



RP

RQ

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EO..

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SUMX

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PRI

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																	
	40-20																	
	50-25																	
	50-30																	
	60-30																	
	60-35																	
	70-40																	
	80-50																	
	90-50																	
100-50																		
EOS	30-15																	
	40-20																	
	50-25																	
	50-30																	
	60-30																	
	60-35																	
	70-40																	
	80-50																	
	90-50																	
100-50																		
EOSX	30-15																	
	40-20																	
	50-25																	
	50-30																	
	60-30																	
	60-35																	
	70-40																	
	80-50																	
	90-50																	
100-50																		

POSITION AND LOCATION

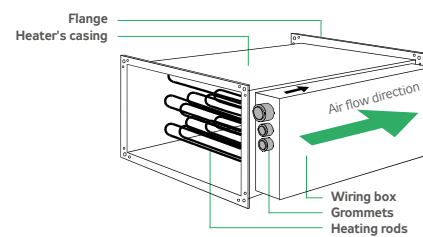
The heaters can operate in any position except the position with the wiring distribution box directed downwards (there is a risk of condensate penetration from the air duct). When projecting the layout of the heater location, we recommend observing the following:

- 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

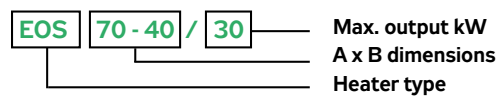


Note: See also Fig. 9, page 189

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

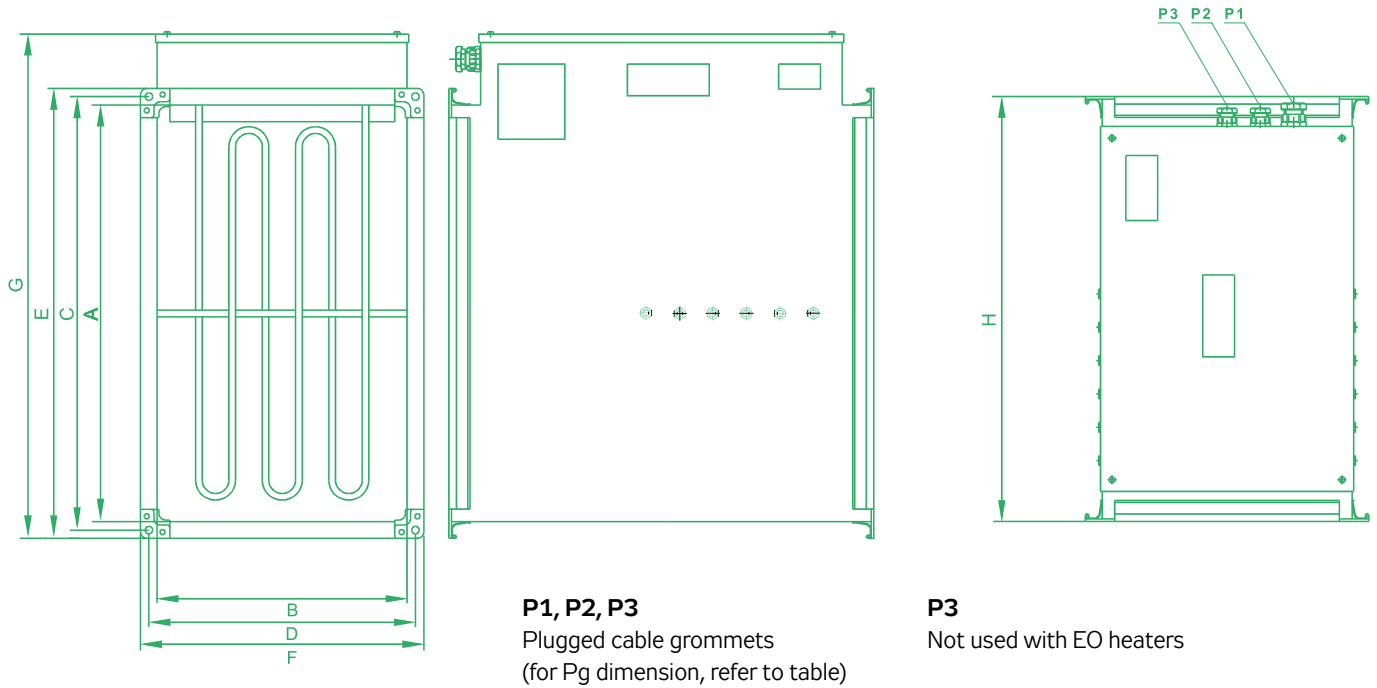


TABLE 2 - DIMENSIONAL RANGE

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

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OUTPUT AND PRESSURE LOSS DETERMINATION

EO, EOS and EOSX electric heaters are dimensioned according to required heating output **Q** according to maximum air flow rate **V** and required heating-up ΔT .

- Preliminary correlations of parameters (Q, V, DT) for all output ranges of standard heaters are included in the graph, see figure # 4. Heating-up DT for the corresponding air flow rate is valid providing the heater works at maximum output. If a control unit is used, the heaters' output will be controlled according to actual need in relation to the required outlet air temperature.
- Pressure losses of EO, EOS and EOSX electric heaters are included in the nomogram, see figure 5.
- Each heater in the table is marked with a number 1 2 3 4 5 in accordance with its output and connecting dimensions, and each number comports with one pressure loss/air flow rate correlation characteristic.

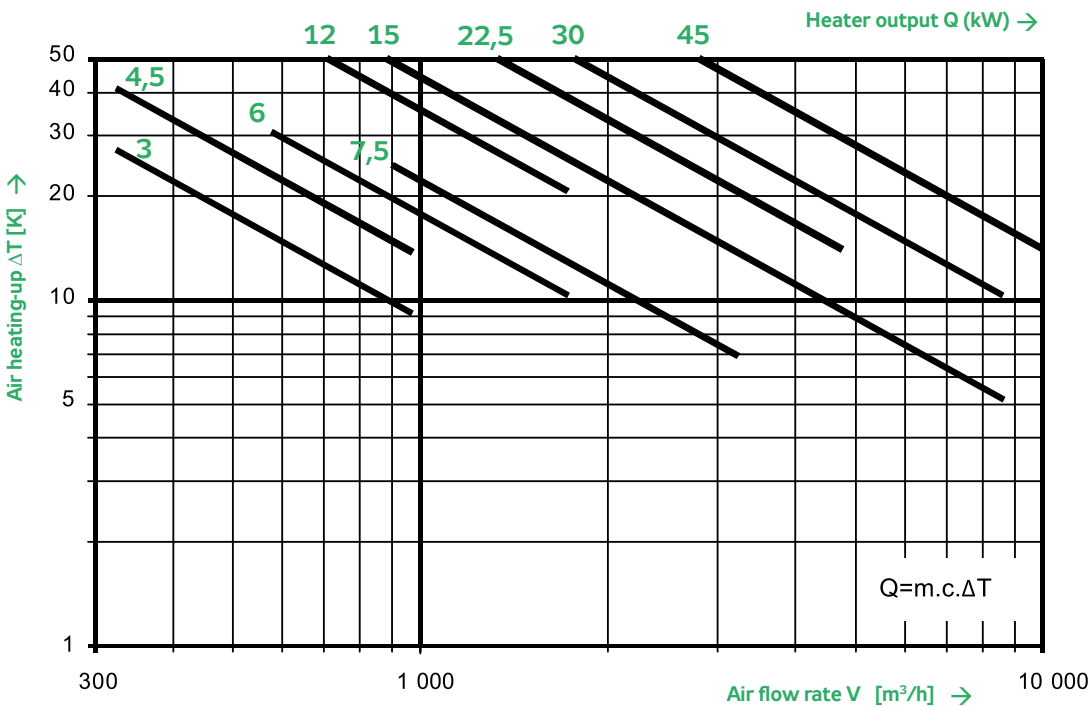
PLANNING THE HEATER

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

- When dimensioning and planning the electric heater, it is necessary to observe the following safety principles:
- The heaters must be situated at a safe distance from flammable or easily inflammable materials. The location of the heater must allow free space for heater surface cooling.
- To reduce the heat loading (by heat radiation and/or

- conduction) of connected devices, we recommend inserting at least a 1 m piece of air duct in front of and behind the heater.
- At a minimum distance of 1–1.5 m in front of the heater, an air filter must be installed to avoid its fouling. Without using an air filter, there is a danger of the heating rods fouling and eventually being damaged due to insufficient cooling.
- According to fire regulations, direct installation of the air filter just in front of the heater is forbidden!
- It is necessary to keep free access to the heater, especially to its wiring distribution box, to enable easy checks, inspections and service.
- The heaters can operate in any position except the position with the wiring distribution box (switchboard) directed downwards (there is a risk of condensate penetration from the air duct).
- The heater output must be automatically controlled so that the outlet air temperature is limited to +40°C.
- The operation of the heater must be blocked if the fan is out of operation for any reason. ⁽¹⁾
- Either the air-handling device is switched off manually or automatically the heater must be switched off first, and then with a time delay sufficient for heater cooling, the dampers can be closed and the fan switched off.
- The speed of the air flow in the electric heater should not fall below 1–2 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

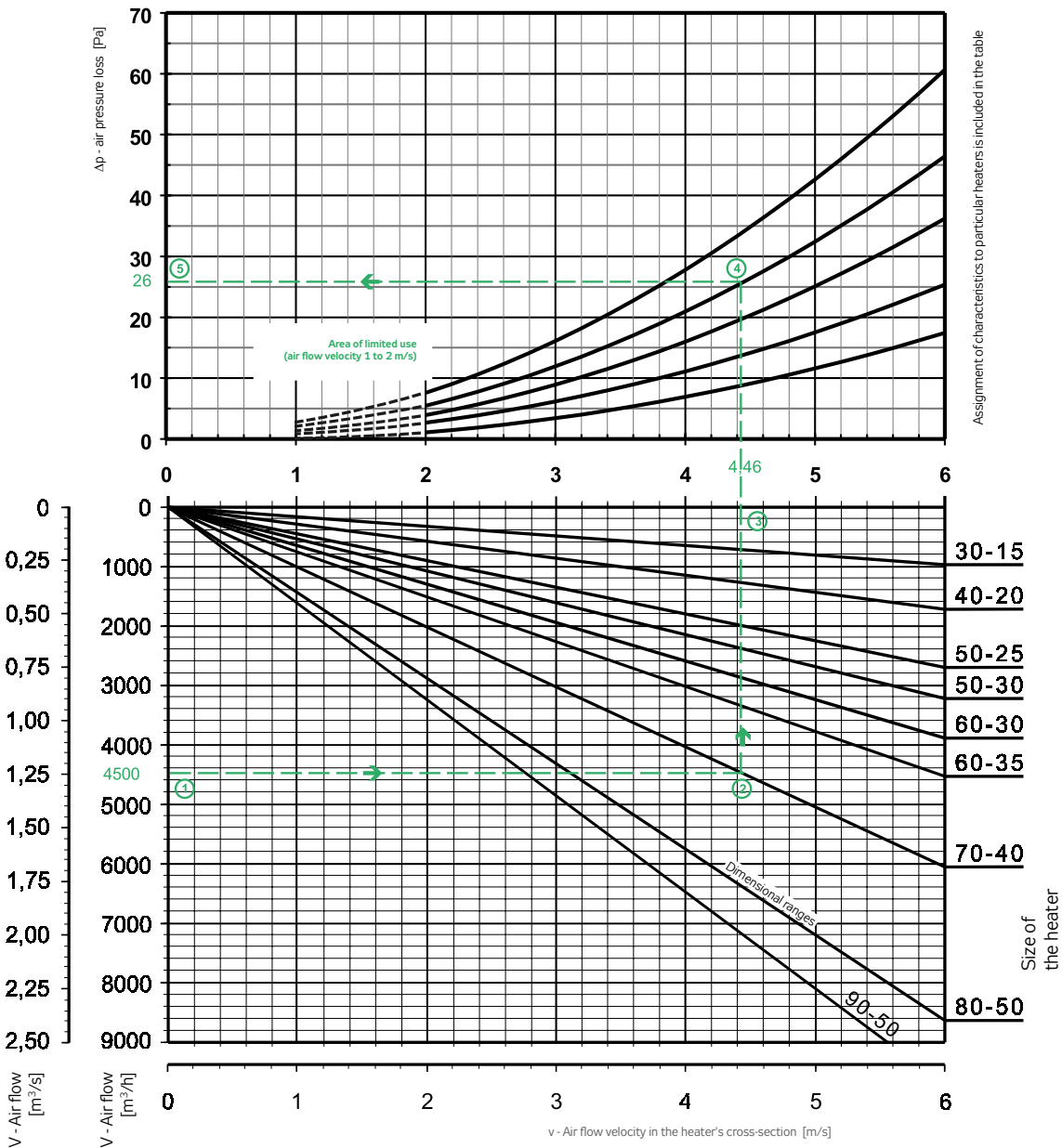
Output (kW) / size	30-15	40-20	50-25	50-30	60-30	60-35	70-40	80-50	90-50
3.0	2								
4.5	3								
6.0		3							
7.5			2	2					
12.0		5							
15.0			4	4	3	2	2	1	
22.5			5	5	4	3			
30.0					5	4	4	2	2
45.0							4	2	3

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

1 2 3 4 5

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.



Assignment of characteristics to particular heaters is included in the table

Size of the heater

! 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.

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SUMX
CHV
CHF
HRV
HRZ
PRI

RP

BASIC DIFFERENCES IN CONTROL

RQ

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).

RO

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.

RE

RF

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).

RPH

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.

EX

TR..

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⁾

EO..

VO

TABLE 3 -TYPES OF CONTROL

Type of control	Type of heater		
	EO	EOS	EOSX
A	✓	✓	
B		✓	
C			✓

SUMX

CHV

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

CHF

HRV

HRZ

PRI

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

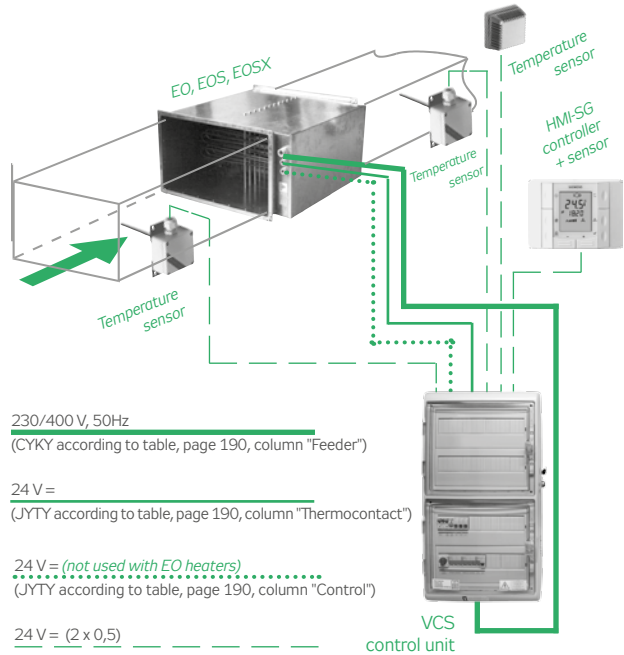
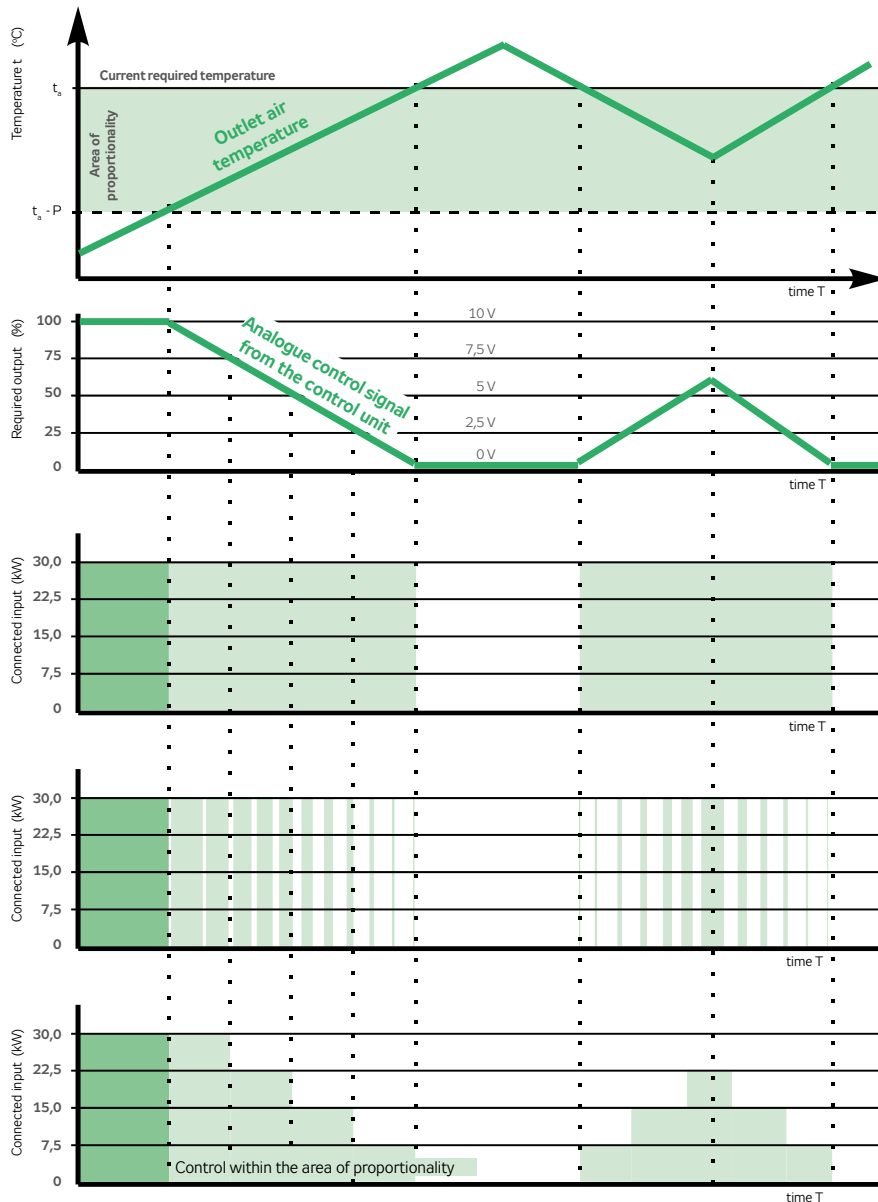


FIGURE 8 - SIMPLIFIED MODEL OF SWITCHING (CONTROL) OF ELECTRIC HEATERS DEPENDING ON THE TEMPERATURE COURSE ⁴⁾**TEMPERATURE COURSE**

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 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.

Control B

Output distribution is controlled an electronic module inside the control unit (the so-called PV current valve). Providing the output is properly dimensioned and the control pressure data points of the control unit are properly set, the fluctuation of the outlet temperature behind the heater will be within ± 0.5 °C. Control mode B is suitable for installations requiring minimum fluctuation of the outlet temperature.

Control C**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.

RP

RQ

RO

RE

RF

RPH

EX

TR.

EO.

VO

SUMX

CHV

CHF

HRV

HRZ

PRI

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 °C, which is situated on the cooler of the SSR switching relays.
- The heater is provided with two emergency thermostats adjusted to +80 °C⁹. 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 °C (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

⁹ First thermostat is adjusted to +80 °C. The second one can be adjusted in a range of +50 °C to +90 °C; factory default setting is +80 °C. If a change in temperature is required, it is advisable to use only the range +50 °C to +80 °C (table 5).

TABLE 4 - SWITCHING OPTIONS

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

- with two stand-alone thermostats (for details, refer to the chapter "Thermal Protection").
- Simpler and cheaper heaters in the EO product line, designed for less demanding conditions, are switched by the contactor directly in the control unit.
 - 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.⁹⁾ 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 time⁷⁾.

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.

⁹⁾ 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 °C (80 °C) ⁵⁾	✓	✓	✓
II. protective thermostat 80 °C	✓	✓	✓
III. protective thermostat 45 °C		✓	✓

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

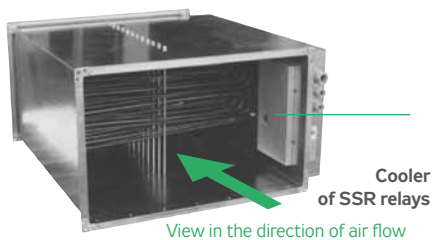
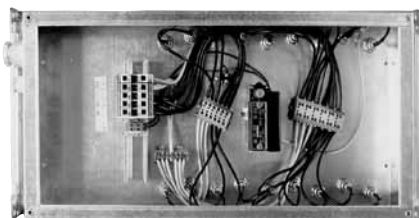
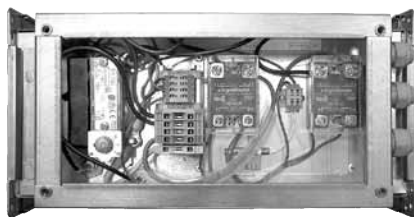


FIGURE 10



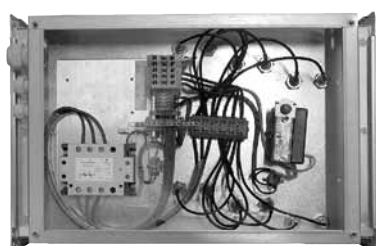
EO... / 3-45, (switching relays are not included)

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)

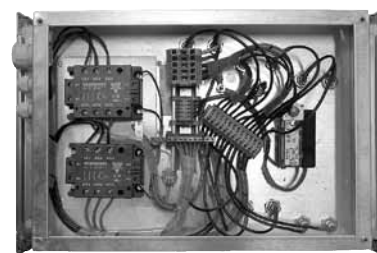
Basic (emergency) thermal protection

Thermal protection of all electric heaters is ensured by two emergency thermostats connected into a serial loop. The thermostats are adjusted in production to +80°C; one reads the temperature among the heating rods while the other reads the temperature inside the wiring distribution box. If the thermo-contact in the loop trips (due to the heater overheating), the power supply of the electric heater must be disconnected.⁶⁾

Extended thermal protection

The thermal protection of EOS and EOSX electric heaters is extended by a protective SSR circuit. The temperature of the cooler of the SSR switching relays is read by the third protective thermostat set to a switching point of +45 °C. When this temperature is exceeded, the control signal to SSR is interrupted. After cooling down, the thermostat will automatically switch the control circuit, while the fans work without stopping all the time.

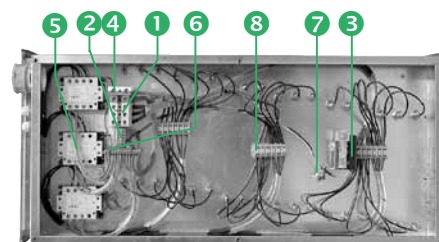
FIGURE 13 – EOSX HEATER WIRING BOX



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

FIGURE 14 – EOSX HEATER WIRING BOX

The EOSX heater's wiring box - protecting cover removed



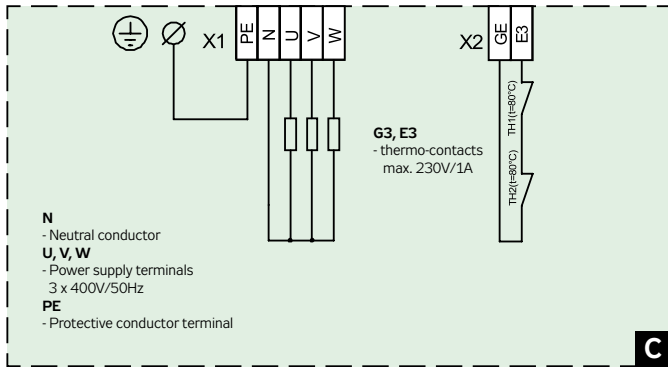
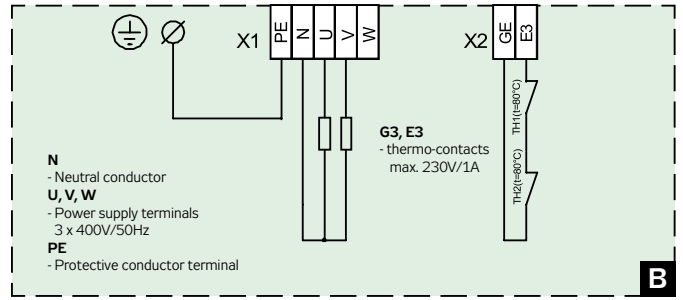
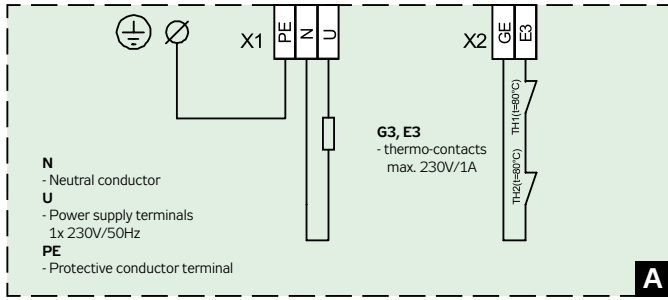
- 1 Power supply, 2 Control and signalling of emergency failure,
- 3 Adjustable limiting thermostat, 4 Protective conductor terminal,
- 5 SSR switching relay, 6 Neutral bus bar, 7 Ground screw,
- 8 Interconnecting bus bar of heating blocks

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
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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
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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
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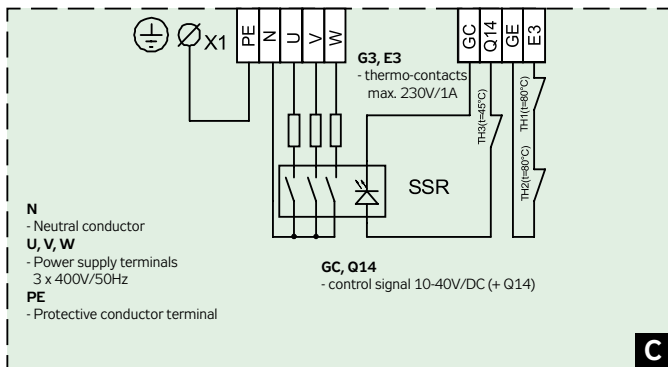
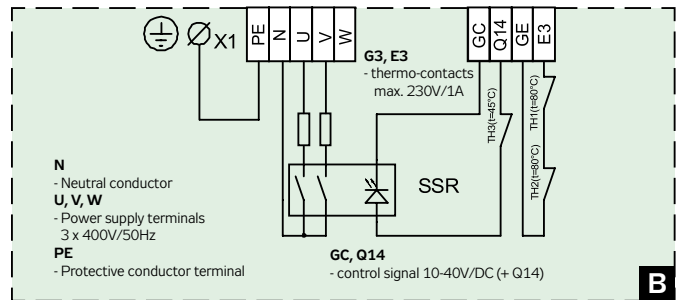
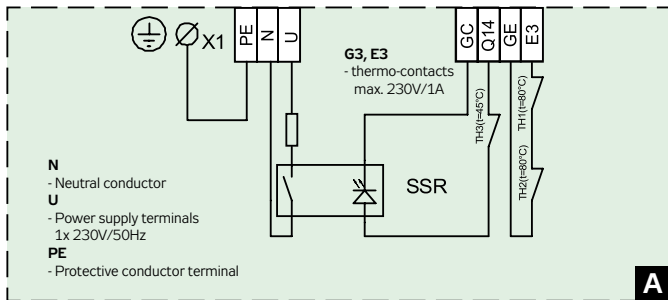
Series	Dimensional range	Type / size	Output	Voltage	Current	Heating rods	Output split	Section output	Feeder	Thermocontact	Control
		Designation	Q	U	I	n	1/s	Qs	Recommended cables		
			kW	V	A	ks x kW		kW	JYTY-O/H05VV-F		
EOS	50-30	EOS 50-30/15	15	400	22,79	6x2,5	1/1	15	5 x 4	2 x 1	2 x 1
EOS	50-30	EOS 50-30/22.5	22,5	400	34,19	9x2,5	1/1	22,5	5 x 6	2 x 1	2 x 1
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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
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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
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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+6x2,5+6x2,5	1/3	15-15-15	5 x 25	2 x 1	4 x 1

WIRING DIAGRAMS, EO SERIES



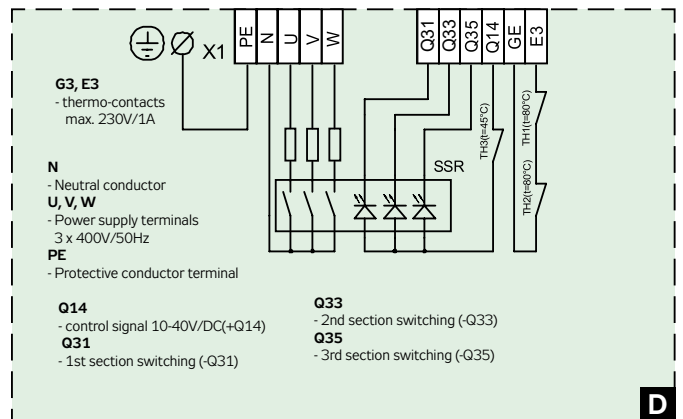
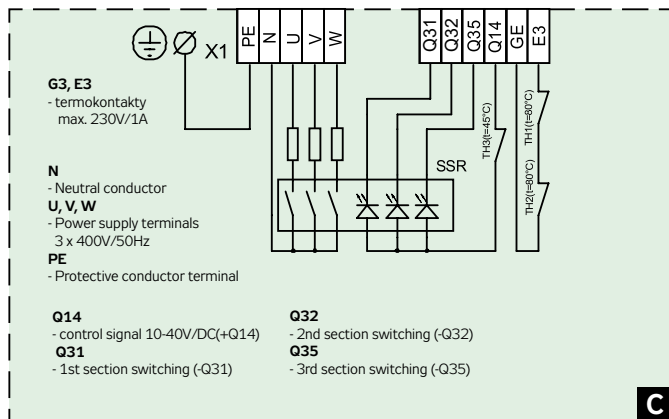
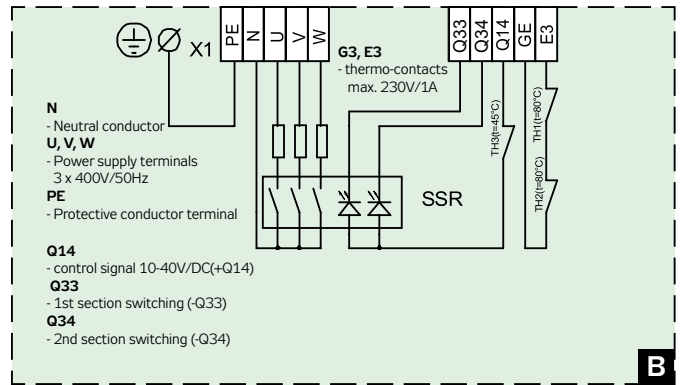
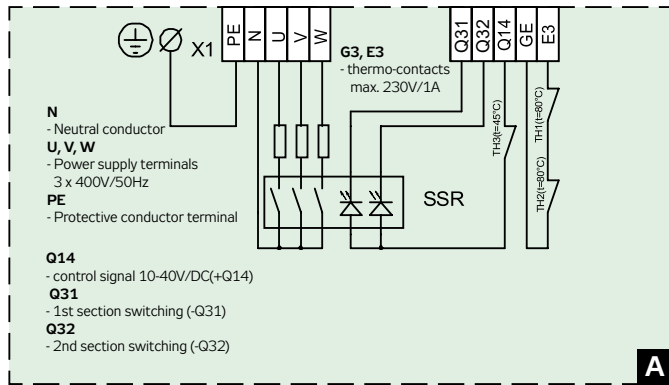
Type / size	Output (kW) / wiring scheme															
	1,5	2	2,5	3	4	4,5	5	6	7,5	10	12	15	22,5	30	37,5	45
EO 30-15	A			B		C										
EO 40-20		A			B			C			C					
EO 50-25			A				B		C		C		C			
EO 50-30							B		C		C		C			
EO 60-30									C		C		C		C	
EO 60-35									C		C		C		C	
EO 70-40									C	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

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