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| VENTILATING AND AIR-CONDITIONING SYSTEM TERNO-S Assembly and operation regulations | | No : MPP -17.4 A |
| | | Valid from: 03.09.2002 |
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Assembly and operation regulations include the data for assembly, operation and maintenance of TERNO-S units of sizes 200, 250, 280, 315, 355 and 400.

The regulations do not specify the data for wiring, distribution of working liquid, related air-conditioning equipment and regulating equipment. These data shall be found in project schemes, user's and installation manuals for regulating systems which constitute a part of supply of this equipment; the safety, assembly and operation activities related thereto shall be executed by the customer.

Operation personnel must be duly acquainted with these operation regulations.

I. USE AND WORKING CONDITIONS

The TERNO-S units are designed for air exchange and treatment in residential and industrial premises.

The units are designed for use in an **ordinary environment**, however, the **TERNO-S** fans are also manufactured in a modification suitable for an environment with the explosion danger **Zone 1 (SNV2) and Zone 2 (SNV1)**, both inside and outside the fan, in accordance with standard ČSN EN 60079-10/9.97 (Electric Equipment for Explosive Gas Atmosphere – Part 10: Determination of Dangerous Premises.). Should the TERNO-S unit be exposed to the outdoor climate conditions, it must be protected with a suitable cover. However, the covers are not supplied by company ALTEKO.

The units may not be used for transporting the air which includes aggressive agents, abrasive additives and adhesive and fibrous particles. The units are not gas-proof.

The TERNO-S units may not be used for working conditions and designation differing from those specified in these instructions. The user must ensure that the pressure of the working liquid will not exceed the determined maximum operation value.

If water is used as a working liquid and equipment is not in operation in winter, the equipment must be protected against freezing by removing the water out of the equipment. Blowing compressed air through the exchanger will enable better removal of water.

Fan Parts K and KB:

Fan parts **K** are pipe fans designated for straight pipeline, whereby fan parts **KB** are pipe fans in which a suction flange and discharge flange form a 90° angle (corner pipe fans of left or right modifications).

The temperature of transported air may fluctuate between -30 °C and +85 °C. In the case of fans with VTR motors, the temperature may fluctuate between -30 °C and +40 °C. Due to the characteristics of the electric motor, the ambient temperature may fluctuate between -30 °C and +40 °C.

See Table 1 for specification of electric motors, their parameters and specification of revolution controllers. See

Figure 1 "Field of output characteristics of fan parts TERNO-S" for output parameters.

NOTE : Fans in the modification suitable for an environment with the explosion danger **Zone 1 (SNV2) and Zone 2 (SNV1)**, both inside and outside the fan, **may not be used with revolution controllers** FID-L and FIA-M !

Heating Parts – Water V:

working liquidwater
maximum water pressure.....1.5MPa
maximum water temperature.....120°C

Water heaters **V** are equipped with exchangers from Cu pipes with a diameter of 10 mm, to which Al plates are attached with pitch of 2 mm. The number of rows is stated in designation of a heater after letter V. Heaters may be installed both as left- and right-orientated on condition that counter-flow connection and the air direction are maintained. Output parameters of heaters are shown in catalogue TD 17.x. Heaters are normally equipped with a mechanical de-aerating valve. However, an automatic de-aerating valve DN6/GIA may be installed. In order to achieve a good regulation of the output of the heater and eliminate the danger that the heater might freeze, mixing neutral points SU are supplied, see Table 2. Dimensions of the heater at points of connection are given in Figure 3. Regulators REGU AD-TV are equipped with anti-freeze protection device, particularly with a pipe temperature sensor of the exchanger ATC10-V. We recommend using additional capillary antifreeze protection TS1-COP for sizes 280 and greater.

Heating Parts - Electric EL:

voltage.....3N AC 400V/50Hz
cover.....IP40

Electric heaters **EL** are equipped with anticorrosive ribbed heating rods whose output equals to 2 kW. The maximum surface temperature of ribbed heating elements equals to 330°C. The total heating output of the heater is stated by a figure in its designation. Heaters are supplied in two basic modifications. Heaters indicated by T are equipped with built-in controlling electronic elements located under the cover of a terminal board that ensures the regulation of the heating output by contactless switching on the individual sections as the line voltage passes through neutral after the control signal 12V DC comes from thermoregulator REGU AD-E.

Heaters without T indication are heaters without controlling electronic elements; their output may be regulated by switching on the individual sections after roughly thirds of their output. Heaters are protected against overheating by

installation of two series connected irreversible thermal fuses set up at 65 °C whose terminal boards must be connected to the controlling system. A third reversible thermal fuse is set up at 55 °C. No part containing flammable material (e.g. filtration part, elastic insert, noise suppressor, etc.) may be installed immediately next to the heater. If this condition may not be met by an appropriate assembly of the unit (e.g. by inserting a valve between a filter and a heater) a spacer MK must be used; spacers being supplied in modifications of 300 and 500 mm length. If the electric heater is assembled on the side of air discharge of the fan, a 500 mm long spacer must be installed between the fan and the electric heater.

Cooling Parts - Water CHV:

working liquid.....water, salt brine
maximum water pressure.....1.5MPa

Water coolers **CHV** are equipped with exchangers from Cu pipes with a diameter of 10 mm, to which Al pipes are attached with pitch of 2 mm. The number of rows is stated in designation of a cooler after letters CH. An anti-underpressure loop for the condensate outlet is a part of the delivery. The exchangers are manufactured in right and left modifications. The output parameters of water coolers are stated in catalogue TD 17.x. Water coolers are normally equipped with a mechanical de-aerating valve. However, an automatic de-aerating valve DN6/GIA may be installed. In order to achieve good regulation of the output of the water cooler and eliminate the danger that the cooler might freeze, mixing neutral points SU are supplied, see Table 2. Dimensions of the exchangers at points of connection are given in Figure 3. Regulators REGU AD-TV are equipped with an anti-freeze protection device, particularly with a pipe temperature sensor of the exchanger ATC10-V. We recommend using additional capillary antifreeze protection TS1-COP for sizes 280 and greater.

Cooling Parts - Evaporators CH:

cooling agent.....R407C
maximum pressure.....1.5MPa

Evaporators **CH** are equipped with exchangers from Cu pipes with a diameter of 10 mm, to which Al plates are attached with pitch of 3 mm. Evaporators have four rows, an anti-underpressure loop for the condensate outlet is a part of the delivery. Dimensions of the evaporators at points of connection are given in Figure 3. The output parameters of evaporators are stated in catalogue TD 17.x. Condenser units which include injection valves and combining elements are supplied as a complement to evaporators.

Filtration Parts F and FS:

filtration class.....EU4 or EU6
maximum thermal endurance80°C

Filtration parts are manufactured in two modifications. In parts indicated by letter **F** the pocket filter is released from the side, whereby in parts indicated by letter **FS** the pocket filter is released from the bottom. Filtration material is made of non-woven synthetic fibres which were thermally and mechanically stabilized. In order to achieve permanent

control and signalisation of filter fouling, the filtration part may be equipped with an indicator of pressure difference. Spare filters are supplied by company ALTEKO s.r.o.

Regulating and Closing Flaps RK:

manual.....RK-RP
with a loose end of shaft.....RK-VH
with a power unit.....RK-SP

Controlling voltage 24V AC/DC or 230V AC is evident from the type identification of Belimo power unit which is stated at the end of a flap identification. In the case of LM power units, both final positions (open – closed) may be restricted by mechanical stops on the power unit. LF power units close the valve by an emergency spring even during the fall-out loss of the controlling voltage, which decreases the risk that water evaporators might freeze. Flaps with power units of 24V are normally used in systems of flaps working in accordance with controlling systems REGU AD.

Mixing Flaps SMK1 and SMK2:

Suction of circulating air comes from the side in the case of mixing flaps **SMK1** and from the bottom or top in the case of mixing flaps **SMK2**.

manual.....SMK1(2)-RP
with a loose end of shaft..... SMK1(2)-VH
with a power unit..... SMK1(2)-SP

Mixing flaps consist of two interconnected flaps. These flaps are operated proportionally. Controlling voltage 24V AC/DC or 230V AC is evident from the type identification of Belimo power unit which is stated at the end of a flaps identification. Power units indicated by SR require supply voltage of 24V AC/DC and their operation requires 0 to 10V DC. Both final positions (open – closed) may be restricted by mechanical stops on the power unit. Flaps with power units of 24V are normally used in systems of flaps working in accordance with controlling systems REGU AD. Regulator SKR10, do not including a sensor, is supplied for the mixing regulation depending on a set up temperature. Flaps with power units LM24-SR or NM24-SR must be used in systems of flaps working in accordance with SKR10 regulator.

Noise Suppressors REA:

Noise suppressors are absorptive; they are combined with resonant noise suppression in the case of sizes of 200, 250 and 280. When assembling suppressors 315, 355 a 400 we recommend using the spacer MK 500 mm long on the side of air discharge of the fan. We recommend to place noise suppressors immediately on the unit and to place the elastic insert after the suppressor.

Gas Heaters MONZUN:

Gas heaters MONZUN are equipped with atmospheric natural gas burners 20/25 mbar and they are equipped with a valve regulating the gas flow with a range of regulation between 100 to 50 per cent of the heating output. The operating voltage signal ranges between 0 and 10V; the supply voltage is 230V/50Hz. Gas heaters may be installed

in the horizontal position only. A combustion pipeline must be installed on a gas heater upon assembly; however, the combustion pipeline is not a part of the delivery. The air for burning is supplied through a grid on a gas heater, i.e. from the space in which the gas heater is installed. Regulator REGU AD-G is used for operating the unit with a gas heater. Reducers PR for individual sizes of TERNO-S units are delivered to gas heaters.

Regeneration Rotating Exchangers ROV:

Regeneration rotation exchangers **ROV** in a standard modification must be installed exclusively in the position with a horizontal axis of rotation; their operation goes without a condensate. When using regulator REGU-AD with a SREK function and a temperature sensor of the outdoor temperature ATC 10-V or ATC 10-Z, the function of starting a rotor at the temperature of $T_{11}-T_{21}>5^{\circ}\text{C}$ is ensured. Supply voltage must be ensured by an independently safeguarded supply of 3x400V/50Hz, $I=0.3\text{A}$, whereby the operating voltage equals to 1x230V/50Hz (terminal connectors in REGU-AD).

Recuperation Board Exchangers RV:

Recuperation exchangers **RV** must be installed in a horizontal position only; they are equipped with a siphon for leading away the condensate. An insert for summer operation LV may be added; it may substitute an AI insert with a thermal-exchange surface in summer months. There is a cross flow through the recuperation exchanger. The 45 ° bends OB and reducers PR for TERNO-S 280 and 355 are supplied in order to increase the variation of the installation of the board exchanger.

II. SAFETY

The assembly of TERNO-S units, their connection with the protective circuit, connection and all electric wiring may be carried out by professional personnel only. The electrically conductive parts of the air-conditioning devices must be interconnected in accordance with the regulation ČSN 33 2000-4-41/10.2000 (Electrotechnical Regulation. Electric Appliances – Part 4: Safety – Chapter 41: Protection against Electric Current Injury.).

The fan parts TERNO-S K (KB) may be operated only after connecting the piping of a corresponding loss in pressure so that the electric motor would not be overloaded (see the values of stator current in the Table 1 or on the electric motor plates).

In the case of fan parts in modifications for **Zone 1 (SNV2) and Zone 2 (SNV1)**, all bolted connections inside fans are protected against loosening; the minimum safety distances are observed in the case of all rotating and the respective stable parts, or, non-sparking materials are used, if appropriate. The electric motor of a fan of a secured type EExe-II-T3 must be provided with a switch and a protection device set up on the rated current. The switching-off characteristics of the switch must conform to the condition so that the warming time t_E corresponding to individual ignition groups would not be exceeded during the short-circuit running (i.e. running with braked motor). If the protective switch of the motor is not in the non-explosive modification, it

must be placed in a premise without the explosion danger. The respective provisions of ČSN EN 60079-14/4.99 (Electrical Appliances for Gas Explosion Atmosphere – Part 14: Electrical Wiring in Non-explosive Premises /Other than Mining/.) shall apply if using the motor in the environment with the danger of inflammable vapour and gas explosion.

Prior to putting the TERNO-S units into operation, an initial revision must be carried out and a revision report must be executed in accordance with ČSN 33 2000-6-61/5.2000 (Electrotechnical regulations. Electrical appliances – Part 6: Revision – Chapter: Procedures of initial revision). Regular revisions of electrical appliances must be executed during operating the appliance in accordance with ČSN 33 1500/5.2000 ((Electrotechnical regulations. Revision of electrical appliances.). The assembly, the initial revision and regular revisions shall be arranged by the user.

Prior to putting the fan parts in the modification for the environment with the explosion danger of **Zone 2 (SNV1) and Zone 1 (SNV2)** into operation, the minimum clearance between the suction inlet and the runner (4 mm) must be checked.

III. TRANSPORT AND STORAGE

The individual elements of TERNO-S units may be transported loose or on pallets. When moving the units, the flanges of units shall be the only parts which may be used for hanging, holding or any handling, whereby each element of the unit must be moved separately.

Accessories to TERNO-S units are supplied in cardboard packaging. The user (or assembly firm) must store TERNO-S units before their assembly in closed and dry premises and must protect them against mechanical and chemical damage.

IV. ASSEMBLY

Assembly of the units into pipes is executed in an ordinary manner by connecting flanges and hangers or consoles. Connecting flanges of individual manufactured elements conform to ČSN EN 1505/4.99 (Ventilation of Buildings. Sheet-metal Pipes and Accessories of Rectangular Section. Dimensions.).

Individual elements of TERNO-S units may be installed into any position, with the exception of elements of cooling water parts CHV, cooling evaporators CH, recuperation board exchangers RV (these elements must be installed in a horizontal position so that leading away the condensate is ensured; a siphon is a part of the delivery), regeneration rotating exchangers ROV (working position in the standard modification is with a horizontal axis of rotation without leading away a condensate) and gas heaters MONZUN (which must be installed in a horizontal position as well). Fan parts K and KB may be assembled in any position of the electric motor.

Before entering heaters, coolers and recuperation exchangers, any mechanical impurities and substance must be removed from the transported air since they may cause fouling or, eventually, damage the thermal-exchange surfaces; see Figure 2(a, b, c) "Recommended Sets of TERNO-S Units...".

A direction plate on a fan part indicates the direction of rotation of an electric motor with a runner which is identical with the direction of air flow. The direction of air flow is also indicated by direction plates on filtration, cooling and heating parts.

Air-conditioning piping is connected to the set of units by means of elastic inserts and it must be hung separately. If a discharge part or the suction part of the fan unit is not connected with the piping, the flanges must be provided with protective grating.

Piping distribution of working liquids in exchangers may not exert an influence on the exchanger by its weight and dilatation forces and may not cause obstruction to maintenance and dismantling the exchanger from the chamber. Upon assembling, it is also necessary to preserve a necessary manipulation space for repair and maintenance at doors of filtration parts and electric motor of fans.

Diameters of connecting piping of individual exchangers are given in Figure 3. Connecting piping of water exchangers is provided with male pipe thread.

V. PUTTING INTO OPERATION

Upon putting into operation, the following must be checked:

- the direction of rotation of a fan; it is further necessary to **measure current** on all phases of an electric motor; should the obtained values be higher than nominal values specified on a plate of the electric motor, the volume of air transported by the fan must be **regulated** and current protection in the operating system or on switchboard must be **set up** on rated current;

- electric motors of TERNO-S fans in modification for an ordinary environment are provided with opening thermocontacts which – upon putting the fan into operation – must be connected in that manner so that to meet their protective function. Electric motors of TERNO-SSNV fans in modification for the environment with the explosion danger must be connected through current protection set up at the rated current of the motor (these electric motors are not equipped with thermocontacts);

- direction of rotation of power unit of valves; if appropriate, the direction of rotation must be changed by a change-over switcher on a power unit;

- direction of rotation of a mixing water valve; if appropriate, the direction of rotation must be changed by a change-over switcher on a power unit;

- direction of rotation of a pump, de-aeration of exchanger and tightness of water distribution system.

The provisions included in "User's and Assembly Manuals" and operating instructions, which constitute a part of delivery of TERNO-S units and related equipment, must be followed up upon assembling, putting into operation, operating and maintaining the TERNO-S units managed by controlling systems REGU AD, revolution regulators, condensant units and other regulators and/or accessories to regulators. "Recommended sets of TERNO-S units and their connection to REGU AD regulator" see Figure 2(a, b, c). It is necessary to place an order with company MANDÍK, Hostomice pod Brdy, tel. 311584811 for putting a gas heater MONZUN into operation.

VI. OPERATION AND MAINTENANCE

When making control, cleaning and repairing the equipment, the electric current must be switched off and its switching on must be blocked and ensured during the work.

When handling the exchanger, the input of working liquid must be closed and the temperature of the exchanger must be below 40°C.

It may be only a mechanic of cooling systems with a required authorization for assembling the respective condensant units who is entitled to connect, disconnect, control or anyhow handle the cooling system itself.

Exchange of a filtration insert (filter): after removing the door of the filtration part and slipping out the frame with a filter pocket insert to sides in the case of **F** filters, or from the bottom in the case of **FS** filters, the filter pocket insert may be withdrawn from the frame and cleaned or replaced by a new one. The exchange frequency depends on operational conditions of the given unit. Air output of a unit may decrease as a result of a fouled filter.

In the case of a fan failure, the fan aggregate (electric motor, supporting board and runner) may be dismantled and replaced. The entire set is supplied as a spare part; it may be repaired at the manufacturer, if required.

In the case of a failure or regular maintenance, the exchange insert shall be withdrawn through an assembly opening, cleaned or replaced by a new one.

VII. DATA ON THE PRODUCT

Individual parts of TERNO-S units are provided with rating plates which include the product mark, manufacturer, output parameters, weight and the production number.

Individual parts of TERNO-S units are further provided, if appropriate, with plates stating the direction of the air flow and direction of rotation of the runner, with a plate indicating non-explosiveness and warning notice.

VIII. SPARE PARTS, GUARANTEE AND SERVICE

Based on an order, the manufacturer will supply the following spare parts:

- electric motor
- runner with hub
- electric motor with supporting board and balanced runner
- filtration inserts
- bearer of a filtration insert (frame)
- exchanger inserts
- other parts as requested.

The guarantee period of TERNO-S units is 24 months as of the day of delivery (the guarantee period of regulators, condensant units and other accessories of regulation is 12 months).

In order to meet claims, the buyer shall be obligated to submit the certificate of warranty and a protocol on electrical revision which was executed before putting the equipment into operation.

Guarantee and post-guarantee repair and service shall be provided by company ALTEKO s.r.o.

Fig. 1- Field of output characteristics of fan parts TERNO-S size 200, 250, 280, 315, 355, 400

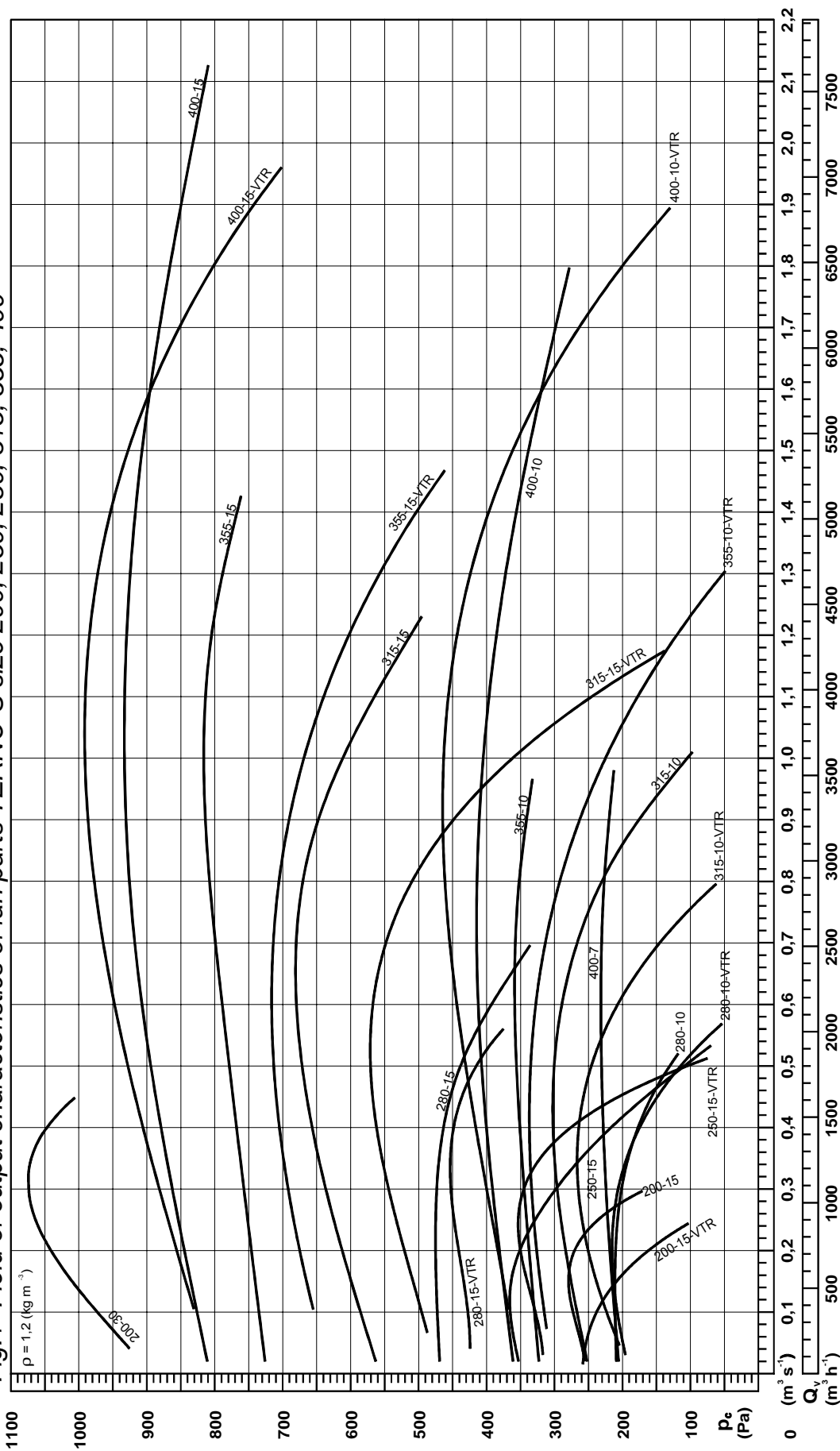


Fig. 2a - References for units configuration using regulator REGU AD-TV

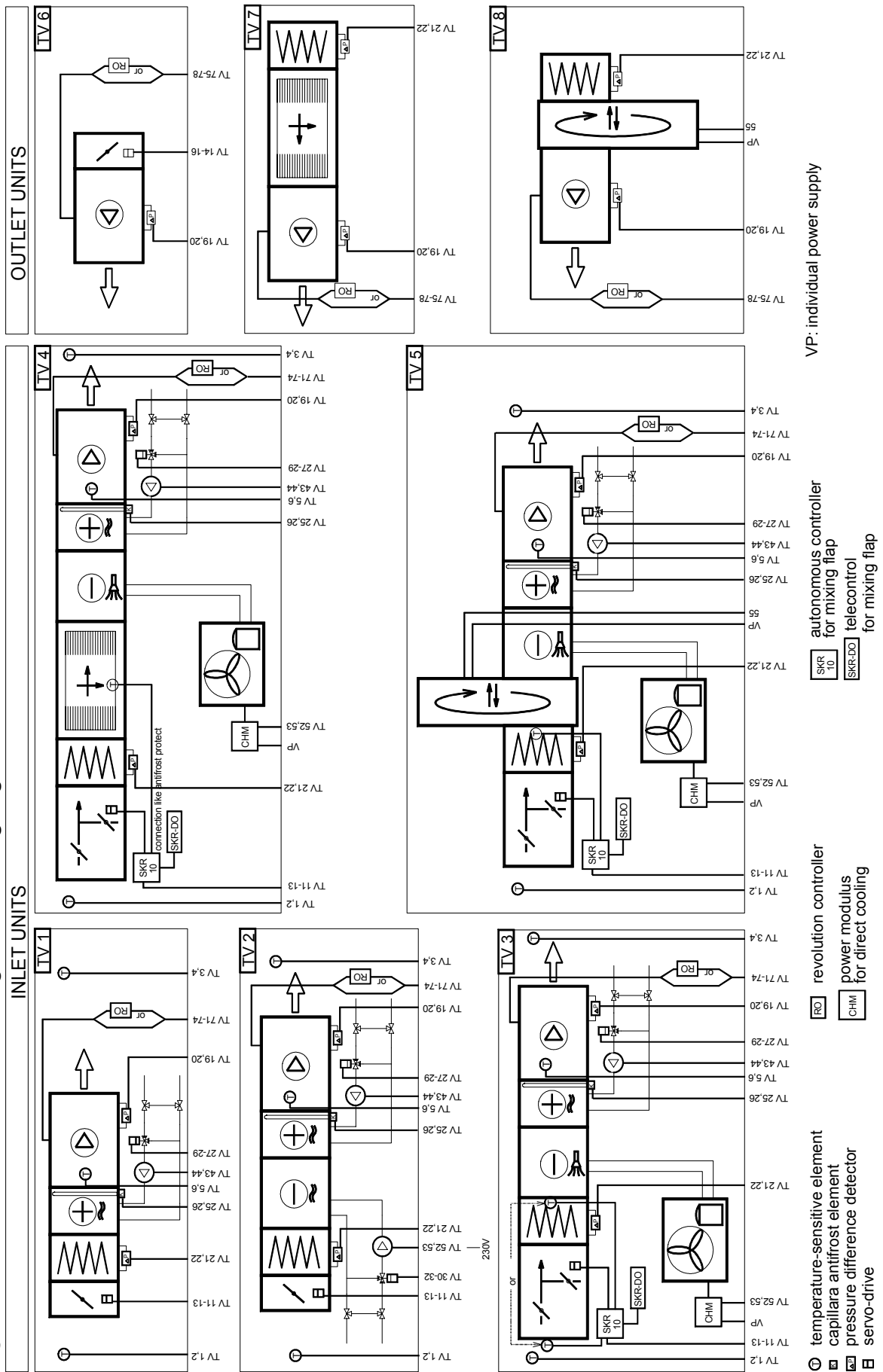
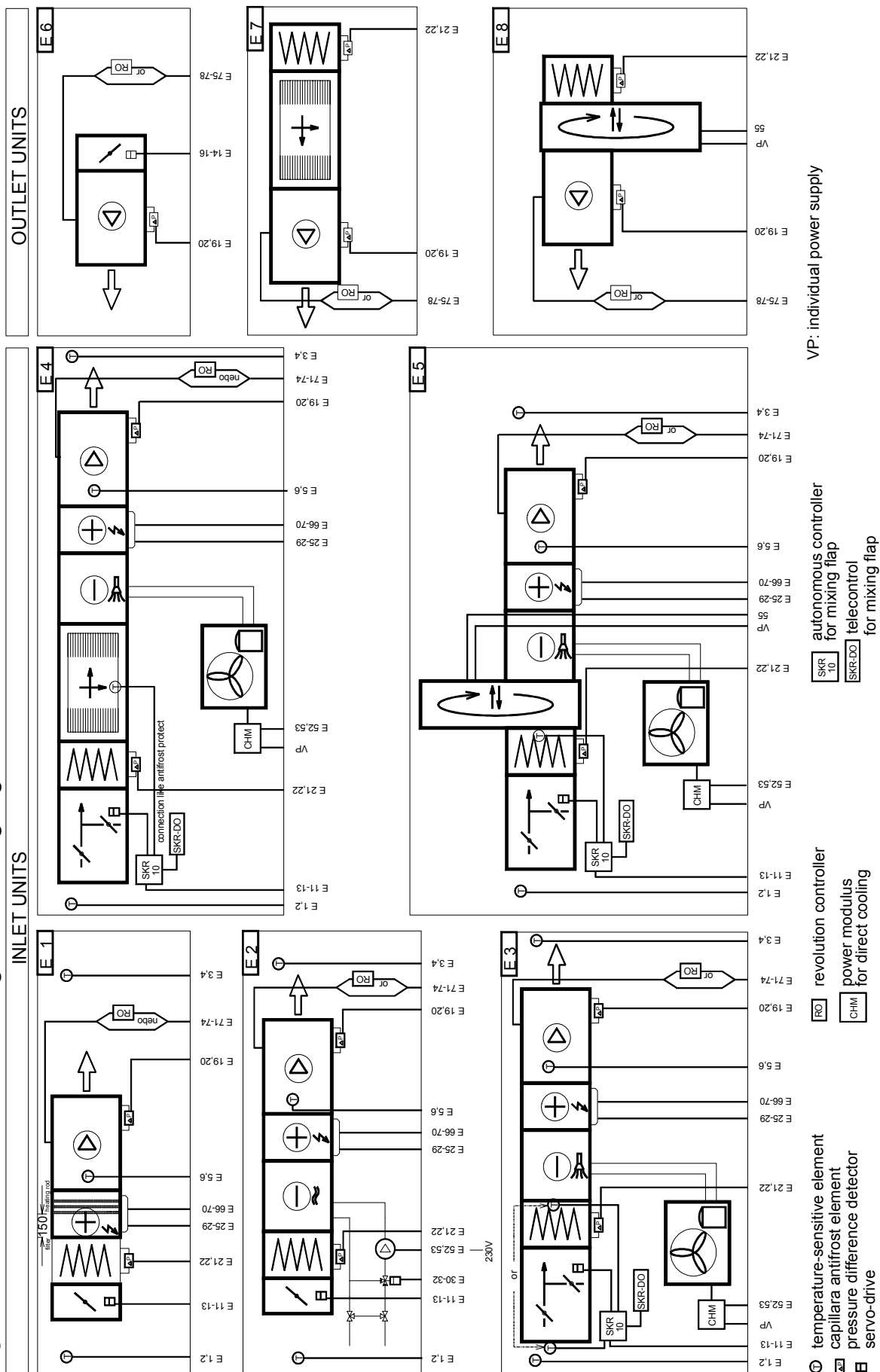


Fig. 2b - References for units configuration using regulator REGU AD-E



Tab. 1 - specification of electric motors, their parameters and specification of revolution controllers

| indication | | | | | motor type | power (W) | voltage * | current (A) λ/Δ | rated speed (1/min) | motor efficiency | motor protection | references for revolution controller | weight (kg) | |
|------------------------|------|----------|-------------------------------|-----|------------|-----------------|--------------|--------------------------------------|--------------------------|---------------------|---------------------|---|------------------|------|
| size | type | motor | position surface finish | SNV | | | | | | | | | | |
| TERNO-S 200 | K | 15 - 1 | KB | P | | 1LF7 063-4AB11 | 180 | ① | 1,57 | 1385 | 58 | IP55 | - | 15 |
| | | 15 - 3 | | | | 1LA7 063-4AB11 | 180 | ③ | 0,56/0,97 | 1350 | 60 | IP55 | FID-L 55 | 14 |
| | | 15 - 3 | | | SNV 2 | 1MA7 063-4BB11 | 180 | ③ | 0,62/1,08 | 1330 | 57 | IP55 | - | 16 |
| | | 15 - VTR | | | | DD 80-30-4CA1 | 120 | ③ | 0,35/0,61 | 1340 | 62 | IP44 | FID-L 55 | 13,5 |
| | | 30 - 3 | | | | 1LA7 083-2AA11 | 1100 | ③ | 2,4/4,2 | 2845 | 77 | IP55 | FID-L 150 | 14 |
| | | 30 - 3 | | | SNV 2 | 1MA7 083-2BA11 | 1100 | ③ | 2,5/3,8 | 2855 | 79 | IP55 | - | 14 |
| TERNO-S 250 | K | 15 - 1 | KB | P | | 1LF7 073-4AB11 | 370 | ① | 2,6 | 1400 | 64 | IP55 | - | 22 |
| | | 15 - 3 | | | | 1LA7 073-4AB11 | 370 | ③ | 1,03/1,82 | 1370 | 65 | IP55 | FID-L 55 | 21 |
| | | 15 - 3 | | | SNV 2 | 1MA7 073-4BB11 | 370 | ③ | 1,1/1,91 | 1355 | 67 | IP55 | - | 21 |
| | | 15 - VTR | | | | DD 106-50-4EB1 | 450 | ③ | 1,32/2,5 | 1315 | 70 | IP54 | FID-L 55 | 20 |
| TERNO-S 280 | K | 10 - 1 | KB | P | | 1LF7 080-6AB11 | 370 | ① | 2,9 | 900 | 60 | IP55 | - | 28 |
| | | 10 - 3 | | | | 1LA7 073-6AA11 | 250 | ③ | 0,78/1,35 | 850 | 61 | IP55 | FID-L 55 | 25 |
| | | 10 - 3 | | | SNV 2 | 1MA7 073-6BA11 | 250 | ③ | 0,81/1,49 | 850 | 63 | IP55 | - | 25 |
| | | 10 - VTR | | | | DD 106-50-6DB1 | 220 | ③ | 0,93/1,61 | 820 | 56 | IP54 | FID-L 55 | 24 |
| | | 15 - 1 | | | | 1LF7 083-4AB11 | 750 | ① | 4,8 | 1405 | 71 | IP55 | - | 29 |
| | | 15 - 3 | | | | 1LA7 083-4AA11 | 750 | ③ | 1,86/3,2 | 1395 | 72 | IP55 | FID-L 150 | 28 |
| | | 15 - 3 | | | SNV 2 | 1MA7 083-4BA11 | 750 | ③ | 2,05/3,3 | 1395 | 73 | IP55 | - | 28 |
| | | 15 - VTR | | | | DD 106-70-4BA1 | 600 | ③ | 1,8/3,1 | 1260 | 69 | IP54 | FID-L 150 | 27 |
| TERNO-S 315 | K | 10 - 3 | KB | P | | 1LA7 096-6AA11 | 1100 | ③ | 2,9/5 | 915 | 72 | IP55 | FID-L 150 | 40 |
| | | 10 - 3 | | | SNV 2 | 1MA7 096-6BA11 | 950 | ③ | 2,6/4,5 | 915 | 72 | IP55 | - | 40 |
| | | 10 - VTR | | | | DD 137-75-6BB1 | 920 | ③ | 2,9/5 | 850 | 70 | IP54 | FID-L 150 | 39 |
| | | 15 - 3 | | | | 1LA7 096-4AA11 | 1500 | ③ | 3,4/5,9 | 1420 | 79 | IP55 | FID-L 150 | 40 |
| | | 15 - 3 | | | SNV 2 | 1MA7 096-4BA11 | 1350 | ③ | 3,1/5,5 | 1415 | 78 | IP55 | - | 40 |
| | | 15 - VTR | | | | DD 137-75-4BB1 | 1500 | ③ | 3,8/6,6 | 1320 | 73 | IP54 | FID-L 150 | 39 |
| TERNO-S 355 | K | 10 - 3 | KB | P | | 1LA7 106-6AA11 | 1500 | ③ | 3,9/6,8 | 925 | 74 | IP55 | FID-L 150 | 66 |
| | | 10 - 3 | | | SNV 2 | 1MA7 106-6BA11 | 1300 | ③ | 3,35/5,8 | 935 | 77 | IP55 | - | 66 |
| | | 10 - VTR | | | | DD 137-100-6CB1 | 1250 | ③ | 3,8/6,6 | 850 | 72 | IP54 | FID-L 150 | 63 |
| | | 15 - 3 | | | | 1LA7 106-4AA11 | 2200 | ③ | 4,7/8,2 | 1420 | 82 | IP55 | FID-L 220 | 66 |
| | | 15 - 3 | | | SNV 2 | 1MA7 107-4BA11 | 2500 | ③ | 5,5/9,6 | 1415 | 81 | IP55 | - | 66 |
| | | 15 - VTR | | | | DD 137-100-4BB1 | 2000 | ③ | 5/8,7 | 1340 | 74 | IP54 | FID-L 220 | 64 |
| TERNO-S 400 | K | 7 - 3 | KB | P | | 1LA7 106-8AB11 | 750 | ③ | 2,15/3,75 | 680 | 66 | IP55 | FID-L 150 | 74 |
| | | 10 - 3 | | | | 1LA7 106-6AA11 | 1500 | ③ | 3,9/6,8 | 925 | 74 | IP55 | FID-L 150 | 81 |
| | | 10 - 3 | | | SNV 2 | 1MA7 106-6BA11 | 1300 | ③ | 3,35/5,8 | 935 | 77 | IP55 | - | 81 |
| | | 10 - VTR | | | | DD 165-95-6BB1 | 2000 | ③ | 5,2/9 | 920 | 76 | IP54 | FID-L 220 | 78 |
| | | 15 - 3 | | | | 1LA7 107-4AA11 | 3000 | ③ | 6,4/11,1 | 1420 | 83 | IP55 | FIA-M 400 | 85 |
| | | 15 - 3 | | | SNV 2 | 1MA7 107-4BA11 | 2500 | ③ | 5,5/9,6 | 1415 | 81 | IP55 | - | 85 |
| | | 15 - VTR | | | | DD 165-120-4AB1 | 3400 | ④ | 3,9/6,8 | 1360 | 84 | IP54 | FIA-M 400 | 82 |

K...directly design
KB...comer design

7...synchr.rev. 750 (1/min)
10...synchr.rev. 1000 (1/min)
15...synchr.rev. 1500 (1/min)
30...synchr.rev. 3000 (1/min)

1...motor outside 1N
3...motor outside 3N
VTR...motor inside 3N

P...right type
L...left type

Z...surface finish galvanized
E...surface finish galvanized+enamel

* ① ... 1PE AC 230V/50Hz
② ... 3PE AC 400V/230V/50Hz
③ ... 3PE AC 690V/400V/50Hz

Examples of indications (ordering) :

TERNO-S 200 K - 15 - 3 - Z
Order Number: 11041

TERNO-S 250 KB - 15 - VTR - P - Z
Order Number: 14171

TERNO-S 315 KB - 15 - 3 - P - Z - SNV2
Order Number: 13152

Order Number : vide Price List

Tab.2 - Associated mixing neutral points for water exchangers

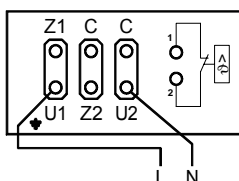
| exchangers | caculation nominal parameter for exchanger | | | | | |
|------------------|--|----------------------|-----------------------|-------------------------|-----------------------------|--------------------------------|
| | air-flow rate Qv | transmit. power Q | water-flow rate Qw | loss pressure exchanger | mixing neutral points SU | loss in valve 3MG pzv3cv |
| typ | m3/s | kW | kg/s | kPa | typ | kPa |
| TERNO-S 200-V2 | 0,2 | 10 | 0,2 | 6,7 | 40-2,5 | 9,7 |
| TERNO-S 200-CHV3 | 0,2 | 3 | 0,4 | 7,7 | 40-4 | 11,5 |
| TERNO-S 250-V2 | 0,3 | 15 | 0,2 | 7,7 | 40-2,5 | 9,7 |
| TERNO-S 250-CHV3 | 0,3 | 5 | 0,4 | 9,4 | 40-4 | 11,5 |
| TERNO-S 280-V2 | 0,55 | 25 | 0,4 | 6,3 | 40-4 | 11,5 |
| TERNO-S 280-V3 | 0,55 | 34 | 0,7 | 9,1 | 60-6,3 | 18,7 |
| TERNO-S 280-CHV3 | 0,55 | 7 | 0,5 | 10,8 | 60-4 | 17,9 |
| TERNO-S 280-CHV6 | 0,55 | 13 | 1,2 | 19,3 | 80-8 | 22,3 |
| TERNO-S 315-V2 | 0,8 | 31 | 0,5 | 7,2 | 60-4 | 17,9 |
| TERNO-S 315-V3 | 0,8 | 41 | 0,5 | 10,1 | 60-4 | 17,9 |
| TERNO-S 315-CHV4 | 0,8 | 12 | 0,6 | 8,6 | 60-6,3 | 10 |
| TERNO-S 355-V2 | 1,2 | 45 | 0,6 | 8,7 | 60-6,3 | 10 |
| TERNO-S 355-V3 | 1,2 | 60 | 0,7 | 8,7 | 60-6,3 | 13,7 |
| TERNO-S 355-CHV4 | 1,2 | 17 | 0,8 | 13,7 | 80-6,3 | 16,3 |
| TERNO-S 400-V2 | 1,8 | 65 | 0,7 | 8,3 | 60-6,3 | 13,7 |
| TERNO-S 400-V3 | 1,8 | 91 | 1,2 | 14,9 | 80-8 | 20,7 |
| TERNO-S 400-CHV4 | 1,8 | 26 | 1,2 | 17,1 | 80-8 | 20,7 |

Fig.3 - Dimensions Exchangers

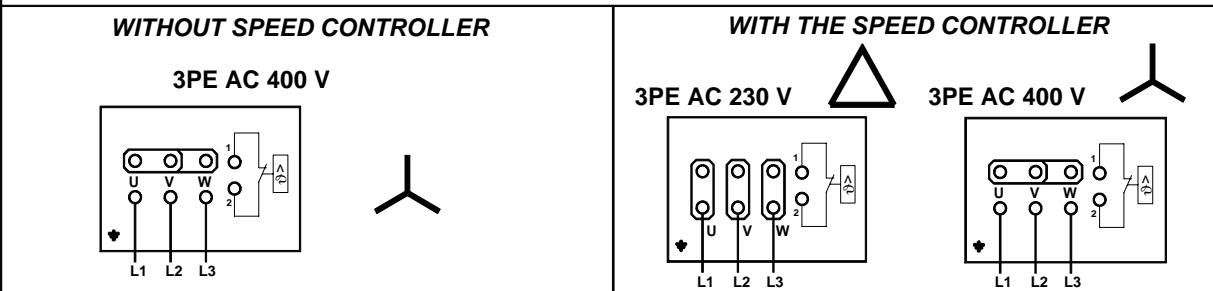
| WATER HEATING PART | | TERNO-S - V2(3) | 2 lines V2 | | 3 lines V3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|-----|--------------------------|---|--------------------|-------------------|--------------------|----|---|----|-----|-----|-----|-------|-----|-----|-------|-----|-------|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|-------|-------|-----|-----|-------|-------|-----|-----|-----|-------|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|-----|----|----|---|---|--|
| | | | <table border="1"> <thead> <tr> <th>vel.</th> <th>A</th> <th>B</th> <th>D</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>200</td> <td>355</td> <td>225</td> <td>G1/2"</td> <td>-</td> </tr> <tr> <td>250</td> <td>450</td> <td>250</td> <td>G1/2"</td> <td>-</td> </tr> <tr> <td>280</td> <td>500</td> <td>300</td> <td>G1/2"</td> <td>G3/4"</td> </tr> <tr> <td>315</td> <td>560</td> <td>355</td> <td>G3/4"</td> <td>G3/4"</td> </tr> <tr> <td>355</td> <td>700</td> <td>400</td> <td>G3/4"</td> <td>G3/4"</td> </tr> <tr> <td>400</td> <td>800</td> <td>500</td> <td>G3/4"</td> <td>G1"</td> </tr> </tbody> </table> | | vel. | A | B | D | D | 200 | 355 | 225 | G1/2" | - | 250 | 450 | 250 | G1/2" | - | 280 | 500 | 300 | G1/2" | G3/4" | 315 | 560 | 355 | G3/4" | G3/4" | 355 | 700 | 400 | G3/4" | G3/4" | 400 | 800 | 500 | G3/4" | G1" | | | | | | | | | | | | | | | | | | | | | | |
| vel. | A | B | D | D | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | 355 | 225 | G1/2" | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 250 | 450 | 250 | G1/2" | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 280 | 500 | 300 | G1/2" | G3/4" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 315 | 560 | 355 | G3/4" | G3/4" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 355 | 700 | 400 | G3/4" | G3/4" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 400 | 800 | 500 | G3/4" | G1" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WATER COOLING PART | | TERNO-S - CHV3(4) | 3 lines CHV3 | 4 lines CHV4 | 6 lines CHV6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>vel.</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th>D</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>200</td> <td>355</td> <td>225</td> <td>350</td> <td>G1/2"</td> <td>-</td> <td>-</td> </tr> <tr> <td>250</td> <td>450</td> <td>250</td> <td>400</td> <td>G1/2"</td> <td>-</td> <td>-</td> </tr> <tr> <td>280</td> <td>500</td> <td>300</td> <td>450</td> <td>G3/4"</td> <td>-</td> <td>G1"</td> </tr> <tr> <td>315</td> <td>560</td> <td>355</td> <td>500</td> <td>-</td> <td>G3/4"</td> <td>-</td> </tr> <tr> <td>355</td> <td>700</td> <td>400</td> <td>550</td> <td>-</td> <td>G1"</td> <td>-</td> </tr> <tr> <td>400</td> <td>800</td> <td>500</td> <td>650</td> <td>-</td> <td>G1"</td> <td>-</td> </tr> </tbody> </table> | | vel. | A | B | C | D | D | D | 200 | 355 | 225 | 350 | G1/2" | - | - | 250 | 450 | 250 | 400 | G1/2" | - | - | 280 | 500 | 300 | 450 | G3/4" | - | G1" | 315 | 560 | 355 | 500 | - | G3/4" | - | 355 | 700 | 400 | 550 | - | G1" | - | 400 | 800 | 500 | 650 | - | G1" | - | | | | | | | | |
| vel. | A | B | C | D | D | D | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | 355 | 225 | 350 | G1/2" | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 250 | 450 | 250 | 400 | G1/2" | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 280 | 500 | 300 | 450 | G3/4" | - | G1" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 315 | 560 | 355 | 500 | - | G3/4" | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 355 | 700 | 400 | 550 | - | G1" | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 400 | 800 | 500 | 650 | - | G1" | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EVAPORATION COOLING PART | | TERNO-S - CH4(6) | 4 lines CH4 inlet | 4 lines CH4 outlet | 6 lines CH6 inlet | 6 lines CH6 outlet | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>vel.</th> <th>A</th> <th>B</th> <th>C</th> <th>D1</th> <th>D2</th> <th>D1</th> <th>D2</th> </tr> </thead> <tbody> <tr> <td>200</td> <td>355</td> <td>225</td> <td>350</td> <td>12</td> <td>16</td> <td>-</td> <td>-</td> </tr> <tr> <td>250</td> <td>450</td> <td>250</td> <td>400</td> <td>12</td> <td>16</td> <td>-</td> <td>-</td> </tr> <tr> <td>280</td> <td>500</td> <td>300</td> <td>450</td> <td>12</td> <td>22</td> <td>16</td> <td>28</td> </tr> <tr> <td>315</td> <td>560</td> <td>355</td> <td>500</td> <td>16</td> <td>28</td> <td>-</td> <td>-</td> </tr> <tr> <td>355</td> <td>700</td> <td>400</td> <td>550</td> <td>16</td> <td>28</td> <td>-</td> <td>-</td> </tr> <tr> <td>400</td> <td>800</td> <td>500</td> <td>650</td> <td>28</td> <td>35</td> <td>-</td> <td>-</td> </tr> </tbody> </table> | | vel. | A | B | C | D1 | D2 | D1 | D2 | 200 | 355 | 225 | 350 | 12 | 16 | - | - | 250 | 450 | 250 | 400 | 12 | 16 | - | - | 280 | 500 | 300 | 450 | 12 | 22 | 16 | 28 | 315 | 560 | 355 | 500 | 16 | 28 | - | - | 355 | 700 | 400 | 550 | 16 | 28 | - | - | 400 | 800 | 500 | 650 | 28 | 35 | - | - | |
| vel. | A | B | C | D1 | D2 | D1 | D2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | 355 | 225 | 350 | 12 | 16 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 250 | 450 | 250 | 400 | 12 | 16 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 280 | 500 | 300 | 450 | 12 | 22 | 16 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 315 | 560 | 355 | 500 | 16 | 28 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 355 | 700 | 400 | 550 | 16 | 28 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 400 | 800 | 500 | 650 | 28 | 35 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

FOR ORDINARY ENVIRONMENT

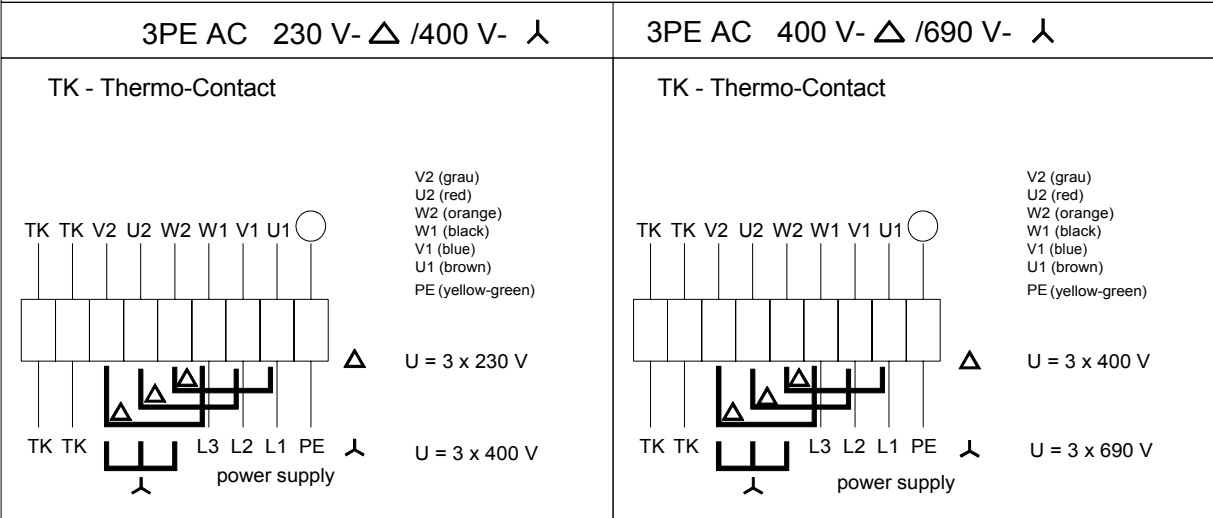
CONNECTION OF THE TERMINAL BOXES OF MOTOR 1NPE AC 230 V / 50 Hz (SIEMENS)



CONNECTION OF THE TERMINAL BOXES OF MOTOR 1NPE AC 400 V / 230 V / 50 Hz (SIEMENS)



CONNECTION OF THE TERMINAL BOXES OF MOTOR FOR FANS "VTR"



FOR ENVIRONMENT WITH THE EXPLOSION DANGER

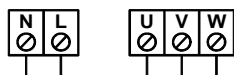
CONNECTION OF THE TERMINAL BOXES OF MOTOR 1NPE AC 400 V / 230 V / 50 Hz (SIEMENS)



NOTE :

Fans in the modification suitable for an environment with the explosion danger may not be used with revolution controllers !

CONNECTION REVOLUTION CONTROLLER FID-L



inlet

outlet to motor

1PEN/AC 230V/ 50 Hz

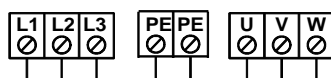
3PE/AC 230V/ 20-50 Hz

Motor must link to Δ !

REFER CIRCUIT BREAKER FOR FID-L

| | | | |
|-----------------------------|------|------|------|
| size | 55 | 150 | 220 |
| size for current protection | 10 A | 16 A | 20 A |

CONNECTION REVOLUTION CONTROLLER FIA-M



inlet

outlet to motor

3PE/AC 400V/ 50 Hz

3PE/AC 400V/ 20-50 Hz

REFER CIRCUIT BREAKER FOR FIA-M

| | | | |
|-----------------------------|--|------|------|
| size | | 400 | 550 |
| size for current protection | | 16 A | 20 A |

CONDUCTOR FOR INTERCONNECTION FID-L
AND TELECONTROL: SYKFY 7 x 0,5

CONDUCTOR FOR INTERCONNECTION FIA-M
AND TELECONTROL: SYKFY 7 x 0,5