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TECHNICAL CONDITIONS FOR ROTARY EXCHANGERS FOR HEAT RECOVERY

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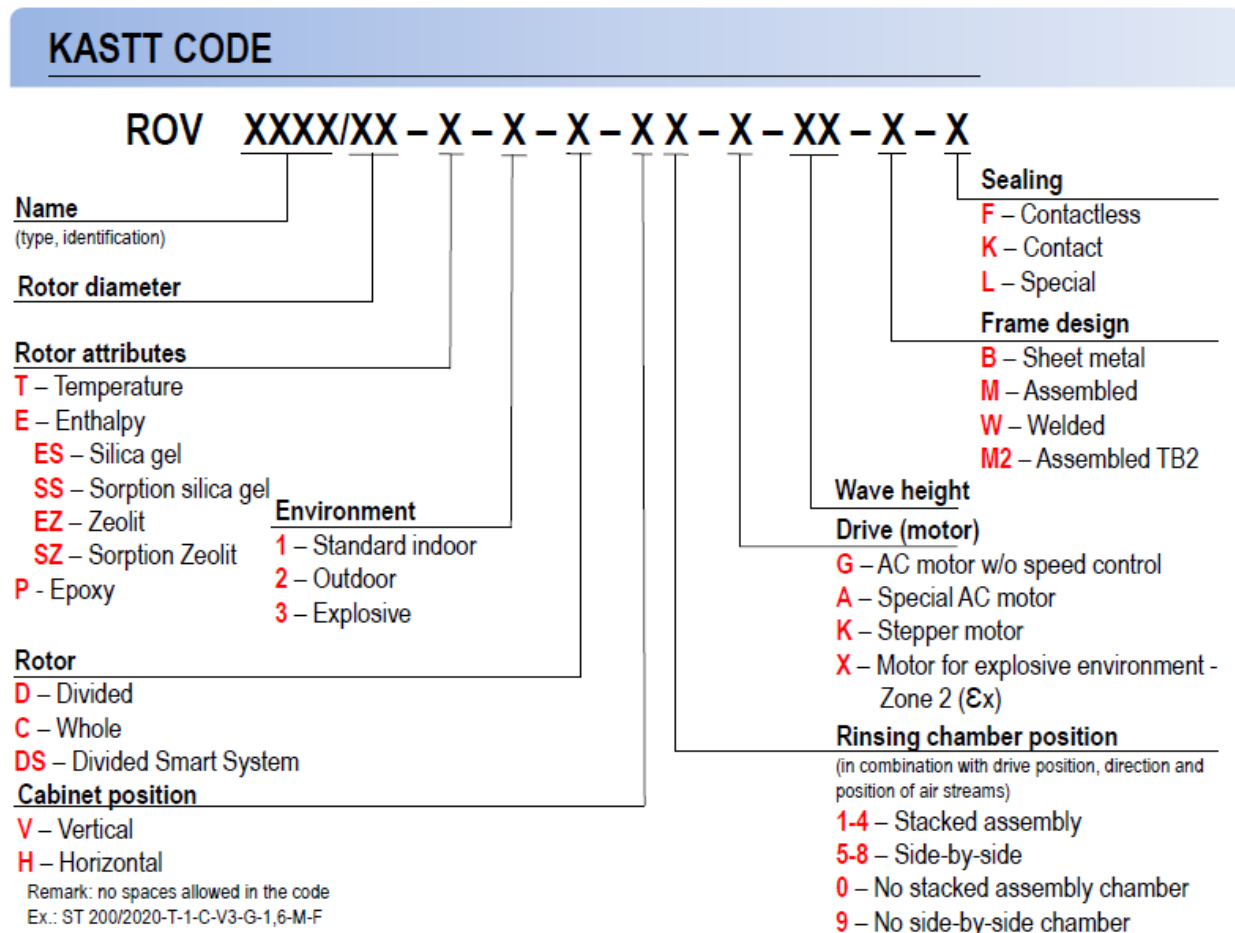
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Dimensions in mm, weight in kg.

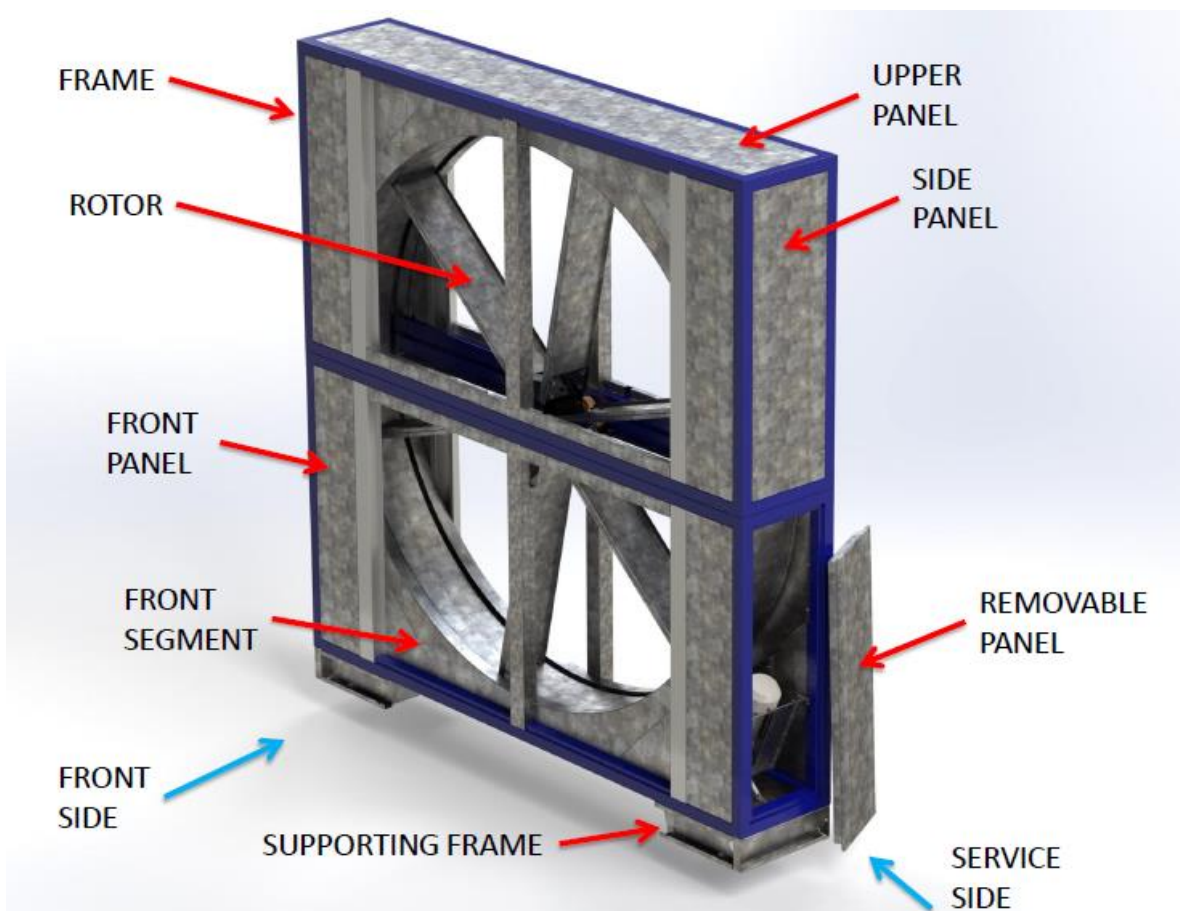
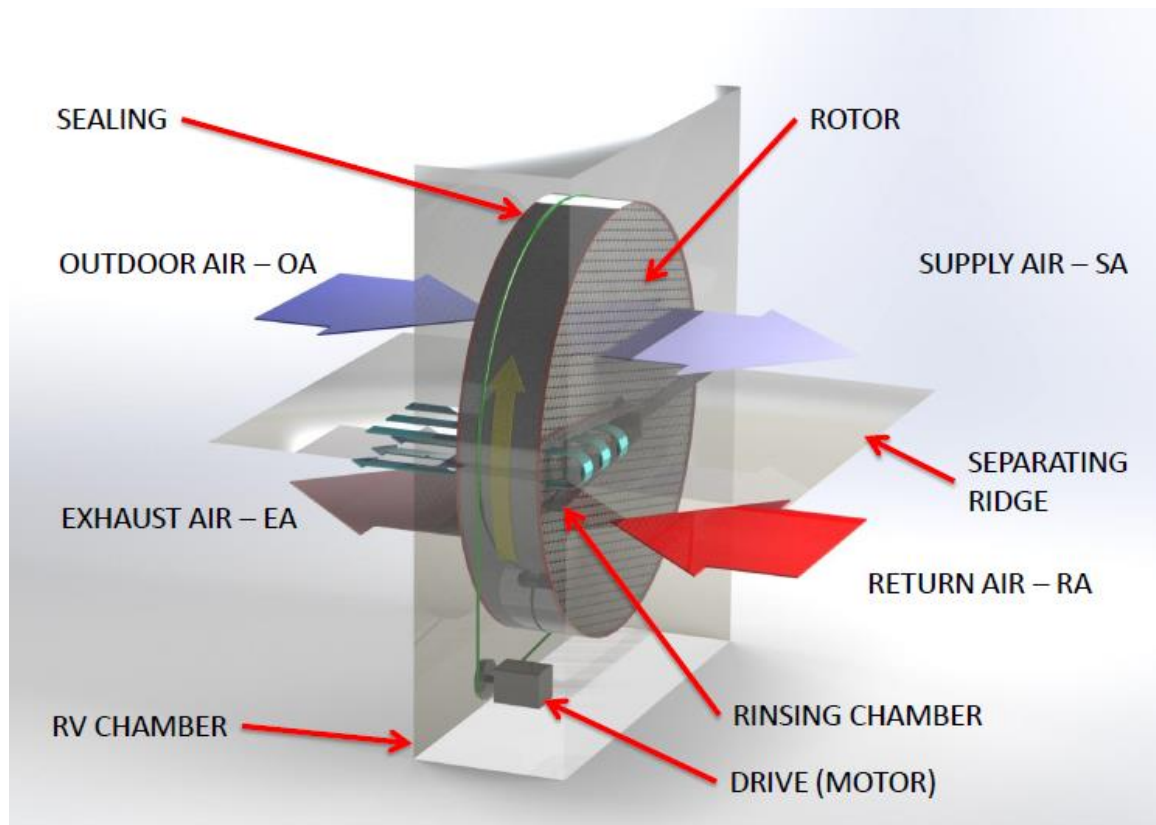
The technical conditions for rotary (regenerative) heat exchangers for heat recovery (hereinafter referred to as "rotary heat exchanger" or "RV") determine the main dimensions, design and performance. The conditions shall apply for the design, ordering and delivery upon mutual agreement between the contractor and the customer as well as for installation, operation and maintenance.

1 TERMINOLOGY

1.1 KASTT CODE for ordering the heat exchanger (as used hereinafter)



1.2 RV Scheme - Description



1.3 RV Construction - CHAMBER

- **RV chamber** is a metal cabinet featuring the rotor for air treatment.
- **Frame** is made of a sheet metal, assembled or welded construction.
- **Chamber edging** is made of a rolled galvanized profile or a galvanized sheet.
- **Corner profile** is a connecting part of profiles in corners of the assembled frame.
- **Separating ridge** is a sheet metal part that divides the space in between the channels.
- **Rinsing chamber** is a wedge-shaped sheet metal part fitted in the dividing plane of the rotary heat exchanger.
- **RV front side** is the space parallel to the functional space of the rotor.
- **Front segment** is a sheet metal part covering the free space around the rotor in the direction of the air flow.
- **Panel** is a flat filler of periphery or front walls of the chamber.
- **External panels** are panels on external sides of RV.
- **Front panels** are panels covering the front side of RV (with their profile coming out of the air handling unit perimeter).
- **Removable panel** is one of the perimeter panels allowing to access the motor connections/wiring.
- **Inspection hole** is a removable component in the perimeter or front wall.
- **Support frame** is a removable part on the bottom side of the frame (frame construction or legs).

1.4 RV Construction – FRAME

- 1.4.1 SHEET METAL / BASIC**, labeled **B**. An independently non-bearing construction is formed using bent galvanized sheets (front segments). This frame may be used as a slide-in module or a basis for shell of rotors with diameters from 500 to 2,400 mm.
- 1.4.2 ASSEMBLED**, labeled **M**. The rolled galvanized profiles are used for the assembled frame construction, interconnected using angular elements to form a partially self-supporting construction. The manufacturer assumes static coordination of other components in the air-handling unit. This frame is used as a separate component for air-handling units with rotors of 700 to 3,800 mm of diameter.
- 1.4.3 WELDED**, labeled **W**. Rolled closed profiles are welded to form a spatial frame that is additionally hot dip galvanized. This frame construction is fully self-supporting. It is recommended for large separated rotors and horizontal RV position. This frame may be used as a separate component for air-handling units with rotors from diameters varying from 1,500 to 5,000 mm.
- 1.4.4 Shell** is made of sandwich panels with thermal insulating attributes. Panels are filled with mineral wool (declared coefficient of heat conductivity according to ČSN EN 12667). Panels are coated with a steel galvanized sheet that may be painted by request. Frames and panels are sealed by sealing tape.

1.5 RV Construction – ROTOR

- **Rotor** of RV is a roller wound from a flat or crenulated aluminum coil and is intended for transfer of heat, heat and moisture or moisture only.
 - **Aluminum coil** (hereinafter referred to as Al coil) is a rolled sheet of aluminum alloy with a width of 200 or 250 mm which is used for the rotor manufacture. Al coil is used with or without surface treatment.
 - **Rotors** up to 2,920 mm of diameter are supplied as a single unit, however they may also come separated or thickened to achieve higher air flow rates. Rotors with diameter exceeding 2,920 mm always come separated.
 - **Rotor shaft support** is assured by ball respectively conical bearings.
- 1.5.1 Rotor for heat transmission - TEMPERATURE**
- **The temperature (condensation) rotor**, labeled **T**, is the rotor designed for the heat transfer. Aluminum coil without surface treatment is used for its manufacture.
 - **The epoxy rotor**, labeled **P**, is a rotor for heat transfer to an aggressive environment (chlorine, marine environment, salt etc.). Aluminum coil with an epoxy resin surface treatment is used for its manufacture.
- 1.5.2 Rotor for heat and moisture transfer - HYGROSCOPIC**
- **Hygroscopic (enthalpy) rotor**, labeled **ES**. This rotor is designed to transfer heat and moisture. It is manufactured using Al coil with a surface layer of silica gel.
 - **Moisture (hygroscopic) rotor**, labeled **EZ**. This rotor is designed to transfer heat and moisture. It is manufactured using Al coil with a surface layer of zeolite, i.e. a molecular sieve (4Å).

1.5.3 Rotor for dehumidification - SORPTION

- **SORPTION rotor**, labeled **SS**. The rotor is designed to transfer heat with a stress put on a maximum transfer of moisture. It is manufactured using Al coil with a surface layer of silica gel.
- **SORPTION rotor**, labeled **SZ**. The rotor is designed to transfer heat with a stress put on a maximum transfer of moisture. It is manufactured using Al coil with a surface layer of zeolite, i.e. a molecular sieve (4Å).

1.6 RV Construction – MOTOR

- 1.6.1 The asynchronous motor**, hereinafter referred to as AC motor, by default supplied without the frequency converter (optional feature), labeled **G**. AC motor (standard version) is always supplied with forced cooling and fitted with spur or worm gearing. The speed control range (using the frequency converter) is 18 to 85 Hz. By default AC motor is supplied with a supply voltage of 3 x 400 V, optionally 3 x 230 V or 1 x 230 V. For details on the motor power see the catalogue sheet. The standard version of AC motor is supplied with IP55 protection rating.
- 1.6.2 Asynchronous motor** - a special motor with bevel-helical gearing, supplied without the frequency converter (optional feature), labeled **A**. The motor is supplied without forced cooling and allows the speed control by the frequency converter within the range from 5 to 120 Hz. By default this special AC motor is supplied with a supply voltage of 3 x 400 V or 3 x 230 V. For details on the motor power see the catalogue sheet. The standard version of AC motor is supplied with IP55 protection rating.
- 1.6.3 Stepper motor**, labeled **K**. To run this type of motor, a control electronics is always required (DRIVER - a stepper motor controller). Speed control is assured by an external signal (0 – 10 V). By default the stepper motor is supplied with a supply voltage of 1 x 230V. For details on the motor power see the catalogue sheet. The standard version of stepper motor is supplied with IP20 protection rating
- 1.6.4 Driving force transmission** between motor and rotor is assured by a driving belt. The belt is (based on its type) connected by welding or a mechanical link.
- 1.6.5 Speed control.** RV may be operated at constant or variable speed. While operating RV at variable speed, the speed control is assured by means of an external or autonomous control unit. Speed is controlled by a frequency converter or a control unit. Maximum allowed speed of RV is 20 rev./min. Should this speed be exceeded, the manufacturer does not provide any warranty. By default pulleys come from manufacture with a specific diameter to provide the speed from 10 to 13 rev./min. at 85 Hz for temperature and hygroscopic RVs, respectively 18 to 20 rev./min. at 85 Hz for sorption RVs.
If a stepper motor is used, a regulation must be set to control the speed.

1.7 RV Construction – SEALING

- 1.7.1 CONTACTLESS sealing**, labeled **F**. This sealing is made of felt and is intended for welded or assembled construction.
- 1.7.2 CONTACT sealing**, labeled **K**. This sealing is made of a set of brushes and is intended for sheet construction (BASIC).
- 1.7.3 SPECIAL / LABYRINTH sealing**, labeled **L**. This sealing is a labyrinth system made of PVC and it is intended for all RV constructions (BASIC, assembled, welded).

1.8 Indicator of leakage

- Outdoor air, labeled OA.
 - Supply air, labeled SA.
 - Return air, labeled RA.
 - Exhaust air, labeled EA.
- **OACF (Outdoor Air Correction Factor)** – represents the factor between the air prior to entering RV (OA) and air after entering RV (SA). It shows the loss due to rinsing and leakages between the supply and exhaust channels.
 - **EATR (Exhaust Air Transfer Ratio)** – is a percentage value representing the transmission of return air

back to the supply air channel due to rotor action and leakages in this direction. Contaminations caused by rotor action may be completely eliminated by a rinsing chamber with a concurrent impairment of OACF.

- Both parameters are completely dependent on the difference of static pressures between the supply and exhaust channels on the relevant RV side.

2 GENERAL

2.1 Description of the RV

The rotary heat recovery exchanger (hereinafter RV) is designed for heat transfer - temperature, for heat and humidity transfer - hygroscopic or for moisture transfer - sorption, from the outlet air to the incoming air. The transfer of heat or moisture occurs on the rotor, half of which is in the stream of warm outgoing air the other of which is in the stream of incoming air. By turning the rotor the heat-exchange surface of the exchanger alternately passes through the stream of outgoing and incoming air and thus transfers the heat, heat and moisture or just moisture.

2.2 Description of the versions - basic differentiation

2.2.1 by cabinet construction

- whole
- divided

2.2.2 by rotor construction

- whole
- divided

2.2.3 by function

- for heat transfer - temperature
- for heat and humidity transfer - hygroscopic
- for moisture transfer - sorption

2.2.4 by environment

- for a normal indoor environment (standard version)
- for an outdoor environment
- for an environment with the risk of explosion
- for an aggressive environment

2.2.5 by the temperature of the transported air

- standard version - 20 °C to + 55 °C
- for higher temperatures up to max. + 120 °C on the basis of agreement with the manufacturer

2.2.6 by location in the air conditioning system

- in the unit
 - a) in a stacked assembly (from the aspect of the pipes position)
 - b) in a side-by-side assembly (from the aspect of the pipes position)
- arbitrary version (in the ducting, building construction, etc.)
 - a) in a stacked assembly (from the aspect of the pipes position)
 - b) in a side-by-side assembly (from the aspect of the pipes position)

2.2.7 by the manner of engine drive and regulation

- with constant speed
 - without control – labeled **G**
- with variable speed
 - with a special AC motor – labeled **A**
 - with a stepper motor with a control unit – labeled **K**

2.3 Use and working conditions for the RV

2.3.1 RV are manufactured in the modifications given in paragraph 2.2.

2.3.2 The standard version of the RV is in an environment, with an ambient temperature of -20 °C to + 55 °C.

- 2.3.3** The project engineer must design any anti-freezing protection on the basis of the incoming and outgoing air's thermal capacity.
- 2.3.4** For the standard version, the air stream cannot exceed a temperature of + 55 °C. Upon arrangement with the manufacturer, a version of the RV can be made for higher temperatures up to a maximum of + 120°C.
- 2.3.5** The RV is placed vertically or horizontally in the cabinet.
- 2.3.6** In the standard version, the transported air should not exceed the manufacturer's recommended rate of 4 m/s (30 % irregularity tolerance). Pressure loss at the inlet and outlet cannot exceed 15% of the theoretical value, based on the design program by Kastt. Should the recommended values be exceeded by more than 30 %, it may lead to engine damage (not covered by manufacturer's warranty). If it is necessary for the air stream being transported to be higher, with a maximum of up to 6 m/s, it is necessary to consult the manufacturer about a particular case, the manufacturer will make a special reinforcement for the rotor and the whole construction of the RV.
- 2.3.7** The manufacturer limits the working range of the AC motor with a variable speed control from 18Hz up to 85 Hz. The limit values must not be exceeded. Failure to comply will lead to engine damage. The working range of special AC motor speed is limited to 5 Hz - 120 Hz. This limit does not apply to stepper motors.
- 2.3.8** In standard version AC motors are supplied with IP55 protection rating according to ČSN EN 60529. Stepper motors are supplied (in standard version) with IP20 protection rating. Should higher protection rating be required (improved waterproofing function), it must be consulted with the manufacturer.
- 2.3.9** The minimum speed for hygroscopic RVs with an active layer of silica gel (ENTHALPY, SORPTION) is 0.5 rev. / min. The manufacturer also prohibits bringing the RV rotor to a complete full stop for the entire year. This restriction does not apply to the hygroscopic versions with a zeolite layer.

3 TECHNICAL REQUIREMENTS

3.1 RV design and purpose

- 3.1.1** RV is used for airflow according to the KASTT design program. Nominal volume flows are determined as optimal with regard to the rotor diameter. Under standard conditions the recommended air flow rate varies from 2 to 4 m/s.
- 3.1.2** The type-sizes of the RV are based on the rotors' diameter series. The RV size is assigned depending on the air flow with regard to the pressure loss of the rotor. This loss of pressure cannot exceed the value based on the design program.
- 3.1.3** The inflow air (OA) and the outflow air (RA) for RV must be filtered to avoid the rotor cells clogging. The project engineer proposes the degree of filtration with regard to the environment and the purpose for which RV is used.
- 3.1.4** Given that the manufacturer does not have the opportunity to comment on the proposed air conditioning unit set up, it is necessary to have access to the RV rotor from both sides to perform common maintenance and servicing, and warranty as well as after-warranty repairs. In the event that the unit set up does not allow this, the manufacturer requires the possibility of removing the entire RV from the unit. In the case of removing the RV, the extra costs incurred shall be borne by the customer (with regard to both the warranty and after-warranty service).
- 3.1.5** RV dimensions are based on the design program, which is available on the website www.kastt.cz. Other modifications to the RV should be consulted upon with the manufacturer depending on specific requirements.
- 3.1.6** Consultations and technical specifications of the design, including processing a precise calculation of the heat exchanger and dimensional design, can be arranged with the manufacturer or processed separately using the design program.

4 PRODUCT LABELLING

- 4.1 Each product is provided with a type plate, which includes the following information and parameters:
- manufacturer,
 - product type,
 - serial number,
 - critical performance parameters of the motor.
- 4.2 The plate for the electric motor and gearbox may be accessed by opening the inspection hole.
- 4.3 The product is accompanied with the EC Declaration of Conformity document in accordance with Act No. 22/1997 Coll.

5 SAFETY

- 5.1 Each installation must be carried out on the basis of a project by a qualified project engineer.
- 5.2 Installation and commissioning of the equipment must be carried out by the manufacturer or a professional assembly company that has been demonstrably trained or specially commissioned for this work.
- 5.3 Electrical installation and commissioning may only be performed by a professional with professional qualifications pursuant to ČSN 34 3205 (Service instructions for rotating electrical machinery) and COOS Decree No. 50/78, Coll., Section 6 or higher. While installing RV abroad (outside the Czech Republic territory), the applicable local legislation must be followed.
- 5.4 Prior to being put into service a review of the electrical installation and the M&R system must be carried out pursuant to CSN 34 1500. During RV operation the operator is obliged to carry out regular inspections of the electrical equipment at frequency pursuant to CSN 33 1500. During assembly and restarting it is necessary to observe all of the manufacturer's instructions. While operating RV abroad (outside the Czech Republic territory), the applicable local legislation must be followed.
- 5.5 It is forbidden to run or operate RV when the inspection hole is open or the panels are uncovered. During operation, it is necessary to prevent persons having access to moving parts.
- 5.6 Prior to starting maintenance, cleaning and service works on RV, the power must be turned off and appropriate measures implemented to prevent the electric motor being turned on in the course of the works.

6 OUTPUT INSPECTION AND TESTING

- 6.1 Each product is subjected to an output control and testing including:
- checking the version's conformity with the documentation,
 - a check of the completeness of the supply
 - a control of belt tension
 - a control of the drive function,
 - a 15 minute test of the rotor's running (a test run) – random sampling,
 - a test of the functionality of the regulation if it is installed – random sampling.
- 6.2 After inspection and testing the status is entered in the Certificate of Product Quality and Completeness.

7 HANDLING, PACKAGING, DELIVERY AND STORAGE

- 7.1 RV is transported by normal means of transport and must always be transported in a vertical position (i.e., the rotor's horizontal axis of rotation). The haulier is responsible for securing it from tipping over and protecting it from mechanical damage.
- 7.2 Each RV is fitted with THIS SIDE UP and FRAGILE GOODS stickers. In the event of proven non-compliance with the handling and transport instructions, the contractor is not bound by the product warranty.

- 7.3 RV with non-separated rotors from diameter of 1,820 mm up to 3,020 mm are fitted with position indicators. Should the indicator reveal prohibited position, RV must be thoroughly checked, especially with regard to integrity of torsion rods in the rotor. This inspection may be only carried out by a qualified operator using an ultrasound measuring instrument.
- 7.4 The product is delivered packaged in PE shrink foil. Deviations are possible upon request by the customer (pallet, foam profiles, bubble wrap, etc.).
- 7.5 If the RV rotor has been secured against movement during transport it is necessary to remove this before start-up.
- 7.6 Each product is accompanied with a delivery note = warranty certificate and a service logbook.
- 7.7 The technical conditions are available at www.kastt.cz. Otherwise the technical conditions are only sent upon request.
- 7.8 Another method of acceptance can be set out in the contract.
- 7.9 The goods are received in accordance with the generally valid rules.
- 7.10 During storage the product should be protected against mechanical damage and from the effects of moisture. This requirement is based on the assumed possibility of air humidity condensing under the PE foil and subsequently oxidising the galvanized elements.

8 INSTALLATION, OPERATION AND MAINTENANCE

- 8.1 RV is installed between the flanges of the air-conditioning ducting, in the air-conditioning unit or in building structures.
- 8.2 RV does not require special servicing.
- 8.3 Within the scope of the maintenance it is necessary to check the tension of the drive belt, rotor sealing, rotor clogging and tension of the perimeter shell of separated RV.
- 8.4 Cleaning is carried out by compressed air, steam or pressurised water. Cleaning must be carried out by a trained person. **A non-professional cleaning procedure runs the risk of serious damage to RV rotor!**
- 8.5 Assembly and operating rules for the RV are part of these TC.
- 8.6 For separate rotors, the manufacturer recommends making a slight tightening of the outer casing after the first 80 hours of operation (carried out evenly around the circumference of the rotary heat recovery exchanger – BEWARE!! of ovality) including adjustments to the sealing elements.

9 DOCUMENTATION

- 9.1 The product is (by request) accompanied with the following documentation:
- Technical conditions for RV,
 - Assembly and operating rules,
 - Certificate of product's quality and completeness,
 - Declaration of conformity pursuant to Act No. 22/1997 Coll., Section 13,
 - Rotor wiring diagram (and possibly also frequency converter wiring diagram),
 - Delivery note = warranty certificate (always),
 - Service logbook (always).

10 SERVICE

- 10.1 The manufacturer provides warranty and post-warranty service. The manufacturer may entrust the service to a trained service firm. The manufacturer provides a contact. For regular service inspections and possible

repairs to RV it is necessary to ensure easy access to the equipment incl. the rotor, i.e. allow easy access to both frontal areas of RV incl. the removable side panel on the side of the motor (engine).

10.2 Any complaints about the goods must be accompanied by the delivery note = warranty certificate and duly completed service log. Any paid services are invoiced according to the valid price list for service work or according to the service agreement.

10.3 Spare parts are not supplied with the product. If necessary, they may be ordered from the manufacturer. The order must include RV type, serial number, year of manufacture and the required spare parts.

Applicable standards, regulations and technical requirements:

- ČSN EN 12667 Thermal performance of building materials and products
Determination of thermal resistance by means of guarded hot plate and heat flow meter methods
Products of high and medium thermal resistance
- ČSN 33 1500 Electrical and engineering regulations - Inspection and testing of electrical installations
- ČSN 33 2000-4-41 ed.2 Electrical and engineering regulations – Electrical equipment
Part 4: Safety
Chapter 41: Protection against electric shock
- ČSN 33 2000-6 Low voltage electrical installations - Part 6: Verification
- ČSN 34 3205 Service instructions for rotating electrical machinery
- ČSN EN 60529 Degrees of protection provided by enclosures (IP Code)
- Decree No. 50/1978 Coll., on professional qualification in electrical engineering
- Act No. 22/1997 Coll., on technical requirements for products