KASTT, spol. s r.o.
Jižní 870 | 500 03 Hradec Králové (CZ)
IČ: 13583948 | DIČ: CZ13583948

TECHNICAL CONDITIONS FOR

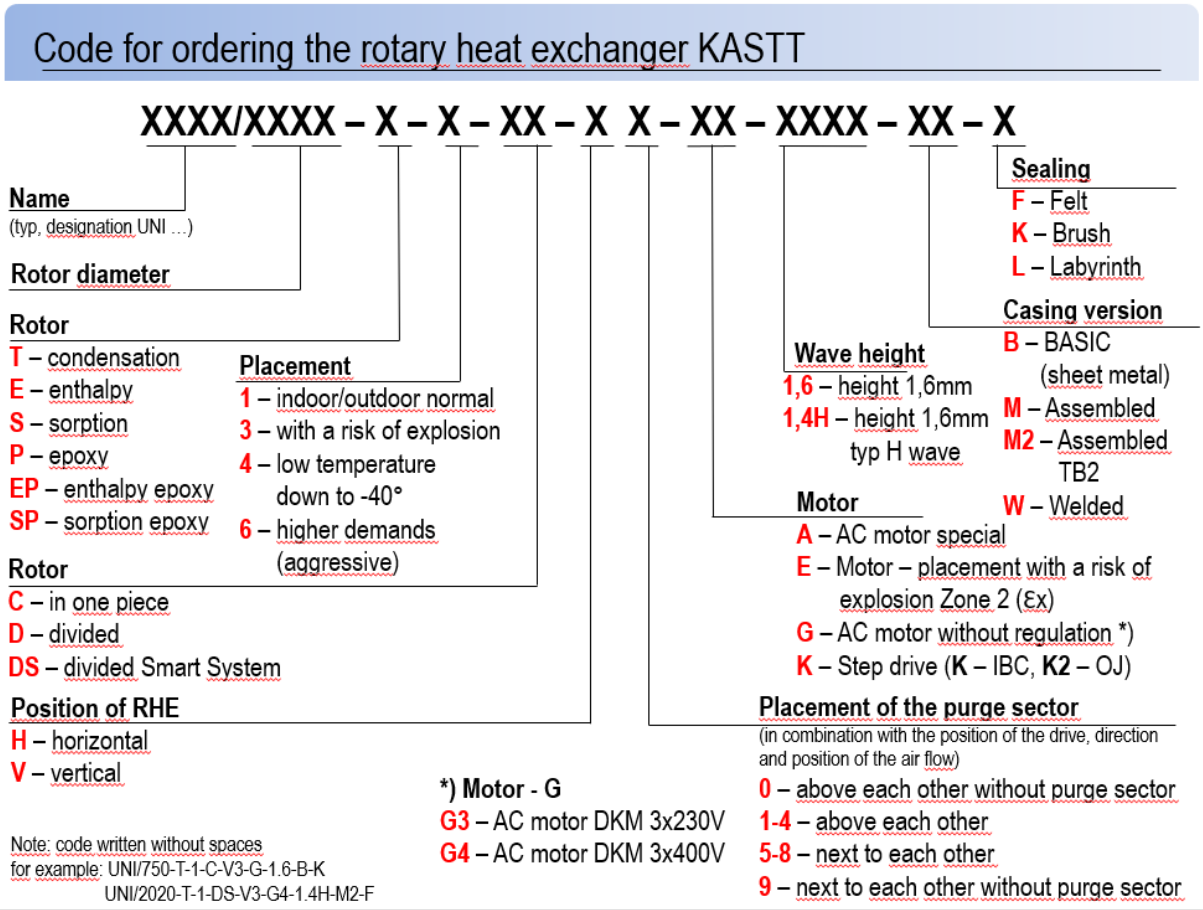
THE KASTT ROTARY HEAT EXCHANGERS

Update: 04.2023 Pages: 15

Dimensions in mm, weight in kg.
The technical conditions for rotary (regenerative) heat exchangers for heat recovery, hereinafter also referred to as "rotary heat exchanger", "exchanger" or "RHE"), determine the main dimensions, design and performance. The conditions apply to design, ordering and delivery subject to mutual agreement between the contractor and the customer, as well as for installation, operation and maintenance.

1 NOMENCLATURE

1.1 KASTT CODE designation of the RHE type (used hereinafter)



+420 495 404 010
info@kastt.cz

KASTT, spol. s r.o.
Jižní 870 | 500 03 Hradec Králové (CZ)
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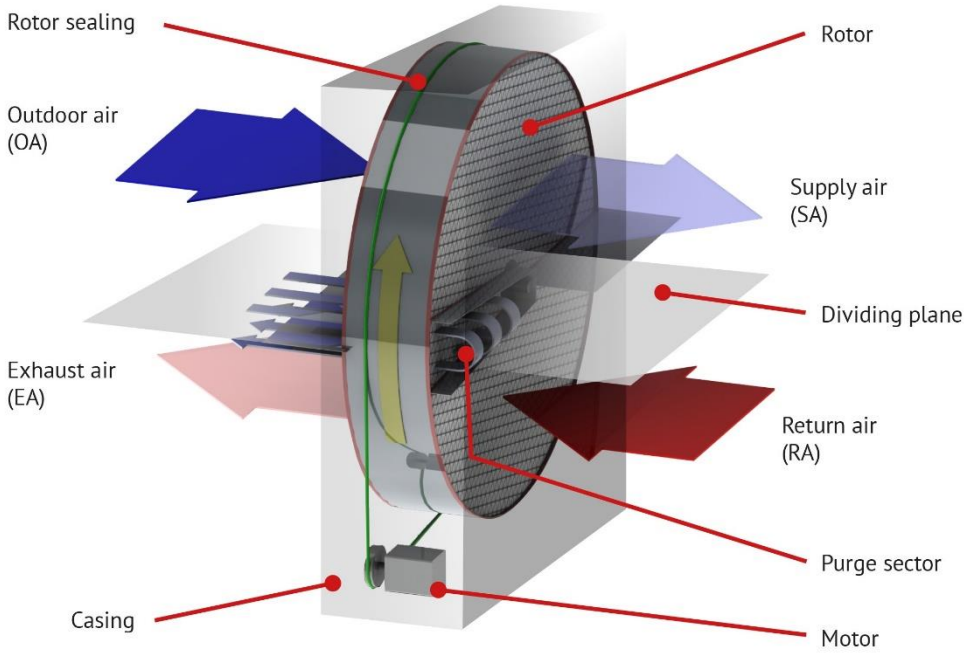
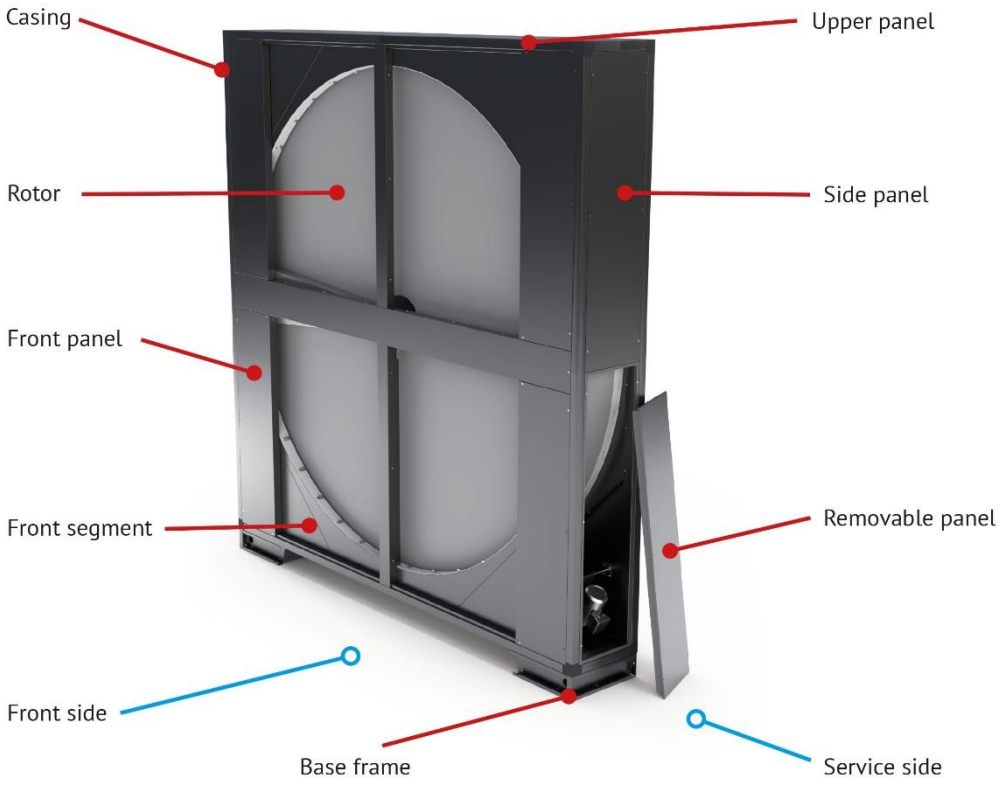
1.2 RHE scheme - description





1.3 Construction of RHE - CASING

- **Casing** is a metal housing to house the exchanger rotor.
- **Casing frame** consists of a sheet metal, prefabricated or welded structure.
- **Casing edging** is made of a rolled galvanized profile or galvanized sheet metal.
- **Corner profile** is the connecting part of the profiles in the corners of the mounted casing.
- **Dividing plane** is a sheet metal part that forms the interface between the outdoor and extract air ducts.
- **Purge sector** is a wedge-shaped sheet metal part mounted in the dividing plane of the rotary heat exchanger.
- **Front side of RHE** is a surface parallel to the functional surface of the rotor.
- **Front panel** is a sheet metal part that forms a cover of the free surface around the rotor in the direction of air flow.
- **Panel** is a planar filling of the peripheral or front walls of the casing.
- **Side panels** are panels around the perimeter of the RHE.
- **Front panels** are panels covering a part of the front side of the RHE protruding from the contour of the entire air handling unit.
- **Removable panel** is one of the side panels, allowing access to the motor wiring.
- **Inspection / mounting hole** is a removable part in the front panel.
- **Base frame** is a removable part on the underside of the casing.

1.4 Construction of RHE - CASING

1.4.1 **Casing construction SHEET METAL / BASIC**, designation in the code - letter **B.** Using bent galvanized sheets of the front panels, a self-supporting structure is created separately. Use as a plug-in module or as a basis for further cladding. This construction is designed for one-piece rotors in the range from 500 to 2,400 mm in diameter. For divided rotors in diameter from 1,000 to 3,600 mm.

1.4.2 **Casing construction MOUNTED,** designation in the code - letter **M.** Using rolled galvanized profiles, connected by corner profiles to the space casing, a partially independent supporting structure is created. The manufacturer assumes the static interaction of other elements in the air handling unit. Use as a separate component in the air handling unit assembly. Suitable for rotors in the range from 1,000 to 3,800 mm in diameter.

1.4.3 **Casing construction WELDED,** designation in the code - letter **W.** Welded into the space casing using rolled closed profiles and additionally hot-dip galvanized. The structure is fully self-supporting. Recommended for large, divided rotor diameters or horizontal RHE position. Use as a separate component in the assembly of the air handling unit for rotors in the range from 1,500 to 5,000 mm in diameter.

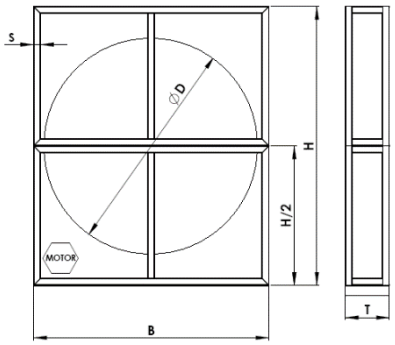
1.5 Construction of RHE - SHEATHING

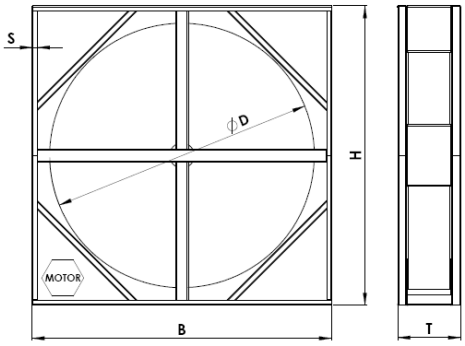
1.5.1 **Sheathing** consists of sandwich panels with thermal insulation properties. The panel filling is made of mineral wool material (declared coefficient of thermal conductivity according to ČSN EN 12667). The shell of the panels is made of galvanized steel sheet, which can be

supplemented with a colored finish on request. The sealing of the casing and panels is ensured with EPDM sealing tape.

1.5.2 General overview of casing sizes

Sheet metal ONE-PIECE design - BASIC							
ØD [mm] from	ØD [mm] to	B [mm]	H [mm]	T brush [mm]	T labyrinth [mm]	S [mm]	AC motor [W]
500	1000	ØD+100	ØD+100	290	310	25	40
1010	1230				350		90
1240	1290			310			
1300	2190						180
2200	2400						370
Sheet metal DIVIDED design - BASIC							
1000	1290	ØD+120	ØD+120	310	X	25	90
1300	1700						180
1710	2190			350			
2200	2400						370
2500	2900	ØD+150	ØD+150				750
3000	3590						
Assembled ONE-PIECE design							
ØD [mm] from	ØD [mm] to	B [mm]	H [mm]	T felt [mm]	T labyrinth [mm]	S [mm]	AC motor [W]
1000	1290	ØD+180	ØD+180	460	380	46/65	90
1300	2190						180
2200	2990				410		370
Mounted DIVIDED design							
1900	2190	ØD+220	ØD+220	460	X	46/65	180
2200	2990						370
3000	3800	ØD+260	ØD+260	505		67/86	750
Welded DIVIDED design							
ØD [mm] from	ØD [mm] to	B [mm]	H [mm]	T felt [mm]	T labyrinth [mm]	S [mm]	AC motor [W]
1500	2190	ØD+130	ØD+130	445	X	50	180
2200	2220						370
2230	2700	ØD+180	ØD+180	465		60	
2710	2990	ØD+260	ØD+260	505		80	
3000	5000						750





1.6 Construction of RHE - ROTOR

- **Rotor** of RHE is a cylinder wound alternately from a straight and corrugated (coiled) aluminum coil and is primarily intended for the transfer of heat or heat and moisture.
- **Aluminum coil** (hereinafter referred to as Al coil) is a rolled sheet of aluminum alloy with a width of 200 mm, which is used to manufacture the rotor. Al coil is used without or with surface treatment. A layer of molecular sieve is used for the so-called hygroscopic design of the rotor. Epoxy coating for use in aggressive environments.
- **Rotor** is supplied as a one-piece rotor up to a diameter of 2,990 mm as standard. Above a diameter of 2,990 mm, the rotor is always divided.

1.6.1 Rotor for heat transfer - CONDENSATION

- **Condensation rotor**, designation in the code - letter **T.** The rotor is designed exclusively for heat transfer. An Al coil without surface treatment is used for the production of the rotor.

1.6.2 Rotor for heat and moisture transfer - ENTHALPY

- **ENTHALPY rotor,** designation in the code - letter **E.** The rotor is designed for heat and moisture transfer. An Al coil is used for the production of the rotor, on which a layer of molecular sieve 4Å - Zeolite is applied. The humidity efficiency of the enthalpy rotor corresponds to at least 60% of its temperature efficiency $\frac{\eta_x}{\eta_t} \geq \mathbf{60}$ %.

1.6.3 Rotor for heat and moisture transfer - SORPTION

- **SORPTION rotor**, designation in the code - letter **S.** The rotor is designed for heat transfer with emphasis on maximum efficiency of moisture transfer. An Al coil is used for the production of the rotor, on which a layer of molecular sieve 4Å - Zeolite is applied. The humidity efficiency of the sorption rotor corresponds to at least 70% of its temperature efficiency $\frac{\eta_x}{\eta_t} \geq \mathbf{70}$ %.

1.6.4 Rotor designed for aggressive environments - EPOXY

- **Epoxy rotor**, designation in the code - letter **P.** The rotor is designed exclusively for heat transfer in aggressive environments (swimming pools, marine environment - chlorine, salt, etc.). An Al coil is used to manufacture the rotor, on which a layer of epoxy resin is applied to protect the surface of the Al coil and other Al parts from the effects of the chemical environment.

1.7 Construction of RHE - MOTOR

- **Electric motor** is an electric machine that converts electrical energy into mechanical energy in order to obtain torque / force.
- **Transmission** reduces the rotational movement of the electric motor (different speed / different torque / different direction of rotation).
- **Pulley and belt** are part of the belt drive. It transmits rotational energy from the el. engine or gearbox on the rotor.
- **Speed control** (electronic) frequency converter or control unit el. engine and signal from control room MaR.

1.7.1 Electric motor

1.7.1.1 Asynchronous motor (hereinafter referred to as AC motor) in delivery without frequency converter (can be added), designation in the code - letter **G**. The standard AC motor is cooled by a stream of air from the motor propeller and is complemented by a bevel or bevel gearbox. The permissible speed control range of the frequency converter is from 18 to 85 Hz. The AC motor is supplied as standard with a supply voltage of 3 x 400 V, optionally 3 x 230 V or 1 x 230 V on request. The motor power is specified in the catalog sheet. The standard version of the AC motor is supplied with IP55 protection rating.

1.7.1.2 **Asynchronous motor - special** with bevel gearbox, also delivered without frequency converter as standard (can be retrofitted), designation in the code - letter **A.** It is supplied without forced cooling up to 400 W. From 400 W, the motor is equipped with a propeller. The motor allows the speed range to be regulated by the frequency converter in the basic interval from 5 to 87 Hz. The motor can be operated up to a frequency of 120 Hz (during this operation the motor power decreases according to the operating curve). The special AC motor is supplied as standard with a supply voltage of 3 x 400 V or 3 x 230 V. The motor power is specified in the catalog sheet. The standard version of the AC motor is supplied with IP55 protection rating.

1.7.1.3 **Stepper motor**, designation in the code - letter **K.** It is a set of a motor with control electronics - driver (stepper motor driver). Speed control is provided by an external signal 0–10 V. The stepper motor is supplied as standard with a supply voltage of 1 x 230 V. The motor power is specified in the data sheet. The standard version of the stepper motor is supplied with IP20 protection rating.

1.7.2 **Transmission**

1.7.2.1 **Worm gear** (worm gears) is one of the most used reducers, which ensures an effective solution of the angular transmission and the required transmission ratio with small installation dimensions. Long service life, low noise and higher efficiency of worm gears depend mainly on a suitable lubricant (oil filling). The main advantages of worm gears include a large gear ratio, low weight, high load capacity, quiet and smooth operation throughout the operation, self-locking. Among the disadvantages are the lower efficiency (ranging from n = 45 to 60%) and the heat generated at this low efficiency, which must be dissipated by the lubricant (oil fill).

1.7.2.2 **Bevel gear** is a very variable and modular solution of angular transmission. The main advantages include high efficiency (up to 96%), low noise and resistance to overheating. Another indisputable advantage of bevel gearboxes (compared to worm gearboxes) is the higher gear ratios (up to i=300). That's all is the main reason why bevel gearboxes replace worm gearboxes. High efficiency and long service life guarantee a quick economic return thanks to the energy saved.

1.7.3 **Transmission of driving force** between the motor and the RHE rotor is ensured by a pulley and a drive belt.

1.7.3.1 **Pulley** is a grooved cylinder into which the belt fits and is firmly connected to the motor or gearbox shaft. Its size is adapted to complete the transmission between the revolutions of the el. engine and the required rotor speed of RHE. The type of pulley / groove shape in the pulley is determined by the shape of the belt (round or wedge cross section).

1.7.3.2 **Belt** it is made of rubber or fabric material and serves to connect the transmission from the pulley to the rotor circumference. Depending on the type of belt, the belt is connected either by welding or by a mechanical coupling.

1.7.4 **Speed control.** The RHE can be operated at constant or variable speeds. In variable speed operation, speed regulation is solved by external or autonomous control. The speed is regulated by a frequency converter or a control unit. The maximum permitted rotor speed is

20 rpm. Above these speeds, the manufacturer is not bound by the warranty. By default, the rotor speeds are set for Condensation, Enthalpy and Sorption RHEs in the range of 10 to 12 rpm at 85 Hz.
In case of a request to change the rotor speed, it is necessary to use a frequency converter or settings using the control unit and an external signal of the MaR system.

1.8 Construction of RHE - SEALING

1.8.1 **CONTACTLESS sealing,** designation in the code - letter **F**. Felt material is used for sealing and is intended for RHE casing construction (mounted and welded).

1.8.2 **CONTACT sealing,** designation in the code - letter **K**. A brush system is used for sealing and it is intended for sheet metal construction of RHE (BASIC).

1.8.3 **SPECIAL - LABYRINTH sealing,** designation in the code - letter **L.** The labyrinth system, PVC material, is used for sealing and is intended for all RHE constructions (BASIC, mounted, welded).

1.9 RHE leakage indicators - OACF and EATR

Outdoor air, designation OA.
Supply air, designation SA.
Extract air, designation RA.
Exhaust air, designation EA.

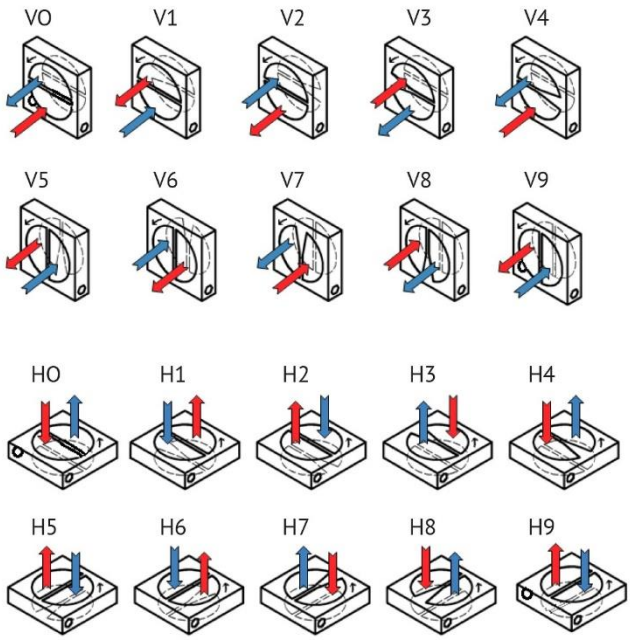
- **OACF (Outdoor Air Correction Factor)** - expresses the ratio of outdoor air before the exchanger (OA) and after the exchanger (SA). It characterizes the loss caused by rinsing and leakage between the supply and exhaust channels.

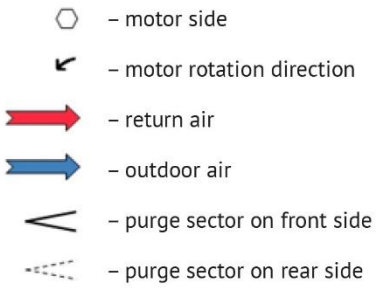
- **EATR (Exhaust Air Transfer Ratio)** - is the percentage transfer of extract air (RA) back to the supply air (SA) channel caused by the rotation of the rotor and leaks in this direction. Contamination caused by rotor rotation can be completely eliminated by the purge sector while deteriorating the OACF.
- Both parameters depend on the difference in static pressures between the supply and exhaust ducts on the respective side of RHE.

1.9.1 **Purge sector size**
The size of the purge sector (angle or area) depends on the pressure conditions at the location of the dividing plane of the rotor, the rotor speed, the inlet air velocity, the rotor type and the wave size of the rotor matrix.

Recommended purge sector sizes:
- Temperature, enthalpy rotors 2 x 2.5°
- Sorption rotors 2 x 5°

1.9.2 Purge sector position





2 GENERAL

2.1 Description of RHE

Heat or moisture transfer occurs in the rotor, one half or part of which enters the extract air stream and the other half into the supply air stream. By rotating the rotor, the heat exchange surface passes alternately through the flow of return and supply air, thereby transferring heat or heat and moisture.

2.2 Description of design - basic division

2.2.1 according to the construction of the casing

- one-piece
- divided

2.2.2 according to the rotor design

- one-piece
- divided

2.2.3 according to function

- for heat transfer - condensation
- for heat and moisture transfer - hygroscopic
  according to the efficiency of moisture transfer, RHEs are further divided into:
  - enthalpy
  - sorption

2.2.4 according to the environment

- for standard indoor environment (standard design)
- for outdoor environment
- for the environment with risk of explosion
- for aggressive environment

2.2.5 according to the temperature of the transported air

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

2.2.6 according to the location in the air conditioning system

- into the unit
    a) into the assembly on top of each other (from the point of view of the location of the pipeline)
    b) into the assembly next to each other (from the point of view of the location of the pipeline)
- free design (into pipes, building structures, etc.)
    a) into the assembly on top of each other (from the point of view of the location of the pipeline)
    b) into the assembly next to each other (from the point of view of the location of the pipeline)

2.2.7 according to the connection and use of the front surface

- design without front panels - above each other type A (in the direction of air flow)
  - fully utilized working area of the rotor
- design with front panels - above each other type B (in the direction of air flow)
  - partial covering of the active surface of the rotor

2.2.8 according to the method of drive (motor) regulation

- with constant speed
- with variable speed

2.3 Use and working conditions for RHE

2.3.1 RHEs are manufactured in modifications according to paragraph 2.2.

2.3.2 The standard version of the RHE is for indoor environment with an ambient temperature of -20°C to +55°C.

2.3.3 The designer, or the designer of the HVAC unit, is obliged to design and solve, based on the parameters of the supply and exhaust air, a suitable frost protection.

2.3.4 The flow of transported air, in the standard version, must not exceed a temperature of +55°C. Subject to agreement with the manufacturer, RHE for higher temperatures, up to +120°C at maximum, can be produced.

2.3.5 RHEs are installed with a vertical or horizontal position of the casing.

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2.3.6 The flow velocity of the transported air must not, in the standard version, exceed the manufacturer's recommended speed of 4 m/s (tolerance 30% for unevenness). The pressure loss at the air supply and exhaust must not exceed more than 15% of the theoretical value, based on KASTT's design program. Even if these recommended values are exceeded by more than 30% locally, the RHE rotor can be damaged and the manufacturer therefore does not provide a guarantee for such a product. In the case of a requirement for a higher speed of the flow of the transported air, but not more than 6 m/s, it is necessary to consult a specific case with the manufacturer, who will perform special reinforcement of the rotor and the entire RHE structure.

2.3.7 The performance parameters in KASTT's design program correspond to the countercurrent RHE connection. In case of design and use of RHE in co-current connection it is necessary to contact the manufacturer.

2.3.8 The operating speed range of the AC motor supplemented by speed control is limited by the motor manufacturer to the range of 18 Hz to 85 Hz. The limit values must not be exceeded. Failure to do so will damage the motor. When operating below 18 Hz, the motor is not able to cool itself, when the speed exceeds 85 Hz, the torque decreases. The motor may then not have the necessary force to rotate with the rotor.
The operating speed range of special AC motors is limited to 5 Hz to 87 (120 Hz this operation must not be long-term).
This restriction does not apply to stepper motors.

2.3.9 AC motors are supplied in the basic version with the degree of protection IP55 according to ČSN EN 60529. Stepper motors are supplied with IP20 protection as standard. If a higher degree of protection is required, in order to increase the resistance to water penetration, it is necessary to consult with the manufacturer.

2.3.10 The manufacturer prohibits complete stopping of the RHE rotor for a longer period of time. If the RHE is taken out of operation, the rotor must be rotated every 30 minutes for at least 10 s. Due to gravity, the ovality of the rotor can change and thus irreversibly damage the entire RHE.

3 TECHNICAL REQUIREMENTS

3.1 RHE design and application

3.1.1 RHEs are used for air output according to the KASTT design program. The nominal volume flows are determined as optimal with respect to the rotor diameter. For standard conditions, an air flow speed in the range of 1 to 4 m/s is recommended.

3.1.2 RHE sizes are based on the average range of rotors. The RHE size is assigned according to the air output under standard conditions (temperature 20°C, relative humidity 50%). The choice of the rotor matrix geometry is based on the requirement of temperature and humidity efficiency of the RHE with respect to the rotor pressure drop.

3.1.3 Both the outdoor air (OA) and the extract air (RA) for the RHE must be filtered to prevent clogging of the rotor casing. The degree of filtration is determined by the designer with regard to the environment and the purpose for which the RHE is used. The degree of filtration the manufacturer recommends a minimum class of ISO Coarse 90% (according to ČSN EN ISO 16890)

3.1.4 As the manufacturer does not have the opportunity to comment on the proposed assembly of the air handling unit, he requires access to the RHE rotor from both front sides so that it is possible to perform routine service, maintenance and warranty and post-warranty repairs. If the unit assembly does not allow it, the manufacturer requires the possibility to extend the entire RHE out of the unit assembly. In the case of RHE extension, the customer pays the additional costs (either in the warranty or post-warranty service).

3.1.5 The dimensions of the RHE are based on the specific design program. The current version of the design program is listed on the website www.kastt.cz, with the option to request a version download. Modifications of the RHE must be consulted with the manufacturer according to specific requirements.

3.1.6 Consultations and technical specification of the design, including the processing of the exact calculation of the heat exchanger and dimensional design, can be agreed with the manufacturer or processed separately using the design program and submitted to the manufacturer for approval.

4 PRODUCT LABEL

4.1 Each product is provided with a type plate, which contains the following data and parameters:
- manufacturer's designation,
- product type,
- serial number,
- decisive motor performance parameters.

4.2 The plate of the electric motor and gearbox is accessible after opening the inspection hole.

4.3 In accordance with Act No. 91/2016 Coll., the product is accompanied with an EC declaration of conformity document.

5 SAFETY

5.1 Each installation must be performed on the basis of a project by a qualified designer.

5.2 The installation and commissioning of the equipment may only be carried out by the manufacturer or a professional installation company, demonstrably trained by the manufacturer or authorized specifically for this work.

5.3 The electrical installation and its commissioning may only be performed by a worker with professional qualifications according to the COOS Decree No. 50/78 Coll., Section 6 or higher.

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When installing RHE outside the territory of the Czech Republic, similar local legislative regulations apply.

5.4 Prior to commissioning, the equipment must be inspected for electrical installation and the M&R system in accordance with ČSN 33 1500. During the operation, the operator is obliged to perform regular inspections of electrical equipment within the deadlines according to ČSN 33 1500. All manufacturer's instructions must be observed during installation and activation. When operating RHE outside the territory of the Czech Republic, similar local legislative regulations apply.

5.5 It is forbidden to start or operate the RHE with the inspection hole open or the panels exposed. During operation, it is necessary to prevent access of persons to moving parts.

5.6 Before starting maintenance, cleaning and service work on the RHE, it is essential to switch off the power supply and take measures to prevent the electric motor from switching on during this work.

6 OUTPUT INSPECTION AND TESTING

6.1 Each product is subjected to a final inspection and test including:

- checking the conformity of the design with the documentation,
- checking the completeness of the delivery,
- belt tension control,
- drive function check,
- rotor operation test for 15 minutes (run-in test) - random selection,
- test of control functionality, if installed - random selection.

6.2 The condition after inspection and testing is entered in the Certificate of Quality and Completeness of the product.

7 HANDLING, PACKAGING, DELIVERY AND STORAGE

7.1 The RHE is transported by conventional means of transport and must always be carried out in a vertical position (i.e. the axis of rotation of the rotor is horizontal). The carrier shall be liable for securing the load against tipping and mechanical damage.

7.2 Each RHE has a DO NOT TURN (THIS SIDE UP) label and a FRAGILE GOODS label. In the case of proven non-compliance with the method of handling and transport, the contractor is not bound by the product warranty.

7.3 RHEs with one-piece rotors from a rotor diameter of 1,820 mm to a rotor diameter of 2,990 mm are additionally equipped with position indicators. If an unauthorized position is detected by the indicator, it is essential to check the RHE with emphasis on the integrity of the reinforcing bars in the rotor. This check can be performed by a qualified person using an ultrasonic meter.

7.4 The product is delivered packed in shrinkable PE foil. Deviations are possible at the customer's request (pallet, foam profiles, bubble wrap, etc.).

7.5 If the rotor is secured against movement in the RHE for transport, this protection must be removed before start-up.

7.6 A delivery note = warranty card is issued for each product and a service book is attached.

7.7 Technical conditions are available at www.kastt.cz. Otherwise, the technical conditions are sent only on request.

7.8 The delivery of goods is fulfilled by enabling the loading of goods in the contractor's production plant.

7.9 Another method of acceptance can be specified in the contract.

7.10 During storage, the product must be protected against mechanical damage and moisture. This requirement is based on the assumption of possible precipitation of air humidity under the PE foil and subsequent oxidation of galvanized elements.

8 INSTALLATION, OPERATION AND MAINTENANCE

8.1 The RHE is mounted between the flanges of the air-handling piping, in the assembly of the air-conditioning unit or in building structures.

8.2 RHE does not require special operation.

8.3 As part of maintenance, it is necessary to check the tension of the drive belt, the rotor seal, the clogging of the rotor and the tension of the perimeter cladding of the divided RHE - see Installation and operating instructions - Preventive maintenance plan.

8.4 When the RHE is put into operation in the HVAC system or unit, there may be a gradual release of technological aluminum chips. These chips are not corrosive and do not affect the functionality of the RHE and HVAC units. As part of maintenance, these chips must be vacuumed from around the RHE.

8.5 Cleaning is performed with compressed air, steam or pressurized water.
Cleaning must be performed by a trained person. **Improper cleaning can cause serious damage to the RHE rotor!**

8.6 Installation and operating instructions for rotary heat exchangers is an integral part of these Technical conditions.

8.7 For divided rotors, the manufacturer recommends after the first 80 hours of operation to lightly tighten the circumferential casing (performed evenly around the entire circumference of the rotary heat exchanger - ATTENTION!! to ovality), including the adjustment of the sealing elements.

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9 DOCUMENTATION

9.1 The following documentation is supplied with the product on request:

- Technical conditions for RHE
- Installation and operating instructions for RHE,
- Certificate of quality and completeness of the product,
- Declaration of conformity according to Act. 22/1997 Coll., Section 13,
- Motor connection diagram, or frequency converter connection,
- Delivery note = warranty card (always),
- Service book.

10 SERVICE

10.1 Warranty and post-warranty service is provided by the manufacturer. The manufacturer may entrust service to trained service companies. Contact details will be provided by the manufacturer. For regular service inspections and possible repairs of the RHE, it is necessary to ensure trouble-free access to the equipment, incl. rotor, i.e. enable seamless access to both front surfaces of the RHE incl. removable side panel on the motor side.

10.2 When claiming goods, it is necessary to submit a delivery note = warranty card and a duly completed service book. All paid service operations are invoiced according to the valid price list of service works or according to the concluded service contract.

10.3 Spare parts are not supplied with the product. If necessary, spare parts can be ordered from the manufacturer. The order must state the type of RHE, serial number, year of manufacture and specify the required part.

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Related standards, regulations and technical conditions:

ČSN EN 12667	Thermal performance of building materials and products Determination of thermal resistance by methods of guarded hot plate and heat flow meter Products with high and medium thermal resistance
ČSN 33 1500	Electrical and engineering regulations - Inspection and testing of electrical equipment
ČSN 33 2000-4-41 ed.3	Electrical and engineering regulations - Electrical equipment Part 4: Safety Chapter 41: Protection against injury caused by electric shock
ČSN 33 2000-6	ed.2 Low voltage electrical installations - Part 6: Revision
ČSN EN 60529	Degrees of protection provided by enclosures (IP code)

Decree No. 50/1978 Coll., on professional competence in electrical engineering
Act No. 22/1997 Coll., on technical requirements for products, as amended
Act No. 91/2016 Coll., amending Act No. 22/1997 Coll., on technical requirements for products and on amendments to certain acts, as amended, and certain other acts