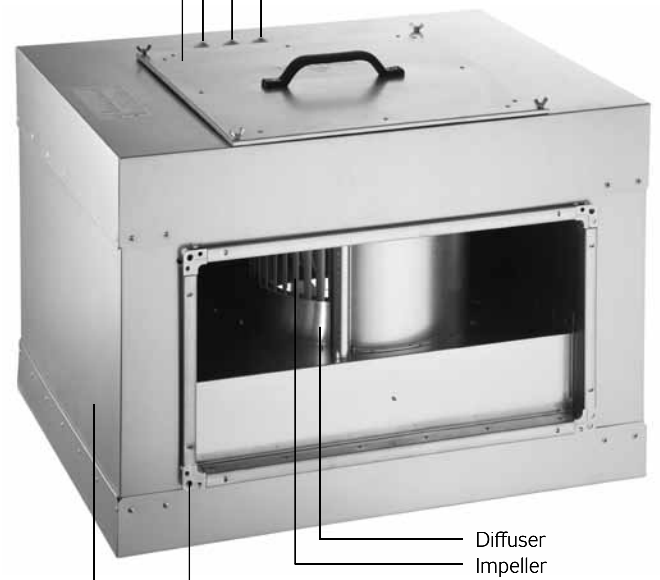


TABLE 3 – FAN DIMENSIONS

FAN 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
RPH 100-50/56-..	1000	500	1030	530	1060	560	775	1173	1220

FIGURE 4 – FAN DIMENSIONAL DIAGRAM

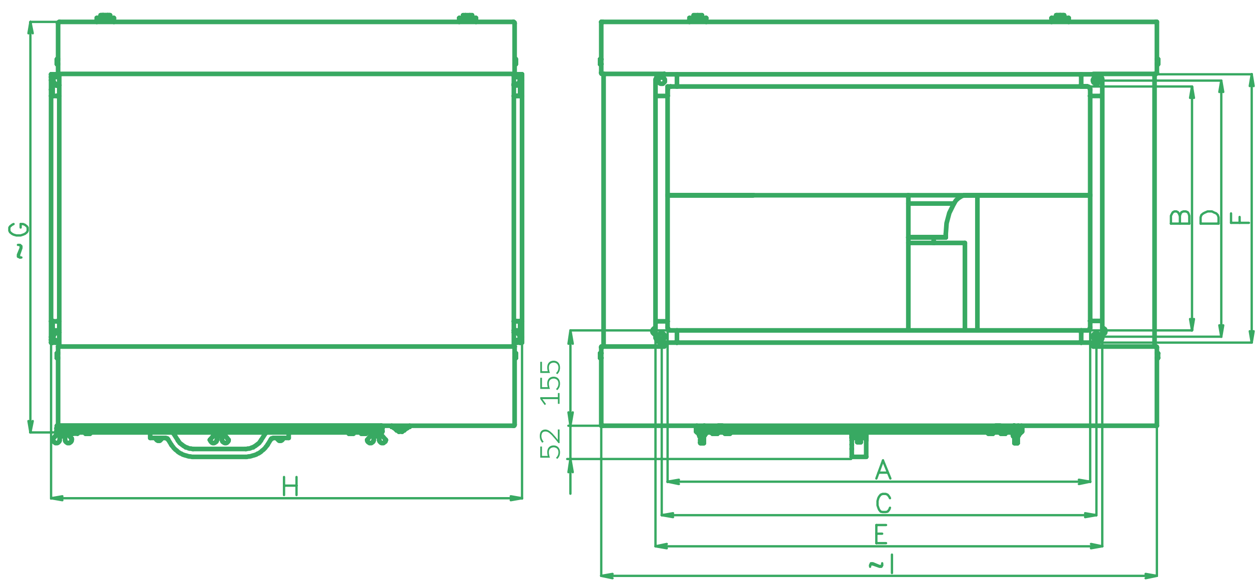


TABLE 4 – FAN BASIC PARAMETERS AND NOMINAL VALUES

Fan Type	V_{max} m³/h	$\Delta p_{t\ max}$ Pa	$\Delta p_{s\ min}$ W	n_{nom} min⁻¹	U_{nom} V	P_{max} W	I_{max} A	t_{max} °C	C µF	Controller type	m kg	ErP2015	
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	✓	η=32.2% (statA) N=44.0 (N44)
RPH 50 - 25/22 - 6D	1376	137	0	940	400	222	0,46	55	-	TRN 2D	43	✓	N/A (P1 < 125 W)
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	✓	η=39.2% (statA) N=47.1 (N44)
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	✓	η=38.8% (statA) N=45.9 (N44)
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	✓	η=36.6% (statA) N=44.0 (N44)
RPH 70 - 40/35 - 4D	5981	806	340	1440	400	3527	6	40	-	TRN 7D	110	✓	η=41.2% (statA) N=46.3 (N44)
RPH 80 - 50/40 - 8D	4720	298	0	700	400	1230	2,29	55	-	TRN 4D	118	✓	η=37.3% (statA) N=45.6 (N44)
RPH 80 - 50/40 - 6D	7357	496	0	960	400	2824	5,11	50	-	TRN 7D	132	✓	η=42.2% (statA) N=48.2 (N44)
RPH 80 - 50/40 - 4D	6831	1040	683	1410	400	4919	8,1	40	-	TRN 9D	139	✓	η=44.4% (statA) N=47.9 (N44)
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	✓	η=42.3% (statA) N=47.3 (N44)
RPH 90 - 50/45 - 8D	7810	386	0	690	400	1892	3,88	55	-	TRN 4D	165	✓	η=38.7% (statA) N=45.7 (N44)
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	✓	η=42.3% (statA) N=47.3 (N44)
RPH 100 - 50/45 - 8D	7810	386	0	690	400	1892	3,88	55	-	TRN 4D	174	✓	η=38.7% (statA) N=45.7 (N44)
RPH 100 - 50/56 - 4D	11731	1039	0	1383	400	3205	5,5	50	-	TRN 7D	206	✓	η=56.1% (statA) N=61.7 (N61)

SYMBOLS USED IN TABLE 4:

V_{max} maximum air flow rate

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)

$P_{max.}$ electric motor maximal power output

$I_{max.}$ maximum phase current at voltage **U** (this value must be checked)

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

C capacitor capacity with single-phase fans

FM. frequency inverter

m weight of the fan (±10%)

ErP2015 Fan compliance with the requirements of Regulation 2009/125/EC (NOT compliant fans must not be used within EU region)

DATA SECTION

Graph 1 enables quick selection of a suitable fan and alternate comparison of RPH 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 RPH fans.
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 ISO 3743-2. The noise parameters "levels of acoustic output into the surroundings" are calculated from the values for acoustic output measured according to EN ISO 11546-1. The output characteristics of the fans are measured according to the norms DIN 24 163 and AMCA Standard 210-74..

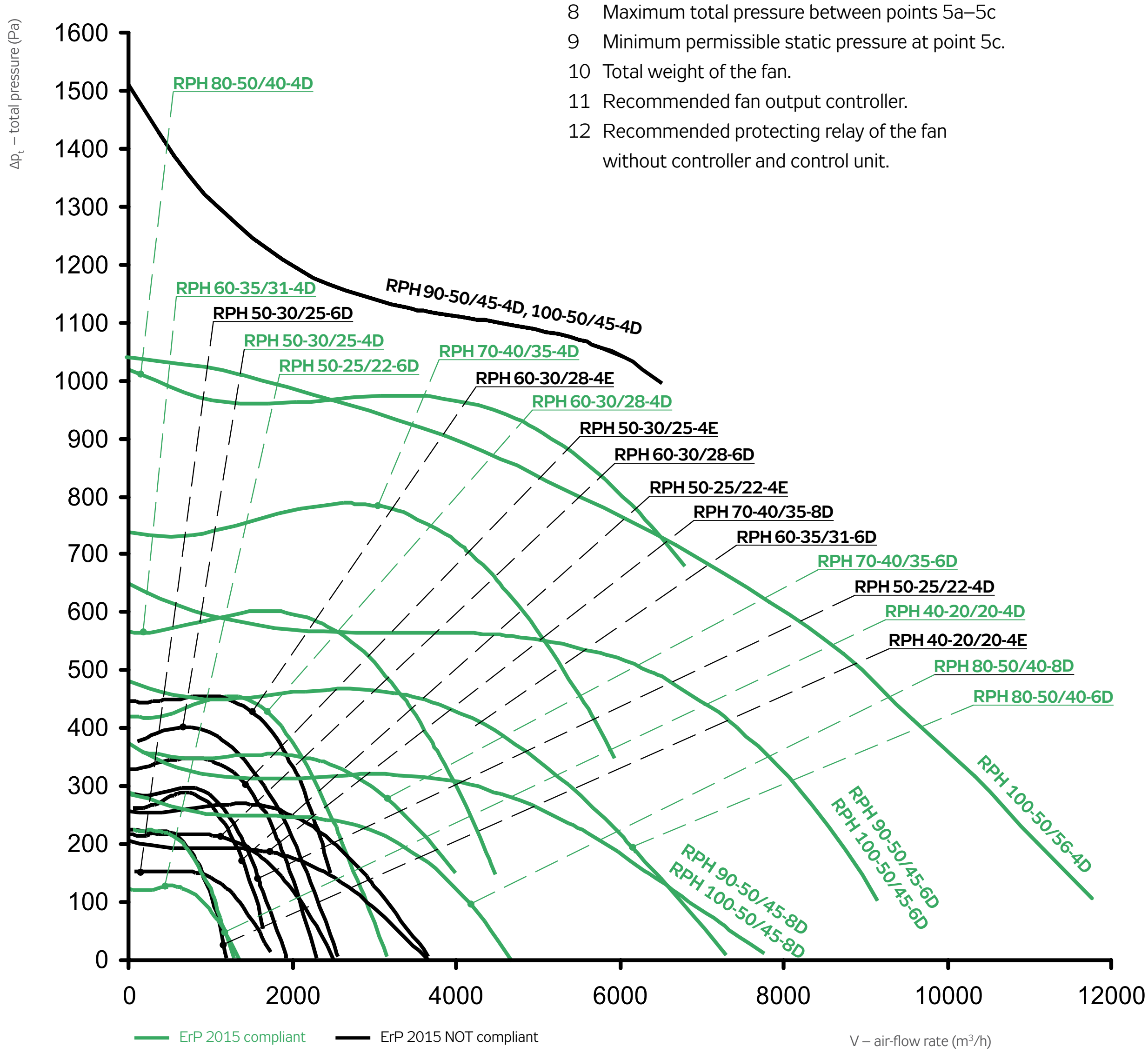
EXAMPLE AND EXPLANATIONS OF FAN DATA

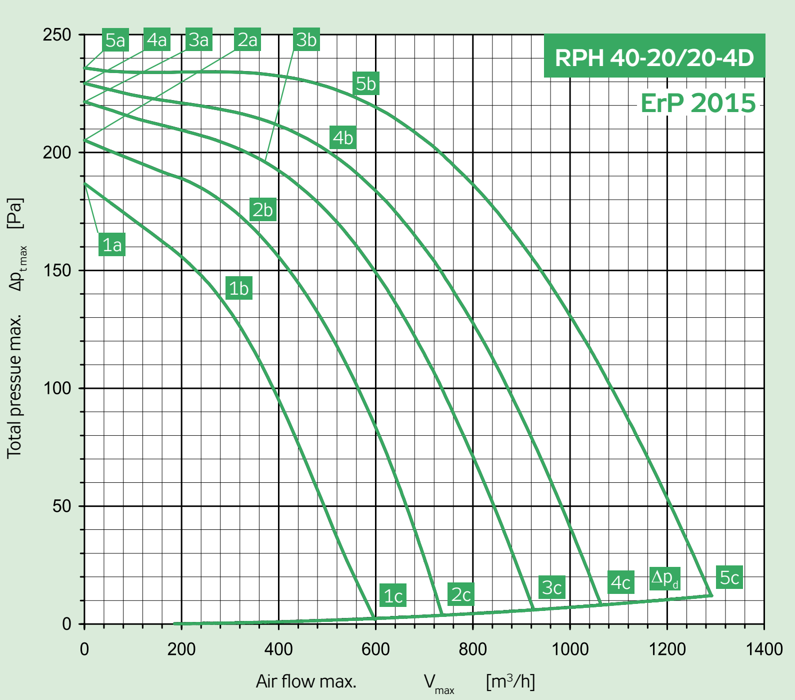
RPH 40-20/20-4D		3× 400 V	50 Hz
Power supply	Y		291
Max. electric input	P_{max}	[W]	0.50
Max. current (5c)	I_{max}	[A]	1420
Mean speed	n	[min^{-1}]	-
Capacitor	C	[F]	70
Max. working temp.	t_{max}	[ºC]	1292
Air flow max.	V_{max}	[m^3/h]	236
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	0
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	12.8
Weight	m	[kg]	TRN 2D
Five-stage controller	type		STD
Protecting relay	type		

The meaning of individual lines is as follows:

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.

GRAPH 1 – RPH FAN CHARACTERISTICS QUICK SELECTION

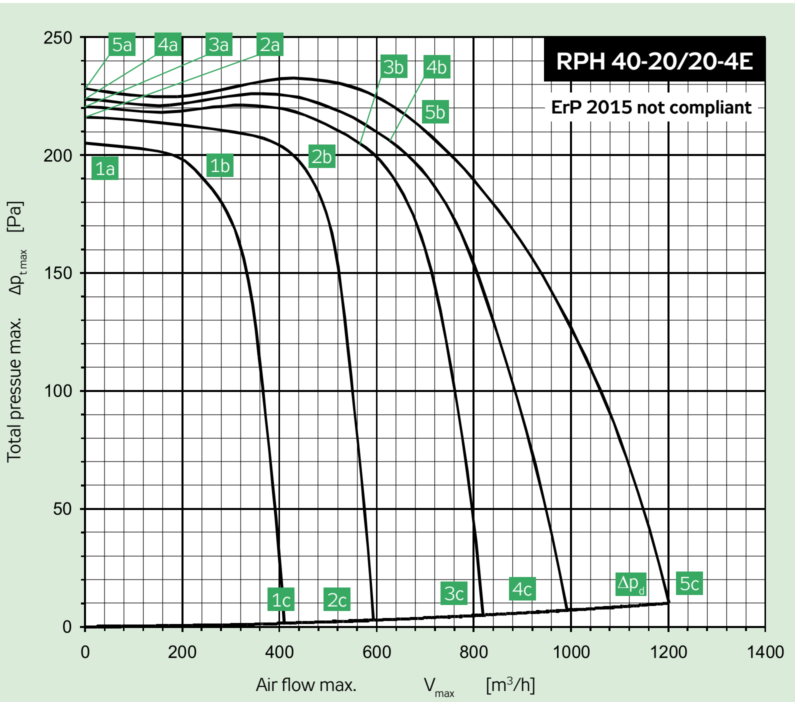




Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	291
Max. current (5c)	I_{max}	[A]	0.50
Mean speed	n	[min⁻¹]	1420
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	70
Air flow max.	V_{max}	[m³/h]	1292
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	236
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	36
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	68	74	34
Sound power level LWAokt [dB(A)]			
125 Hz	54	55	32
250 Hz	61	62	20
500 Hz	59	65	10
1000 Hz	62	70	0
2000 Hz	62	68	0
4000 Hz	60	66	0
8000 Hz	53	58	42

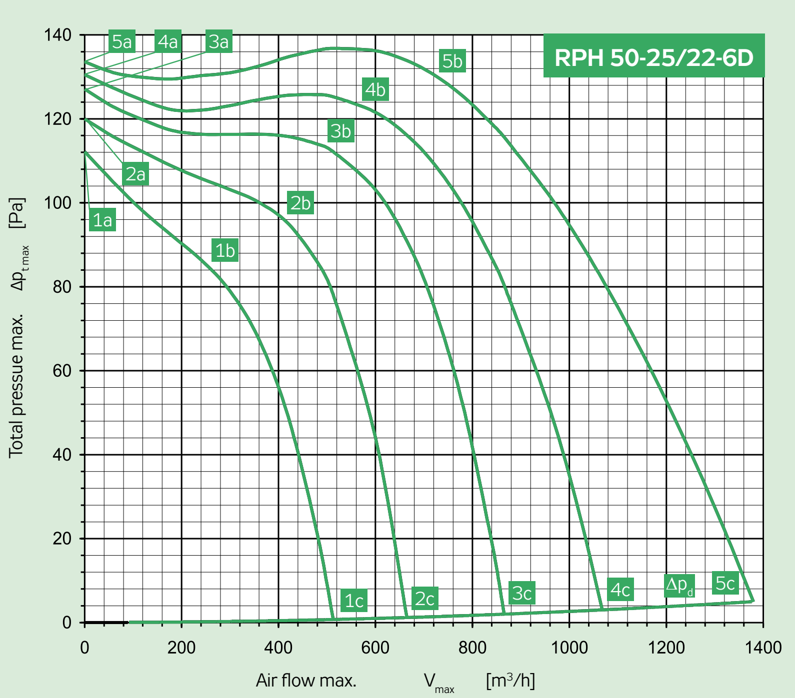
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.30	0.32	0.50	0.19	0.26	0.50	0.17	0.22	0.47	0.17	0.22	0.43	0.15	0.22	0.37
Input power P [W]	71	125	291	49	98	215	41	71	170	41	60	120	31	49	81
Speed n [min⁻¹]	1468	1418	1232	1438	1340	1011	1410	1319	892	1329	1226	734	1271	1094	590
Air flow V [m³/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



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	322
Max. current (5c)	I_{max}	[A]	1.60
Mean speed	n	[min⁻¹]	1420
Capacitor	C	[F]	5
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	1200
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	233
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	36
Five-stage controller	type		TRN 2E
Protecting relay	type		STE

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	71	78	43
Sound power level LWAokt [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

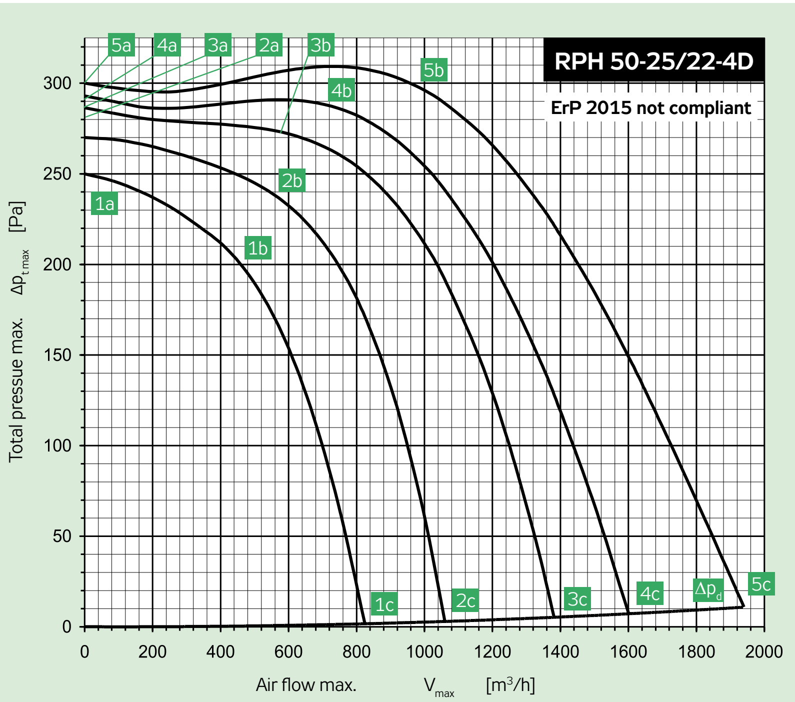
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	0.99	1.08	1.6	0.56	0.81	1.58	0.49	0.78	1.46	0.46	0.72	1.17	0.48	0.57	0.95
Input power P [W]	144	197	322	91	141	237	77	122	189	62	92	122	49	56	75
Speed n [min⁻¹]	1388	1416	1244	1459	1387	885	1449	1363	649	1428	1319	520	1391	1337	399
Air flow V [m³/h]	0	692	1200	0	629	851	0	576	607	0	459	470	0	254	358
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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	222
Max. current (5c)	I_{max}	[A]	0.46
Mean speed	n	[min^{-1}]	940
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	1376
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	137
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	43
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	66	66	35
Sound power level LWAokt [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

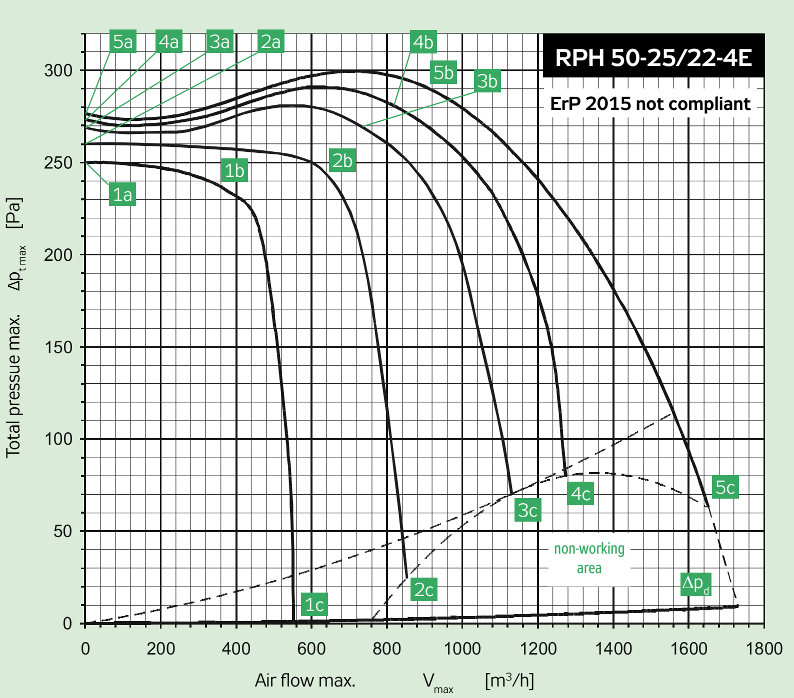
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.30	0.33	0.46	0.20	0.24	0.42	0.17	0.21	0.38	0.15	0.20	0.33	0.14	0.17	0.27
Input power P [W]	62	110	222	36	68	151	31	56	111	26	44	73	22	30	45
Speed n [min^{-1}]	986	943	825	971	912	650	954	878	548	921	823	420	873	795	347
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	590
Max. current (5c)	I_{max}	[A]	1.00
Mean speed	n	[min^{-1}]	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	1937
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	309
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	45
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	72	78	42
Sound power level LWAokt [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

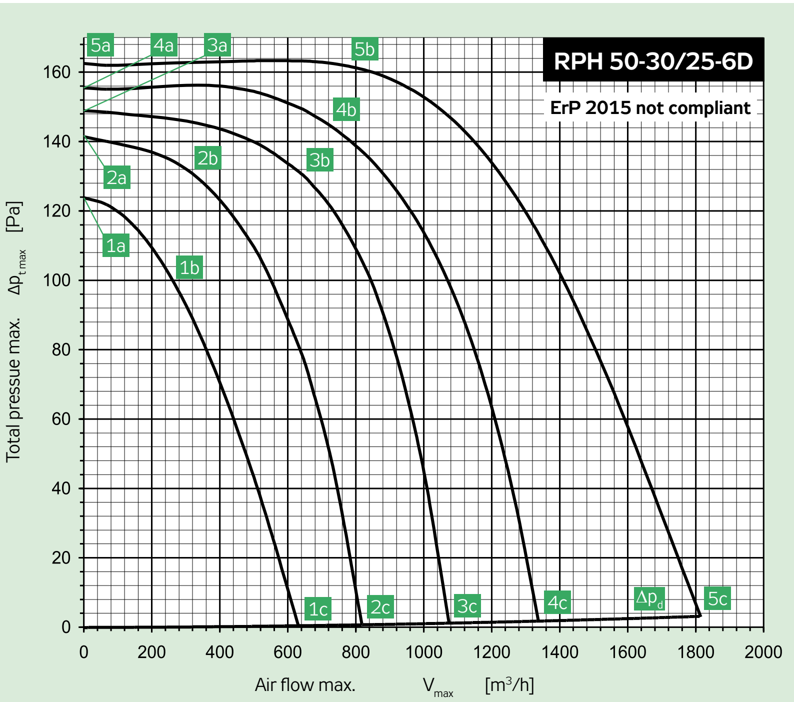
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.58	0.63	1.00	0.34	0.46	1.07	0.28	0.40	1.00	0.26	0.45	0.97	0.27	0.45	0.84
Input power P [W]	119	249	590	85	174	478	67	131	379	60	121	251	54	96	167
Speed n [min^{-1}]	1485	1439	1306	1463	1400	1085	1448	1377	948	1409	1284	744	1353	1189	585
Air flow V [m³/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



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	499
Max. current (5c)	I_{max}	[A]	2.30
Mean speed	n	[min⁻¹]	1420
Capacitor	C	[F]	8
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	1648
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	299
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	45
Weight	m	[kg]	18.1
Five-stage controller	type		TRN 4E
Protecting relay	type		STE

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	73	77	44
Sound power level LWAokt [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

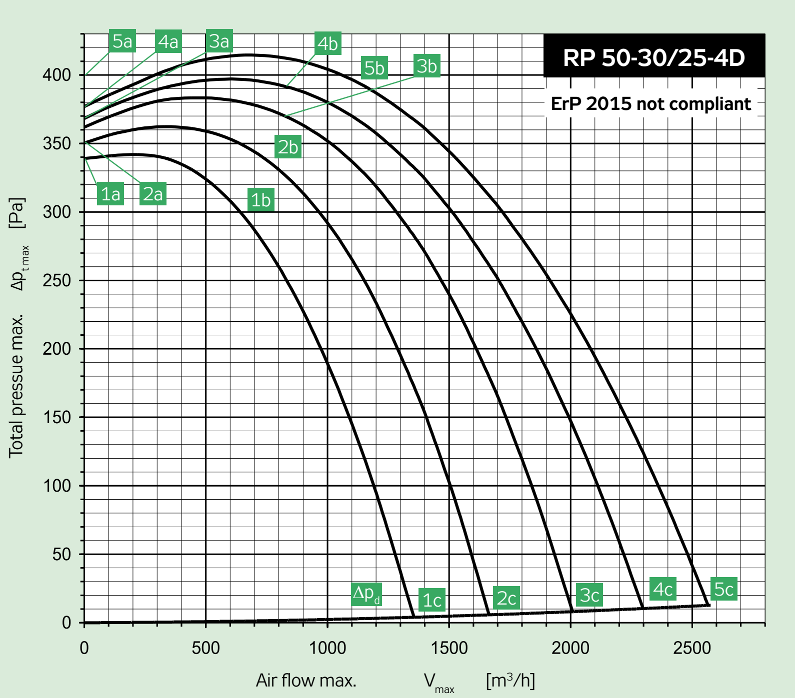
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	1.07	1.33	2.30	0.69	1.15	2.25	0.66	1.11	2.20	0.70	1.11	2.01	0.66	0.90	1.64
Input power P [W]	181	275	499	124	211	381	108	180	319	95	147	225	73	97	146
Speed n [min⁻¹]	1471	1419	1259	1466	1398	1081	1456	1373	881	1426	1318	541	1399	1316	416
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	356
Max. current (5c)	I_{max}	[A]	0.69
Mean speed	n	[min⁻¹]	940
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	50
Air flow max.	V_{max}	[m³/h]	1811
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	163
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	49
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	65	68	34
Sound power level LWAokt [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

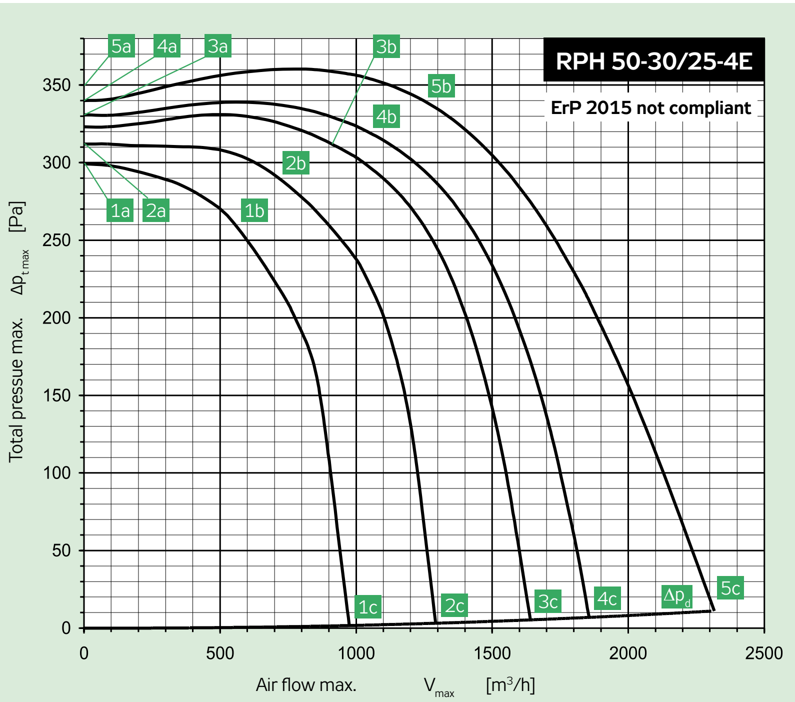
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.42	0.45	0.69	0.30	0.36	0.65	0.25	0.33	0.57	0.21	0.25	0.47	0.21	0.24	0.38
Input power P [W]	76	133	356	49	104	223	42	88	157	37	51	98	33	41	59
Speed n [min⁻¹]	977	943	770	959	891	593	942	844	481	912	861	377	840	772	306
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1004
Max. current (5c)	I_{max}	[A]	1.97
Mean speed	n	[min⁻¹]	1450
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	50
Air flow max.	V_{max}	[m³/h]	2576
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	414
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	52
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	74	79	44
Sound power level LWAokt [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

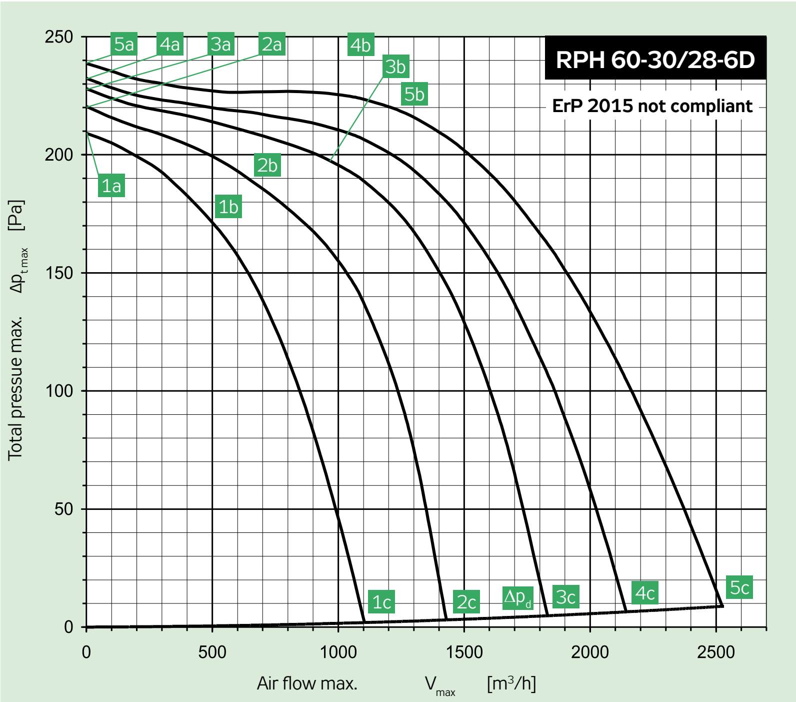
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.30	1.37	1.97	0.72	0.88	1.92	0.60	0.89	2.10	0.52	0.90	1.99	0.49	0.93	1.77
Input power P [W]	223	441	1004	133	271	803	120	268	700	114	246	519	97	205	358
Speed n [min⁻¹]	1479	1454	1362	1469	1417	1216	1457	1387	1096	1434	1336	904	1390	1277	731
Air flow V [m³/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



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	831
Max. current (5c)	I_{max}	[A]	3.68
Mean speed	n	[min⁻¹]	1380
Capacitor	C	[F]	14
Max. working temp.	t_{max}	[°C]	50
Air flow max.	V_{max}	[m³/h]	2305
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	360
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	53
Five-stage controller	type		TRN 4E
Protecting relay	type		STE

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	75	81	45
Sound power level LWAokt [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

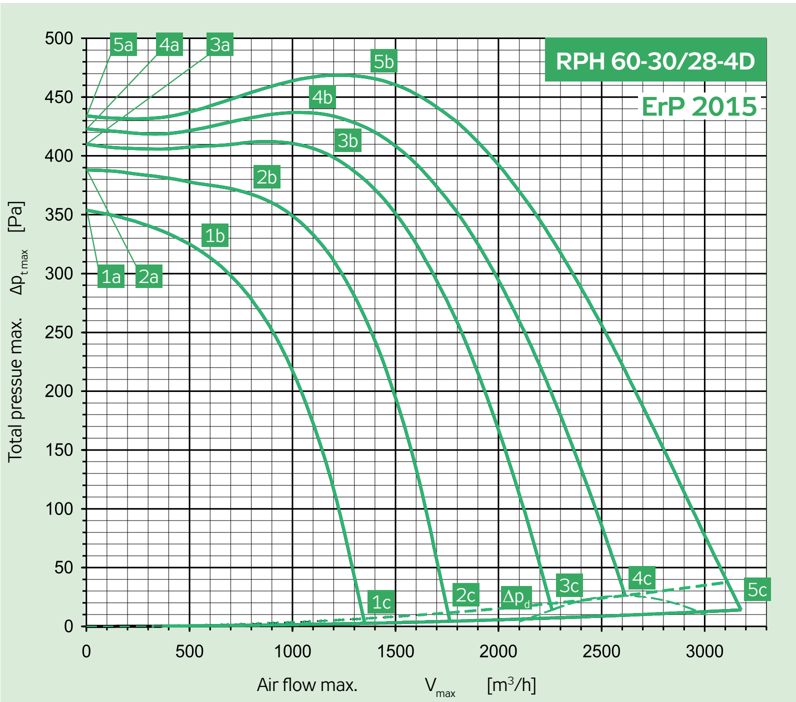
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	1.23	1.94	3.68	1.11	1.87	3.64	1.09	1.76	3.51	1.02	1.62	3.07	0.98	1.55	2.64
Input power P [W]	270	444	831	199	339	632	174	286	539	135	215	381	107	167	262
Speed n [min⁻¹]	1453	1382	1162	1436	1336	943	1424	1319	830	1402	1276	664	1368	1205	508
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	575
Max. current (5c)	I_{max}	[A]	1.28
Mean speed	n	[min⁻¹]	960
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Air flow max.	V_{max}	[m³/h]	2531
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	239
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	62
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	69	73	43
Sound power level LWAokt [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

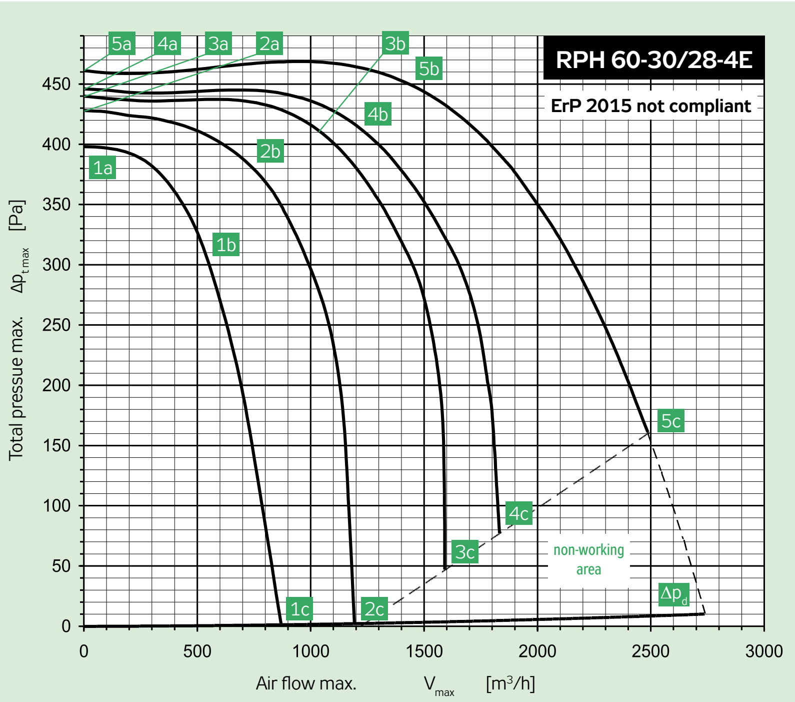
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.30	0.32	0.50	0.19	0.26	0.50	0.17	0.22	0.47	0.17	0.22	0.43	0.15	0.22	0.37
Input power P [W]	71	125	291	49	98	215	41	71	170	41	60	120	31	49	81
Speed n [min⁻¹]	1468	1418	1232	1438	1340	1011	1410	1319	892	1329	1226	734	1271	1094	590
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1397
Max. current (5c)	I_{max}	[A]	2.38
Mean speed	n	[min⁻¹]	1450
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	3178
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	469
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	68
Five-stage controller	type		TRN 4 D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	78	83	46
Sound power level LWAokt [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

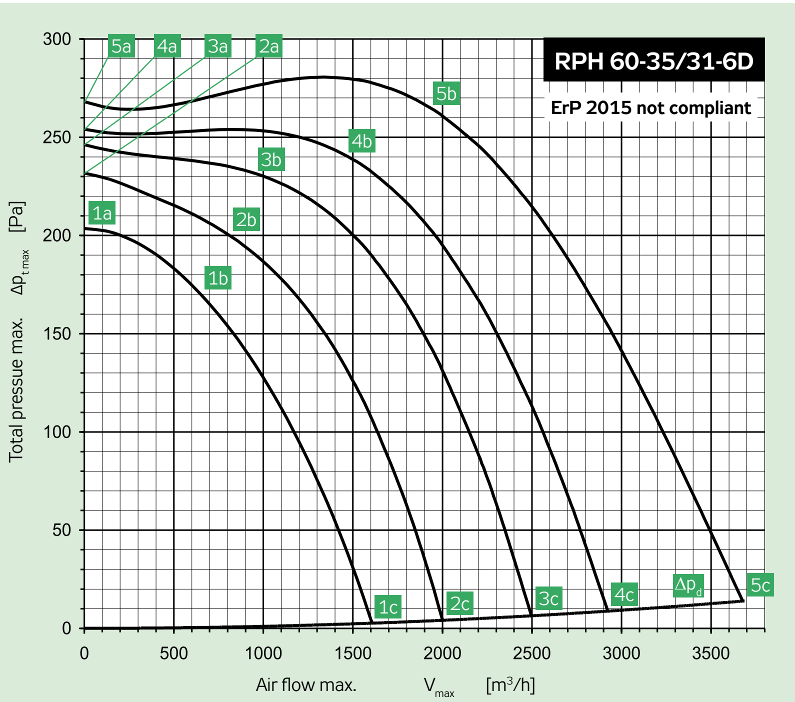
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.04	1.20	2.38	0.69	0.98	2.60	0.62	1.07	2.60	0.62	1.02	2.43	0.66	0.94	2.06
Input power P [W]	267	512	1397	201	380	1088	181	372	870	161	285	612	142	206	393
Speed n [min⁻¹]	1483	1448	1307	1461	1409	1105	1438	1346	938	1404	1301	736	1344	1246	568
Air flow V [m³/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



Power supply		230 V	50 Hz
Max. electric input	P_{max}	[W]	1046
Max. current (5c)	I_{max}	[A]	5.10
Mean speed	n	[min^{-1}]	1400
Capacitor	C	[F]	16
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	2496
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	469
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	152
Weight	m	[kg]	68
Five-stage controller	type		TRN 7E
Protecting relay	type		STE

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	77	83	49
Sound power level LWAokt [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

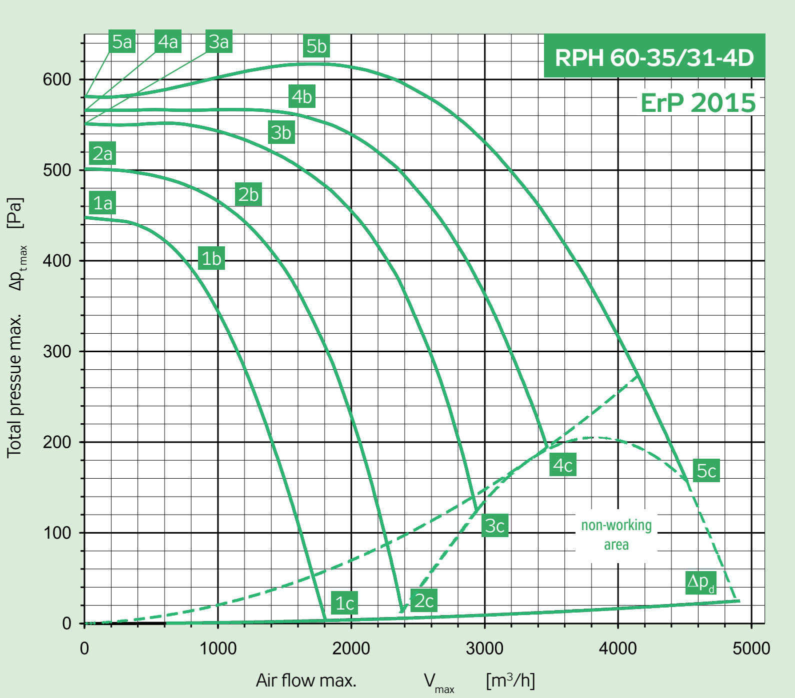
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		230			180			160			130			105	
Current I [A]	2.08	2.96	5.10	1.42	2.66	5.10	1.43	2.52	5.10	1.40	2.38	4.30	1.49	2.43	3.48
Input power P [W]	345	603	1046	247	452	775	225	389	681	185	294	457	158	234	294
Speed n [min^{-1}]	1465	1400	1237	1453	1353	898	1446	1345	760	1422	1288	499	1372	1157	385
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	948
Max. current (5c)	I_{max}	[A]	1.86
Mean speed	n	[min^{-1}]	910
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	3687
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	281
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	72
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	70	75	45
Sound power level LWAokt [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

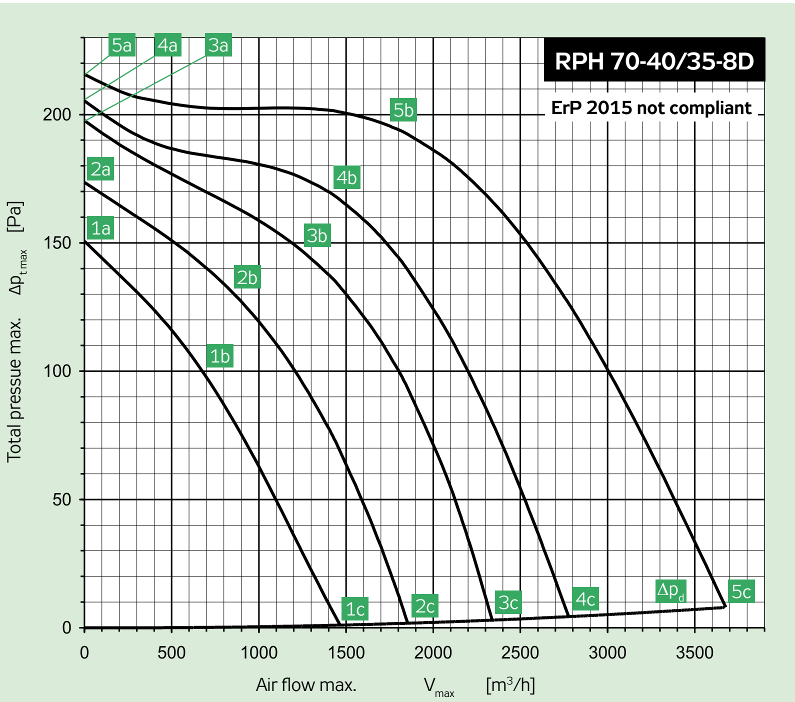
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.30	1.36	1.86	0.68	0.87	1.56	0.56	0.68	1.42	0.46	0.64	1.23	0.44	0.60	1.02
Input power P [W]	226	476	948	120	287	606	109	186	457	87	152	302	69	110	194
Speed n [min^{-1}]	977	908	754	959	866	609	940	878	532	909	808	429	866	755	355
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	2464
Max. current (5c)	I_{max}	[A]	4.10
Mean speed	n	[min⁻¹]	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	4512
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	617
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	136
Weight	m	[kg]	80
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	78	83	53
Sound power level LWAokt [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

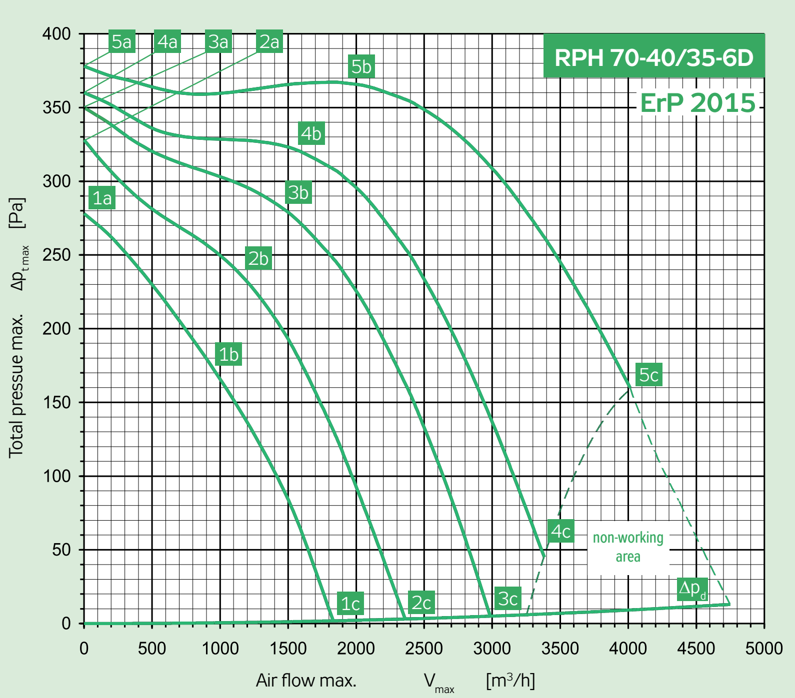
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.41	1.72	4.10	1.04	1.62	4.10	1.06	1.62	4.10	1.07	1.73	4.10	1.13	1.77	3.39
Input power P [W]	503	832	2464	351	666	1730	343	563	1374	295	484	1007	252	382	629
Speed n [min⁻¹]	1474	1440	1252	1445	1383	1083	1418	1346	912	1381	1270	603	1321	1164	461
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	642
Max. current (5c)	I_{max}	[A]	1.38
Mean speed	n	[min⁻¹]	670
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	55
Air flow max.	V_{max}	[m³/h]	3669
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	216
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	93
Five-stage controller	type		TRN 2D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	68	72	45
Sound power level LWAokt [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

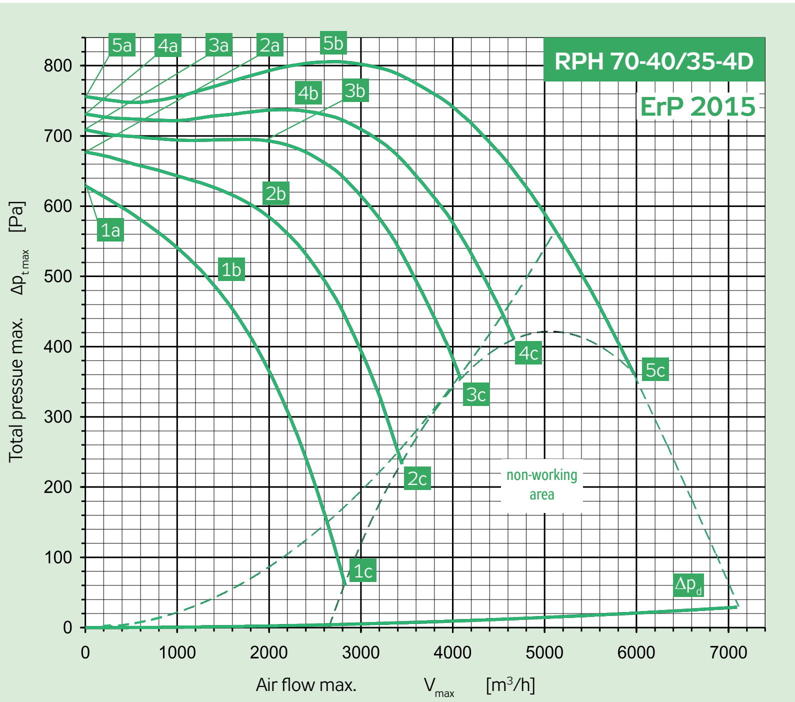
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.90	0.97	1.38	0.57	0.71	1.15	0.48	0.64	1.00	0.41	0.53	0.83	0.37	0.49	0.68
Input power P [W]	166	318	642	100	205	390	84	167	277	71	111	179	60	84	113
Speed n [min⁻¹]	725	673	532	706	631	406	689	592	351	657	573	278	605	495	223
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1096
Max. current (5c)	I_{max}	[A]	2.00
Mean speed	n	[min⁻¹]	920
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	4032
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	378
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	151
Weight	m	[kg]	92
Five-stage controller	type		TRN 4D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	73	79	68
Total sound power level LWA [dB(A)]			
L_{WA}	74	79	47
Sound power level LWAokt [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

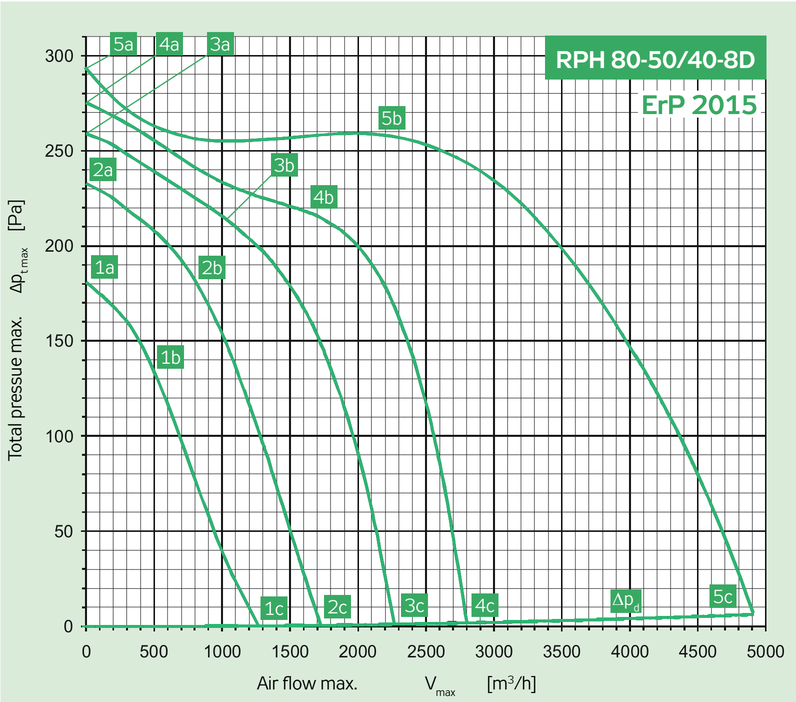
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.98	1.19	2.00	0.67	0.97	2.00	0.60	0.99	1.92	0.56	0.93	1.60	0.57	0.91	1.29
Input power P [W]	206	500	1096	153	350	784	138	316	600	127	239	392	112	182	243
Speed n [min⁻¹]	977	922	779	954	872	566	935	813	424	896	756	354	835	644	285
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	3527
Max. current (5c)	I_{max}	[A]	6.00
Mean speed	n	[min⁻¹]	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	5981
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	806
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	340
Weight	m	[kg]	110
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	84	90	57
Sound power level LWAokt [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

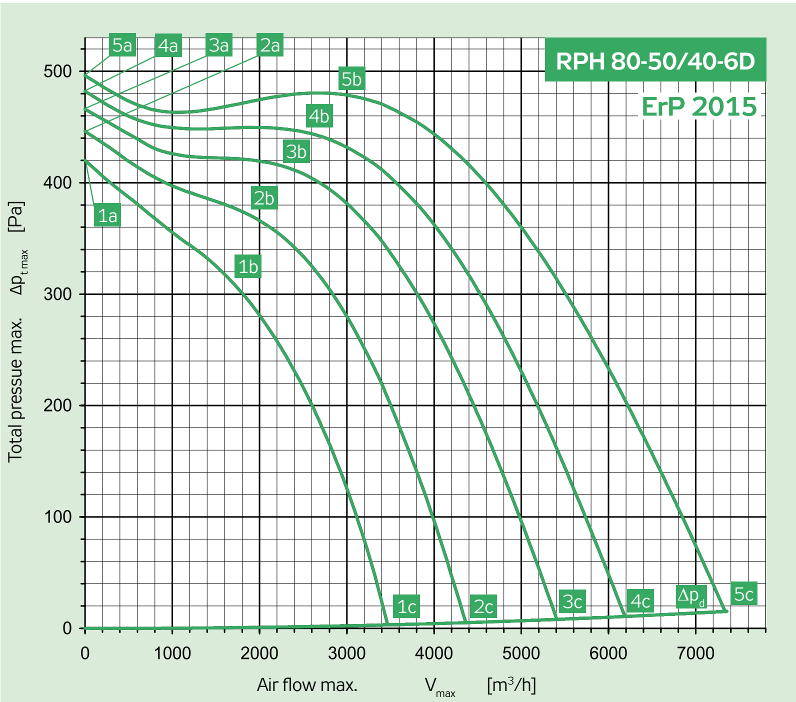
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.98	2.67	6.00	1.54	2.61	6.00	1.41	2.68	6.00	1.84	3.34	6.00	1.98	3.27	5.73
Input power P [W]	442	1231	3527	483	1065	2522	410	931	2028	503	924	1520	437	697	1055
Speed n [min⁻¹]	1478	1442	1312	1457	1397	1189	1441	1355	1083	1387	1244	891	1327	1157	598
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1230
Max. current (5c)	I_{max}	[A]	2.29
Mean speed	n	[min⁻¹]	700
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	4720
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	298
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	118
Five-stage controller	type		TRN 4D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	69	74	45
Sound power level LWAokt [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 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
Input power 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 [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	2824
Max. current (5c)	I_{max}	[A]	5.11
Mean speed	n	[min⁻¹]	960
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	50
Air flow max.	V_{max}	[m³/h]	7357
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	496
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	132
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	77	81	48
Sound power level LWAokt [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 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]	2.17	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
Input power 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 [m³/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

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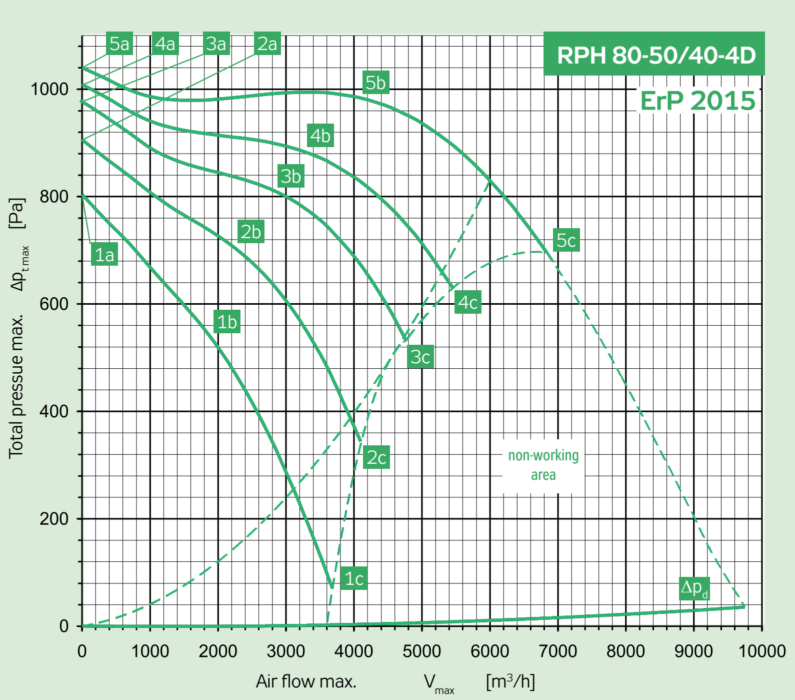
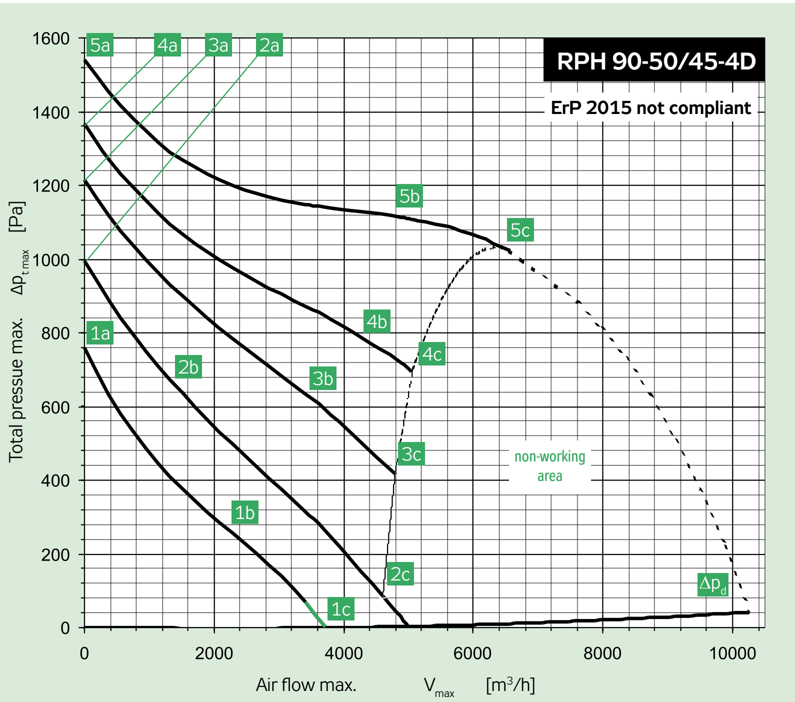


Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8.10
Mean speed	n	[min⁻¹]	1410
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	6831
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	1040
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	683
Weight	m	[kg]	139
Five-stage controller	type		TRN 9D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	88	92	57
Sound power level LWAokt [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

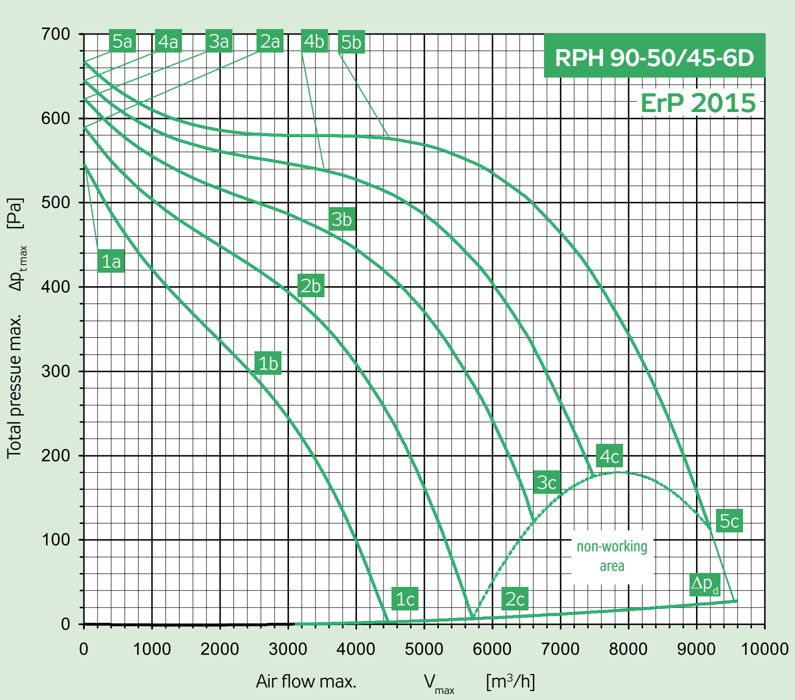
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	3.00	5.01	8.10	2.38	4.91	8.10	2.33	4.93	8.10	2.54	4.88	8.10	2.96	5.21	8.10
Input power P [W]	1217	2915	4919	903	2143	3498	782	1770	2800	721	1379	2117	671	1110	1516
Speed n [min⁻¹]	1480	1414	1322	1452	1348	1195	1427	1293	1088	1380	1214	890	1298	1055	548
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8.30
Mean speed	n	[min⁻¹]	1260
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	6558
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	1541
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	1014
Weight	m	[kg]	168
Five-stage controller	type		TRN 9D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	88	95	58
Sound power level LWAokt [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

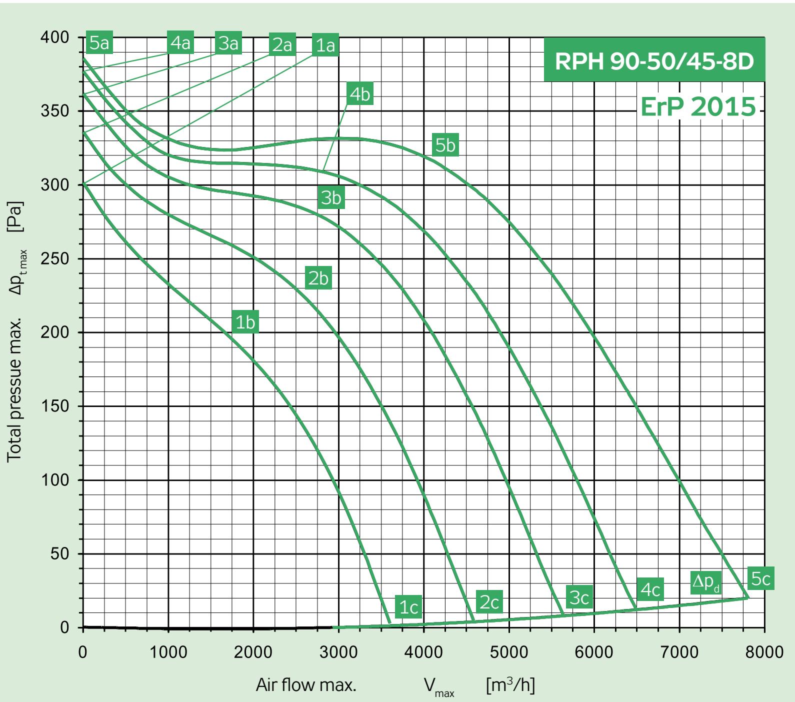
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	3.74	7.20	8.30	3.44	7.41	8.30	3.65	6.97	8.30	4.07	5.07	8.17	4.11	5.50	6.32
Input power P [W]	1993	4269	4919	1402	3055	3367	1259	2318	2718	1073	1330	1927	829	1041	1119
Speed n [min⁻¹]	1396	1259	1211	1343	1069	997	1280	957	800	1137	1009	376	978	623	285
Air flow V [m³/h]	0	5512	6558	0	4398	5055	0	3583	4805	0	1543	4986	0	2286	3707
Static pressure Δp_s [Pa]	1541	1111	1014	1367	777	693	1216	617	435	994	652	0	758	267	0
Total pressure Δp_t [Pa]	1541	1118	1023	1367	781	699	1216	619	440	994	652	5	758	268	3



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	3780
Max. current (5c)	I_{max}	[A]	6.80
Mean speed	n	[min⁻¹]	930
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	9200
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	667
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	90
Weight	m	[kg]	168
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	81	88	48
Sound power level LWAokt [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

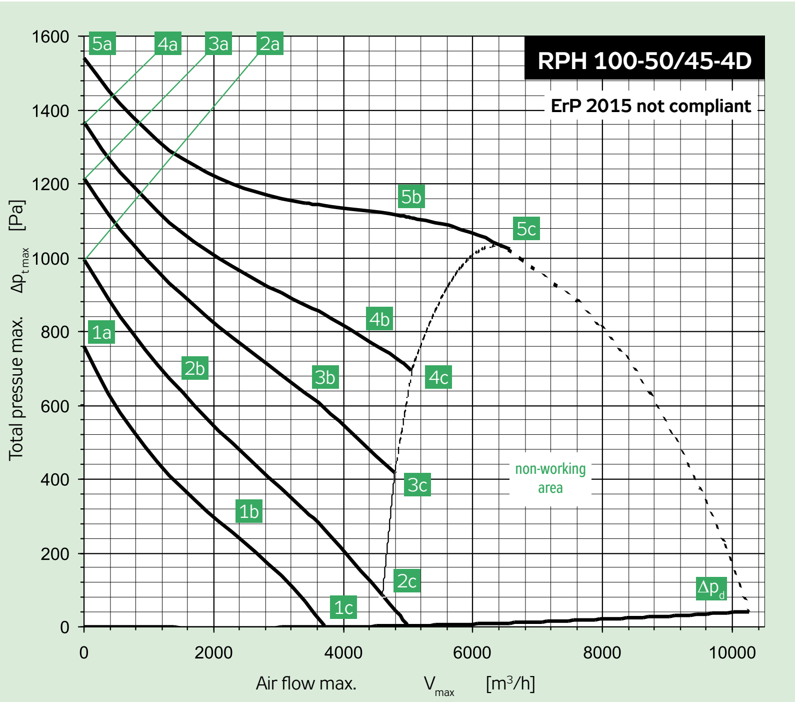
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	2.96	3.87	6.80	2.15	3.45	6.80	1.99	3.75	6.80	1.98	3.86	6.66	2.03	3.74	5.59
Input power P [W]	665	1757	3780	564	1315	2785	518	1242	2271	476	1025	1640	415	760	1040
Speed n [min⁻¹]	968	926	832	948	879	713	931	825	621	899	749	443	846	659	351
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	1892
Max. current (5c)	I_{max}	[A]	3.88
Mean speed	n	[min⁻¹]	690
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	7810
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	386
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	165
Five-stage controller	type		TRN 4D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	74	81	41
Sound power level LWAokt [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

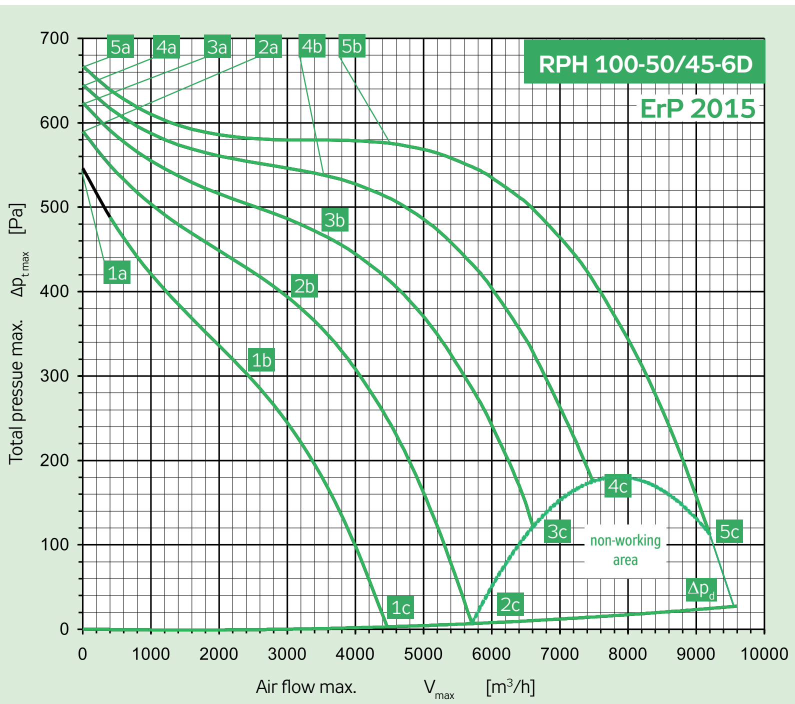
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	2.20	2.49	3.88	1.54	2.03	3.78	1.32	1.87	3.61	1.14	1.92	3.20	1.08	1.67	2.73
Input power P [W]	350	813	1892	264	624	1398	222	518	1081	196	455	733	178	311	477
Speed n [min⁻¹]	725	694	610	715	661	505	704	641	434	683	577	349	646	543	277
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	4919
Max. current (5c)	I_{max}	[A]	8.30
Mean speed	n	[min⁻¹]	1260
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	6558
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	1541
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	1014
Weight	m	[kg]	177
Five-stage controller	type		TRN 9D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	88	95	58
Sound power level LWAokt [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

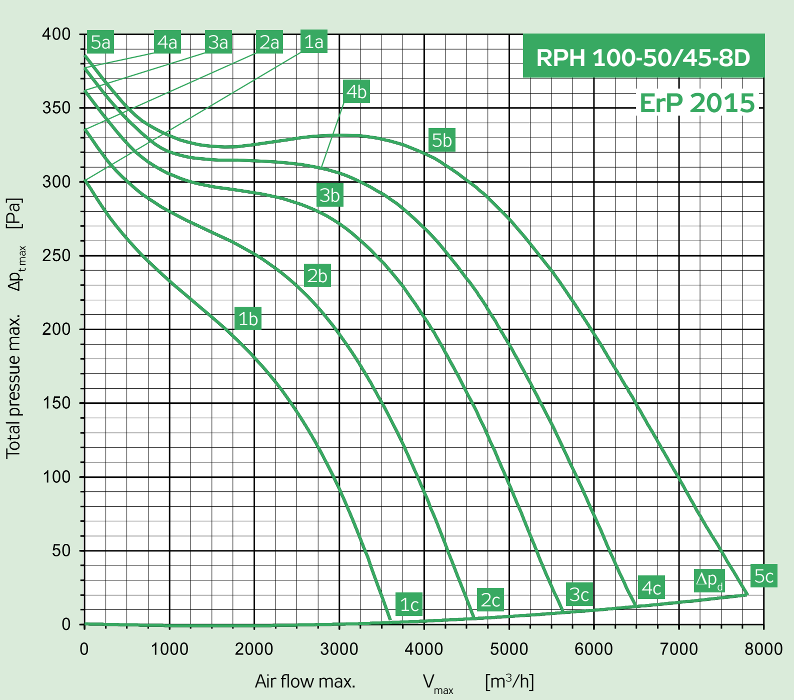
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	3.74	7.20	8.30	3.44	7.41	8.30	3.65	6.97	8.30	4.07	5.07	8.17	4.11	5.50	6.32
Input power P [W]	1993	4269	4919	1402	3055	3367	1259	2318	2718	1073	1330	1927	829	1041	1119
Speed n [min⁻¹]	1396	1259	1211	1343	1069	997	1280	957	800	1137	1009	376	978	623	285
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	3780
Max. current (5c)	I_{max}	[A]	6.80
Mean speed	n	[min⁻¹]	930
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	9200
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	667
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	90
Weight	m	[kg]	177
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	81	88	48
Sound power level LWAokt [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

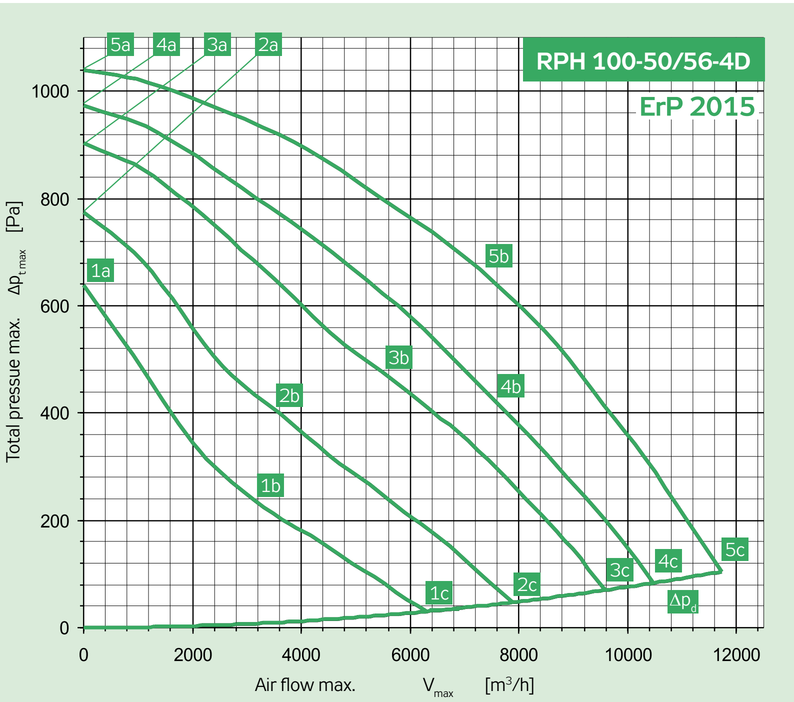
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	2.96	3.87	6.80	2.15	3.45	6.80	1.99	3.75	6.80	1.98	3.86	6.66	2.03	3.74	5.59
Input power P [W]	665	1757	3780	564	1315	2785	518	1242	2271	476	1025	1640	415	760	1040
Speed n [min⁻¹]	968	926	832	948	879	713	931	825	621	899	749	443	846	659	351
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1892
Max. current (5c)	I_{max}	[A]	3.88
Mean speed	n	[min⁻¹]	690
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	55
Air flow max.	V_{max}	[m³/h]	7810
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	386
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	174
Five-stage controller	type		TRN 4D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	74	81	41
Sound power level LWAokt [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 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
Input power 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 [m³/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



Power supply	Y	3× 400 V	50 Hz
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}	[ºC]	50
Air flow max.	V_{max}	[m³/h]	11731
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	1039
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	206
Five-stage controller	type		TRN 7D
Protecting relay	type		STD

	Sání	Výtlak	Okolí
Bod	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	92	98	55
Sound power level LWAokt [dB(A)]			
125 Hz	73	78	53
250 Hz	80	90	51
500 Hz	88	93	40
1000 Hz	87	94	27
2000 Hz	85	90	19
4000 Hz	77	82	0
8000 Hz	68	71	0

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
Input power 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 V [m³/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

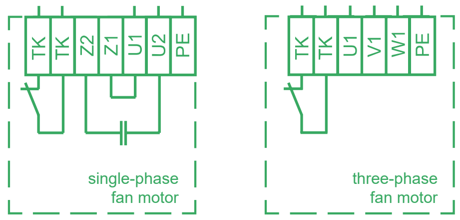
INSTALLATION

- RPH 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.
- It is recommended to insert the DV elastic connections in front of and behind the fan.
- It is advisable to always place the KFD or VFK air filters, respectively VFT metal grease filter in front of the fan to protect the fan and duct against dirtying and dust fouling.
- The fan must always be mounted on a separate hinges to avoid dampers or connected piping to be burdened. Trailers must be noise-isolated noise and vibration-proof (elastic shock absorber).
- RPH fans can work only in a horizontal position. When placed under the ceiling is useful (for better access to the terminal block and the motor) to mount fan motor facing cup downwards.
- 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.
- The construction and arrangement of the fan outlet is similar to the RP fan. It is obvious that from the entire cross-section (e.g. 500 x 250) only 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 attenuators (or other resistant elements) from the outlet, the better [1].
  On the inlet side, the DV elastic connection will be sufficient as a distance piece in most cases.

WIRING

- The wiring can be performed only by a qualified worker licensed in accordance with national regulations.
- Terminal box located under opening panel with handle is fixed with screws to the fan casing is equipped with WAGO terminals; max. cross-section of connecting conductors 1.5 mm^2
- 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.
- For fan wiring diagram refer to figure 5.

FIGURE 5 – WIRING DIAGRAM



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

TK
– motor thermo-contact terminals
U1, V1, W1
– three-phase motor power supply terminals 400 V / 50 Hz
PE
– protective conductor terminal

On 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.

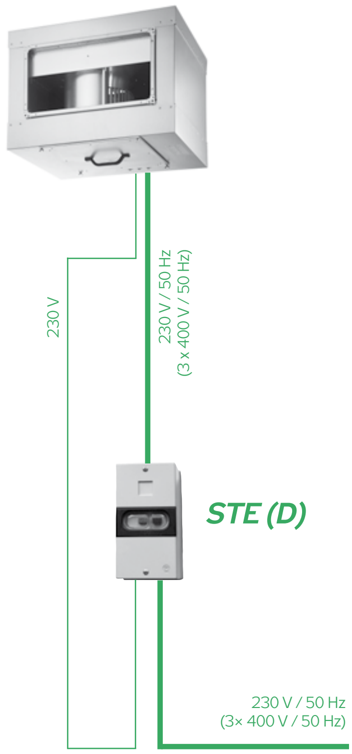
[1] That recommendation applies to all duct fans.

EXAMPLE A
RPH FAN WITHOUT OUTPUT CONTROL
AND WITH STE(D) PROTECTING RELAY

The RPH fan connection in a simple venting system without output control is shown in figure # 6.
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 ºC 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 black "I" button.

FIGURE 6 – FAN CONNECTION

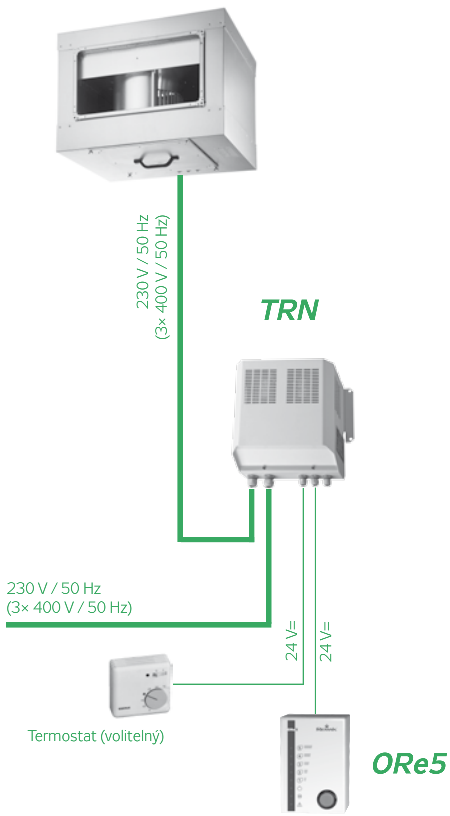


EXAMPLE B
RPH FAN WITH OUTPUT CONTROL
AND TRN CONTROLLER

The RPH fan connection in a venting system with output control using TRN controller with ORe5 controller is shown in figure # 7.
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 ORe 5 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 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 option "STOP" on Ore 5 must not be blocked.

FIGURE 7 – FAN CONNECTION



EXAMPLE C
RPH FAN WITH TRN CONTROLLER AND CONTROL UNIT

The RPH fan with TRN output controller and a common internal controller in more sophisticated venting systems using the control unit is shown in figure # 8. The internal control is installed in the control unit during production.

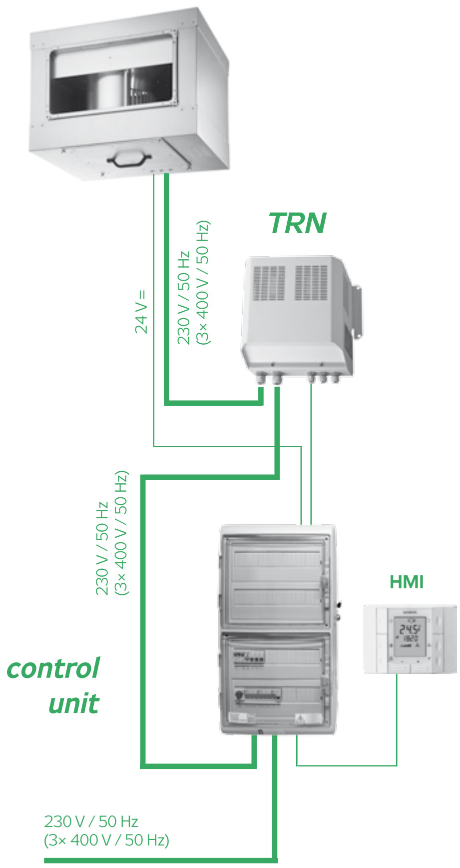
This connection ensures:

- 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.
- Fan output control within the stage range 1-5 manually via HMI controller or using time schedule function of the control unit.

In the connection with control unit, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the TRN-D controller..

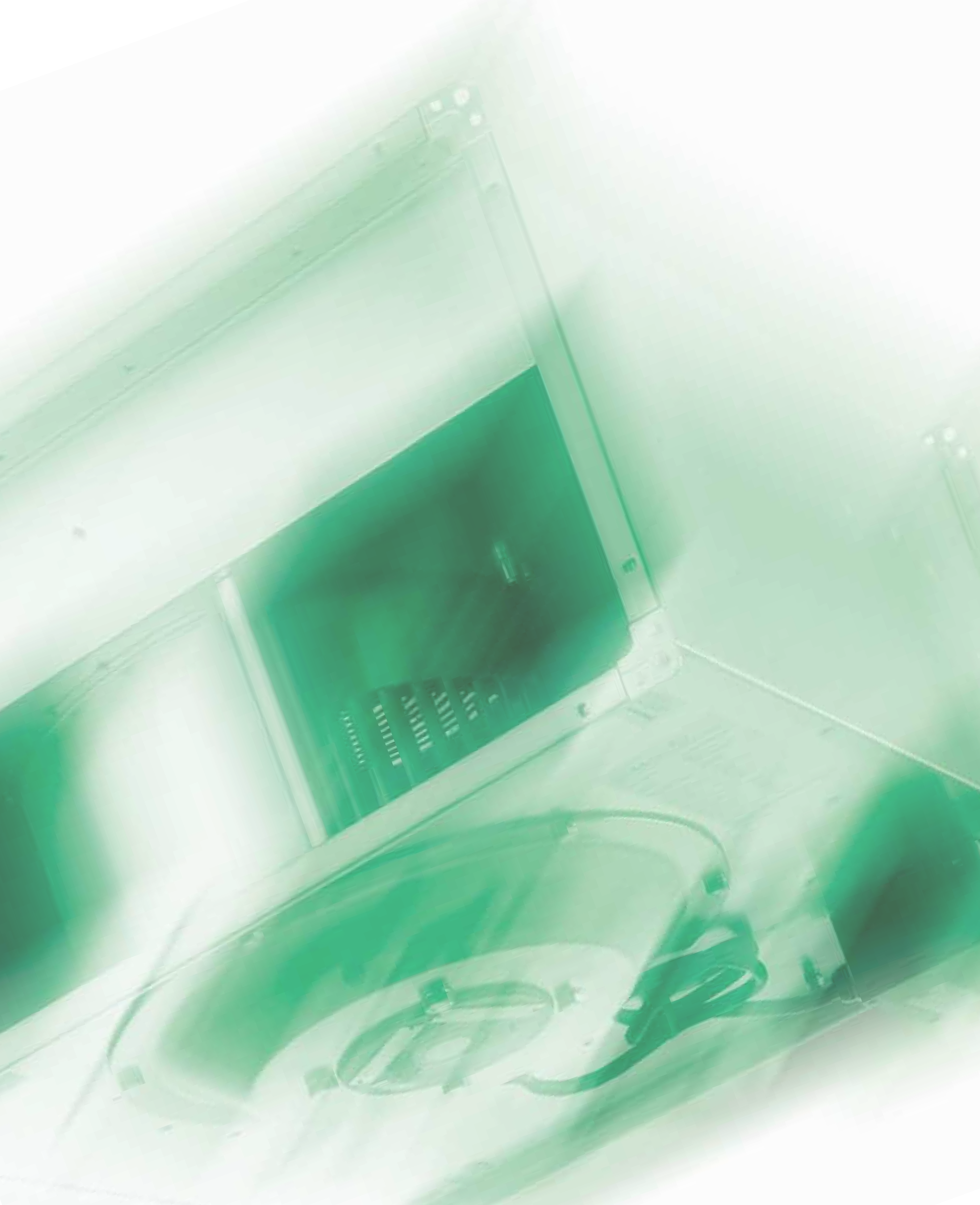
The air-handling system is started by the control unit. All protecting and safety functions of fans as well as the entire system are ensured by the control unit.

FIGURE 8 – FAN CONNECTION



RP Ex Fans

RP * - */* - ** Ex



FANS USE

Ex versions of fully controlled, low-pressure RP radial fans can be universally used for complex air-conditioning, from simple venting installations to sophisticated air-handling systems..
Due to the special design preventing the formation of mechanical sparks according to EN 80079-36, EN 80079-37 (formerly EN 13463-1, EN 13463-5) and the secured design of the "e" electric motor according to EN 60079-0 ed. 4, the fans are predestined for use in explosion hazardous environments.

OPERATING CONDITIONS, POSITION

RP Ex fans are approved by the Notified Body No. NB 1026, Physical-Technical Testing Institute, s.p., Ostrava-Radvanice, certificate number FTZÚ 06 ATEX 0336X.
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.
In terms of the classification of areas with a risk of explosion ČSN EN 60079-10-1, the fans are designed for the environment and for the extraction of air from the environment **Zone 1** nebo **Zone 2**.
Explosion-proof RP Ex fans, secure version "e", belong according to EN 60079-0 to Group II[1)] and are labelled with the **II 2G Ex eb IIC T3 Gb** marks.
The fans themselves are labelled with the **II 2 / 2 G Ex h IIB+H_2 T3 Gb / Gb** marks.
The fans can work in any position.

FIGURE 1 – THE EXPLOSION PROOF DESIGNATION

Marking according to Directive No. 2014/34/EU

Ex	explosion proof symbol
II	equipment group – equipment for surface applications in an explosive atmosphere
2/2 G	equipment category – fan extracting from zone 1, located in zone 1 [1)]

Marking according to the ČSN EN ISO 80079-36:2016 standard

Ex h	non-electrical equipment: – protection by safe construction "c" – aerial distance between parts, IP
IIB+H_2	a subgroup of gases according to the properties of the explosive gas atmosphere
T3	temperature class, maximum surface temperature of the device T ≤ 200 °C
Gb/Gb	equipment protection level (EPL) for the interior and exterior of the equipment

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

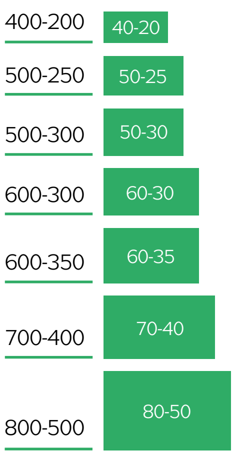
When positioned under the ceiling, it is advisable to situate the RP Ex fan with its cup directed downwards to ease access to the motor terminal box. However, if transported air is oversaturated with moisture or if the risk of intensive steam condensation inside the fan exists, it is advisable to situate 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.

DIMENSIONAL RANGE

RP Ex fans are manufactured in a range of six sizes according to the A x B dimensions of the connecting flange.
The standard dimensional and performance range of explosion-proof fans enables the designers to optimize all parameters for air flow up to 5,800 m^3 per hour.

FIGURE 2 - DIMENSIONAL RANGE

RP Ex fans
A × B [mm]



MATERIALS

The external casing and connecting flanges of RP 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 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) resp. 2014/34/EU 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 motors are characterized by a relatively low inrush current.

FIGURE 4

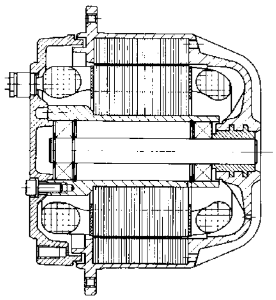


FIGURE 5 – THERMISTOR

ELECTRICAL INSTALLATION

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! Electric motors must not be connected in a delta. They are always connected only to the star (at nominal voltage 3x400V / 50Hz or reduced voltage).

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. The thermistors must be connected to an ATEX certified thermistor relay (approved type in Ex **II (2) G** design and must be located outside an environment with a risk of explosion and at a temperature of 130 °C irreversibly disconnects the control circuit (switching circuit of the contactor) meeting the conditions of operation in the relevant **Zone 1** or **Zone 2**.
The specific requirements of the ČSN EN 60079-14 standard must be respected for the design, selection and establishment of electrical installations in explosive atmospheres. The mentioned method protects the motor from operationally unfavorable influences - for example, from overloading, failure of one phase of the network or short circuit, firm braking of the motor, interruption or short circuit of the protection current circuit, high temperature of the transported air. Thermal protection is comprehensive and reliable when connected correctly. Thermistors of a maximum of two fans can be connected to one thermistor relay, provided that they must be connected in series. With such a combined connection, it must be remembered that in the event of a failure of one electric motor, both fans will be stopped.

Attention! it is forbidden to protect the fan motors by conventional thermal protection ensured by the motor overcurrent protective elements!

TABLE 1 - INPUT VOLTAGE AND CONTROLLER'S STAGE

MOTOR TYPE	Curve characteristics – controller stage				
	5	4	3	2	1
3 – phase	400 V	280 V	230 V	180 V	140 V

FAN OUTPUT CONTROL

Generally, several types of control can be used with fans; however, voltage control is the most suitable for RP Ex 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 fans can be steplessly controlled providing the change in voltage is stepless. In practice, stage voltage controllers are usually used. The voltage must not increase above the rated value according to the nameplate value and the current must not exceed the rated value of the fan electric motor.

Attention! It is not permissible to regulate the speed of the electric motor of the RP Ex fan with a frequency converter!

Five-stage voltage control (transformer)

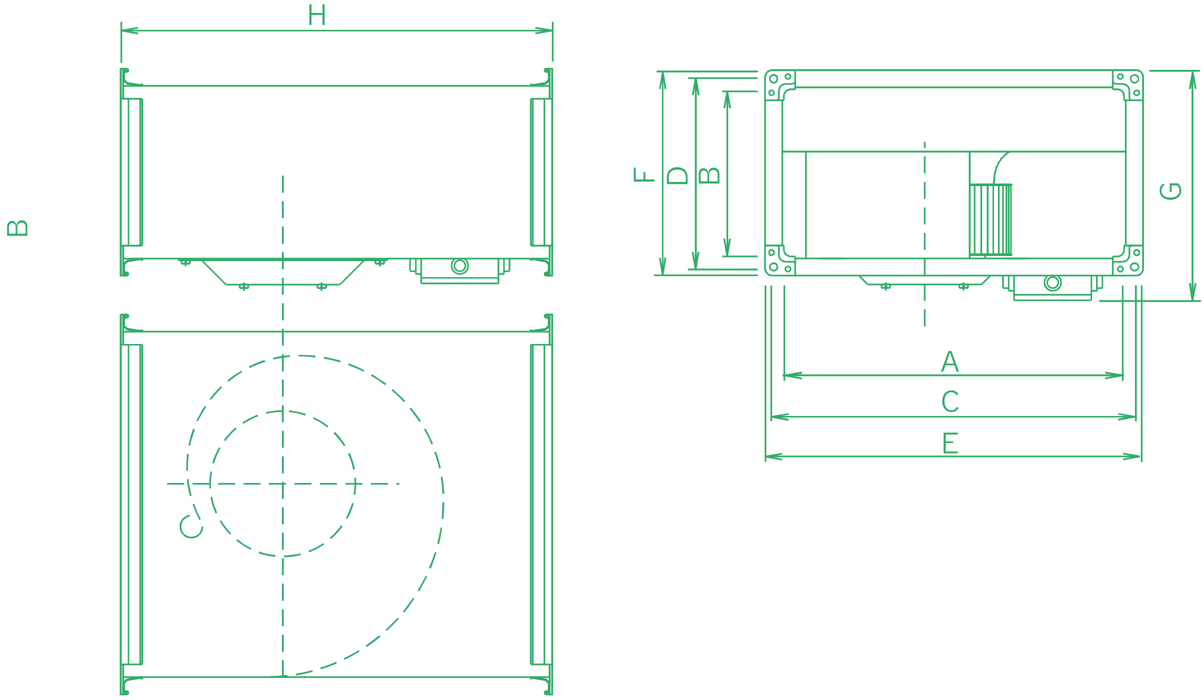
The voltage control of Vento fans is the most suitable, technically as well as operationally. There is no interference, humming, squeaking or vibration of the motor; furthermore, voltage controlled motors feature lower warming. TRN and TRR voltage controllers can control the fan output in five stages 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 7D and TRN 9D, 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).

Attention! No other type of regulation is allowed!

ACCESSORIES

RP 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 thermal protection of fans, an approved type of thermistor relay can be ordered with the fan.

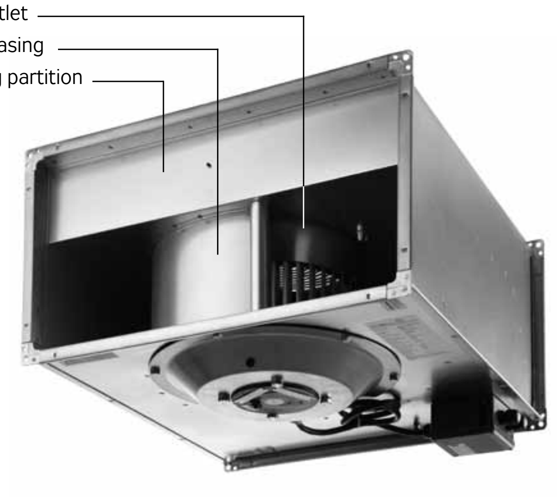
FIGURE 5 – RP EX FAN DIMENSIONAL DIAGRAM



DIMENSIONS, WEIGHTS AND PERFORMANCE

Figure 5 and Table 2 contain data on important dimensions of fans, Table 4 contains basic parameters and nominal values of fans type RP Ex.

FIGURE 6 – FAN OUTLET ARRANGEMENT



OPERATING CHARACTERISTICS

Output characteristics of RP 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:

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 recommended safety relay during fan operation without controller and without control unit

TABLE 2 - RP EX FAN DIMENSIONS

Fan 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

TABLE 3 - RP EX FAN BASIC PARAMETERS AND NOMINAL VALUES

Typ ventilátoru	V_{max}	$\Delta p_{t\ max}$	$\Delta p_{s\ min}$	n_{nom}	U_{nom}	P_{max}	I_{max}	t_{max}	Control.	m
	m^3/h	Pa	W	min^{-1}	V	W	A	ºC	type	kg
RP EX – SINGLE-PHASE MOTORS										
RP 40-20/20-4D Ex	1306	260	0	1400	400	281	0,5	40	TRN 2	13
RP 50-25/22-4D Ex	1813	320	60	1430	400	545	0,93	40	TRN 2	18
RP 60-30/28-4D Ex	3195	480	0	1440	400	1300	2,32	40	TRN 4	33
RP 60-35/31-4D Ex	3950	603	220	1440	400	2044	3,9	40	TRN 4	47
RP 70-40/35-6D Ex	4108	360	150	900	400	1100	2	40	TRN 2	44
RP 80-50/40-6D Ex	5829	496	238	930	400	1950	3,7	40	TRN 4	68

SYMBOLS USED IN TABLE 3:

V_{max} maximum air flow rate
$\Delta p_{t\ max.}$ the maximum total fan pressure is the maximum of the sum of Δp_s and Δp_d ($\Delta p_s + \Delta p_d$) max.
$\Delta p_{s\ min.}$ minimum allowed static pressure (pressure drop of the connected duct) indicates the lowest value to which the fan must be throttled (at the nominal voltage in 5c) to avoid from overloading and activating the 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)
$P_{max.}$ electric motor maximal power output
$I_{max.}$ maximum phase current at voltage **U**
$t_{max.}$ maximum permissible transported air temperature at air flow $\mathbf{V}_{max}$
Control. voltage regulator type
m weight of the fan (±10%)

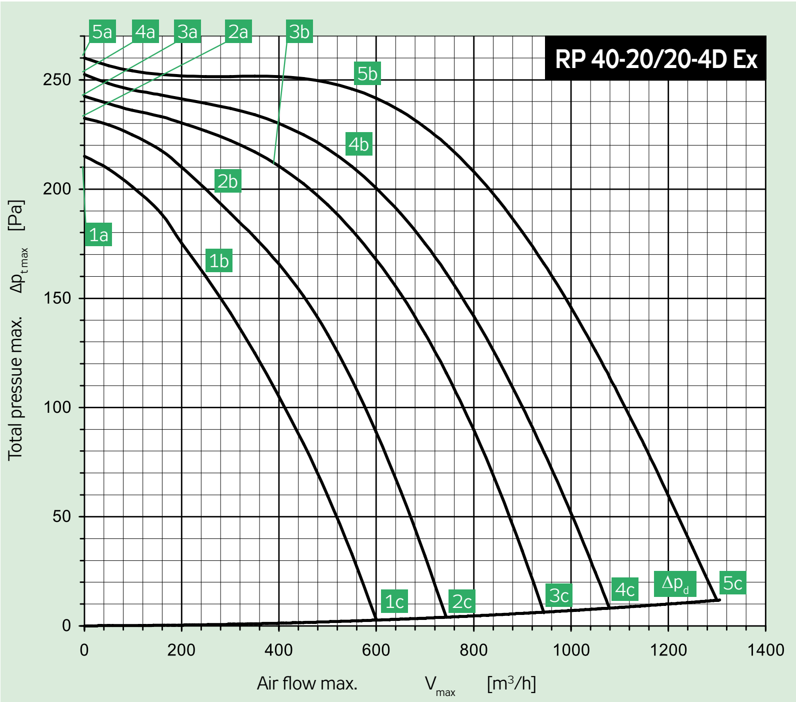
EXAMPLE AND EXPLANATIONS OF FAN DATA

RP 40-20/20-4D Ex

Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	281
Max. current (5c)	I_{max}	[A]	0.50
Mean speed	n	[min^{-1}]	1400
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m^3/h]	1306
Total pressure max.	$\Delta p_{t\ max}$	[Pa]	260
Static pressure min. (5c)	$\Delta p_{s\ min}$	[Pa]	0
Weight	m	[kg]	13
Five-stage controller	type		TRN 2
Protecting relay	type		therm. relay

The meaning of individual lines is as follows:

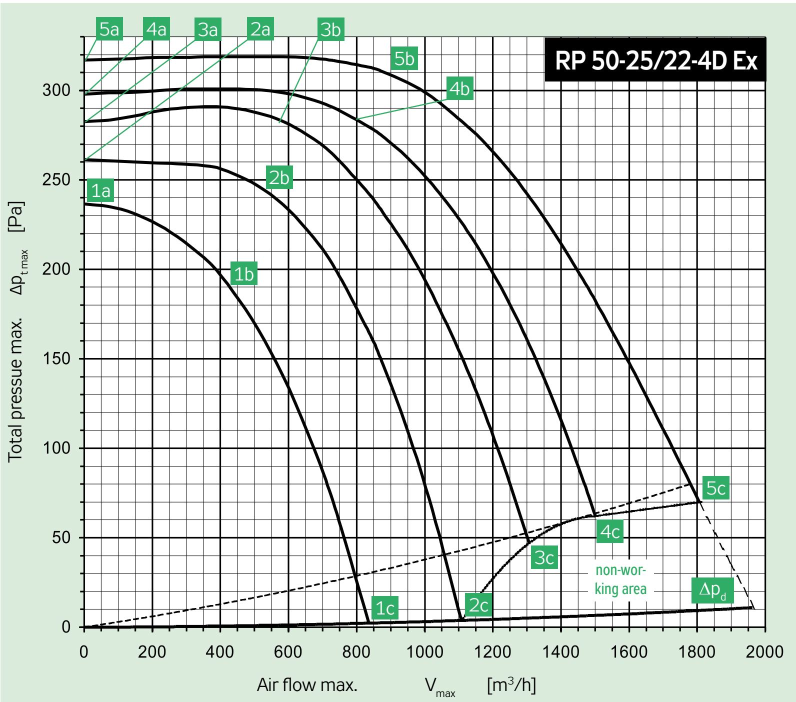
1 Value of nominal power supply voltage
2 Maximum power input of the motor at working point 5c.
3 Maximum current at nominal voltage at working point 5c.
4 Mean speed, rounded to tens, measured at working point 5b.
5 Capacitor capacity with single-phase fans.
6 Maximum permissible transported air temperature.
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.



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	281
Max. current (5c)	I_{max}	[A]	0.50
Mean speed	n	[min⁻¹]	1400
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	1306
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	260
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	13
Five-stage controller	type		TRN 2
Protecting relay	type		ATEX therm. relay

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	67	73	61
Sound power level LWAokt [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

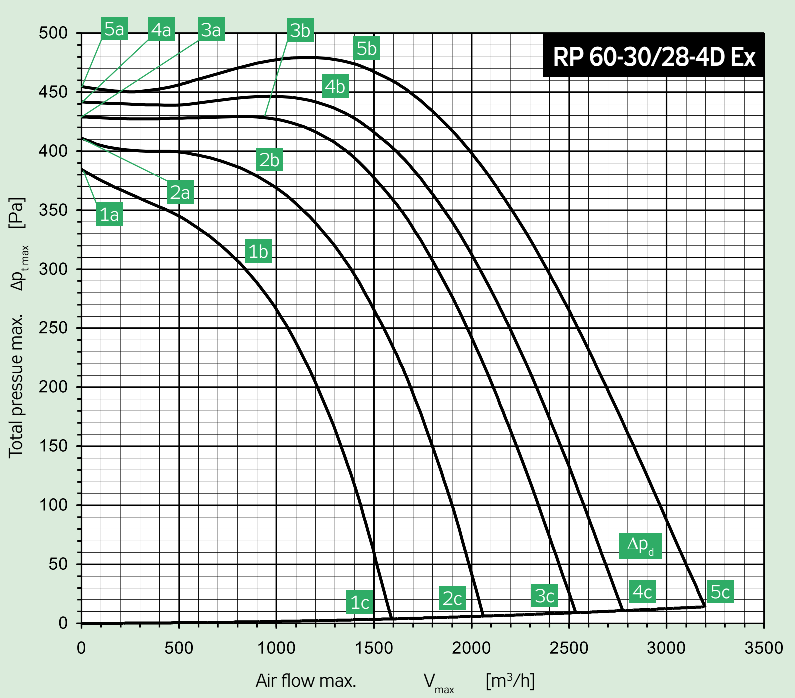
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.32	0.34	0.50	0.20	0.27	0.49	0.17	0.22	0.47	0.15	0.19	0.42	0.14	0.20	0.36
Input power P [W]	64	123	281	43	103	217	36	71	172	35	50	119	29	44	81
Speed n [min⁻¹]	1457	1397	1222	1430	1308	1014	1409	1303	895	1346	1265	712	1285	1135	586
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	545
Max. current (5c)	I_{max}	[A]	0.93
Mean speed	n	[min⁻¹]	1430
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	1813
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	320
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	60
Weight	m	[kg]	18
Five-stage controller	type		TRN 2
Protecting relay	type		ATEX therm. relay

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	71	76	63
Sound power level LWAokt [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

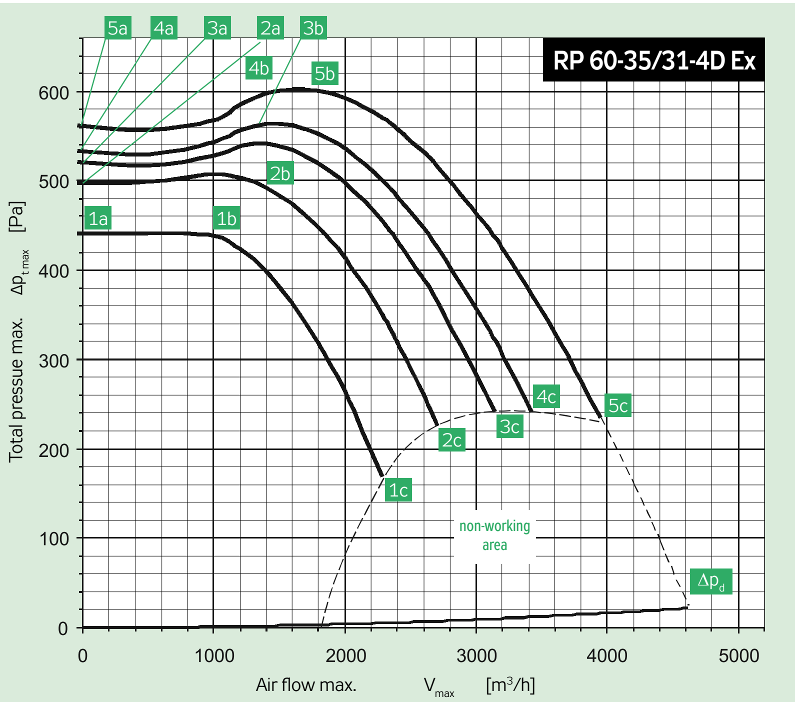
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	0.59	0.62	0.93	0.37	0.48	0.95	0.37	0.44	0.97	0.31	0.45	0.99	0.35	0.48	0.83
Input power P [W]	164	248	545	105	180	414	113	143	341	76	124	264	75	104	168
Speed n [min⁻¹]	1458	1425	1300	1432	1371	1120	1384	1348	971	1374	1274	733	1271	1136	567
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1300
Max. current (5c)	I_{max}	[A]	2.32
Mean speed	n	[min⁻¹]	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	3195
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	480
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	0
Weight	m	[kg]	33
Five-stage controller	type		TRN 4
Protecting relay	type		ATEX therm. relay

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	77	83	69
Sound power level LWAokt [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

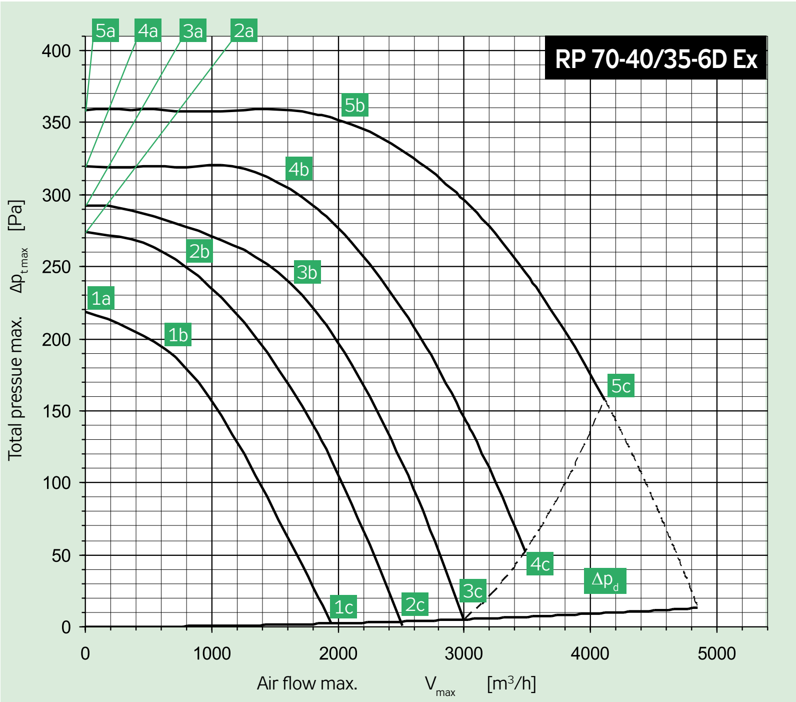
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	1.29	1.39	2.32	0.77	1.11	2.49	0.68	0.98	2.50	0.67	1.06	2.40	0.72	1.18	2.08
Input power P [W]	248	502	1300	192	418	1037	175	323	882	170	293	634	150	252	412
Speed n [min⁻¹]	1476	1440	1326	1453	1385	1152	1437	1376	1056	1395	1297	854	1326	1167	673
Air flow V [m³/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



Power supply	Y	3 × 400 V	50 Hz
Max. electric input	P_{max}	[W]	2044
Max. current (5c)	I_{max}	[A]	3.90
Mean speed	n	[min⁻¹]	1440
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[°C]	40
Air flow max.	V_{max}	[m³/h]	3950
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	603
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	220
Weight	m	[kg]	47
Five-stage controller	type		TRN 4
Protecting relay	type		ATEX therm. relay

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	80	86	71
Sound power level LWAokt [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

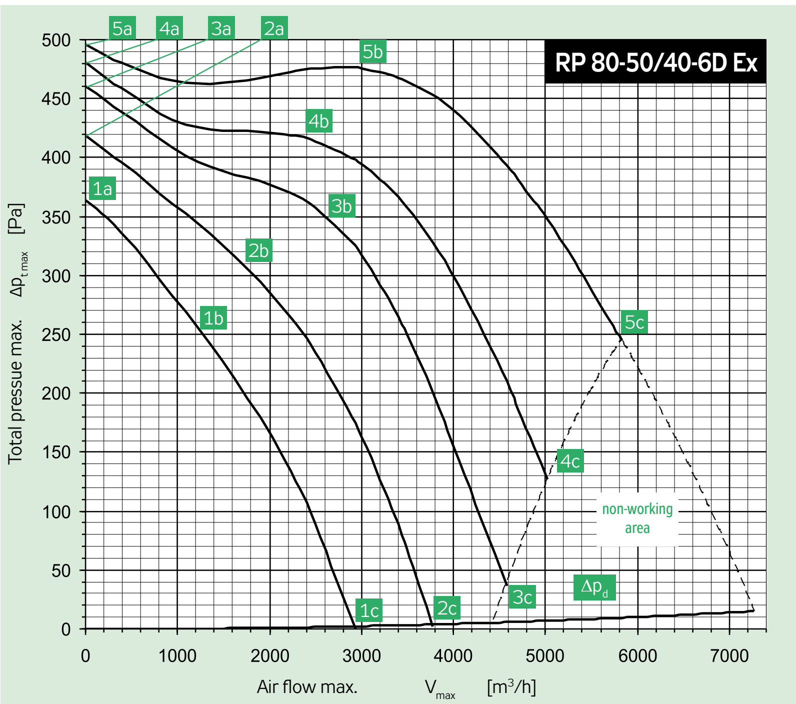
Parameters in selected working points	5a	5b	5c	4a	4b	4c	3a	3b	3c	2a	2b	2c	1a	1b	1c
Voltage U [V]		400			280			230			180			140	
Current I [A]	2.64	2.81	3.90	2.08	2.10	3.90	1.73	1.94	3.90	1.71	2.21	3.90	1.86	2.13	3.90
Input power P [W]	376	682	2044	419	478	1558	499	601	1390	444	610	1089	413	476	858
Speed n [min⁻¹]	1453	1437	1375	1422	1413	1271	1403	1383	1207	1360	1304	1096	1288	1248	945
Air flow V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1100
Max. current (5c)	I_{max}	[A]	2.00
Mean speed	n	[min⁻¹]	900
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	4108
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	360
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	150
Weight	m	[kg]	44
Five-stage controller	type		TRN 2
Protecting relay	type		ATEX therm. relay

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	75	81	66
Sound power level LWAokt [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
Input power 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 V [m³/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



Power supply	Y	3× 400 V	50 Hz
Max. electric input	P_{max}	[W]	1950
Max. current (5c)	I_{max}	[A]	3.70
Mean speed	n	[min⁻¹]	930
Capacitor	C	[F]	-
Max. working temp.	t_{max}	[ºC]	40
Air flow max.	V_{max}	[m³/h]	5829
Total pressure max.	$\Delta p_{t\,max}$	[Pa]	496
Static pressure min. (5c)	$\Delta p_{s\,min}$	[Pa]	238
Weight	m	[kg]	68
Five-stage controller	type		TRN 4
Protecting relay	type		ATEX therm. relay

	Inlet	Outlet	Surrounding
Point	5b	5b	5b
Total sound power level LWA [dB(A)]			
L_{WA}	75	80	67
Sound power level LWAokt [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
Input power 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 V [m³/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

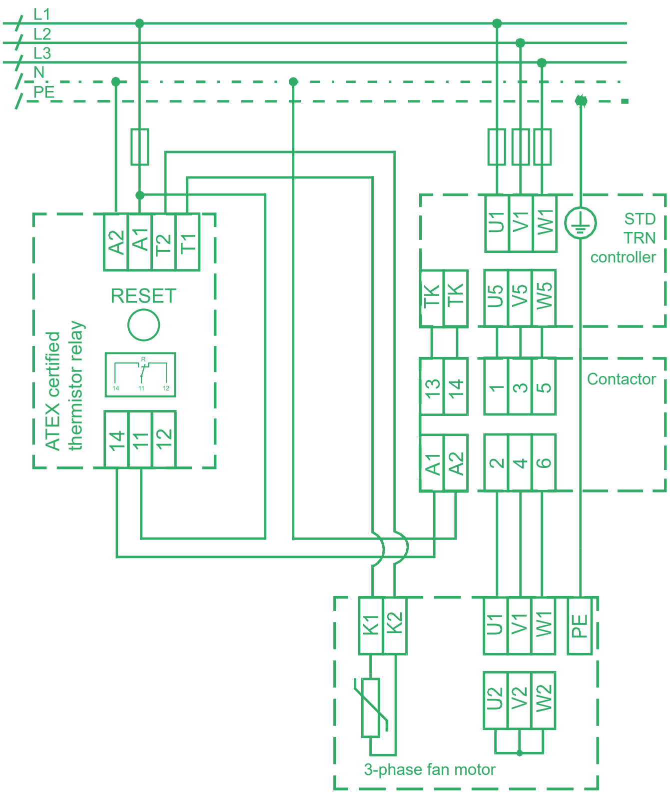
THERMISTOR PROTECTION OF EX FANS

The temperature inside the motors of all RP Ex fans is permanently read by temperature sensitive sensors (PTC thermistors) situated in the motor winding. The thermistors must be connected to the ATEX certified thermistor relay, that disconnects the contactor switching circuit.

At a maximum, two fans can be connected to the thermistor relay, and they must be connected in series. It is 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.

During failure (off) state, terminals 11 and 12 are interconnected.
During failure-free (on) state, terminals 11 and 14 are interconnected.

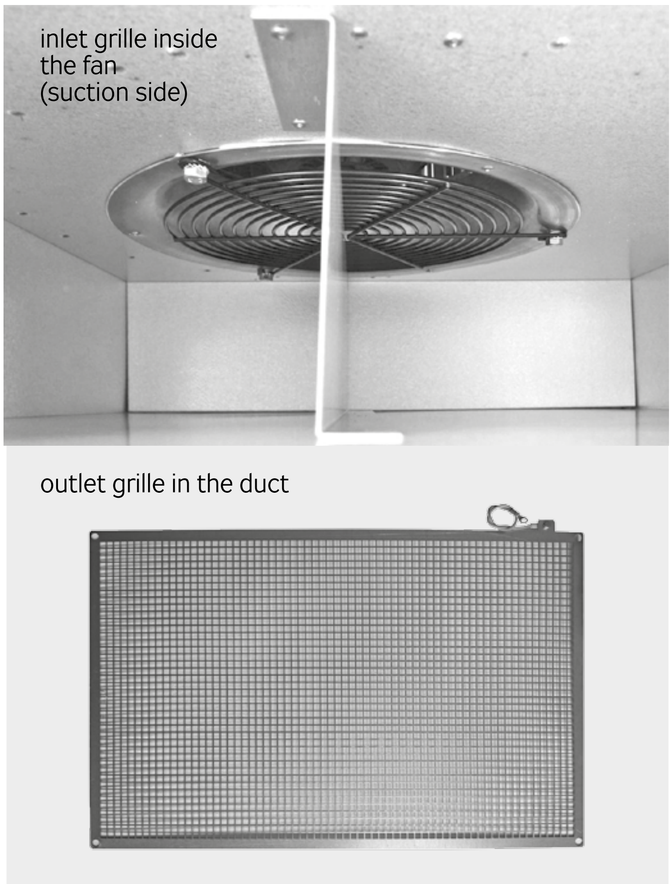
FIGURE 7 – EXAMPLE OF THE THERMISTOR RELAY'S WIRING



INSTALLATION

- RP 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 according to the nature of the environment with an atmosphere with a risk of explosion of gases and vapors, the location of the fan, local dispersion conditions and other conditions for its safe operation. The installation and commissioning may only be carried out by a professional assembly company authorized in accordance with generally applicable regulations on the basis of a specific specific project.
- 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. The minimum clearance between the rotating and fixed parts is 1% of the impeller diameter and must be checked regularly. Operating the fan with less than the minimum clearance is prohibited for safety reasons and such a fan must be taken out of service and repaired (adjust the clearance).
- In front of and behind the fan, it is necessary to mount elastic connections in an antistatic design. The reason is, among other things, the exclusion of external forces acting on the fan housing, which could cause unwanted deformation of the housing.

FIGURE 8 – DESIGN OF THE PROTECTIVE GRILLE



- The fan must always be fixed on separate hinges or the foundation so that it does not load the elastic connections or the connected piping.
- In order to protect the fan and piping against dirt and dust deposits, it is advisable to install an air filter of an appropriate design in front of the fan. Dirt settled on the impeller blades must be removed regularly to prevent rotor imbalance, vibrations and thereby reduce the service life of the bearings.
- The fan is fitted as standard with an inlet grille (Figure 8) on the suction mouth (diffuser) with IP20 protection according to ČSN EN 60529 to prevent objects from entering the impeller space that could cause ignition. Also on the outlet side of the fan, a metal grille of an approved type with IP20 protection must be fitted, which is placed in the duct route at a distance of 0.5 to 1.5 m from the fan. The cover grid must be conductively connected to the fan housing, metal pipe and grounded.
- 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 4 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.
- Detailed information for the installation, operation and maintenance of RP Ex fans can be found in the document on the website of REMAK a.s.: "Installation and operating instructions - Radial fans RP, Ex design, type: RP * - */* - ** Ex".

WIRING

- he wiring can be performed only by a qualified worker licensed in accordance with national regulations.
- The fans are equipped with a plastic terminal box – **zone 1 Ex II 2G Ex eb IIC T6 Gb**. The terminal box is fixed with screws to the fan casing, and equipped with labelled screw terminals (see figure # 9).
- To connect the fan motor to the supply, use only cables approved for this purpose.
- The fan must be properly grounded.
- 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. When designing the installation, take into account the requirements arising from the Fire Safety Solution report and the protocol for determining external influences.
- See Figure 10 for wiring diagram.

FIGURE 9 – ALL-PLASTIC TERMINAL BOX ON THE CASING (LID REMOVED)

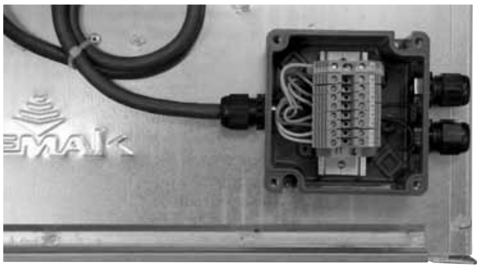
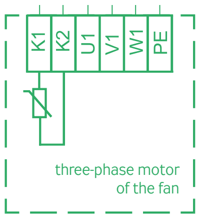


FIGURE 10 – WIRING DIAGRAM



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

Attention!
Electric motors must not be connected in a delta.
They are always connected only to the star.

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

On 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.

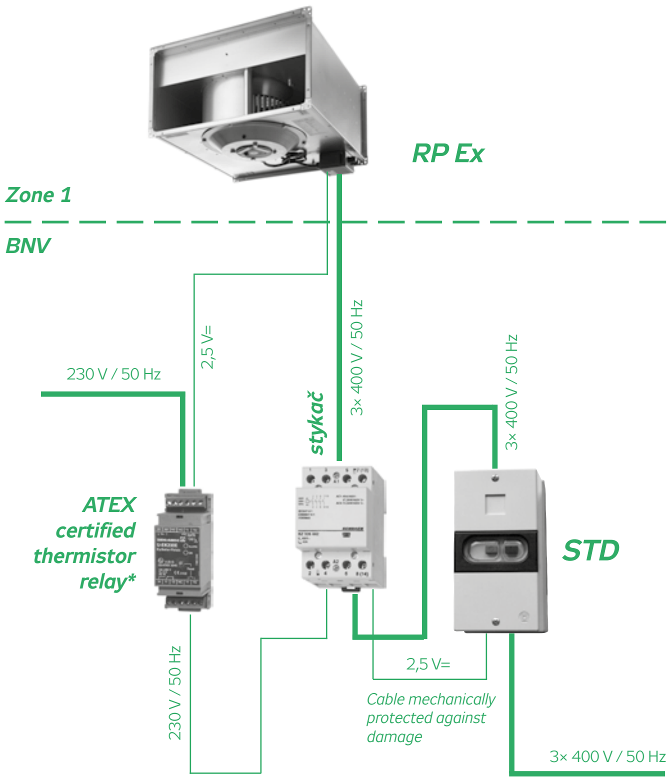
EXAMPLE A
FAN EQUIPPED WITH THERMAL PROTECTION, WITHOUT OUTPUT CONTROL

An RP Ex fan connection in a simple venting system without output control is shown in figures # 11.
This type of connection ensures full thermal protection of the fan using thermistors, ATEX certified 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 130ºC due to overloading, the impedance of the K1 and K2 thermistors in the motor winding will be increased several times.
The ATEX certified thermistor relay will detect the increased impedance and open contacts 11 and 14. Opening contacts 11 and 14 disconnects the control coil of the contactor, which disconnects the power supply of the overheated RP Ex fan and disconnects the control coil of the circuit TB1, TB2 of the STD protection relay. The STD reacts to this state by turning off the power supply. After cooling down, the motor is not automatically started. The failure must be confirmed (unblocked) by the operator by pressing the red "I" button.

** ATEX certified thermistor relay, eg type U-EK230E manufactured by Ziehl-Abegg. The suitability of using another type must be consulted with the manufacturer.*

FIGURE 11 – FAN CONNECTION

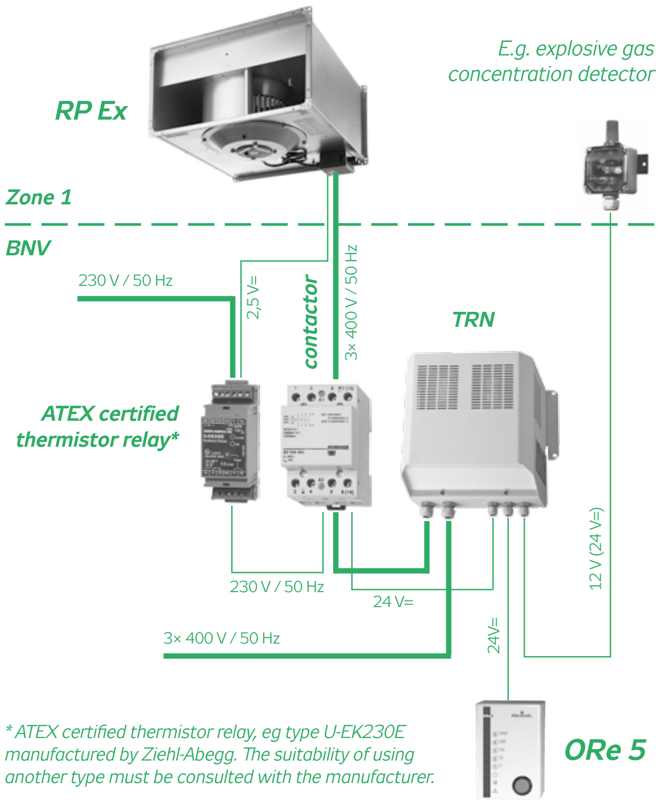


EXAMPLE B
FAN WITH OUTPUT CONTROL AND PROTECTION CONTROLLER

An RP Ex fan connection in a venting system with output control using the TRN controller equipped with an ORe5 control unit is shown in figures # 12.
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, ATEX certified 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 ATEX certified 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 12 – FAN CONNECTION



** ATEX certified thermistor relay, eg type U-EK230E manufactured by Ziehl-Abegg. The suitability of using another type must be consulted with the manufacturer.*

EXAMPLE C

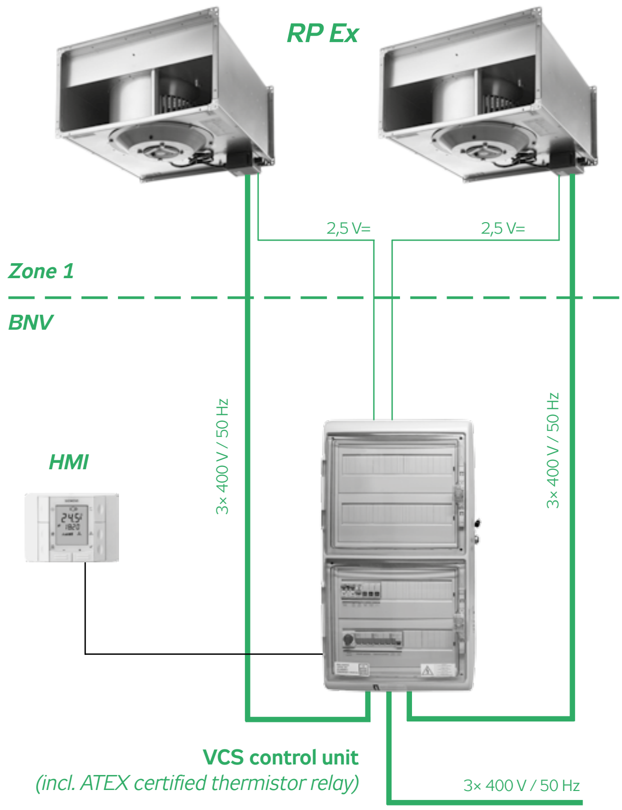
FANS WITH CONTROL UNIT WITHOUT OUTPUT CONTROL

An RP Ex fan without output control connection in a more sophisticated venting system equipped with a VCS control unit (e.g. with air heating) is shown in figure # 13.

This type of connection ensures full thermal protection of the fan using thermistors and a VCS control unit which already contains an ATEX certified 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 K1, K2 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 VCS control unit.

FIGURE 13 – FAN CONNECTION



EXAMPLE D

FAN WITH CONTROL UNIT AND OUTPUT CONTROL

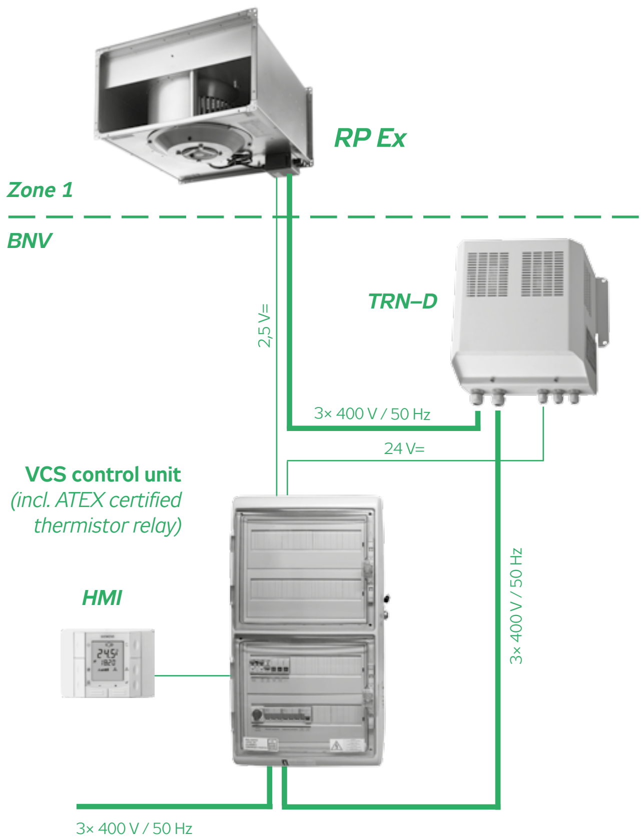
An RP Ex fan equipped with an output controller in a more sophisticated venting system with a VCS control unit (e.g. with air heating) is shown in figure # 14.

This type of connection ensures full thermal protection of the fan using thermistors and a VCS control unit which already contains an ATEX certified 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 K1, K2 thermistor terminals to the 5a, 5a, 5b and 5b terminals in the control unit. The internal fan output 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".

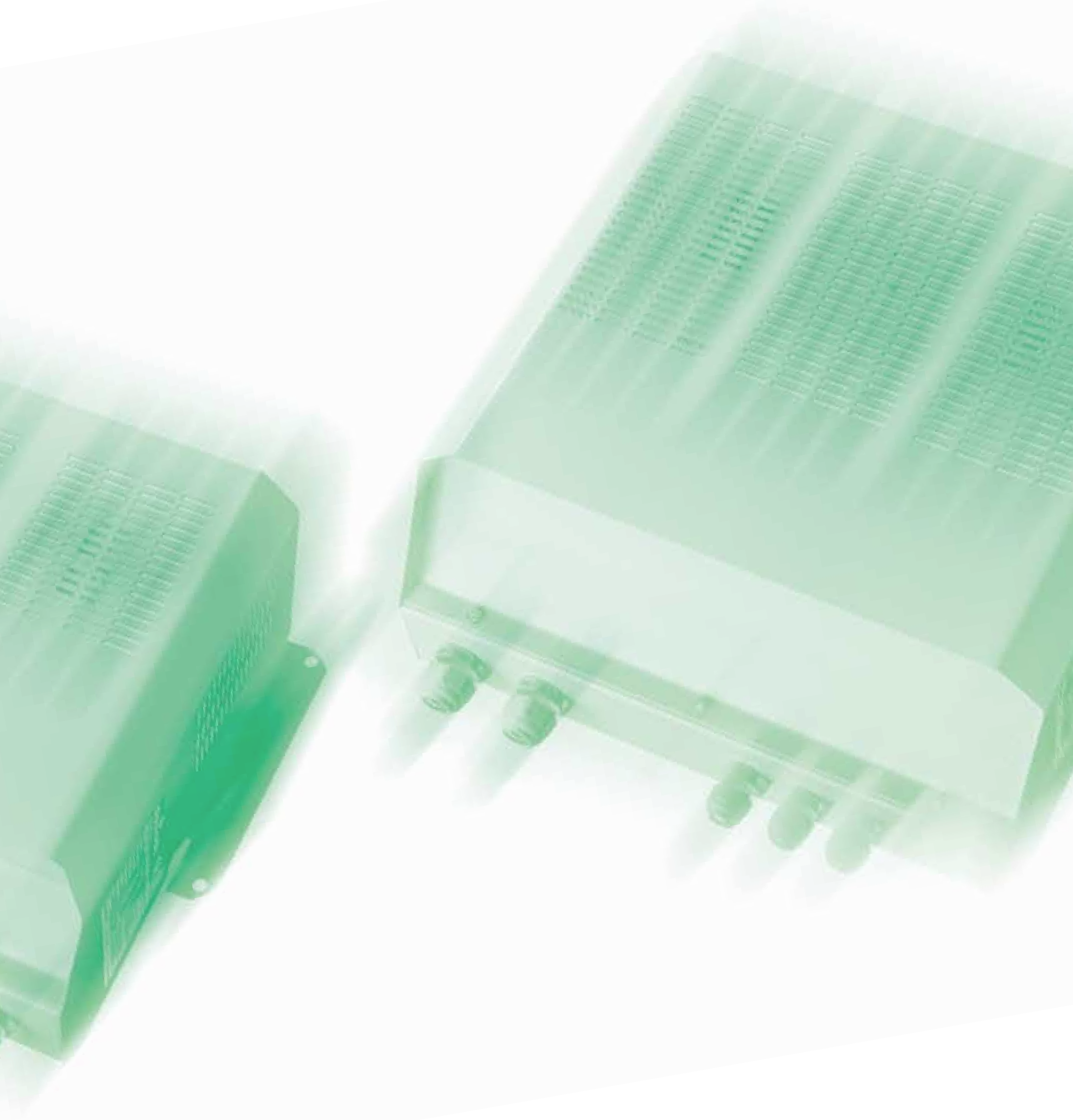
In the D connection example, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller.

The air-handling system is started by the control unit. An internal controller is integrated into the control unit, which enables remote control of the controller. All protection and safety functions of the fan as well as the entire system are ensured by the WebClima control unit.

FIGURE 14 – FAN CONNECTION



Fan Output Controllers



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 single-phase RF 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-air-flow relation curves in working characteristic of each fan comport. Motors of voltage controlled fans 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 – THE INPUT VOLTAGE AND CONTROLLER'S STAGE

MOTOR TYPE	CURVE CHARACTERISTICS – CONTROLLER'S STAGE				
	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

Stepless Electronic Control

Stepless electronic output control is suitable for single-phase fans; especially for RO fans (all sizes) and RF fans. Higher warming of motors at lower speed and noisiness can be considered as disadvantages of electronic control using PE 2,5 and PE 4 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.

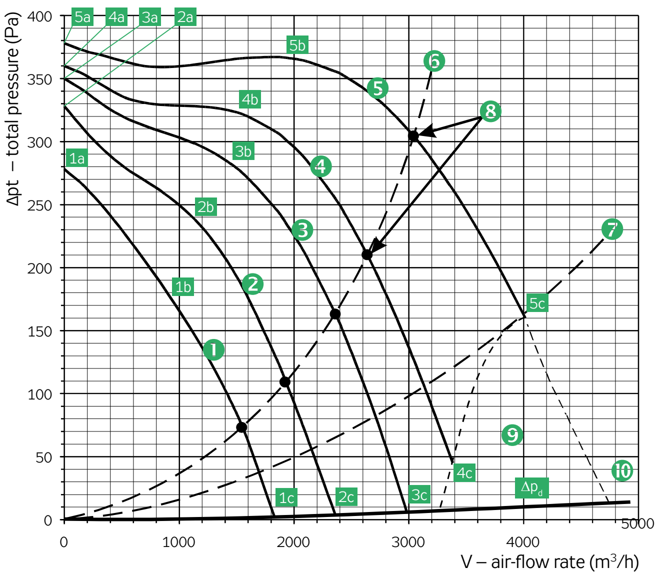
Speed Control using Frequency Converters

The use of frequency converters for frequency regulation is suitable for ISO standard motors (see 3-phase RF fans).

WORKING CHARACTERISTICS AND CONTROL

The following text explains relationships of fan control and their working characteristics. Output characteristics determine the relationship curve of the air flow rate V (m^3/h) and total fan pressure Δp_t (Pa). An example in graph # 1 gives detailed explanation. All RP, RQ, RO and single-phase RF fans, including their modifications, are fully controllable, and they can be operated in connection with TRN or TRR 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). Each input voltage corresponds to one of the fan's working curves, the so-called fan's characteristic curve ❺❹❸❷❶ (see graph # 1).

GRAPH 1 – OUTPUT VOLTAGE WORKING CURVES



If no controller is connected to the fan, then 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). 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 $\Delta p_{s\ min}$ 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 ºC, 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.

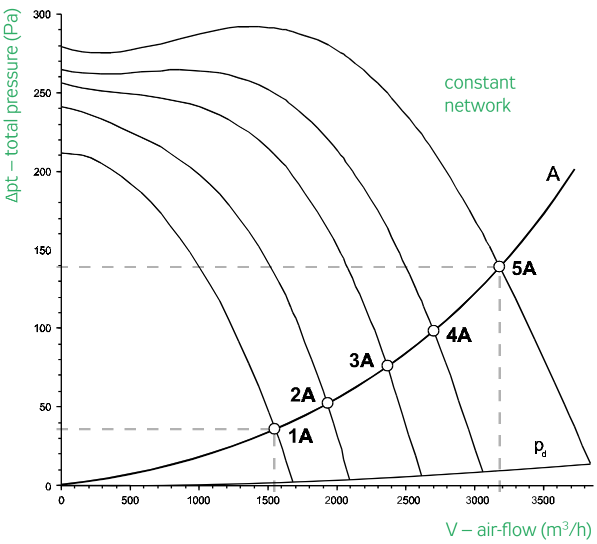
For assignment of the controller to the fan, refer to the catalogue of the respective fan. The controller's version must comply with the fan (single-phase/three-phase), and the controller's maximum current must be higher than, or at least equal to, maximum current of the fan, refer to the fan's catalogue.

Example: According to RP fans' section, RP 70-40/35-4D three--phase fan has maximum current I_{max} = 6 Amp. TRN 7D three--phase controller is the closest controller with higher maximum current. This controller is also recommended in the "RP fans data Section" of the catalogue.

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 1 – MAXIMUM AIR-FLOW RATE

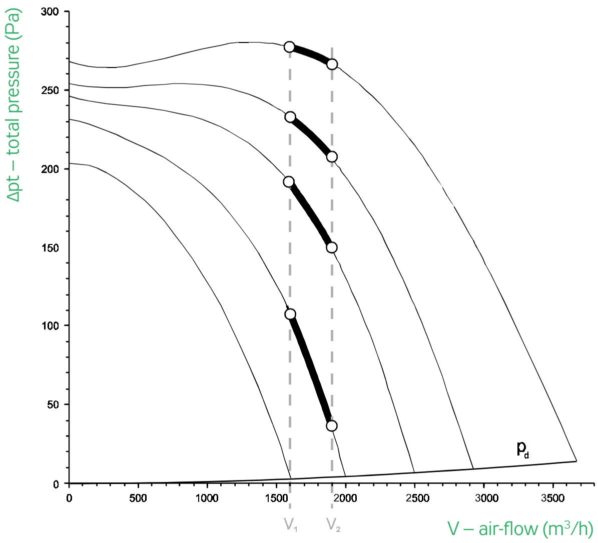


It is common practice to assemble similar air-handling systems with variable air flow rates using components of Vento system. Examples of these applications are presented in scheme diagrams on the following pages.

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 from 40 Pa to 270 Pa is shown in figure # 2. 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 2 – PRACOVNÍ CHRAKTERISTIKA VENTILÁTORU

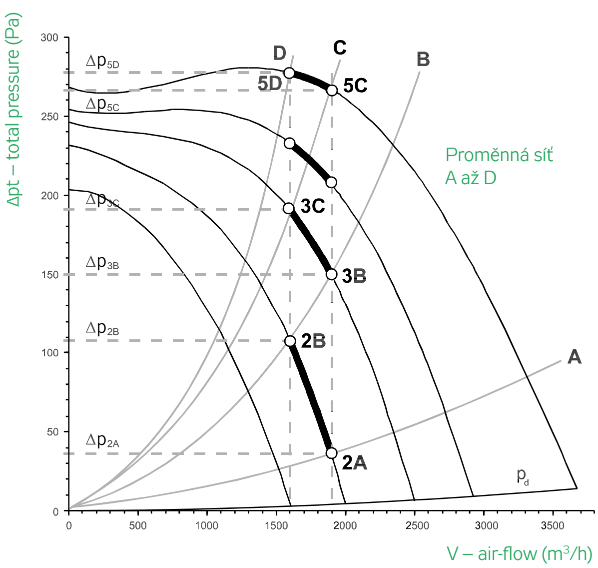


The duct system's characteristic curves going through the initial and end points of particular segments are shown in figure # 3. The duct system's rising characteristic curves are marked with letters A to D. Let's suppose that during service life of air filters initial A curve for clean filters will 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 (Δpt = pt2 - ps1). 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..

The following components are needed to configure a simple pressure controlled air-handling assembly:

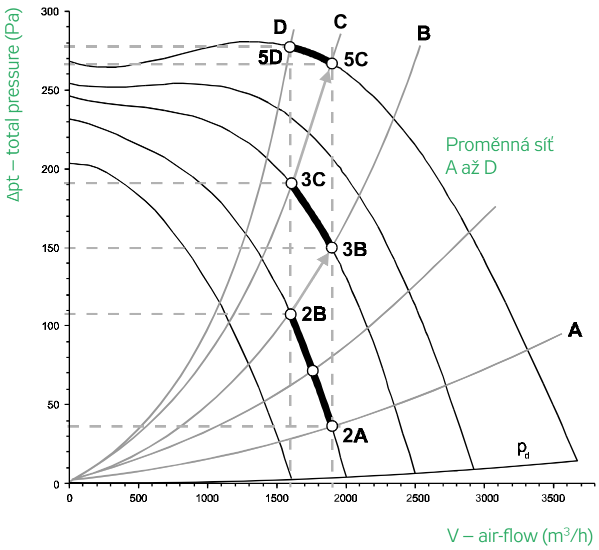
- Fan (for example RP 60-35/31-6D)
- Fan output controller (for example TRN 2D)
- OSX control unit
- Differential pressure sensor of working range, e.g. 0–30 Pa, which provides output signal of 0–10V.

FIGURE 3 – CHARAKTERISTIKA SÍTĚ



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 Δp_{2B}. If pressure differential goes above the value of Δp_{2B} the controller will automatically switch to stage # 3.
If pressure differential goes above the value of Δp_{3C} 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 # 3 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 Δp_{2B}. 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 Δp_{3C} 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..

FIGURE 4 – PRACOVNÍ STAVY ZAŘÍZENÍ



EXAMPLES OF AIR-HANDLING ASSEMBLIES EQUIPPED WITH AIR FLOW AND PRESSURE CONTROL

Air-Handling Assembly with Manual Air Flow Control

A simple air-handling system with variable air flow rate is shown in figure # 5. 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 # 6; however, here the inlet and outlet fan air flow rates can be adjusted individually using two separate ORe 5 controllers.
If ORe 5 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 # 7. 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 5

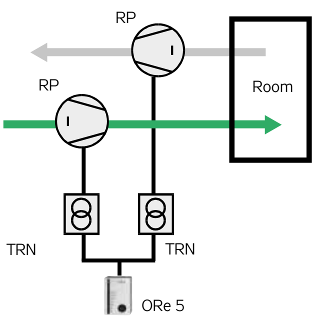


FIGURE 6

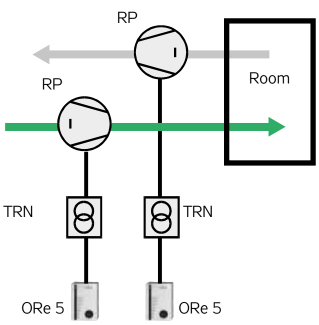
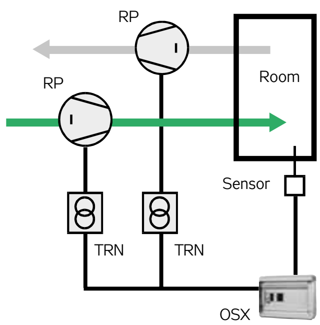


FIGURE 7

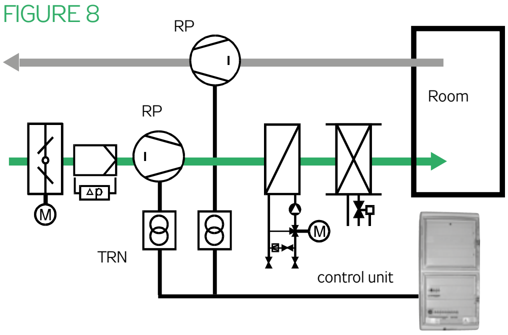


RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

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 # 8. In this case, internal controls of the controllers directly from the control unit is used (instead of using separate ORe 5 controllers). Internal controls can again be common ("dependent") for inlet and outlet, or separate ("independent") for each controller.

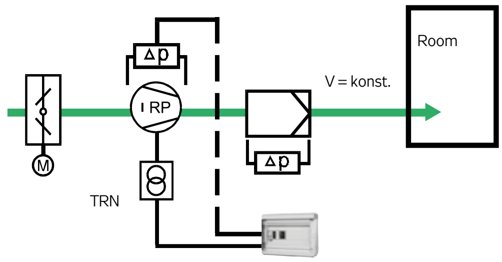
FIGURE 8



Zařízení s regulací tlaku

Na obrázku 9 je uveden příklad zařízení, které má zajišťovat konstantní průtok v proměnné síti (např. velká změna tlakových ztrát v důsledku zanášení koncových filtrů). Instalace z hlediska principu regulace průtoku odpovídá sestavě na obrázku 10. Místo ovládací skříňky OSX je však v tomto případě zobrazena řídicí jednotka s interním řízením průtoku, příp. tlaku. Zařízení je tedy ovládáno a regulováno zcela automaticky a komplexně (chod, teplota, tlak, lze samozřejmě doplnit také chlazení a směšování, příp. rekuperaci). Podrobné informace
k zapojení a konfigurace viz návrhový software AeroCAD.

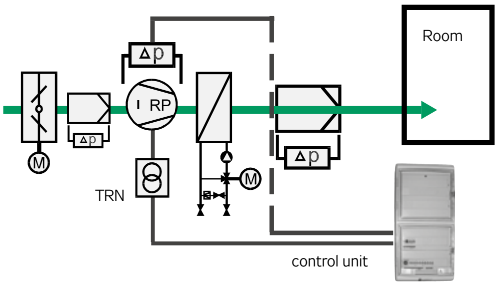
FIGURE 9



Složitější zařízení s regulací průtoku/tlaku

Příklad zařízení, které má zajišťovat konstantní průtok v proměnné síti (např. velká změna tlakových ztrát v důsledku zanášení koncových filtrů) je uveden na obrázku 10. Jednoduchá instalace zcela automaticky udržuje průtok vzduchu ve velmi úzkém rozmezí. Zařízení bude pracovat tak, že tlakové čidlo měřící diferenci tlaku bude generovat spojitý analogový signál 0–10 V. Ovládací skříňka OSX podle tohoto signálu přepíná vybrané výkonové stupně regulátoru. Podrobný rozbor vzorového zařízení je na straně s příkladem E zapojení RP s OSX, strana 31.

FIGURE 10



TYPY NAPĚŤOVÝCH REGULÁTORŮ

Regulátory TRN

Regulátory TRN jsou určeny ke spínání a pětistupňové regulaci otáček ventilátorů typu RP, RQ, RO, RF (1-fázových), včetně jejich modifikací. Transformátorové regulátory TRN mají standardně integrovanou ochranu elektromotorů. Ovládají se externím ovladačem, proto nemusí být v dosahu obsluhy. Regulátory umožňují ovládání přímo z řídicí jednotky, případně plně automatickou regulaci.

FIGURE 11 – REGULÁTOR ŘADY TRN

Regulátory TRRE(D)

Regulátory TRRE(D) jsou určeny ke spínání a pětistupňové regulaci otáček ventilátorů typu RP, RQ, RO, RF (1-fázových), včetně jejich modifikací. Transformátorové regulátory TRRE(D) nemají integrovanou teplotní ochranu elektromotorů, proto musí být provozovány ve spojení s řídicími jednotkami, příp. s ochranným relé STE(D). Regulátory se ovládají ručně otočným přepínačem na čelním panelu, proto musí být instalovány
v dosahu obsluhy.

FIGURE 12 – REGULÁTOR ŘADY TRRE(D)

PE 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 RF 30/...). These controllers are manually operated by the rotary selector situated on the front panel. They can be installed on the wall or into the mounting box embedded under the plaster (PE 2,5 only).

FIGURE 13 – PE CONTROLLER

USE OF VOLTAGE 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.

TABLE 2 - SPECIFICATION OF CONTROLLERS

Controller type	TRN-E	TRN-D	TRRE	TRRD	PE
specification					
for single-phase fans	✓		✓		✓
for three-phase fans		✓		✓	
max. fan current $I_{max.}$ (A)	≤ 7	≤ 9	≤ 7	≤ 9	≤ 4
type of control					
stage control (5 stages)	✓	✓	✓	✓	
stage control (5 stages)					✓
equipment					
integrated thermal protection of the fan	✓	✓			
integrated control			✓	✓	✓
an operation indicator light on the regulator or controller	[1]	[1]	✓	✓	✓
accessories					
external protection of the fan required			✓	✓	✓
external control required	✓	✓			
control and modes					
swith off blocking (output stage "0") enabled			✓	✓	✓
blocking of some output stages (1–5) enabled	1–3	1–3	0–3	0–3	[2]
controller must be within the operators 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	page 158–167		page 168–174		page 175

[1] In the controller

[2] Enables to set minimal speed level (stepless).

APPLICATION OF TRN CONTROLLERS

TRN transformer controllers are intended for the switching and five-stage speed control of RP, RQ, RO and single-phase RF 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

Regulace výkonu (otáček) ventilátoru v 5-ti stupních podle povelu z ovladače.

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 ORe 5:

- 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 262.
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 2000-1 ed.2 (IEC 60364-1).

- Degree of protection: IP 20
- Permissible ambient temperature: +5 ºC to +40 ºC
- 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 standard.

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...

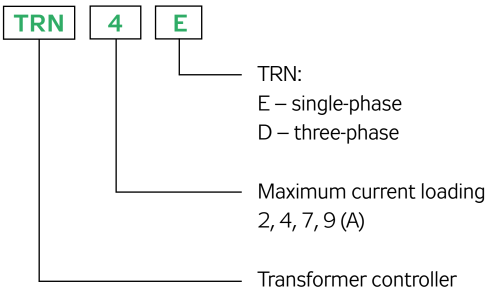
TABLE 3 – OUTPUT RANGE

Three-phase (3x 400 V)	Single-phase (1x 230 V)	Max. current (A)
TRN 2D	TRN 2E	2
TRN 4D	TRN 4E	4
TRN 7D	TRN 7E	7
TRN 9D	–	9

DESIGNATION OF CONTROLLERS

Example: Designation TRN 4E specifies a single-phase fan controller designed for maximum current of 4 Amp.

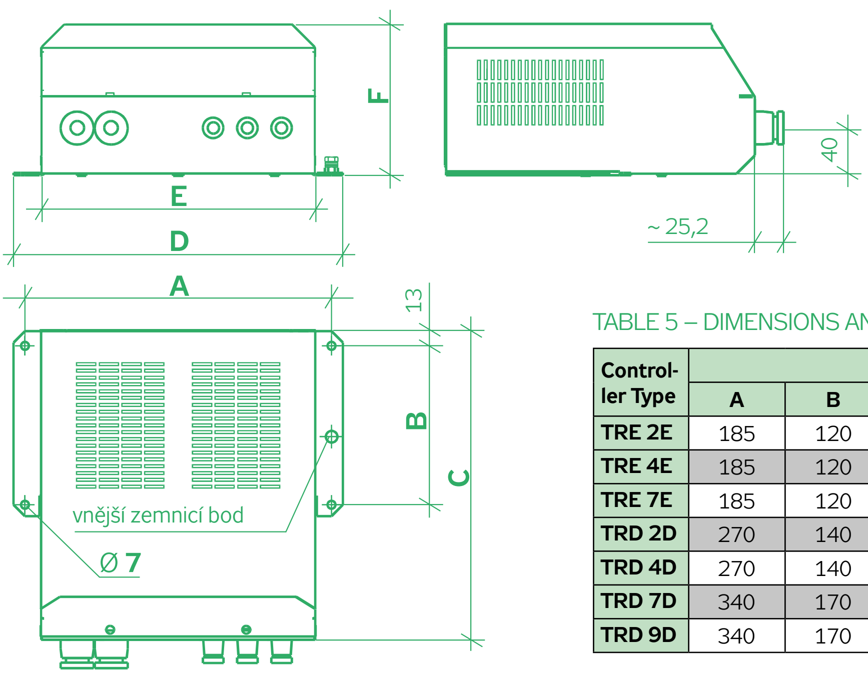
FIGURE 14 – TYPE DESIGNATION



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 15 – DIMENSIONS AND WEIGHTS



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.

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 4 – CONTROLLERS COMPARISON

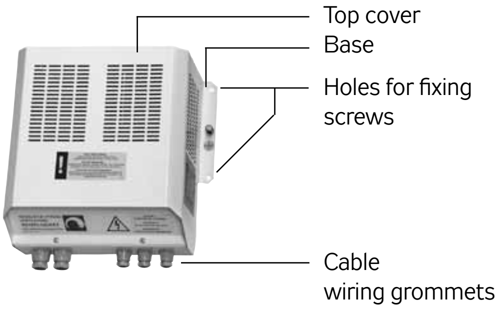
Control	
according to location	stand-alone
	from the control unit (built-in)
according to use	manual
	automatic

Integrated controls (in terms of control unit functions available via the controller menu and in the time schedule) and description of the function plus wiring diagrams are part of configuration of the control unit and, if necessary, it must be consulted with the manufacturer. 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 (refer to page 270). Automatic control without using the control unit can be solved by using OSX unit.

TABLE 5 – DIMENSIONS AND WEIGHTS

Controller Type	Dimensions in mm						m
	A	B	C	D	E	F	kg
TRE 2E	185	120	253	205	157	134	5
TRE 4E	185	120	253	205	157	134	7
TRE 7E	185	120	253	205	157	134	8
TRD 2D	270	140	273	290	242	134	10
TRD 4D	270	140	273	290	242	134	14
TRD 7D	340	170	303	360	312	157	26
TRD 9D	340	170	303	360	312	157	32

FIGURE 17 – CONTROLLER DESCRIPTION



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.
- 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.
- The installation must be performed considering the weight of the controller, easy wiring, barrier-free service access, and free cooling openings.
- The remote control can be situated at any distance from the controller, and mounted on a wall at the operator's location.

WIRING

- 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 # 18.
- For controller wiring refer to figure # 19

- 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.
- TRN controllers enable remote (external) start and stop of the fan independently of the controller. This function is controlled connecting and disconnecting the circuit between terminals PT1, PT2. This function can be used to start the fan by an external switch (thermostat, pressure switch, humidistat, auxiliary contact ...).
- Installation must be done on a project basis and in accordance with the catalogue and mounting instructions).
  Before commissioning an electric installation must be revised.

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. For more information refer to Instruction manual.

FIGURE 18 – JUMPER LOCATION

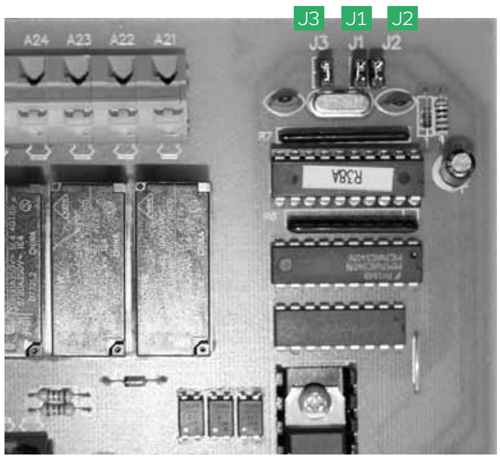
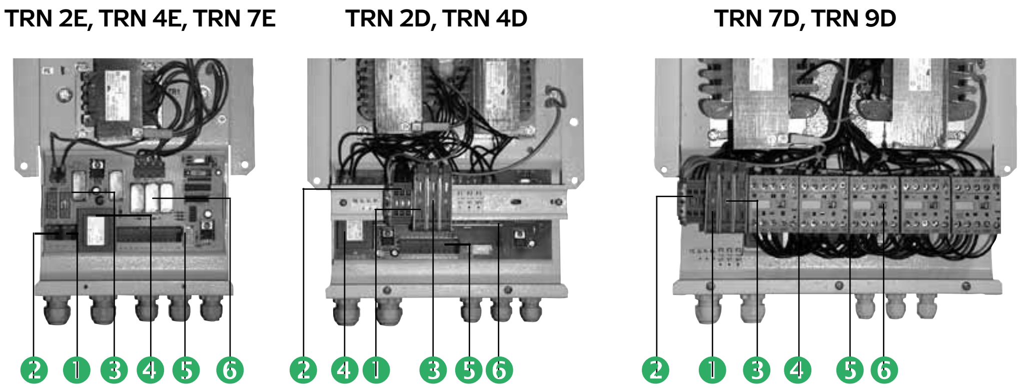


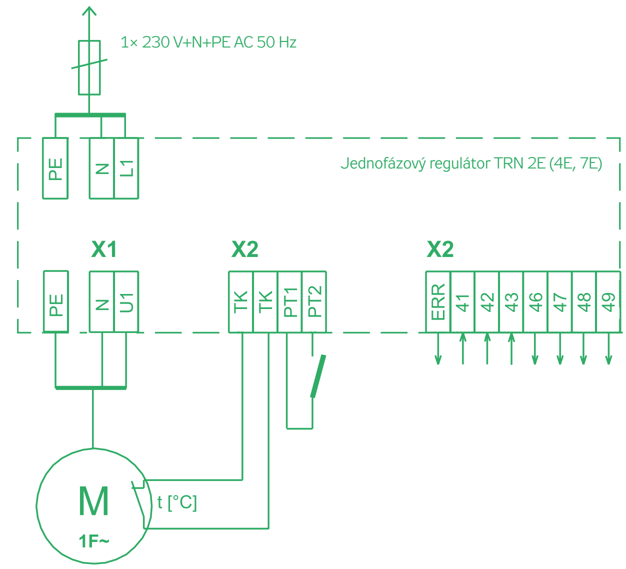
FIGURE 16 – CONTROLLER CONNECTING POINTS

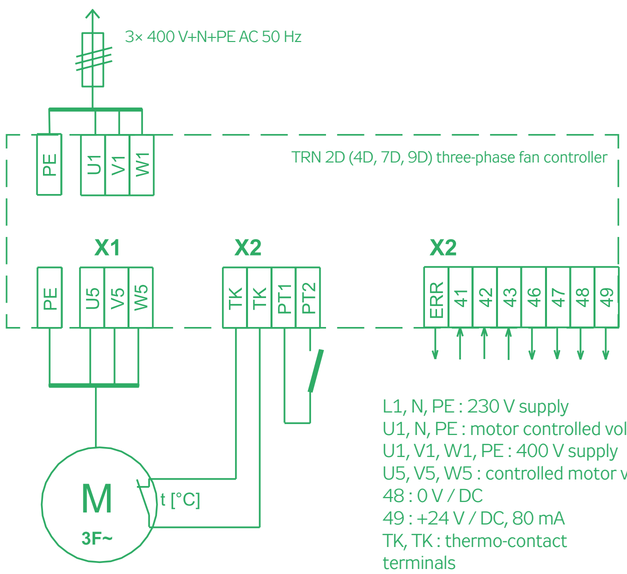


power supply terminals ❶, fan motor connecting terminals ❷, fuses ❸, power supply ❹, remote control connecting terminal box ❺, assembly of switching relays (or contactors) ❻.

WIRING DIAGRAM

FIGURE 19 – TRN CONTROLLER TERMINAL DIAGRAM





L1, N, PE : 230 V supply
U1, N, PE : motor controlled voltage
U1, V1, W1, PE : 400 V supply
U5, V5, W5 : controlled motor voltage
48 : 0 V / DC
49 : +24 V / DC, 80 mA
TK, TK : thermo-contact terminals
PT1, PT2 : external switching terminals (e.g. room thermostat)

TABLE 6 – CONTROLLER STATES ACCORDING TO STATE OF CONTROL INPUTS

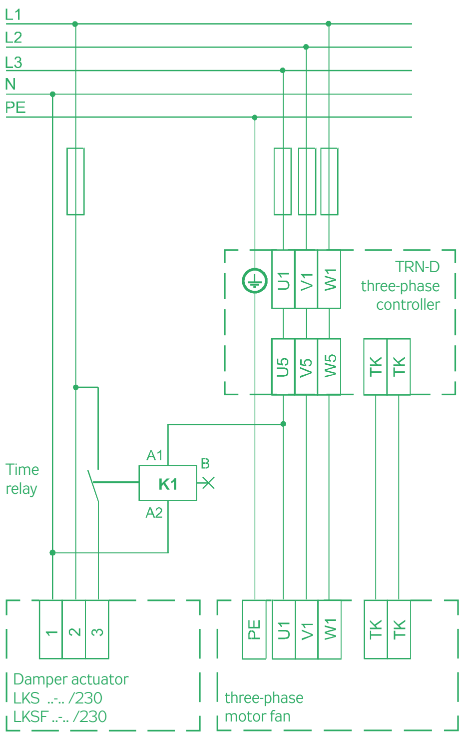
Speed	49 41	49 42	49 43
Speed 1	─╲─	─╲─	─╲─
Speed 2	─╲─	╲	───
Speed 3	─╲─	───	─╲─
Speed 4	─╲─	───	───
Speed 5	───	─╲─	─╲─
STOP (Speed 0)	───	───	───

Stop/Reset	47 46 48	Dimensioning of contacts 24V/DC, 0,1A
Start	47 46 48	

CONTROL OF LKS, 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, LKSF DAMPERS WIRING SCHEME



CONTROL STAGES

RP, RQ, RO and single-phase RF fan motors, including their modifications, can be operated within the range approx. from 25 % to 110 % of the rated voltage. The table 1, page 250 shows the correlation between the input voltage and selected stage of the controller for single-phase and three-phase motors.

On following pages you find illustrations of installations and wiring of TRN controllers.

Installations using ORe 5 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

Installations using controls installed directly into the control unit

C Control unit with two TRN controllers and common internal controls
D Two TRN controllers with protective funcrtions and common OSX control box

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..

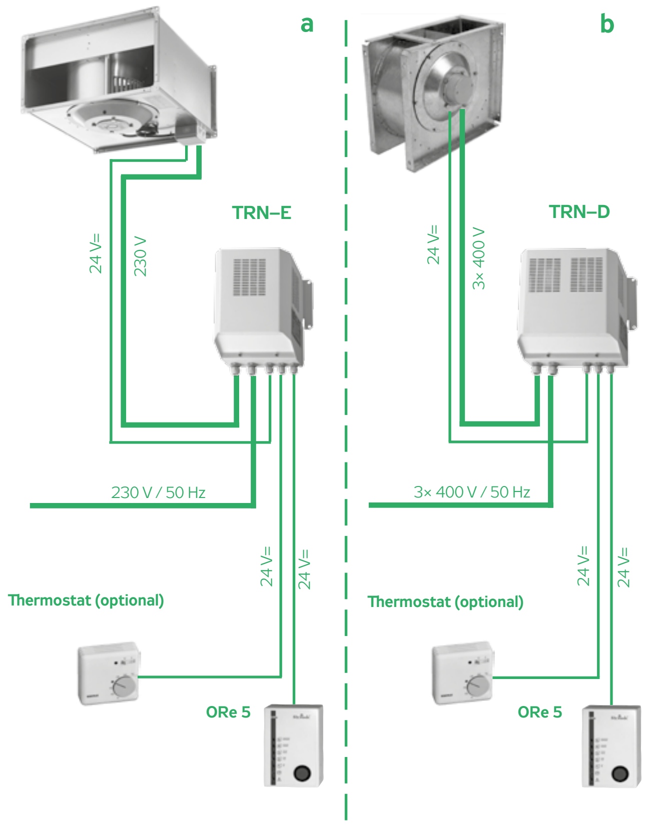
EXAMPLE A
ONE TRN CONTROLLER FEATURING PROTECTION FUNCTION EQUIPPED WITH AN ORE5 CONTROLLER

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 ORe 5 controller must not be blocked.

FIGURE 21 – CONTROLLER CONNECTION



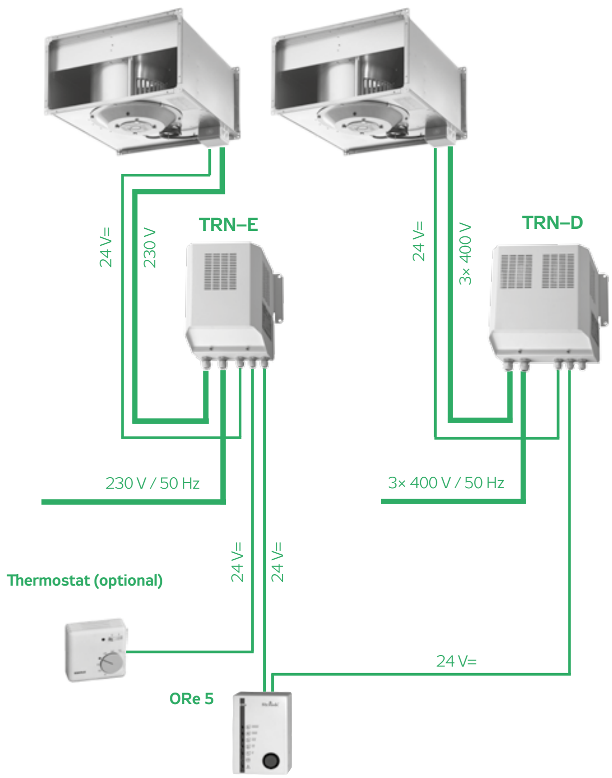
EXAMPLE B
TWO TRN CONTROLLERS FEATURING PROTECTION FUNCTION EQUIPPED WITH A COMMON ORE5 CONTROLLER

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 ORe 5
- → 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 ORe 5 controller must not be blocked.

FIGURE 22 – CONTROLLER CONNECTION



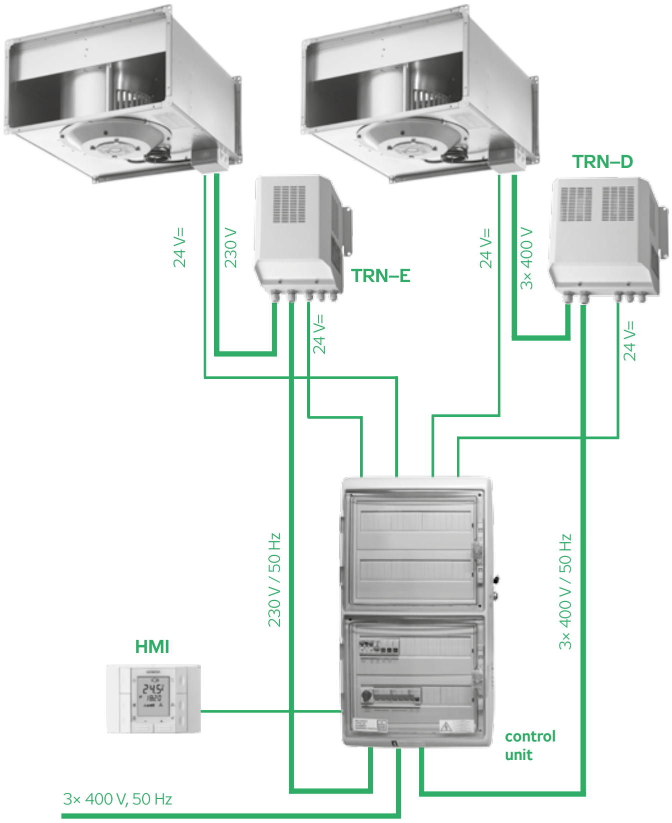
EXAMPLE C
CONTROL UNIT WITH TWO CONTROLLERS AND INTERNAL CONTROL FOR BOTH CONTROLLERS

An assembly of the control unit with two TRN controllers and HMI controller in figure # 23. Among others, this connection ensures:

- → Manual selection of the fan output within the stage range 1-5
- → 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.

FIGURE 23 – CONTROLLER CONNECTION



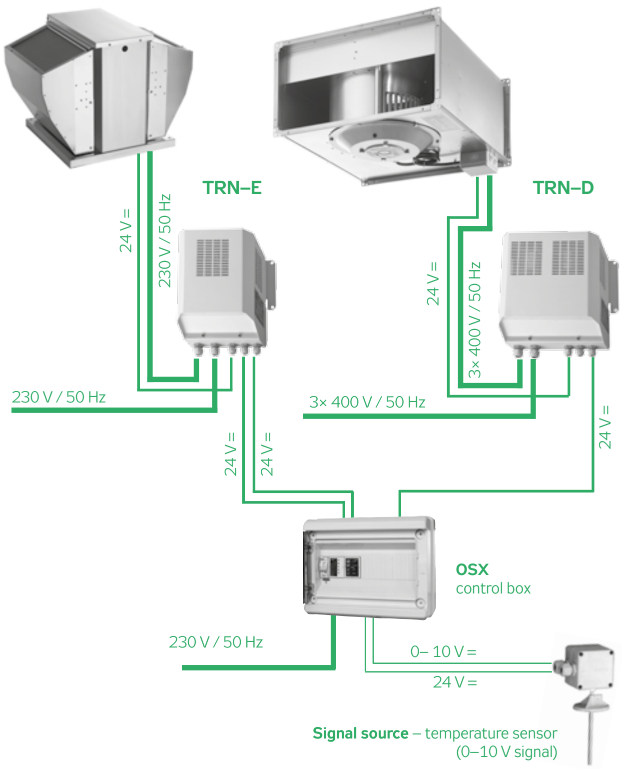
EXAMPLE D
TWO TRN CONTROLLERS FEATURING PROTECTION FUNCTION EQUIPPED WITH A COMMON OSX UNIT

An assembly of the control unit with TRN controllers and a common OSX unit is shown in figure # 24. 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 24 – ZAPOJENÍ REGULÁTORŮ



USE OF CONTROLLER

The ORe 5 remote controller is intended for remote control of TRN controllers and RPFM frequency inverters.

- It serves to set the speed of fans while simultaneously signalling the operating state.
- If the control unit is used in an air-handling assembly, the controller also serves to switch it on/off.
- The controller enables automatic restart of the fan controller after a power failure.

OPERATING CONDITIONS

- Power supply: 24 V AC / DC, max. 80 mA
- Control outputs: dry contacts, separated by relay.
- Protection Class: II IEC 536
- Degree of protection: IP 40
- Environment: Normal Influence Class
- Dimensions (W × H × D): 83 × 125 × 37 mm

ORe 5 controllers must be energized by a power supply which complies with safety rules of protection against electric shock - SELV circuit in accordance with the ČSN 33 2000-4-41, ed 2 standard.
ORe 5 controller is built into a plastic casing, which enables the controller to be installed in residential as well as commercial building interiors. It can be installed in the vertical position with its rear side to the wall.
One ORe 5 controller can drive two TRN speed controlor up to four RFFM controllers.

USER SETTINGS

Blocking of the fan's switching-off

Configuring the controller for security protection function – delayed shutdown of fans for air handling units with electric heater and control unit. If the „0" speed stage is blocked, the control unit will not stop the fans until the electric heater cools down. The switching-off request from the controller is only transmitted, and the fan's speed is set to stage # 1 to cool the heater down. If the ORe 5 controller is connected to a control unit and an electric heater, blocking of the „0" stage is compulsory! It is not necessary to block the „0" stage with an air-handling assembly equipped with a water heater.

Setting the Sequence of Output Stages

User sequence settings of transition from one speed to another in two variants (0, 1, 2, 3, 4, 5, 4, 3, 2, 1, 0, ...) or (0, 1, 2, 3, 4, 5, 0, 1, 2, 3, 4, 5,...).
If the stage "0" is blocked (after switching to this position) the yellow LED (STOP) and green LED (speed) "1" is lit (until the device is stopped by control unit), finally LED for level 1" then goes off.

User settings procedures, see ORe 5 user manual.

CONNECTING TO TRN CONTROLLERS

FIGURE 25 – ORE 5 FRONT VIEW

- The connection of the ORe 5 controller to the TRN controllers is shown in figure # 26 and # 27.
- For connection to RFFM refer to figure # 28.
- The connection of the controller to the TRN controllers is included in the control unit's documentation.
- Control cable must be routed separately from power cables with minimal concurrency.
- The ORe 5 controller is connected to the speed controller using an SYKFY 4×2×0,5 shielded cable..

Note:
If necessary, to control the output for a group of roof fans RF (total air-flow) it is recommended to always consider the possibility of regulating the air-flow by turning off individual fans and without the use of ORe 5 and RFFM controllers (cost savings, ease of installation, eliminating the EMC solutions).

FIGURE 26 – ORE 5 CONNECTION TO TRN-D CONTROLLER

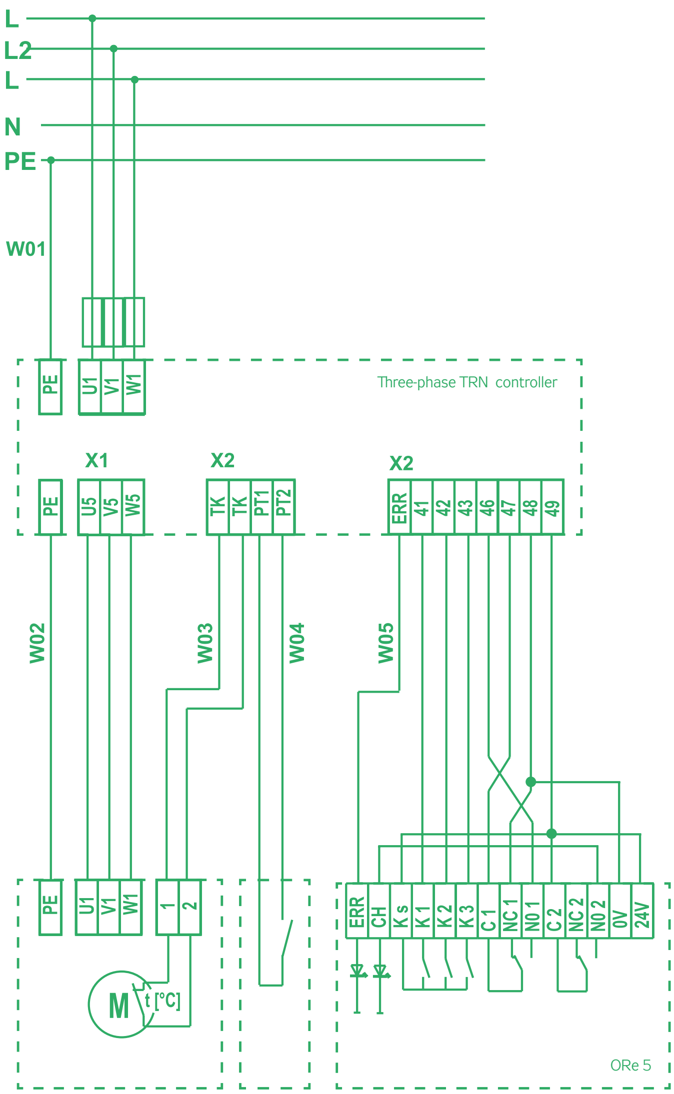
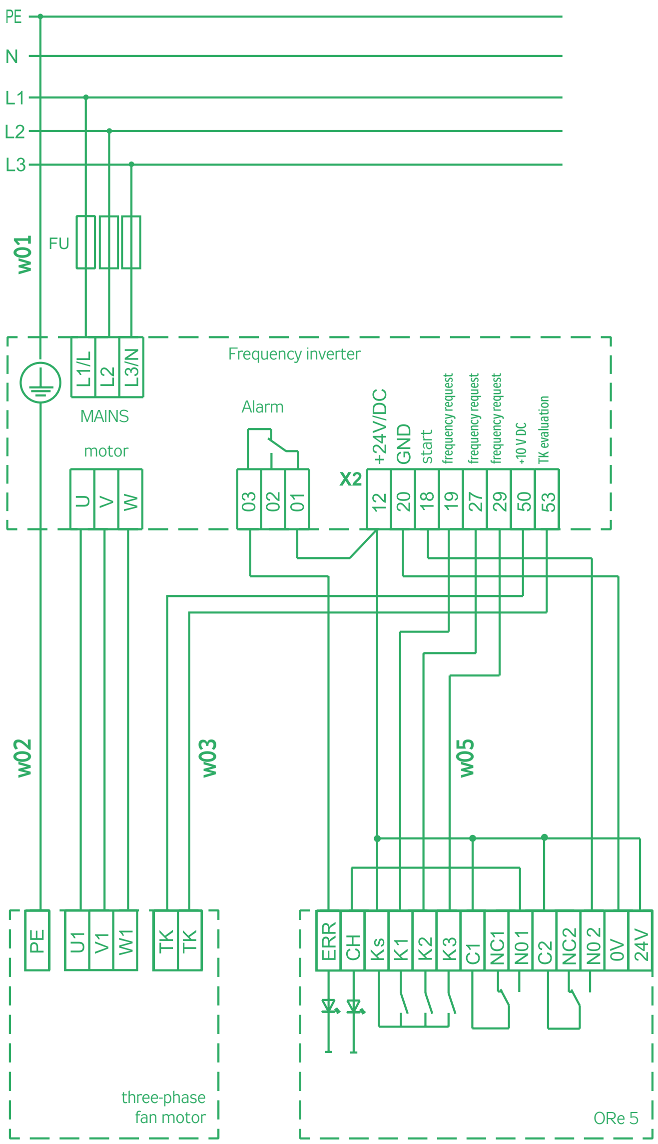


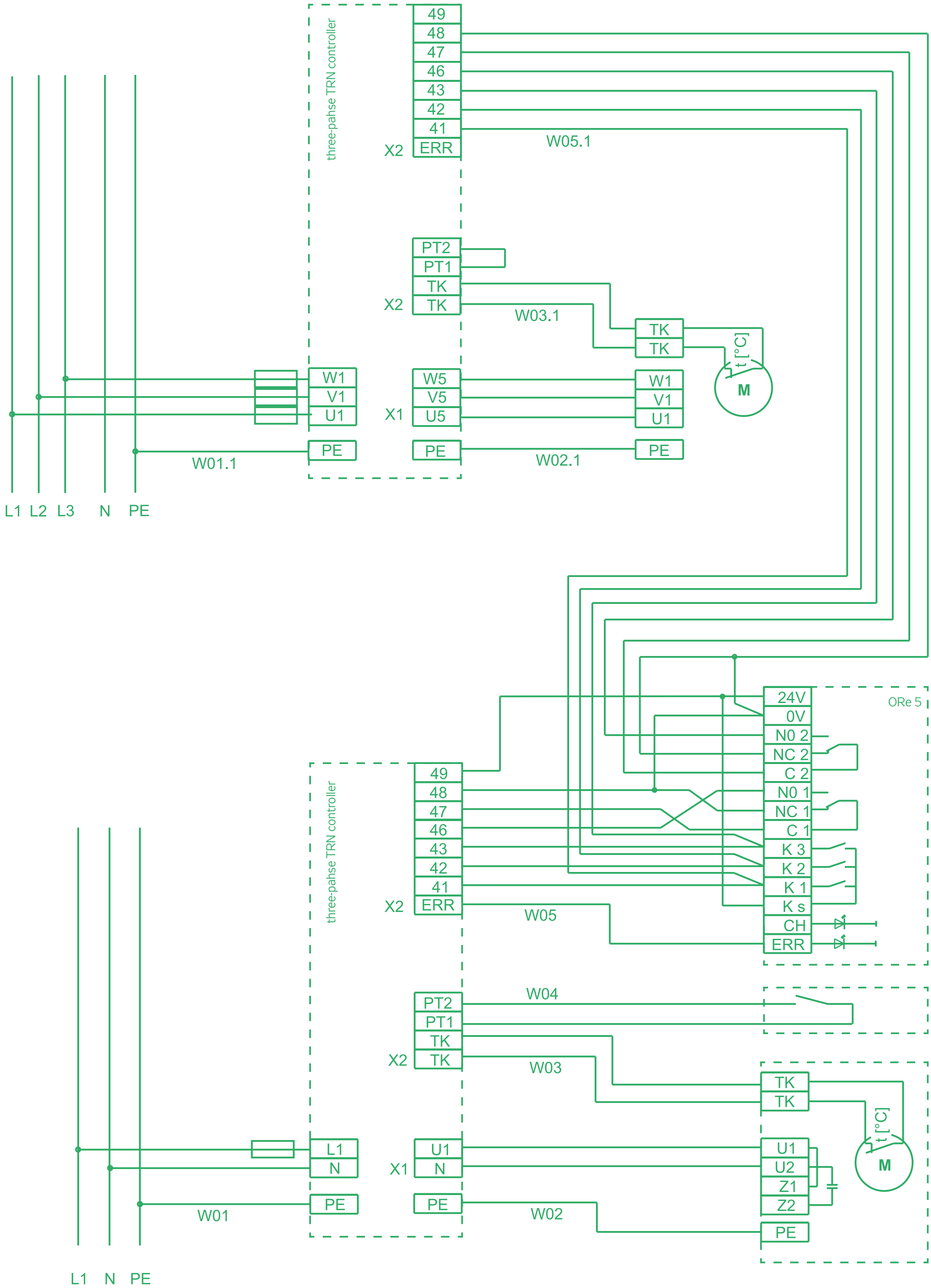
FIGURE 28 – CONTROLLER CONNECTION TO RFFM CONTROLLER (3 × 400 V)



Connecting multiple RFFM controllers to ORe 5:

If two or more (max. 5) RFFM regulators have to be connected to one ORe 5 controller, regulators terminals for frequency request (19, 27, 29) to the ORe 5 K1, K2, K3 terminals should be connected in parallel, equally in parallel are connected controllers terminals for start (18, 20) to the NO2, 0V terminals of the controller. 12 (+ 24V) terminal of only one reference controller is connected to 24 V, Ks, C1, C2 terminals of ORe 5 controller.
At the same time, 01 terminals of all alarm contacts of RFFM regulators are connected in parallel to 12 (+24 V) terminal of the same controller (do not interconnect 12 (+ 24V) terminal of any controller!). ERR failure terminal of ORe 5 controller is connected to the 03 (Alarm) terminal of all controllers.

FIGURE 27 – CONTROLLER CONNECTION,
TWO TRN 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 RF 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 # 6.

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 2000-1 ed.2 (IEC 60364-1).

- → 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.

DIMENSIONAL AND OUTPUT RANGE

Totally seven types of TRRE (D) five-stage controllers are manufactured in accordance with table #7 and figure # 29..

TABLE 7 – OUTPUT RANGE

Three-phase (3× 400 V)	Single-phase (1× 230 V)	Max. current (A)
TRRD 2D	TRRE 2	2
TRRD 4D	TRRE 4	4
TRRD 7D	TRRE 7	7
TRRD 9D	–	9

DESIGNATION OF CONTROLLERS

Example: Designation TRRE 4 specifies a single-phase fan controller designed for maximum current of 4 Amp.

FIGURE 29 – TRRE(D) CONTROLLER

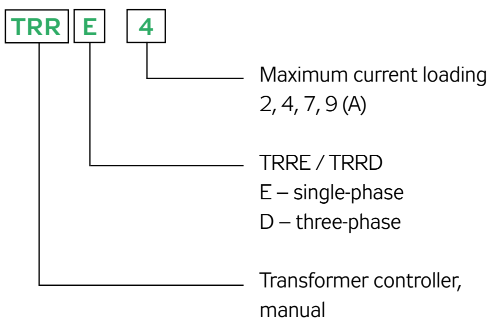


FIGURE 30 – CONTROLLER DESCRIPTION

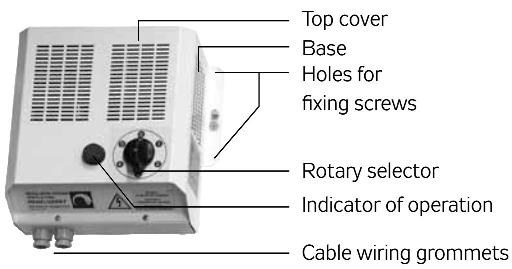
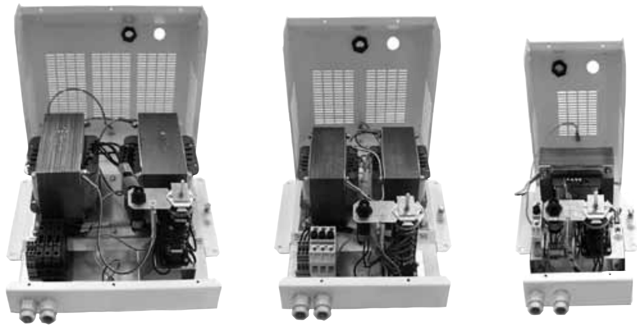


FIGURE 31 – TRRE(D) CONTROLLER TYPES

Controllers - top cover closed

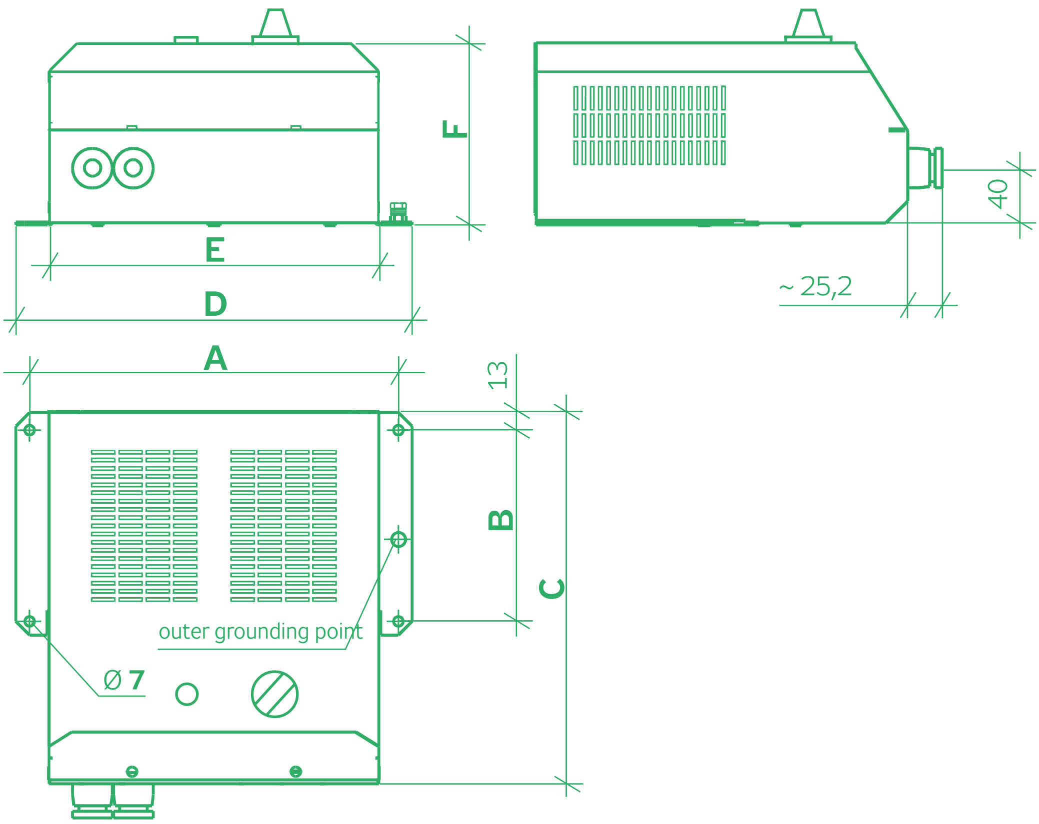


Controllers - top cover open

TABLE 8 – DIMENSIONS AND WEIGHTS

Controller Type	Dimensions in mm						m
	A	B	C	D	E	F	kg
TRRE 2	185	120	253	205	157	134	5
TRRE 4	185	120	253	205	157	134	7
TRRE 7	185	120	253	205	157	134	8
TRRD 2	270	140	273	290	242	134	10
TRRD 4	270	140	273	290	242	134	14
TRRD 7	340	170	303	360	312	157	26
TRRD 9	340	170	303	360	312	157	32

FIGURE 32 – CONTROLLER DIMENSIONS

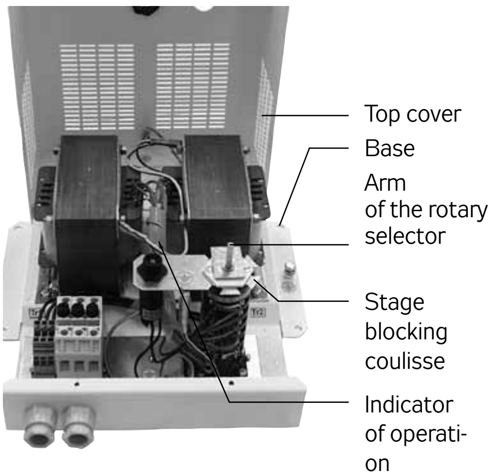


INSTALLATION

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 can be mounted in a vertical or horizontal position and mounted on a wall or on auxiliary construction.
- he 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.
- he 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. For more information about blocking refer to the installation instructions.

FIGURE 33 – MECHANICAL STAGE BLOCKING



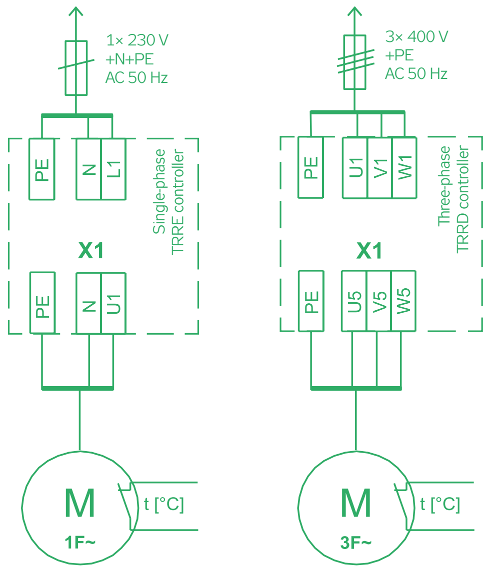
WIRING

- 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.
- 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).
- 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.

- 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.
- Prior to commissioning, it is necessary to carry out all inspection and adjustment operations.

FIGURE 34 – TRRE(D) WIRING SCHEME



On following page you find illustrations of installations and wiring of TRRE and TRRD controllers.

- **A** – Installation including STE(D) protecting relay
  One TRRE controller with STE protecting relay
- One TRRD controller with STD protecting relay
- **B** – Installation including the control unit
  Control unit (VCX) with two TRRE and TRRD controllers

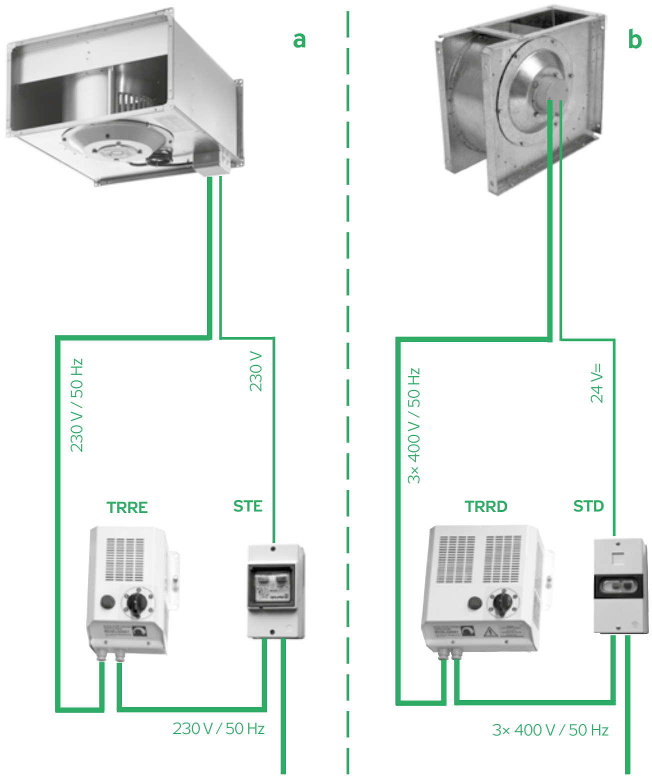
Non-standard assembly connections must be consulted with the manufacturer in writing. The controller's wiring in accordance with the manufacturer's prescription or approval is essential for validity of the guarantee..

EXAMPLE A
FAN WITH THERMAL PROTECTION,
WITHOUT CONTROL

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 # 35 (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 35 – CONTROLLER CONNECTION



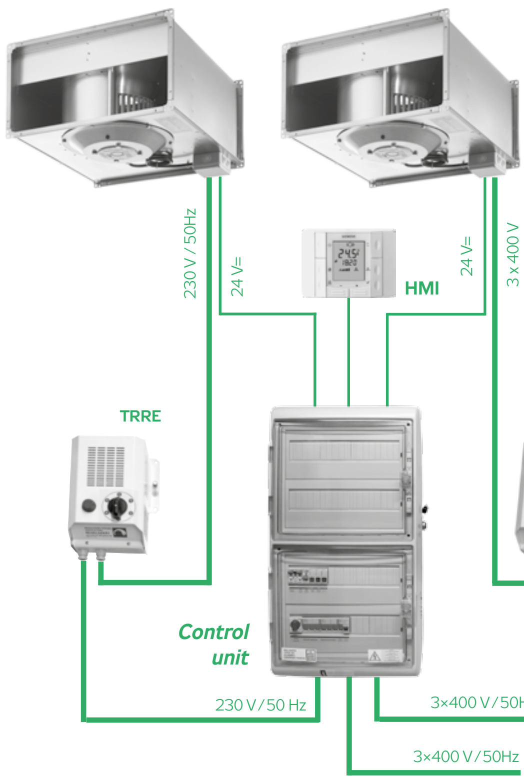
EXAMPLE B
FAN WITH CONTROL UNIT
AND PROTECTION BY TRRE (TRRD) CONTROLLER

An assembly of the control unit with TRRE and TRRD controllers is shown in figure # 36.
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 "0" on the controller must be blocked in the assembly with a control unit 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 36 – CONTROLLER CONNECTION



USE OF CONTROLLER

The manual ORP controller is intended for remote speed control of the RE fan's EC motor.

- It is used for manual start-up and step-less fan speed settings ranging from 0%, respectively from the minimum fan speed, to 100% speed.
- It controls the fans using a control signal of 0–10 V DC controlled by the potentiometer which is supplied from the standard +10 V DC voltage output of the RE fans.
- It enables multiple fans (max. 10), connected in parallel to the control output of the controller, to be controlled.
- The ORP IP 54 type enables the single pole of another circuit to be switched along with fan start-up (e.g., opening and closing of the closing damper).

OPERATING CONDITIONS, DESCRIPTION

- Power supply: 10 V DC (from the fan motor)
- ORP IP 40 degree of protection: IP 40
- ORP IP 54 degree of protection: IP 54 for wall installation using the supplied box, IP 44 for embedded installation under plaster.
- Environment: Normal Influence Class
- Max. ambient temperature: 35 °C
- Auxiliary closing contact for ORP IP 54: max. 230 V AC, 1 A, in the left end position of the potentiometer.
- It is forbidden to install it on vibrating surfaces (directly on the fan, duct)

The potentiometer is equipped with a knob and connection points situated on the circuit board in the box; the box can be installed on the wall using screws.

FIGURE 37 – ORP (IP 40) FRONT PANEL

FIGURE 38 – ORP (IP 40) DIMENSIONS

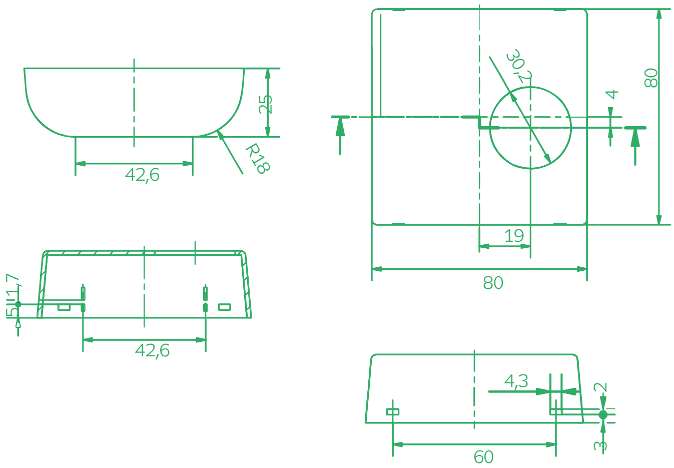
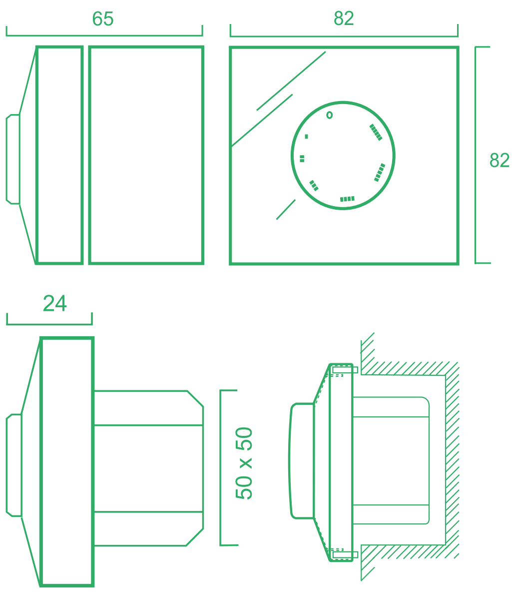


FIGURE 39 – ORP (IP 54) FRONT PANEL

FIGURE 40 – ORP (IP 54) DIMENSIONS



CONTROLLER CONNECTION TO THE FAN

Figures # 41 and # 42 show the wiring diagrams, respectively terminal boxes, for both ORP controller versions.
When multiple fans are controlled by (connected to) one controller, the ORP power supply (+10 V) can only be connected to one of the fans.

FIGURE 41 – ORP (IP 40) CONTROLLER CONNECTION

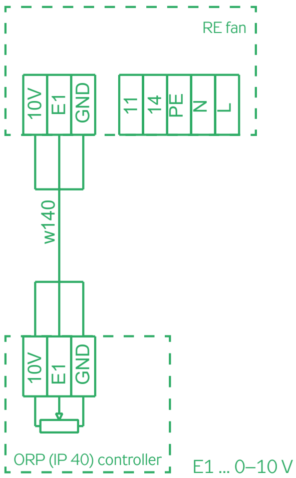


FIGURE 42 – ORP (IP 54) CONTROLLER CONNECTION

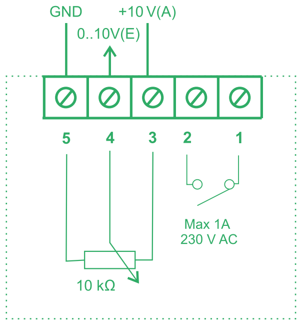
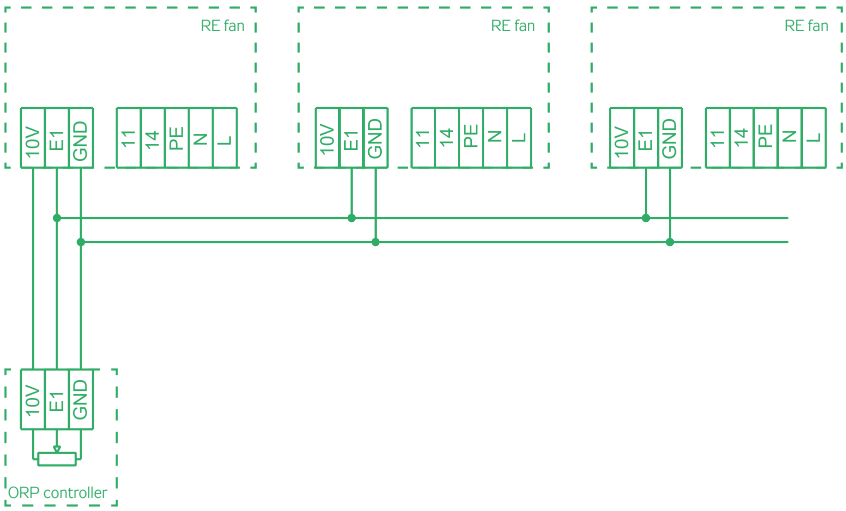


FIGURE 43 – ORP CONTROLLER CONNECTION TO MULTIPLE RE FANS



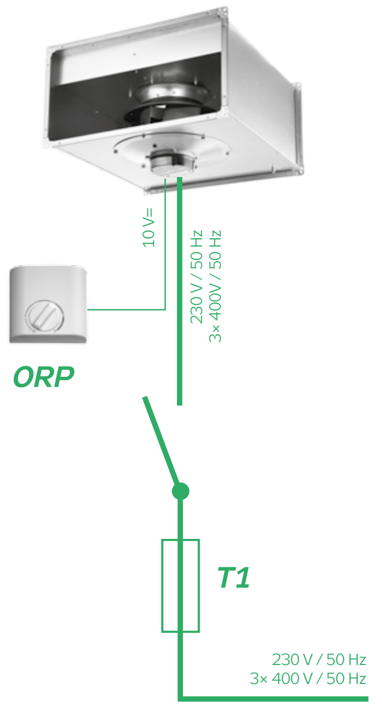
Note:
The fan's power supply is not displayed in the figure - see fan documentation.
The ORP controller must only be supplied (10 V) from one fan!

ORP
DISTANT CONTROLLER

EXAMPLE A
BASIC CONNECTION OF THE ORP TO THE FAN

The example shows the basic version of the ORP IP 40 controller connection to the RE fan for manual control.
The power supply switch is used for fan service switching-off. It is not suitable for switching off in normal operation; this is performed using the ORP controller (see RE Fan Instructions).

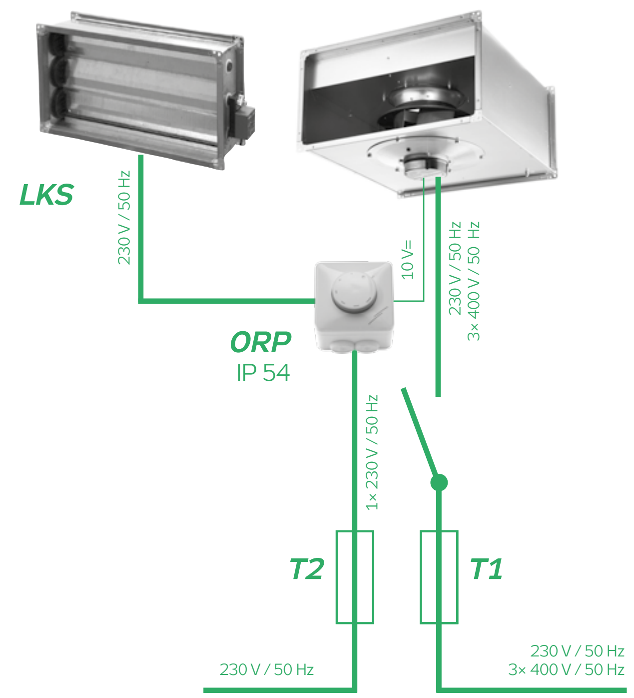
FIGURE 44 – CONTROLLER CONNECTION



EXAMPLE B
CONNECTION OF THE ORP IP 54 TO A FAN WITH LKS DAMPER CONTROL

The example shows a variant of the ORP IP 54 controller connection to the RE fan for manual control, including use of the auxiliary switch which is integrated into the ORP IP 54 for one-pole switching of the closing damper.

FIGURE 45 – CONTROLLER CONNECTION



USE 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 RE 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 # 49 and mentioned in "Wiring" section. 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".

FIGURE 46 – REGULÁTOR ŘADY PE

TABLE 9 – PARAMETERS

Technical parameters	PE 2,5	PE 4
Rated voltage	230 V / 50 Hz	
Rated current	2,5 A	4 A
Minimum motor current	0,2 A	0,4 A
Internal fuse	F 1,25A-H	F 5,00A-H
Cover / Color	Plast / RAL 9010	
Weight	300 g	360 g

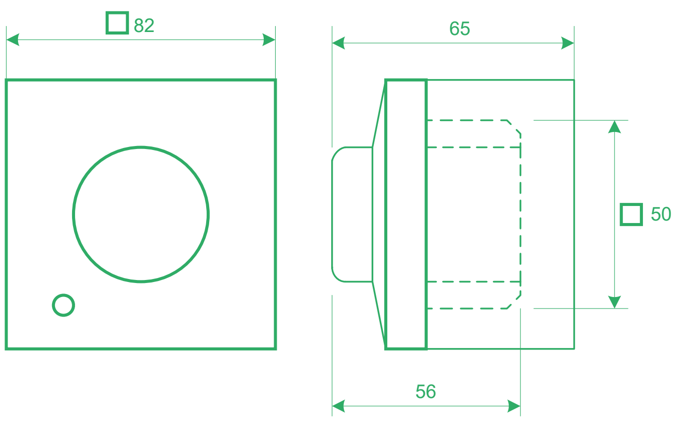
Operation and Output Signalling

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.

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 2000-1 ed. 2). They can be installed on the wall or into the mounting box embedded under the plaster (PE 2,5). Degree of protection is IP 54 (PE 2,5 – using only the supplied boxes and mounting on plaster, or IP 44 when mounting PE 2.5 to installation flush box). Permissible ambient temperature +0 to +35 ºC.

FIGURE 47 – CONTROLLER DIMENSIONS



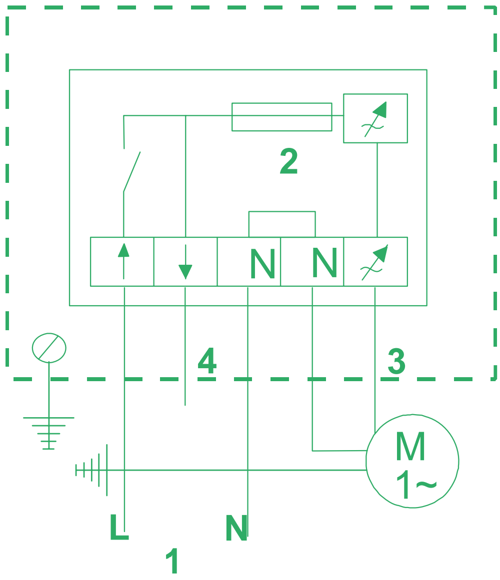
WIRING

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 downwards.
- **Attention!** If PE controller works in assembly with a control unit L1 phase conductor must be connected to the controller's ↓ 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 ↑ terminal. Then, the fan can be switched off by the controller.
- inimum 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.

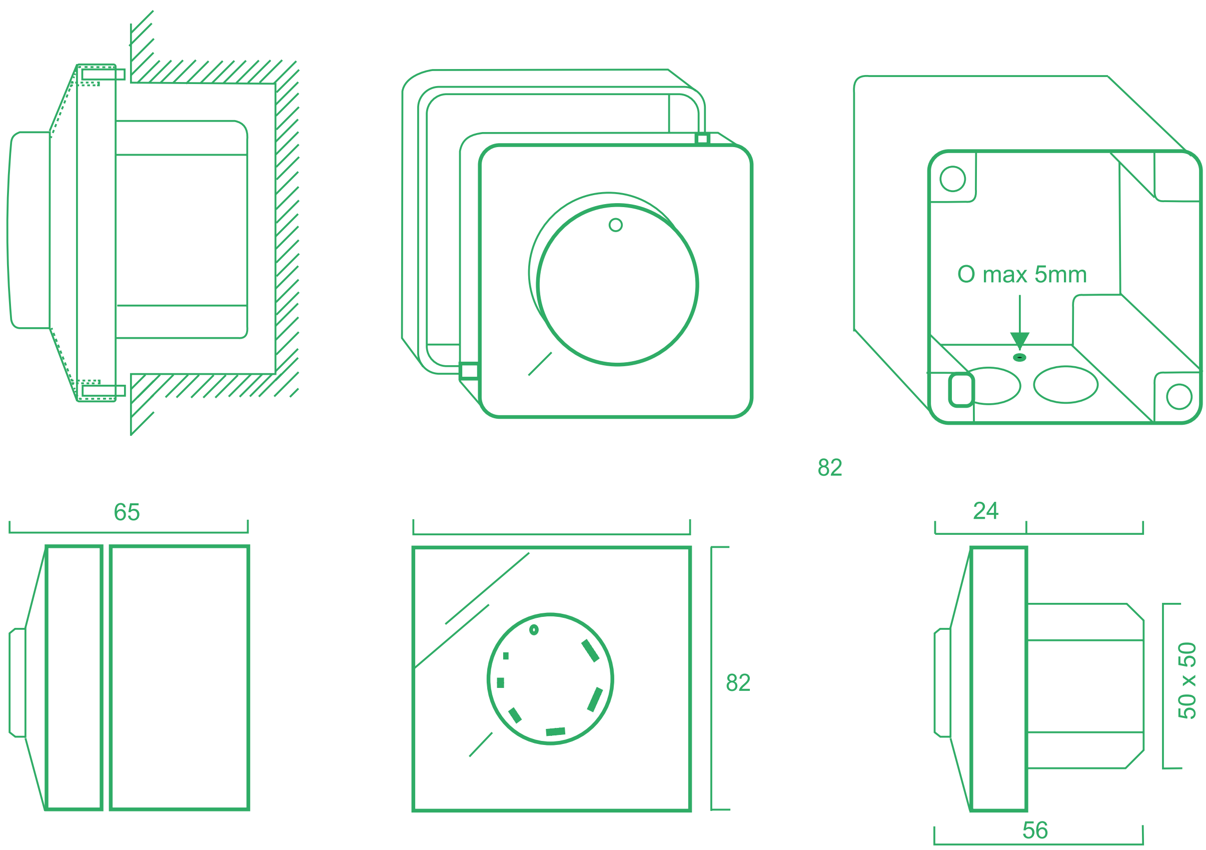
Unlike TRN controllers, PE controllers can cause humming (squeaking) of the motor at low speed.

FIGURE 49 – ELECTRIC CONNECTION



- Supply: 1× 230 V AC, 50/60 Hz
- Internal fuse
- Regulated output for motor
- Not regulated output 230 V respectively. switching ON/OFF bypass

FIGURE 48 – MOUNTING INSTRUCTIONS



Electric heaters

APPLICATIONS OF HEATERS

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 2000-1 ed. 2 (IEC 60364-1). 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).

TABLE 1 – OUTPUT RANGE

Type	Size	Output [kW]															
		1,5	2	2,5	3	4	4,5	5	6	7,5	10	12	15	22,5	30	37,5	45
EO	30-15	■			■		■										
EO	40-20		■			■			■			■					
EO	50-25			■				■		■	■		■	■			
EO	50-30							■		■	■		■	■			
EO	60-30									■	■		■	■	■		
EO	60-35									■	■		■	■	■		
EO	70-40										■		■	■	■	■	■
EO	80-50										■		■	■	■	■	■
EO	90-50												■	■	■	■	■
EO	100-50												■	■	■	■	■
EOS	30-15	■			■		■										
EOS	40-20		■			■			■			■					
EOS	50-25			■				■		■	■		■	■			
EOS	50-30							■		■	■		■	■			
EOS	60-30									■	■		■	■	■		
EOS	60-35									■	■		■	■	■		
EOS	70-40										■		■	■	■	■	■
EOS	80-50										■		■	■	■	■	■
EOS	90-50												■	■	■	■	■
EOS	100-50												■	■	■	■	■
EOSX	30-15																
EOSX	40-20											■					
EOSX	50-25												■	■			
EOSX	50-30												■	■			
EOSX	60-30												■	■	■		
EOSX	60-35												■	■	■		
EOSX	70-40												■	■	■	■	■
EOSX	80-50												■	■	■	■	■
EOSX	90-50												■	■	■	■	■
EOSX	100-50												■	■	■	■	■

POSITION AND LOCATION

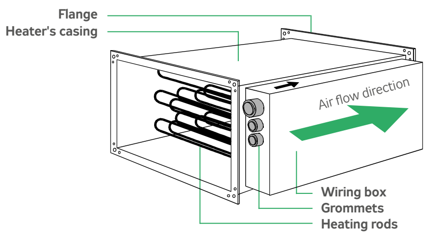
The heaters can operate in any position except the position with the wiring distribution box directed downwards (there is a risk of condensate penetration from the air duct). When projecting the layout of the heater location, we recommend observing the following:

- → 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).

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.

FIGURE 1 - AIR FLOW DIRECTION

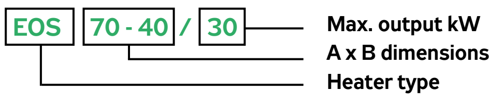


Note: See also Fig. 9, page 189

DESIGNATION OF HEATERS

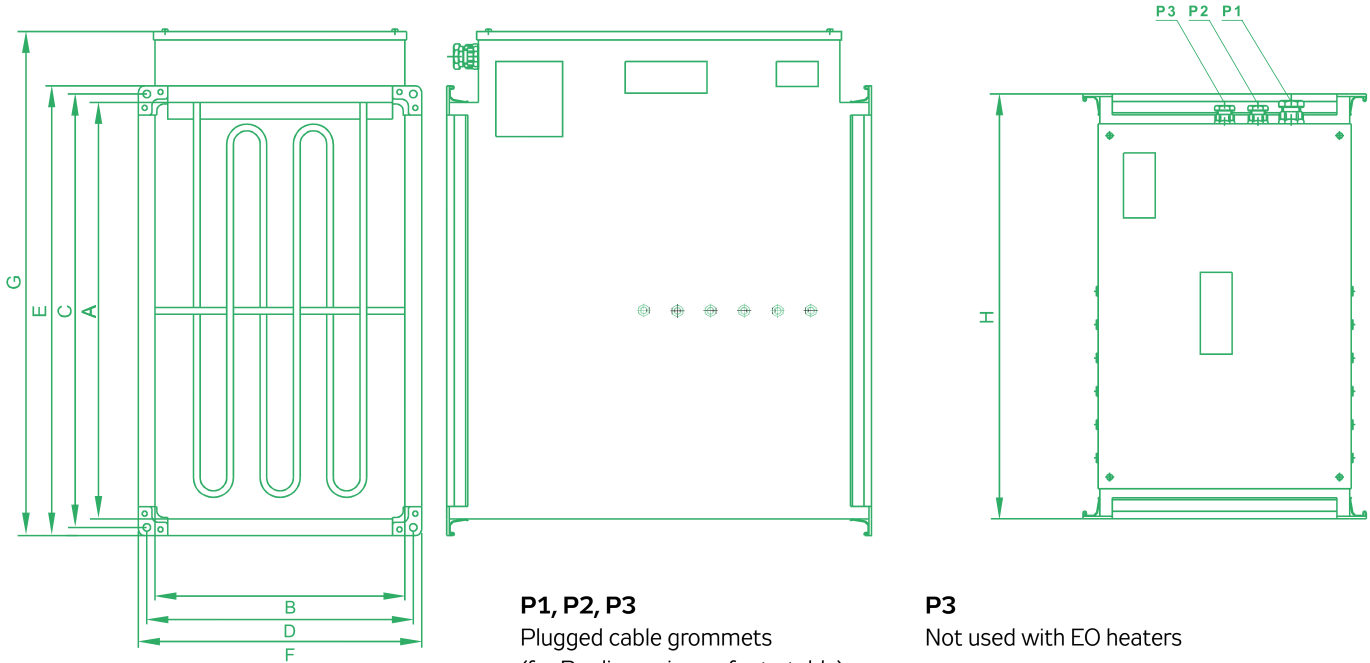
Type designation of the electric heaters in projects and orders is defined by the key in figure # 2. The heater's type designation includes its rounded up max. output.

FIGURE 2 - TYPE DESIGNATION



Electric heater without switching – EO
Electric heater with switching – EOS
Electric heater with cascade switching – EOSX

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

Type and size	A	B	C	D	E	F	G	H	m *	P1	P2	P3
	mm	mm	mm	mm	mm	mm	mm	mm	kg	Pg	Pg	Pg
EO 30-15/1.5	300	150	320	170	340	190	407	360	5,8	13,5	11	11
EO 30-15/3	300	150	320	170	340	190	407	360	6,5	13,5	11	11
EO 30-15/4.5	300	150	320	170	340	190	407	360	6,8	13,5	11	11
EO 40-20/2	400	200	420	220	440	240	507	360	7	13,5	11	11
EO 40-20/4	400	200	420	220	440	240	507	360	7,5	13,5	11	11
EO 40-20/6	400	200	420	220	440	240	507	390	9,3	13,5	11	11
EO 40-20/12	400	200	420	220	440	240	507	510	12,6	16	11	11
EO 50-25/2.5	500	250	520	270	540	290	607	360	9	13,5	11	11
EO 50-25/5	500	250	520	270	540	290	607	390	10	13,5	11	11
EO 50-25/7.5	500	250	520	270	540	290	607	390	11,5	16	11	11
EO 50-25/10	500	250	520	270	540	290	607	510	14,5	16	11	11
EO 50-25/15	500	250	520	270	540	290	607	510	16,5	16	11	11
EO 50-25/22.5	500	250	520	270	540	290	607	630	19,5	21	11	11
EO 50-30/5	500	300	520	320	540	340	607	390	10,8	13,5	11	11
EO 50-30/7.5	500	300	520	320	540	340	607	390	12,3	16	11	11
EO 50-30/10	500	300	520	320	540	340	607	510	14,5	16	11	11
EO 50-30/15	500	300	520	320	540	340	607	510	17	16	11	11
EO 50-30/22.5	500	300	520	320	540	340	607	630	22,2	21	11	11
EO 60-30/7.5	600	300	620	320	640	340	707	390	11,9	16	11	11
EO 60-30/10	600	300	620	320	640	340	707	510	16,7	16	11	11
EO 60-30/15	600	300	620	320	640	340	707	510	18,6	16	11	11
EO 60-30/22.5	600	300	620	320	640	340	707	630	23,5	21	11	11
EO 60-30/30	600	300	620	320	640	340	707	750	30,5	29	11	11
EO 60-35/7.5	600	350	620	370	640	390	707	390	12,8	16	11	11
EO 60-35/10	600	350	620	370	640	390	707	510	16,8	16	11	11
EO 60-35/15	600	350	620	370	640	390	707	510	19,5	16	11	11
EO 60-35/22.5	600	350	620	370	640	390	707	630	25,8	21	11	11

* Weight ±10 %

Type and size	A	B	C	D	E	F	G	H	m *	P1	P2	P3
	mm	mm	mm	mm	mm	mm	mm	mm	kg	Pg	Pg	Pg
EO 60-35/30	600	350	620	370	640	390	707	750	30,8	29	11	11
EO 70-40/10	700	400	720	420	740	440	807	510	19	16	11	11
EO 70-40/15	700	400	720	420	740	440	807	510	21	16	11	11
EO 70-40/22.5	700	400	720	420	740	440	807	630	26	21	11	11
EO 70-40/30	700	400	720	420	740	440	807	750	31,7	29	11	11
EO 70-40/37.5	700	400	720	420	740	440	860	990	40	42	11	11
EO 70-40/45	700	400	720	420	740	440	860	990	43,5	42	11	11
EO 80-50/10	800	500	820	520	840	540	907	510	21,5	16	11	11
EO 80-50/15	800	500	820	520	840	540	907	510	24	16	11	11
EO 80-50/22.5	800	500	820	520	840	540	907	630	28,5	21	11	11
EO 80-50/30	800	500	820	520	840	540	907	750	35,2	29	11	11
EO 80-50/37.5	800	500	820	520	840	540	960	990	42,6	42	11	11
EO 80-50/45	800	500	820	520	840	540	960	990	48	42	11	11
EO 90-50/15	900	500	930	530	960	560	1015	510	25,8	16	11	11
EO 90-50/22.5	900	500	930	530	960	560	1015	630	33,6	21	11	11
EO 90-50/30	900	500	930	530	960	560	1030	750	43,7	29	11	11
EO 90-50/37.5	900	500	930	530	960	560	1060	990	51,2	42	11	11
EO 90-50/45	900	500	930	530	960	560	1060	990	57	42	11	11
EO 100-50/15	1000	500	1030	530	1060	560	1115	510	32,3	16	11	11
EO 100-50/22.5	1000	500	1030	530	1060	560	1115	630	39,8	21	11	11
EO 100-50/30	1000	500	1030	530	1060	560	1130	750	48,8	29	11	11
EO 100-50/37.5	1000	500	1030	530	1060	560	1160	990	57,3	42	11	11
EO 100-50/45	1000	500	1030	530	1060	560	1160	990	64,2	42	11	11
EOS 30-15/1.5	300	150	320	170	340	190	407	360	6	13,5	11	11
EOS 30-15/3	300	150	320	170	340	190	407	360	6,5	13,5	11	11
EOS 30-15/4.5	300	150	320	170	340	190	407	360	6,8	13,5	11	11
EOS 40-20/2	400	200	420	220	440	240	507	360	7,5	13,5	11	11
EOS 40-20/4	400	200	420	220	440	240	507	360	8,1	13,5	11	11
EOS 40-20/6	400	200	420	220	440	240	507	390	9,3	13,5	11	11
EOS 40-20/12	400	200	420	220	440	240	507	510	12,6	16	11	11
EOS 50-25/2.5	500	250	520	270	540	290	607	360	9,6	13,5	11	11
EOS 50-25/5	500	250	520	270	540	290	607	390	10,7	13,5	11	11
EOS 50-25/7.5	500	250	520	270	540	290	607	390	11,5	16	11	11
EOS 50-25/10	500	250	520	270	540	290	607	510	15,1	16	11	11
EOS 50-25/15	500	250	520	270	540	290	607	510	16,5	16	11	11
EOS 50-25/22.5	500	250	520	270	540	290	607	630	19,5	21	11	11
EOS 50-30/5	500	300	520	320	540	340	607	390	11,5	13,5	11	11
EOS 50-30/7.5	500	300	520	320	540	340	607	390	12,3	16	11	11
EOS 50-30/10	500	300	520	320	540	340	607	510	15,3	16	11	11
EOS 50-30/15	500	300	520	320	540	340	607	510	17	16	11	11
EOS 50-30/22.5	500	300	520	320	540	340	607	630	22,2	21	11	11
EOS 60-30/7.5	600	300	620	320	640	340	707	390	12,5	16	11	11
EOS 60-30/10	600	300	620	320	640	340	707	510	17,4	16	11	11
EOS 60-30/15	600	300	620	320	640	340	707	510	18,6	16	11	11
EOS 60-30/22.5	600	300	620	320	640	340	707	630	23,5	21	11	11
EOS 60-30/30	600	300	620	320	640	340	707	750	30,5	29	11	11
EOS 60-35/7.5	600	350	620	370	640	390	707	390	13,5	16	11	11
EOS 60-35/10	600	350	620	370	640	390	707	510	17,6	16	11	11
EOS 60-35/15	600	350	620	370	640	390	707	510	19,5	16	11	11
EOS 60-35/22.5	600	350	620	370	640	390	707	630	25,8	21	11	11
EOS 60-35/30	600	350	620	370	640	390	707	750	30,8	29	11	11
EOS 70-40/10	700	400	720	420	740	440	807	510	19,6	16	11	11

Type and size	A	B	C	D	E	F	G	H	m *	P1	P2	P3
	mm	mm	mm	mm	mm	mm	mm	mm	kg	Pg	Pg	Pg
EOS 70-40/15	700	400	720	420	740	440	807	510	21	16	11	11
EOS 70-40/22.5	700	400	720	420	740	440	807	630	26,8	21	11	11
EOS 70-40/30	700	400	720	420	740	440	807	750	33,5	29	11	11
EOS 70-40/37.5	700	400	720	420	740	440	860	990	41	42	11	11
EOS 70-40/45	700	400	720	420	740	440	860	990	45	42	11	11
EOS 80-50/10	800	500	820	520	840	540	907	510	22,1	16	11	11
EOS 80-50/15	800	500	820	520	840	540	907	510	24	16	11	11
EOS 80-50/22.5	800	500	820	520	840	540	907	630	29,2	21	11	11
EOS 80-50/30	800	500	820	520	840	540	907	750	37,2	29	11	11
EOS 80-50/37.5	800	500	820	520	840	540	960	990	43,3	42	11	11
EOS 80-50/45	800	500	820	520	840	540	960	990	50,5	42	11	11
EOS 90-50/15	900	500	930	530	960	560	1015	510	26,6	16	11	11
EOS 90-50/22.5	900	500	930	530	960	560	1015	630	34,3	21	11	11
EOS 90-50/30	900	500	930	530	960	560	1030	750	43,7	29	11	11
EOS 90-50/37.5	900	500	930	530	960	560	1060	990	51,9	42	11	11
EOS 90-50/45	900	500	930	530	960	560	1060	990	57	42	11	11
EOS 100-50/15	1000	500	1030	530	1060	560	1115	510	32,9	16	11	11
EOS 100-50/22.5	1000	500	1030	530	1060	560	1115	630	40,5	21	11	11
EOS 100-50/30	1000	500	1030	530	1060	560	1130	750	49,6	29	11	11
EOS 100-50/37.5	1000	500	1030	530	1060	560	1160	990	57,9	42	11	11
EOS 100-50/45	1000	500	1030	530	1060	560	1160	990	64,9	42	11	11
EOSX 40-20/12	400	200	420	220	440	240	507	510	12,6	16	11	11
EOSX 50-25/15	500	250	520	270	540	290	607	510	16,5	16	11	11
EOSX 50-25/22.5	500	250	520	270	540	290	607	630	19,5	21	11	11
EOSX 50-30/15	500	300	520	320	540	340	607	510	17	16	11	11
EOSX 50-30/22.5	500	300	520	320	540	340	607	630	22,2	21	11	11
EOSX 60-30/15	600	300	620	320	640	340	707	510	18,6	16	11	11
EOSX 60-30/22.5	600	300	620	320	640	340	707	630	23,5	21	11	11
EOSX 60-30/30	600	300	620	320	640	340	707	750	30,5	29	11	11
EOSX 60-35/15	600	350	620	370	640	390	707	510	19,5	16	11	11
EOSX 60-35/22.5	600	350	620	370	640	390	707	630	25,8	21	11	11
EOSX 60-35/30	600	350	620	370	640	390	707	750	30,8	29	11	11
EOSX 70-40/15	700	400	720	420	740	440	807	510	21	16	11	11
EOSX 70-40/22.5	700	400	720	420	740	440	807	630	27,4	21	11	11
EOSX 70-40/30	700	400	720	420	740	440	807	750	34	29	11	11
EOSX 70-40/37.5	700	400	720	420	740	440	860	990	41,5	42	11	11
EOSX 70-40/45	700	400	720	420	740	440	860	990	45,7	42	11	11
EOSX 80-50/15	800	500	820	520	840	540	907	510	24	16	11	11
EOSX 80-50/22.5	800	500	820	520	840	540	907	630	29,6	21	11	11
EOSX 80-50/30	800	500	820	520	840	540	907	750	36,8	29	11	11
EOSX 80-50/37.5	800	500	820	520	840	540	960	990	43,7	42	11	11
EOSX 80-50/45	800	500	820	520	840	540	960	990	45,7	42	11	11
EOSX 90-50/15	900	500	930	530	960	560	1015	510	27	16	11	11
EOSX 90-50/22.5	900	500	930	530	960	560	1015	630	34,8	21	11	11
EOSX 90-50/30	900	500	930	530	960	560	1030	750	43,7	29	11	11
EOSX 90-50/37.5	900	500	930	530	960	560	1060	990	53,2	42	11	11
EOSX 90-50/45	900	500	930	530	960	560	1060	990	57	42	11	11
EOSX 100-50/15	1000	500	1030	530	1060	560	1115	510	33,3	16	11	11
EOSX 100-50/22.5	1000	500	1030	530	1060	560	1115	630	42	21	11	11
EOSX 100-50/30	1000	500	1030	530	1060	560	1130	750	51,7	29	11	11
EOSX 100-50/37.5	1000	500	1030	530	1060	560	1160	990	59,2	42	11	11
EOSX 100-50/45	1000	500	1030	530	1060	560	1160	990	66	42	11	11

* Weight ±10 %

RP RQ RO RE RF RPH EX TR.. EO.. VO SUMX CHV CHF HRV HRZ PRI

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 Δ**T**.

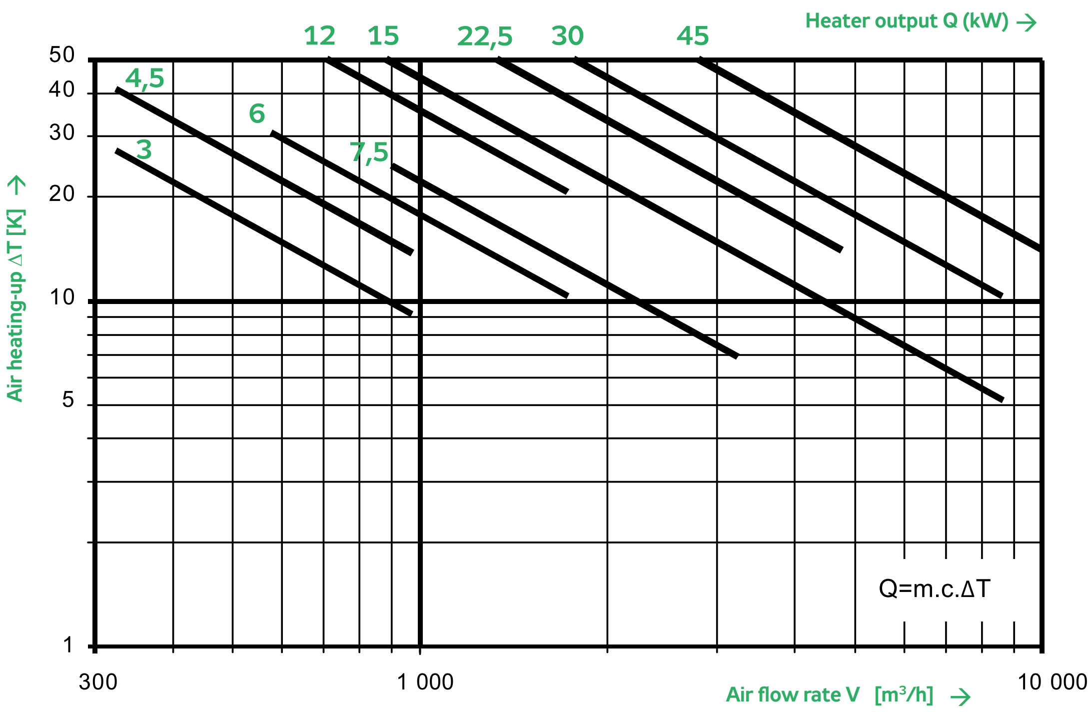
- Preliminary correlations of parameters (Q, V, DT) for all output ranges of standard heaters are included in the graph, see figure # 4. Heating-up DT for the corresponding air flow rate is valid providing the heater works at maximum output. If a control unit is used, the heaters' output will be controlled 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 n accordance with its output and connecting dimensions, and each number comports with one pressure loss/air flow rate correlation characteristic.

PLANNING THE HEATER

When dimensioning and planning the electric heater, it is necessary to observe the following safety principles:

- hen 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 +40ºC.
- 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 m/s. If the output of the fan is controlled by the TRN controller, it is possible to block the lower stages 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



Sample parameter dependency data. Actual data are in the AeroCAD design software.

[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

FIGURE 5 - PRESSURE LOSSES IN HEATERS

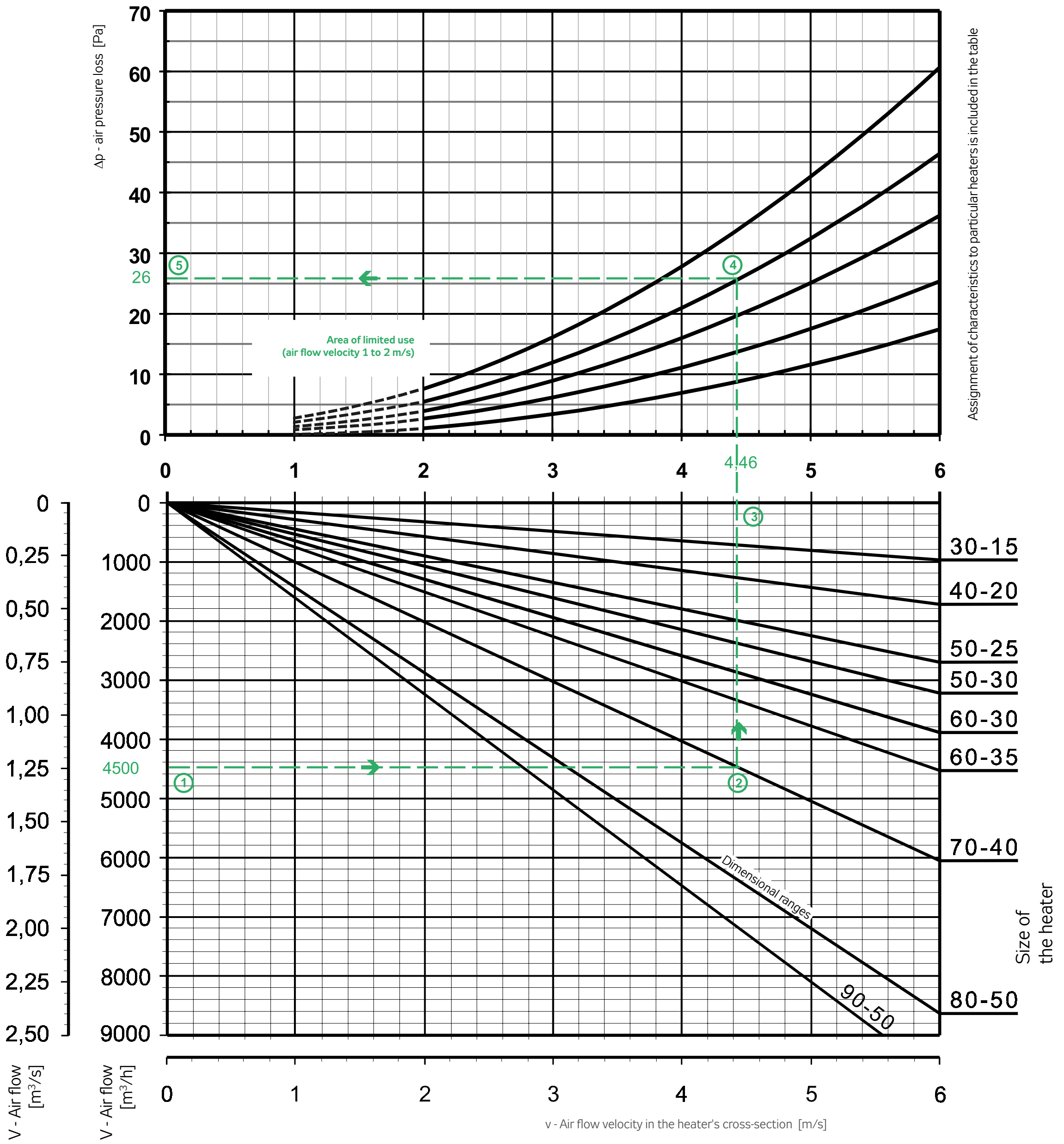
Output (kW) / size	30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50
3.0	❷								
4.5	❸								
6.0		❸							
7.5			❷	❷					
12.0		❺							
15.0			❹	❹	❸	❷	❷	❶	
22.5			❺	❺	❹	❸			
30.0					❺	❹	❹	❷	❷
45.0							❹	❷	❸

Each EO, EOS or EOSX heater in the table is marked with one number in accordance with its output and connecting dimensions:

❶❷❸❹❺

Each number comports with one pressure loss/air flow rate correlation characteristic.

Sample combinations of size ranges and performance. Actual data are in the AeroCAD design software.



Sample pressure loss nomogram. Current and complete data are in the AeroCAD design software.

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 ④ 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 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 ④.

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	✓	✓	
B		✓	
C			✓

The control unit must be configured for each type of control!

[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 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..

FIGURE 6 - EXAMPLE OF CONNECTING HEATER TO CONTROL UNIT

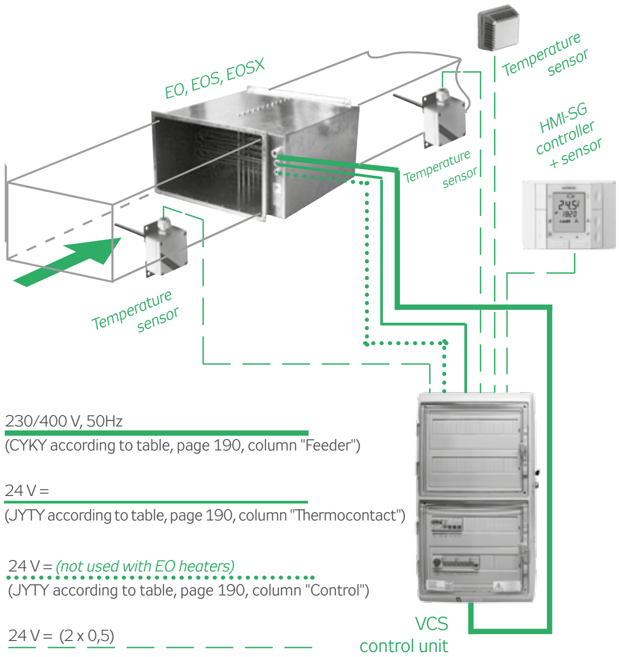
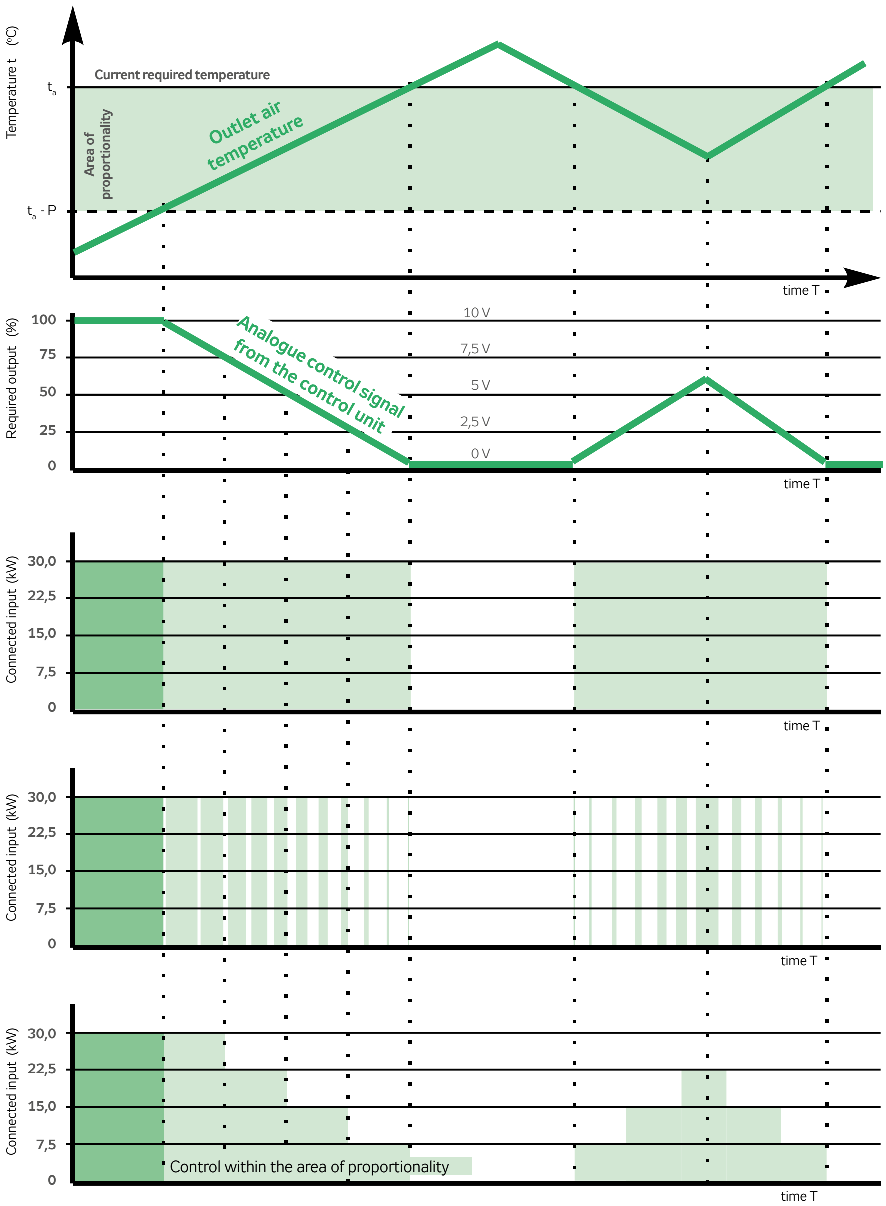


FIGURE 8 - SIMPLIFIED MODEL OF SWITCHING (CONTROL) OF ELECTRIC HEATERS DEPENDING ON THE TEMPERATURE COURSE [4)]



TEMPERATURE COURSE
Schematic diagram of the temperature course in the duct behind the electric heater.

REQUIRED OUTPUT
Schematic diagram of the course of the control unit's request for the heating output. The request is represented by the value of the control voltage in the range 0–10V.

Control A

Control B

Control C

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 ºC. 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)] This example shows only a simplified model.

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 heaters can operate in any position except the position with the wiring distribution box directed downwards.
- 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
- The electric heater output must be automatically controlled. REMAK units are recommended to supply, control and protect electric heaters.

WIRING AND COMMISSIONING

- 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 190.
- The wiring must be checked before putting the device into operation.
- The EOSX heaters are controlled by a voltage of 10-40V/DC from the control unit. The control voltage of the EOSX heater is led through a limiting thermostat with a switching point of +45 ºC, which is situated on the cooler of the SSR switching relays.
- The heater is provided with two emergency thermostats adjusted to +80 ºC [5]. The thermostats are connected to terminals E3 and GE.

For basic electrical parameters and recommended cables to connect the electric heaters to the control unit, refer to Table 6 on page 188.
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 ºC (ČSN 33 2000-5-523, resp. IEC 364-5-523).

- 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").

TABLE 4 - SWITCHING OPTIONS

Type of heater >	EO	EOS	EOSX
Without switching	✓		
Output switching by SSR		✓	
Output switching by SSR in cascades			✓

- Simpler and cheaper heaters in the EO product line, designed for less demanding conditions, are switched by the contactor directly in the control unit.
- 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

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].

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.

5) First thermostat is adjusted to +80 ºC. The second one can be adjusted in a range of +50 ºC to +90 ºC; factory default setting is +80 ºC. If a change in temperature is required, it is advisable to use only the range +50 ºC to +80 ºC (table 5).

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.

TABLE 5 - PROTECTING THERMOSTATS

Heater type >	EO	EOS	EOSX
I. protective thermostat 50–90 ºC (80 ºC) 5)	✓	✓	✓
II. protective thermostat 80 ºC	✓	✓	✓
III. protective thermostat 45 ºC		✓	✓

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).

EXAMPLES OF WIRING BOX DESIGN

FIGURE 9 - LOCATION OF THE SWITCHES' COOLER

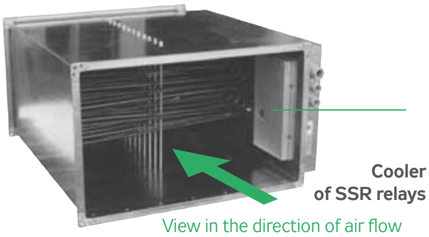
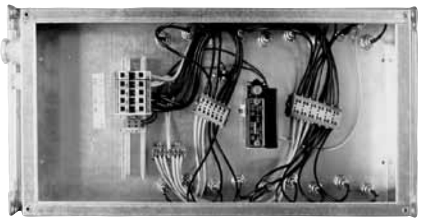
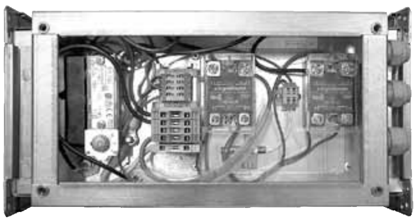


FIGURE 10



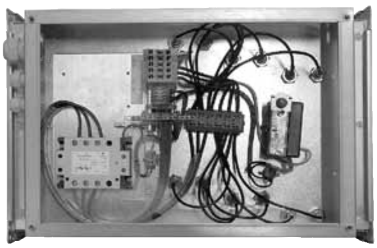
EO... / 3–45, (switching relays are not included)

FIGURE 11



EOS... / ....–..., (two single-phase SSR switching relays are included)

FIGURE 12 – EOS HEATER WIRING BOX - COVER REMOVED



EOS... / ....–..., (one three-phase SSR switching relay is included)

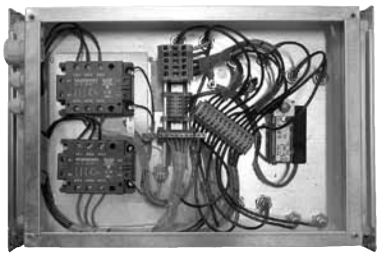
Basic (emergency) thermal protection

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 ºC. 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.

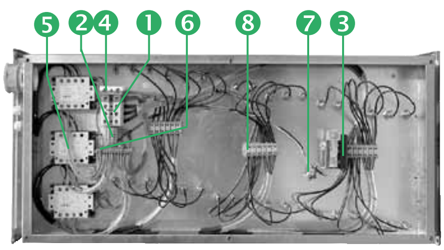
FIGURE 13 – EOSX HEATER WIRING BOX



EOS... / ....–..., (two three-phase SSR switching relays are included)

FIGURE 14 – EOSX HEATER WIRING BOX

The EOSX heater's wiring box - protecting cover removed



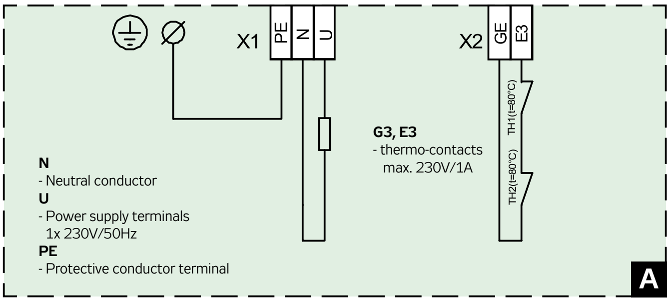
❶ Power supply, ❷ Control and signalling of emergency failure, ❸ Adjustable limiting thermostat, ❹ Protective conductor terminal, ❺ SSR switching relay, ❻ Neutral bus bar, ❼ Ground screw, ❽ Interconnecting bus bar of heating blocks

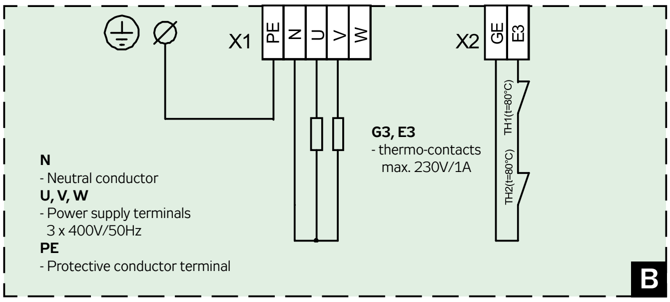
TABLE 6 - BASIC ELECTRICAL PARAMETERS

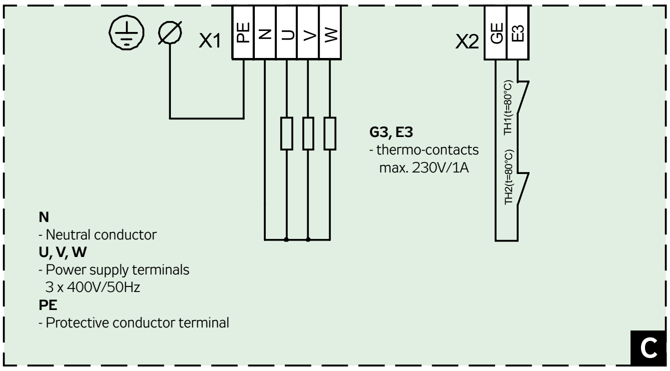
Series	Dimensional range	Type / size	Output	Voltage	Current	Heating rods	Output split	Section output	Feeder	Thermocontact	Control
		Designation	Q	U	I	n	1/s	Qs	Recommended cables		
			kW	V	A	ks x kW		kW	JYTY-O/H05VV-F		
EO	30-15	EO 30-15/1.5	1,5	230	6,52	1x1,5	1/1	1,5	3 x 1.5	2 x 1	-
EO	30-15	EO 30-15/3	3	400	6,52	2x1,5	1/1	3	5 x 1.5	2 x 1	-
EO	30-15	EO 30-15/4.5	4,5	400	6,84	3x1,5	1/1	4,5	5 x 1.5	2 x 1	-
EO	40-20	EO 40-20/2	2	230	8,70	1x2	1/1	2	3 x 1.5	2 x 1	-
EO	40-20	EO 40-20/4	4	400	8,70	2x2	1/1	4	5 x 1.5	2 x 1	-
EO	40-20	EO 40-20/6	6	400	9,12	3x2	1/1	6	5 x 1.5	2 x 1	-
EO	40-20	EO 40-20/12	12	400	18,23	6x2,0	1/1	12	5 x 4	2 x 1	-
EO	50-25	EO 50-25/2.5	2,5	230	10,87	1x2,5	1/1	2,5	3 x 2.5	2 x 1	-
EO	50-25	EO 50-25/5	5	400	10,87	2x2,5	1/1	5	5 x 2.5	2 x 1	-
EO	50-25	EO 50-25/7.5	7,5	400	11,40	3x2,5	1/1	7,5	5 x 2.5	2 x 1	-
EO	50-25	EO 50-25/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	-
EO	50-25	EO 50-25/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	-
EO	50-25	EO 50-25/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	-
EO	50-30	EO 50-30/5	5	400	10,87	2x2,5	1/1	5	5 x 2.5	2 x 1	-
EO	50-30	EO 50-30/7.5	7,5	400	11,40	3x2,5	1/1	7,5	5 x 2.5	2 x 1	-
EO	50-30	EO 50-30/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	-
EO	50-30	EO 50-30/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	-
EO	50-30	EO 50-30/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	-
EO	60-30	EO 60-30/7.5	7,5	400	11,40	3x2,5	1/1	7,5	5 x 2.5	2 x 1	-
EO	60-30	EO 60-30/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	-
EO	60-30	EO 60-30/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	-
EO	60-30	EO 60-30/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	-
EO	60-30	EO 60-30/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	-
EO	60-35	EO 60-35/7.5	7,5	400	11,40	3x2,5	1/1	7,5	5 x 2.5	2 x 1	-
EO	60-35	EO 60-35/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	-
EO	60-35	EO 60-35/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	-
EO	60-35	EO 60-35/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	-
EO	60-35	EO 60-35/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	-
EO	70-40	EO 70-40/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	-
EO	70-40	EO 70-40/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	-
EO	70-40	EO 70-40/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	-
EO	70-40	EO 70-40/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	-
EO	70-40	EO 70-40/37.5	37,5	400	56,98	15x2,5	1/1	37,5	5 x 16	2 x 1	-
EO	70-40	EO 70-40/45	45	400	68,37	18x2,5	1/1	45	5 x 25	2 x 1	-
EO	80-50	EO 80-50/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	-
EO	80-50	EO 80-50/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	-
EO	80-50	EO 80-50/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	-
EO	80-50	EO 80-50/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	-
EO	80-50	EO 80-50/37.5	37,5	400	56,98	15x2,5	1/1	37,5	5 x 16	2 x 1	-
EO	80-50	EO 80-50/45	45	400	68,37	18x2,5	1/1	45	5 x 25	2 x 1	-
EO	90-50	EO 90-50/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	-
EO	90-50	EO 90-50/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	-
EO	90-50	EO 90-50/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	-
EO	90-50	EO 90-50/37.5	37,5	400	56,98	15x2,5	1/1	37,5	5 x 16	2 x 1	-
EO	90-50	EO 90-50/45	45	400	68,37	18x2,5	1/1	45	5 x 25	2 x 1	-
EO	100-50	EO 100-50/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	-
EO	100-50	EO 100-50/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	-
EO	100-50	EO 100-50/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	-
EO	100-50	EO 100-50/37.5	37,5	400	56,98	15x2,5	1/1	37,5	5 x 16	2 x 1	-
EO	100-50	EO 100-50/45	45	400	68,37	18x2,5	1/1	45	5 x 25	2 x 1	-
EOS	30-15	EOS 30-15/1.5	1,5	230	6,52	1x1,5	1/1	1,5	3 x 1.5	2 x 1	2 x 1
EOS	30-15	EOS 30-15/3	3	400	6,52	2x1,5	1/1	3	5 x 1.5	2 x 1	2 x 1
EOS	30-15	EOS 30-15/4.5	4,5	400	6,84	3x1,5	1/1	4,5	5 x 1.5	2 x 1	2 x 1
EOS	40-20	EOS 40-20/2	2	230	8,70	1x2	1/1	2	3 x 1.5	2 x 1	2 x 1
EOS	40-20	EOS 40-20/4	4	400	8,70	2x2	1/1	4	5 x 1.5	2 x 1	2 x 1
EOS	40-20	EOS 40-20/6	6	400	9,12	3x2	1/1	6	5 x 1.5	2 x 1	2 x 1
EOS	40-20	EOS 40-20/12	12	400	18,23	6x2,0	1/1	12	5 x 4	2 x 1	2 x 1
EOS	50-25	EOS 50-25/2.5	2,5	230	10,87	1x2,5	1/1	2,5	3 x 2.5	2 x 1	2 x 1
EOS	50-25	EOS 50-25/5	5	400	10,87	2x2,5	1/1	5	5 x 2.5	2 x 1	2 x 1
EOS	50-25	EOS 50-25/7.5	7,5	400	11,40	3x2,5	1/1	7,5	5 x 2.5	2 x 1	2 x 1
EOS	50-25	EOS 50-25/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	2 x 1
EOS	50-25	EOS 50-25/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	50-25	EOS 50-25/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
EOS	50-30	EOS 50-30/5	5	400	10,87	2x2,5	1/1	5	5 x 2.5	2 x 1	2 x 1
EOS	50-30	EOS 50-30/7.5	7,5	400	11,40	3x2,5	1/1	7,5	5 x 2.5	2 x 1	2 x 1
EOS	50-30	EOS 50-30/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	2 x 1

Series	Dimensional range	Type / size	Output	Voltage	Current	Heating rods	Output split	Section output	Feeder	Thermocontact	Control
		Designation	Q	U	I	n	1/s	Qs	Recommended cables		
			kW	V	A	ks x kW		kW	JYTY-O/H05VV-F		
EOS	50-30	EOS 50-30/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	50-30	EOS 50-30/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
EOS	60-30	EOS 60-30/7.5	7,5	400	11,40	3x2,5	1/1	7,5	5 x 2.5	2 x 1	2 x 1
EOS	60-30	EOS 60-30/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	2 x 1
EOS	60-30	EOS 60-30/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	60-30	EOS 60-30/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
EOS	60-30	EOS 60-30/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	2 x 1
EOS	60-35	EOS 60-35/7.5	7,5	400	11,40	3x2,5	1/1	7,5	5 x 2.5	2 x 1	2 x 1
EOS	60-35	EOS 60-35/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	2 x 1
EOS	60-35	EOS 60-35/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	60-35	EOS 60-35/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
EOS	60-35	EOS 60-35/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	2 x 1
EOS	70-40	EOS 70-40/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	2 x 1
EOS	70-40	EOS 70-40/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	70-40	EOS 70-40/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
EOS	70-40	EOS 70-40/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	2 x 1
EOS	70-40	EOS 70-40/37.5	37,5	400	56,98	15x2,5	1/1	37,5	5 x 16	2 x 1	2 x 1
EOS	70-40	EOS 70-40/45	45	400	68,37	18x2,5	1/1	45	5 x 25	2 x 1	2 x 1
EOS	80-50	EOS 80-50/10	10	400	22,26	4x2,5	1/1	10	5 x 4	2 x 1	2 x 1
EOS	80-50	EOS 80-50/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	80-50	EOS 80-50/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
EOS	80-50	EOS 80-50/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	2 x 1
EOS	80-50	EOS 80-50/37.5	37,5	400	56,98	15x2,5	1/1	37,5	5 x 16	2 x 1	2 x 1
EOS	80-50	EOS 80-50/45	45	400	68,37	18x2,5	1/1	45	5 x 25	2 x 1	2 x 1
EOS	90-50	EOS 90-50/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	90-50	EOS 90-50/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
EOS	90-50	EOS 90-50/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	2 x 1
EOS	90-50	EOS 90-50/37.5	37,5	400	56,98	15x2,5	1/1	37,5	5 x 16	2 x 1	2 x 1
EOS	90-50	EOS 90-50/45	45	400	68,37	18x2,5	1/1	45	5 x 25	2 x 1	2 x 1
EOS	100-50	EOS 100-50/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	100-50	EOS 100-50/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
EOS	100-50	EOS 100-50/30	30	400	45,58	12x2,5	1/1	30	5 x 10	2 x 1	2 x 1
EOS	100-50	EOS 100-50/37.5	37,5	400	56,98	15x2,5	1/1	37,5	5 x 16	2 x 1	2 x 1
EOS	100-50	EOS 100-50/45	45	400	68,37	18x2,5	1/1	45	5 x 25	2 x 1	2 x 1
EOSX	40-20	EOSX 40-20/12	12	400	18,23	3x2,0+3x2,0	1/2	6-6	5 x 4	2 x 1	3 x 1
EOSX	50-25	EOSX 50-25/15	15	400	22,79	3x2,5+3x2,5	1/2	7.5-7.5	5 x 4	2 x 1	3 x 1
EOSX	50-25	EOSX 50-25/22.5	22,5	400	34,19	3x2,5+6x2,5	1/3	7.5-15	5 x 6	2 x 1	3 x 1
EOSX	50-30	EOSX 50-30/15	15	400	22,79	3x2,5+3x2,5	1/2	7.5-7.5	5 x 4	2 x 1	3 x 1
EOSX	50-30	EOSX 50-30/22.5	22,5	400	34,19	3x2,5+6x2,5	1/3	7.5-15	5 x 6	2 x 1	3 x 1
EOSX	60-30	EOSX 60-30/15	15	400	22,79	3x2,5+3x2,5	1/2	7.5-7.5	5 x 4	2 x 1	3 x 1
EOSX	60-30	EOSX 60-30/22.5	22,5	400	34,19	3x2,5+6x2,5	1/3	7.5-15	5 x 6	2 x 1	3 x 1
EOSX	60-30	EOSX 60-30/30	30	400	45,58	3x2,5+3x2,5+6x2,5	1/4	7.5-7.5-15	5 x 10	2 x 1	4 x 1
EOSX	60-35	EOSX 60-35/15	15	400	22,79	3x2,5+3x2,5	1/2	7.5-7.5	5 x 4	2 x 1	3 x 1
EOSX	60-35	EOSX 60-35/22.5	22,5	400	34,19	3x2,5+6x2,5	1/3	7.5-15	5 x 6	2 x 1	3 x 1
EOSX	60-35	EOSX 60-35/30	30	400	45,58	3x2,5+3x2,5+6x2,5	1/4	7.5-7.5-15	5 x 10	2 x 1	4 x 1
EOSX	70-40	EOSX 70-40/15	15	400	22,79	3x2,5+3x2,5	1/3	7.5-15	5 x 4	2 x 1	3 x 1
EOSX	70-40	EOSX 70-40/22.5	22,5	400	34,19	3x2,5+6x2,5	1/3	7.5-15	5 x 6	2 x 1	3 x 1
EOSX	70-40	EOSX 70-40/30	30	400	45,58	3x2,5+3x2,5+6x2,5	1/4	7.5-7.5-15	5 x 10	2 x 1	4 x 1
EOSX	70-40	EOSX 70-40/37.5	37,5	400	56,98	3x2,5+6x2,5+6x2,5	1/5	7.5-15-15	5 x 16	2 x 1	4 x 1
EOSX	70-40	EOSX 70-40/45	45	400	68,37	6x2,5+6x2,5+6x2,5	1/3	15-15-15	5 x 25	2 x 1	4 x 1
EOSX	80-50	EOSX 80-50/15	15	400	22,79	3x2,5+3x2,5	1/2	7.5-7.5	5 x 4	2 x 1	3 x 1
EOSX	80-50	EOSX 80-50/22.5	22,5	400	34,19	3x2,5+6x2,5	1/3	7.5-15	5 x 6	2 x 1	3 x 1
EOSX	80-50	EOSX 80-50/30	30	400	45,58	3x2,5+3x2,5+6x2,5	1/4	7.5-7.5-15	5 x 10	2 x 1	4 x 1
EOSX	80-50	EOSX 80-50/37.5	37,5	400	56,98	3x2,5+6x2,5+6x2,5	1/5	7.5-15-15	5 x 16	2 x 1	4 x 1
EOSX	80-50	EOSX 80-50/45	45	400	68,37	6x2,5+6x2,5+6x2,5	1/3	15-15-15	5 x 25	2 x 1	4 x 1
EOSX	90-50	EOSX 90-50/15	15	400	22,79	3x2,5+3x2,5	1/2	7.5-7.5	5 x 4	2 x 1	3 x 1
EOSX	90-50	EOSX 90-50/22.5	22,5	400	34,19	3x2,5+6x2,5	1/3	7.5-15	5 x 6	2 x 1	3 x 1
EOSX	90-50	EOSX 90-50/30	30	400	45,58	3x2,5+3x2,5+6x2,5	1/4	7.5-7.5-15	5 x 10	2 x 1	4 x 1
EOSX	90-50	EOSX 90-50/37.5	37,5	400	56,98	3x2,5+6x2,5+6x2,5	1/5	7.5-15-15	5 x 16	2 x 1	4 x 1
EOSX	90-50	EOSX 90-50/45	45	400	68,37	6x2,5+6x2,5+6x2,5	1/3	15-15-15	5 x 25	2 x 1	4 x 1
EOSX	100-50	EOSX 100-50/15	15	400	22,79	3x2,5+3x2,5	1/5	7.5-7.5	5 x 4	2 x 1	3 x 1
EOSX	100-50	EOSX 100-50/22.5	22,5	400	34,19	3x2,5+6x2,5	1/3	7.5-15	5 x 6	2 x 1	3 x 1
EOSX	100-50	EOSX 100-50/30	30	400	45,58	3x2,5+3x2,5+6x2,5	1/4	7.5-7.5-15	5 x 10	2 x 1	4 x 1
EOSX	100-50	EOSX 100-50/37.5	37,5	400	56,98	3x2,5+6x2,5+6x2,5	1/5	7.5-15-15	5 x 16	2 x 1	4 x 1
EOSX	100-50	EOSX 100-50/45	45	400	68,37	6x2,5+6,2,5+6x2,5	1/3	15-15-15	5 x 25	2 x 1	4 x 1

WIRING DIAGRAMS, EO SERIES

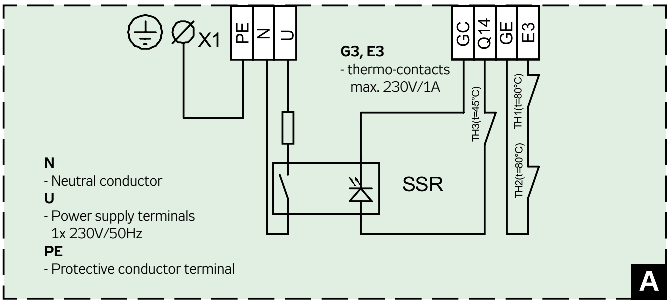


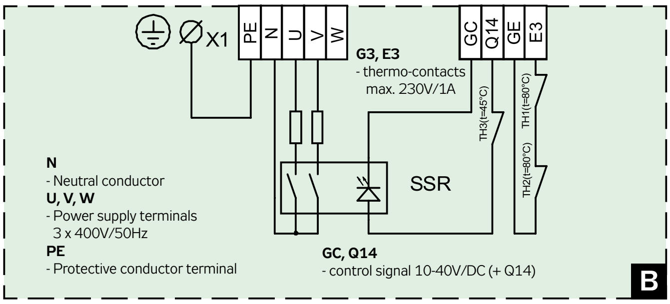


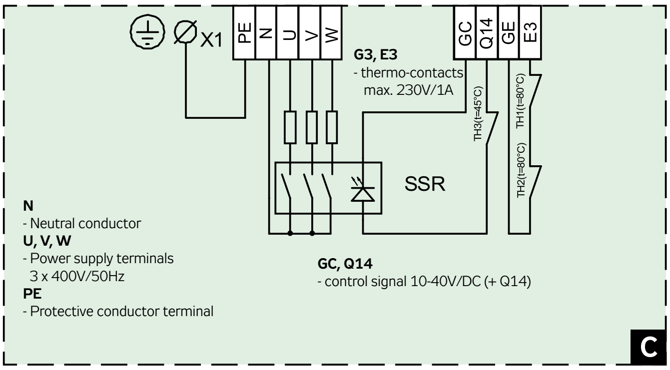


Type / size	Output (kW) / wiring scheme															
	1,5	2	2,5	3	4	4,5	5	6	7,5	10	12	15	22,5	30	37,5	45
EO 30-15	A			B		C										
EO 40-20		A			B			C			C					
EO 50-25			A				B		C	C		C	C			
EO 50-30							B		C	C		C	C			
EO 60-30									C	C		C	C	C		
EO 60-35									C	C		C	C	C		
EO 70-40										C		C	C	C	C	C
EO 80-50										C		C	C	C	C	C
EO 90-50										C		C	C	C	C	C
EO 100-50										C		C	C	C	C	C

WIRING DIAGRAMS, EOS SERIES

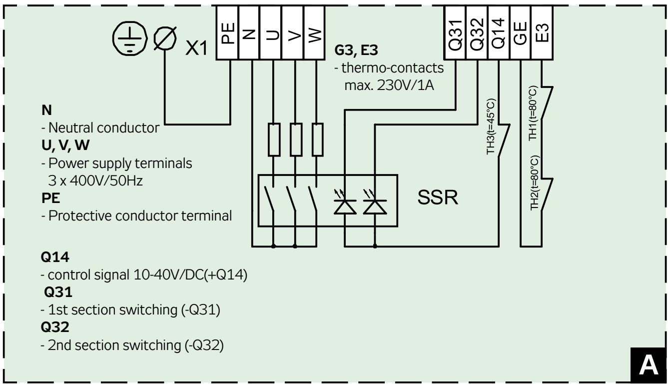


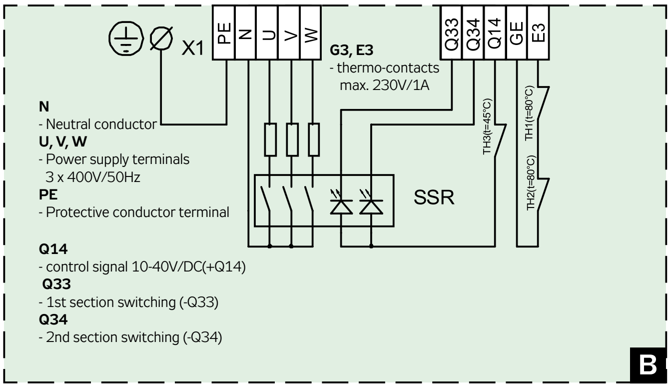


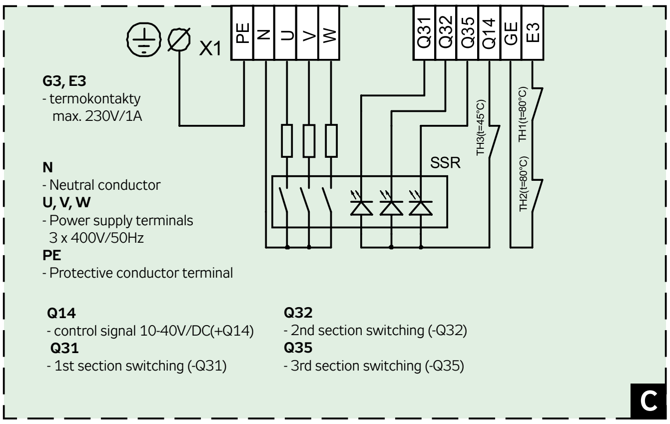


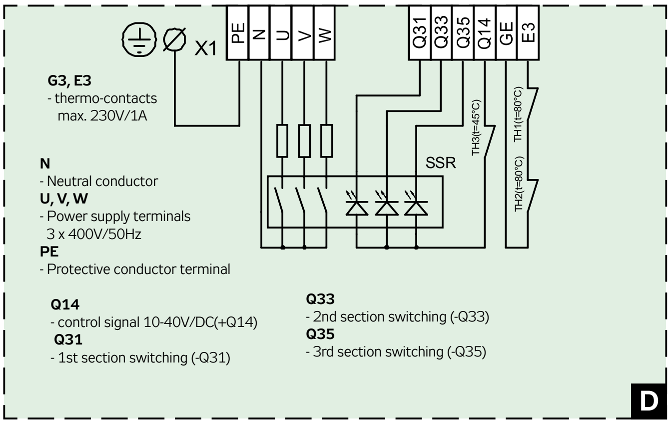
Type / size	Output (kW) / wiring scheme															
	1,5	2	2,5	3	4	4,5	5	6	7,5	10	12	15	22,5	30	37,5	45
EOS 30-15	A			B		C										
EOS 40-20		A			B			C			C					
EOS 50-25			A				B		C	C		C	C			
EOS 50-30							B		C	C		C	C			
EOS 60-30									C	C		C	C	C		
EOS 60-35									C	C		C	C	C		
EOS 70-40										C		C	C	C	C	C
EOS 80-50										C		C	C	C	C	C
EOS 90-50										C		C	C	C	C	C
EOS 100-50										C		C	C	C	C	C

WIRING DIAGRAMS, EOSX SERIES









Type / size	Output (kW) / wiring scheme					
	12	15	22,5	30	37,5	45
EOSX 40-20	A					
EOSX 50-25		A	B			
EOSX 50-30		A	B			
EOSX 60-30		A	B	C		
EOSX 60-35		A	B	C		
EOSX 70-40		A	B	C	C	D
EOSX 80-50		A	B	C	C	D
EOSX 90-50		A	B	C	C	D
EOSX 100-50		A	B	C	C	D

Water heaters

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 ºC**
- 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.

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.

POSITION AND LOCATION

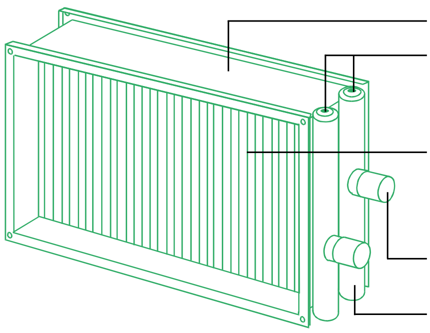
When projecting the layout of the heater location, we recommend observing the following principles:

- 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.
- 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 ⌀ 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 3–3,6 MPa.

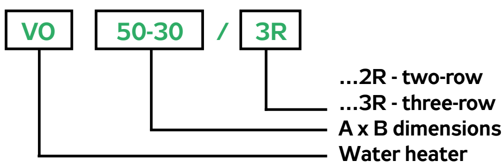
FIGURE 2 - HEATER'S DESIGN



DESIGNATION OF HEATERS

The type designation of heaters in projects and orders is defined by the key in figure # 3.
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 ºC and heating water operating temperature gradient of +90 ºC / +70 ºC. 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.

FIGURE 3 - DESIGNATION OF HEATERS



AIR-VENTING OF THE HEATER

Pro zabezpečení správné funkce ohřívače je nutno zajistit jeho spolehlivé odvzdušnění, nejlépe automatické.
Automatický odvzdušňovací ventil TACO s vnějším závitem G 1/2" je určen pro zašroubování přímo do sběračů ohřívače. Instaluje se v nejvyšším místě obou sběračů. Díky malým rozměrům je ventil vhodný zejména pro instalaci ohřívače těsně pod strop místnosti.

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:
řídicí jednotky

- 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.

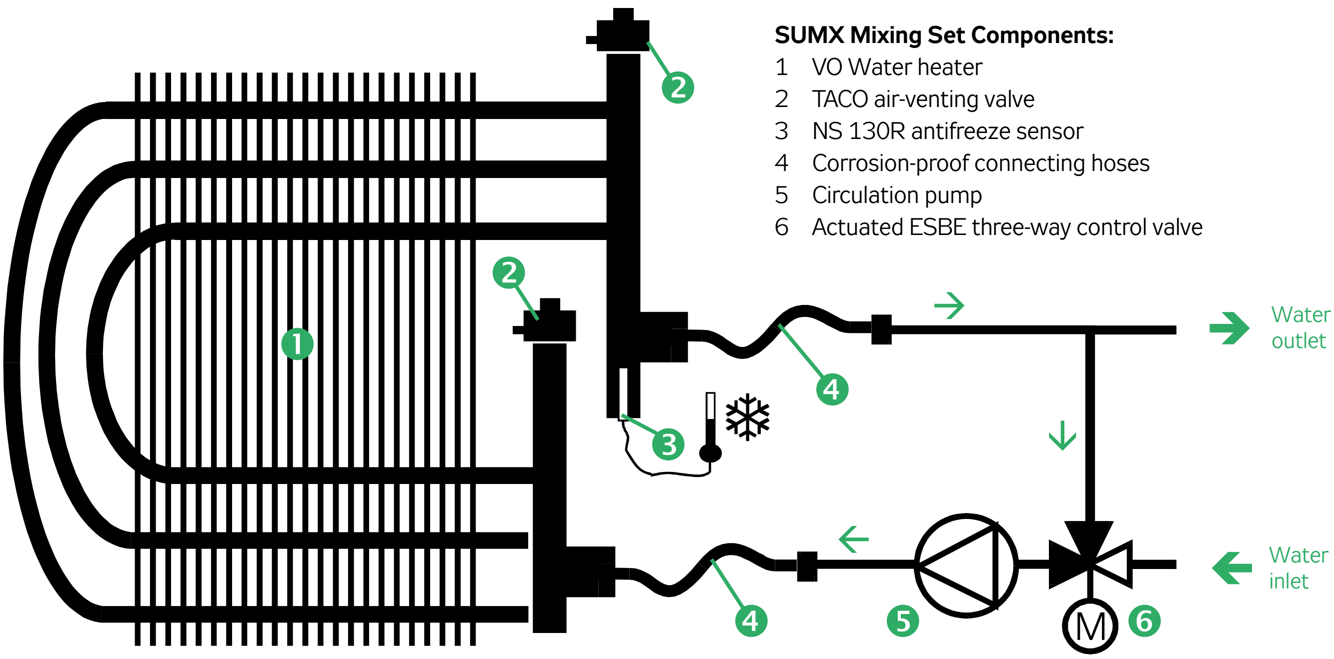
DIMENSIONS AND WEIGHTS

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

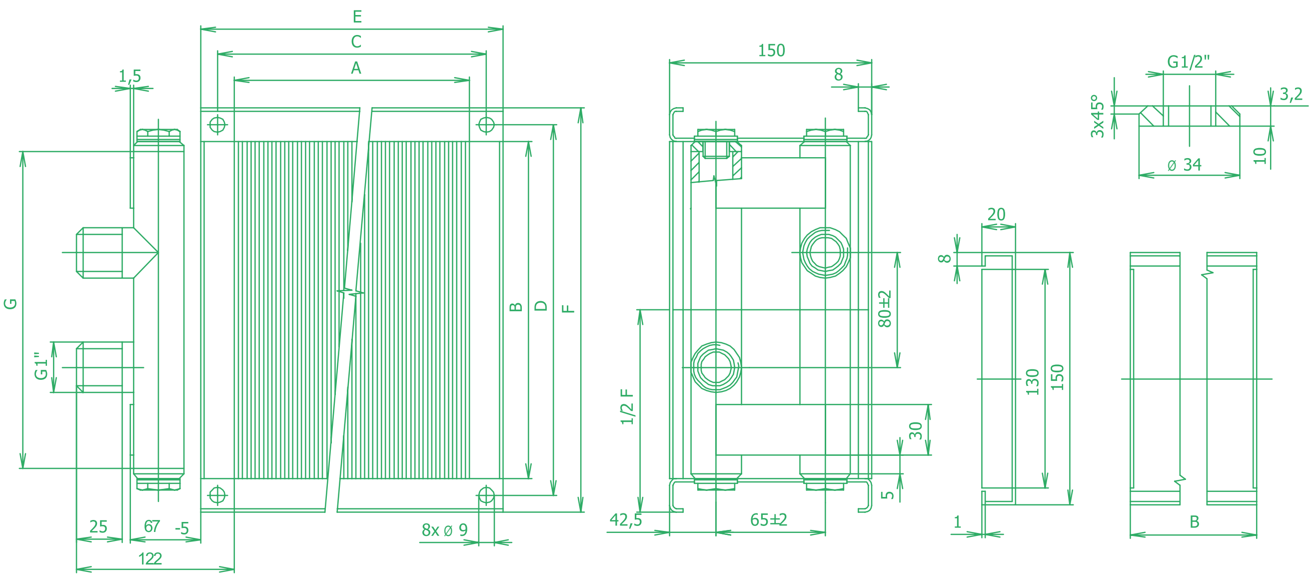
FIGURE 4 - HEATER WITH A MIXING SET



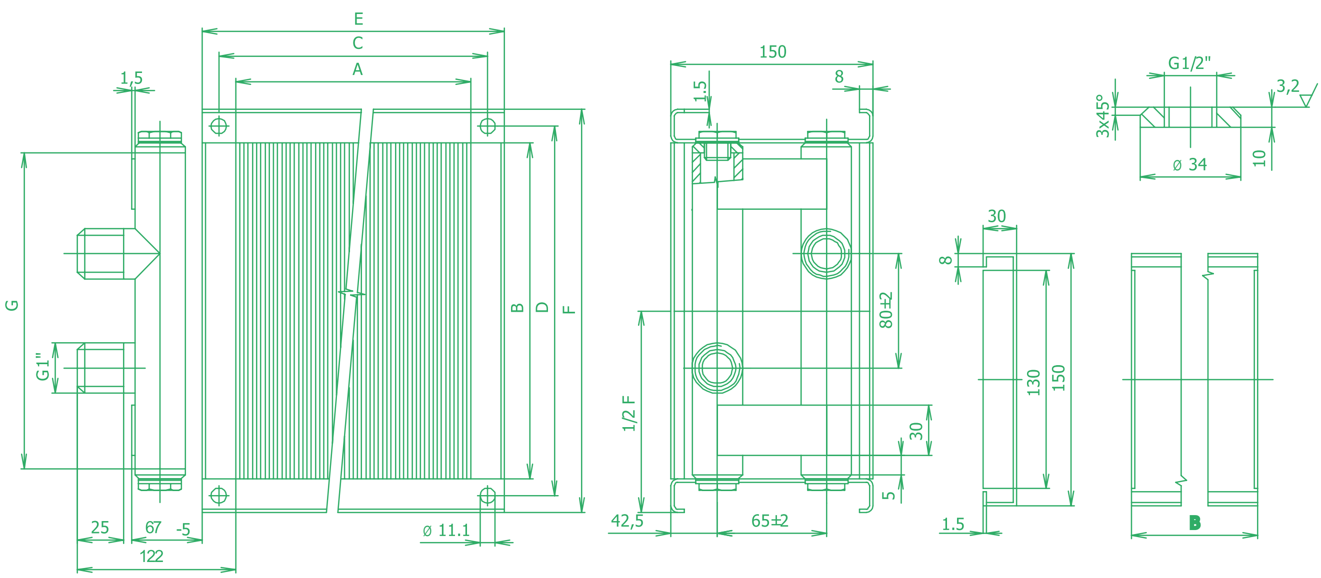
SUMX Mixing Set Components:
1 VO Water heater
2 TACO air-venting valve
3 NS 130R antifreeze sensor
4 Corrosion-proof connecting hoses
5 Circulation pump
6 Actuated ESBE three-way control valve

FIGURE 5 - DIMENSIONS OF VO WATER HEATERS (TYPE DESIGNATION CORRESPONDS WITH TABLE # 1)

Dimensional range 30-15 to 80-50



Dimensional range 90-50 to 100-50



HEATER DIMENSIONING

For nomograms showing the thermodynamic correlation for each heater, refer to pages 198-214. 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]

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 215.

[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.

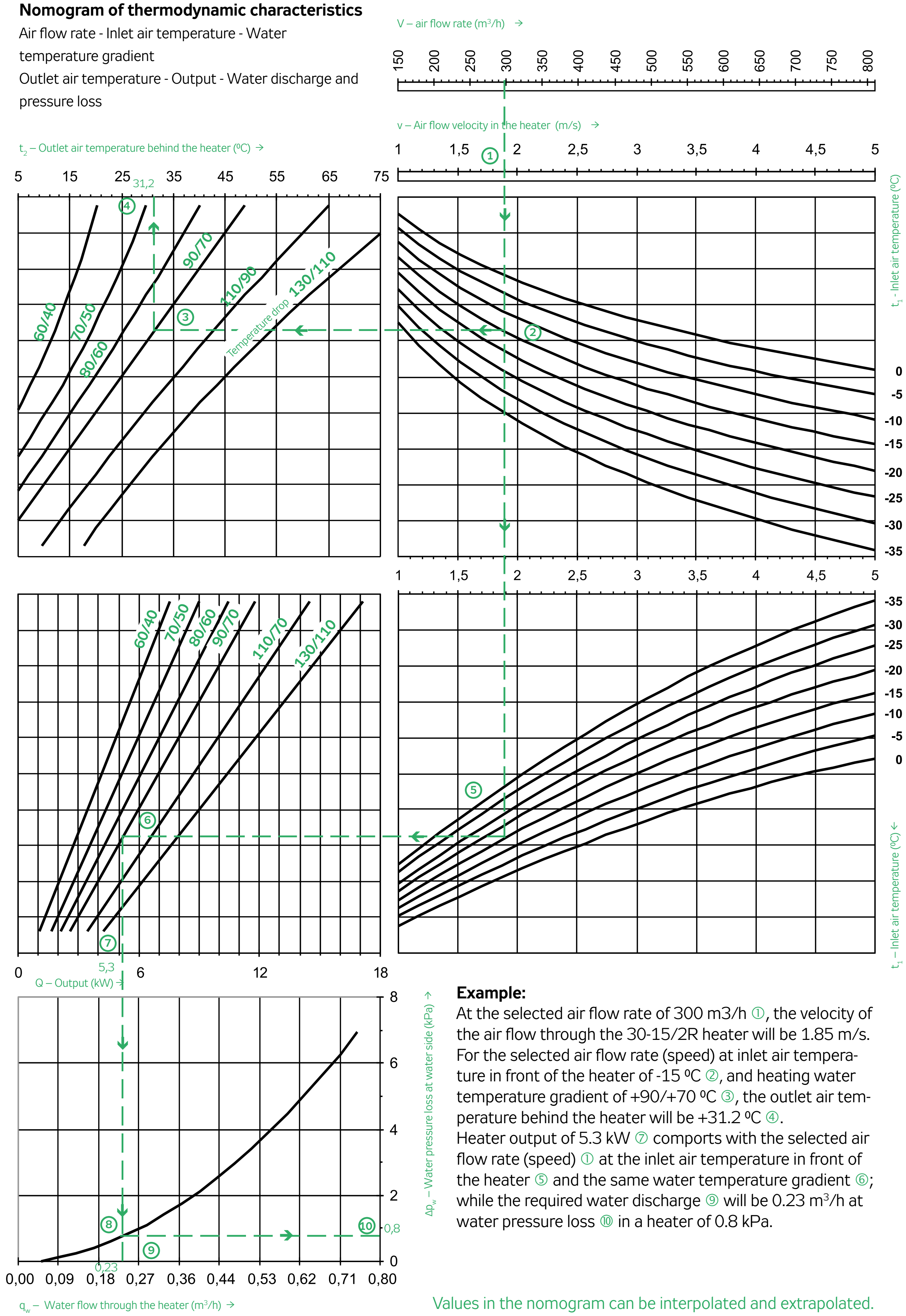
[4] The nomograms cannot be used to determine the maximum calculated output and water discharge because value Δt_w = 20K is given for the fixed heating water temperature gradients.

VO 30-15/2R (Cu/Al vodní ohřívač 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +31.2 ºC 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.

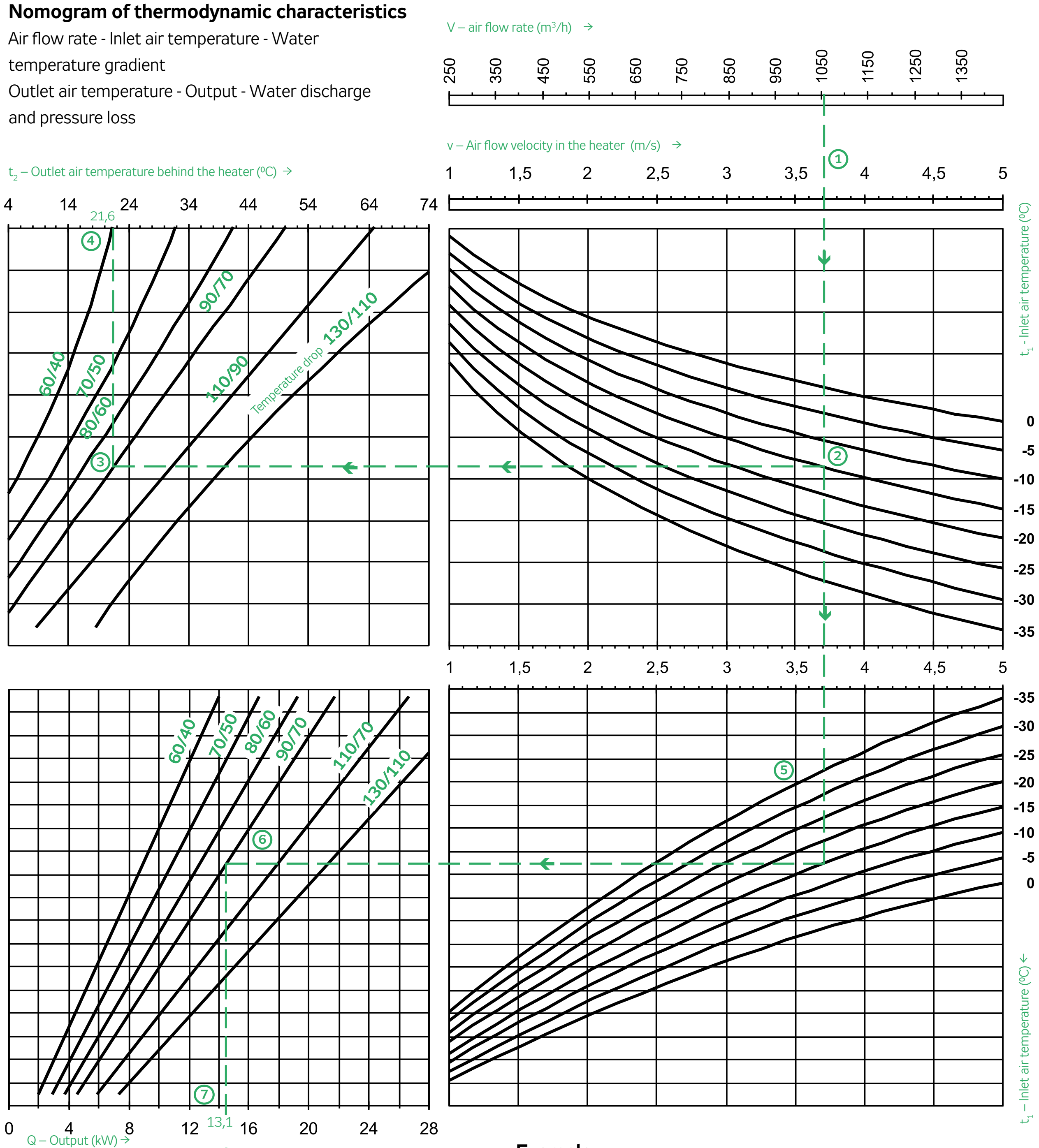
Values in the nomogram can be interpolated and extrapolated.

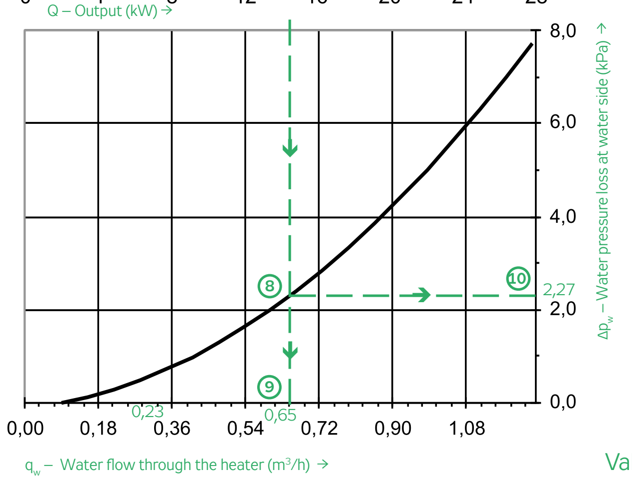
VO 40-20/2R (Cu/Al vodní ohřívač 400 x 200 mm)

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 1066 m³/h ①, the velocity of the air flow through the VO 40-20/2R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +21,6 ºC 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.

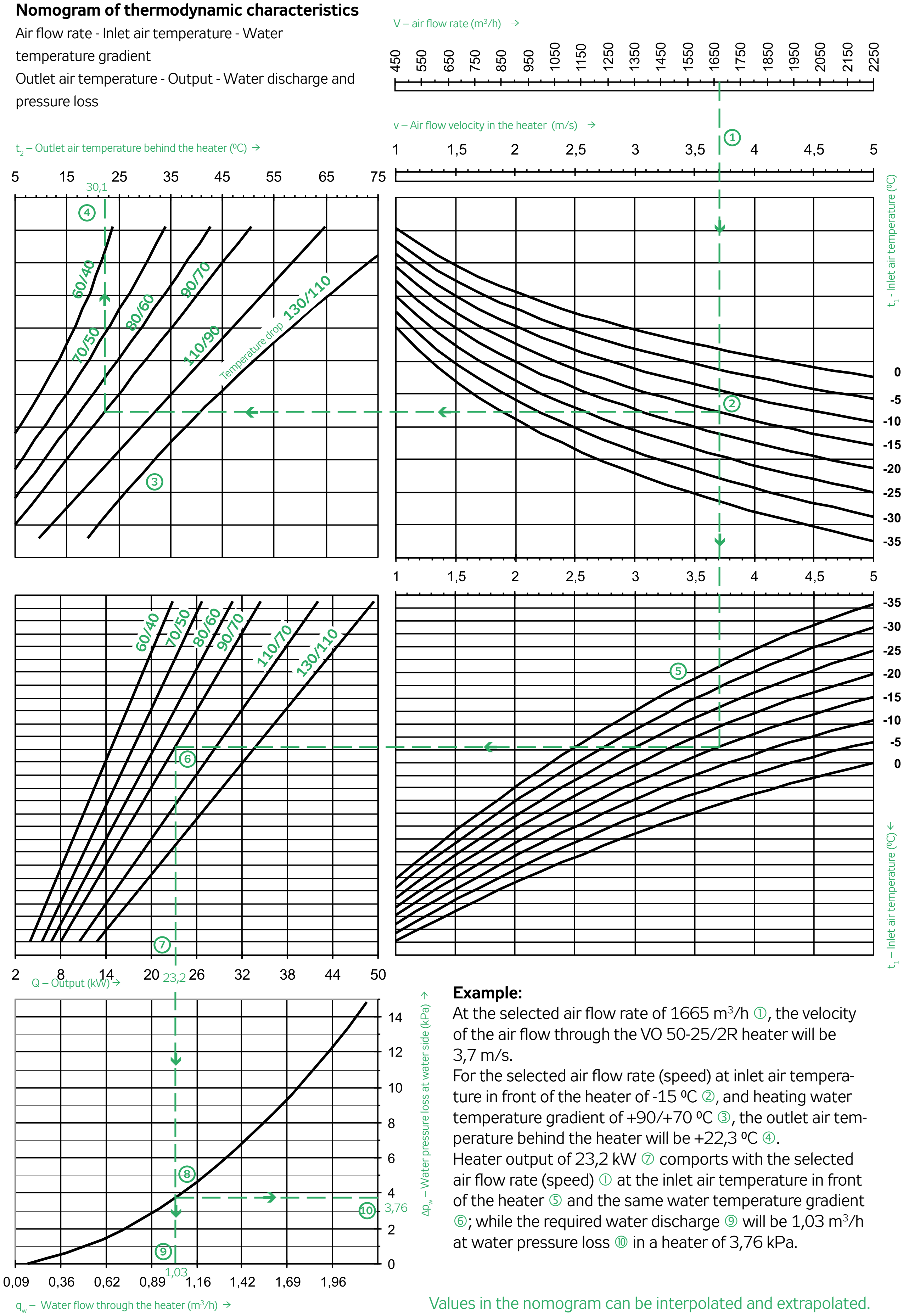
Values in the nomogram can be interpolated and extrapolated.

VO 50-25/2R (Cu/Al vodní ohřívač 500 x 250 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 1665 m³/h ①, the velocity of the air flow through the VO 50-25/2R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +22,3 ºC 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.

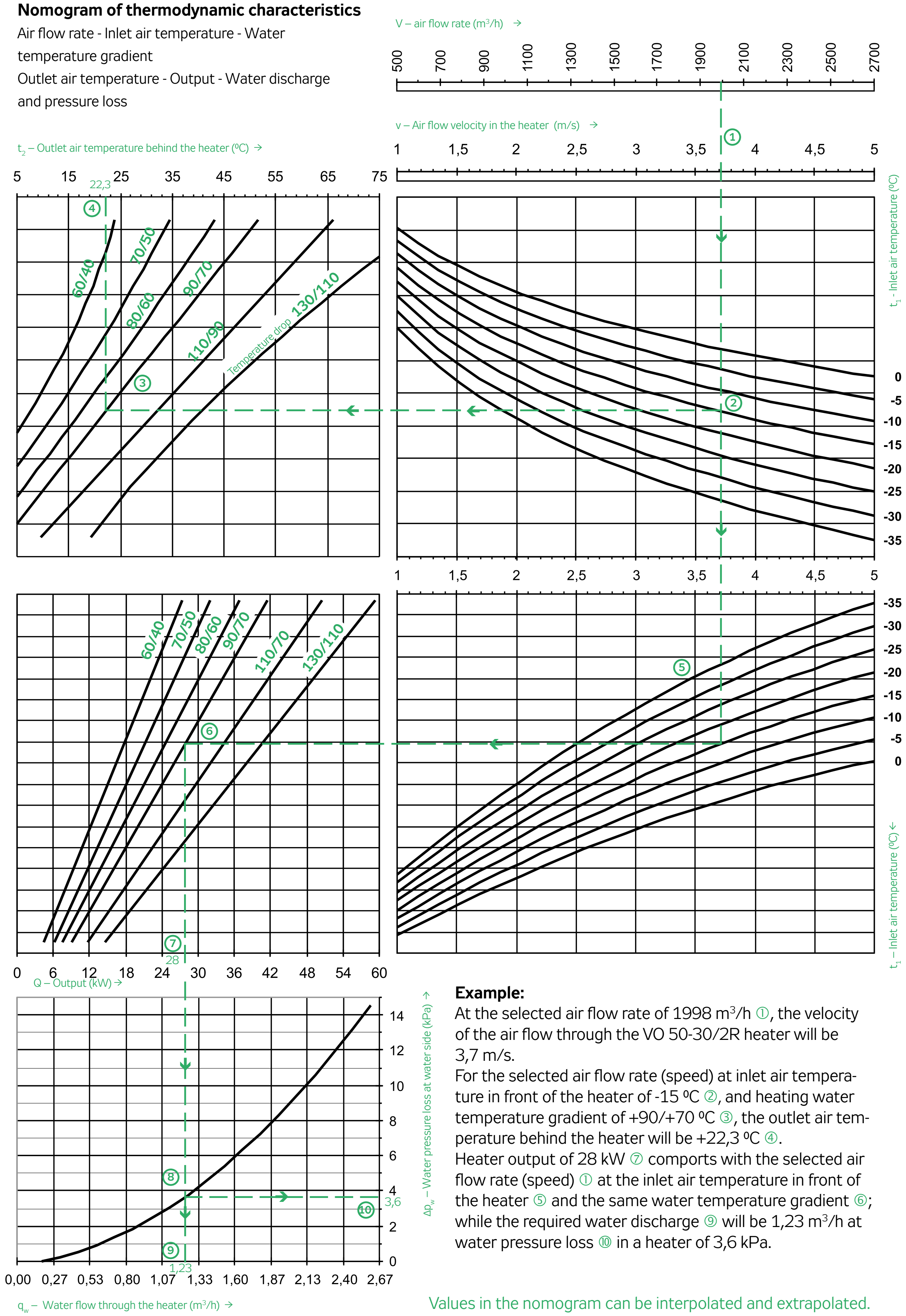
Values in the nomogram can be interpolated and extrapolated.

VO 50-30/2R (Cu/Al vodní ohřívač 500 x 300 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 1998 m³/h ①, the velocity of the air flow through the VO 50-30/2R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +22,3 ºC 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.

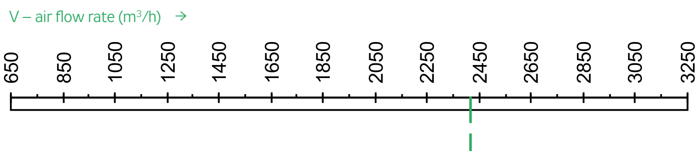
Values in the nomogram can be interpolated and extrapolated.

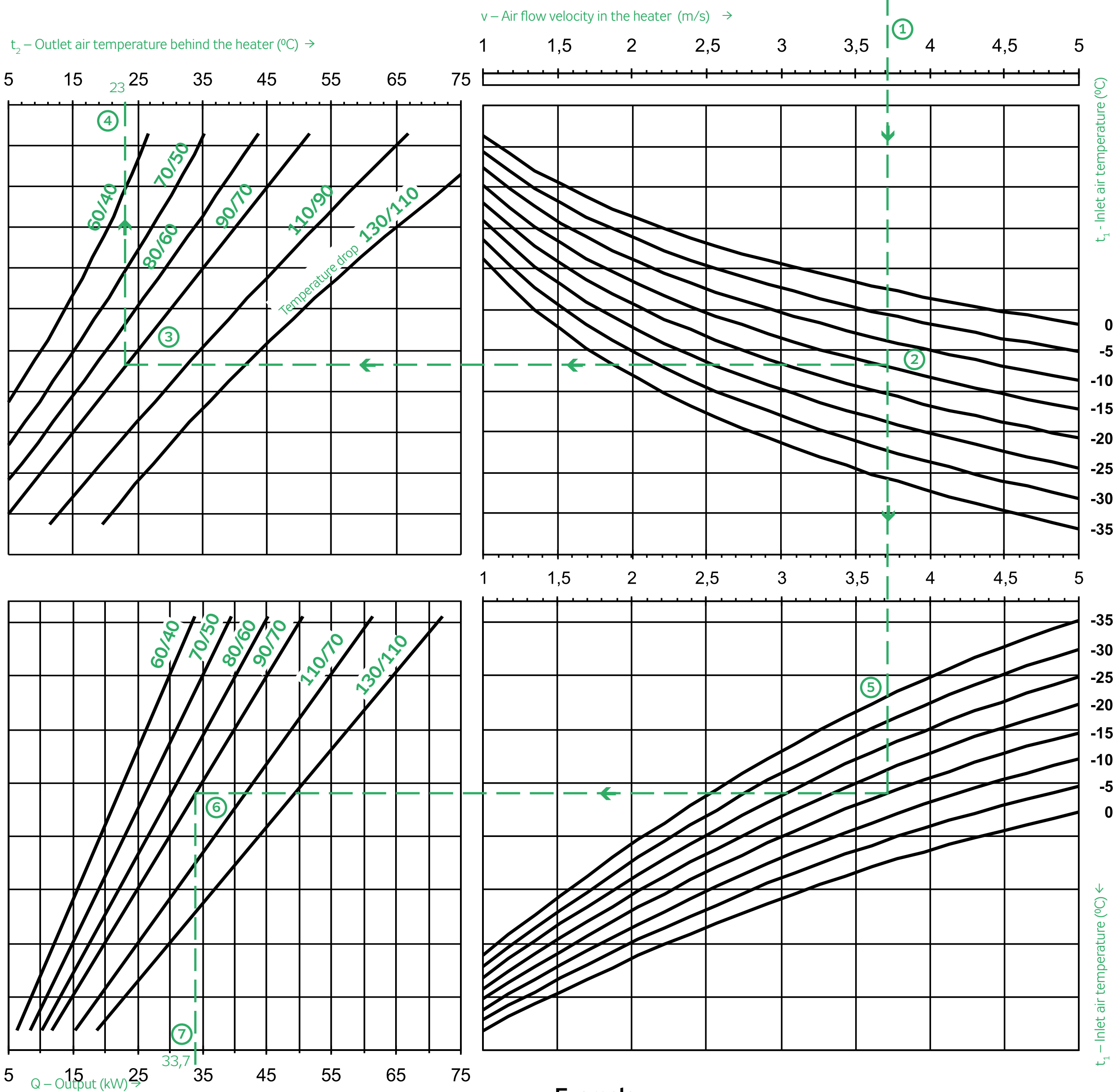
VO 60-30/2R (Cu/Al vodní ohřívač 600 x 300 mm)

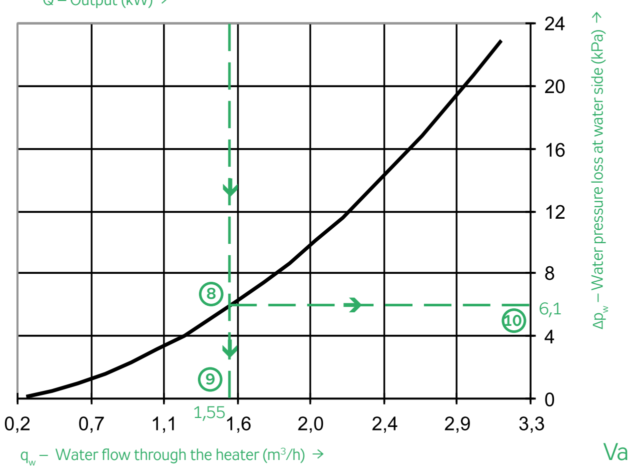
Nomogram of thermodynamic characteristics

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 2398 m³/h ①, the velocity of the air flow through the VO 60-30 / 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +23 ºC 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 6,1 kPa.

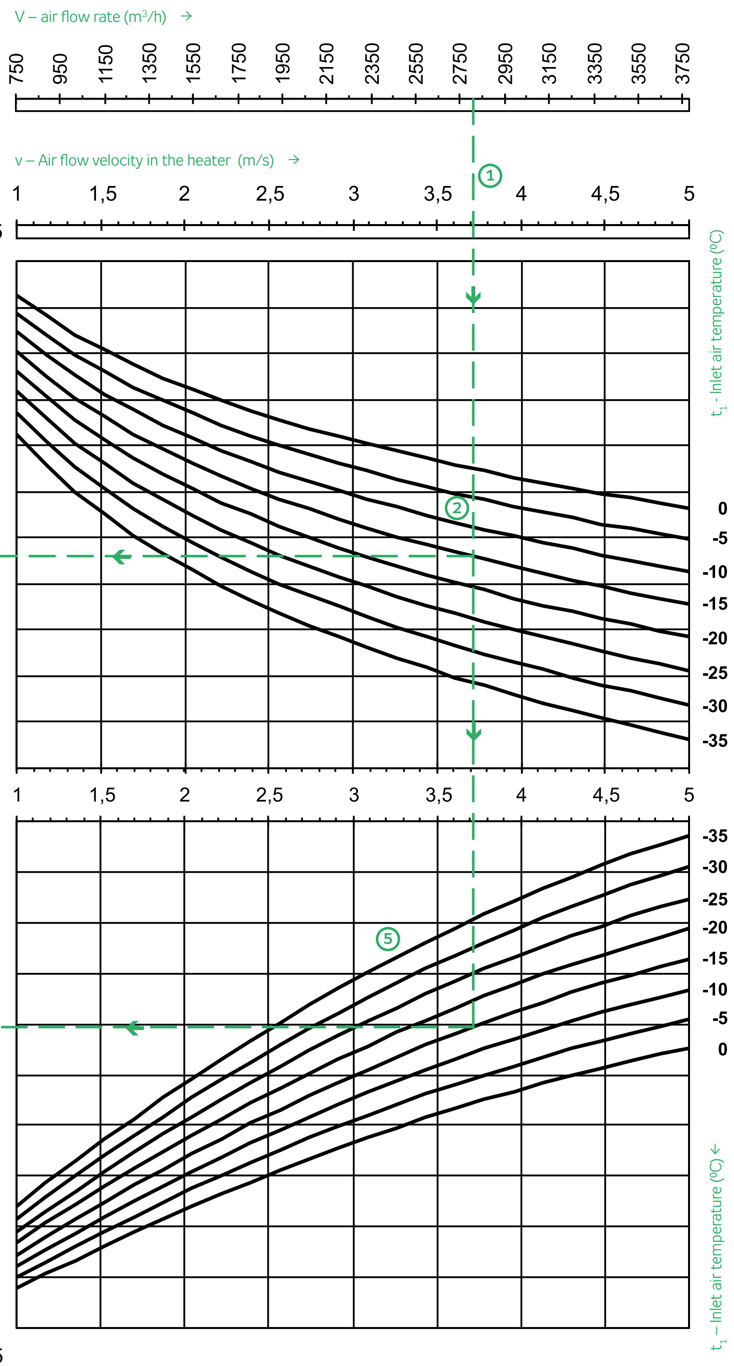
Values in the nomogram can be interpolated and extrapolated.

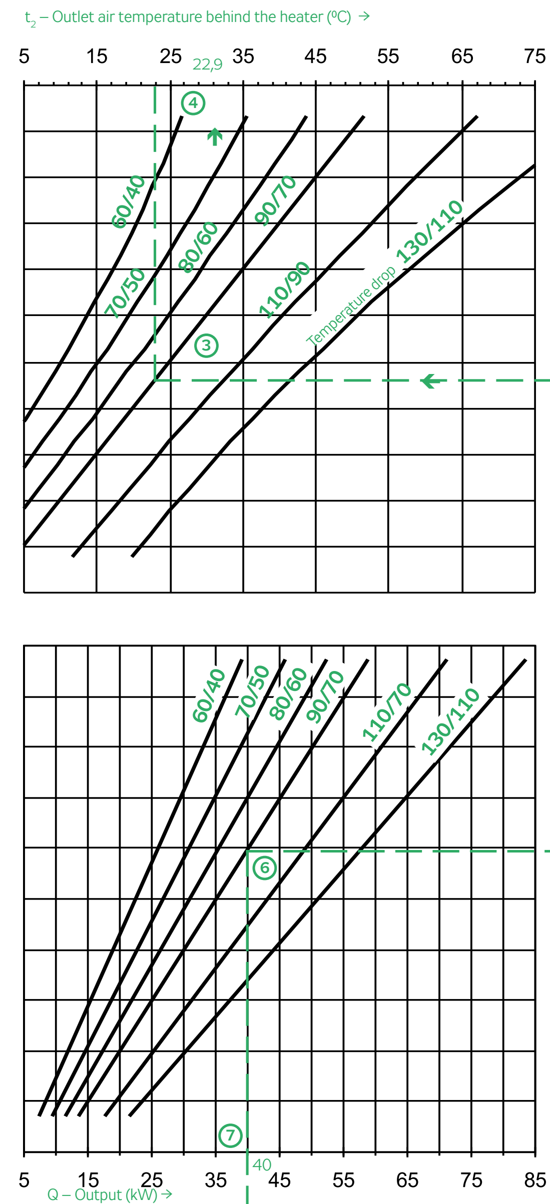
VO 60-35/2R (Cu/Al vodní ohřívač 600 x 350 mm)

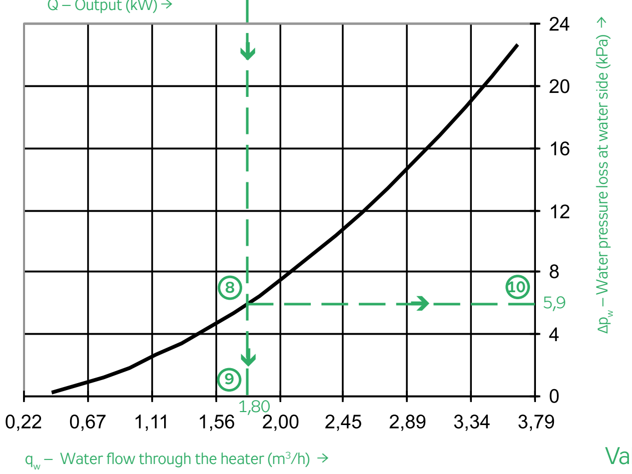
Nomogram of thermodynamic characteristics

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 2797 m³/h ①, the velocity of the air flow through the VO 60-35/2R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +22,9 ºC ⑦.

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.

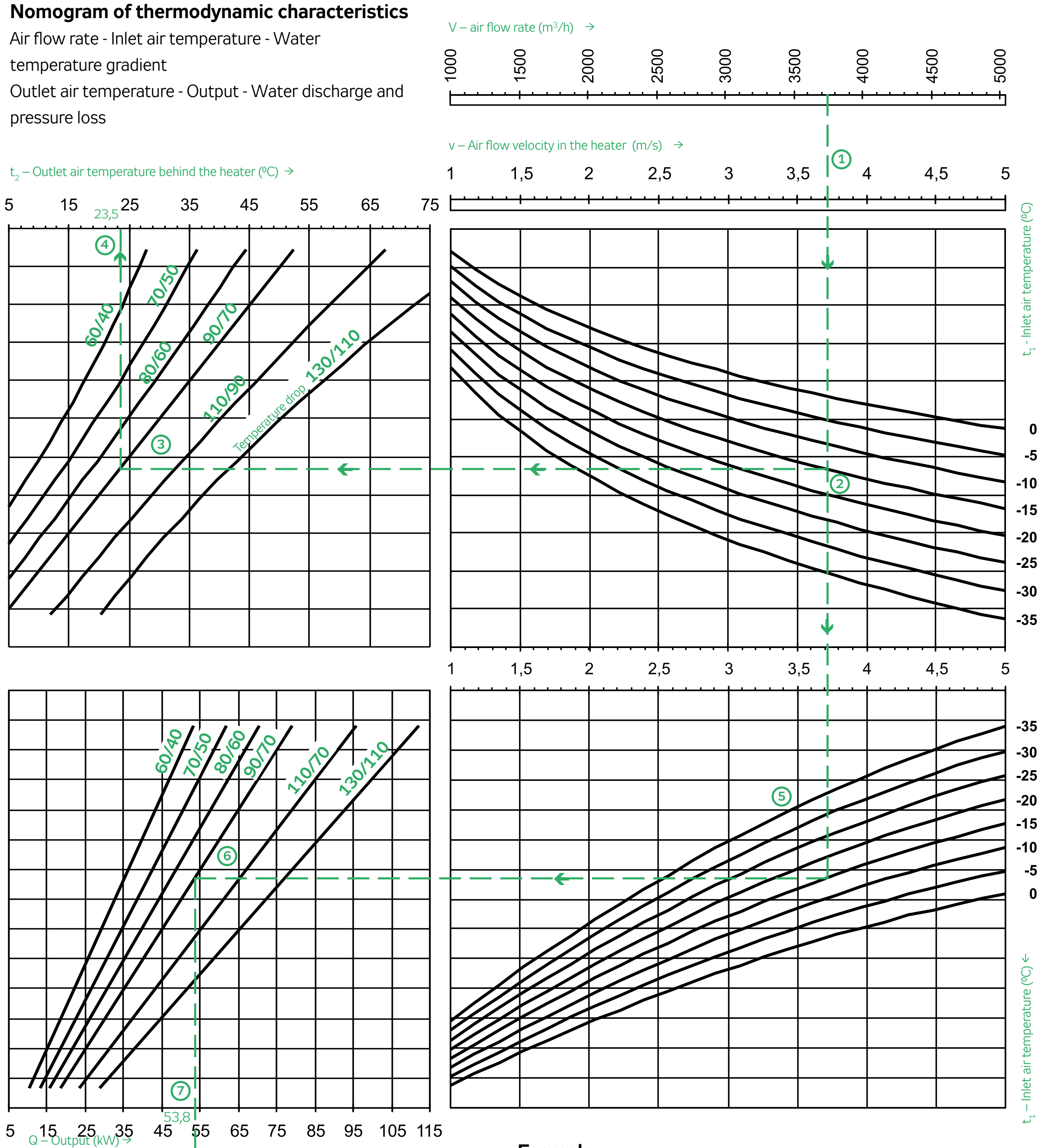
Values in the nomogram can be interpolated and extrapolated.

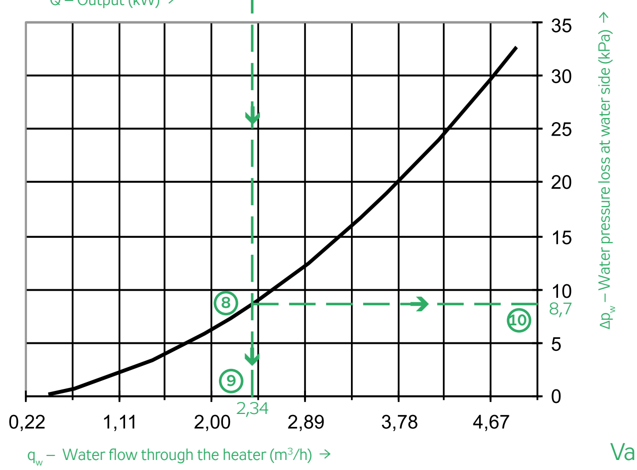
VO 70-40/2R (Cu/Al vodní ohřívač 700 x 400 mm)

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 3730 m3/h ①, the velocity of the air flow through the VO 70-40 / 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.

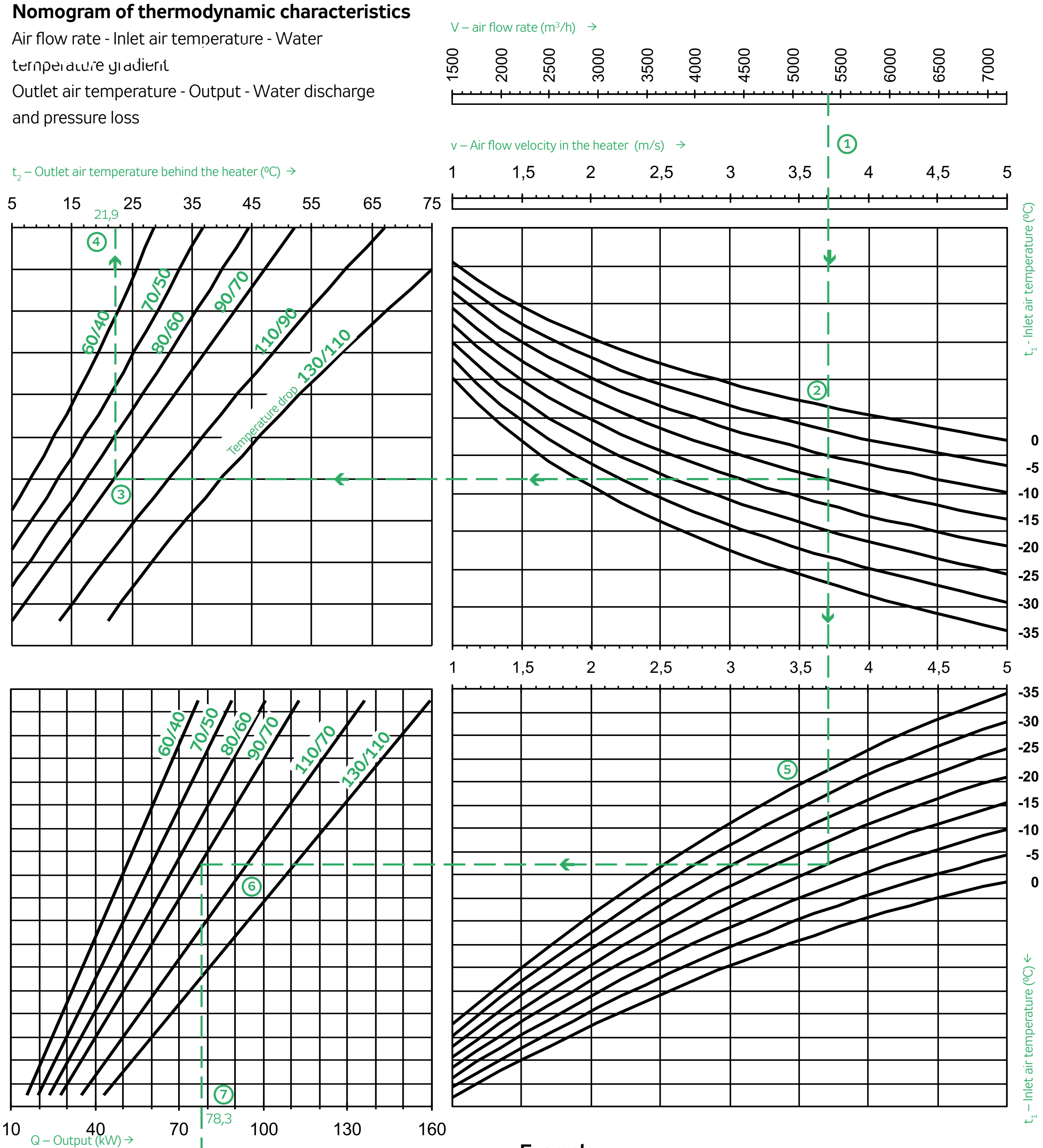
Values in the nomogram can be interpolated and extrapolated.

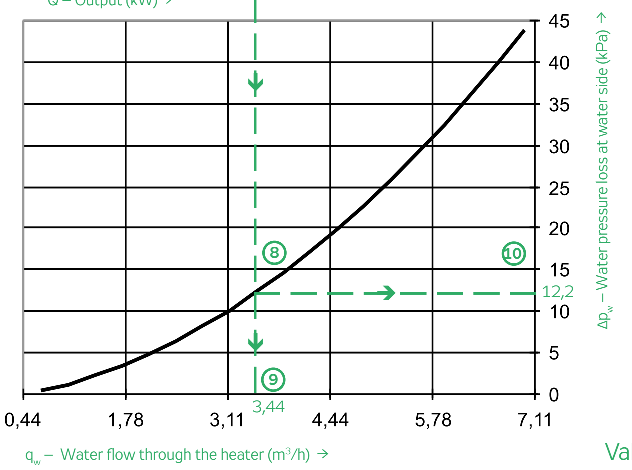
VO 80-50/2R (Cu/Al vodní ohřívač 800 x 500 mm)

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 5370 m³/h ①, the velocity of the air flow through the VO 80-50/2R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +21,9 ºC 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.

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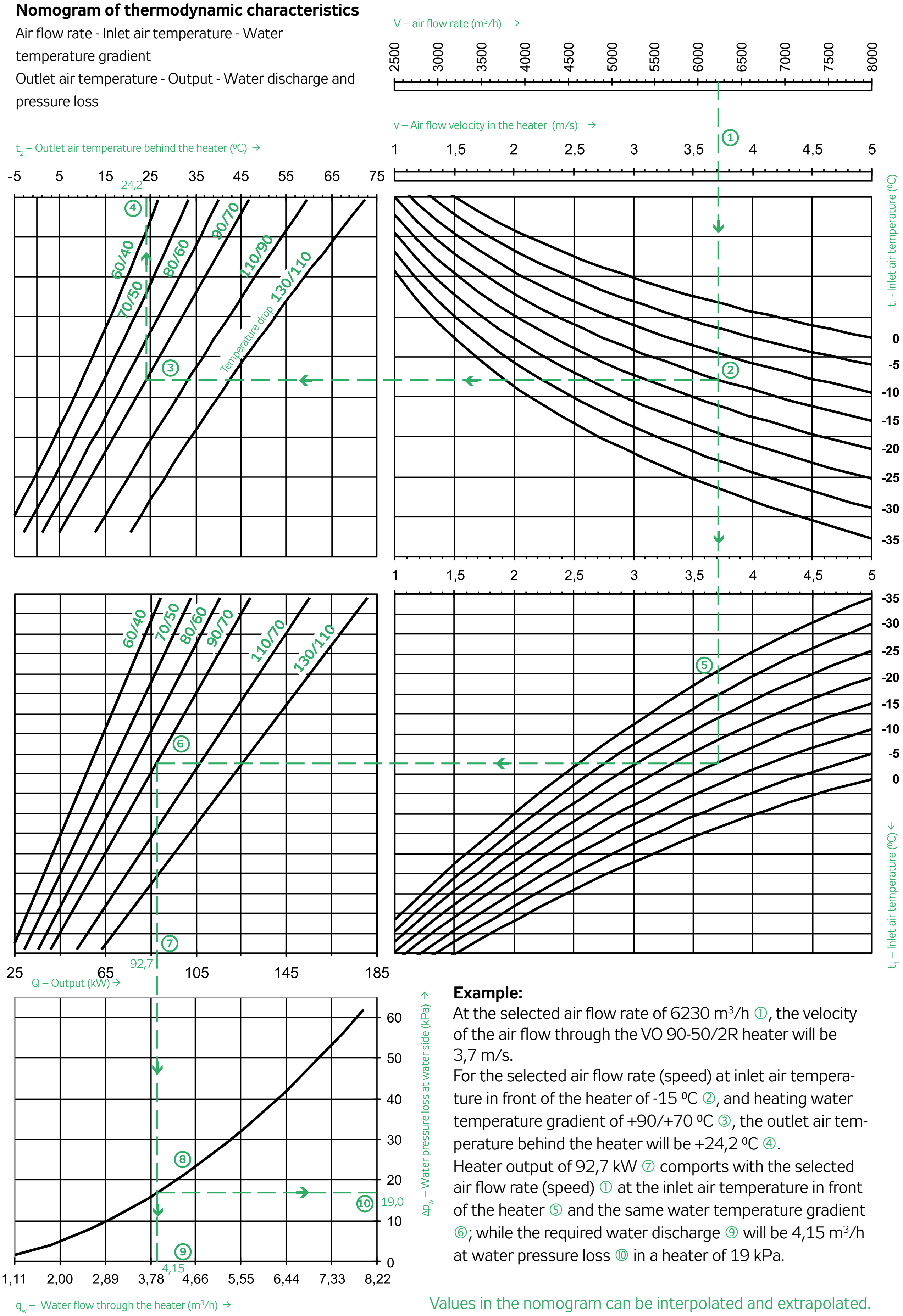
VO 90-50/2R (Cu/Al vodní ohřívač 900 x 500 mm)

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 6230 m³/h ①, the velocity of the air flow through the VO 90-50/2R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +24,2 ºC 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 4,15 m³/h at water pressure loss ⑩ in a heater of 19 kPa.

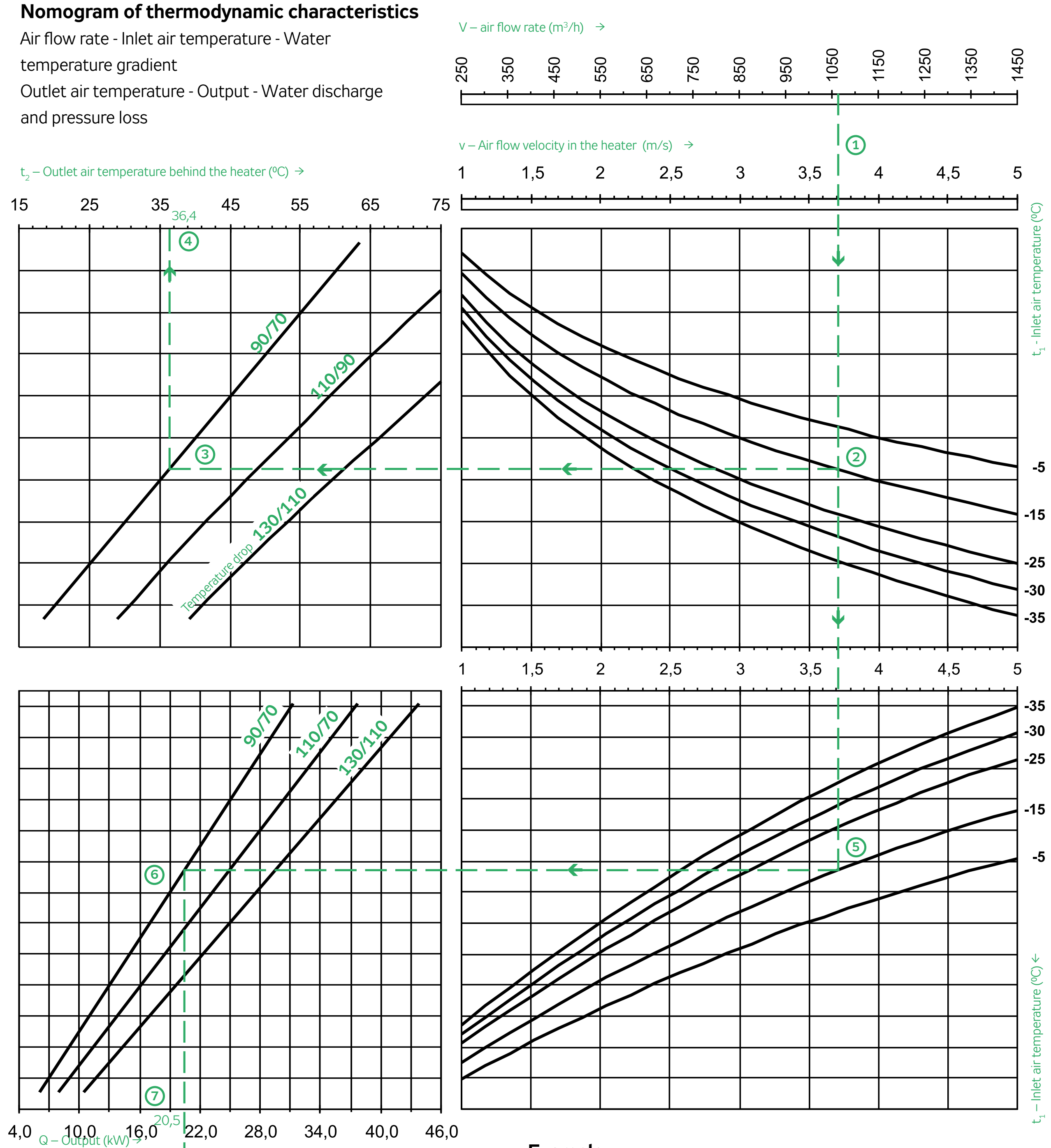
Values in the nomogram can be interpolated and extrapolated.

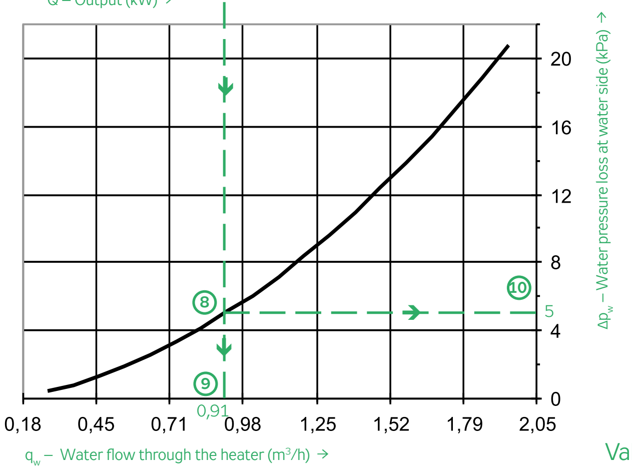
VO 40-20/3R (Cu/Al vodní ohřívač 400 x 200 mm)

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 1065 m³/h ①, the velocity of the air flow through the VO 40-20/3R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +36,4 ºC 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.

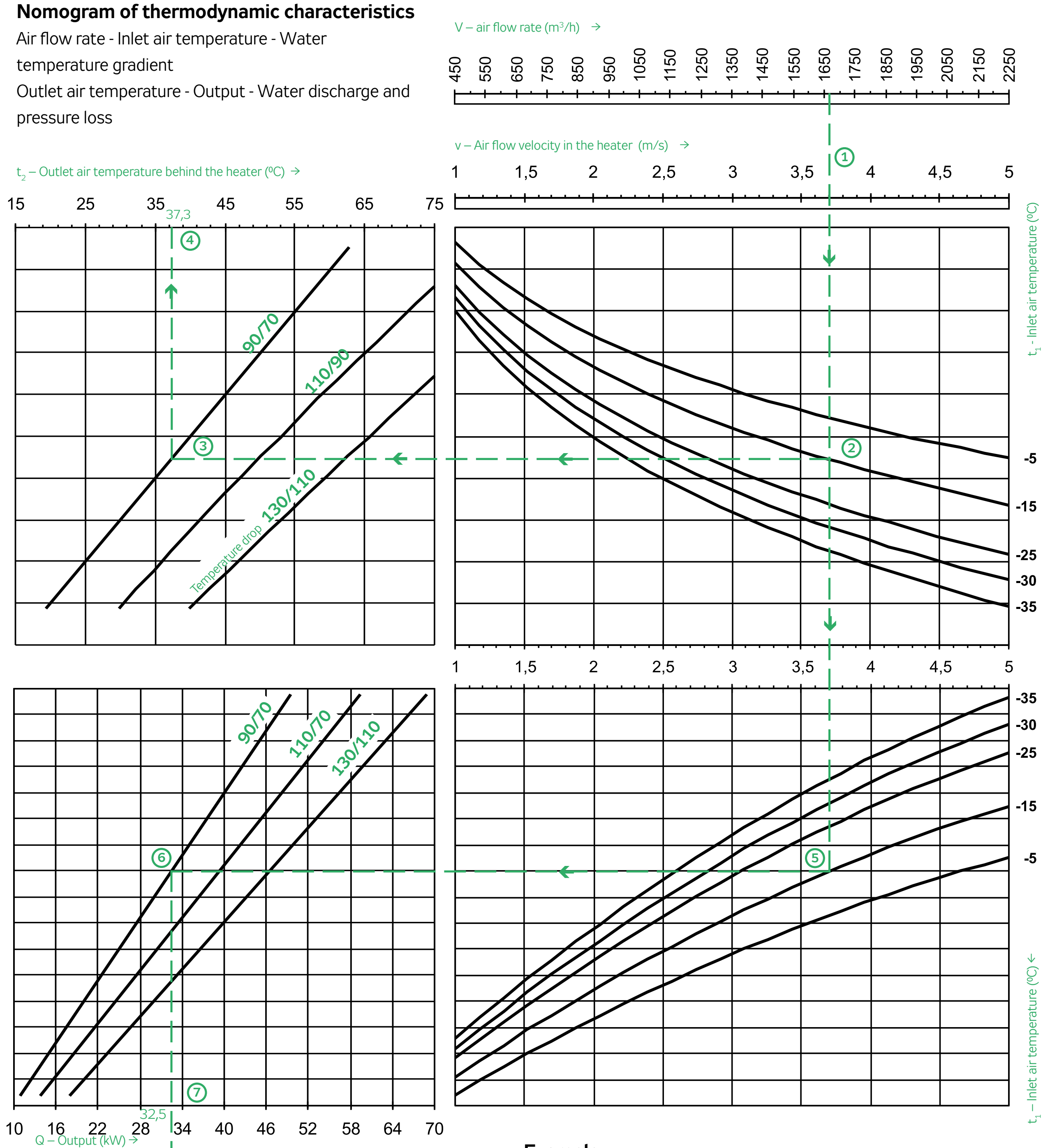
Values in the nomogram can be interpolated and extrapolated.

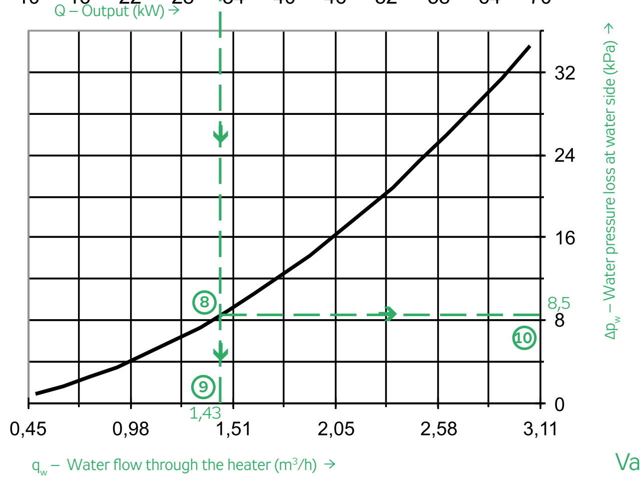
VO 50-25/3R (Cu/Al vodní ohřívač 500 x 250 mm)

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 1675 m³/h ①, the velocity of the air flow through the VO 50-25/3R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +37,3 ºC 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.

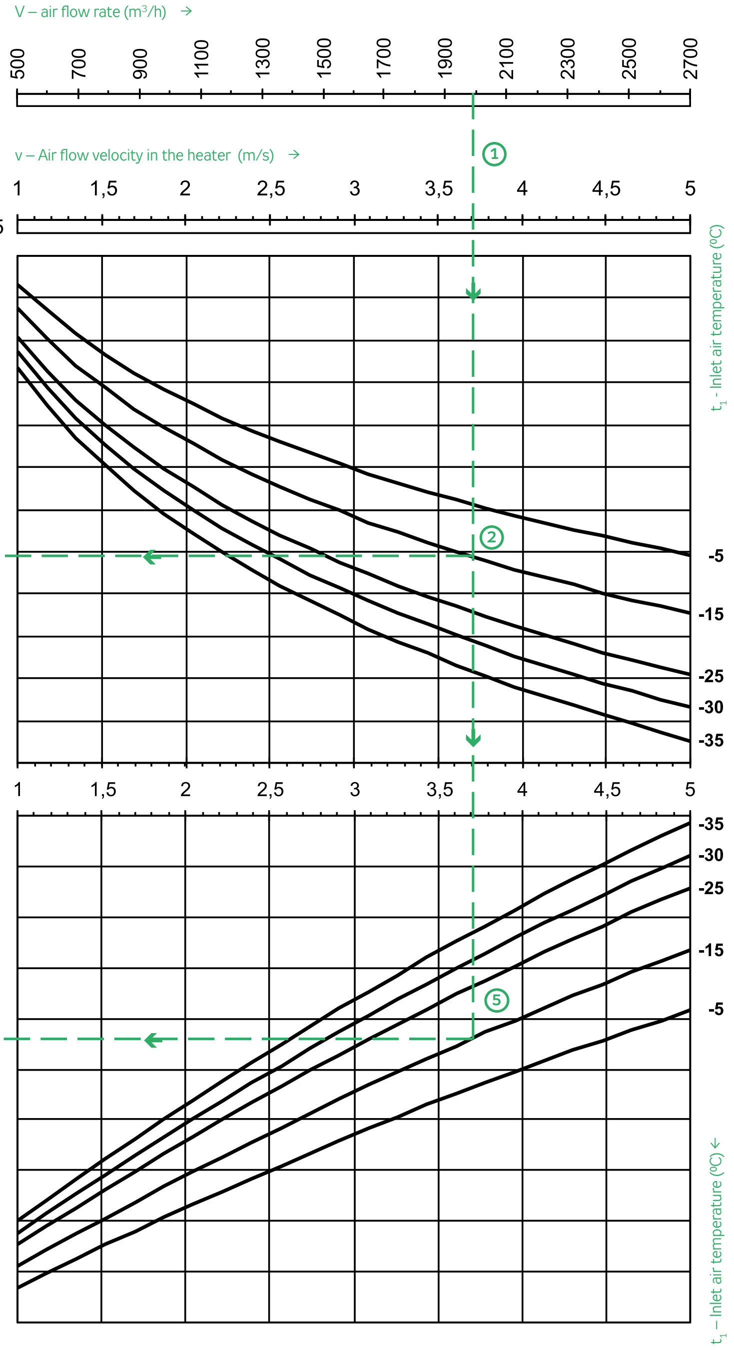
Values in the nomogram can be interpolated and extrapolated.

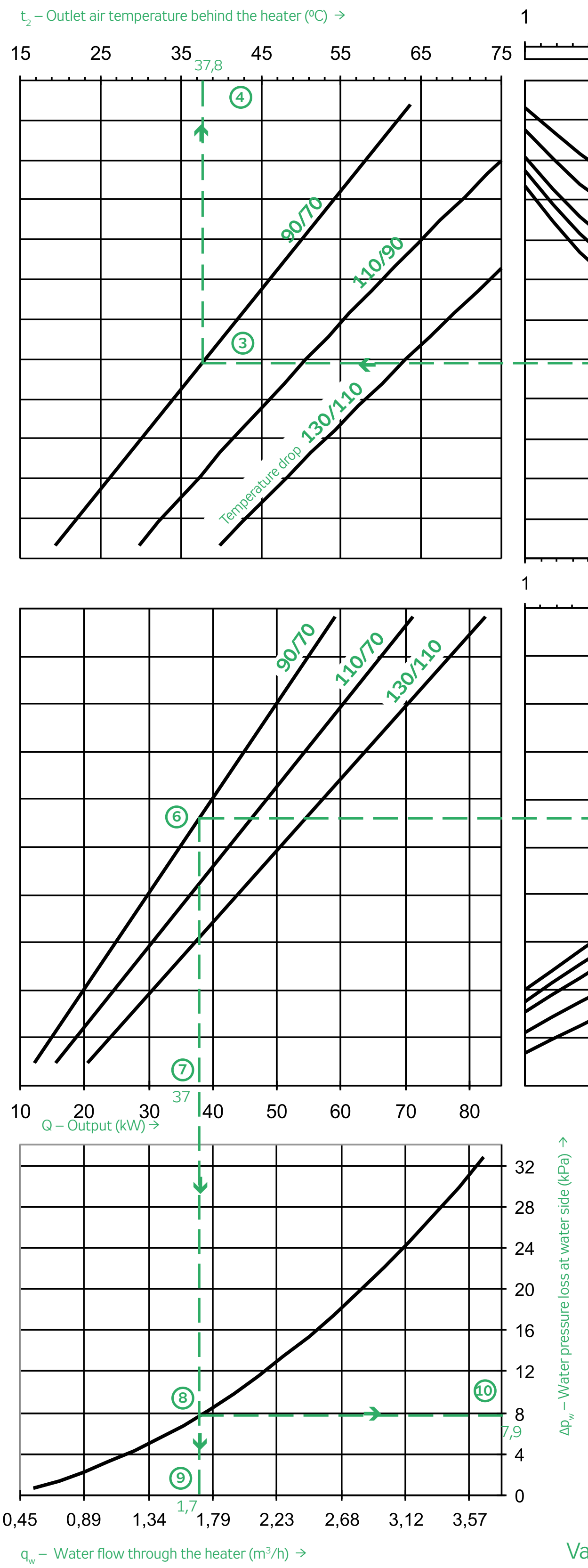
VO 50-30/3R (Cu/Al vodní ohřívač 500 x 300 mm)

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 5328 m³/h ①, the velocity of the air flow through the VO 50-30/3R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +37,8 ºC 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.

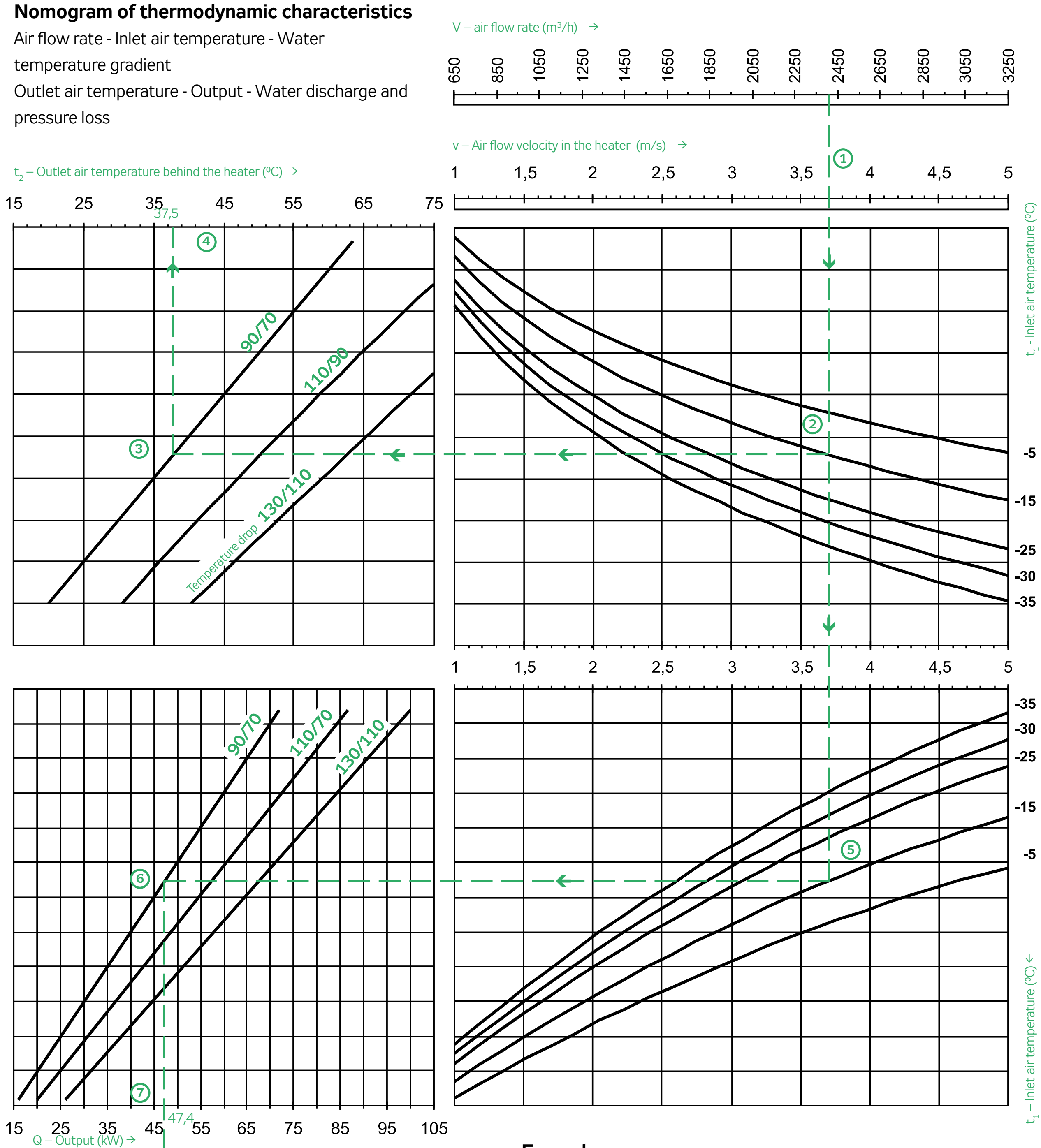
Values in the nomogram can be interpolated and extrapolated.

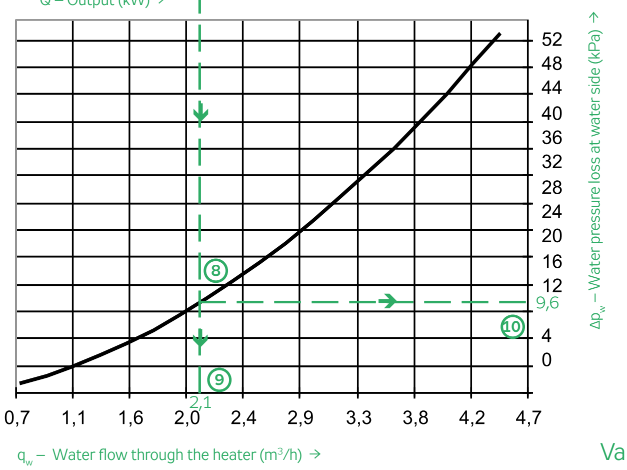
VO 60-30/3R (Cu/Al vodní ohřívač 600 x 300 mm)

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 2410 m³/h ①, the velocity of the air flow through the VO 60-30/3R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +37,5 ºC 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.

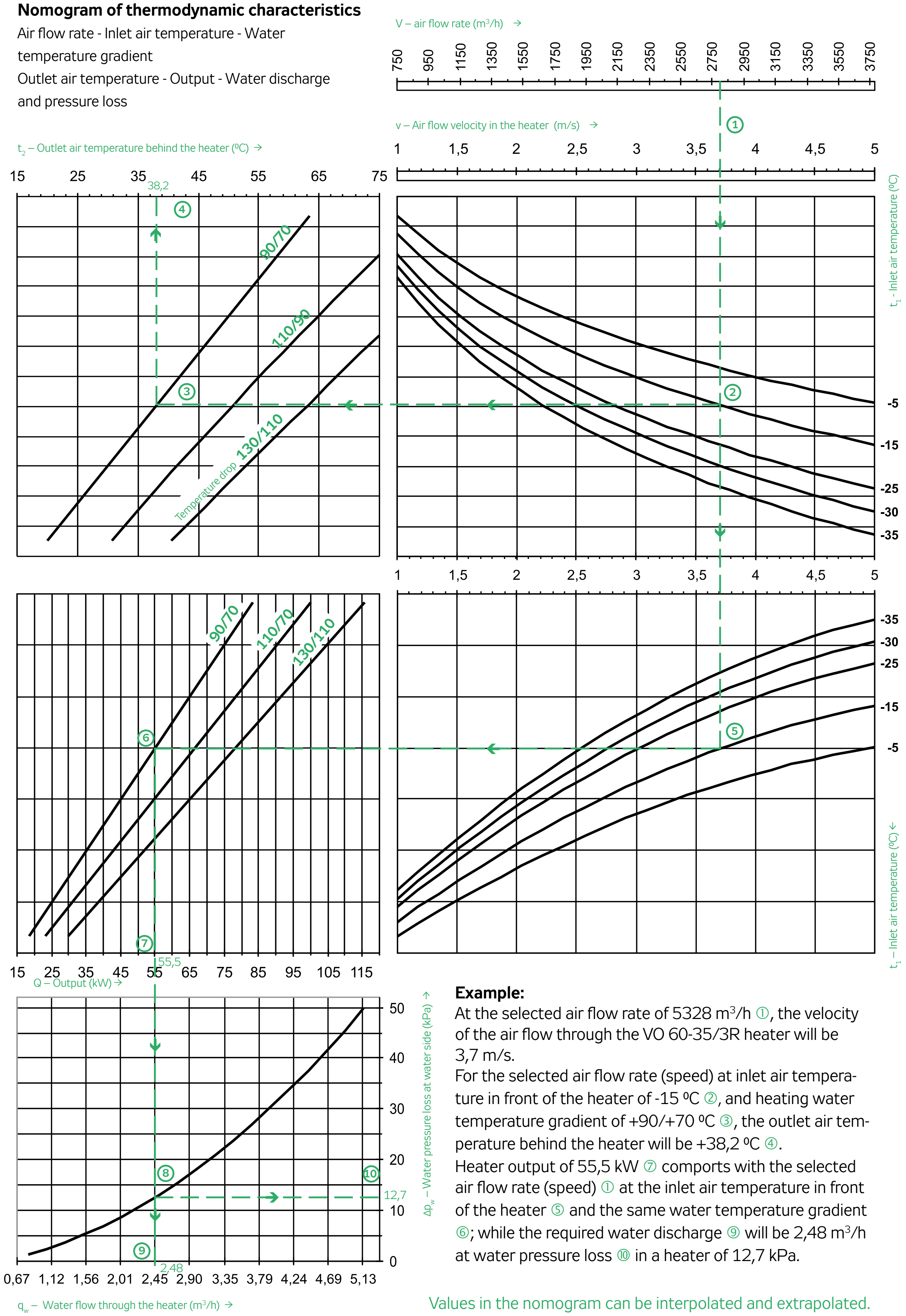
Values in the nomogram can be interpolated and extrapolated.

VO 60-35/3R (Cu/Al vodní ohřívač 600 x 350 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 5328 m³/h ①, the velocity of the air flow through the VO 60-35/3R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +38,2 ºC 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.

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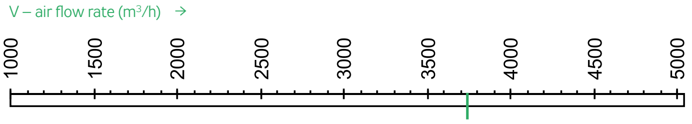
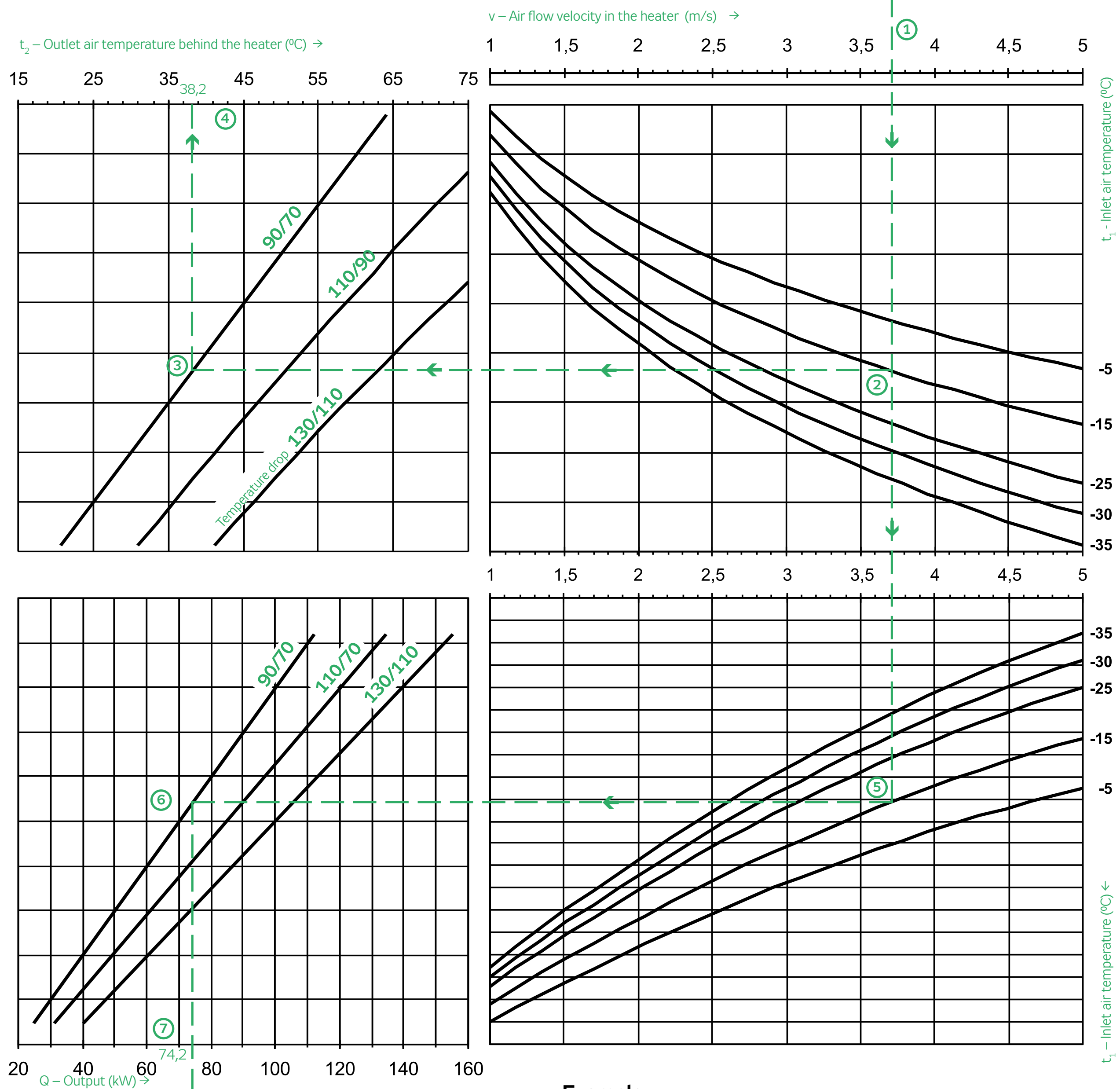
VO 70-40/3R (Cu/Al vodní ohřívač 700 x 400 mm)

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient

Outlet air temperature - Output - Water discharge and pressure loss

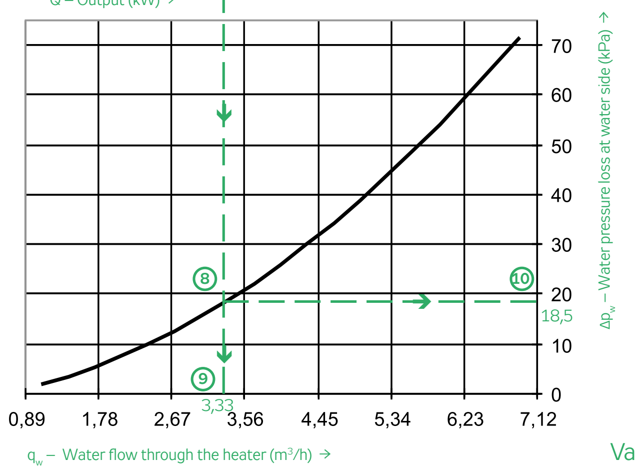




Example:

At the selected air flow rate of 3743 m³/h ①, the velocity of the air flow through the VO 70-40/3R will be 3,7 m/s. For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +38,2 ºC 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.



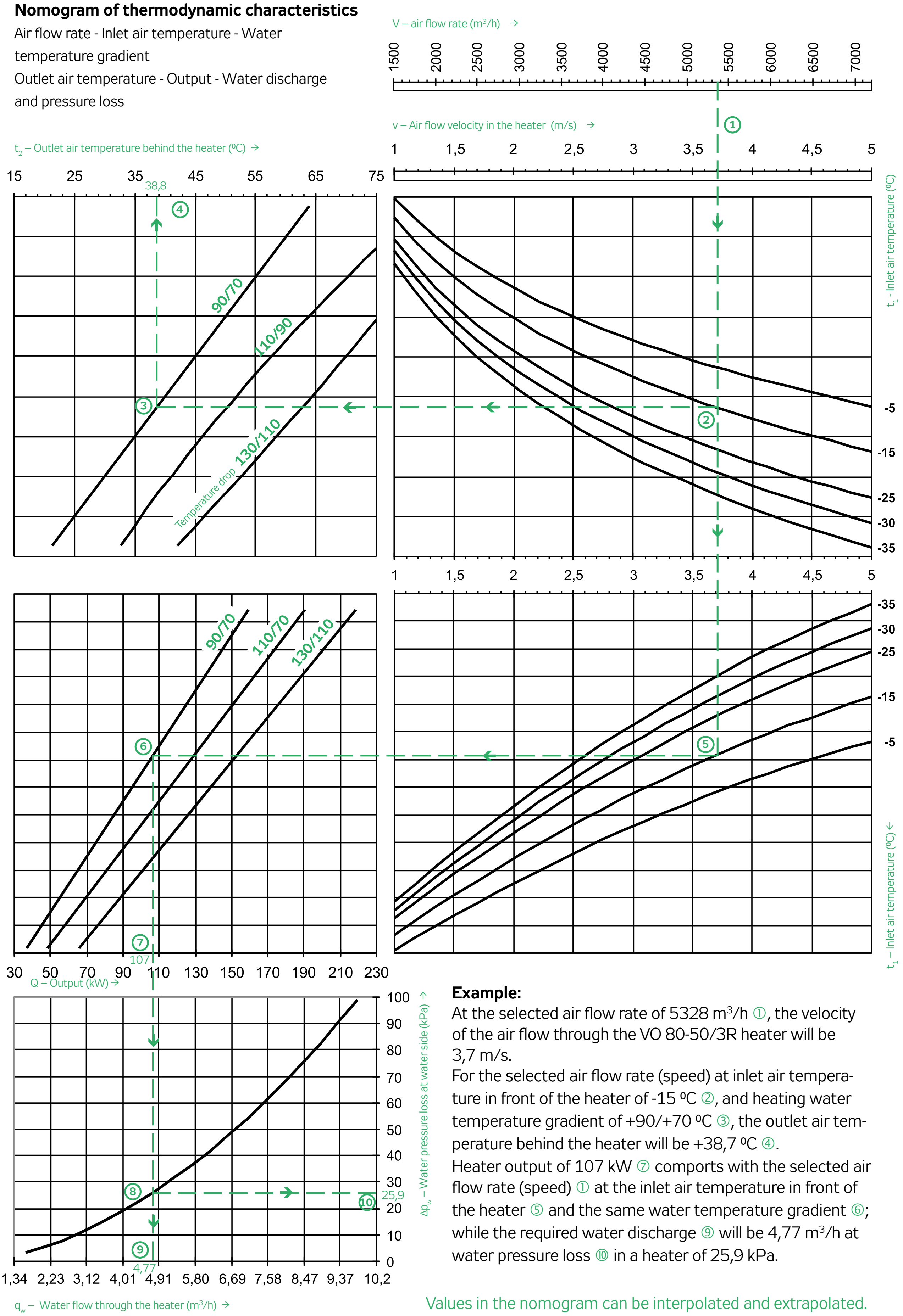
Values in the nomogram can be interpolated and extrapolated.

VO 80-50/3R (Cu/Al vodní ohřívač 800 x 500 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 5328 m³/h ①, the velocity of the air flow through the VO 80-50/3R 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 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +38,7 ºC 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.

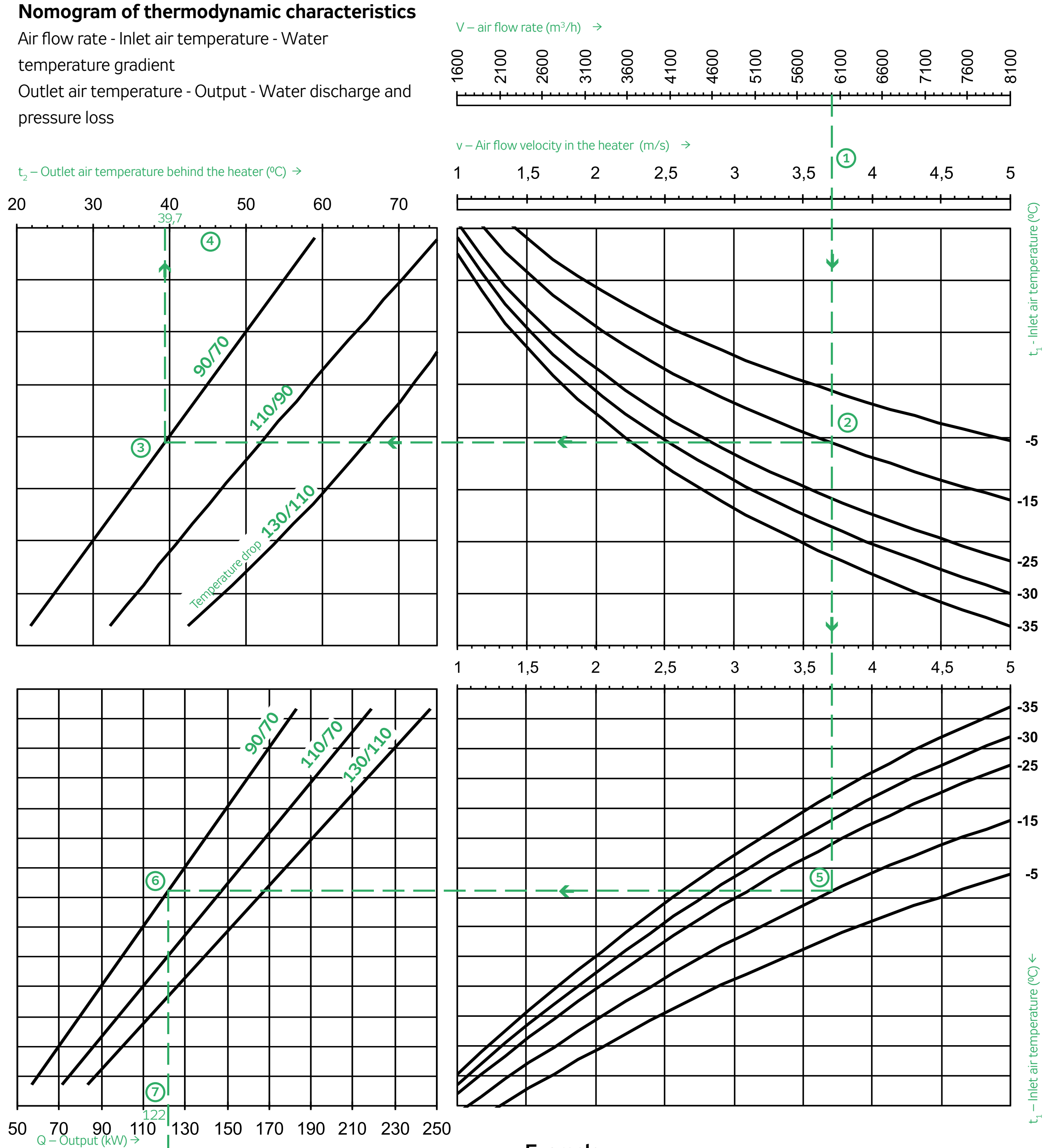
Values in the nomogram can be interpolated and extrapolated.

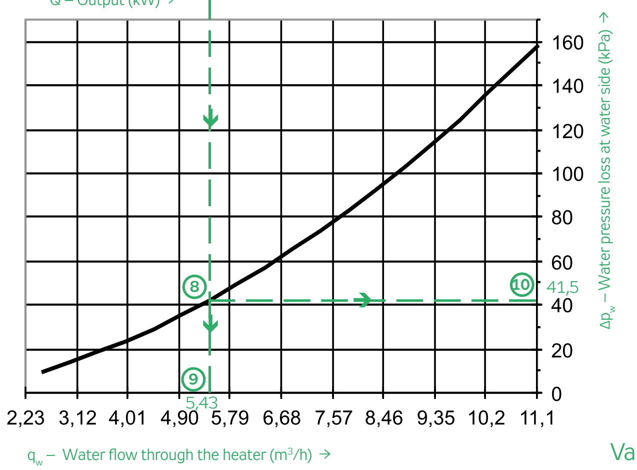
VO 90-50/3R (Cu/Al vodní ohřívač 900 x 500 mm)

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 6000 m³/h ①, the velocity of the air flow through the VO 90-50/3R heater will be 3,7 m/s.

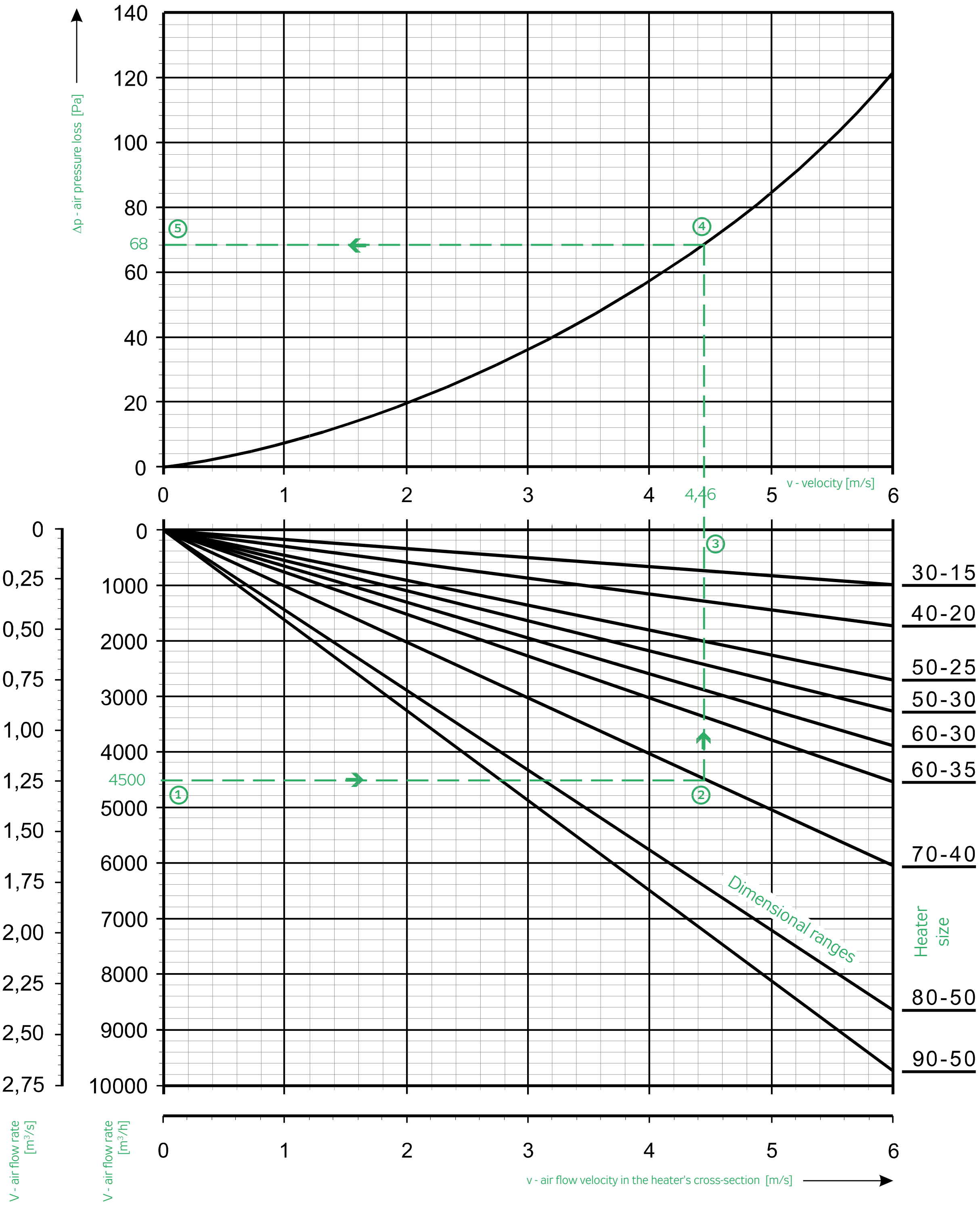
For the selected air flow rate (speed) at inlet air temperature in front of the heater of -15 ºC ②, and heating water temperature gradient of +90/+70 ºC ③, the outlet air temperature behind the heater will be +39,7 ºC ④.

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 m³/h at water pressure loss ⑩ in a heater of 41,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

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 ⑤ at the known velocity 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 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.

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

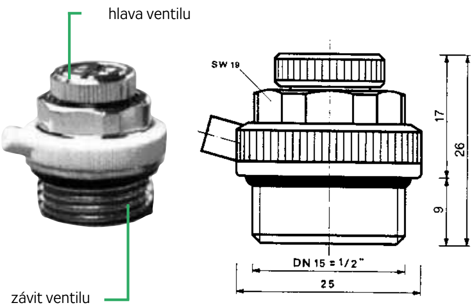
The heater can be vented either manually or automatically. With regard to the fact that the heater is mostly installed in places difficult to access, at height or on ceilings, automatic air-venting is a necessity. The TACO automatic air-venting valve with outer G1/2" thread (see fig. #6) is designed to be screwed directly into the heater header pipe. It is installed on the very top of the headers.[5]

Max. allowed operating parameters of heating water:

- Max. water operating temperature: **115 ºC** [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!

OBRÁZEK 6 – ODVZDUŠŇOVACÍ VENTIL TACO



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:

- water plus ethylenglycol (Antifrogen N)
- water plus 1,2-propylenglycol (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).

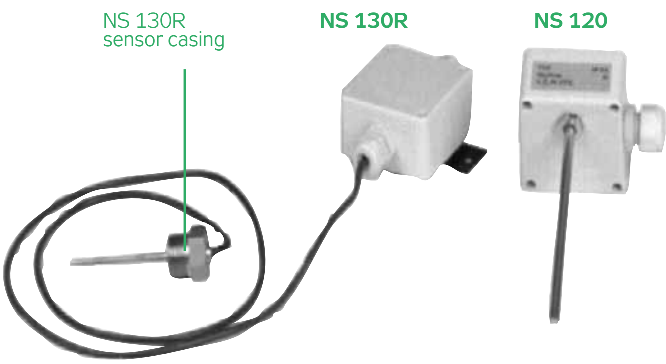
ANTIFREEZE PROTECTION ACCESSORIES

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 7 - 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 ºC or higher, it will be necessary to ensure air-venting by a float valve.

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).
- 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).
- . 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.
-
- The TACO air-venting valves must be mounted onto the highest point of the inlet/outlet header pipe. The openings in the header pipes have G1/2" inner thread and were closed with plugs in the plant.
- The casing of the antifreeze protection NS 130 sensor can be mounted on the bottom side of the header pipe.
- An air filter must always be placed in front of the heater to avoid heater fouling.

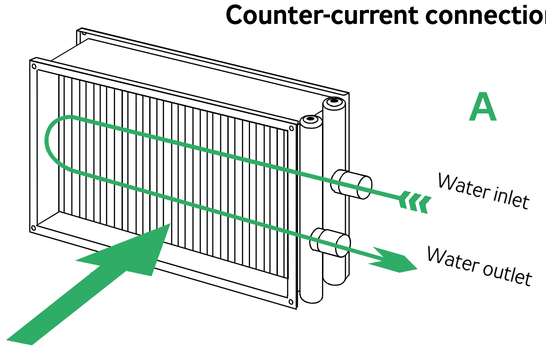
- The heater can be situated either in front of or behind the fan. However, if the heater is in front of the fan, the heater output must be controlled so that the air temperature will not exceed the maximum allowed value for the given fan.
- PThe heater can be situated either in front of or behind the 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. # 8).
- 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. (1
- 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. (2
- 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.

OPERATION, MAINTENANCE AND SERVICE

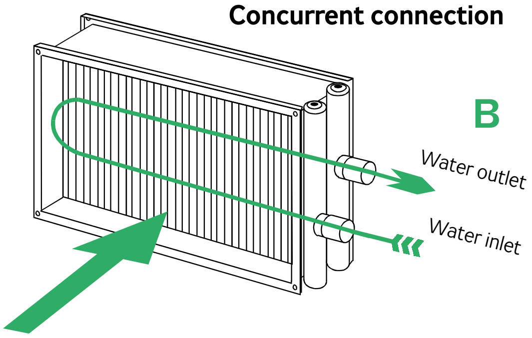
The water heater requires regular maintenance at least at the beginning and end of the heating season. During operation, it is necessary to check proper air venting and water leakages, respectively increasing pressure losses in the water piping or air duct (due to fouling). It is necessary to supervise 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!

FIGURE 8 - HEATER'S POSITIONS

Counter-current connection



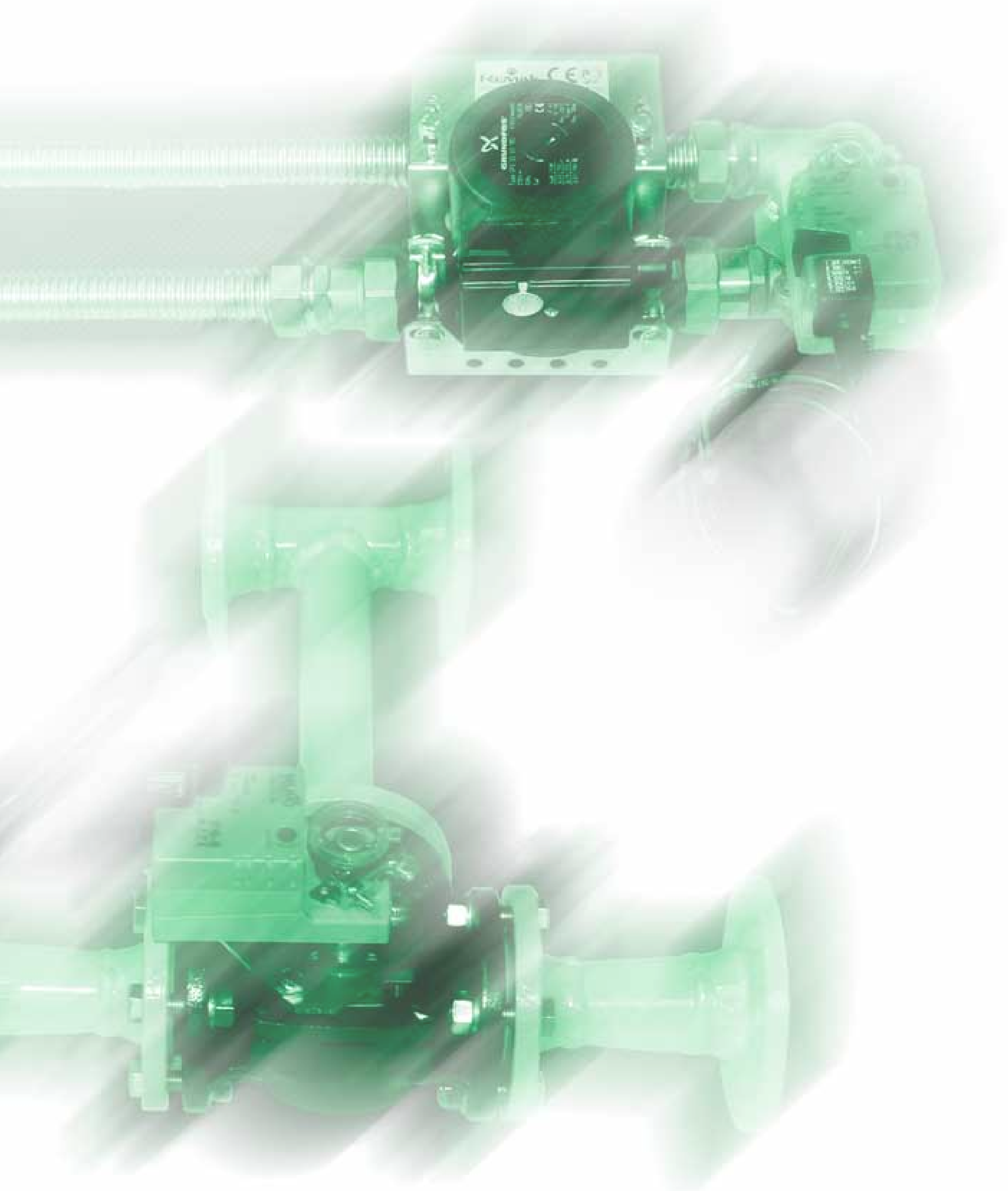
Concurrent connection



[1] If the anti-freeze protection is correctly designed, the above-mentioned feature of the concurrent connection is insignificant.

[2] Therefore, only one version of the heaters is used in the Vento system (no right or left versions).

SUMX Mixing Sets



APPLICATION OF MIXING SETS

SUMX mixing sets ensure continuous output control (proportional control using an analogue voltage signal of 0-10 V) and protection of the water heater. Output control is ensured by a 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. The below-mentioned information can also be suitably used for integration of the mixing sets into a cooling system equipped with a water heat exchanger.

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 or cast iron.
The heating system inlet branch must always be equipped with a sludge and cleaning filter. The mixing set must not be operated without this filter. The allowed ambient temperature is 0 to +70 ºC for medium temperatures up to 105 º C (for media with temperatures up to 110 ºC, the maximum ambient temperature is 35 ºC (55 º C for SUMX 1-16). The minimum medium temperature is + 2 ºC.
Maximum allowed operating parameters of heating water:

- maximum allowed water temperature: **+110 º C** (**+95 ºC** for **SUMX 10** to **SUMX 16**)
- max. permissible water pressure for **SUMX 1–25: 1 MPa**
- max. permissible water pressure for **SUMX 28-90: 0.6 MPa**

For installations using hot water up to 130 ºC, it is possible to use the so-called inverted (reverse) mixing set configuration with a pump situated in the return water branch to ensure the required water temperature of
110 ºC in the heater outlet. The designation of the inverted mixing set is **SUMX/I**.
Sealing of a corresponding quality must be used for the installation. It is advisable to consult the manufacturer.

- If water is used as the heating medium, the mixing set can only be situated in an indoor environment where the temperature never falls below freezing point.
- Outdoor installation is acceptable only if glycol antifreeze solution is used as the heating medium. Salt brine solutions are not recommended, see the chapter "Water Heaters".
- In applications in which it is necessary to avoid primary circuit water cooling or in applications in which it is necessary to avoid interference from the primary and secondary circuit pumps (undesirable heating water flow direction through the heater), it is possible to equip the primary circuit with a bypass (respectively with a thermo-hydraulic separator). The bypass should be situated as close as possible to the mixing set connection point. The heating water bypassing increases the return water temperature therefore, the bypass (thermo-hydraulic separator) must not be used in association with modern condensing boilers. The same applies if the heating water supplier does not allow the cooled water to be returned to the system.
- As the mixing set pump overcomes only the secondary circuit (the heater circuit) pressure losses, the primary circuit pump must be designed to cover all pressure losses up to the mixing set at the nominal water discharge which has been determined by the water heater design.

TABLE 1 – MIXING SET TYPES

Typ	ErP 2015 compliant	Pump	3-way valve	Discharge height	Actuator
			Version with screwed components		
SUMX 1 EU	✓	UPM3 25-70	VRG131 15-1	7 m	HTYD24-SR
SUMX 1	×	UPS 25-40		4 m	HTYD24-SR
SUMX 1,6 EU	✓	UPM3 25-70	VRG131 15-1,6	7 m	HTYD24-SR
SUMX 1,6	×	UPS 25-40		4 m	HTYD24-SR
SUMX 2,5 EU	✓	UPM3 25-70	VRG131 15-2,5	7 m	HTYD24-SR
SUMX 2,5	×	UPS 25-40		4 m	HTYD24-SR
SUMX 4 EU	✓	UPM3 25-70	VRG131 20-4	7 m	HTYD24-SR
SUMX 4	×	UPS 25-60		6 m	HTYD24-SR
SUMX 6,3 EU	✓	UPM3 25-70	VRG131 20-6,3	7 m	HTYD24-SR
SUMX 6,3	×	UPS 25-60		6 m	HTYD24-SR
SUMX 10 EU	✓	UPML 25-105	VRG131 25-10	10,5 m	HTYD24-SR
SUMX 10	×	UPS 25-80		8 m	HTYD24-SR
SUMX 16 EU	✓	UPML 25-105	VRG131 32-16	10,5 m	HTYD24-SR
SUMX 16	×	UPS 25-80		8 m	HTYD24-SR
SUMX 25 EU	✓	Magna1 32-80	VRG131 40-25	8 m	HTYD24-SR
SUMX 25	×	UPS 32-80		8 m	HTYD24-SR
			Version with flanged components		
SUMX 28 EU	✓	Magna1 40-60F	3F 32	6 m	HTYD24-SR
SUMX 44 EU	✓	Magna1 40-60F	3F 40	6 m	HTYD24-SR
SUMX 60 EU	✓	Magna1 65-60F	3F 50	6 m	HTYD24-SR
SUMX 90 EU	✓	Magna1 65-60F	3F 65	6 m	HTY24-SR

- The primary circuit pump must not affect the mixing set pump, i.e. the mixing set must not be loaded by the pressure from the primary circuit. It is not advisable to include other consumers in the heater's circuit. Further, it is necessary to equip the primary circuit inlet and outlet branch with ball closing valves and the inlet branch with a sludge and cleaning filter (which should also be separated by a closing valve).
- **The mixing set must not be operated without a sludge and cleaning filter.**
- Components of the primary circuit are not the subject of the delivery from REMAK a.s..

POSITION AND LOCATION

When projecting the layout of the mixing set location, we recommend observing the following principles:

- The mixing set must be mounted so that the shaft of the circular pump motor will always be in the horizontal position!
- The mixing set must be situated so that air-venting will be possible.
- If the mixing set is covered by a ceiling, it is necessary to ensure access to the entire mixing set to enable maintenance.
- The mixing set is connected to the heater via corrosion-proof hoses while the flange assembly should be mounted using standard heat-engineering techniques as close as possible to the heater. It is advisable to minimize the length of the hoses so that the control response will not be unnecessarily delayed.
- The mixing set is mounted using an integrated holder, respectively, tube clamps can be used, if necessary. The weight of the mixing set must never be transferred onto the heat exchanger.
- The flange-connected mixing sets are delivered disassembled. The connecting hoses are not included in the delivery.

MATERIALS

Common heat-engineering materials and components are used to manufacture the mixing set. The mixing sets are made of brass, stainless steel, respectively, cast iron and in smaller scale, of galvanized steel and steel. The sealing components are made of rubber or plastic.

DIMENSIONAL RANGE AND DESIGN

Mixing sets are supplied in 12 power types (according to table 1). Of these, eight nodes are designed with screw connections including connection hoses (Fig. 3) and in two alternatives – with pumps compliant with **ErP2015** (for the EU market) and **non-compliant** with ErP2015 (**only outside the EU market**). The four sizes of mixing sets are available with flange connections without connecting pipes / fittings (Fig. 4B) and are delivered disassembled and only in a variant complying with **ErP2015.**

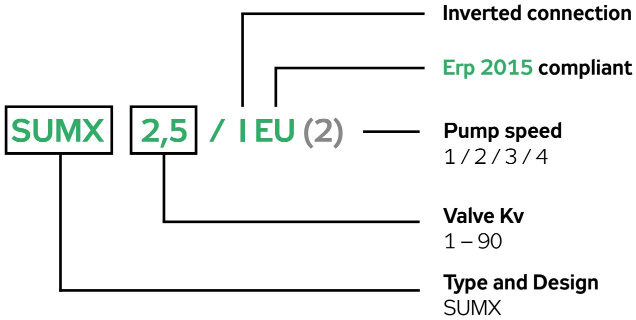
MIXING SET TYPE

The rate of flow and pressure of the 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. Manual selection is performed according to the diagrams and description in section Characteristics, node design (p. 226).

MIXING SET DESIGNATION

The type designation of mixing sets in projects and orders is defined by the key in figure # 2.
The project must also include the pump speed, which is set during the course of installation. The speed of the pump is indicated in parenthesis behind the type code of the mixing set.

FIGURE 2 – TYPE DESIGNATION



DIMENSIONS AND PERFORMANCE

The basic specifications can be found in pictures #3a to #4b and in table #4. The types are listed in table #1. The pump and actuator specifications and electrical parameters are included in table #2 and #3.

FIGURE 3A – BASIC LAYOUT OF MIXING SETS

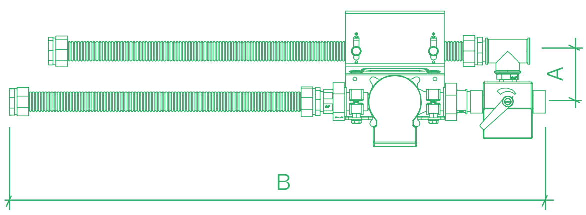
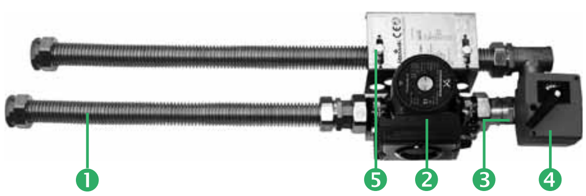


FIGURE 3B – BASIC LAYOUT OF MIXING SETS



❶ Connecting hose
❷ Circulation pump
❸ 3-way regulating valve
❹ Valve actuator
❺ Integrated holder

FIGURE 4A – BASIC LAYOUT OF MIXING SETS

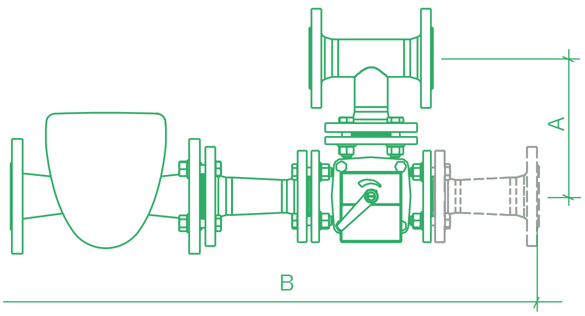
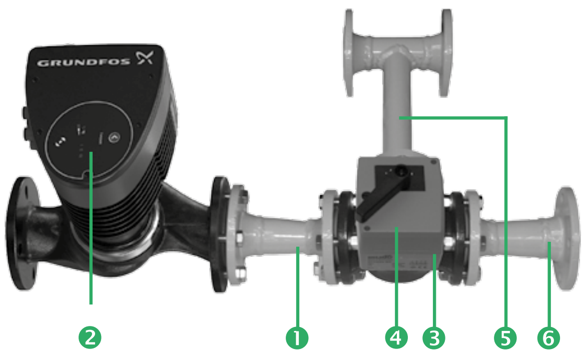


FIGURE 4B – BASIC LAYOUT OF MIXING SETS



❶❻ Connecting fittings, ❷ Circulation pump, ❸ Three-way regulating valve, ❹ Valve actuator, ❺ T-Piece
Connecting fitting ❻ s only used with mixing set sizes 28 and 60.

TABLE 4 – DIMENSIONS, WEIGHT

Type / dimensions *	Width A ** (mm)	Length B ** (mm)	Connecting dimension	m (kg)
Version with screwed components				
SUMX 1 EU	90	850	G1	7
SUMX 1	90	850	G1	7
SUMX 1,6 EU	90	850	G1	7,5
SUMX 1,6	90	850	G1	7,5
SUMX 2,5 EU	90	850	G1	7,5
SUMX 2,5	90	850	G1	7,5
SUMX 4 EU	90	850	G1	7,5
SUMX 4	90	850	G1	7,5
SUMX 6,3 EU	90	850	G1	7,5
SUMX 6,3	90	850	G1	7,5
SUMX 10 EU	90	850	G1	7
SUMX 10	90	850	G1	8,5
SUMX 16 EU	100	850	G1 1/4	7
SUMX 16	100	850	G1 1/4	8,5
SUMX 25 EU	110	870	G1 1/4	9,5
SUMX 25	110	870	G1 1/4	11,5
Version with flanged components				
SUMX 28 EU	350	630	DN 40	29
SUMX 44 EU	350	540	DN 40	27
SUMX 60 EU	350	875	DN 65	49
SUMX 90 EU	350	710	DN 65	46

* The dimensions are according to Fig. 3A, 4A ** ± 20 mm

TABLE 2 – PUMP PARAMETERS

Pump	ErP 2015 compliant	Input power	Current max.	Supply voltage	Protection
		W	A	V	
UPM3 25-70	✓	52	0.52	1 x 230 AC	IP 44
UPML 25-105	✓	140	1.1	1 x 230 AC	IP X2D
Magna1 32-80	✓	151	1.22	1 x 230 AC	IP X4D
Magna1 40-60F	✓	194	1.56	1 x 230 AC	IP X4D
Magna1 65-60F	✓	365	1.64	1 x 230 AC	IP X4D
UPS 25-40	×	45	0,2	1 x 230 AC	IP 44
UPS 25-60	×	70	0,3	1 x 230 AC	IP 44
UPS 25-80	×	165	0,7	1 x 230 AC	IP X2D
UPS 32-80	×	220	0,98	1 x 230 AC	IP X2D

TABLE 3 – ACTUATOR PARAMETERS

		HTYD24-SR	HTY24-SR
Supply voltage	V	24 AC / DC	24 AC / DC
Degree of protection	IP	40	40
Input power	W	1.5	2.5
Dimensioning	VA	3	4
Rotation angle	°	max. 90	max. 90
Rotation time	sec	35	35
Torque	Nm	5	10
Control signal	V	DC 0-10	DC 0-10

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. The same applies for the inverted connection (distribution function of the three-way valve).

FIGURE 5 – INSTALLATION USING SUSPENSION RODS

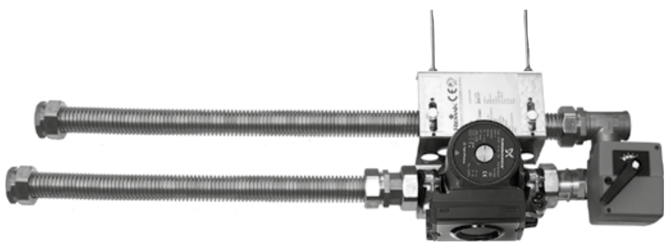
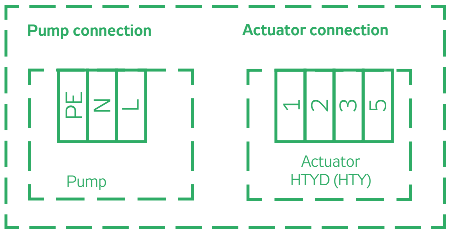


FIGURE 6 – PUMP SPEED SETTINGS

INSTALLATION

- SUMX 1-25 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.
- 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 entire mixing set to enable electric cable connections, checking and maintenance.
- SUMX 28 - 90 flange-connected mixing sets can be connected to 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.
- 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 will always be in the horizontal position!
- 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 after the type designation of the mixing set. For example, the mixing set SUM 6,3 (3) is equipped with the pump UPM3 25-70 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.
- The mixing sets are delivered unassembled, the mixing set must be assembled following figure # 7.
- If the actuator turns incorrectly, change the direction of rotation by just turning switch S1 to the other position. The switch is accessible after removing the actuator's cover, see fig. # 10.
- 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 points, is always closed (figure # 11 shows the three-way valve's function).
- After connecting the mixing set, it is necessary to check the correct direction of rotation of the actuator depending on the control signal (heating/no heating).
- After starting the pump, it is necessary to measure the current, which must not exceed the maximum allowed current $I_{max.}$ indicated on the pump nameplate.

FIGURE 8 – MIXING SET WIRING DIAGRAM

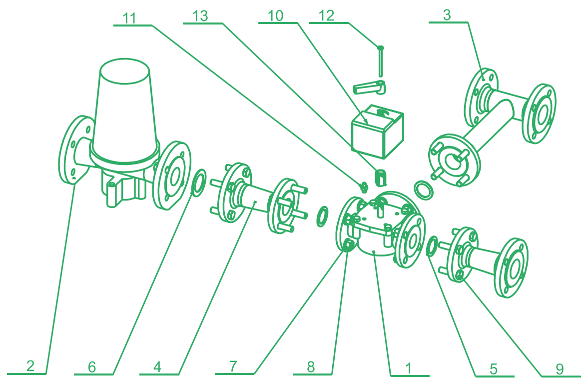


1 x 230V + PE + N
PE... protective conductor terminal
N..... Neutral conductor
L...... Phase conductor

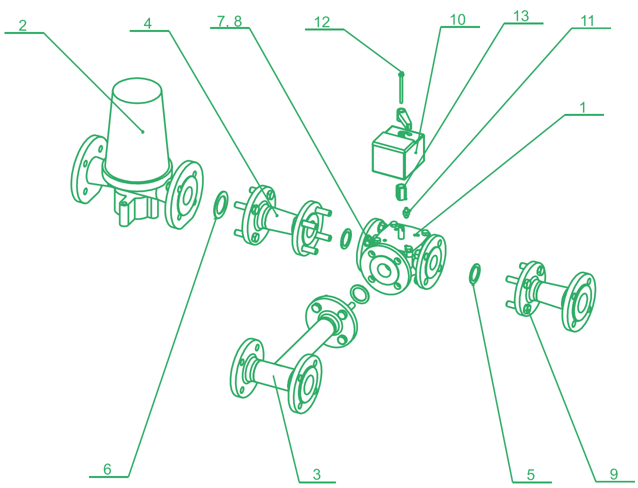
1....grounding conductor (⊥)
2....24 V AC / DC (+ ~)
3....control signal (Y)
5....measuring voltage

FIGURE 7 – EXPLODED VIEW OF THE MIXING SET

standard



reversed set-up



(1) Valve, **(2)** Pump, **(3)** T-piece, **(4)** making-up piece, **(5)** Sealing, **(6)** Sealing, **(7)** Washer, **(8)** Nut, **(9)** Screw, **(10)** Actuator, **(11)** Pin, **(12)** Fixing screw, **(13)** Adapter

FIGURE 9 – MIXING SET CONNECTION

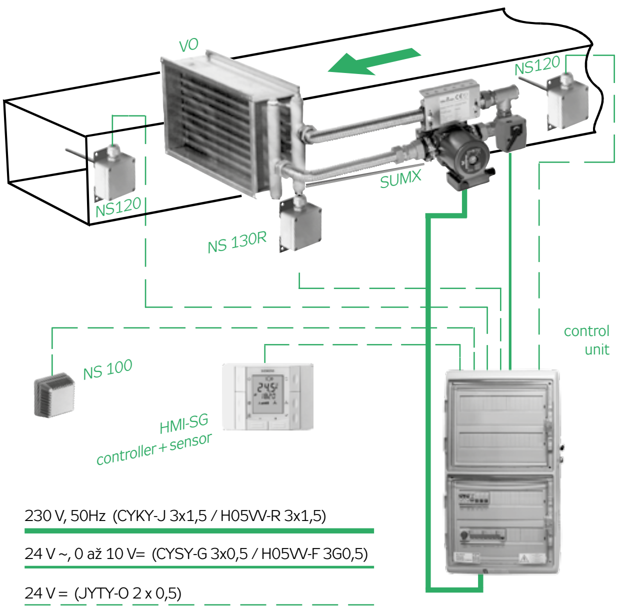


FIGURE 10 - SWITCHING THE ACTUATOR TURNING DIRECTION

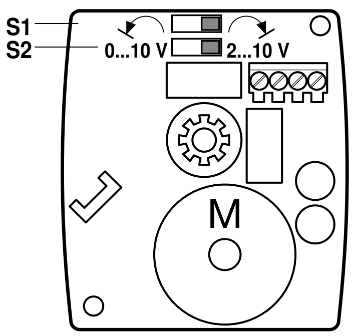
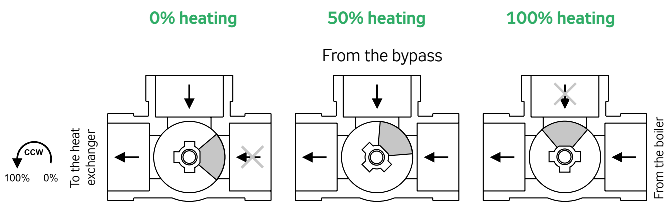
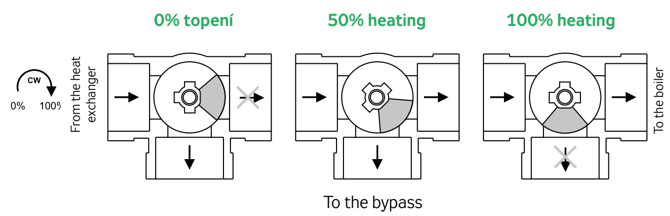


FIGURE 11 – THREE-WAY VALVE FUNCTION

Standard connection (mixing)



Inverted connection (separation)



WIRING

- The wiring can be performed only by a qualified worker licensed in accordance with national regulations.
- The pump must be connected via the terminal box in accordance with the manual. The actuator is equipped 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.
- For the mixing set wiring diagram, refer to figure # 8.
- The principle diagram of the mixing set connection to the control unit is shown in figure # 9.

OPERATION, MAINTENANCE AND SERVICE

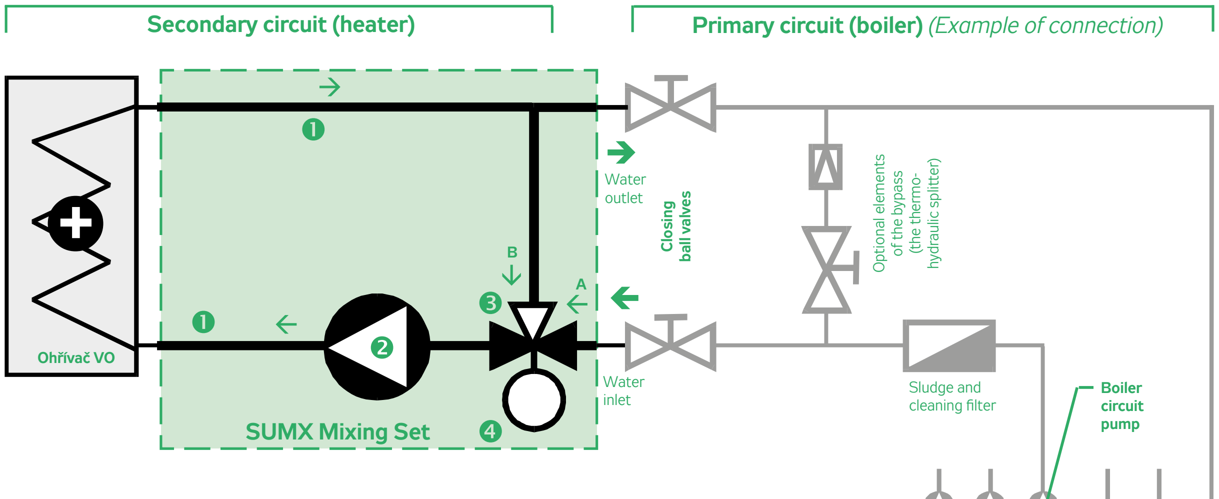
- The mixing set requires regular maintenance at least at the beginning and end of the heating season.
- During operation, it is necessary to check the system for proper air venting and water leakage. It is necessary to supervise proper operation of the pump and actuator, and keep the filters in front of the mixing set 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".

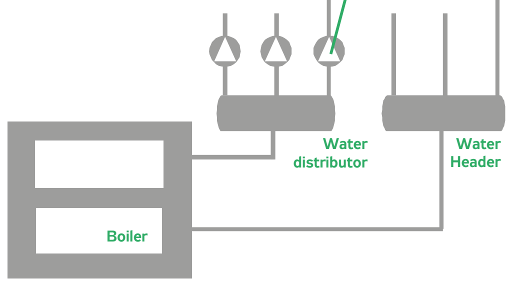
All important system protection functions, including antifreeze protection of the mixing sets and heaters, must be permanently controlled by the control unit.

Attention! During the winter season, the control unit must not be disconnected from the power supply for too long! Power supply failure during air-handling system operation is especially dangerous!

FIGURE 12 – CONNECTING SCHEME OF THE HEATER AND MIXING SET IN A HEATING SYSTEM

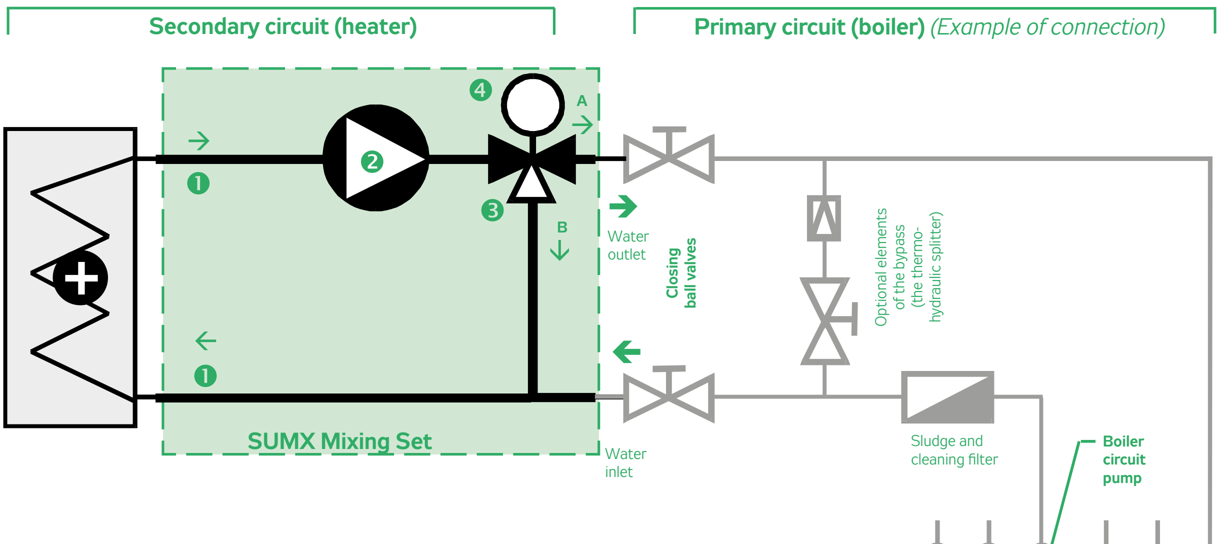
a) Standard connection (mixing)

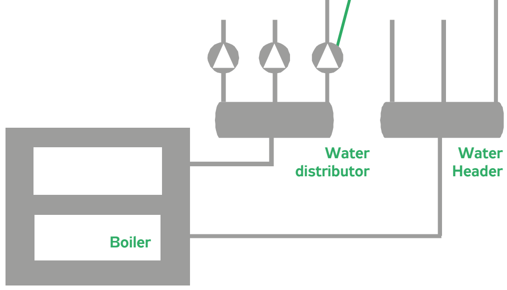




SUMX Mixing Set Components:
1. Corrosion-proof connecting hoses (connecting pipes)
2. Hot water circulating pump
3. Three-way regulating and mixing valve
4. Mixing valve actuator

b) Inverted connection (separation)





SUMX Mixing Set Components:
1. Corrosion-proof connecting hoses (connecting pipes)
2. Hot water circulating pump
3. Three-way regulating and mixing valve
4. Mixing valve actuator

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

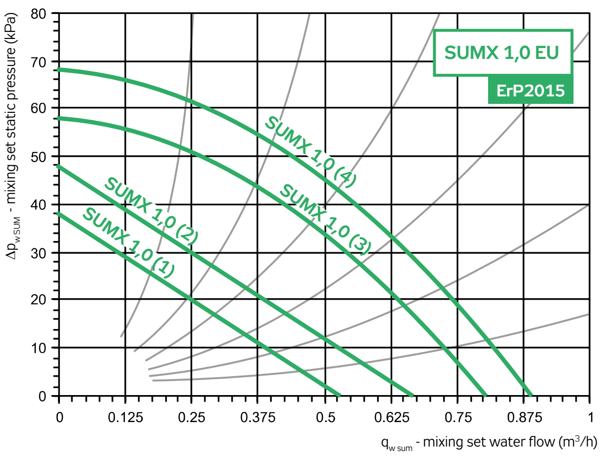
MIXING SET CHARACTERISTICS AND DIMENSIONING

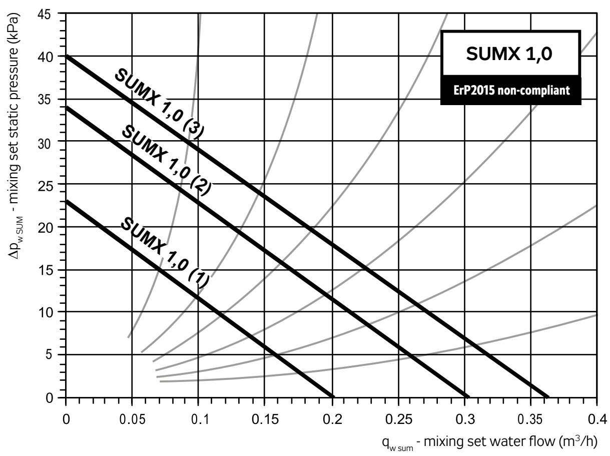
The proper dimensioning of the mixing set is essential for stepless control of the water heater. The mixing set selection is critical for optimal operation of the heating system.
The graph of each mixing set includes three or four characteristics related to the pump speed (1), (2), (3), (4). The mixing set working characteristic is given by the correlation of the mixing set water discharge ($q_{w\,sum}$) and pressure ($\Delta p_{w\,sum}$) 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.

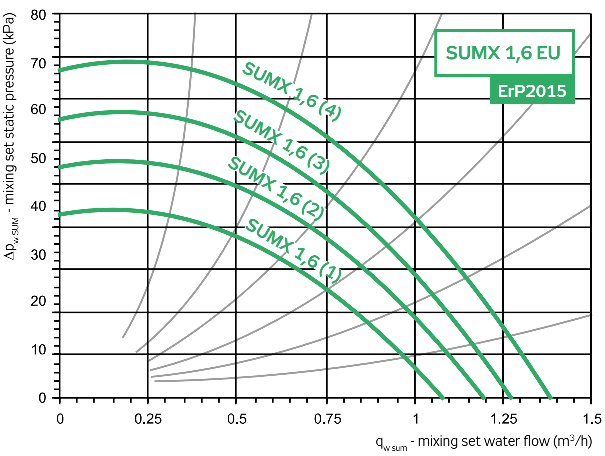
Design of the VO and SUMX Assembly

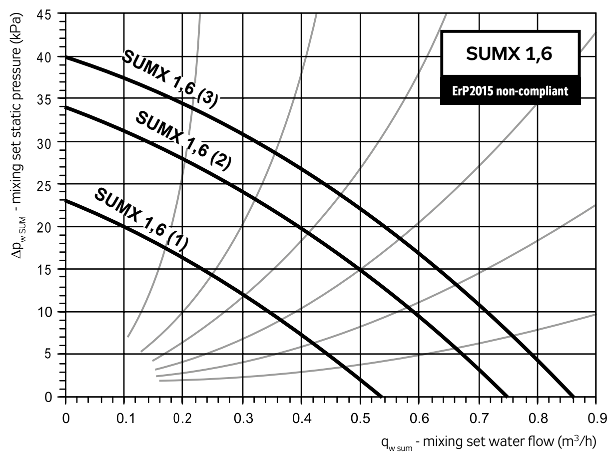
Input variables:
VO 60-35 water heater, Air flow rate 2.800 m³/h, Water temperature gradient +90/+70 ºC, Design outdoor air temperature -15 ºC, Required outlet air temperature +22 ºC.
Design and calculation:

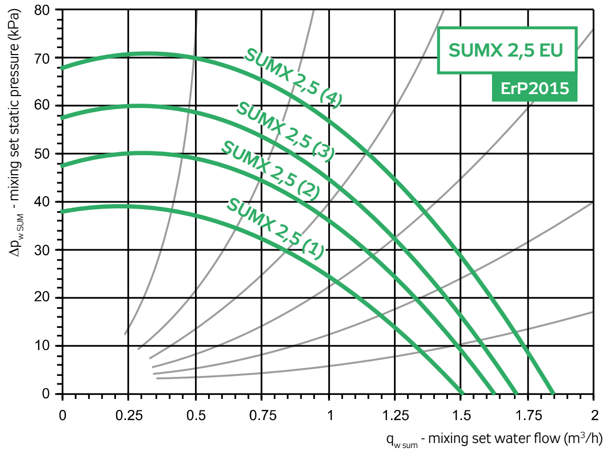
- Maximum outlet air temperature of +39 ºC at output of 40 kW and water discharge of 1.80 m3/h for pre-assigned air flow rate of 2.800 m3/h, heater input air temperature of -15 ºC and water temperature gradient of +90/+70 ºC can be determined in the VO 60-35 heater nomogram (the chapter Water heaters).
- 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 ºC:
- **Q = m.c.∆ t = (2800/3600.1,2).1010.(22-(-15)) = 34,9kW**
- Water discharge of 1.56 m³/h needed for output of 35 kW (rounded 34.9 kW) can be determined in the **VO 60-35 / 2R** heater nomogram on page #164 or in the aggregate graph valid for all heaters on page #176, and the water pressure loss in the VO 60-35 / 2R heater will be Δp_w = 5 kPa.
- The **SUMX 2,5 (2)** mixing set suits best for water discharge of 1.56 m³/h at pressure loss of 5 kPa, see the graph.
- The heater-mixing assembly effective working point will lie on the **SUMX 2,5 (2)** curve with $q_{w\,sum}$ = 1.56 m³/h and $\Delta p_{w\,sum}$ = 5 kPa.

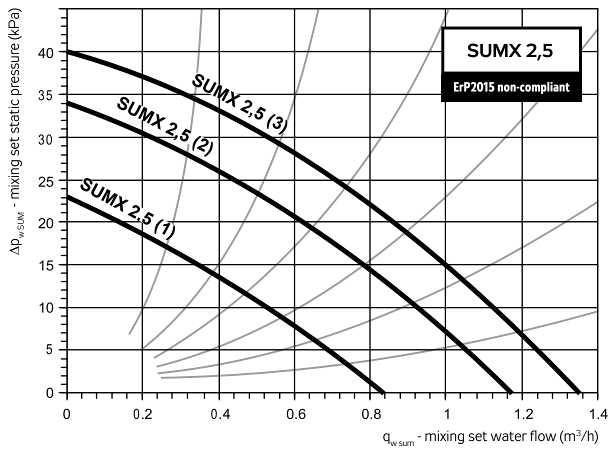


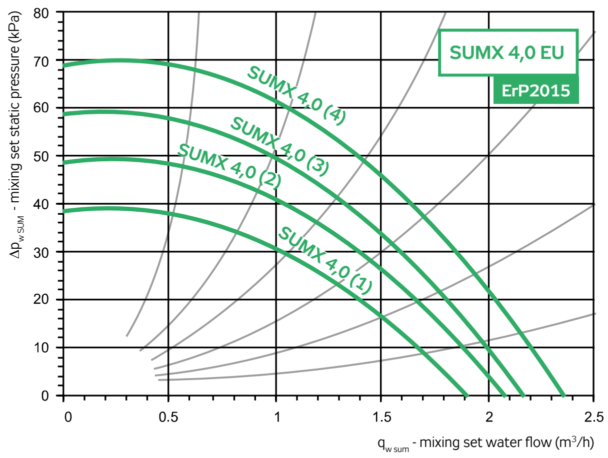


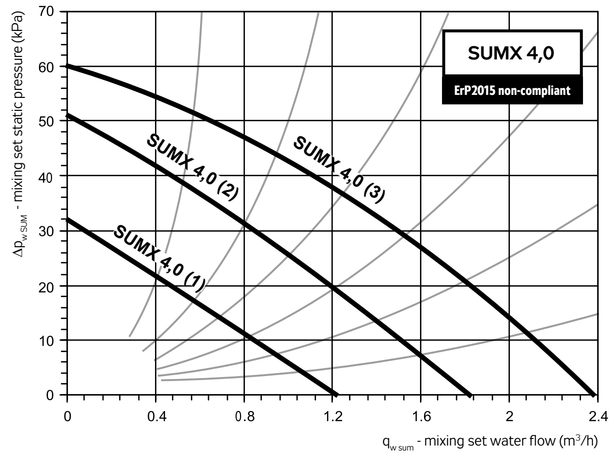


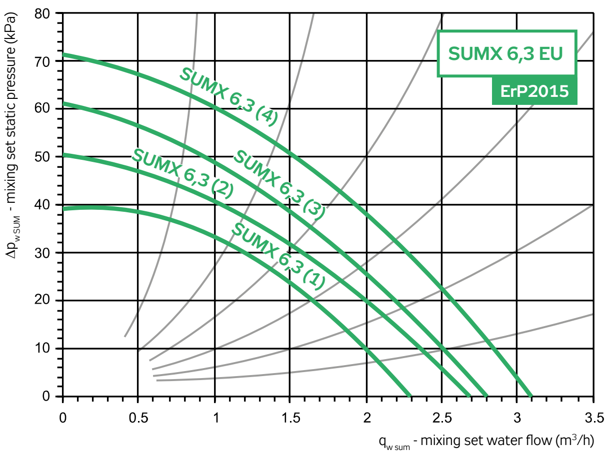


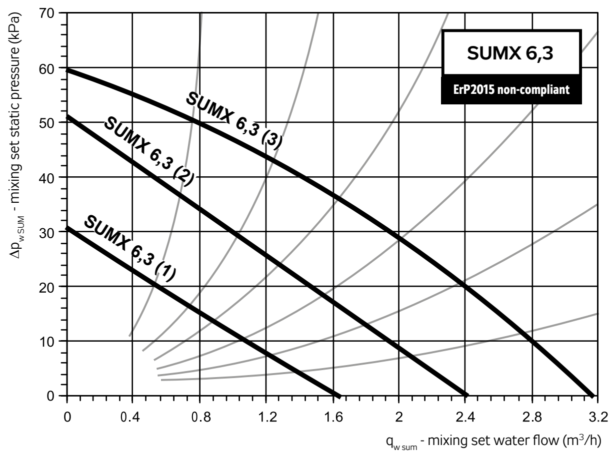

SUMX 2,5 EU
ErP2015
SUMX 2,5 (4)
SUMX 2,5 (3)
SUMX 2,5 (2)
SUMX 2,5 (1)
Δp w SUM - mixing set static pressure (kPa)
q w sum - mixing set water flow (m³/h)
0 10 20 30 40 50 60 70 80
0 0.25 0.5 0.75 1 1.25 1.5 1.75 2

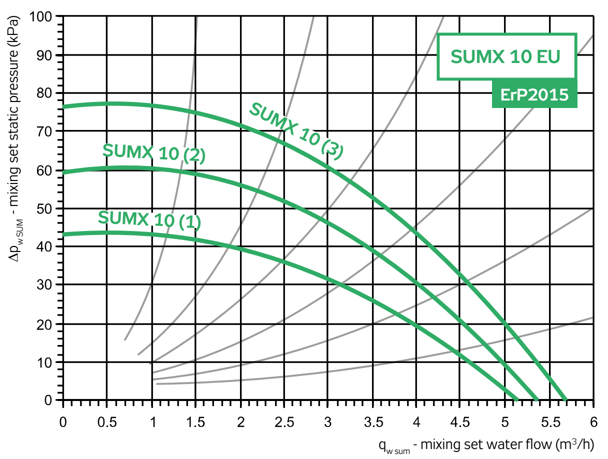

SUMX 2,5
ErP2015 non-compliant
SUMX 2,5 (3)
SUMX 2,5 (2)
SUMX 2,5 (1)
Δp w SUM - mixing set static pressure (kPa)
q w sum - mixing set water flow (m³/h)
0 5 10 15 20 25 30 35 40
0 0.2 0.4 0.6 0.8 1 1.2 1.4

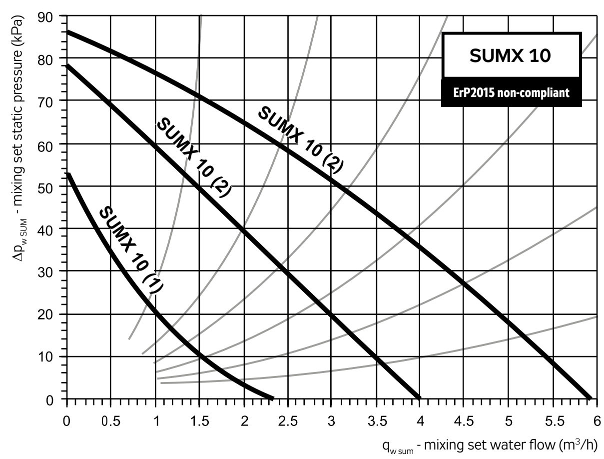

SUMX 4,0 EU
ErP2015
SUMX 4,0 (4)
SUMX 4,0 (3)
SUMX 4,0 (2)
SUMX 4,0 (1)
Δp w SUM - mixing set static pressure (kPa)
q w sum - mixing set water flow (m³/h)
0 10 20 30 40 50 60 70 80
0 0.5 1 1.5 2 2.5

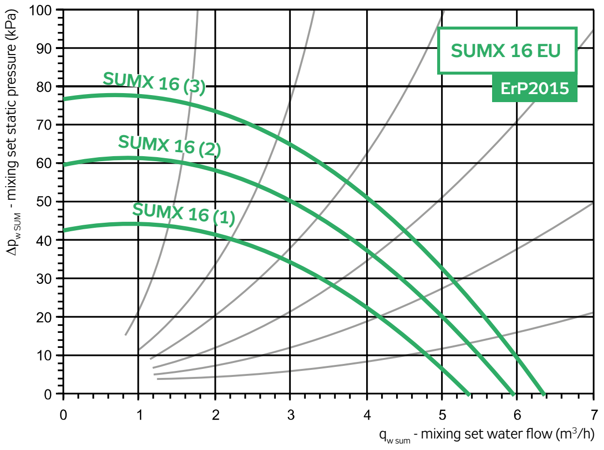

SUMX 4,0
ErP2015 non-compliant
SUMX 4,0 (3)
SUMX 4,0 (2)
SUMX 4,0 (1)
Δp w SUM - mixing set static pressure (kPa)
q w sum - mixing set water flow (m³/h)
0 10 20 30 40 50 60 70
0 0.4 0.8 1.2 1.6 2 2.4

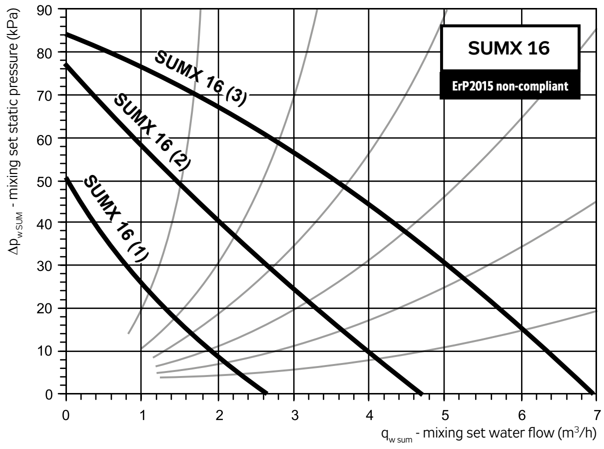

SUMX 6,3 EU
ErP2015
SUMX 6,3 (4)
SUMX 6,3 (3)
SUMX 6,3 (2)
SUMX 6,3 (1)
Δp w SUM - mixing set static pressure (kPa)
q w sum - mixing set water flow (m³/h)
0 10 20 30 40 50 60 70 80
0 0.5 1 1.5 2 2.5 3 3.5

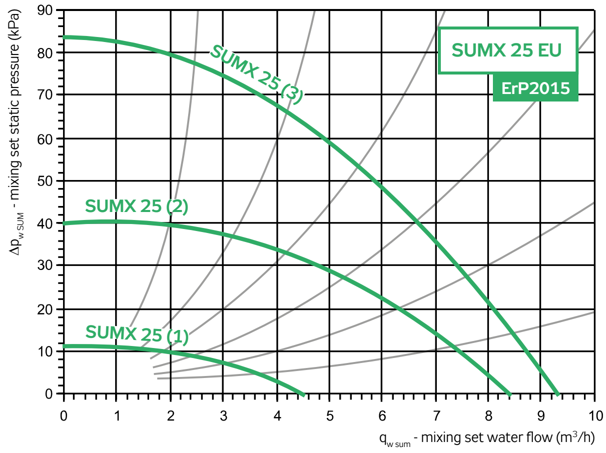

SUMX 6,3
ErP2015 non-compliant
SUMX 6,3 (3)
SUMX 6,3 (2)
SUMX 6,3 (1)
Δp w SUM - mixing set static pressure (kPa)
q w sum - mixing set water flow (m³/h)
0 10 20 30 40 50 60 70
0 0.4 0.8 1.2 1.6 2 2.4 2.8 3.2

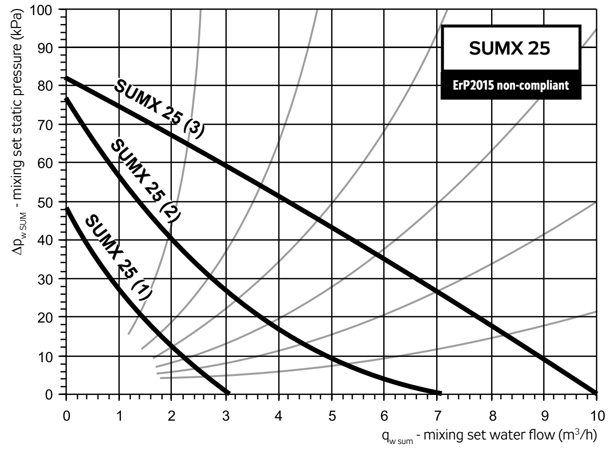

SUMX 10 EU
ErP2015
SUMX 10 (3)
SUMX 10 (2)
SUMX 10 (1)
Δp w SUM - mixing set static pressure (kPa)
q w sum - mixing set water flow (m³/h)
0 10 20 30 40 50 60 70 80 90 100
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6

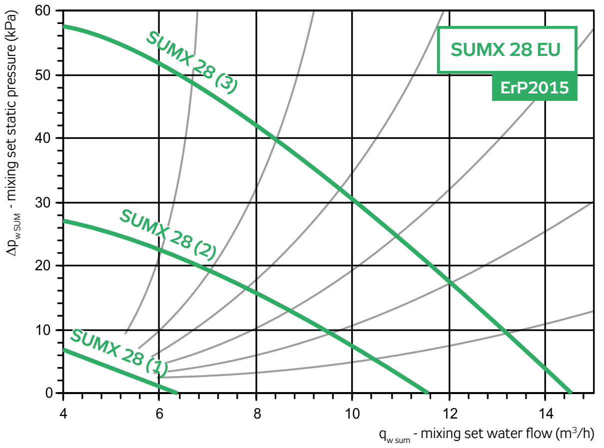

SUMX 10
ErP2015 non-compliant
SUMX 10 (2)
SUMX 10 (2)
SUMX 10 (1)
Δp w SUM - mixing set static pressure (kPa)
q w sum - mixing set water flow (m³/h)
0 10 20 30 40 50 60 70 80 90
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6

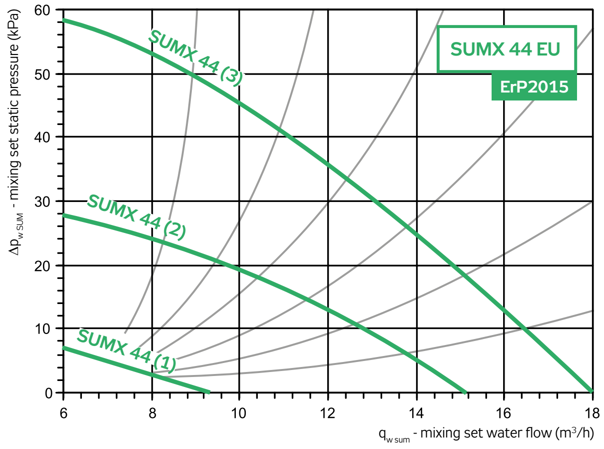

SUMX 16 EU
ErP2015
SUMX 16 (3)
SUMX 16 (2)
SUMX 16 (1)
$\Delta p_{w\,SUM}$ - mixing set static pressure (kPa)
$q_{w\,sum}$ - mixing set water flow (m^3/h)

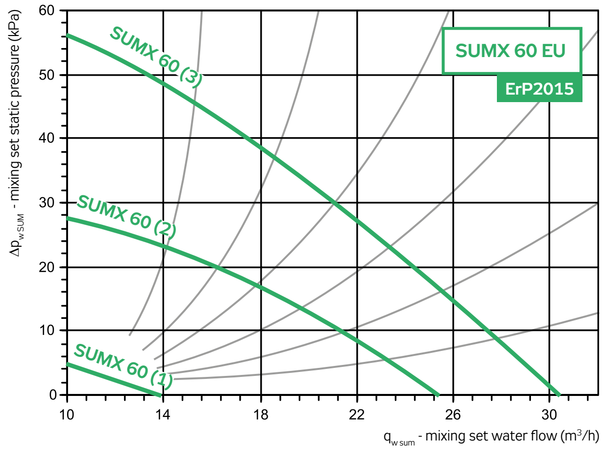

SUMX 16
ErP2015 non-compliant
SUMX 16 (3)
SUMX 16 (2)
SUMX 16 (1)
$\Delta p_{w\,SUM}$ - mixing set static pressure (kPa)
$q_{w\,sum}$ - mixing set water flow (m^3/h)

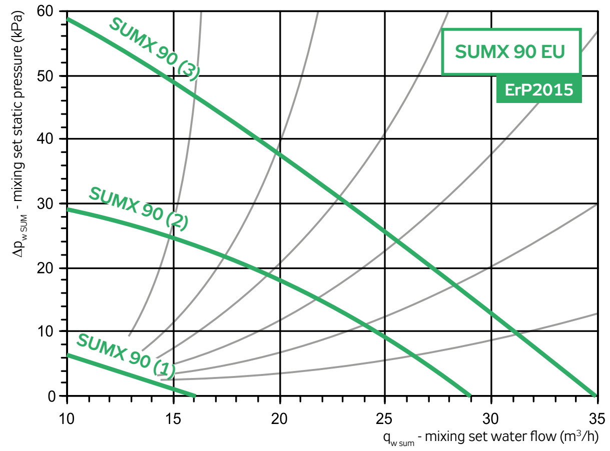

SUMX 25 EU
ErP2015
SUMX 25 (3)
SUMX 25 (2)
SUMX 25 (1)
$\Delta p_{w\,SUM}$ - mixing set static pressure (kPa)
$q_{w\,sum}$ - mixing set water flow (m^3/h)


SUMX 25
ErP2015 non-compliant
SUMX 25 (3)
SUMX 25 (2)
SUMX 25 (1)
$\Delta p_{w\,SUM}$ - mixing set static pressure (kPa)
$q_{w\,sum}$ - mixing set water flow (m^3/h)


SUMX 28 EU
ErP2015
SUMX 28 (3)
SUMX 28 (2)
SUMX 28 (1)
$\Delta p_{w\,SUM}$ - mixing set static pressure (kPa)
$q_{w\,sum}$ - mixing set water flow (m^3/h)


SUMX 44 EU
ErP2015
SUMX 44 (3)
SUMX 44 (2)
SUMX 44 (1)
$\Delta p_{w\,SUM}$ - mixing set static pressure (kPa)
$q_{w\,sum}$ - mixing set water flow (m^3/h)


SUMX 60 EU
ErP2015
SUMX 60 (3)
SUMX 60 (2)
SUMX 60 (1)
$\Delta p_{w SUM}$ - mixing set static pressure (kPa)
$q_{w sum}$ - mixing set water flow (m^3/h)
60
50
40
30
20
10
0
10
14
18
22
26
30


SUMX 90 EU
ErP2015
SUMX 90 (3)
SUMX 90 (2)
SUMX 90 (1)
$\Delta p_{w SUM}$ - mixing set static pressure (kPa)
$q_{w sum}$ - mixing set water flow (m^3/h)
60
50
40
30
20
10
0
10
15
20
25
30
35

Water coolers

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.

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.

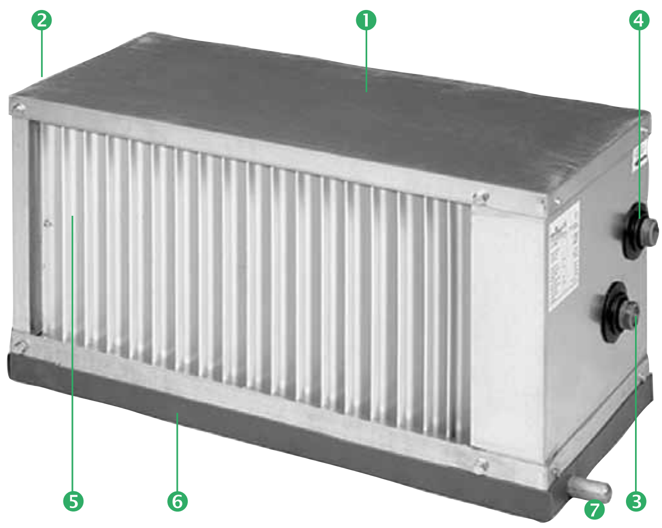
→ The cooler can be situated either in front of or behind the fan.

→ If the cooler is situated behind the fan, we recommend inserting a spacer (e.g. 1-1.5 m long straight duct) between the fan and the cooler 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 ∅ 10 mm.

FIGURE 1 – STANDARD DESIGN OF THE COOLER



❶ External casing, ❷ Cooler, ❸ Coolant inlet (G1"), ❹ Coolant inlet (G1"), 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.

DESIGNATION OF COOLERS

The type designation of coolers in projects and orders is defined by the key in figure # 2.

FIGURE 2 – TYPE DESIGNATION

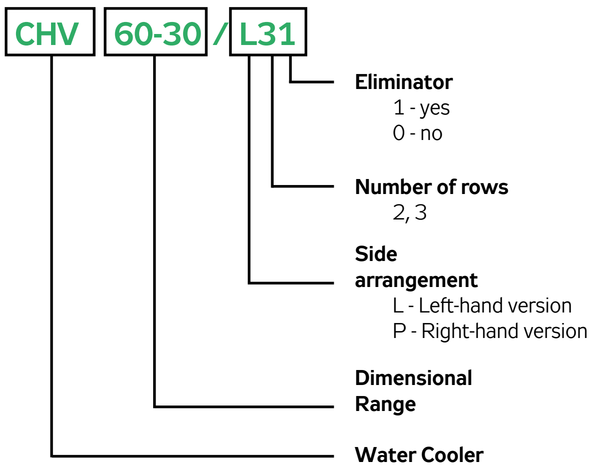
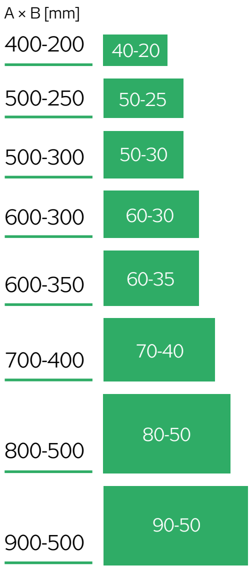


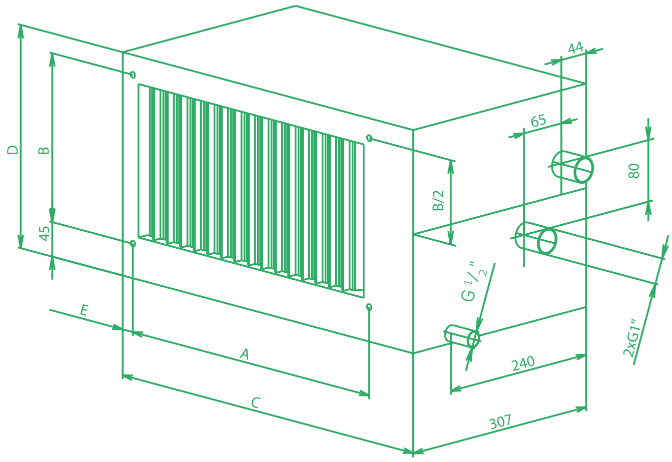
FIGURE 3



DIMENSIONAL RANGE

CHV 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.
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



8 x M8 screws to connect Vento components

TABLE 1 – DIMENSIONS OF WATER COOLERS

Size	A	B	C	D	E
	mm	mm	mm	mm	mm
CHV 40-20	420	220	535	283	20
CHV 50-25	520	270	635	333	20
CHV 50-30	520	320	635	400	20
CHV 60-30	620	320	735	400	20
CHV 60-35	620	370	735	433	20
CHV 70-40	720	420	835	483	20
CHV 80-50	820	520	935	600	20
CHV 90-50	930	530	1057	610	25

ACCESSORIES

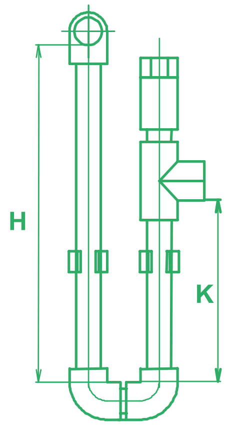
Accessories like the TACO automatic air-venting valve and SUMX mixing set can be delivered as an internal part of the cooler. Accessories are not included in the cooler delivery so must be specified and ordered separately.
Water coolers can be completed with accessories which ensure the following essential 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.

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).
Please pay great attention to the installation and subsequent maintenance of the siphon, in particular it is necessary to check the water level of the siphon and its permeability.

FIGURE 5 – EXAMPLE OF CONDENSATE DRAINAGE SIPHON



H	K	Pa
mm	mm	mm
100	55	600
200	105	1100
300	140	1400

H... Siphon height
K... Siphon drain height
P... Total pressure of the fan

COOLER DIMENSIONING

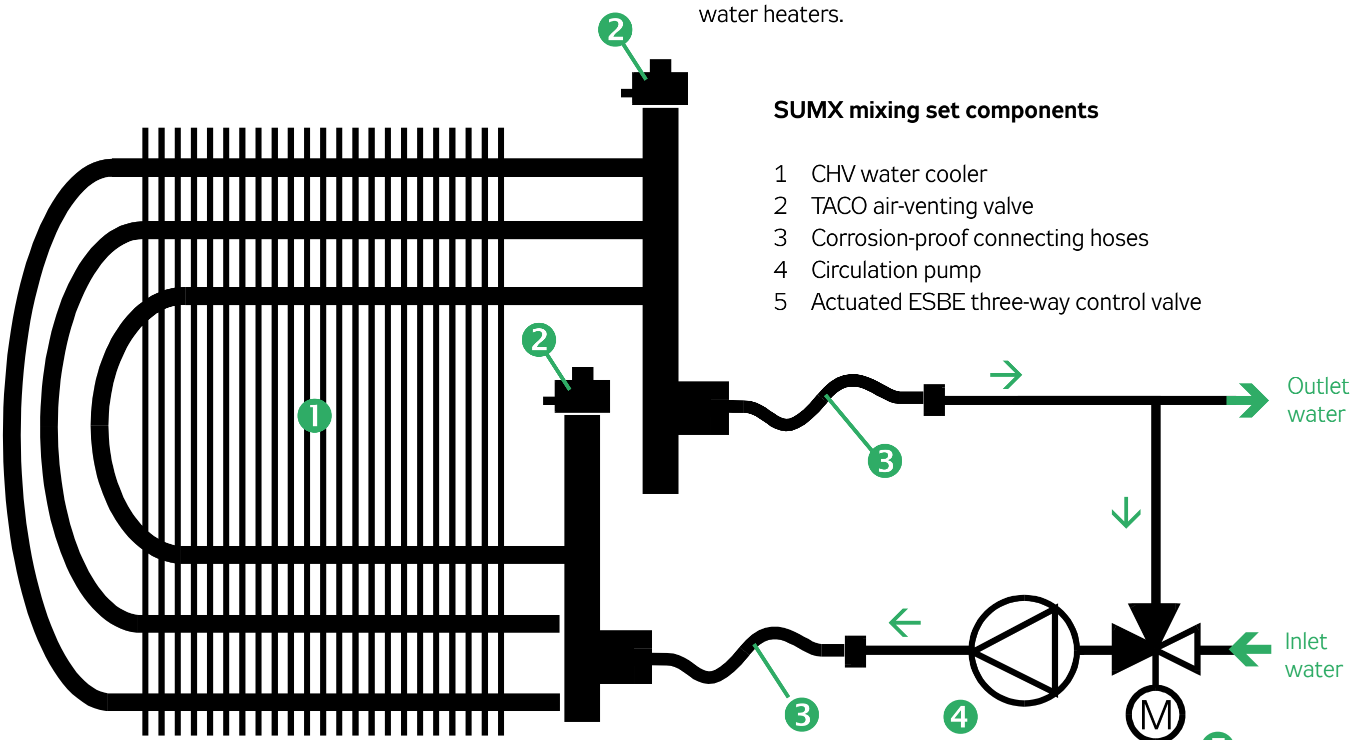
Pro každý chladič je na straně 233–240 uvedena soustava nomogramů termodynamických závislostí. V nomogramech lze z výchozího zadání určit všechny potřebné výsledné parametry chladiče odpovídající zadání. Nomogramy jsou konstruovány pro tířadé chladiče a pro nejčastěji používaný teplotní spád na straně vody: +6 °C/+12 °C. Chladič je konfigurovaný výrobek, který se přednostně navrhuje pomocí výpočtu v AeroCADu na konkrétní pracovní požadavky.

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.

FIGURE 6 - COOLER EQUIPPED WITH A MIXING SET



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 ④, maximum water discharge ⑨ and water pressure loss ⑩ at maximum discharge for the required default parameters ①⑤⑥can 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 183-184.

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 241.

COOLER CONTROL

SUMX mixing sets are designed as compact fixtures. They are dimensioned using the same principles applied when used with VO water heaters.

SUMX mixing set components

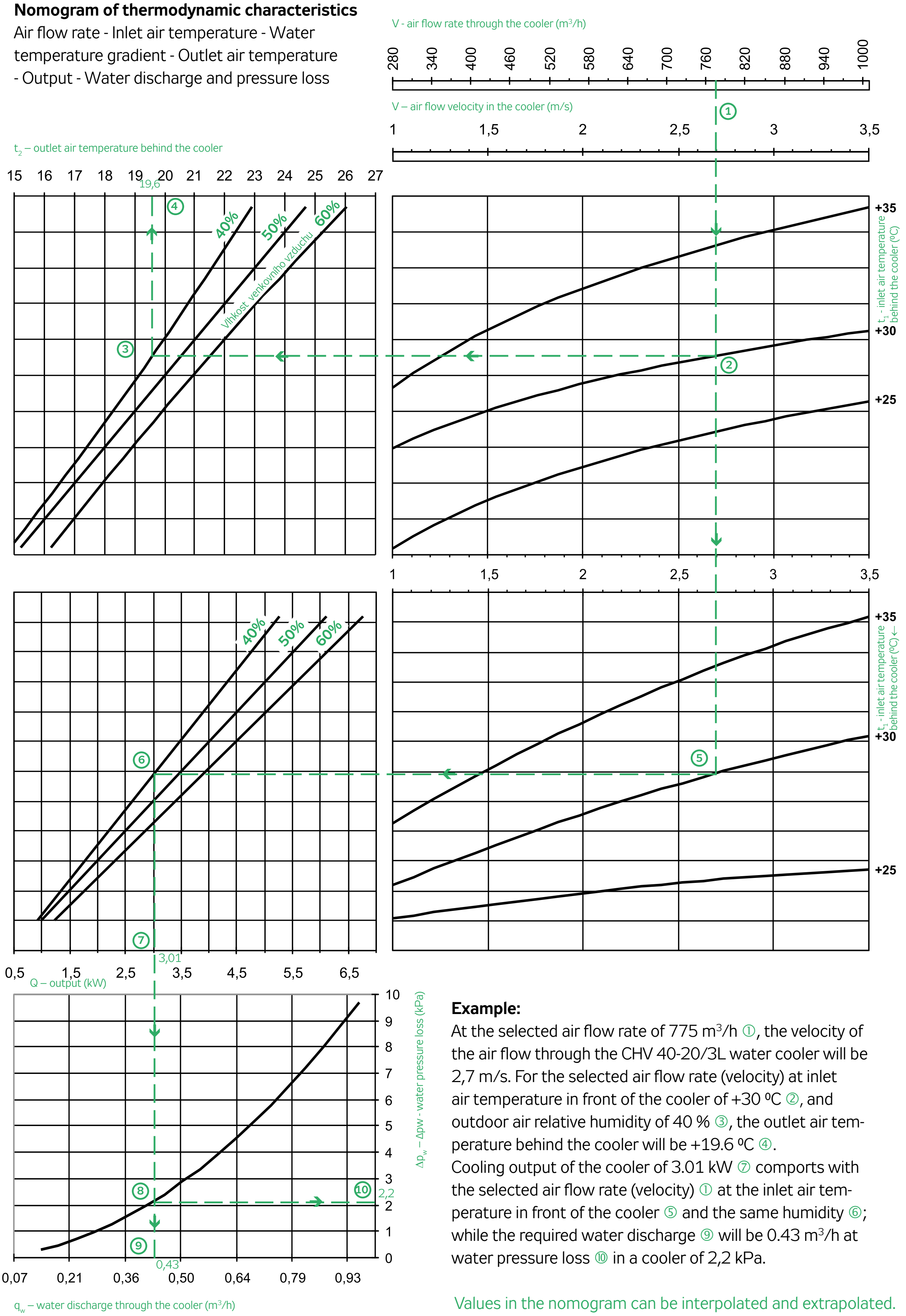
1 CHV water cooler
2 TACO air-venting valve
3 Corrosion-proof connecting hoses
4 Circulation pump
5 Actuated ESBE three-way control valve

[3] The nomograms on pages 191 to 198 can be used to determine the maximum calculated output and water discharge because they are given for the fixed water temperature gradient $\Delta tW = 6$ 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 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 ºC ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +19.6 ºC ④.

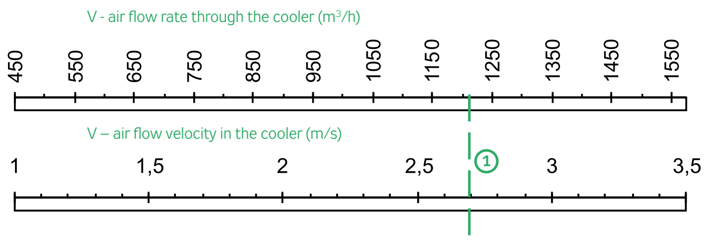
Cooling output of the cooler of 3.01 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 0.43 m³/h at water pressure loss ⑩ in a cooler of 2,2 kPa.

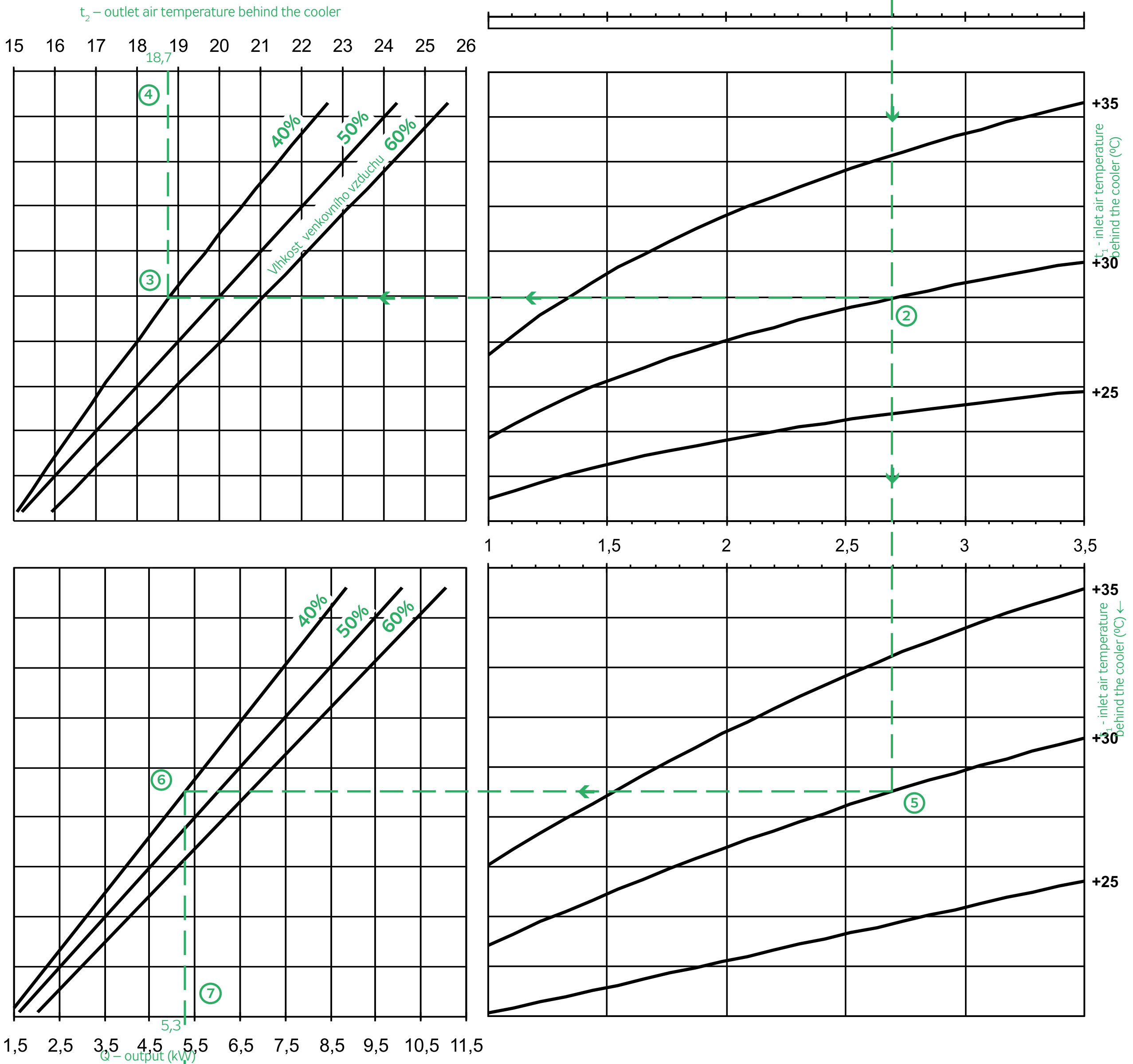
Values in the nomogram can be interpolated and extrapolated.

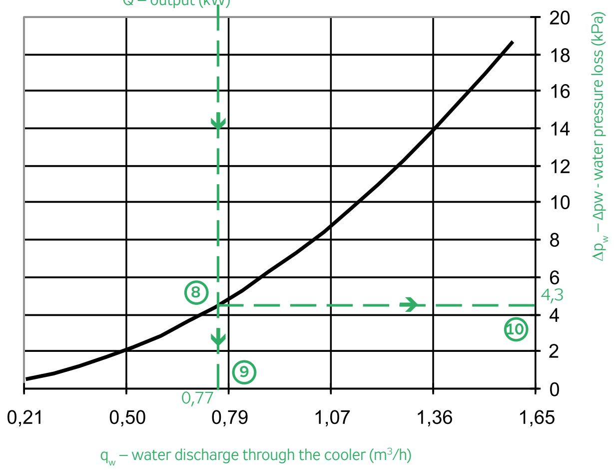
CHV 50-25 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient - Outlet air temperature - Output - Water discharge and pressure loss







Example:

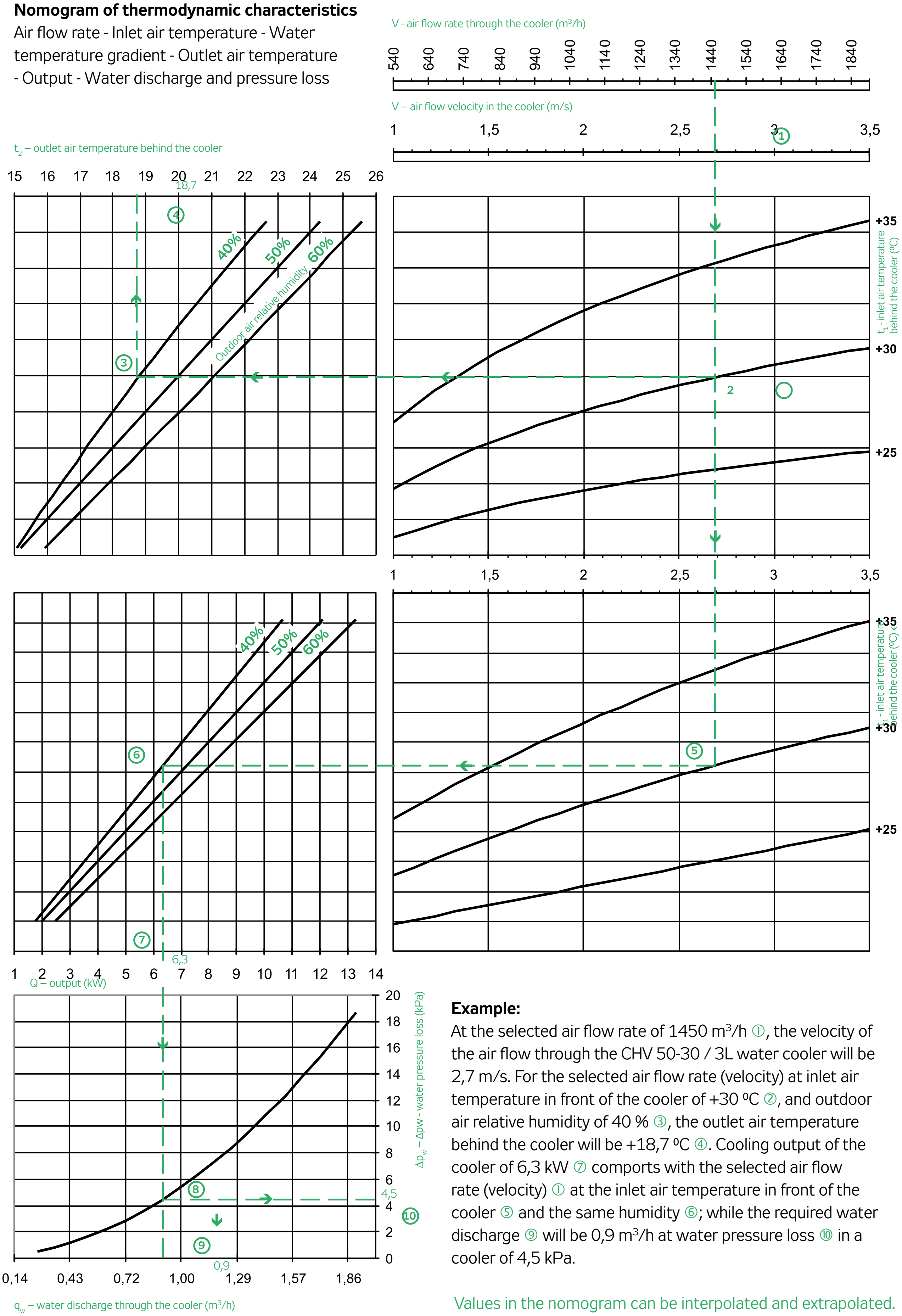
At the selected air flow rate of 1210 m³/h ①, the velocity of the air flow through the CHV 50-25 / 3L water cooler will be 2,7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,7 ºC 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 0,77 m³/h at water pressure loss ⑩ in a cooler of 4,3 kPa.

Values in the nomogram can be interpolated and extrapolated.

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



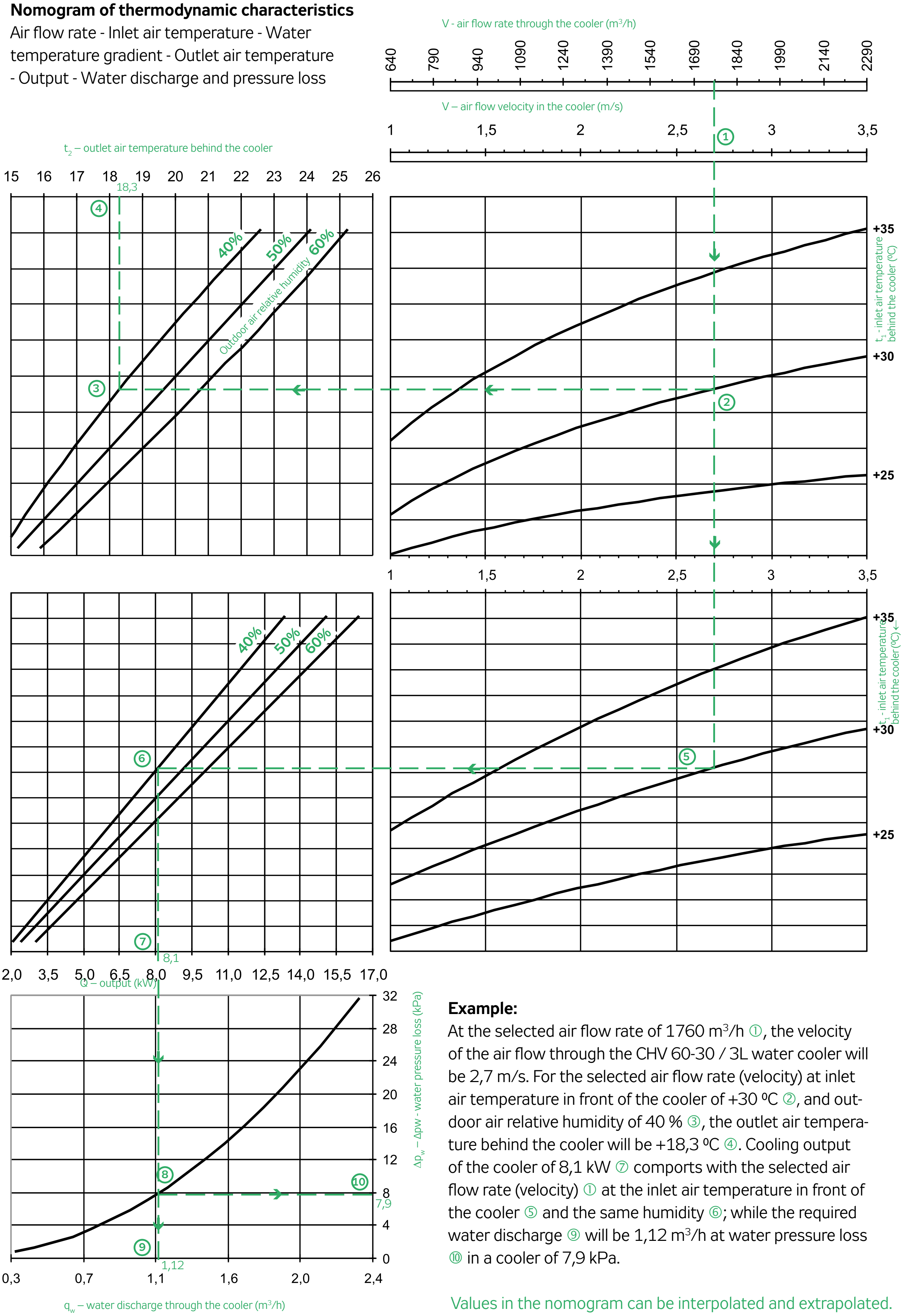
Example:

At the selected air flow rate of 1450 m³/h ①, the velocity of the air flow through the CHV 50-30 / 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 ºC ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,7 ºC 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 cooler of 4,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

CHV 60-30 / 3L

Nomogram of thermodynamic characteristics
Air flow rate - Inlet air temperature - Water temperature gradient - Outlet air temperature - Output - Water discharge and pressure loss



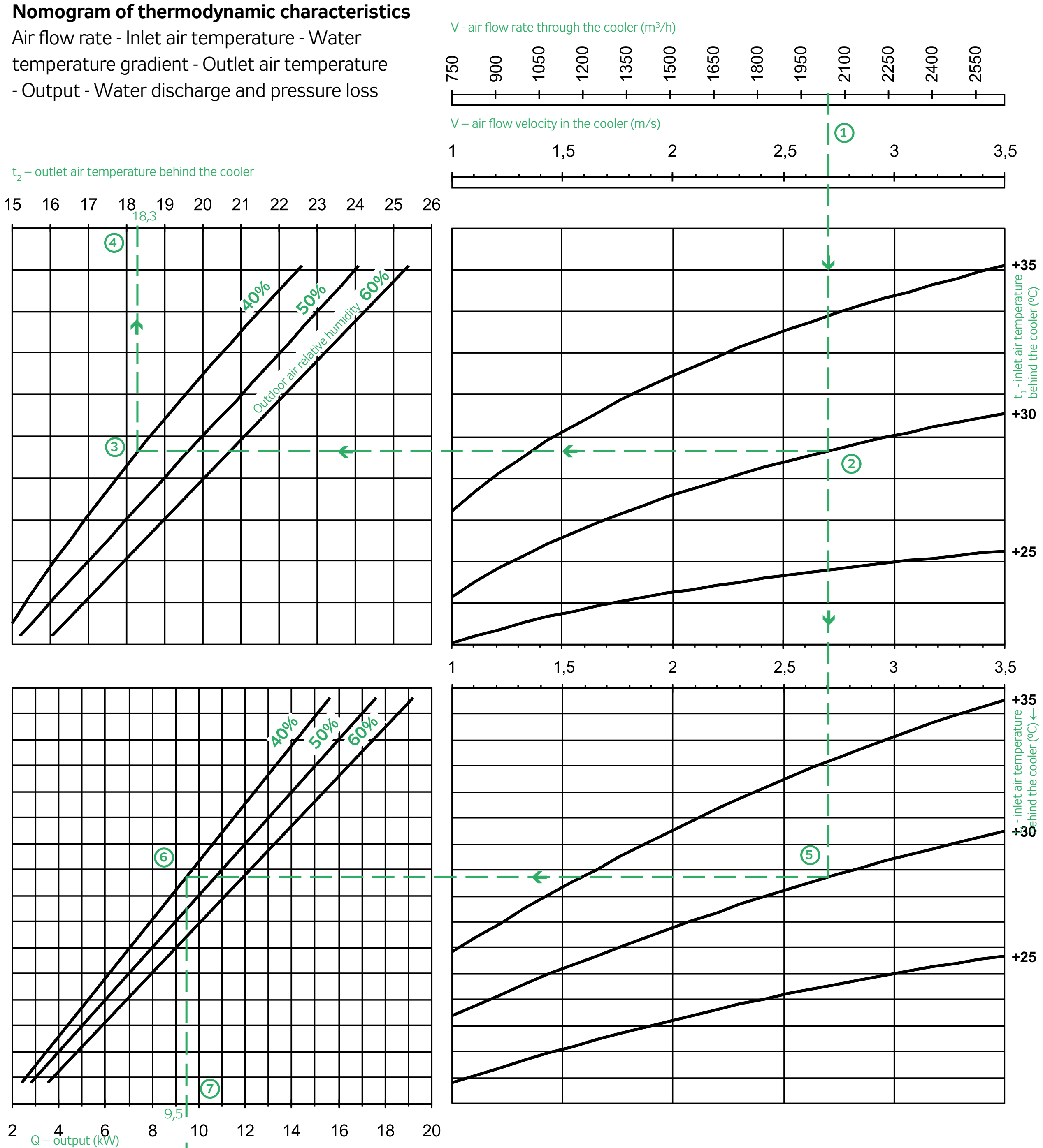
Example:
At the selected air flow rate of 1760 m³/h ①, the velocity of the air flow through the CHV 60-30 / 3L water cooler will be 2,7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,3 ºC 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 cooler of 7,9 kPa.

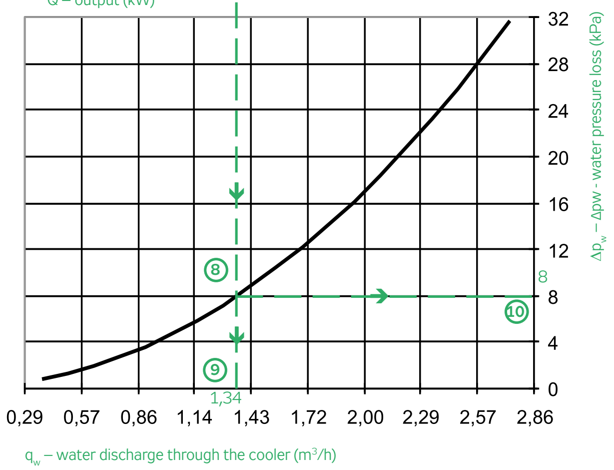
Values in the nomogram can be interpolated and extrapolated.

CHV 60-35 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient - Outlet air temperature - Output - Water discharge and pressure loss





Example:

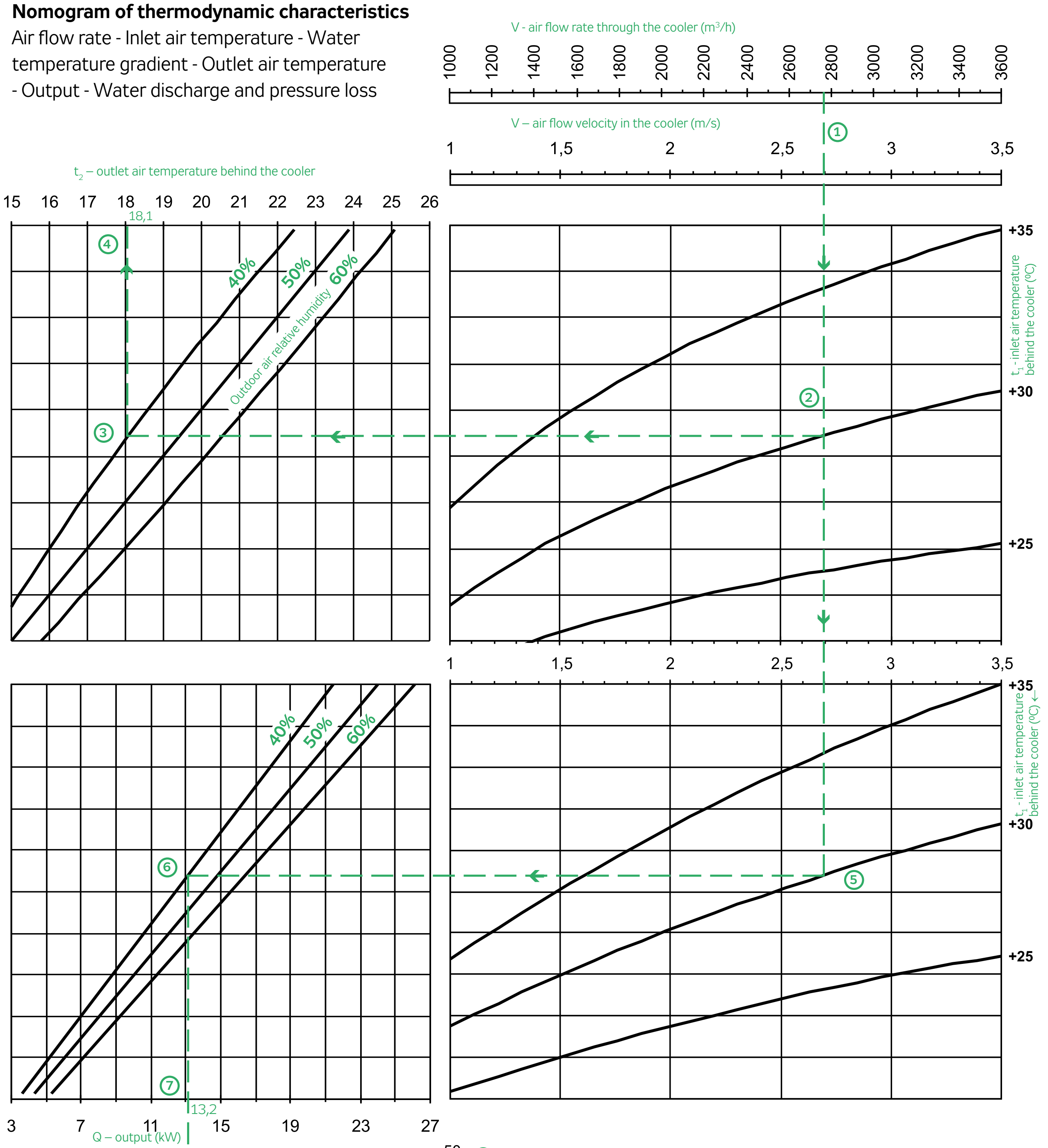
At the selected air flow rate of 2040 m³/h ①, the velocity of the air flow through the CHV 60-35 / 3L water cooler will be 2,7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,3 ºC ④.

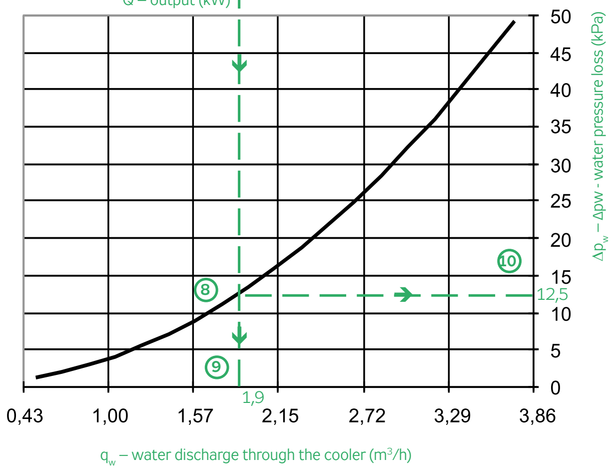
Cooling output of the cooler of 9,5 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 1,34 m³/h at water pressure loss ⑩ in a cooler of 8 kPa.

Values in the nomogram can be interpolated and extrapolated.

CHV 70-40 / 3L

Nomogram of thermodynamic characteristics
Air flow rate - Inlet air temperature - Water temperature gradient - Outlet air temperature - Output - Water discharge and pressure loss





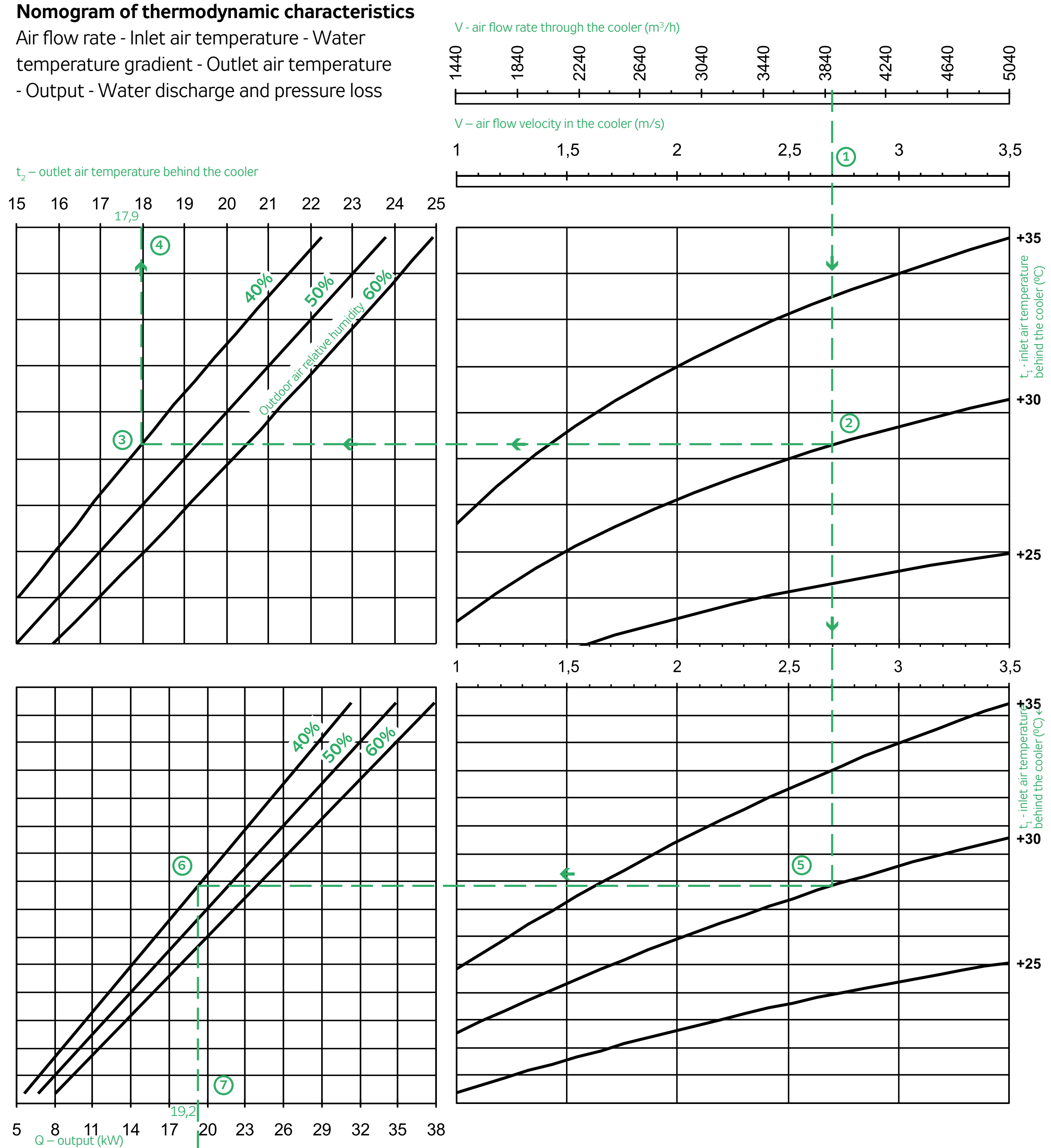
Example:
At the selected air flow rate of 2760 m³/h ①, the velocity of the air flow through the CHV 70-40 / 3L water cooler will be 2,7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +19.6 ºC 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 cooler of 12,5 kPa.

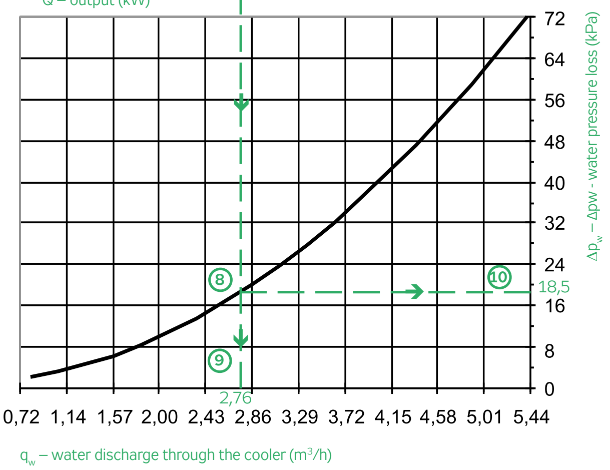
Values in the nomogram can be interpolated and extrapolated.

CHV 80-50 / 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 3880 m³/h ①, the velocity of the air flow through the CHV 80-50 / 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 ºC ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +17,9 ºC ④.

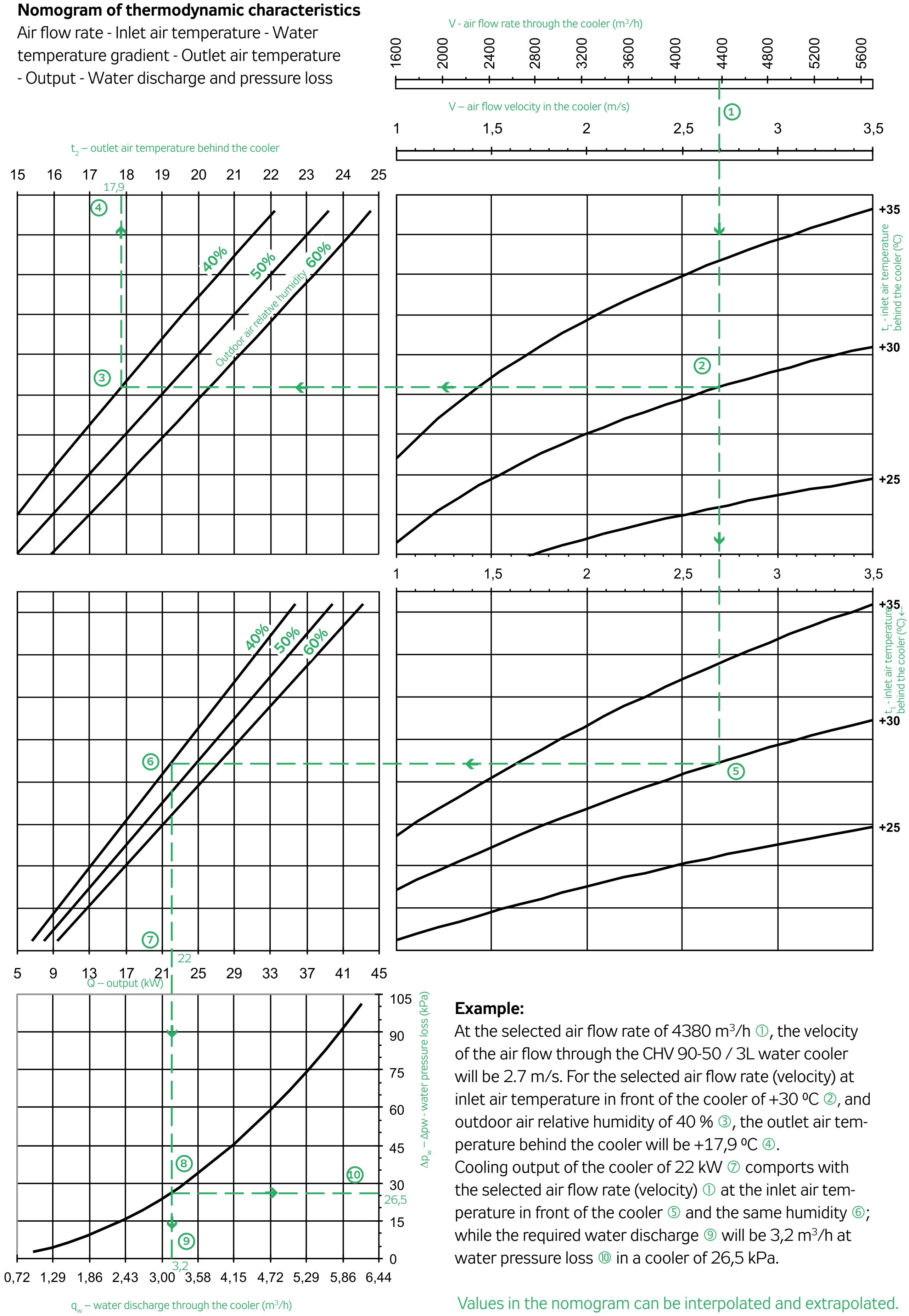
Cooling output of the cooler of 19,2 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 2,76 m³/h at water pressure loss ⑩ in a cooler of 18,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

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:

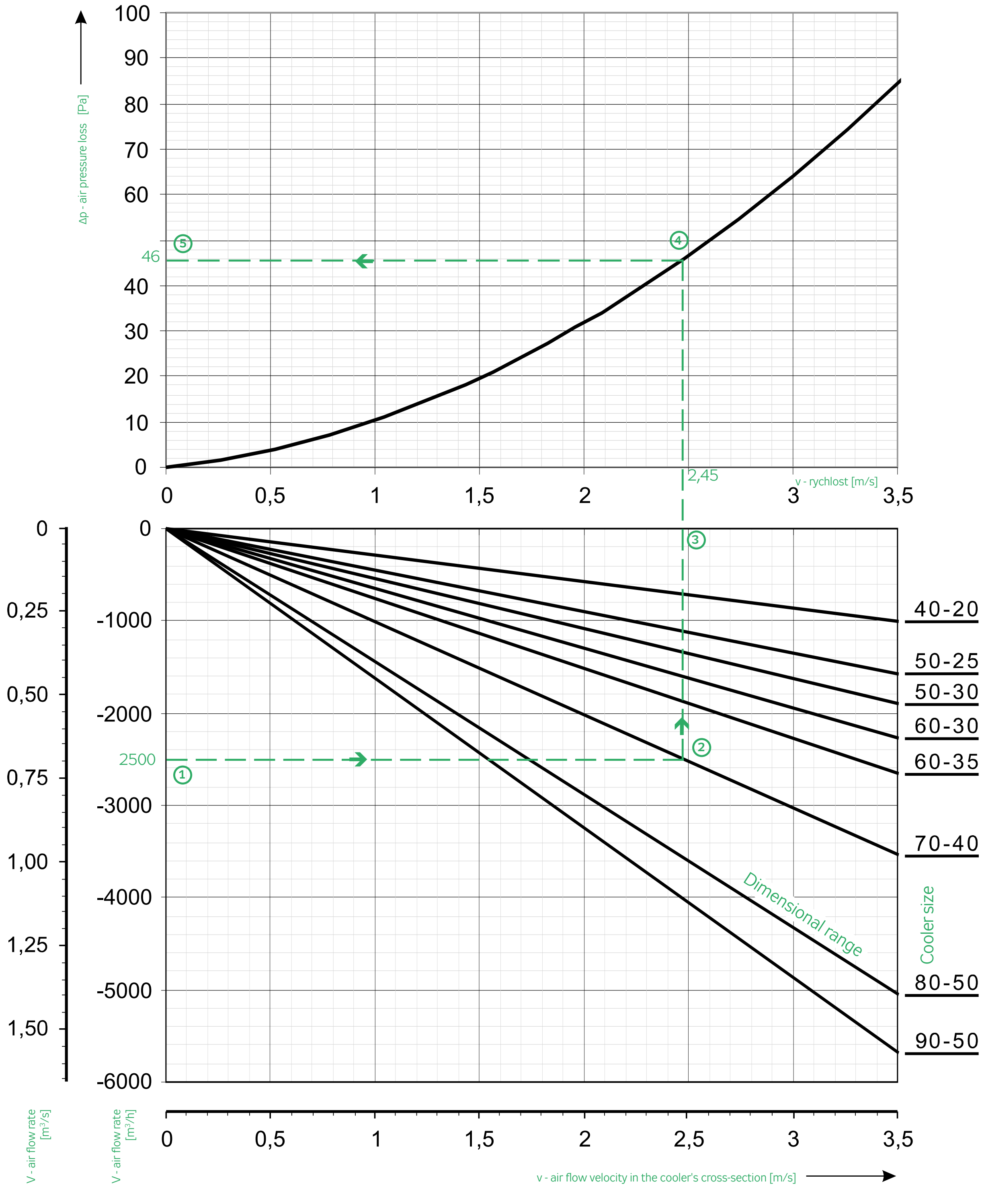
At the selected air flow rate of 4380 m³/h ①, the velocity of the air flow through the CHV 90-50 / 3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +17,9 ºC 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 cooler of 26,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

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.



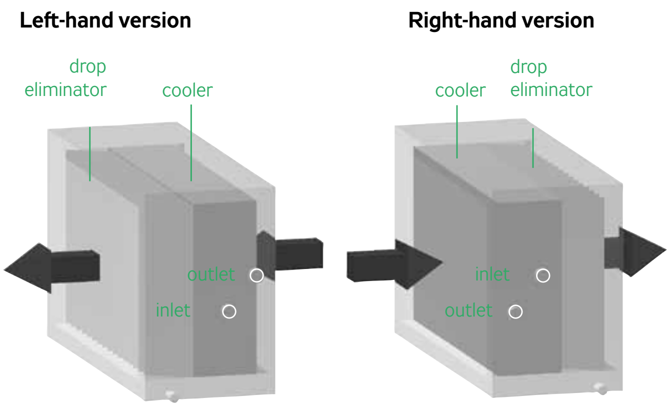
The nomogram of pressure losses is valid for all CHV water coolers. For the selected air flow rate ①, the air flow velocity ③ in the free cooler's cross-section ②, can be read in the lower graph, and then the corresponding cooler's air pressure loss ⑤ at the known velocity can be determined in the upper part ④.

Example:
At an air flow rate of 2,500 m^3/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

- 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.
- 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.
- 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.
- Water coolers can work only in the horizontal position, in which condensate draining and air venting of the cooler are possible.
- **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.
- For maximum performance, the cooler must be connected as countercurrent. With this in mind and the service approach in relation to the air flow, it is necessary to choose the correct side design of the cooler (Figure 7).
- All calculations and nomograms apply to countercurrent 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



Mixing Sets

Installation instructions included in the section "Mixing Sets" (except the anti-freeze correlations) are fully valid for installation of the mixing sets with CHV coolers.

OPERATION, MAINTENANCE AND SERVICE

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.
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.
When activating the air-handling system, you could face some undesirable situations. In this case, it must be identified and removed cause according to the procedure given in the Installation and Operating Instructions in the Mixing Units section, section "Outline of possible faults" (with application to cooling).

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). However, the legislative requirements for the use of coolants must always be taken into account.

POSITION AND LOCATION

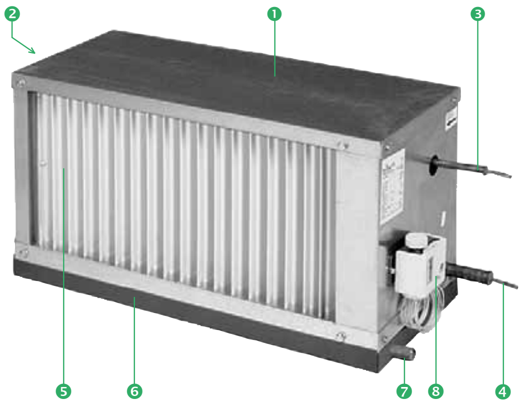
When projecting the layout of the direct cooler location in the air-handling system, we recommend observing the following principles:

- 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..
CHF direct coolers are supplied with prepared mounting threads for the capillary sensor of frost protection (on the side of the refrigerant inlets, see Fig. 1), which is ordered as a separate accessory.

FIGURE 1 - 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 # 2..

FIGURE 2 - TYPE DESIGNATION

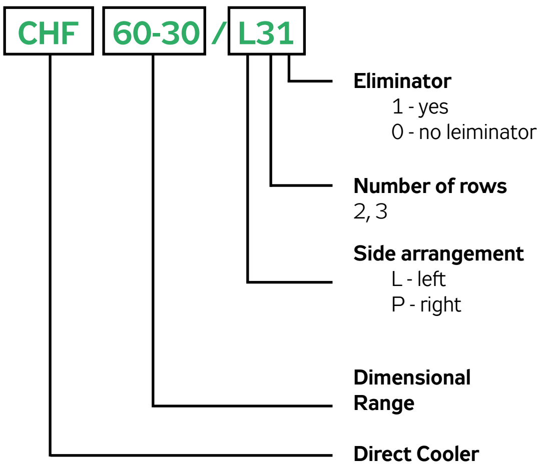
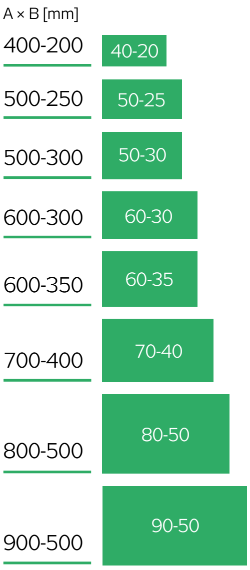


FIGURE 3



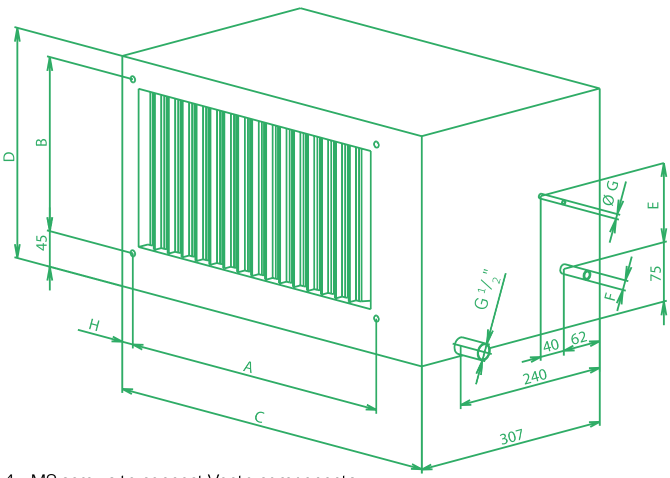
DIMENSIONAL RANGE

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.

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.

The cooler is a configured product which should be preferably ordered using AeroCAD software, which will generate its ordering code.
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 4 - DIMENSIONS OF CHF DIRECT COOLERS



4 x M8 screws to connect Vento components

TABLE 1 - DIMENSIONS OF CHF DIRECT COOLERS

Size and dimensions	A	B	C	D	E	F	G	H
	mm	mm	mm	mm	mm	mm	mm	mm
CHF 40-20	420	220	508	281	100	16	12	23
CHF 50-25	520	270	608	331	150	16	12	23
CHF 50-30	520	320	608	381	150	16	12	23
CHF 60-30	620	320	708	381	200	22	12	23
CHF 60-35	620	370	708	431	200	22	12	23
CHF 70-40	720	420	808	481	200	28	16	23
CHF 80-50	820	520	908	581	250	28	16	23
CHF 90-50	930	530	1014	610	250	28	16	28

ACCESSORIES

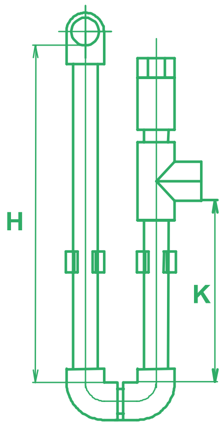
Accessories are not part of the heatsink, so they must be prescribed and ordered separately. Direct coolers can be supplemented with accessories that provide the following necessary functions:

- **Anti-freeze protection**
  Capillary sensor CAP 3m
- **Condensate drain (siphon)**
  The cooler must always be equipped with a condensate drain. Without this siphon, condensate drainage from the sump is not ensured.

The condensate drain

A condensate collection tank is installed in the cooler, terminated by a spout for connecting a condensate drainage set. Condensate drain kits are only available as separately ordered accessories. The height of the siphon depends on the total fan pressure and ensures its proper function. The siphon must be designed according to the fan pressure, see figure 5.
Please pay great attention to the installation and subsequent maintenance of the siphon, in particular it is necessary to check the water level of the siphon and its permeability.

FIGURE 5 - EXAMPLE OF CONDENSATE DRAINAGE SIPHON



H	K	Pa
mm	mm	mm
100	55	600
200	105	1100
300	140	1400

H... Siphon height
K... Siphon drain height
P... Total pressure of the fan

DIRECT COOLER DIMENSIONING

For nomograms showing the thermodynamic correlation for each direct cooler, refer to pages 204-211. 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

Attention: If another coolant is used, it is necessary to calculate the coolerparameters using the AeroCAD program.

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. (1
- 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 249-56.
- The air pressure loss for all coolers can be determined from the nomogram on page 257. 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.

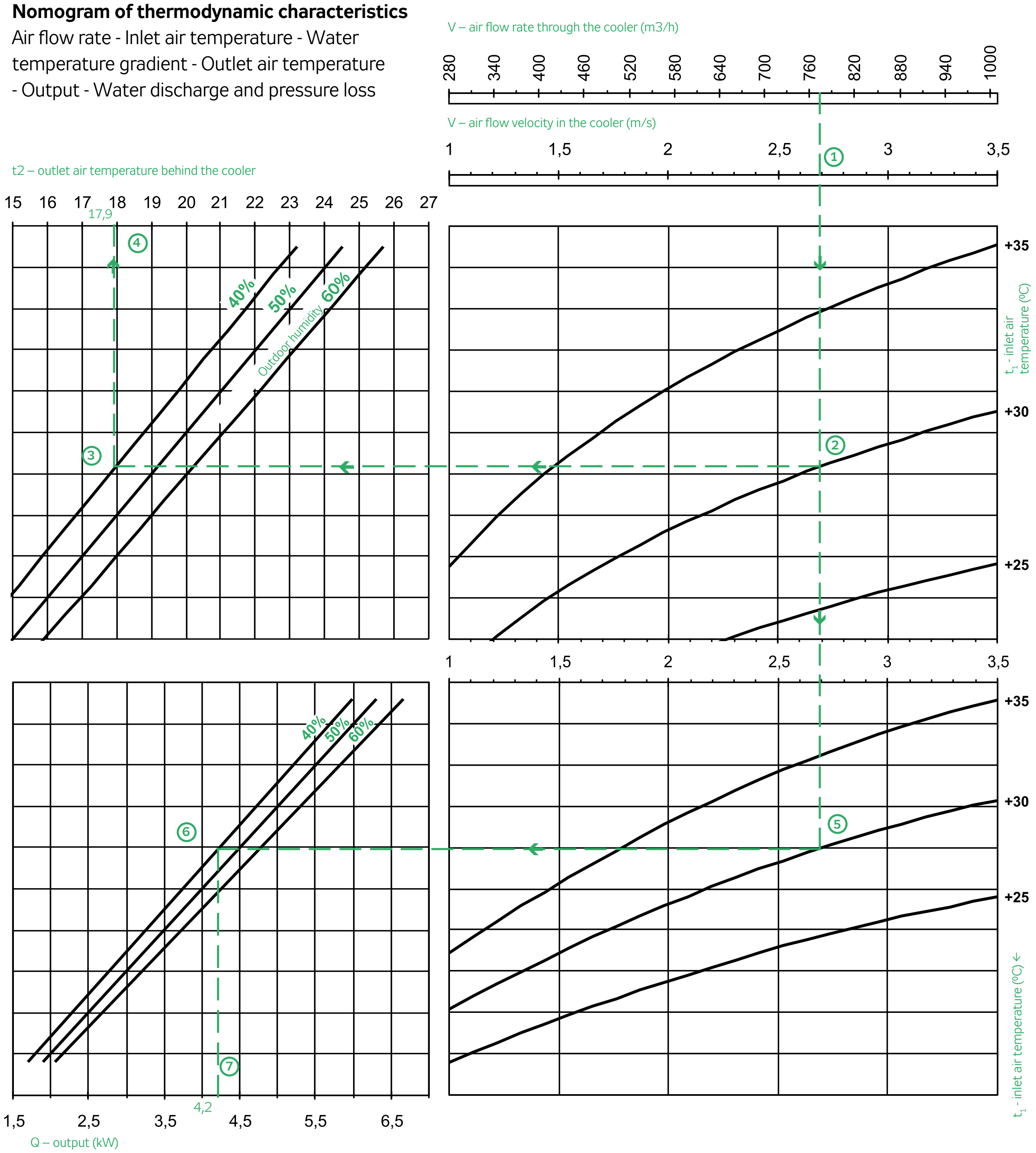
INSTALLATION, SERVICE AND MAINTENANCE

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.
- Coolers must only be installed in a horizontal position that allows condensate to be collected and drained.
- Coolants for direct coolers are regulated substances and legislative regulations must be observed when installing and using the device and professional procedures and inspections and service must be performed by an authorized person.

1) If 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

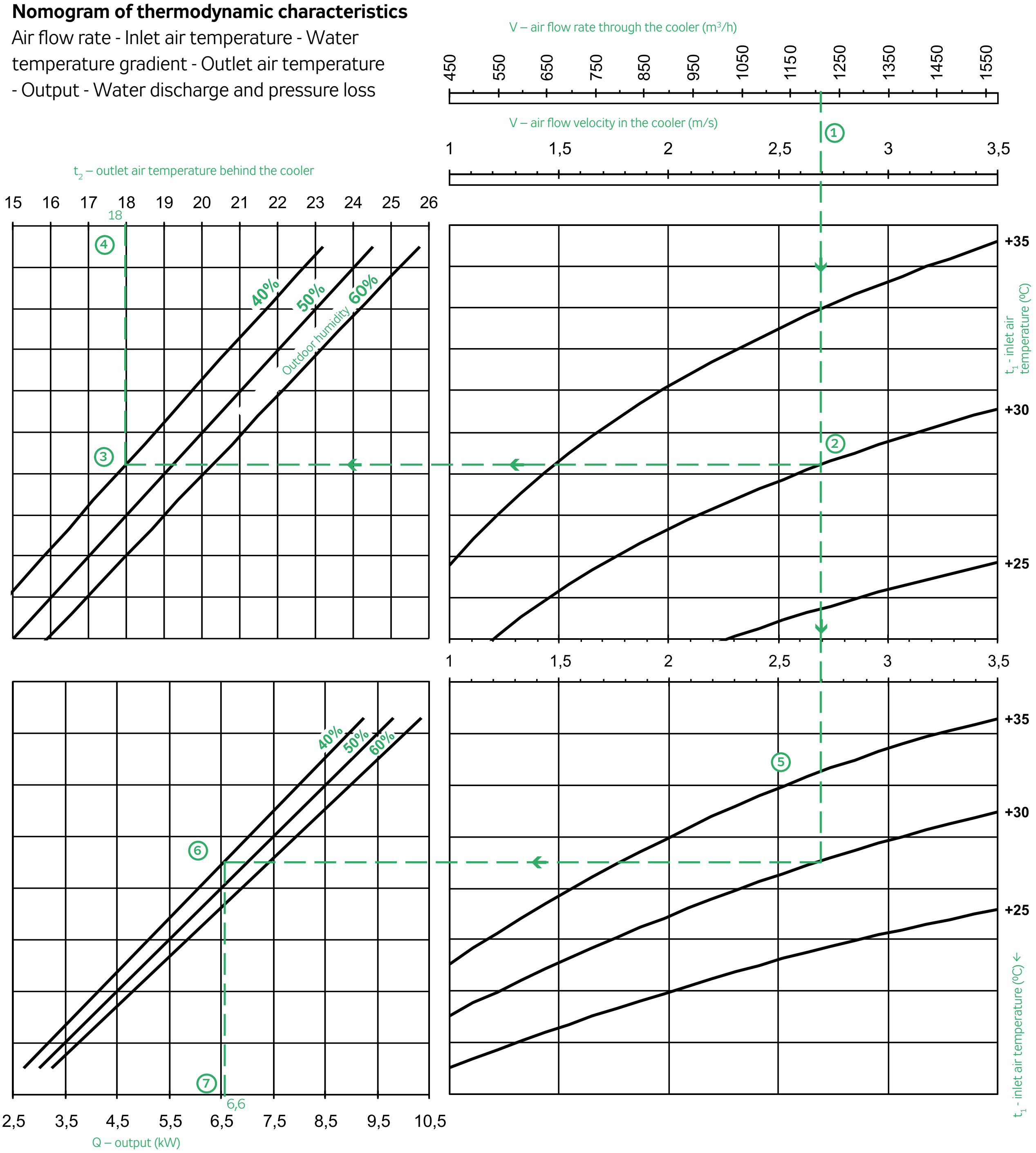


Example:
At the selected air flow rate of 775 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 ºC 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

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

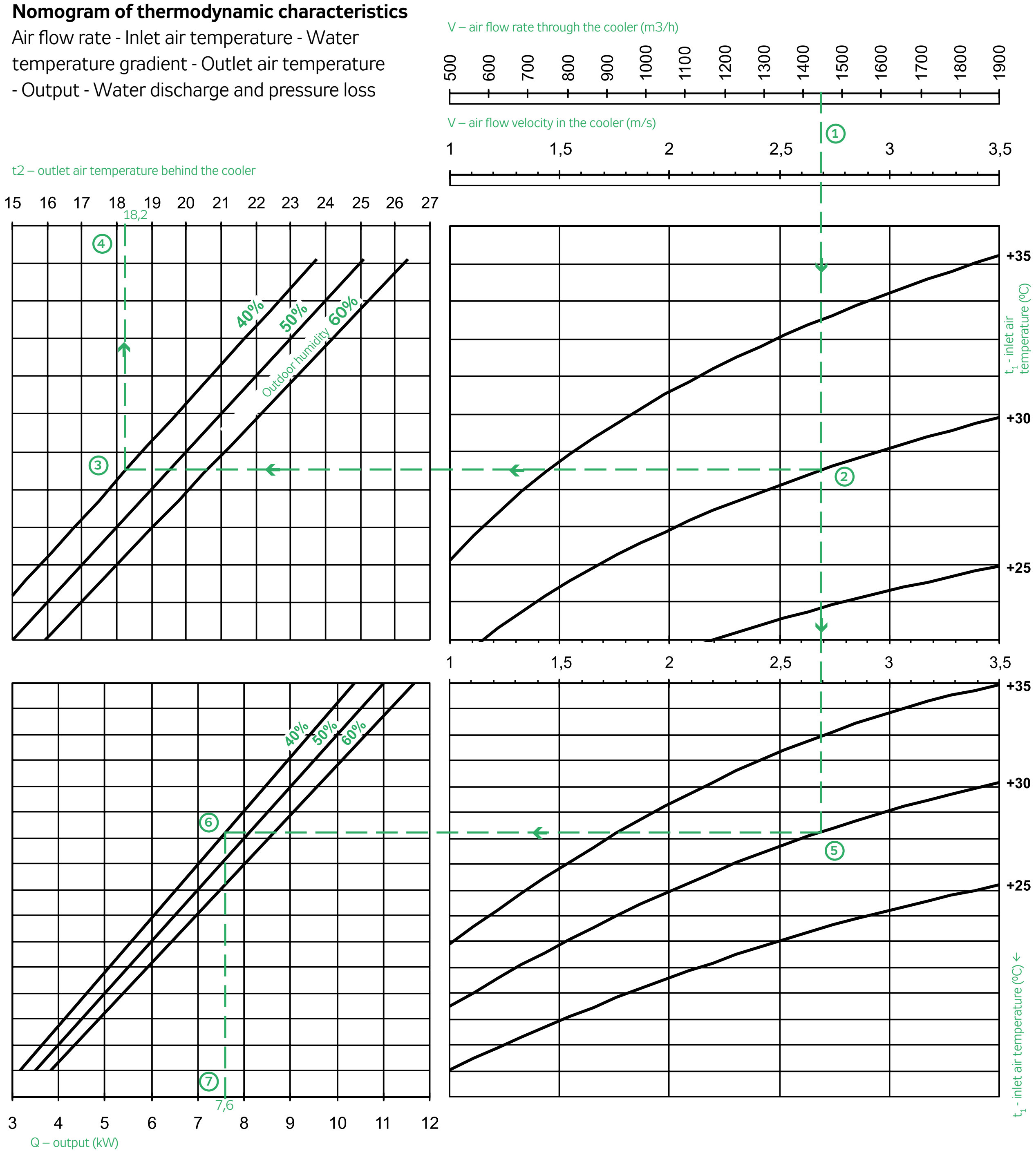


Example:
At the selected air flow rate of 1210 m³/h ①, the velocity of the air flow through the CHF 50-25 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +18 ºC 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

CHF 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



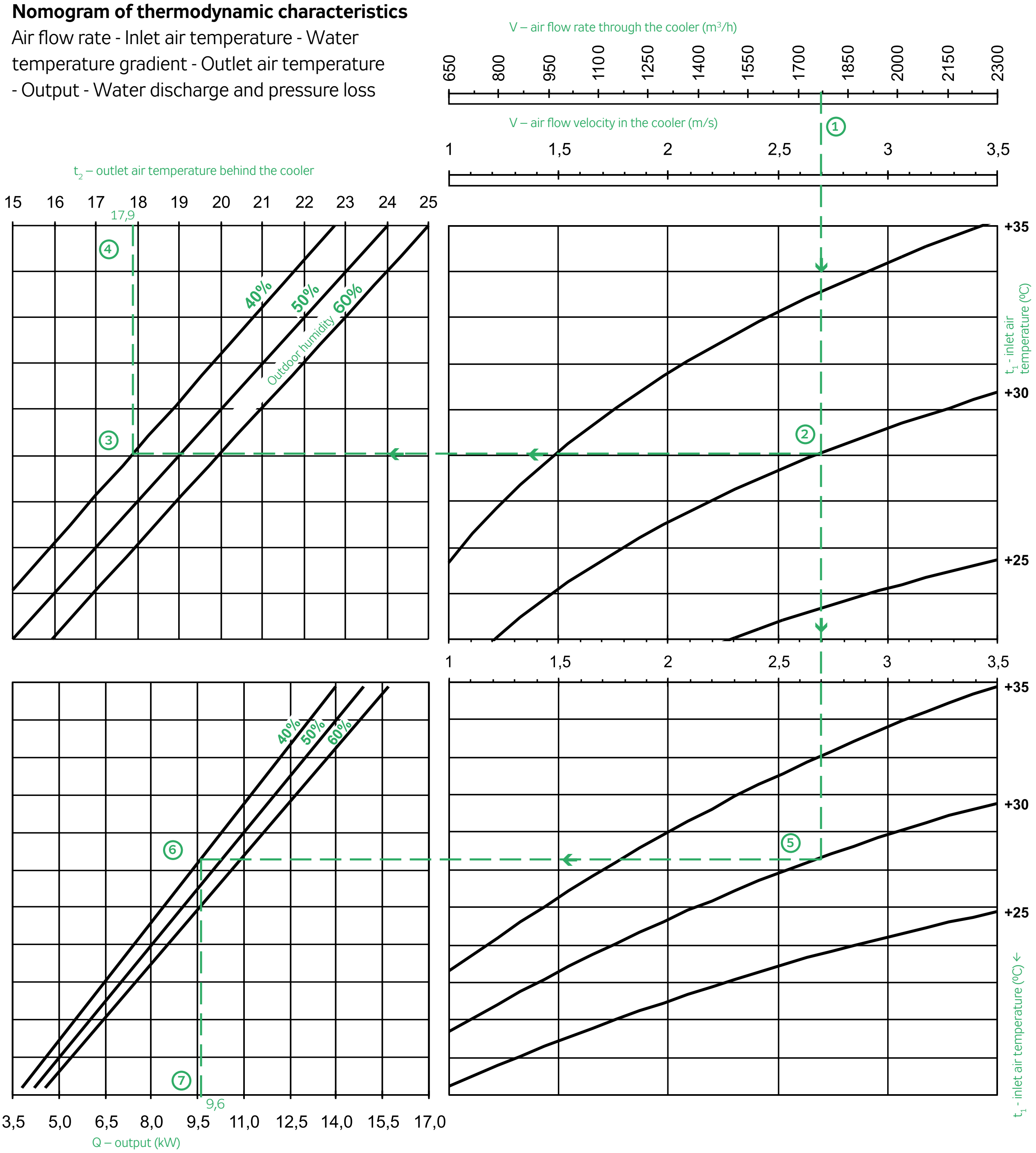
Example:
At the selected air flow rate of 1450 m³/h ①, the velocity of the air flow through the CHF 50-30 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +18,2 ºC 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

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

CHF 60-30 / 3L

Nomogram of thermodynamic characteristics
Air flow rate - Inlet air temperature - Water temperature gradient - Outlet air temperature - Output - Water discharge and pressure loss



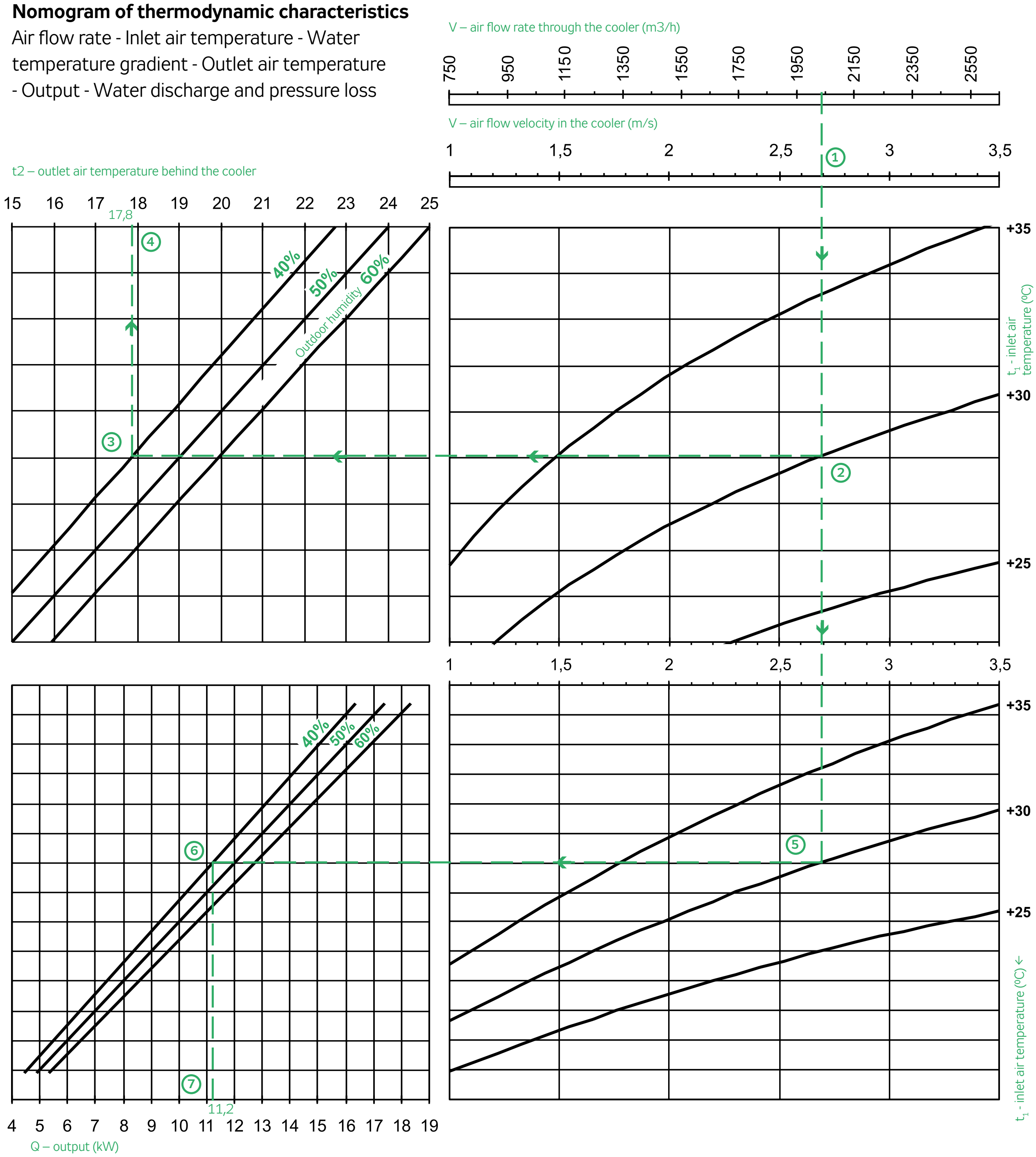
Example:
At the selected air flow rate of 1760 m³/h ①, the velocity of the air flow through the CHF 60-30 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 ºC 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

CHF 60-35 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient - Outlet air temperature - Output - Water discharge and pressure loss



Example:

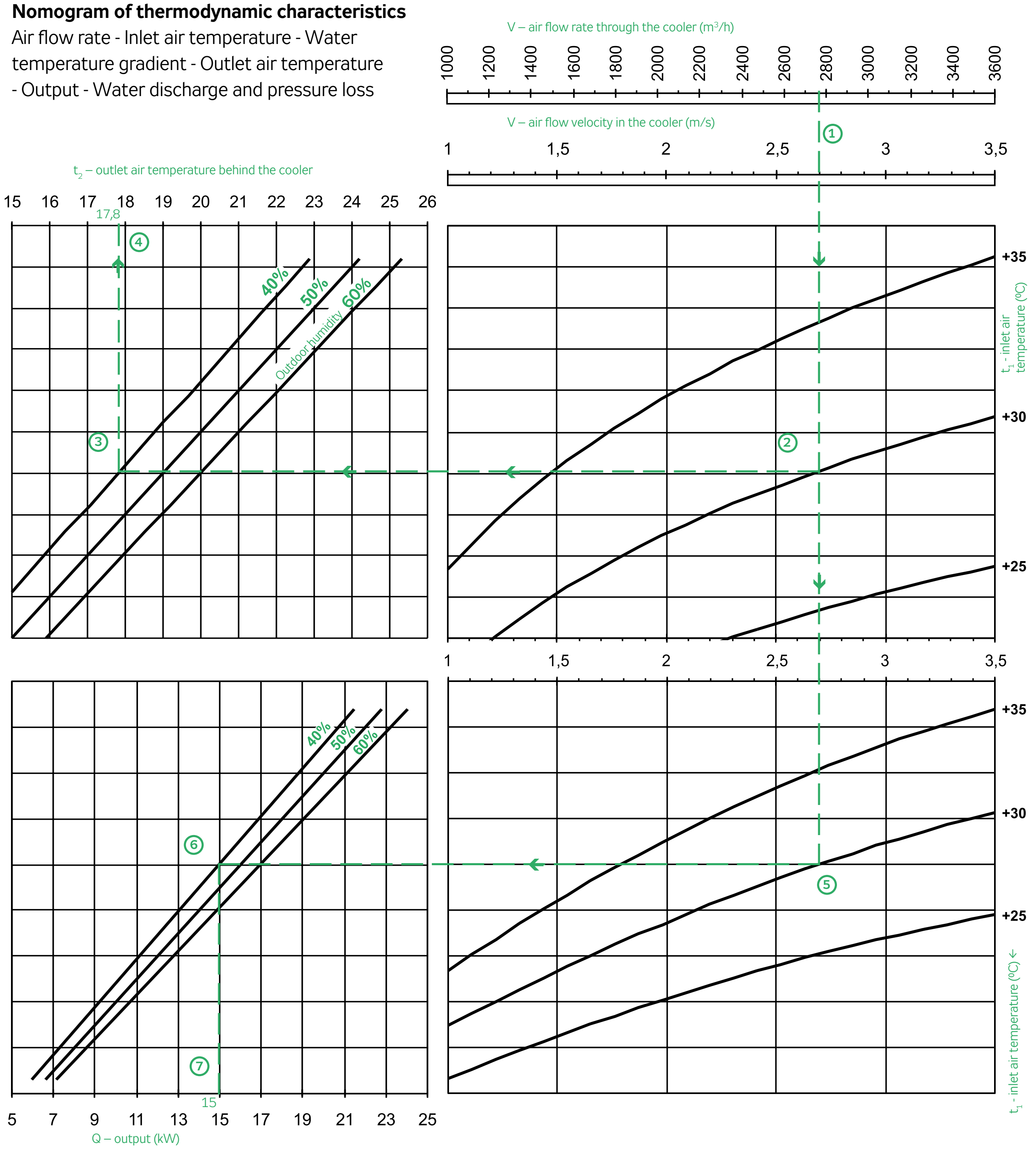
At the selected air flow rate of 2040 m³/h ①, the velocity of the air flow through the CHF 60-35 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind 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

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

CHF 70-40 / 3L

Nomogram of thermodynamic characteristics
Air flow rate - Inlet air temperature - Water temperature gradient - Outlet air temperature - Output - Water discharge and pressure loss



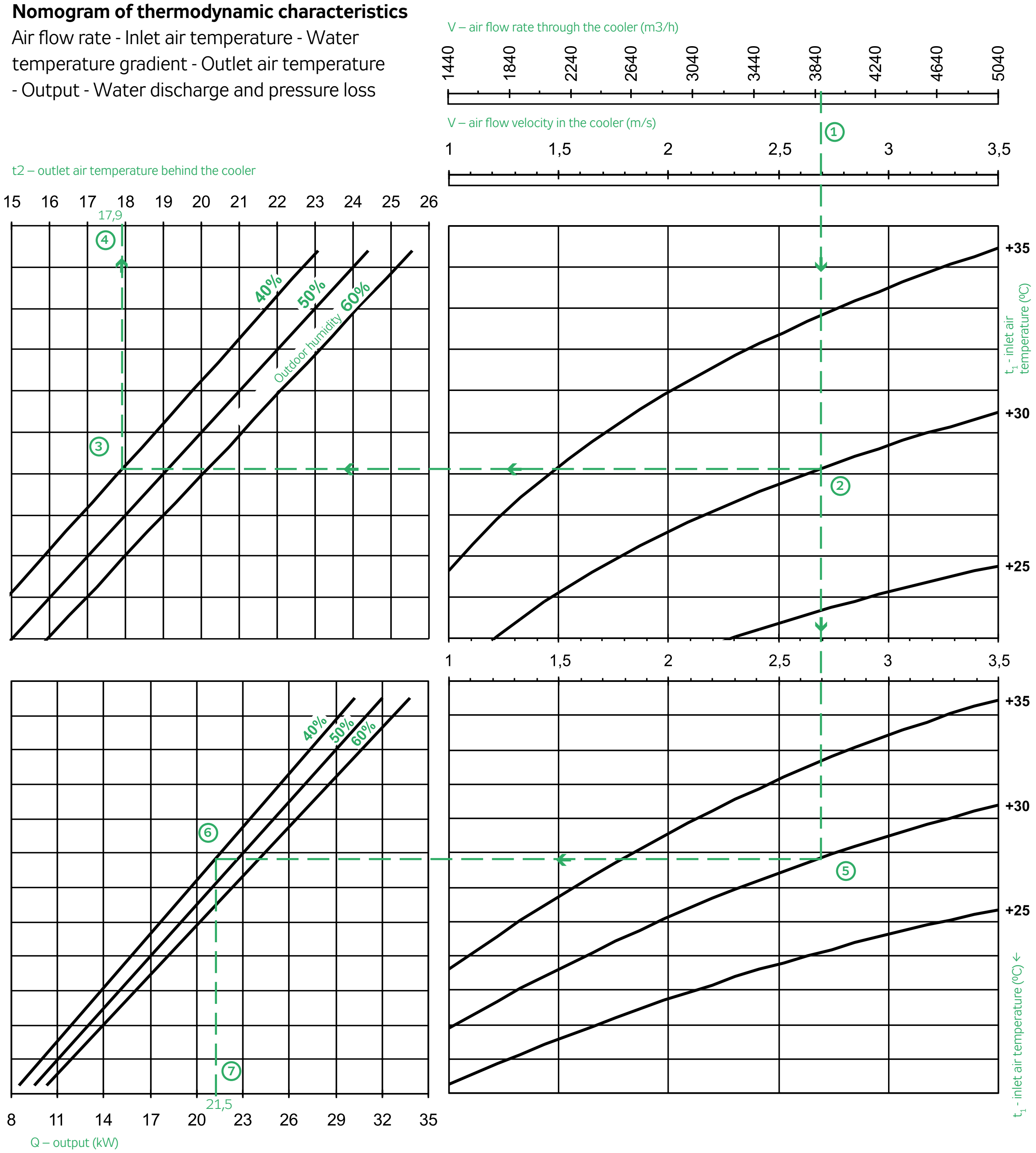
Example:
At the selected air flow rate of 2760 m³/h ①, the velocity of the air flow through the CHF 70-40 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17,8 ºC 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

CHF 80-50 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient - Outlet air temperature - Output - Water discharge and pressure loss



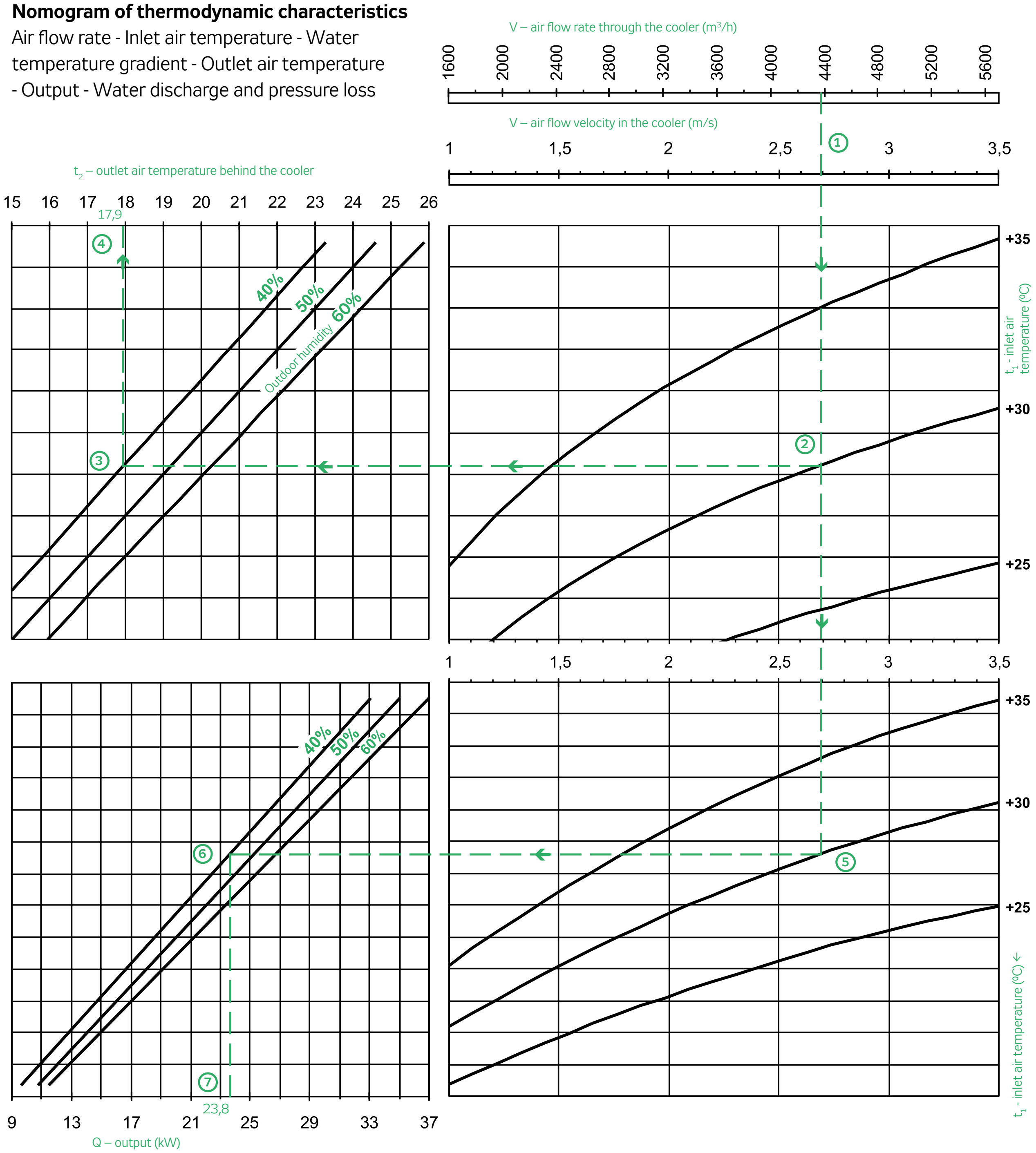
Example:

At the selected air flow rate of 3880 m³/h ①, the velocity of the air flow through the CHF 80-50 / 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 ºC ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 ºC 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

CHF 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

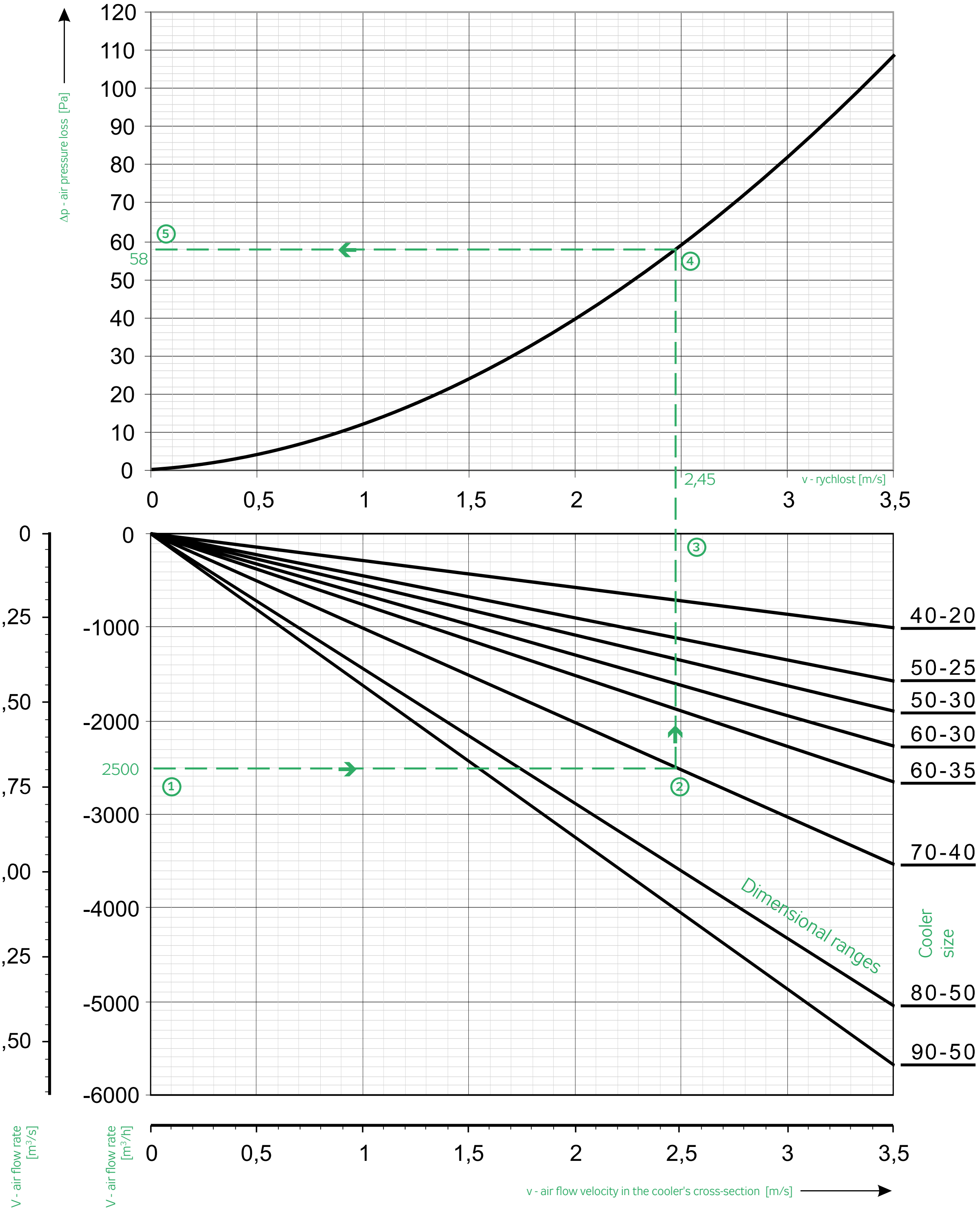


Example:
At the selected air flow rate of 4380 m³/h ①, the velocity of the air flow through the CHF 90-50 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 ºC ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 ºC 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 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 m^3/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.

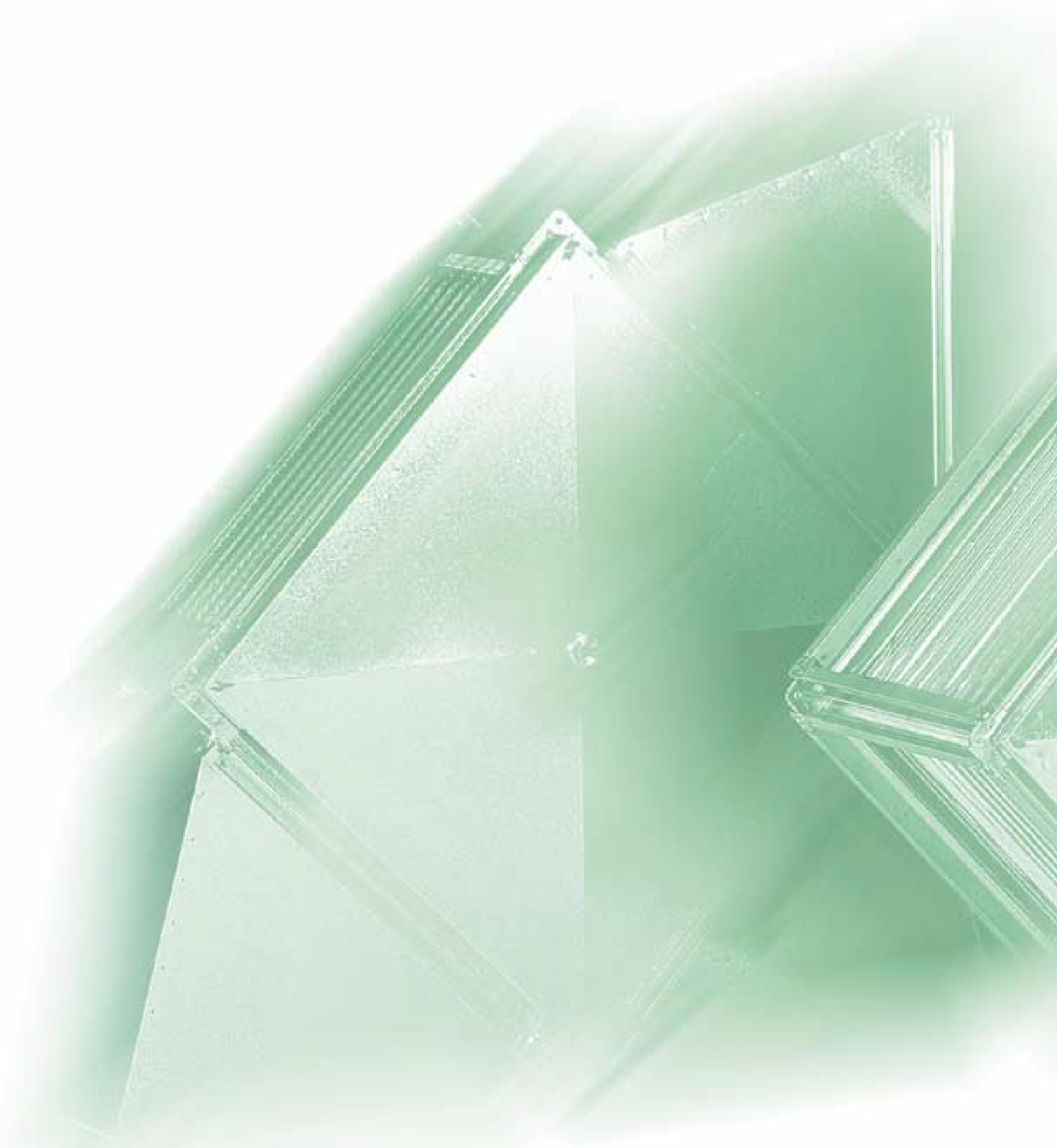


Plate Heat Exchangers

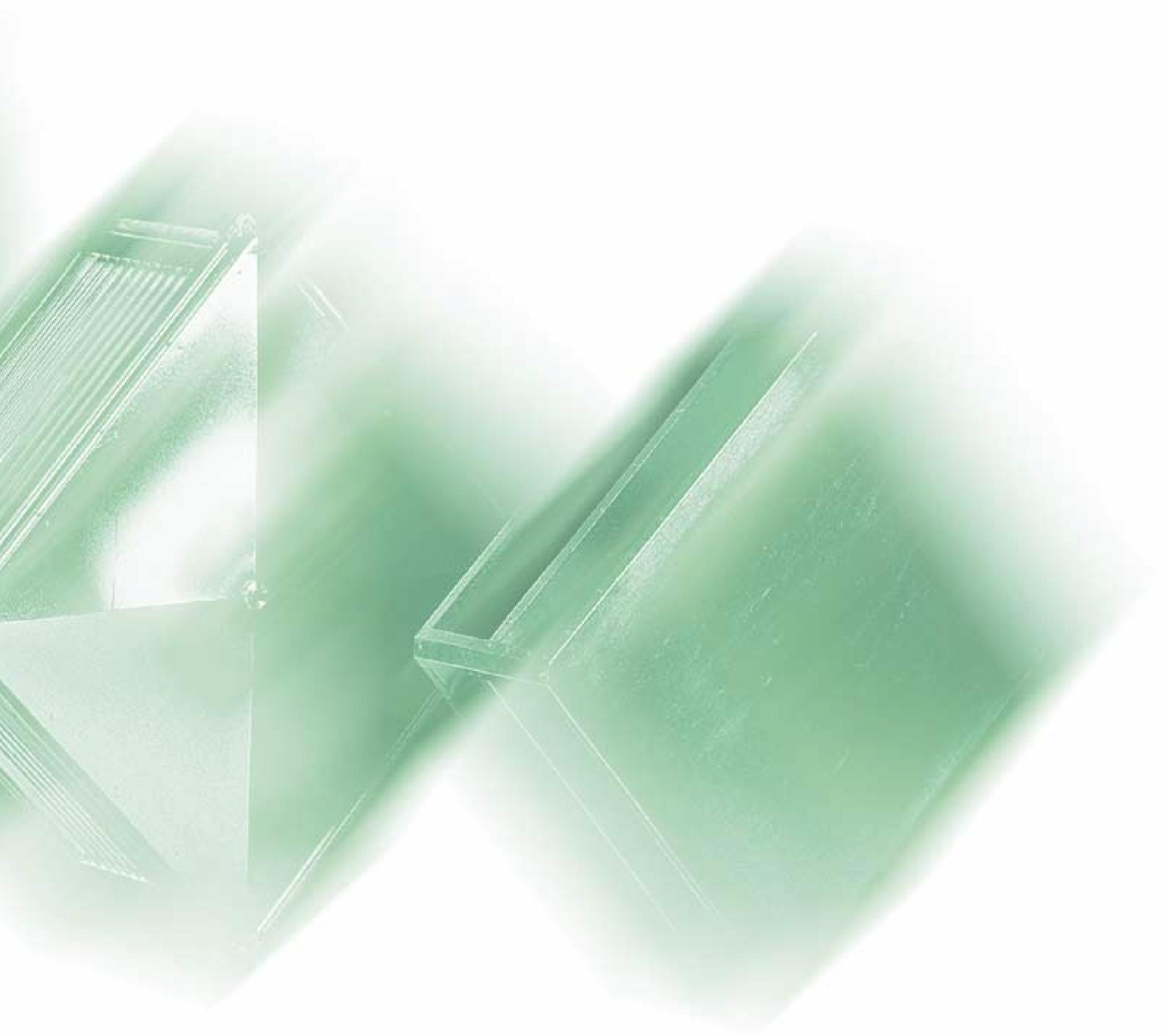
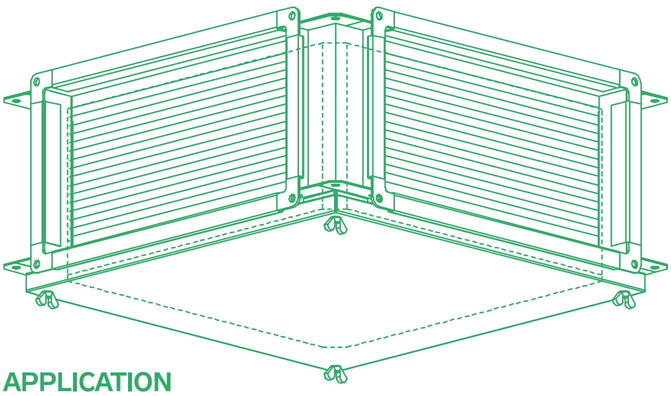


FIGURE 1 - CROSS-AIRFLOW HEAT EXCHANGER, NO BY-PASS



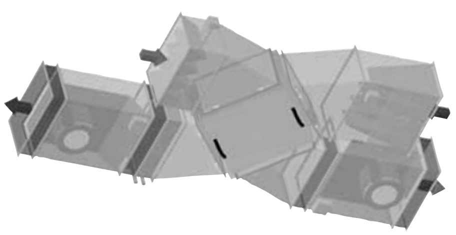
APPLICATION

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 45º 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

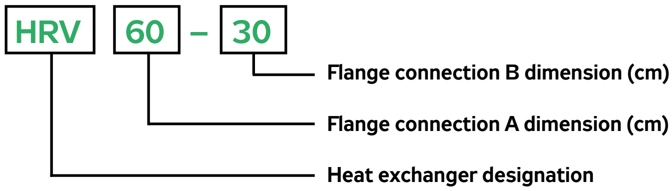


FIGURE 4 - IMPORTANT DIMENSIONS OF HEAT EXCHANGERS

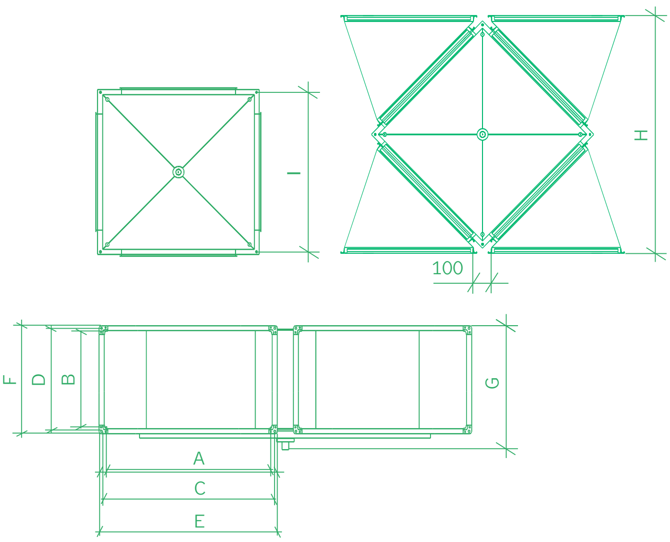
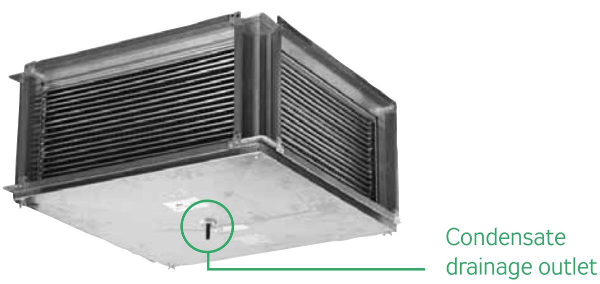


TABLE 1 - DIMENSIONS AND WEIGHTS OF HEAT EXCHANGERS

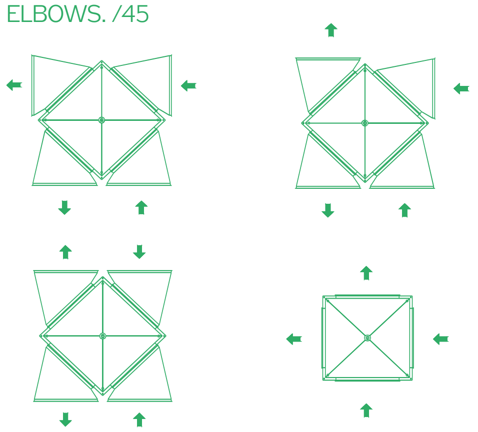
Type/Size (mm)	A	B	C	D	E	F	G	H	I	m ±10%
HRV 40-20	400	200	420	220	440	240	250	845	561	24
HRV 50-25	500	250	520	270	540	290	300	985	661	35
HRV 50-30	500	300	520	320	540	340	350	985	661	38
HRV 60-30	600	300	620	320	640	340	400	1130	761	50
HRV 60-35	600	350	620	370	640	390	450	1130	761	54
HRV 70-40	700	400	720	420	740	440	500	1270	861	71
HRV 80-50	800	500	820	520	840	540	550	1410	961	103
HRV 90-50	900	500	930	530	960	560	600	1590	1107	94

FIGURE 5 - PVC OUTLET



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 #5 and # 11 on page 263.

FIGURE 6 - HEAT EXCHANGER LAYOUT ARRANGEMENTS IN THE DUCTING DEPENDING ON THE ORIENTATION OBL ELBOWS. /45



HEAT EXCHANGER DIMENSIONING, PARAMETERS

On page 262 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 t_{p2} 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 $t_{o1} = 25$ºC, and the inlet air temperature was in all cases selected as $t_{p1} = -10$ºC. 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 -10ºC 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

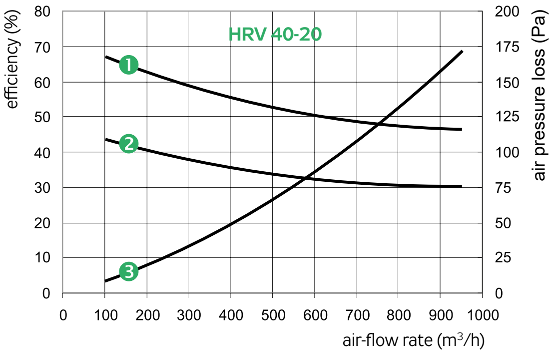
Determined final parameters

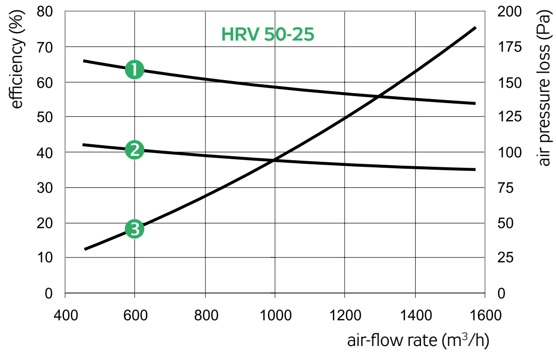
- Outlet air temperature behind the heat exchanger
- Heat exchanger's pressure loss

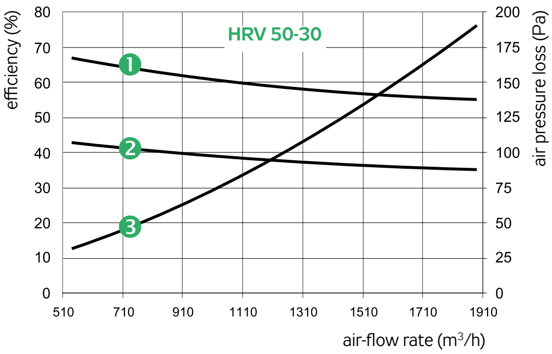
Heat Exchanger Dimensioning Procedure

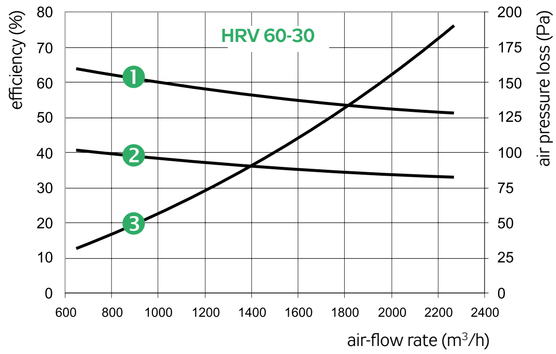
- Dry" or „wet" efficiency of the heat exchanger for the required values of the air flow rate can be determined from the graph. If the expected relative humidity value of the outlet air lies in the area between the „dry" and „wet" efficiency curves, the efficiency can be estimated within the range between 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:
  $t_{p2} = \Phi \cdot (t_{o1} - t_{p1}) + t_{p1}$
- 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 t_{p2} will be used to dimension the water heater as the inlet air temperature.

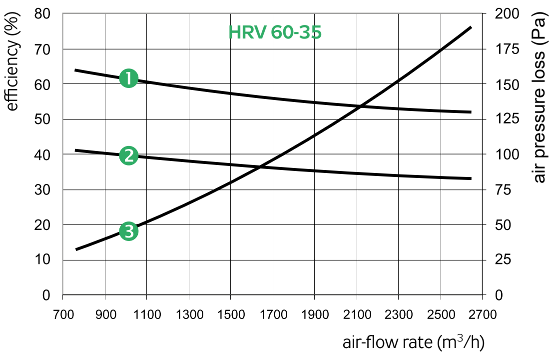
HEAT EXCHANGER WORKING CHARACTERISTICS

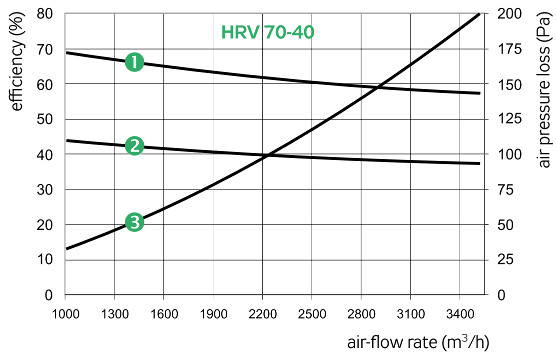


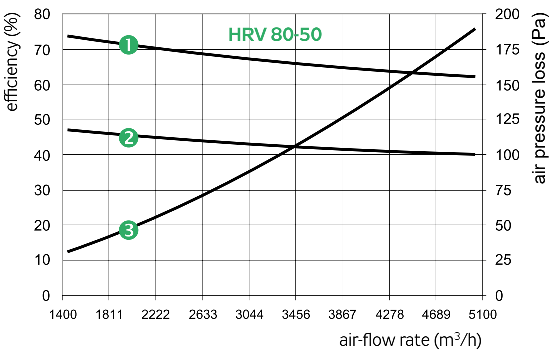


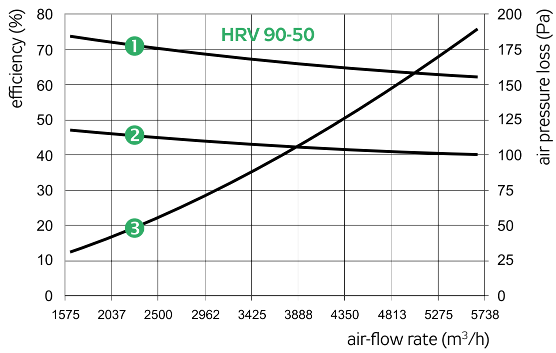












1. Correlation of „wet“ efficiency [%] and pressure loss [Pa] related to the air flow rate [m3/h] through the heat exchanger
2. Correlation of „dry“ efficiency [%] related to the air flow rate [m³/h] through the heat exchanger without condensation (applicable for outlet air relative humidity from 0 % 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)
Teperature	°C	-15	20
Relative air humidity for „dry“ efficiency [1]	%	Result not affected	max. 25
Relative air humidity for „wet“ efficiency [1]	%		min. 65
Air flow	m³/h	1400—5100 (inlet/outlet ratio = 1:1)	
Altitude	m	250	

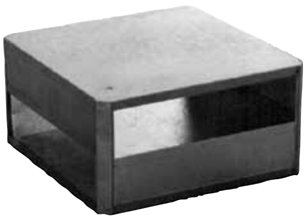
ACCESSORIES

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 (fig. 6 & 8)
- **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).

FIGURE 7 - HEAT EXCHANGER ACCESSORIES

OBL elbow



LV summer insert

FIGURE 8

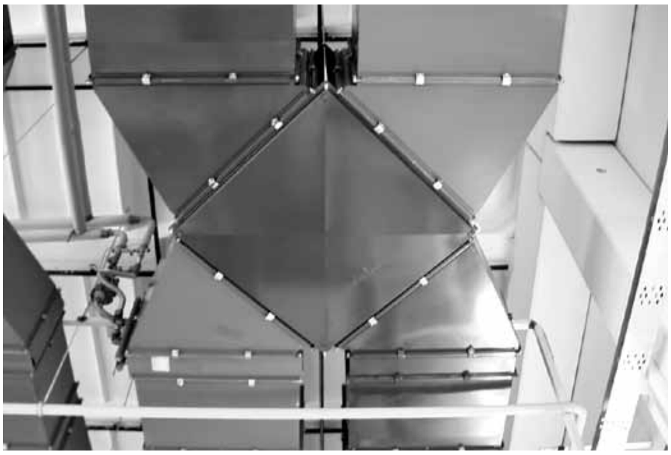


FIGURE 9 - EXAMPLE OF ELBOW DESIGNATION

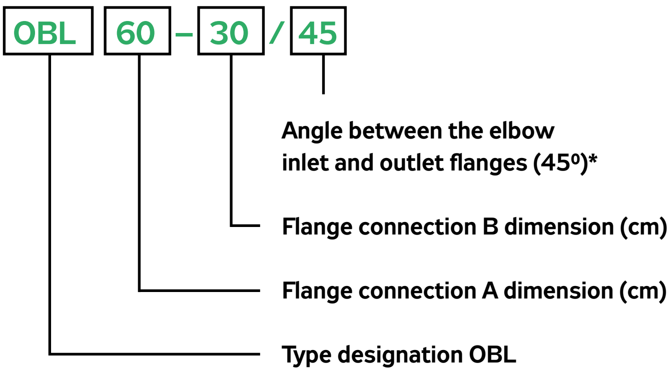
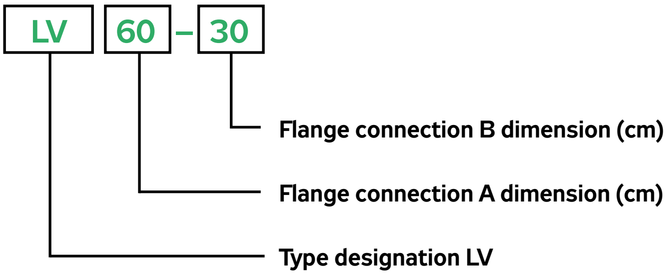


FIGURE 10 - EXAMPLE OF THE SUMMER INSERT DESIGNATION



INSTALLATION

- 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 #5 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.
- 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.

FIGURE 11 – PVC OUTLET INSTALLATION

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

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 (fig. 15) 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-section[1)] of the heat exchanger connecting flanges.
- Alternatively, it is advisable to use HRZ heat exchangers with integrated bypass (see further, HRZ Chapter)

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 Installation and operating instructions for Vento Duct Units.

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 12 - 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.

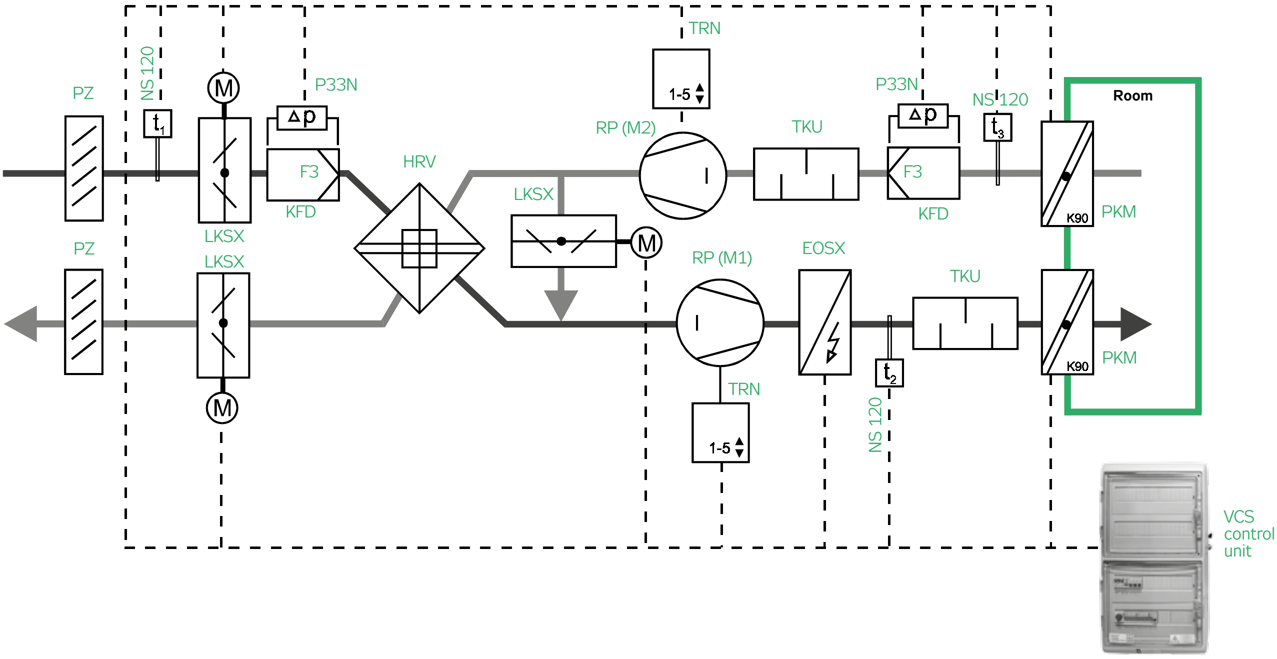


FIGURE 13 - HEAT EXCHANGER WITH A BYPASS

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 previ-ous 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.

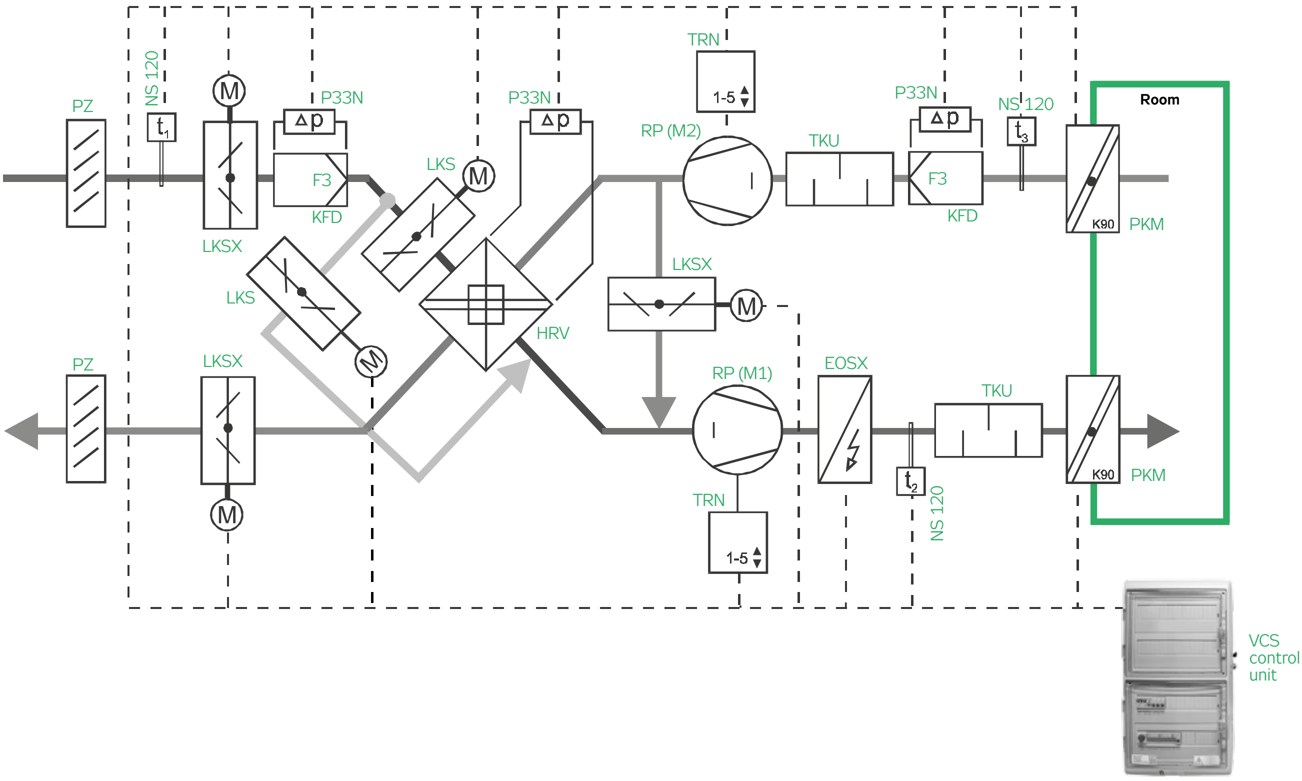
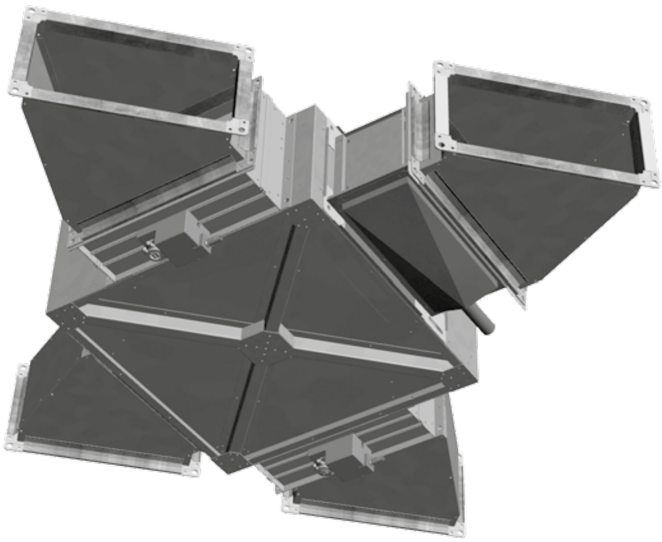


PLATE HEAT EXCHANGERS HRZ

FIGURE 1 – HRZ HEAT EXCHANGER WITH INTEGRATED BYPASS



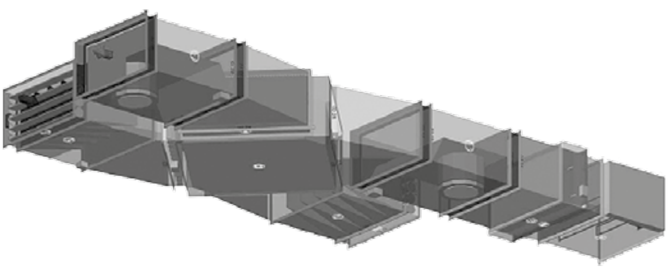
APPLICATION

HRZ plate heat exchangers are designed to recover heat energy from air exhausted from an air-conditioned room. As compared with the HRV type, they provide greater efficiency, lower pressure losses and offer more additional features, such as a by-pass, mixing and drop eliminator. Further, they offer a significantly wider range of variants which can be divided into two basic groups: the "F" (Flat) design, respecting the height of the given Vento dimensional range, and the "T" (Thick) design, which minimises the installation area but is higher than the elements of the given Vento dimensional range (i.e., needs to adapted to the standard dimensions of the Vento elements). Therefore, the "T" design is suitable for installations in corridors, stairs and areas between roof girders, such as hall-type buildings. Further, they can be classified according to the efficiency classes (E2016 and E2018 classes) defined by the EU Ecodesign regulation and can be delivered in Left-Hand or Right-Hand versions.

OPERATING CONDITIONS AND POSITION

Inlet and outlet air must not contain solid, fibrous, sticky, aggressive or explosive contaminants. Heat exchangers are designed to be installed in an air-handling system, in a parallel, perpendicular or diagonal (45ºangle) air inlet/outlet duct line, or various combinations of these. The disposition variability of the heat exchanger is provided by special elbows OBL.../xx. The number of these elbows must be specified depending on the intended disposition.

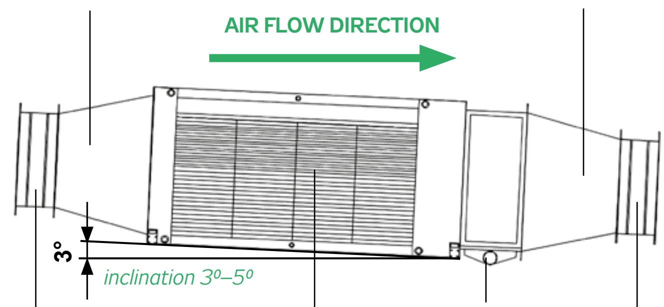
FIGURE 2 – THE HEAT EXCHANGER IN THE VENTO ASSEMBLY



Note:

- HRZ heat exchangers without elbows or reducing adapters (the reducing adapters are specified but not included in the Remak delivery) do not have the standard connecting dimensions of the Vento system.
- These heat exchangers are designed only for indoor installation in the horizontal (overhead) or vertical (wall) position. If installed in the vertical position, draining of condensate from the outlet air duct behind the heat exchanger must be ensured.
- When designing the air-handling system, it is necessary to ensure access space for installation of the heat exchanger and servicing of the M&C elements.
- The chamber must always be suspended in the balanced position.
- To ensure ideal condensate drainage, it is recommended to suspend the chamber with a positive inclination (towards the condensate drainage tray), a 3ºto 5º angle depending on the condensate volume and pressure conditions.
- These effects cannot be defined in advance. Therefore, the installation should be performed so that additional inclination adjustment will be possible. The adjustment of the chamber inclination in relation to the building structure and air handling assembly can be enabled by using an elastic connection on fans along with elastic connections on other branches (not included in the Remak delivery).
  Positioning with a negative inclination in relation to condensate drainage is PROHIBITED!

FIGURE 3 – SUSPENSION WITH A POSITIVE INCLINATION



MATERIALS AND DESIGN

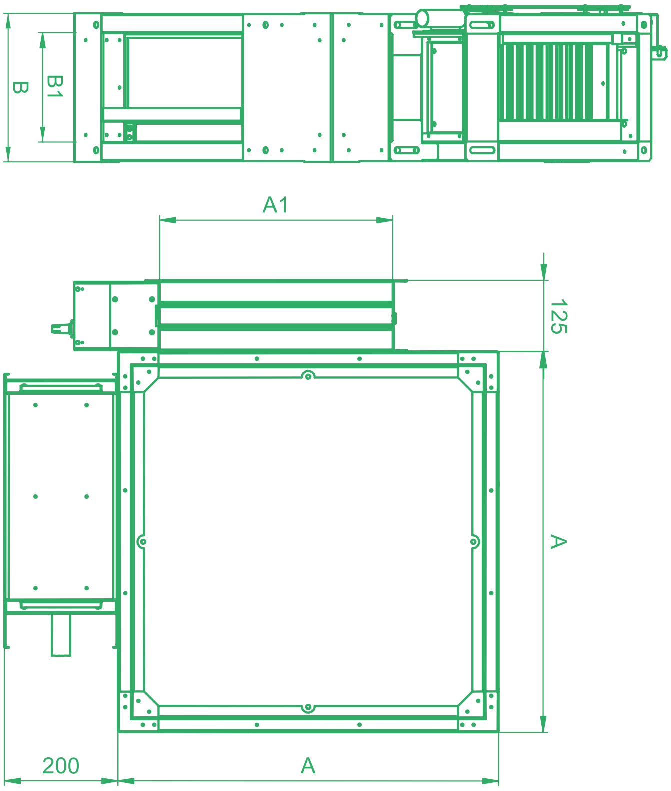
- Casing and linkage – galvanised steel Z275
- Sealing (on the air side)
  - Moisture-proof sealing with closed pores
  - Silicon-free polyurethane sealant (PU)
- Drop eliminator:
  - Frame – stainless steel AISI 304
  - Profiles – plastic
- Condensate drainage tray and parts – stainless steel
- Heat exchanger – aluminium
- Dampers
  - Profiles – aluminium
  - Gears, distance pieces, stops, bearings – plastic

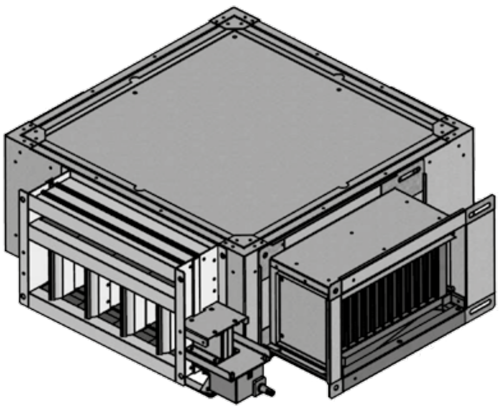
DIMENSIONAL RANGE

HRZ plate heat exchangers are included in all the dimensional ranges of the modular Vento air-handling system, i.e., from the 30-15 to 100-50 range (except the 50-25 range).

DIMENSIONS AND PARAMETERS

FIGURE 4 – DIMENSIONS





Dimensions of Adapters (elbows and reduction adapters)

- On the air-handling duct connection side, the dimensions are compatible with the flange dimensions of the Vento dimensional range, i.e., 20 or 30 mm.
- On the heat exchanger connection side (respectively the tray duct piece or damper), the dimension of the flange is 30 mm.

The flange dimension of the heat exchanger chamber, bypass damper, mixing damper and tray duct piece is always 30 mm.

TABLE 1 – DIMENSIONAL RANGES AND PARAMETERS

Dimensional range	Heat exchanger designation	Air flow rate [m³/h]	Efficiency [%]	Air pressure loss [Pa]	Connection width A1 [mm]	Connection height B1 [mm]	Total width A [mm]	Total height [mm]
30-15	HRZT 21-30 / 3S / ...	330	78	160	210	300	515	375
40-20	HRZT 51-35 / 9Z / ...	760	73	130	510	350	770	425
50-30 60-30	HRZT 61-60 / 0S / ...	1810	75	140	610	600	870	675
60-35	HRZT 61-80 / 6S / ...	2160	76	120	610	800	870	875
70-40	HRZT 71-80 / 7Z / ...	2880	78	170	710	800	970	875
80-50	HRZT 121-90 / 6S / ...	4110	77	130	1210	900	1465	975
90-50 100-50	HRZT 121-100 / 4Z / ...	5000	76	150	1210	1000	1465	1075

The parameters are calculated at the ODA air parameters (5ºC, 87%) and ETA air parameters (25ºC, 27%). The stated air flow rates are not maximum possible. Their values are selected so that the assembly in the given dimensional range and reference configuration will comply with the Ecodesign assessment.

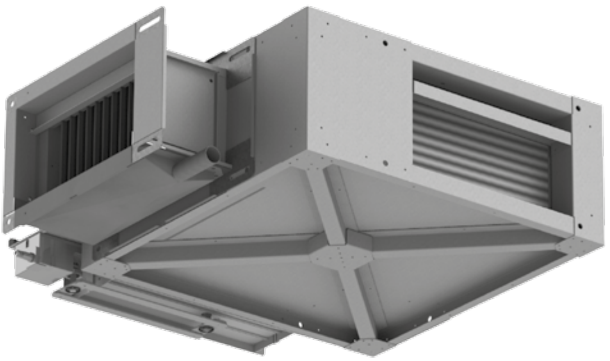
TABLE 1 – TORQUE VALUES OF DAMPERS
(If the actuators are not included in the REMAK delivery.)

Heat exchanger designation	Bypass damper actuator	Mixing damper actuator
HRZT 2130	LM(5Nm)	LM(5Nm)
HRZT 3130	LM(5Nm)	LM(5Nm)
HRZF 4120	LM(5Nm)	LM(5Nm)
HRZF 5120	LM(5Nm)	LM(5Nm)
HRZT 5135	LM(5Nm)	LM(5Nm)
HRZT 6135	LM(5Nm)	LM(5Nm)
HRZT 6160	LM(5Nm)	LM(5Nm)
HRZT 6180	LM(5Nm)	LM(5Nm)
HRZT 6110	NM(10Nm)	LM(5Nm)
HRZT 7160	LM(5Nm)	LM(5Nm)
HRZT 7180	NM(10Nm)	LM(5Nm)
HRZT 7110	NM(10Nm)	LM(5Nm)
HRZT 1060	NM(10Nm)	LM(5Nm)
HRZF 1230	LM(5Nm)	LM(5Nm)
HRZF 1235	LM(5Nm)	LM(5Nm)
HRZF 1240	LM(5Nm)	LM(5Nm)
HRZF 1250	NM(10Nm)	LM(5Nm)
HRZT 1256	NM(10Nm)	LM(5Nm)
HRZT 1280	NM(10Nm)	LM(5Nm)
HRZT 1290	NM(10Nm)	LM(5Nm)
HRZT 1210	NM(10Nm)	LM(5Nm)
HRZF 1420	LM(5Nm)	LM(5Nm)
HRZF 1430	LM(5Nm)	LM(5Nm)
HRZF 1435	LM(5Nm)	LM(5Nm)
HRZF 1440	NM(10Nm)	LM(5Nm)
HRZF 1450	NM(10Nm)	LM(5Nm)

PLATE HEAT EXCHANGERS HRZ

We offer numerous variants of HRZ heat exchangers and their accessories. Therefore, the offering process is performed exclusively using the AeroCAD design software, respectively though our commercial representatives The heat exchangers described here and the data are only for information purposes to provide a general overview of outputs, efficiencies and dimensions.

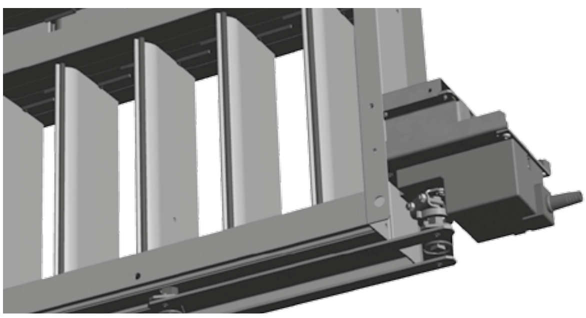
FIGURE 5 – HRZ HEAT EXCHANGER CHAMBER



ASSEMBLED ELEMENTS

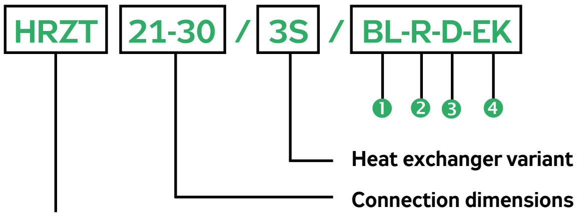
- The purpose of the **heat exchanger chamber** is to recover the heat energy and it consists of the following elements:
  - A chamber with an integrated by-pass channel
  - A counter-flow plate heat exchanger, for selected sizes in the "combi" version, consisting of two separate heat exchangers and two baffles
  - Suspensions
- The **By-pass**, designed as an extension of the heat exchanger chamber, serves as an antifreeze protection of the heat exchanger and/or as a summer by-pass.
  It consists of the following elements:
  - **Damper**
    - Flexible side arrangement - by turning the damper
    - Covered gear drive
    - The damper flaps in the vertical position (in relation to the chamber position) are divided into two parts (by-pass and heat exchanger) with an angular displacement of 90º.
    - "Downward-oriented" damper axis (in relation to the horizontal position of the chamber).
  - **Damper drive** (optional)
    - Variants: an actuator or a hand lever;
    - Actuator position: either under the damper or on the damper side.

FIGURE 6 – BY-PASS DAMPER ACTUATOR



  - **Linkage** (optional) serves to lead the damper control/actuator out to the damper side
- **The tray duct piece** is designed as an extension of the chamber to collect and drain the condensate and serves for the following parts:
  - **Chamber with an integrated tray** :
    - 3D sloping
    - Side outlet, side flexible (by turning the tray
    - DN32 dimension
  - **Holders to fit the drop eliminator**
  - **Drop eliminator** (optional)

FIGURE 7 – HEAT EXCHANGER CHAMBER DESIGNATION



HRZT version higher than other elements of a specific dimensional range
HRZF version respecting the installation height of the given Vento dimensional range

❶ **Side arrangement**

❷ **Type of bypass damper actuator:**

R	hand lever
X	actuator controlled by 0-10V signal and powered by 24V
H	without drive
24	actuator controlled by ON/OFF signal and powered by 24V
230	sactuator controlled by ON/OFF signal and powered by 230V

❸ **Position and location of the damper**

D	lower
B	side

❹ **Drop eliminator**

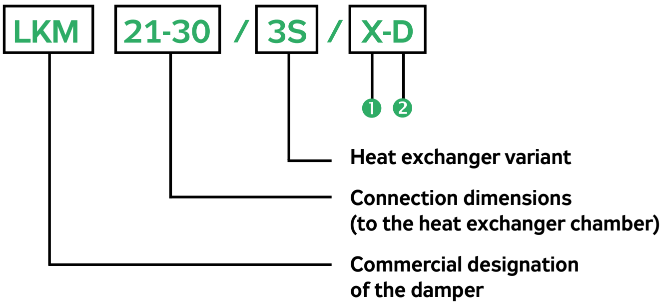
EK	integrated drop eliminator
BE	without drop eliminator

NON-ASSEMBLED ELEMENTS
(enclosed with the delivery as separate parts)

- **Condensate drainage kit** (siphon)
- **Mixing as an extension to the heat exchanger**,
  It is used to mix the inlet and outlet air using the heat exchanger by-pass channel and consists of:
  - **Damper**
    - Flexible side arrangement - by turning the damper
    - Covered gear drive
    - The damper flaps in the vertical position (in relation to the chamber position) are divided into two parts (by-pass and free space without flaps).
    - "Downward-oriented" damper axis (in relation to the horizontal position of the chamber)
  - **Damper drive** (optional)
    - Variants: an actuator or a hand lever
    - Actuator position: either under the damper or on the damper side
  - **Linkage** (optional) serves to lead the damper control/actuator out to the damper side

- **45⁰ Elbow** directs the air flow of the air branch and simultaneously can extend the connection dimension A1 – width (as needed for the selected size)
- **Sensors of antifreeze protection** (P33, NS)
- **VCS control system**
(if a complete air-handling unit assembly is ordered)

FIGURE 8 – MIXING DAMPER DESIGNATION



❶ Type of bypass damper actuator:

R hand lever
X actuator controlled by 0-10V signal and powered by 24V
H without drive
24 actuator controlled by ON/OFF signal and powered by 24V
230 actuator controlled by ON/OFF signal and powered by 230V

❷ Position and location of the damper drive

D lower
B side

FIGURE 9 – 45⁰ ELBOW

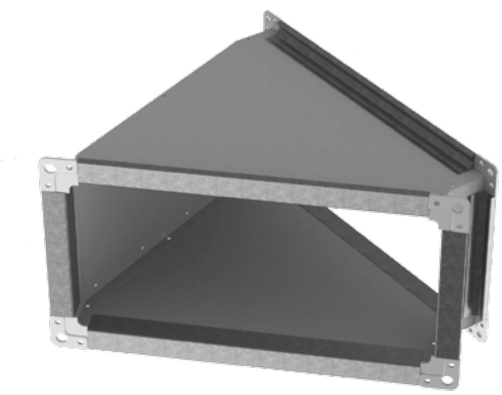
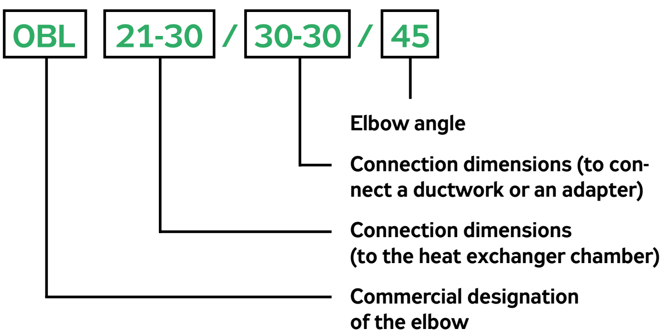


FIGURE 10 – ELBOW DESIGNATION

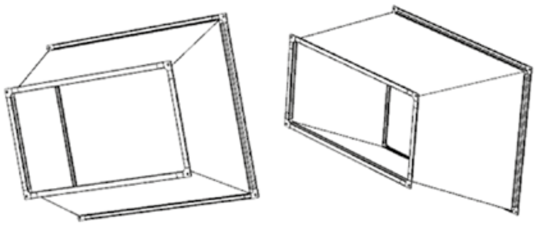


NON-REMAK ELEMENTS

(Remak only specifies the design)

- Adapters are intended to reduce or extend the B connection dimension (height) to the selected/desired value. Adapters can be designed with a reduced dimension of one side or reduced dimensions of both sides (a variant with a short length).

FIGURE 11 – EXAMPLE OF AN ADAPTER/EXTENSION



MOUNTING AND INSTALLATION

Installation of the heat exchanger can be performed in a way similar to the installation of other Vento components.

HRZ CHAMBER SUSPENSION

Horizontal position (overhead installation):

The heat exchanger chamber can be suspended either using Z--hangers with silent-blocks (included in the Remak delivery) and M8 threaded rods (not included in the Remak delivery) or by other options, i.e., using suspension bars or brackets (not included in the Remak delivery).

Vertical position (wall installation):

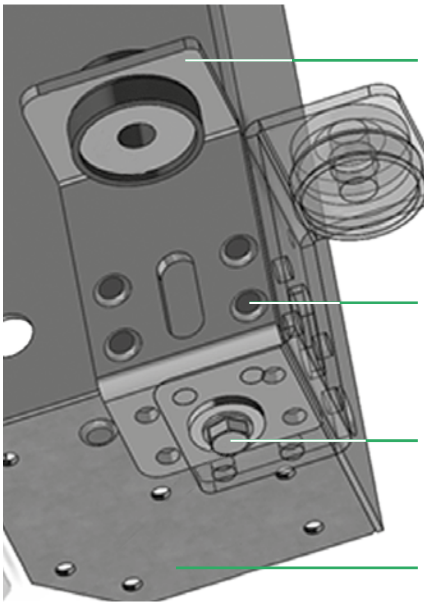
It is recommended to support and secure the heat exchanger chamber at the location of the edge support profiles. It is advisable to use suitable rubber pads between the chamber and supports (not included in the Remak delivery).

Z-Hanger Installation

The Z-hanger with a silent-block is designed only for horizontal overhead installation of the unit using the M8 threaded rods and is always situated in the lower corners (corner-iron) of the heat exchanger chamber. When installing the Z-hanger, it is possible to select the side of the suspension silent-block location, e.g., due to the damper actuator linkage (if the Z-hanger collides with the actuator).

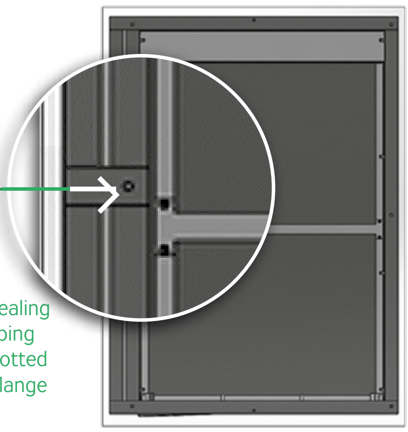
The Z-hanger is secured to the chamber corner-iron by a "TEX" 5.5 x 19 self-tapping screw with an M8 washer and four steel tear-off rivets 4 x 8 mm – if the location of the Z-hanger is changed, it is necessary to drill new holes for the rivets according to the holes in the Z-hanger using a drill bit of 4.0 mm diameter.

FIGURE 12 – SUSPENSION USING THE Z-HANGER



Note:
To maintain joint tightness and strength when connecting the 45º elbows, reduction adapters or other elements of the air-handling assembly to the flange of the condensate drainage tray, we recommend applying self-adhesive 35 x 3 sealing (included in the Remak delivery).

FIGURE 13 – SELF-ADHESIVE SEALING APPLICATION



Installation of 45º Elbows and Reduction Adapters

Before installation, always apply self-adhesive sealing onto the connecting flange faces of the 45ºelbows and reduction adapters. The connection of the elbows and reduction adapters to the heat exchanger chamber is carried out using the flange with pressed nuts situated in the connecting chamber wall corners. To brace flanges with a side longer than 40 cm, it is advisable to also connect them in the middle (to prevent flange bar gapping). This centre connection to the heat exchanger chamber is carried out using the self-tapping screws and to the duct or reduction adapter using the screw coupling clamps. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides on at least one flange connection.

Mixing Damper Installation

Before installation, always apply self-adhesive sealing onto the connecting flange faces.
The connection of the mixing damper to the heat exchanger chamber is carried out through the pre-drilled holes in the flange to the pressed nuts on the connecting wall of the heat exchanger.
It is necessary to ensure conductive connection of the damper flange using fan-washers on at least one flange connection.
If the damper is equipped with a side situated linkage and actuator, it is possible to change the linkage location to right-hand or left-hand by turning the entire damper according to operating needs or space requirements.

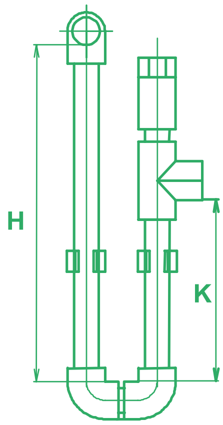
Note:
If retrofitting the mixing damper, the by-pass cover panel must be disassembled and removed to open the air inlet on the mixing damper side – the cover panel can be unscrewed from outside, i.e., from the side where the mixing damper is to be installed.

Condensate Drainage Installation

It is recommended to place the siphon right behind the tray neck.
Correct
The correctly selected siphon height depends on the total pressure of the fan and heat exchanger chamber and ensures its proper functioning. The siphon height dimension must be designed depending on the fan pressure.

The condensate drainage tray is attached to the structure using sealing and screws which enable removal of the tray and its side arrangement – a left-hand and right-hand neck.

FIGURE 14 – CONDENSATE DRAINAGE



H	K	Pa
mm	mm	mm
100	55	600
200	105	1100
300	140	1400

H... Siphon height
K... Siphon neck height
P... Total pressure of the fan

Drop Eliminator Installation

In the condensate drainage tray's piping piece area, the prepared attachments are situated, enabling installation/insertion (also retrofitting) of the eliminator. The eliminator can be inserted into the condensate drainage tray's duct piece area through the removable (screwed) side covers of the duct piece, or through the removable (screwed) tray in the lower part of the duct piece. Removal of the eliminator, e.g., for cleaning, can performed the same way.

Note:
Please ensure the correct orientation of the eliminator's fins.

INSTALLATION OF M&C ELEMENT

If needed, the M&C elements can be installed/attached to the external side of the corner profiles of the chamber casing (here, the attachment holes can be drilled into the chamber casing).

Recommended locations of M&C elements:

- NA 120 – standard installation on the ductwork, 45⁰ elbow or reduction adapter behind the heat exchanger in accordance with the Sensor Installation Instructions.
- CAP (capillary tube) – installation on the chamber casing. The capillary tube must be evenly distributed in the area behind the heat exchanger.
- P33N –installation on the ductwork, 45⁰ elbow or reduction adapter of the outlet branch in front of or behind the heat exchanger.

Note: Never drill or install the M&C elements onto the chamber bottom or chamber lid – there is a risk of damage to the heat exchanger or leakage of the casing.

OPERATION AND MAINTENANCE

When used in accordance with the project designed in the AeroCAD software and instructions in the chapter "Operating Conditions and Position", HRZ heat exchangers require only minimum maintenance related mainly to cleaning the condenser, free passage through the condensate drainage, functionality (rotation) of the dampers and functionality of the M&C elements.

Inspections

(Minimum recommended interval for inspections and cleaning – 2x per year)

- Check the intactness and internal cleanliness of the heat exchanger and eliminator.
- Check functionality of the dampers, linkage and actuators.
- Check functionality of the installed M&C elements.
- Check free passage through the entire condensate drainage.
- Check state of the unit's suspension

Access to Individual Components of the HRZ Heat Exchanger

- Dampers (by-pass and mixing) with actuators are installed from the outer side of the chamber – free access.
- The installed heat exchanger – access through the elbows, reduction adapter (removable) and from above through the removable (screws) cover of the heat exchanger chamber.
- By-pass area – access from above through the removable (screws) cover of the heat exchanger chamber.
- The ductwork piece and tray with eliminator – access through the removable (screws) side covers and removable condensate drainage tray.

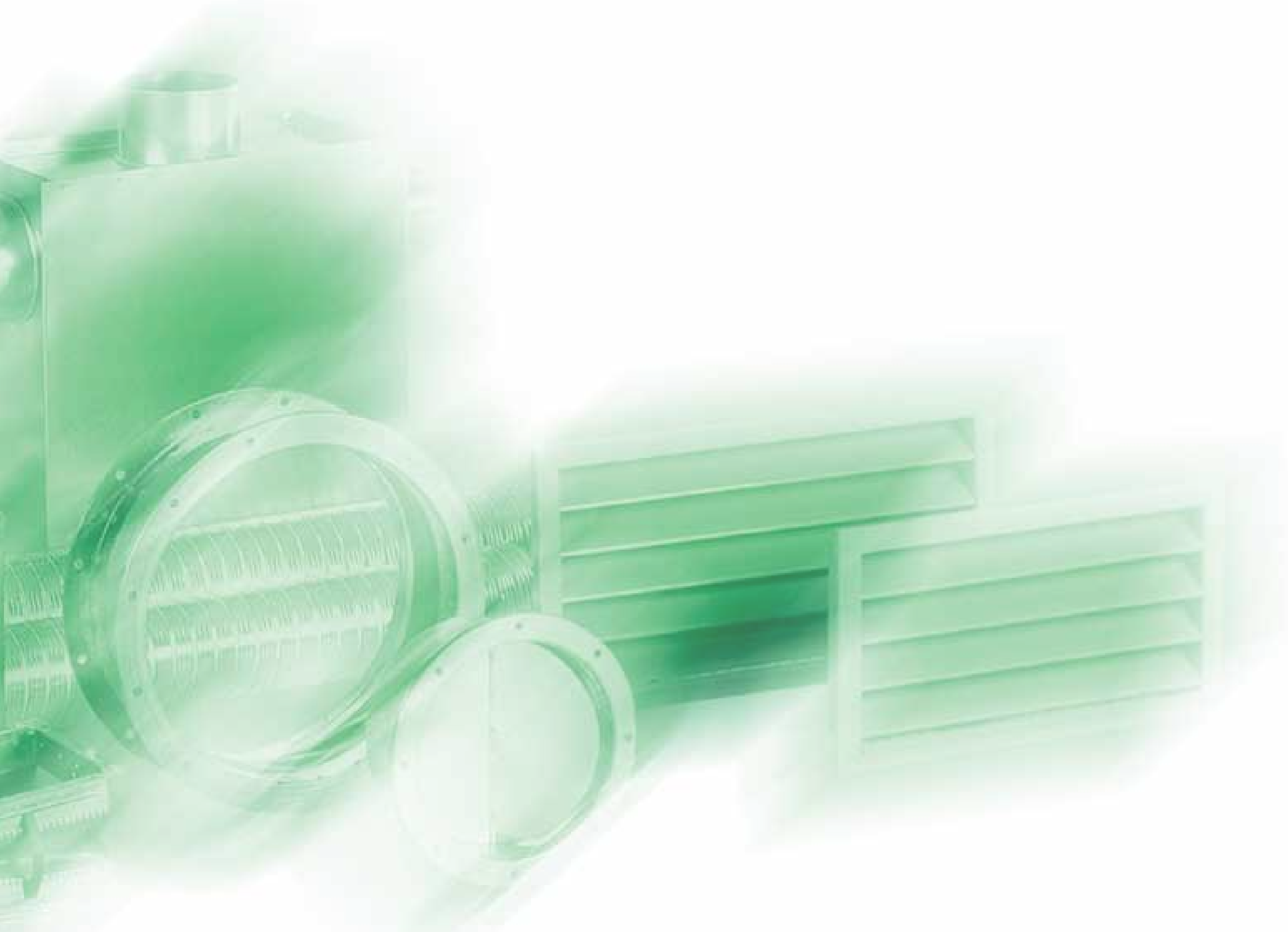
Caution

- The VCS control system includes the function of heat exchanger drying which, using the fan run-out, helps remove the remaining condensate when the equipment is switched off. If a quick service action is needed, the equipment must be switched off by the main switch to eliminate the fan run-out.
- The heat exchanger is made of thin aluminium profiles. Any unqualified handling can cause permanent and unrepairable damage. The bypass duct must be regulated, so that the air pressure loss in the duct bypass will be approximately the same 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 the heat exchange mode as well as during the bypass mode.
- 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.

HANDLING AND TRANSPORT

- Handling and transport of the chamber must always be performed in the horizontal position, i.e., with the by-pass channel situated upwards, on a flat surface (e.g., pallet + cardboard box).
- Lifting must be performed using the **lower** corners of the casing, respectively, the **lower** edges of the chamber.
- The chamber structure allows 3 chambers to be stacked during transport. Cardboard must always be inserted between the chambers.
- The support area of the chamber is created by the corners and perimeter of the chamber. Therefore, do not place smaller items on the cover of the chamber – risk of breakage of the chamber cover and area around the by-pass channel.
- The heat exchanger is made of thin aluminium profiles. Any unqualified handling can cause permanent and unrepairable damage.

Accessories



ACCESSORIES KFD BAG 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 ºC to +70 ºC.
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.

FIGURE 1

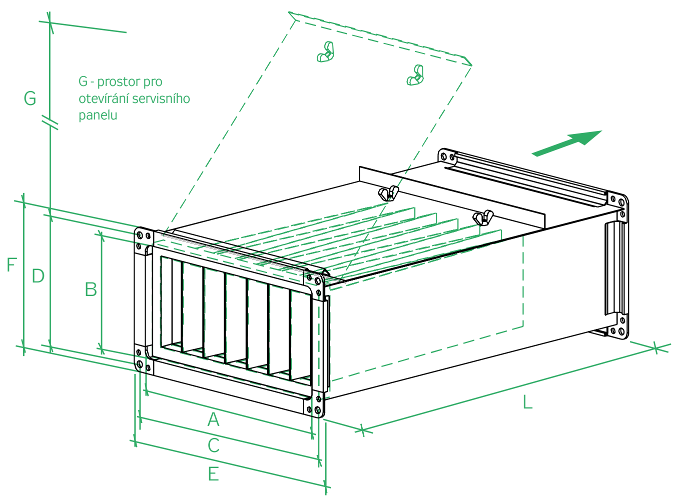


TABLE 1

Filter type/ Size (mm)	A	B	C	D	E	F	G	L	m ±10% (kg)
KFD 30-15	300	150	320	170	340	190	310	550	6,5
KFD 40-20	400	200	420	220	440	240	410	550	8
KFD 50-25	500	250	520	270	540	290	410	650	11
KFD 50-30	500	300	520	320	540	340	410	650	12
KFD 60-30	600	300	620	320	640	340	410	650	13
KFD 60-35	600	350	620	370	640	390	410	650	14
KFD 70-40	700	400	720	420	740	440	410	720	18
KFD 80-50	800	500	820	520	840	540	410	800	21
KFD 90-50	900	500	930	530	960	560	405	800	24
KFD 100-50	1000	500	1030	530	1060	560	410	800	27

FIGURE 3 – TYPE DESIGNATION

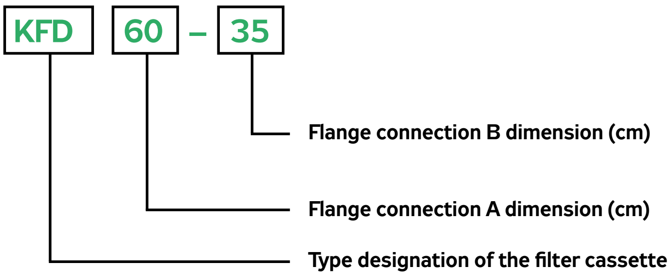
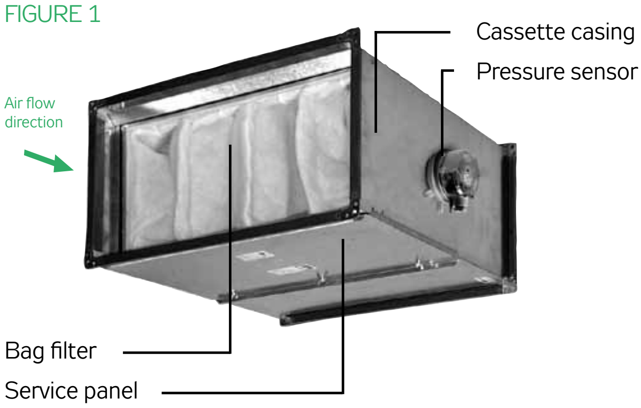


FIGURE 1



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.

ACCESSORIES

A bag filter of the corresponding size and required filtration class is an essential accessory of the KFD filter cassette, The recommended accessory is a P33N differential pressure sensor for evaluating and signaling filter clogging according to the pressure drop (it must be provided in combination with the control system).

- → **KF3** – bag filter, ISO Coarse 50 % class
- → **KF5** – bag filter ISO Coarse 80 % class
- → **KF7** – bag filter ISO ePM 10 75 % class
- → **P33N** – snímač tlakové diference

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.

APPLICATION

Bag filters KF3 jsou určeny pro kazety filtrů KFD. Používají se jako jediný stupeň filtrace v méně náročnějších aplikacích nebo jako předfiltry pro první stupeň filtrace pro odloučení hrubších prachových částic.

OPERATING CONDITIONS

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..

FIGURE 1

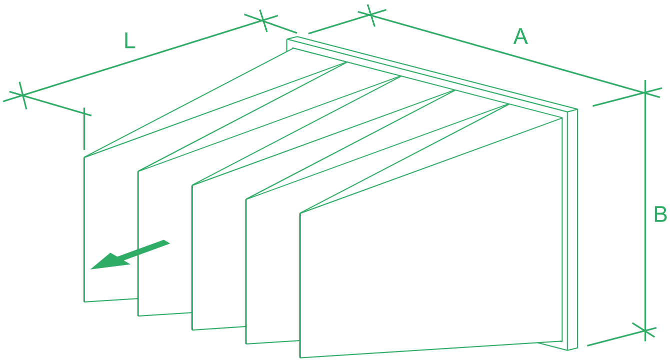


FIGURE 2 – TYPE DESIGNATION

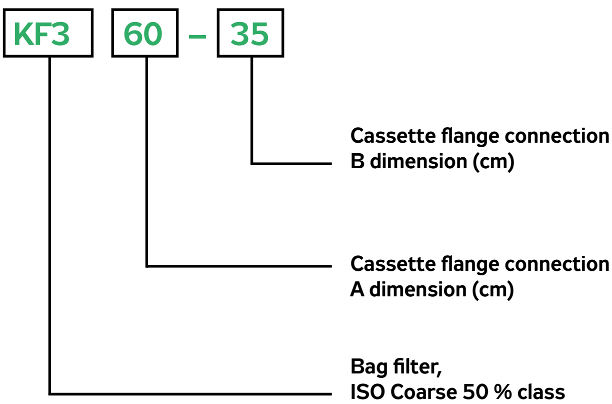
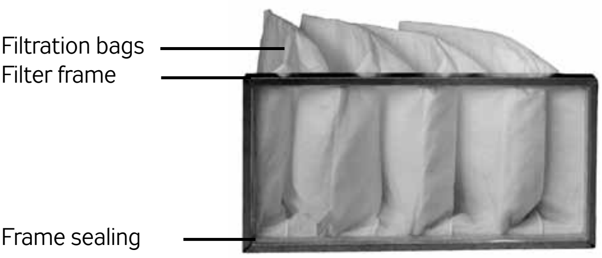


FIGURE 3



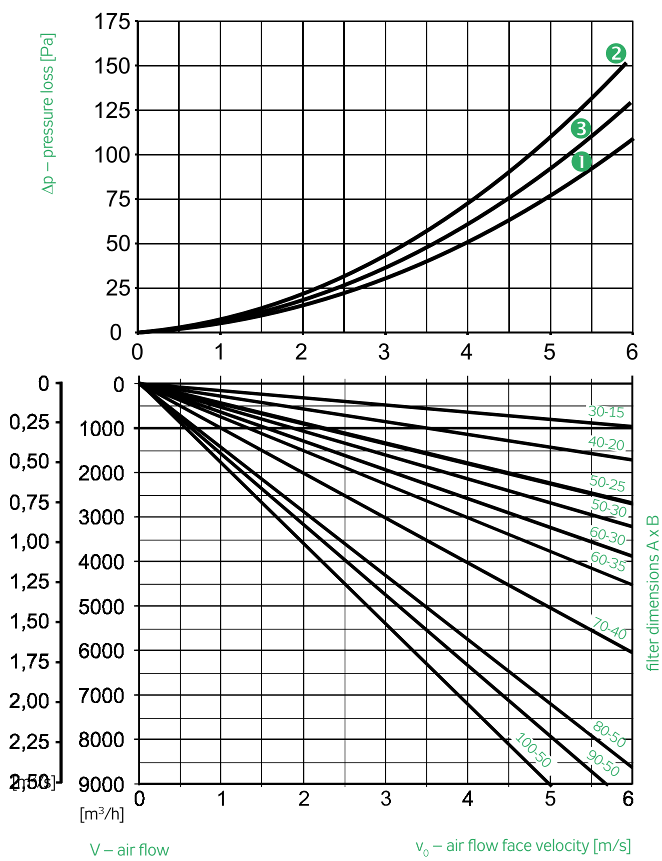
MATERIALS

Filtration bags are made of unwoven, thermally and mechanically reinforced 100 % polyether textile. 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 AND MAINTENANCE

The filters require regular inspections for fouling. During operation, pressure loss gradually rises due to the filter fouling with dust. The recommended final pressure loss of the KF3 filter according to ČSN EN 13053 + A1: 2011 is 150 Pa. The final pressure drop of the filter specified by the manufacturer 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].

GRAPH 1 – AIR PRESSURE LOSS OF CLEAN KF3 BAG FILTERS



For the curve numbers corresponding to each air filter, refer to the table.

[1] Fouled filter can only be partly recovered via a dry process (dusted or vacuumed); however, impaired filter properties can be expected after the Recoverability.

TABLE 1

Filter type KF3		30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50	100-50
A-B dimensions	[cm]	29,5-14,5	39,5-19,5	49,5-24,5	49,5-29,5	59,5-29,5	59,5-34,5	69,5-39,5	79,5-49,5	89,5-49,5	99,5-49,5
L dimension	[cm]	42	42	42	42	42	42	42	42	42	42
Filtration class according to ČSN EN ISO 16890-1	[-]	ISO Coarse 50 %									
Mean rate of synthetic dust separation A_m	[%]	> 80									
Filtration area	[m²]	0,36	0,65	0,82	0,99	1,2	1,4	1,99	2,9	3,32	3,74
Number of bags	[ks]	3	4	4	4	5	5	6	7	8	9
Weight	[kg]	1,5	1,5	2	2,5	2,5	3	3	3,5	3,5	4
Rated (nominal) air flow [2]	[m³/h]	520	920	1440	1730	2070	2420	3220	4610	5180	5760
Initial pressure loss [3]	[Pa]	34	33	49	48	47	47	42	40	40	38
Clean state pressure loss	curve no.	❶	❶	❷	❷	❷	❷	❸	❸	❸	❸
Recommended final pressure loss [3]	[Pa]	150									
Final pressure loss	[Pa]	250									
Holding capacity	[g]	143	259	327	395	478	558	794	1157	1324	1492
Thermal resistance	[°C]	70									
Combustibility class	[-]	B-s1, d1 (according to ČSN EN 13501-1+A1); K2/F2 (according to DIN 53438-1)									
Recoverability	[-]	Partial only, via a dry process (impaired filter properties can be expected after the Recoverability)									

[2] Applies to a flow velocity of 3.2 m/s (KF3, KF5) resp. 2.5 m/s in KF7

[3] At the nominal air flow

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

Maximum temperature of the transported air can be up to +100 ⁰C 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.

FIGURE 1

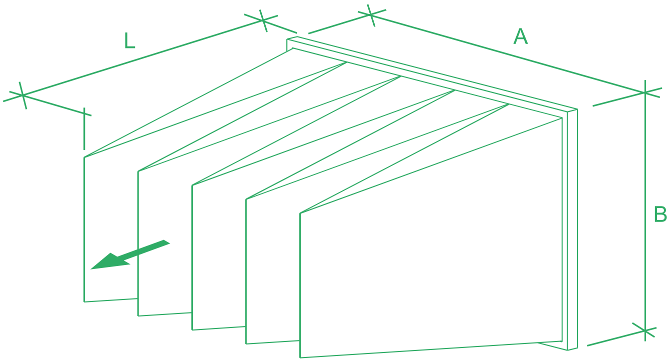


FIGURE 2 – TYPE DESIGNATION

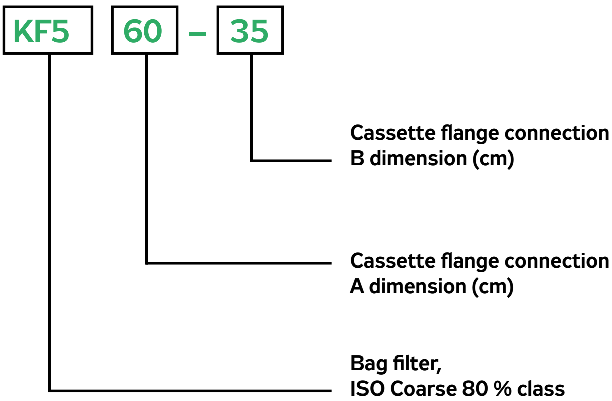
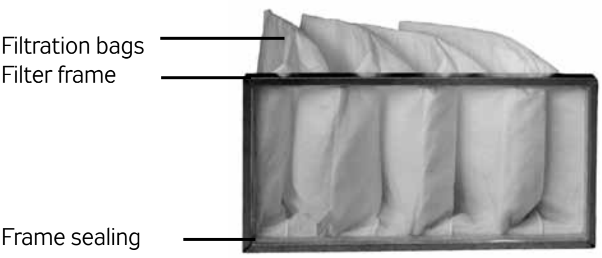


FIGURE 3



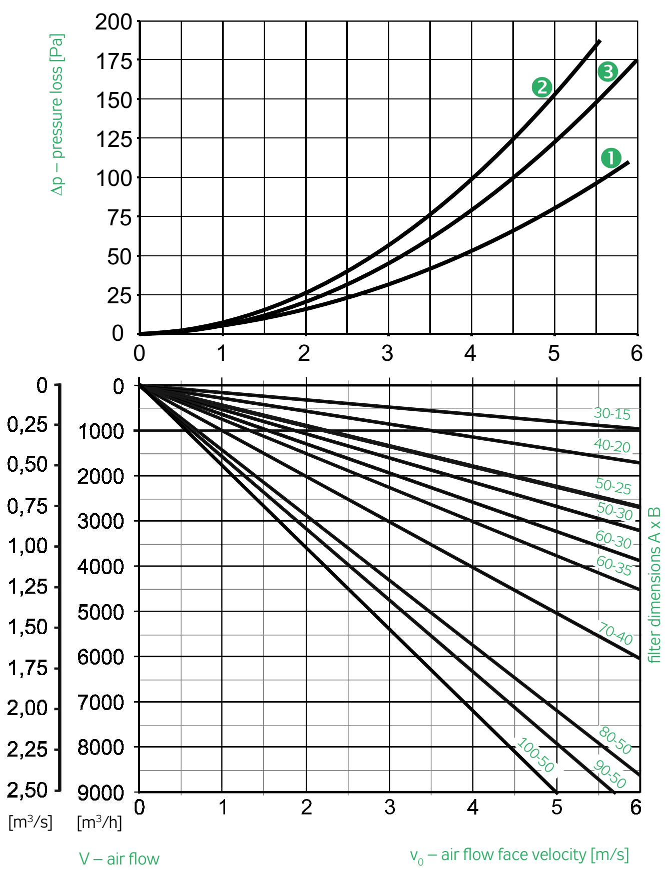
MATERIALS

Filtration bags are made of progressively designed, unwoven 100 % synthetic textile. 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 AND MAINTENANCE

The filters require regular inspections for fouling. During operation, pressure loss gradually rises due to the filter fouling with dust. The recommended final pressure loss of the KF3 filter according to ČSN EN 13053 + A1: 2011 is 200 Pa. The final pressure drop of the filter specified by the manufacturer 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. [1)]

GRAPH 1 – AIR PRESSURE LOSS OF CLEAN KF5 BAG FILTERS



For the curve numbers corresponding to each air filter, refer to the table.

[1)] Znečištěný filtr je pouze omezeně regenerovatelný suchou cestou (vyklepáním, vysavačem), přičemž po regeneraci nutno počítat se zhoršením vlastností

[2)] Platí pro rychlost proudění 3,2 m/s (KF3,KF5) resp. 2,5 m/s u KF7

[3)] Při jmenovitém průtoku

TABLE 1

Filter type KF5		30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50	100-50
A-B dimensions	[cm]	29,5-14,5	39,5-19,5	49,5-24,5	49,5-29,5	59,5-29,5	59,5-34,5	69,5-39,5	79,5-49,5	89,5-49,5	99,5-49,5
L dimension	[cm]	42	42	52	52	52	52	60	60	60	60
Filtration class according to ČSN EN ISO 16890-1	[-]	ISO Coarse 80 %									
Mean rate of synthetic dust separation A_m	[%]	> 90									
Mean rate of atmospheric dust separation E_m	[%]	> 40									
Filtration area	[m²]	0,36	0,65	1	1,2	1,5	1,8	2,8	4,1	4,7	5,34
Number of bags	[ks]	3	4	4	4	5	5	6	7	8	9
Weight	[kg]	1,5	1,5	2	2,5	2,5	3	3	3,5	3,5	4,5
Rated (nominal) air flow (2	[m³/h]	520	920	1440	1730	2070	2420	3220	4610	5180	5760
Initial pressure loss (3	[Pa]	37	36	63	65	60	57	56	53	51	49
Clean state pressure loss (graph)	curve no.	1	1	2	2	2	2	3	3	3	3
Recommended final pressure loss (2	[Pa]	200									
Final pressure loss	[Pa]	400									
Holding capacity	[g]	85	154	240	285	357	404	666	975	1118	1270
Thermal resistance	[°C]	70									
Combustibility class	[-]	B-s1, d1 (according to ČSN EN 13501-1+A1); K2/F2 (according to DIN 53438-1)									
Recoverability	[-]	Unrecoverable									

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

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.

FIGURE 1

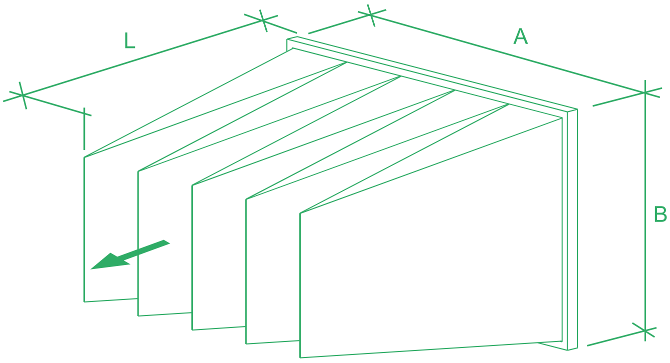


FIGURE 2 – TYPE DESIGNATION

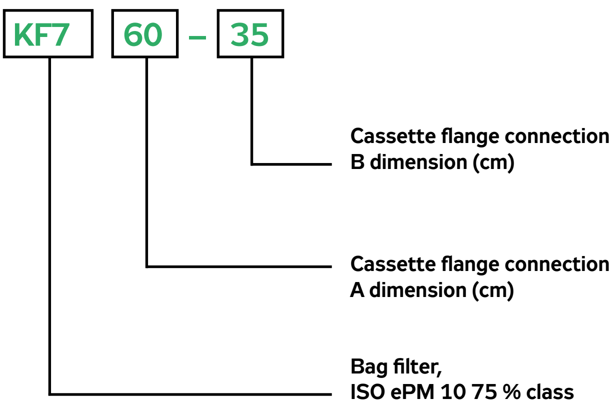
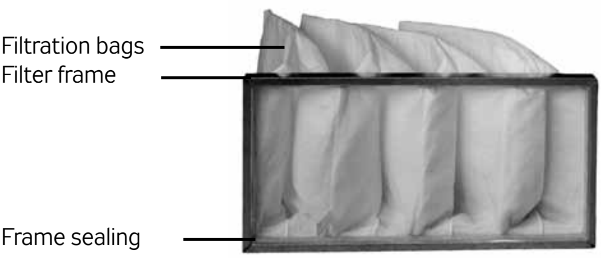


FIGURE 3



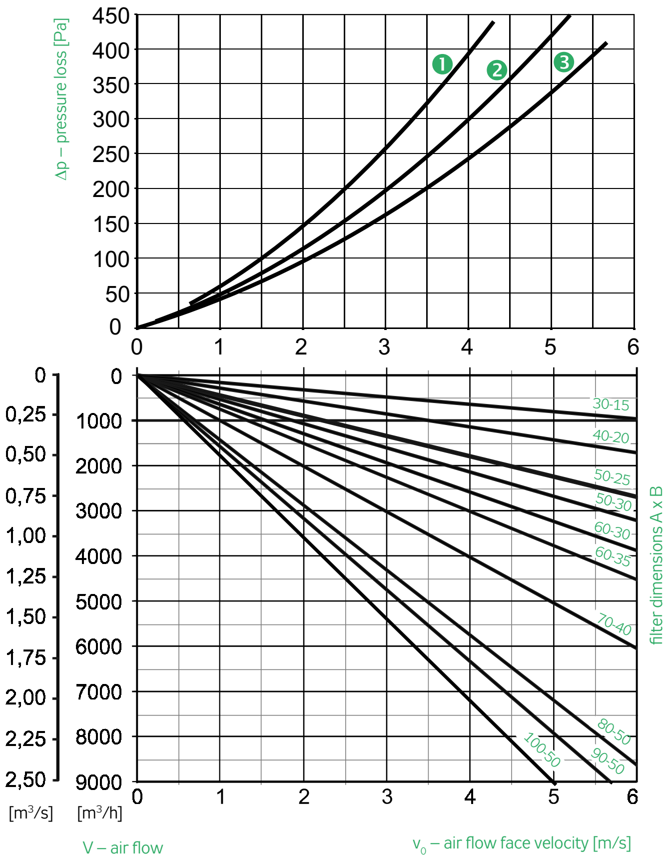
MATERIALS

Filtration bags are made of progressively designed, unwoven 100 % synthetic textile.
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 AND MAINTENANCE

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 according to ČSN EN 13053+A1:2011 is 200 Pa. The final pressure loss filter specified by the manufacturer 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. (1.

GRAPH 1 – AIR PRESSURE LOSS OF CLEAN KF7 BAG FILTERS



For the curve numbers corresponding to each air filter, refer to the table.

1) Znečištěný filtr je pouze omezeně regenerovatelný suchou cestou (vyklepáním, vysavačem), přičemž po regeneraci nutno počítat se zhoršením vlastností
2) Platí pro rychlost proudění 3,2 m/s (KF3, KF5) resp. 2,5 m/s u KF7
3) Při jmenovitém průtoku

TABLE 1

Filter type KF7		30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50	100-50
A-B dimensions	[cm]	29,5-14,5	39,5-19,5	49,5-24,5	49,5-29,5	59,5-29,5	59,5-34,5	69,5-39,5	79,5-49,5	89,5-49,5	99,5-49,5
L dimension	[cm]	42	42	52	52	52	52	60	60	60	60
Filtration class according to ČSN EN ISO 16890-1	[-]	ISO ePM 10 75 %									
Mean rate of synthetic dust separation A_m	[%]	› 90									
Mean rate of atmospheric dust separation E_m	[%]	› 40									
Filtration area	[m²]	0,36	0,65	1,27	1,5	1,8	2,15	3,3	4,7	5,3	5,9
Number of bags	[ks]	3	4	5	5	6	6	7	8	9	10
Weight	[kg]	1,5	1,5	2	2,5	2,5	3	3	3,5	3,5	4,5
Rated (nominal) air flow [2]	[m³/h]	320	720	1125	1350	1620	1890	2520	3600	4050	4500
Initial pressure loss [3]	[Pa]	145	135	155	145	145	145	125	130	125	135
Clean state pressure loss (graph)	curve no.	1	3	2	2	2	2	3	3	3	3
Recommended final pressure loss [3]	[Pa]	200									
Final pressure loss	[Pa]	400									
Holding capacity	[g]	16	30	58	69	82	99	151	216	244	270
Thermal resistance	[°C]	70									
Combustibility class	[-]	B-s1, d1 (according to ČSN EN 13501-1+A1); K2/F2 (according to DIN 53438-1)									
Recoverability	[-]	Unrecoverable									

ACCESSORIES VFK INSERT AIR FILTER CASSETTE

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 ºC to +70 ºC. 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 1.

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..

FIGURE 1

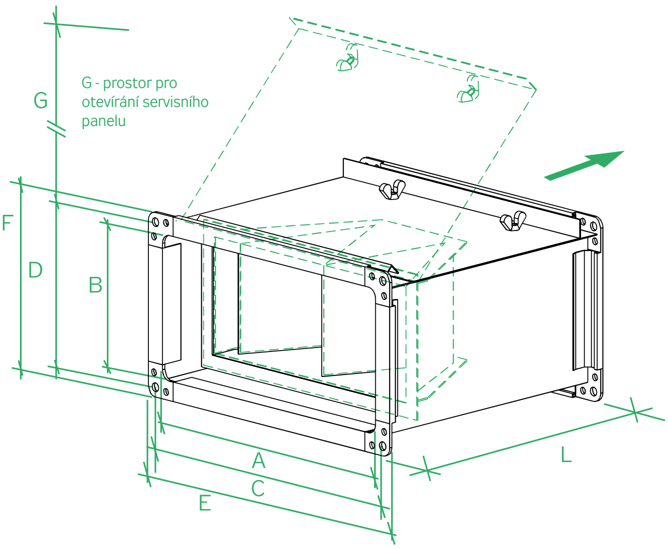


TABLE 1

Filter type/ Size (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	L (mm)	m ±10% (mm)
VFK 30-15	300	150	320	170	340	190	230	300	5
VFK 40-20	400	200	420	220	440	240	230	300	6
VFK 50-25	500	250	520	270	540	290	230	300	7
VFK 50-30	500	300	520	320	540	340	230	300	7
VFK 60-30	600	300	620	320	640	340	230	300	8
VFK 60-35	600	350	620	370	640	390	230	300	8
VFK 70-40	700	400	720	420	740	440	230	300	10
VFK 80-50	800	500	820	520	840	540	230	300	12
VFK 90-50	900	500	930	530	960	560	225	300	13
VFK 100-50	1000	500	1030	530	1060	560	230	300	14

FIGURE 2 – TYPE DESIGNATION

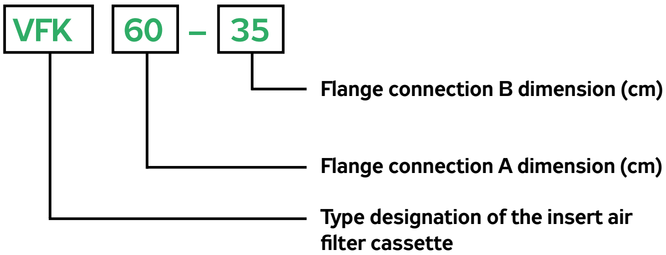
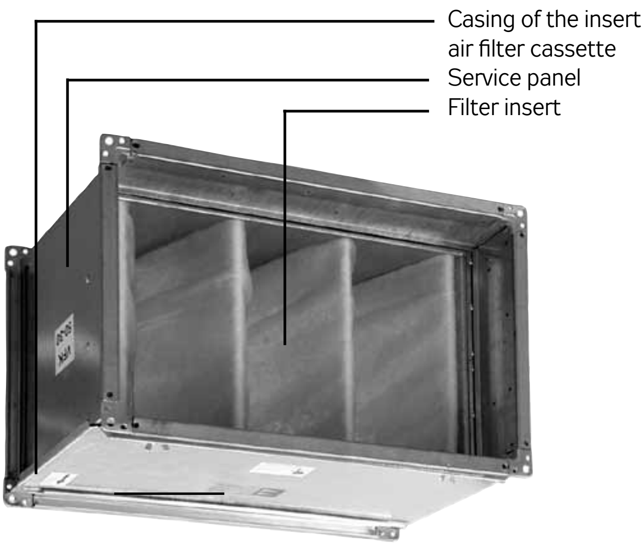


FIGURE 3



ACCESSORIES

A necessary accessory of the VFK filter cartridge is a filter insert of the appropriate size. The recommended accessories are a replacement filter cloth and a differential pressure sensor.

- **VF3:** filter insert, ISO Coarse 50 % class (page 284)
- **VF3N:** filter insert spare filtration textile
- **P33N:** differential pressure sensor

ACCESSORIES
SPARE FILTER INSERTS
VF3

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

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 100-50.

MATERIALS

Filtration insert contains unwoven, thermally reinforced 100 % polyether textile of 400 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

FIGURE 1

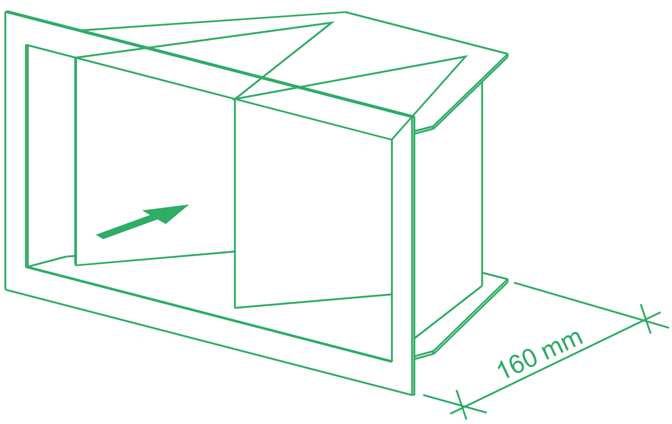
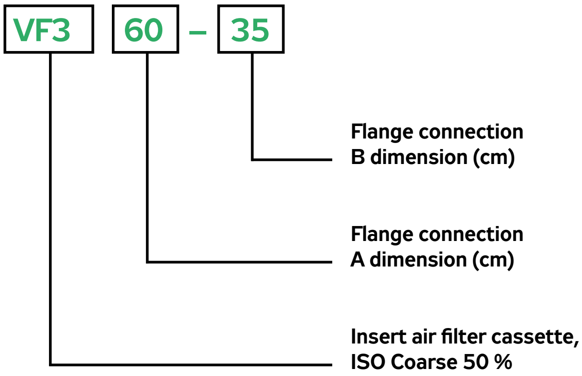


FIGURE 2 – TYPE DESIGNATION



GRAPH 1 – AIR PRESSURE LOSS OF CLEAN VFK FILTERS

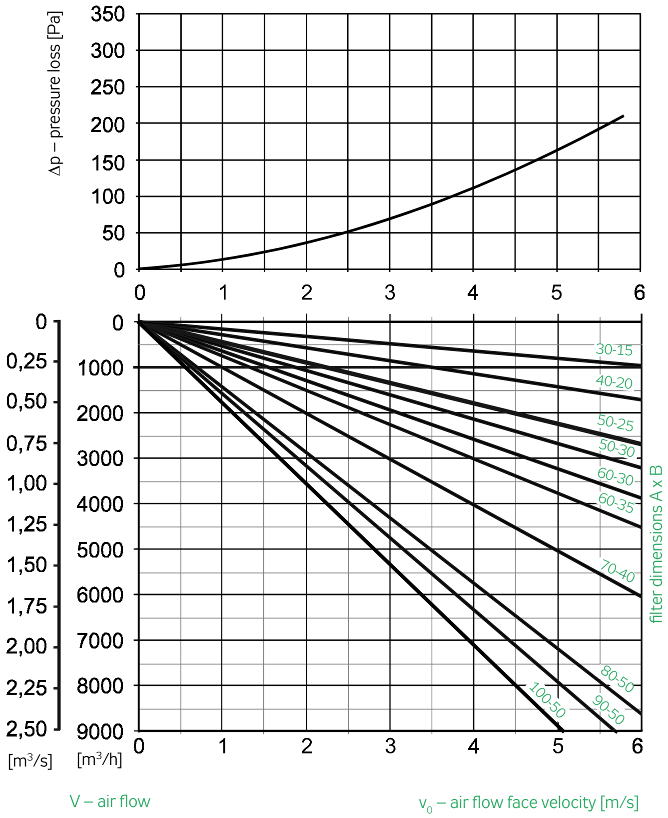


TABLE 1

Filter type VF3		30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50	100-50
A-B dimensions	[cm]	29,5-14,5	39,5-19,5	49,5-24,5	49,5-29,5	59,5-29,5	59,5-34,5	69,5-39,5	79,5-49,5	89,5-49,5	99,5-49,5
Mean rate of synthetic dust separation A_m	[%]	80 - 85									
Filtration area	[m²]	0,07	0,11	0,21	0,25	0,33	0,4	0,6	0,86	1	1,17
Weight	[kg]	2	2	2,5	3	3	3	4	4	5	5,5
Rated (nominal) air flow	[m³/h]	380	600	1130	1350	1780	2160	3240	4640	5400	6000
Initial pressure loss	[Pa]	48	39	52	52	60	64	77	78	82	78
Koncová pressure loss	[Pa]	250									
Holding capacity	[g]	28	44	84	100	132	160	240	344	400	468
Recoverability	[-]	Limited via a wet process (impaired filter properties can be expected)									

APPLICATION

The grease filter is fitted:
- metal filter element (Filtration class **ISO Coarse 50 %**)
- tray for capturing separated waste particles (fats, oils).
The tray can be pulled out and cleaned.
The metal filter element (insert) is used to capture grease and oil aerosols on the exhaust from bakeries, kitchens, grills, etc. or as a prefilter to capture high concentrations of the coarsest dust particles in industry (foundries, smelters). It is also recommended to apply filter elements in tropical and desert areas to trap coarse floating particles. After removing the filter elements, they can be washed with hot water (Thermal resistance of the cell is up to 200 º C) with the addition of detergent. Possibly, a highly soiled (or damaged) metal filter element can be replaced with a spare one.

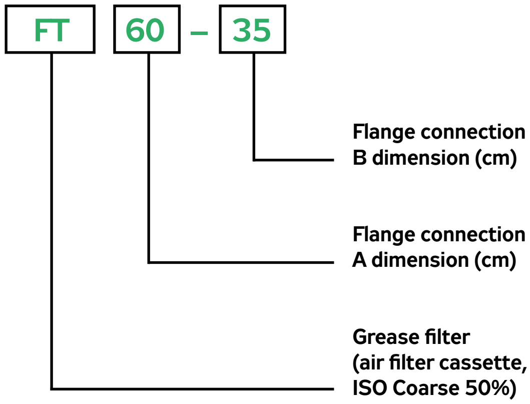
OPERATING CONDITIONS

The filter cassette is installed in the air duct at the beginning of the equipment assembly (always in front of the exchangers, recuperator, fan). The working position is horizontal. The permissible temperature range of the supplied air is -30 º C to +70 º C, the relative humidity is not limited (it can be up to 100%).
The removable control and service panel must be easily accessible. When installing in the ceiling, it is necessary to take into account the place for opening the service panel and replacing the filter insert. This service space is defined by dimension G in tabl.

DIMENSIONAL AND TYPE RANGE

FT grease filters are manufactured in size ranges from 40-20 to 100-50.

FIGURE 1 – TYPE DESIGNATION



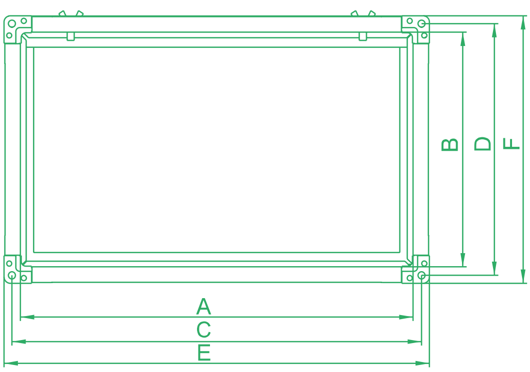
MATERIALS

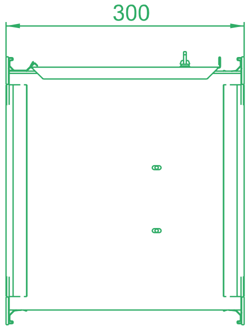
The outer casing, collecting tray and connecting flanges are made of galvanized sheet metal. Rail connection flanges have a height of 20 mm (FT 40-20 to FT 80-50) or a height of 30 mm (FT 90-50 and FT 100-50). Perfect sealing of the filter element frame and the service panel is secured with a rubber seal.
The metal filter element (insert) has an aluminum frame and an aluminum filter mesh.

ACCESSORIES

The recommended accessories are:
→ **P33N:** differential pressure sensor

FIGURE 1





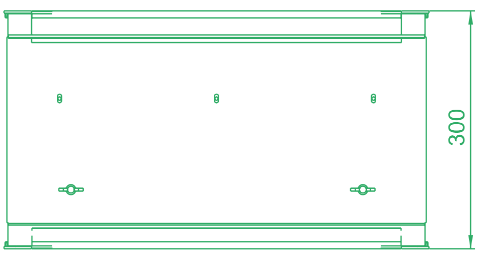
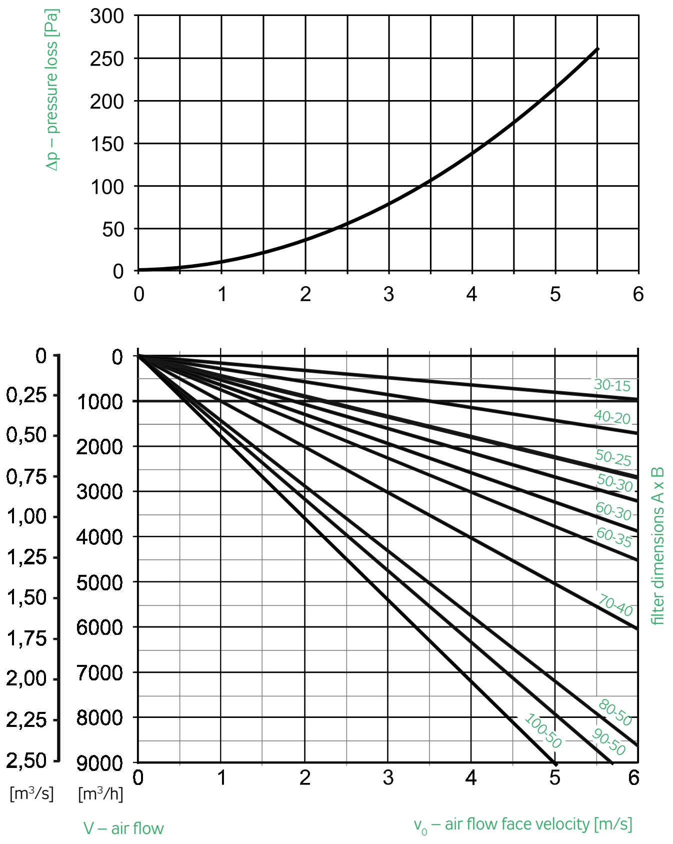


FIGURE 2

TABLE 1

Filter type/ Size (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	m ±10% (mm)
FT 30-15	300	150	320	170	340	190	4.1
FT 40-20	400	200	420	220	440	240	6.1
FT 50-25	500	250	520	270	540	290	7.1
FT 50-30	500	300	520	320	540	340	7.6
FT 60-30	600	300	620	320	640	340	8.6
FT 60-35	600	350	620	370	640	390	8.6
FT 70-40	700	400	720	420	740	440	11.2
FT 80-50	800	500	820	520	840	540	12.9
FT 90-50	900	500	930	530	960	560	15.9
FT 100-50	1000	500	1030	530	1060	560	18.9

GRAPH 1 – AIR PRESSURE LOSS OF CLEAN VFT FILTERS



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

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.

FIGURE 1

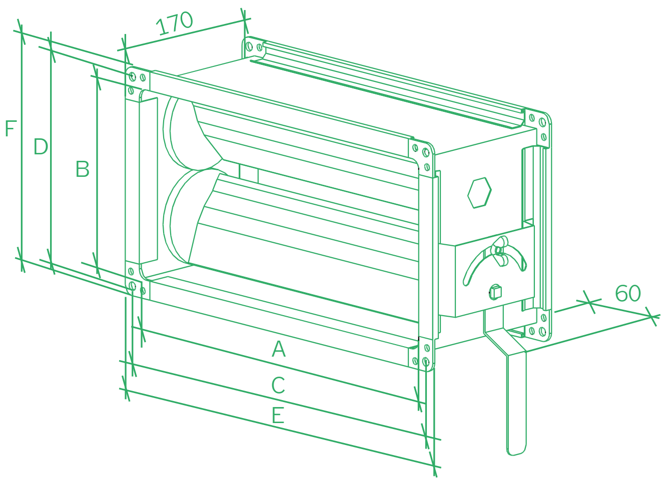
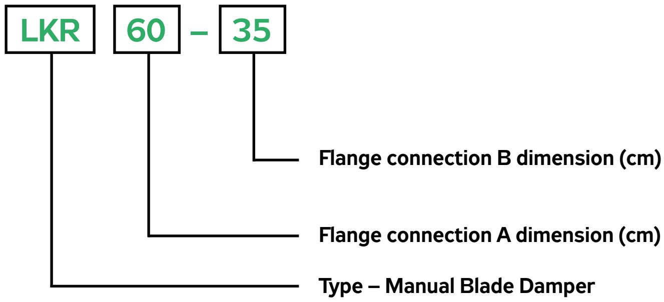


TABLE 1

Type/Size (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	m ±10% (mm)	graph (curve)
LKR 30-15	300	150	320	170	340	190	4	❶
LKR 40-20	400	200	420	220	440	240	4	❶
LKR 50-25	500	250	520	270	540	290	5	❷
LKR 50-30	500	300	520	320	540	340	6	❶
LKR 60-30	600	300	620	320	640	340	7	❶
LKR 60-35	600	350	620	370	640	390	7	❷
LKR 70-40	700	400	720	420	740	440	8	❶
LKR 80-50	800	500	820	520	840	540	10	❶
LKR 90-50	900	500	930	530	960	560	11	❶
LKR 100-50	1000	500	1030	530	1060	560	13	❶

FIGURE 2 – TYPE DESIGNATION



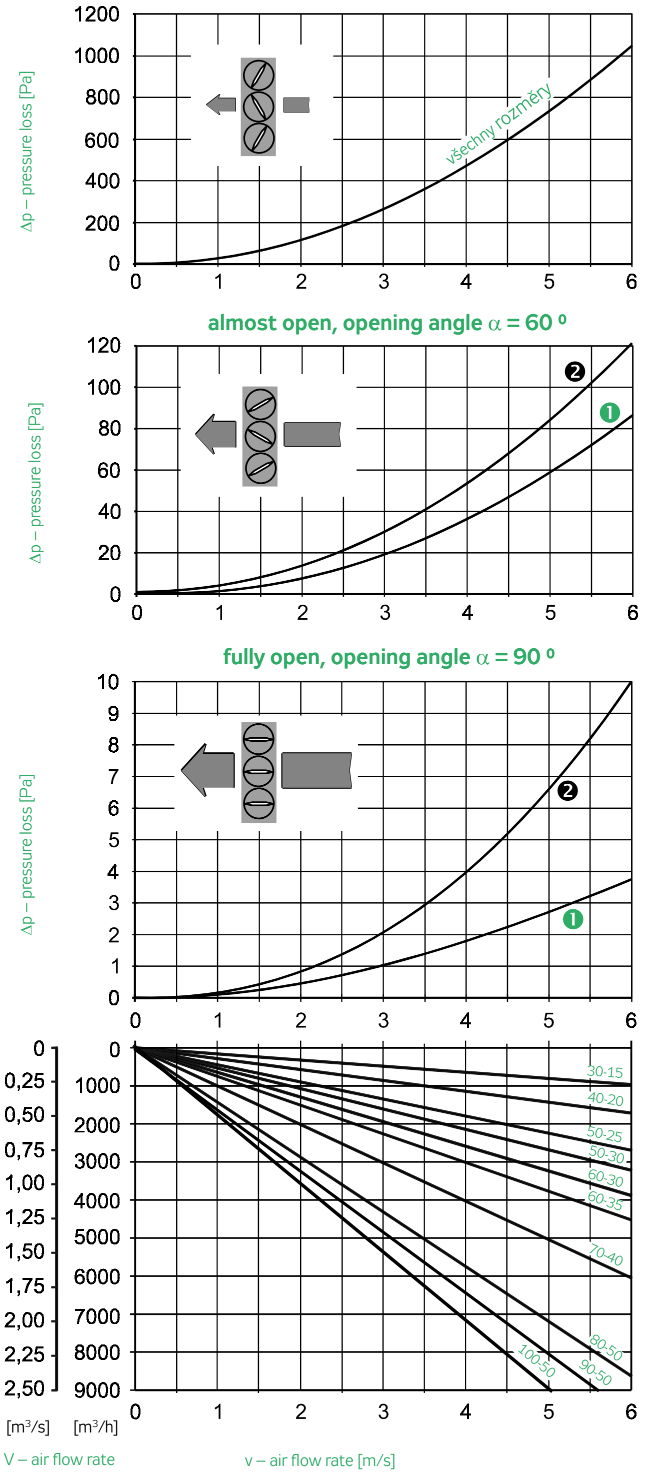
MATERIALS AND DESIGN

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 tooth-wheels seated in the bearings, which are also made of plastic.

FIGURE 3 – LKR BLADE DAMPER EQUIPPED WITH A HAND LEVER AND A MECHANICAL POSITION ARRESTING DEVICE

[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.

GRAPH 1 – PRESSURE LOSS OF LKR, LKS, LKSX, LKSF BLADE DAMPERS



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

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 ºC to +50 ºC. Pressure loss-air flow rate-blade opening angle correlation is shown in the graph "Blade damper pressure losses", see page 289.

DIMENSIONAL AND TYPE RANGE

These blade dampers are manufactured in ten Vento dimensional ranges, refer to the table.

FIGURE 1

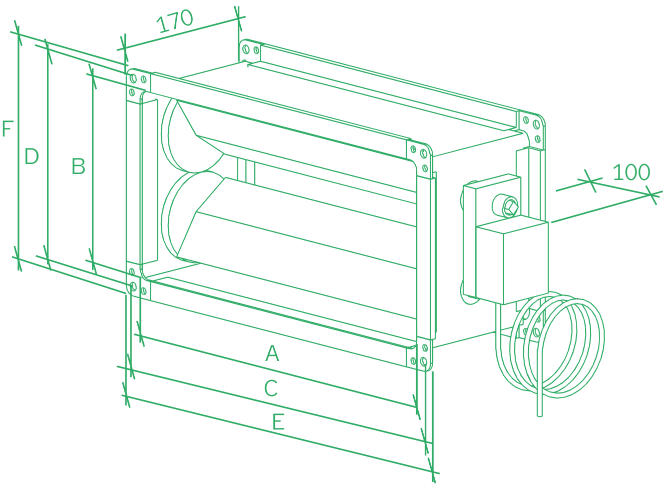
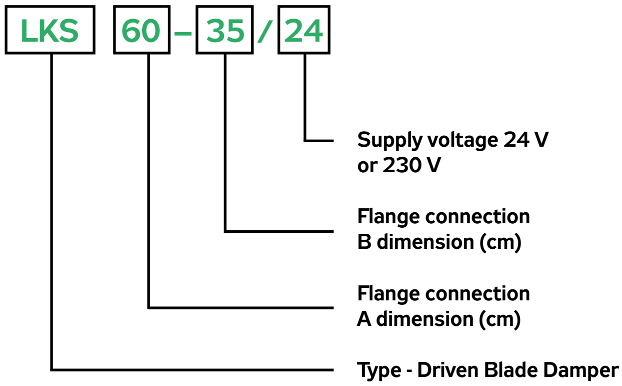


TABLE 1

Type/Size (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	m ±10% (mm)	graph (curve)
LKS 30-15/..	300	150	320	170	340	170	5	❶
LKS 40-20/..	400	200	420	220	440	220	5	①
LKS 50-25/..	500	250	520	270	540	270	6	❷
LKS 50-30/..	500	300	520	320	540	320	7	①
LKS 60-30/..	600	300	620	320	640	320	8	❶
LKS 60-35/..	600	350	620	370	640	370	8	②
LKS 70-40/..	700	400	720	420	740	420	9	❶
LKS 80-50/..	800	500	820	520	840	520	11	①
LKS 90-50 /..	900	500	930	530	960	530	12	❶
LKS 100-50/..	1000	500	1030	530	1060	530	14	①

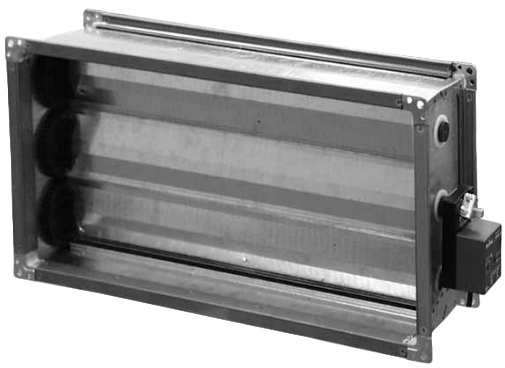
FIGURE 2 – TYPE DESIGNATION



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.

FIGURE 3 – KLAPKA LKS SE ACTUATOREM



[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.

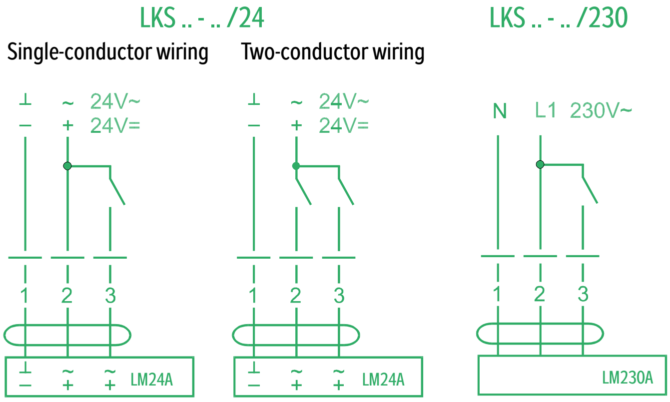
ACTUATOR

LKS blade damper is equipped with an LM 24 actuator (voltage 24 V) or an LM 230 actuator (voltage 230 V).
The control is two-position using single or two-wire control. Manual adjustment is performed using the release button (the transmission is deactivated as long as the button is pressed). When the button is released, the actuator returns to the home position. The working angle can be defined by mechanical stops. The actuator has overload protection, no limit switches (remains automatically on the stop)..

INSTALLATION

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 connection is made via the wiring box, the actuator is equipped with a cable 3x 0.75 mm2 1 m long.
If the damper is installed in such a way that people or objects could come into contact with the closing damper blades or rotating gears, a protective grille must be fitted.

FIGURE 4 – WIRING DIAGRAM OF DAMPER ACTUATORS



TECHNICAL DATA - LM 24A AND LM 230A ACTUATORS

power supply voltage	**LM 24A**: 24 V~ ±20%, 50/60 Hz nebo 24 V=, ± 20%
	LM 230A: 230 V~, 50/60 Hz), ± 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. 95º (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	IP 54

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

LKSX blade dampers are designed for indoor and outdoor use [1] 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 ºC to +50 ºC. 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.

FIGURE 1

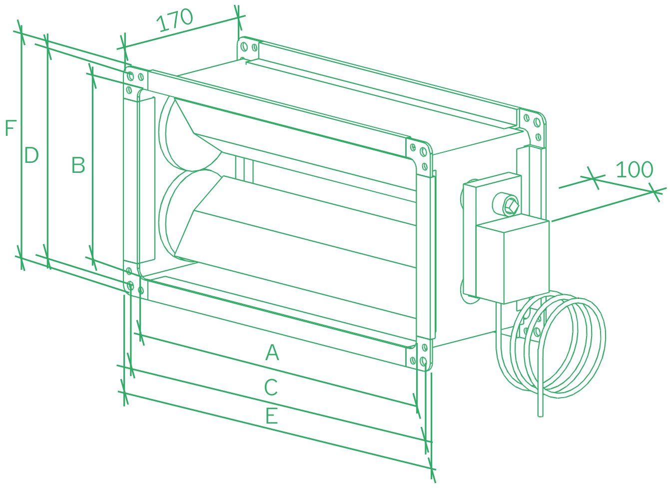
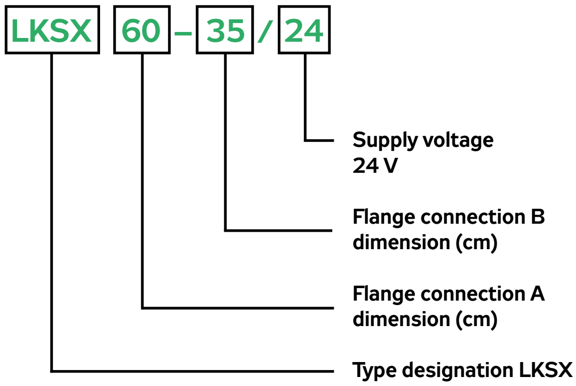


TABLE 1

Type/Size (mm)	A	B	C	D	E	F	m ±10%	graph
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(curve)
LKSX 30-15/24	300	150	320	170	340	190	5	❶
LKSX 40-20/24	400	200	420	220	440	240	5	❶
LKSX 50-25/24	500	250	520	270	540	290	6	❷
LKSX 50-30/24	500	300	520	320	540	340	7	❶
LKSX 60-30/24	600	300	620	320	640	340	8	❶
LKSX 60-35/24	600	350	620	370	640	390	8	❷
LKSX 70-40/24	700	400	720	420	740	440	9	❶
LKSX 80-50/24	800	500	820	520	840	540	11	❶
LKSX 90-50/24	900	500	930	530	960	560	12	❶
LKSX 100-50/24	1000	500	1030	530	1060	560	14	❶

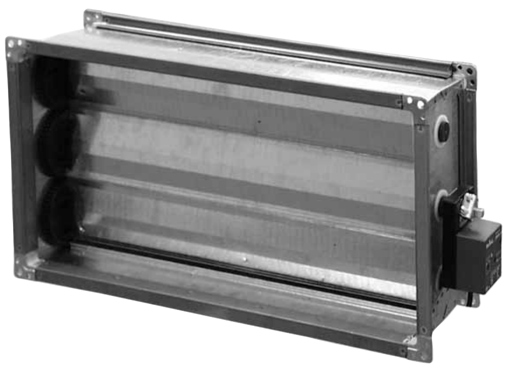
FIGURE 2 – TYPE DESIGNATION



MATERIALS AND DESIGN

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.

FIGURE 3 – LKSX BLADE DAMPER



[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.

ACTUATOR

The LKSX damper is equipped with an LM 24X actuator as standard (details in the table).
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

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.
If the damper is installed in such a way that people or objects could come into contact with the closing damper blades or rotating gears, a protective grille must be fitted.

FIGURE 4 – DAMPER ACTUATOR WIRING DIAGRAM

LKSX ..-.. /24

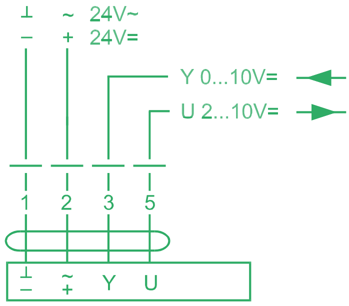


TABLE 2 – TECHNICAL DATA - LM 24A-SR ACTUATOR

power supply voltage	24 V~ ±20%, 50/60 Hz, 24 V= ±10%
dimensioning, input power	2 VA, 1 W
řídící signál Y	0...10 V=, input impedance 100 kΩ
pracovní rozsah	2...10V= (for the set working angle)
měřící napětí U	2...10 V=, ≤ 0,5 mA (for the set working angle)
směr otáčení	can be selected by the left/right (L/R) selector
manual adjustment	sing the button, automatic return to the default position
torque	min. 5 Nm (at the rated voltage)
working angle	max. 95º (adjustable by the potentiometer within the range 20...100%)
adjustment time	35 s
noise level	max. 35dB (A)
position indicator	mechanical
protection class	III (low voltage)
degree of protection	IP54

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

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 ºC to +50 ºC. Pressure loss - air flow rate - blade opening angle correlation is shown in the graph "Blade damper pressure losses".

DIMENSIONAL AND TYPE RANGE

Klapky se vyrábí v deseti rozměrových řadách systému Vento according to tabulky.

FIGURE 1

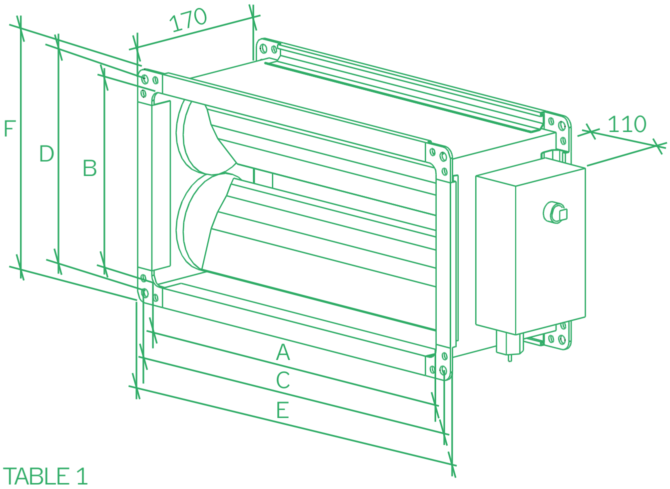
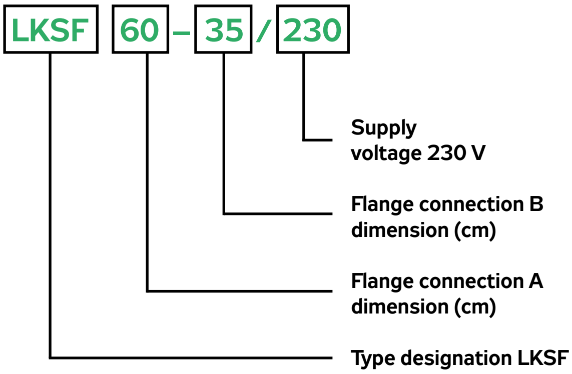


TABLE 1

Type/Size (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	m ±10% (mm)	graph (curve)
LKSF 30-15/230	300	150	320	170	340	190	6	➊
LKSF 40-20/230	400	200	420	220	440	240	6	➊
LKSF 50-25/230	500	250	520	270	540	290	7	➋
LKSF 50-30/230	500	300	520	320	540	340	8	➊
LKSF 60-30/230	600	300	620	320	640	340	9	➊
LKSF 60-35/230	600	350	620	370	640	390	9	➋
LKSF 70-40/230	700	400	720	420	740	440	10	➊
LKSF 80-50/230	800	500	820	520	840	540	12	➊
LKSF 90-50/230	900	500	930	530	960	560	13	➊
LKSF 100-50/230	1000	500	1030	530	1060	560	15	➊

FIGURE 2 – TYPE DESIGNATION



MATERIALS

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.

FIGURE 3 – 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.

ACTUATOR

LKSF driven blade damper is equipped with an LF 230 actuator with return spring as standard (details in the table)..
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

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.
If the damper is installed in such a way that people or objects could come into contact with the closing damper blades or rotating gears, a protective grille must be fitted.

FIGURE 4 – DAMPER ACTUATOR WIRING DIAGRAM

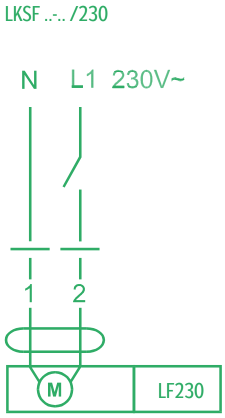


TABLE 2 – DAMPER ACTUATOR TECHNICAL DATA

power supply voltage	230V~ ±15%, 50/60Hz
dimensioning	7 VA (I_{max} 150 mA, t=10 ms)
input power	5 W when taking up the spring
	4W resting position
směr otáčení	optional left/right installation
torque	min. 4Nm (at the rated voltage)
working angle	max. 95º (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

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 hanaccording tod by an actuator controlled by the control unit. Two parallel dampers in the SKX section can also ensure the closing function.

OPERATING CONDITIONS

Mixing sections are designed for indoor and outdoor1) 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 ºC to +50 ºC. 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.

FIGURE 1

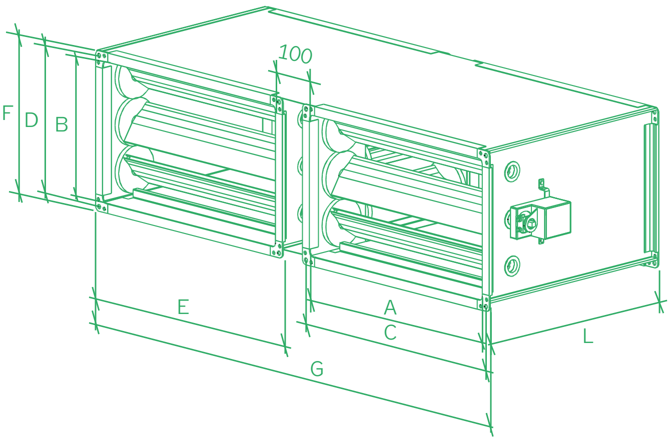
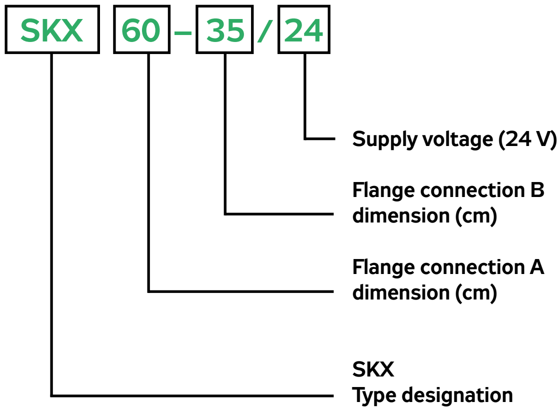


TABLE 1

Type/Size (mm)	A	B	C	D	E	F	G	L	m ±10%	graph
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(curve)
SKX 40-20/24	400	200	420	220	1010	240	940	390	19	❷ ➀
SKX 50-25/24	500	250	520	270	1200	290	1140	440	25	❷ ➁
SKX 50-30/24	500	300	520	320	1210	340	1140	490	33	❶ ➀
SKX 60-30/24	600	300	620	320	1400	340	1340	490	36	❷ ➀
SKX 60-35/24	600	350	620	370	1430	390	1340	540	41	❷ ➁
SKX 70-40/24	700	400	720	420	1610	440	1540	590	45	❶ ➀
SKX 80-50/24	800	500	820	520	1800	560	1740	690	56	❶ ➀
SKX 90-50/24	900	500	930	530	2000	590	1960	790	68	❶ ➀

FIGURE 2 – TYPE DESIGNATION

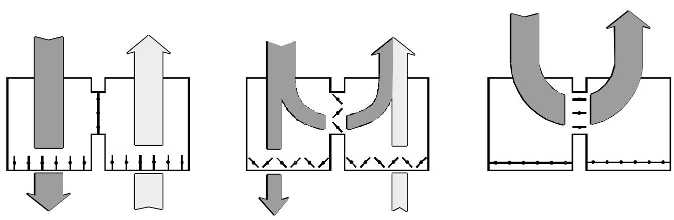


MATERIALS

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.

FIGURE 3 – SKX AIR MIXING SECTION EQUIPPED WITH ACTUATOR

FIGURE 4 – FUNCTION OF SKX MIXING SECTIONS



100 % fresh air

approx. 50 % fresh air

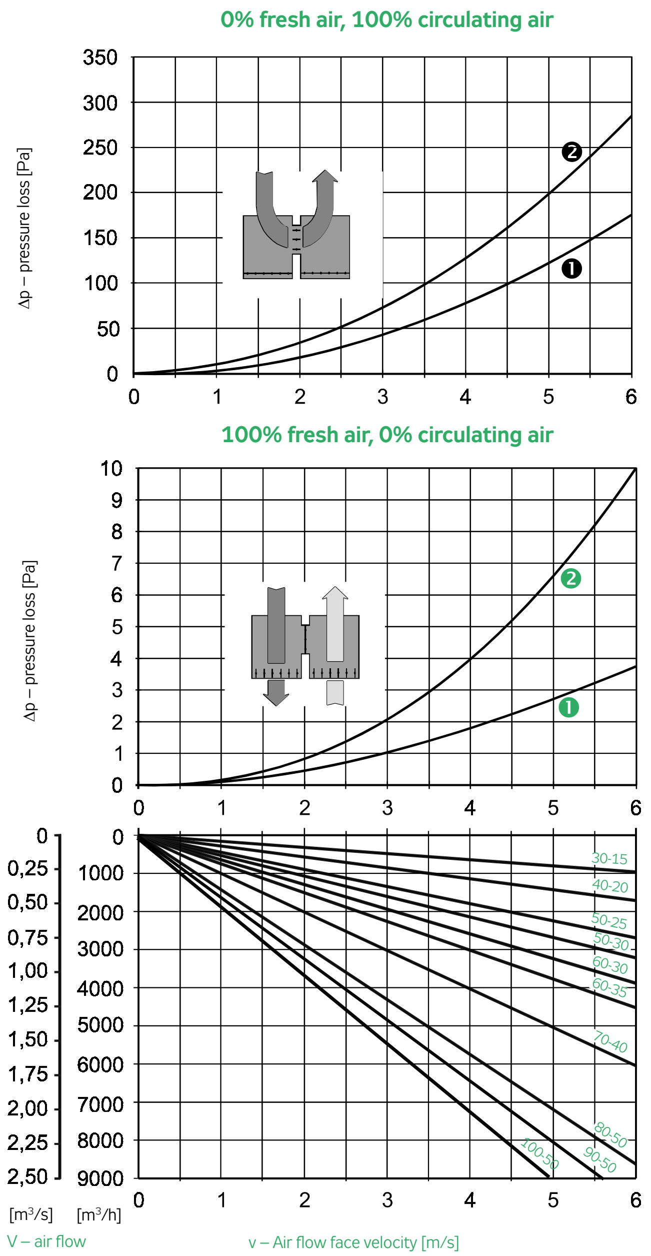
0 % fresh air

[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.

ACTUATOR

SKX Mixing Section is equipped with an Actuator NM 24A-SR as standard.
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.

GRAPH 1 – SKX MIXING SECTION PRESSURE LOSS CHART



INSTALLATION

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 midaccording to 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.
If the damper is installed in such a way that people or objects could come into contact with the closing damper blades or rotating gears, a protective grille must be fitted.

FIGURE 5 – ACTUATOR WIRING DIAGRAM

SKX ..-.. /24

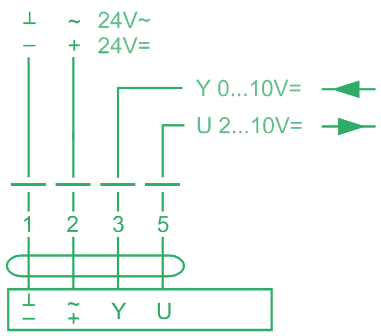


TABLE 2 – NM 24A-SR DATA ACTUATOR TECHNICAL DATA

power supply voltage	24 V~ ±20%, 50/60 Hz, 24 V= ±10%
dimensioning, input power	4 VA, 2 W
control signal Y	0...10 V=, input impedance 100 kΩ
working range	2...10 V= (for the set working angle)
measuring voltage signal U	2...10 V=, max 1 mA (for the set working angle)
direction of rotation	can be selected by the left/right (L/R) selector
manual adjustment	sing the button, automatic return to the default position
torque	min. 10 Nm (at the rated voltage)
working angle	max. 95º (adjustable by mechanical stops)
adjustment time	150 s
noise level	max. 35 dB (A)
position indicator	mechanical, clap-on type
protection class	III (low voltage)
degree of protection	IP 54

RECOMMENDED CONNECTIONS OF LKS(F), LKSX, SKX MIXING SECTIONS IN VENTO SYSTEM ASSEMBLIES

FIGURE 6A

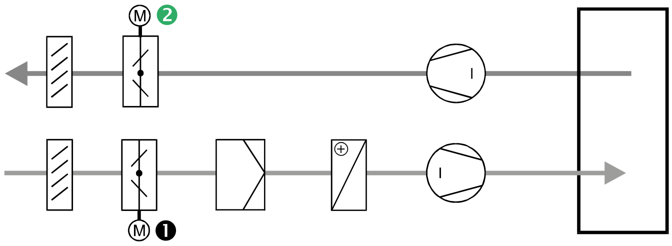


Figure A shows an air-handling system equipped with an inlet ❶ and an outlet ❷ damper. **LKS ..-.. /24** (or **LKS ..-.. /230**) mixing sections are mostly used in this or similar situations. If the air--handling assembly is equipped with a water heater, it is recommended to use the **LKSF ..-.. /230** 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 6B

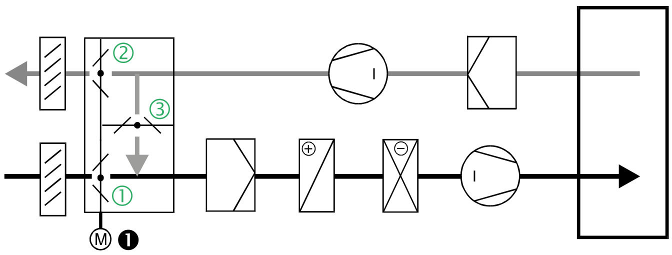


Figure B shows an air-handling system with air mixing using the **SKX ..-.. /24** air mixing section ❶. This section is consistently equipped with three integrated dampers from which dampers ①②, also provide inlet and outlet closing functions. The contra--rotating damper ③ is a mixing damper. If the 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 6C

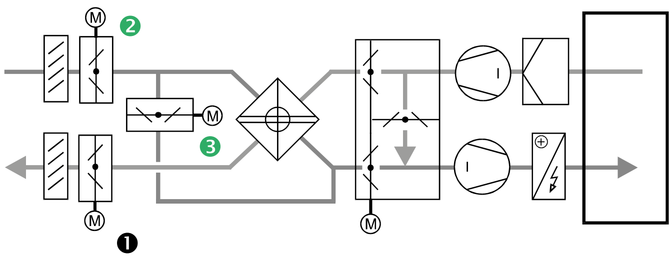


Figure C shows an air-handling system with a heat exchanger and an air mixing section. If a heat exchanger is used in the assembly, it is possible to use the SKX air mixing section; however, air mixing must be situated between the heat exchanger and the room. In this case, the fans cannot be situated 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.

ACCESSORIES TKU SPLITTER ATTENUATORS

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

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 ºC to +70 ºC. 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.

FIGURE 1

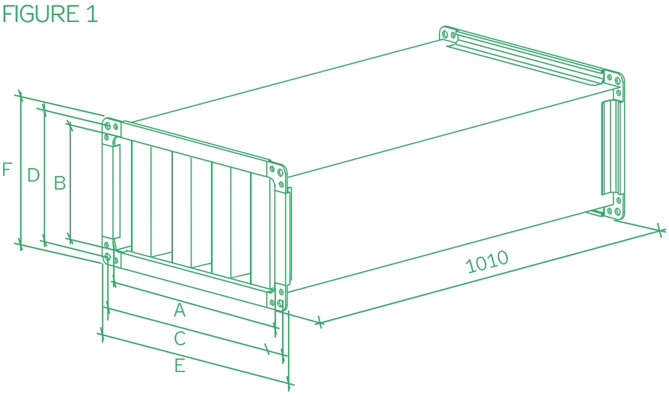
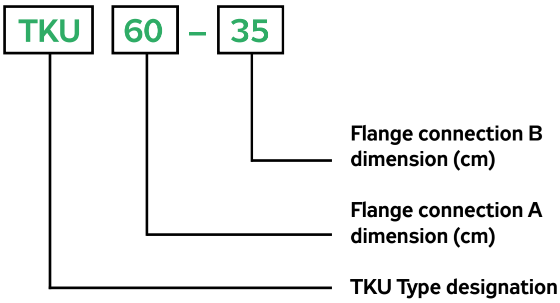


TABLE 1

Type/Size (mm)	A	B	C	D	E	F	m ±10%	graph
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(curve)
TKU 30-15	300	150	320	170	340	190	13	3
TKU 40-20	400	200	420	220	440	240	14	1
TKU 50-25	500	250	520	270	540	290	19	3
TKU 50-30	500	300	520	320	540	340	21	3
TKU 60-30	600	300	620	320	640	340	23	1
TKU 60-35	600	350	620	370	640	390	24	1
TKU 70-40	700	400	720	420	740	440	31	2
TKU 80-50	800	500	820	520	840	540	40	1
TKU 90-50	900	500	930	530	960	560	44	2
TKU 100-50	1000	500	1030	530	1060	560	50	1

FIGURE 2 – TYPE DESIGNATION

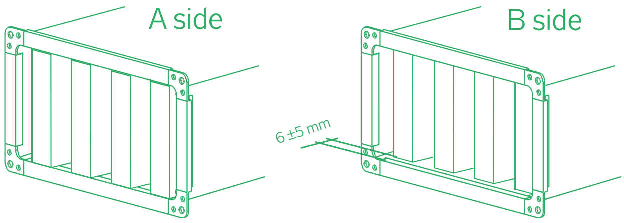


The interconnection must be performed using a 500mm-long transition piece.

MATERIALS

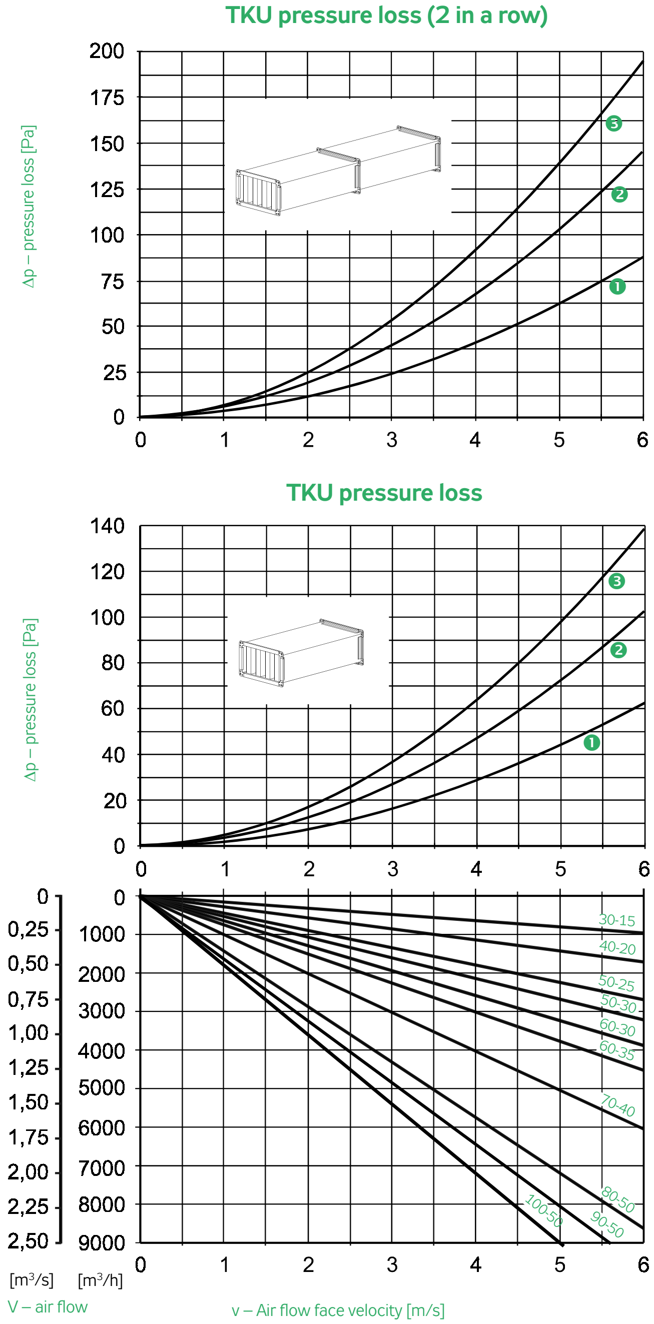
The attenuator consists of the casing and hard installed splitters. The external casing is made of galvanized steel sheets (Zn 275 g/m2) reinforced by "Z" profiles. The splitters are created by the profiled frame, made of galvanized steel sheets and non-combustible sound-absorbing lining. The splitters are mould-resistant and impregnated with water-repellent coating. The splitter surface is backed with a special glass textile. The material complies with A2--s1,d0 Combustibility Class (non-combustible) in accordance with the DIN EN 13501-1 standard.

FIGURE 3 – ALIGNMENT OF ATTENUATORS, WHEN CONNECTED TOGETHER

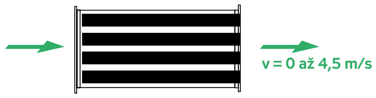


If two successive attenuators are installed in series, they must be interconnected by the A sides (i.e. A-A connection), where the faces of the splitters match with the flange edge. If incorrectly connected (B-B, A-B, or B-A), the splitters do not bear on each other, and do not create continuous 2m-long splitters.

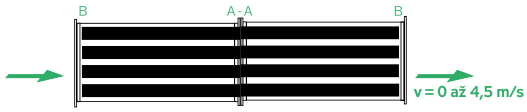
GRAPH 1 – TKU PRESSURE LOSS



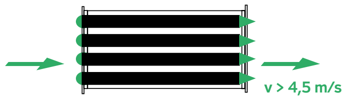
EXAMPLES OF ATTENUATOR ARRANGEMENTS AND INSTALLATION OF LEADING SHEETS



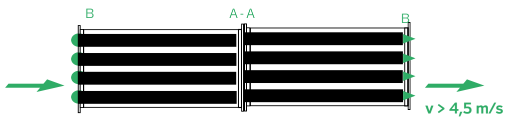
One standard attenuator, total effective length 1 m; installation of leading sheets is not recommended for air flow velocities below 4 m/s.



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.

RP
RQ
RO
RE
RF
RPH
EX
TR..
EO..
VO
SUMX
CHV
CHF
HRV
HRZ
PRI

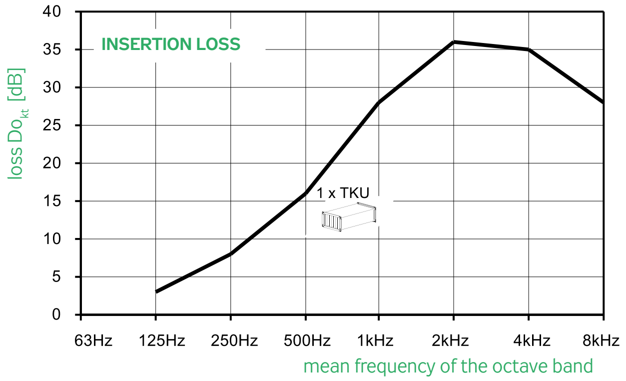
OPERATING CHARACTERISTICS

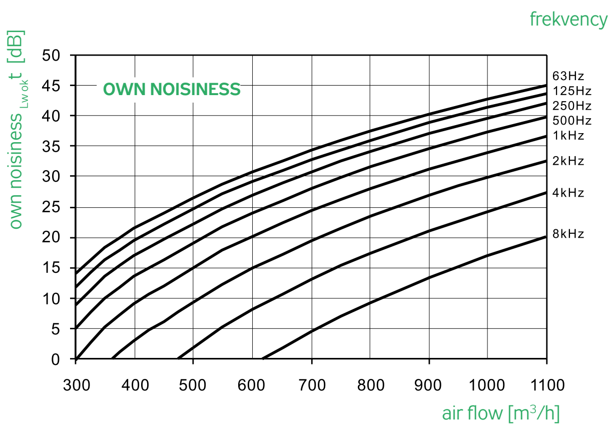
Absorbent TKU splitter attenuators feature excellent attenuation characteristics within the frequency range 500 to 4,000 Hz. Graphs contain the noise attenuation (insertion loss) of attenuators and their own noisiness. Insertion loss is a reduction of sound coming through the duct after the attenuator 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.

INSERTION LOSSES OF ATTENUATORS

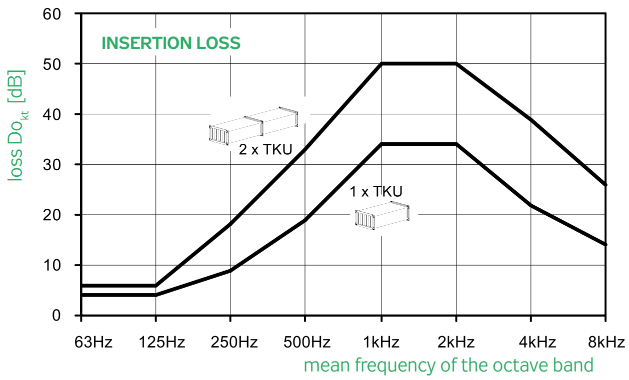
OWN NOISINESS OF ATTENUATORS

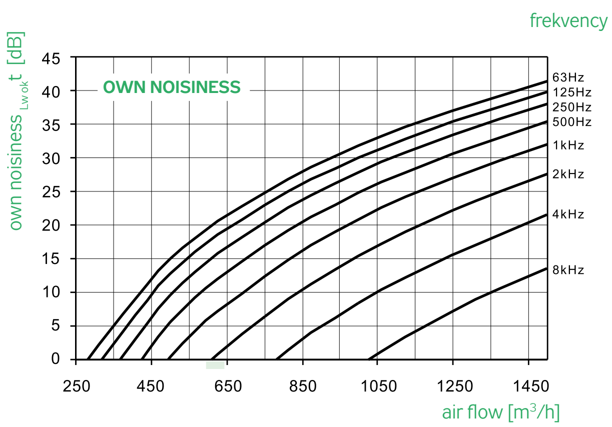
TKU 30-15



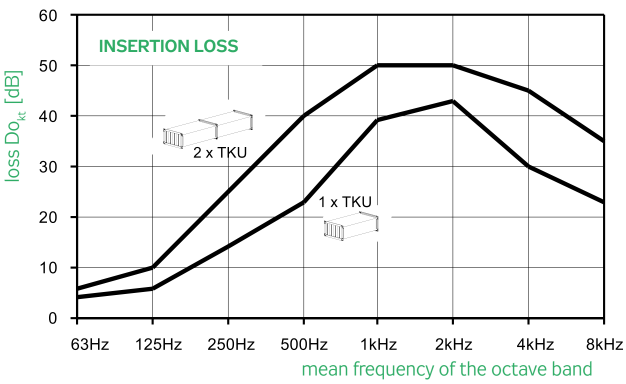


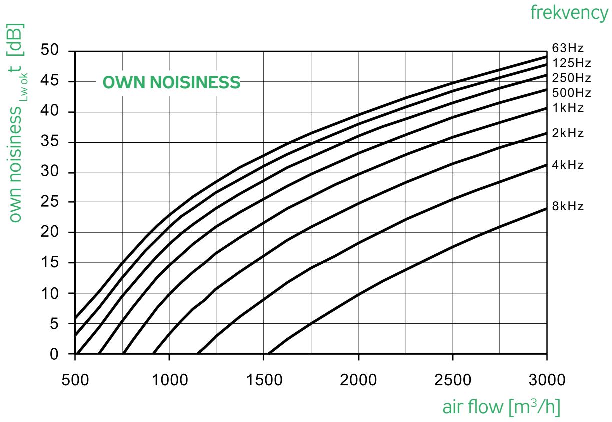
TKU 40-20



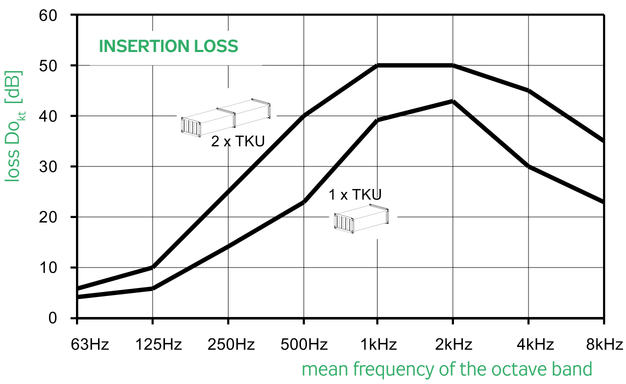


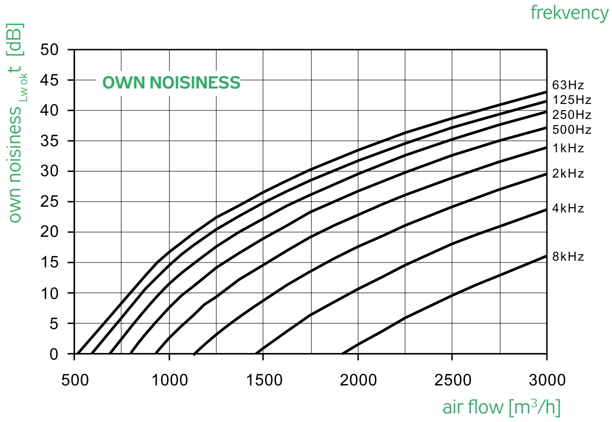
TKU 50-25



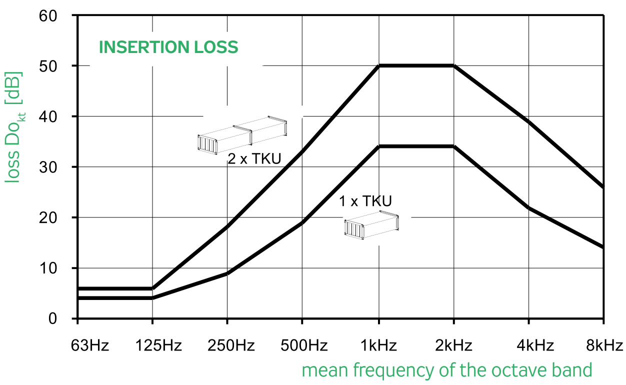


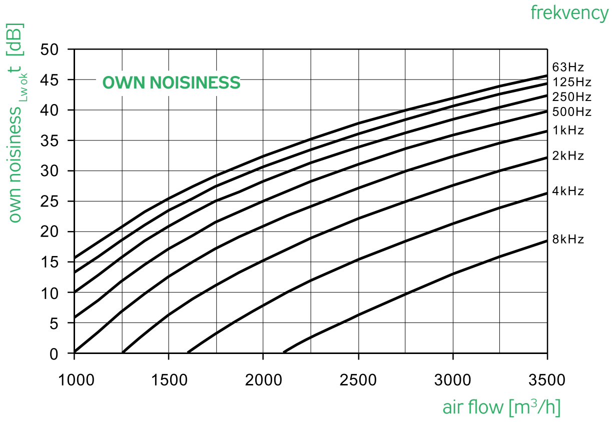
TKU 50-30



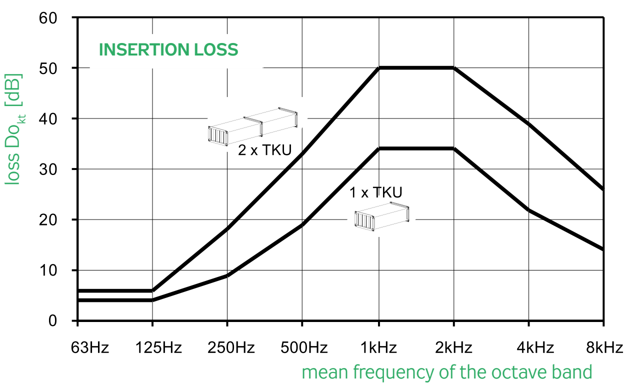


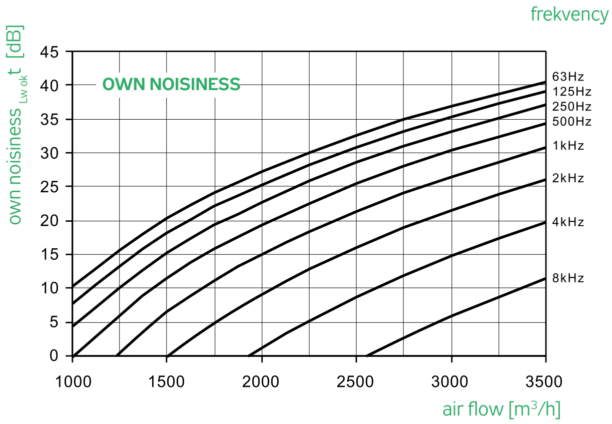
TKU 60-30





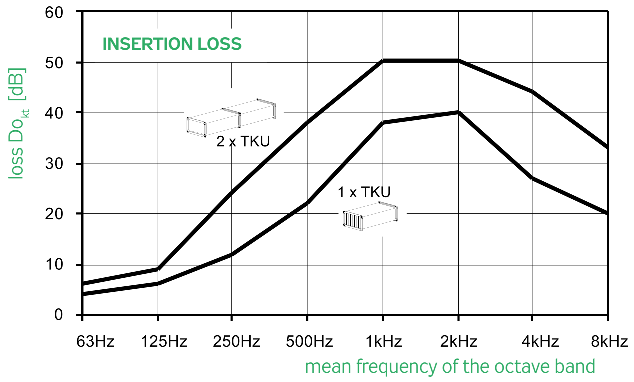
TKU 60-35

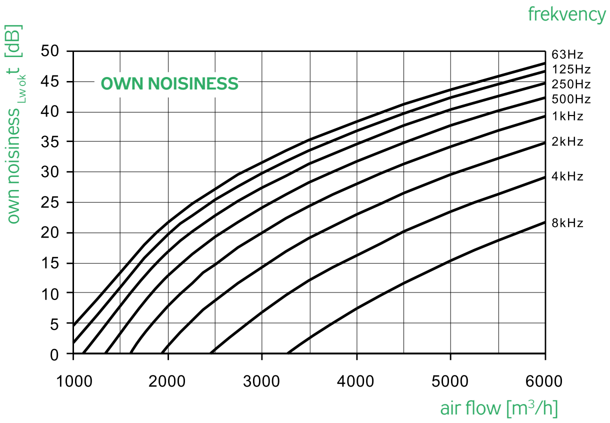




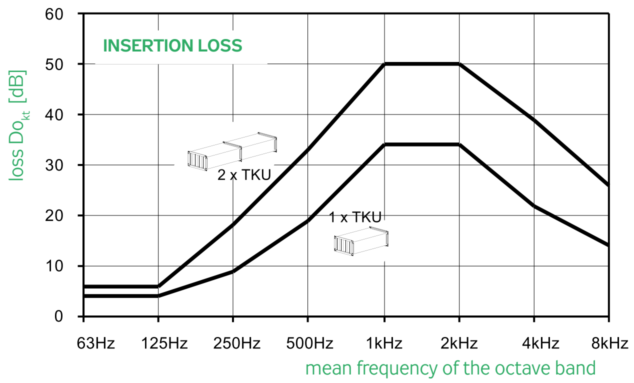
ACCESSORIES TKU SPLITTER ATTENUATORS

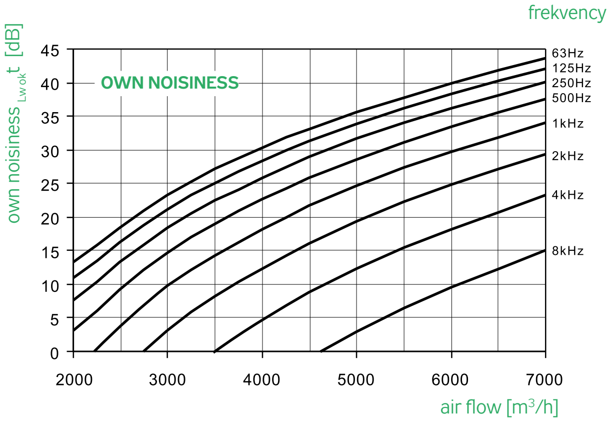
TKU 70-40



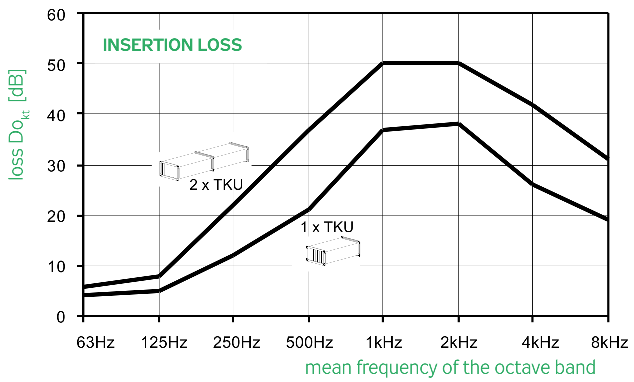


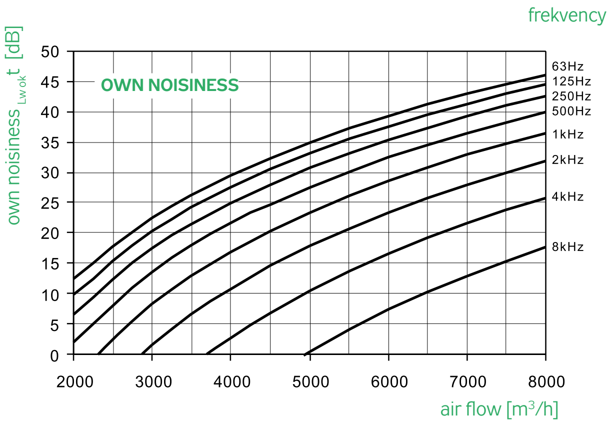
TKU 80-50



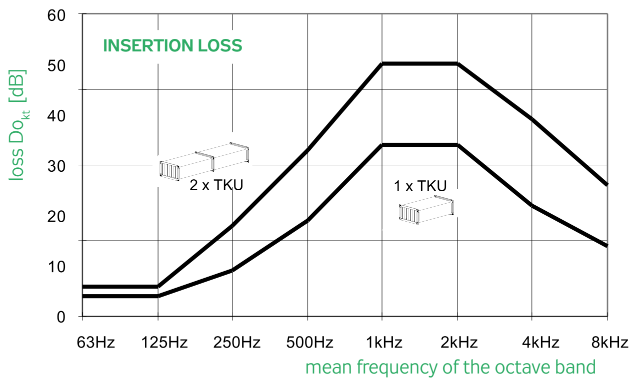


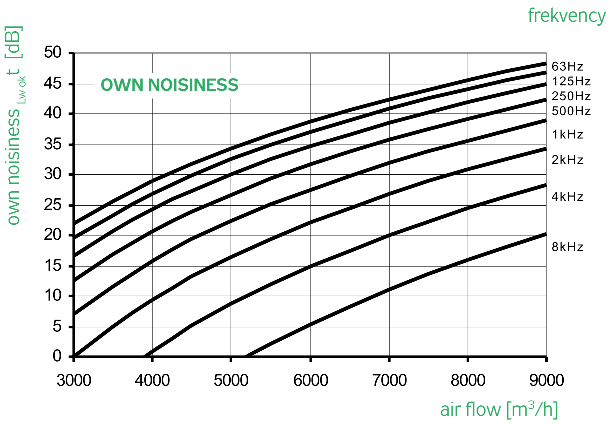
TKU 90-50





TKU 100-50





APPLICATION

VLH chambers and steam humidifiers are designed for installation in indoor environments, for humidifying air that must not contain chemicals that corrode or decompose zinc or solid impurities (dust, etc.).

OPERATING CONDITIONS

The position of the VLH chamber must be horizontal to ensure the correct inclination of the steam distribution tube and condensate drainage. When installing in the pipework, it is advisable to first pre-mount the distribution tube on the VLH chamber to ensure its correct position according to the humidifier instructions and then install the VLH chamber into the ductwork, ensuring a horizontal position.

INSTALLATION

The VLH chamber has a lower part designed in the form of a removable tray for condensate collection, so it is necessary to provide service access and space to it and it is necessary to clean it during regular inspections, or to treat the damage to the galvanized sheet with a protective coating (settling impurities promote the formation of corrosion). The VLH condensate tray is equipped with a condensate drain outlet with a G ½" thread at the bottom, which must be fitted with a suitable drain with a siphon depending on the pressure conditions in the chamber (similarly to radiators and HRVs). The aggregate (steam generator and tubes) are supplied as separate items and their design is carried out in AeroCAD software. All information on installation, connection, operation and maintenance of the steam humidifier is provided in the separate documentation supplied with the humidifier.

FIGURE 1 – VISUALIZATION OF THE VLH HUMIDIFICATION CHAMBER

FIGURE 2 – ASSEMBLED CHAMBER AND CONDENSATE DRAINAGE

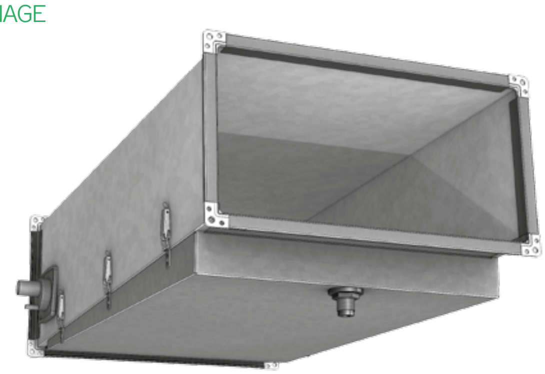


FIGURE 3 – INCLINATION AND CONNECTION OF THE DISTRIBUTION TUBE

connection of the supply hose

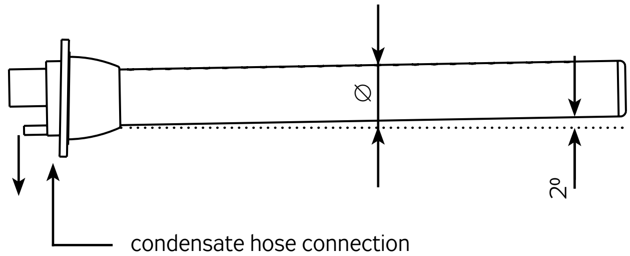
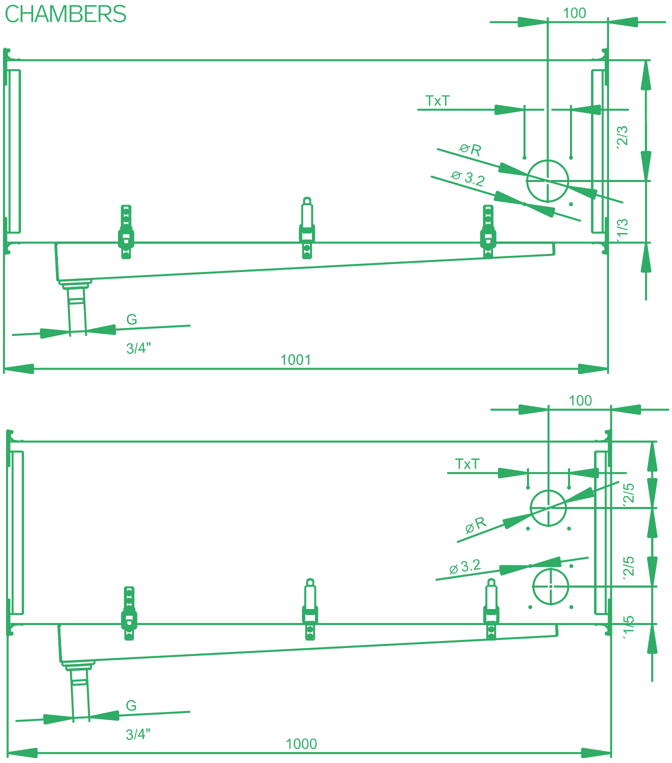


FIGURE 1 – DIMENSIONS OF THE HUMIDIFIER CHAMBERS



Note: The other connection dimensions are the same as the other Vento system components.

TABLE 1 – DIMENSIONS OF THE HUMIDIFIER CHAMBERS

Tube diameter (mm)	Code	Diameter R (mm)	T (mm)
22	A	58	68
30	B	68	77
40	C	90	99

ACCESSORIES 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.

DIMENSIONS AND WEIGHTS

EKP drop eliminators are available in eight sizes according to the AxB flange dimension. The air side connection is the same for the drop eliminators as for all other components of the Vento piping system. Drop eliminators allow designers to cover the full range of airflows of Vento system fans.
For important dimensions and weights of drop eliminators, refer to figure # 1 and table # 1. The connection of the drop eliminator depends on the selected dimensional range.

FIGURE 1 – DROP ELIMINATOR DIMENSIONS

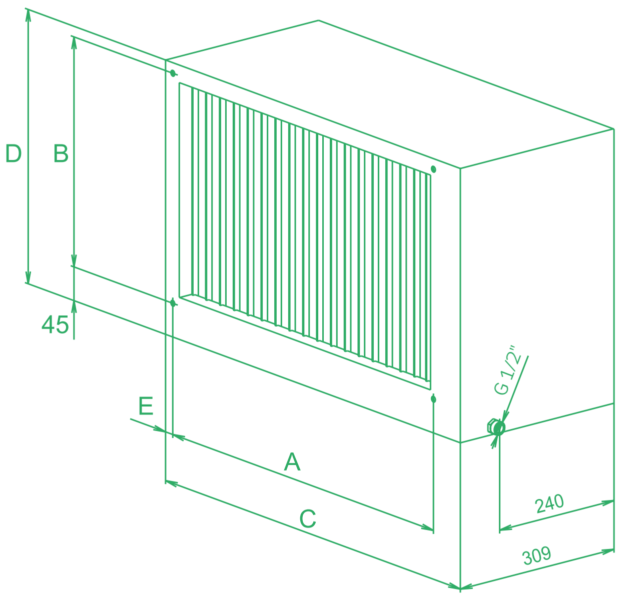


TABLE 1 – DROP ELIMINATOR DIMENSIONS

Type/Size (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
EKP 40-20	420	220	508	283	23
EKP 50-25	520	270	608	333	23
EKP 50-30	520	320	608	400	23
EKP 60-30	620	320	708	400	23
EKP 60-35	620	370	708	433	23
EKP 70-40	720	420	808	483	23
EKP 80-50	820	520	908	600	23
EKP 90-50	930	530	1014	600	28

FIGURE 2 – DESCRIPTION OF DROP ELIMINATOR COMPONENTS

❶ External casing, ❷ Drop eliminator,
❸ Condensate tray, ❹ Condensate Drainage

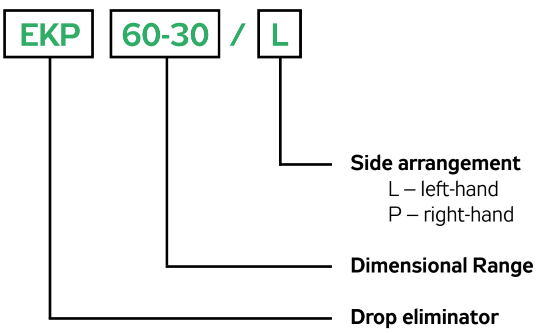
OPERATING CONDITIONS

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.

DROP ELIMINATOR DESIGNATION

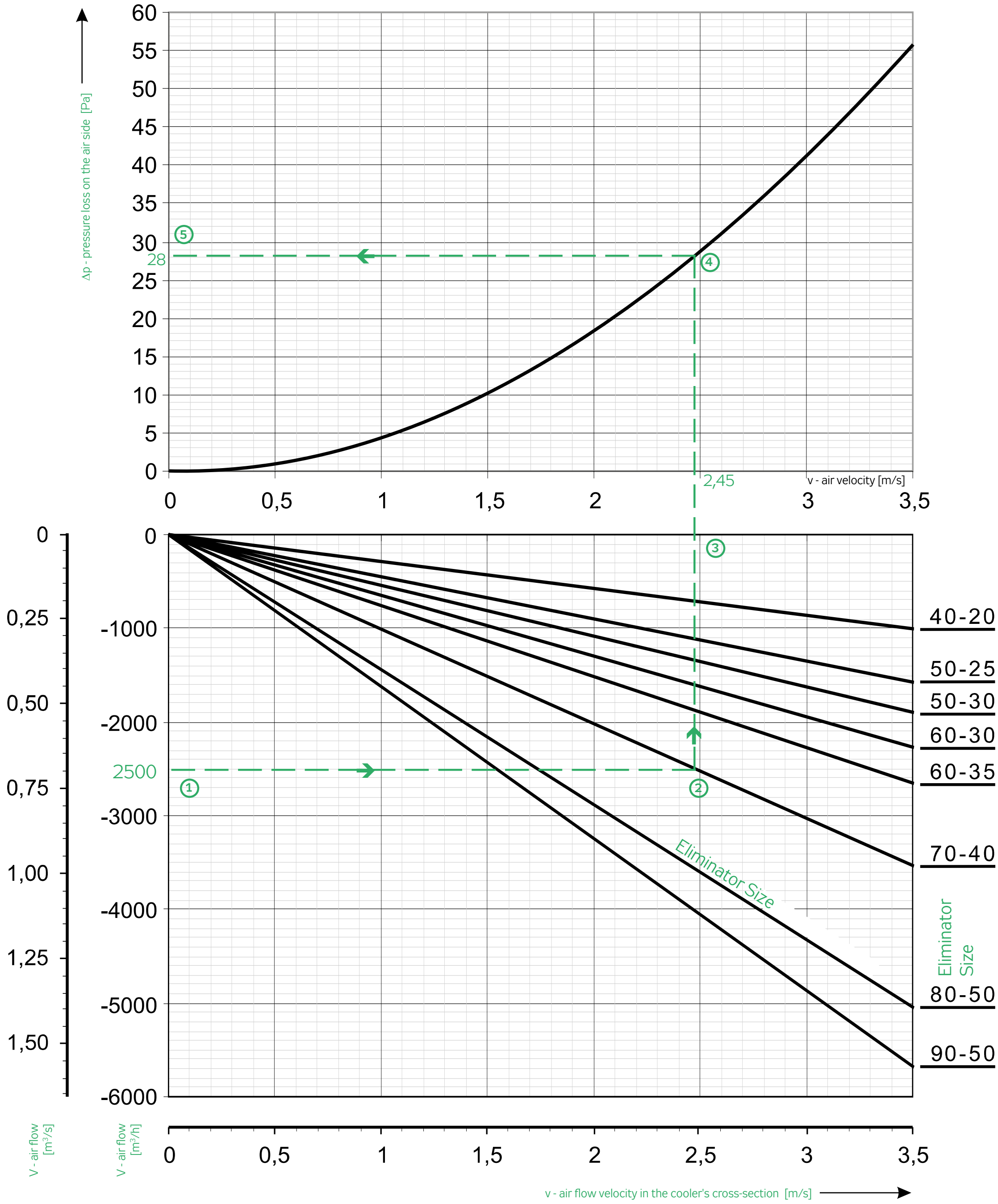
The type designation of coolers in projects and orders is defined by the key in figure # 3.
The above-mentioned specification without an ordering code corresponds to the stock configuration of the product, i.e. the left-hand arrangement. The drop eliminator is a configured product which should be preferably ordered using AeroCAD software, which will generate its ordering code.

FIGURE 3 – TYPE DESIGNATION



AIR PRESSURE LOSSES IN A DROP ELIMINATOR

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.

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).
- 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..
- The outer casing of the drop eliminators is made of galvanized sheet metal with insulation against moisture condensation.
- The EKP drop eliminators do not need to be mounted on separate hangers, they can be integrated into the pipe route. However, in no case must the droplet eliminator be subjected to stresses and especially torsion in the connected pipe route.
- Before installation, a self-adhesive seal is applied to the face of the eliminator flange. The mounting of the flanges of the individual parts of the Vento piping units is carried out with galvanised bolts and M8 nuts. The conductive connection must be ensured by fan washers on both sides at one flange joint or by connecting with a Cu wire.

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 304.
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.

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

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 ºC to +60 ºC. 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.

FIGURE 1

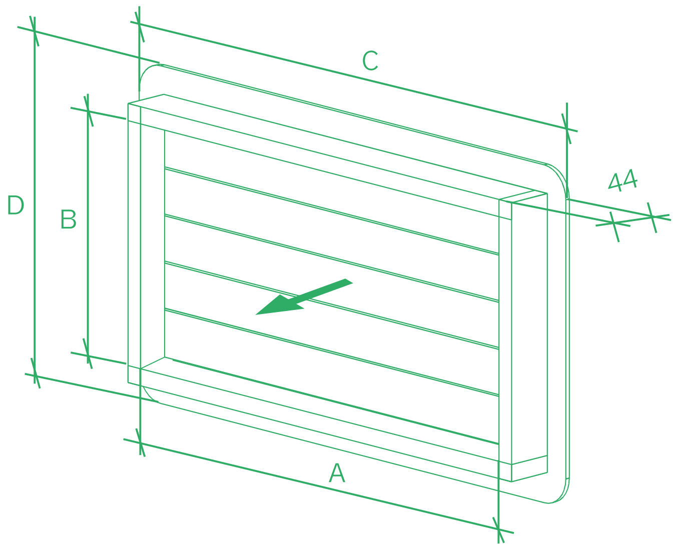
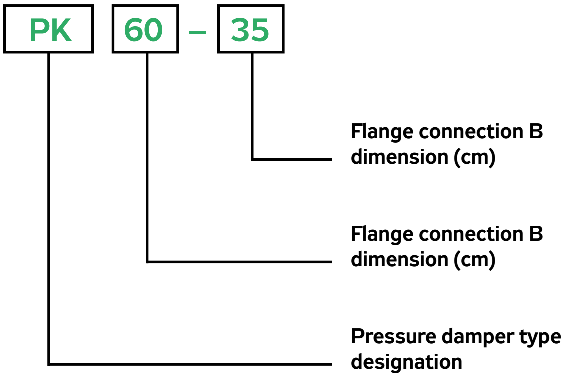


TABLE 1

Type/Size (mm)	A	B	C	D	m ±10%
	(mm)	(mm)	(mm)	(mm)	(mm)
LKSF 30-15	300	150	376	226	0,5
LKSF 40-20	400	200	476	276	1
LKSF 50-25	500	250	576	326	1
LKSF 50-30	500	300	576	376	1
LKSF 60-30	600	300	676	376	1
LKSF 60-35	600	350	676	426	1
LKSF 70-40	700	400	776	476	2
LKSF 80-50	800	500	876	576	2
LKSF 90-50	900	500	976	576	2
LKSF 100-50	1000	500	1076	576	2,5

FIGURE 2 – TYPE DESIGNATION



MATERIALS

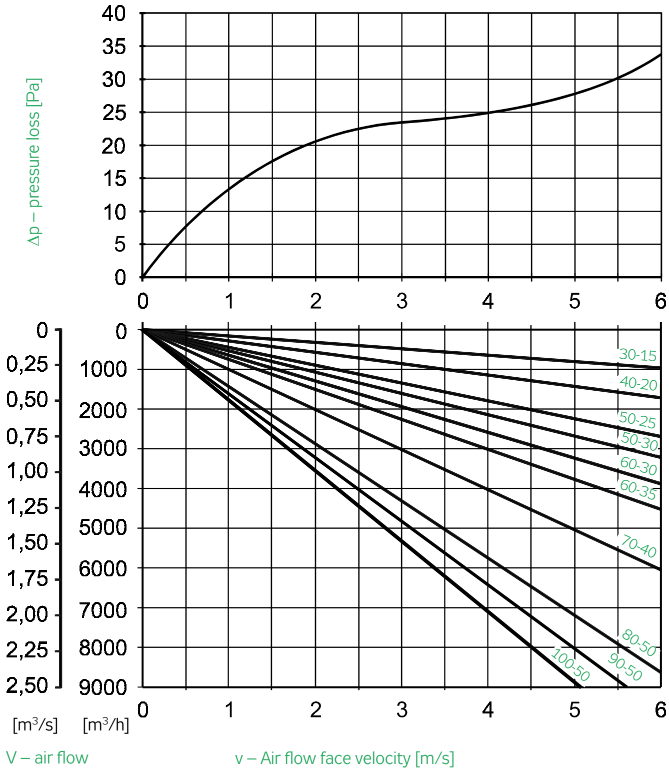
The pressure damper is made of plastics resistant to UV radiation and weather effects; grey RAL 7040 colour.
The damper's frame is glued from plastic profiles with a closed air gap. Extremely light and aerodynamic plastic vanes are hinged on plastic pivots, which are inserted into the external frame. The lowest vane covers the inner frame jut, and thus creates a weather moulding.

FIGURE 3 – PK PRESSURE DAMPER WITHOUT A BRACE UP TO SIZE 50-30, INCL.

FIGURE 3 – PK PRESSURE DAMPER WITH A BRACE, SIZES FROM 60-30 TO 90-50

ACCESSORIES PK PRESSURE DAMPERS

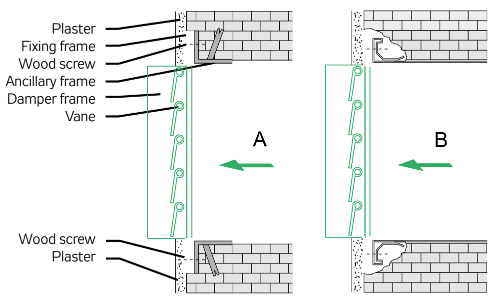
GRAPH 1 – PK PRESSURE LOSS



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.

PK PRESSURE DAMPERS - INSTALLATION DIAGRAM



A - Installation on ancillary frame
B - Installation on flange of air-handling duct

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

PZ louvers are designed for outdoor use. The range of operating temperatures can be from -40 ºC to +80 ºC. 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".

FIGURE 1

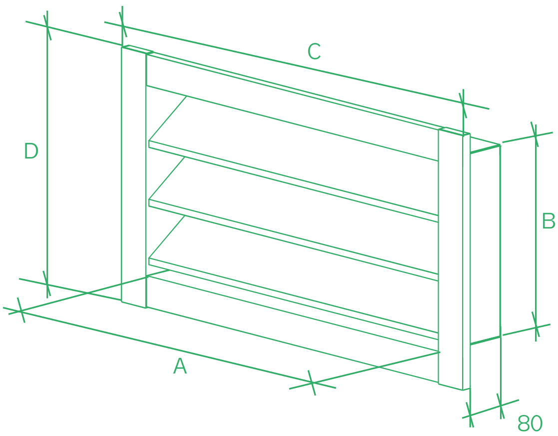
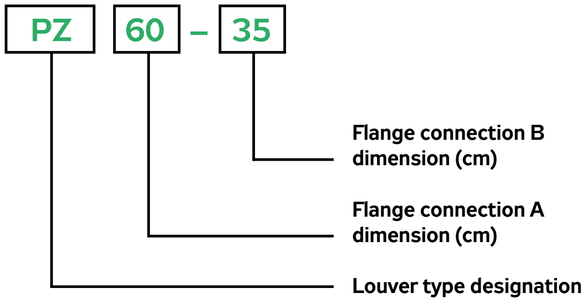


TABLE 1

Type/Size (mm)	A	B	C	D	m ±10%	graph
	(mm)	(mm)	(mm)	(mm)	(mm)	(curve)
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

FIGURE 2 – TYPE DESIGNATION



DIMENSIONAL AND TYPE RANGE

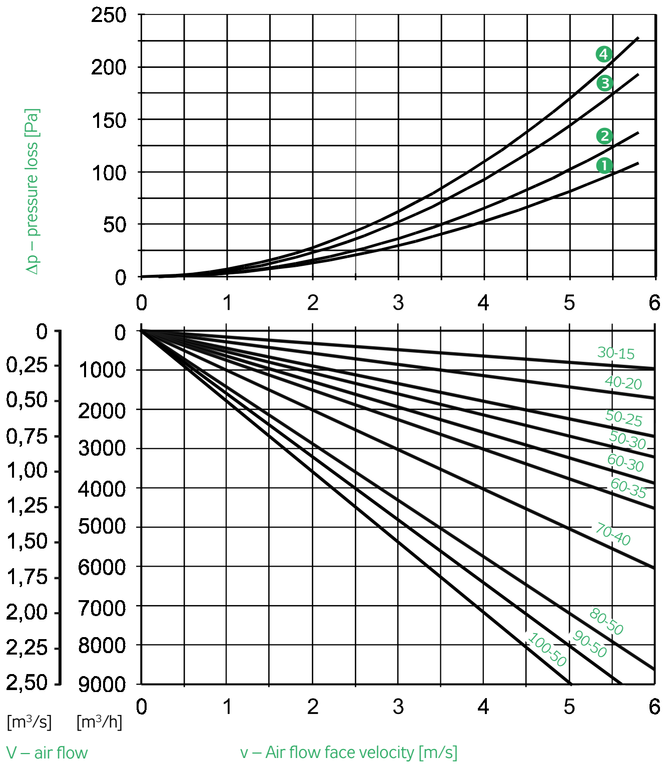
The louvers are manufactured in ten Vento dimensional ranges, from 30-15 to 100-50..

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.

PZ LOUVER

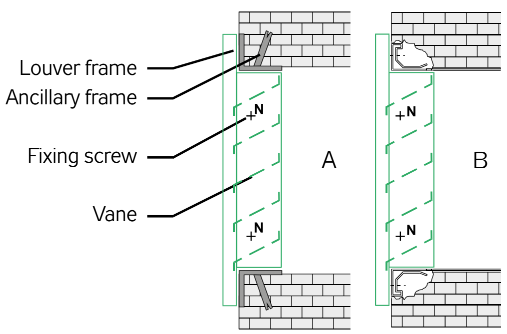
GRAPH 1 – PZ LOUVER PRESSURE LOSS



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").

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)

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.

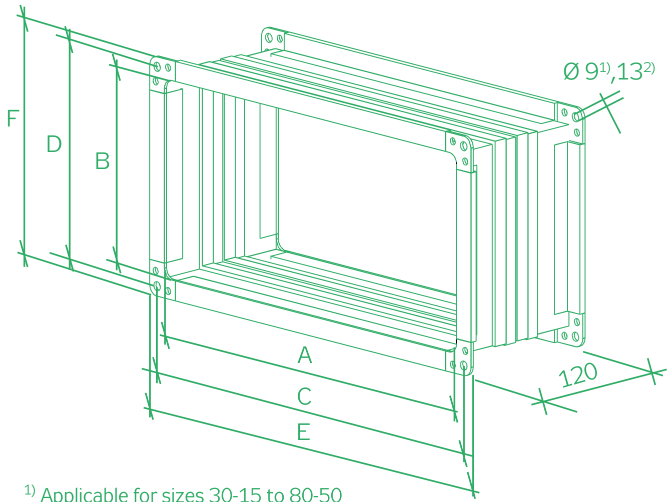
OPERATING CONDITIONS

The range of operating temperatures can be from -30 ºC to +80 ºC, while the maximum allowed temperature is + 100 ºC. 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.

ROZMĚROVÁ ŘADA

The DV elastic connections are manufactured in all Vento dimensional ranges, from 30-15 to 100-50.

FIGURE 1



[1] Applicable for sizes 30-15 to 80-50
[2] Applicable for sizes 90-50 to 100-50

TABLE 1

Type/Size (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	m ±10% (mm)
DV 30-15	300	150	320	170	340	190	1,6
DV 40-20	400	200	420	220	440	240	2
DV 50-25	500	250	520	270	540	290	2,5
DV 50-30	500	300	520	320	540	340	2,6
DV 60-30	600	300	620	320	640	340	2,9
DV 60-35	600	350	620	370	640	390	3
DV 70-40	700	400	720	420	740	440	3,5
DV 80-50	800	500	820	520	840	540	4
DV 90-50	900	500	930	530	960	560	4,3
DV 100-50	1000	500	1030	530	1060	560	4,7

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 giraccording to of 6 mm diameter, to ensure conductive connection of the flanges.

INSTALLATION

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.

DV ELASTIC CONNECTION

ACCESSORIES DV, DK ELASTIC CONNECTIONS

APPLICATION

DK square elastic connections are designed to eliminate the transfer of fan (RQ or RF inlet) vibrations to ducting. They also eliminate strain and loading caused by thermal dilatation in air--handling ducting.

OPERATING CONDITIONS

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.

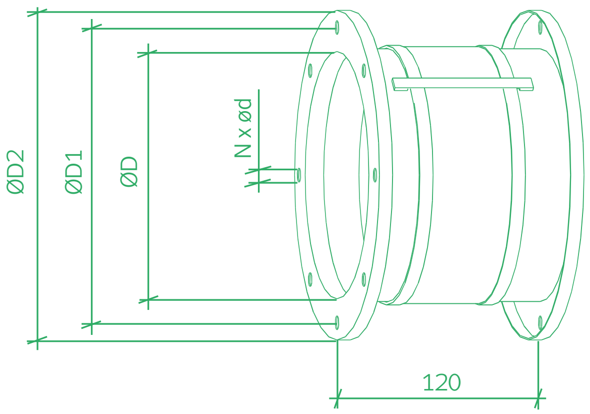
MATERIALS

The same as DV elastic connections.

INSTALLATION

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.

FIGURE 1



* Dimension D2 can vary between +2-8 mm

DK ELASTIC CONNECTION

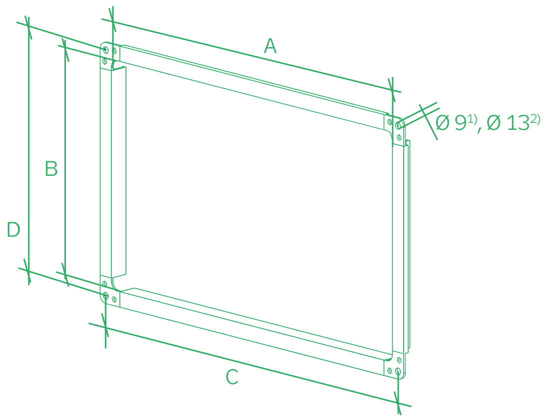
TABLE 1

Type/Size (mm)	D	D1	D2*	d	N	m ±10%
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
DK 180	180	215	240	10	8	1,1
DK 200	200	235	260	10	8	1,2
DK 225	225	260	285	10	8	1,35
DK 250	250	285	310	10	8	1,5
DK 280	280	315	340	10	8	1,65
DK 315	315	350	375	10	12	1,85
DK 355	355	390	415	10	12	2,1
DK 400	400	445	480	12	12	2,95
DK 560	560	605	640	12	16	4
DK 630	630	675	720	12	16	4,75

APPLICATION

EP counter-flanges are used to terminate the air-handling duct, and thus to enable its connection to Vento system standard elements.
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.
.

FIGURE 1 – DIMENSIONAL RANGE

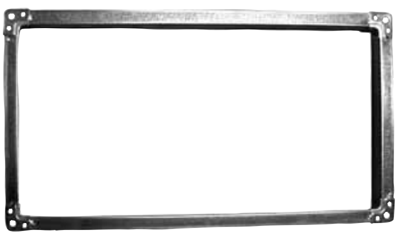


[1] Applicable for sizes 30-15 to 80-50
[2] Applicable for sizes 90-50 to 100-50

TABLE 1 – DIMENSIONAL RANGE

Type/Size (mm)	A	B	C	D	m ±10%
	(mm)	(mm)	(mm)	(mm)	(mm)
EP 30-15	300	150	320	170	0,51
EP 40-20	400	200	420	220	0,65
EP 50-25	500	250	520	270	0,80
EP 50-30	500	300	520	320	0,85
EP 60-30	600	300	620	320	0,95
EP 60-35	600	350	620	370	1,02
EP 70-40	700	400	720	420	1,15
EP 80-50	800	500	820	520	1,35
EP 90-50	900	500	930	530	1,65
100-50	1000	500	1030	530	1,95

FIGURE 2 – EP COUNTER-FLANGE



DIMENSIONAL AND TYPE RANGE

EP flanges are manufactured in all Vento dimensional ranges, from 30-15 to 100-50.

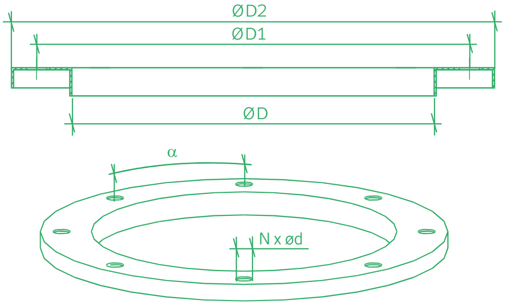
MATERIALS

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.

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, RF fans (not used if the RF fan is connected to a roof adaptor). 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.

FIGURE 1 – DIMENSIONAL RANGE



* * Dimension D2 can vary between +2-8 mm

TABLE 1 – DIMENSIONAL RANGE

Type/Size (mm)	D (mm)	D1 (mm)	D2* (mm)	d (mm)	N (mm)	α (°)	m ±10% (mm)
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
GK 630	630	675	720	12	16	22,5	1,95

OBR. 1 – PROTIPŘÍRUBA GK

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 (Zinc layer of thickness min 275 g/m²).

WARNING
The manufacturer reserves the right to make changes and amend the documentation due to technical innovations and changes to legislation without prior notice.

The up to date version of this document is available at our website www.remak.eu

Always observe local laws and regulations.

řešení pro lepší klima

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