RTU user guide

TPM 173/25 - Valid from 11.3.2025

COMPACT AIR HANDLING UNIT MANDÍK TYPE-R

PRELIMINARY VERSION 20250527

A brand-new air conditioning unit from Mandík a.s., featuring modern components and high-quality construction. Thanks to its compact dimensions and full factory testing and adjustment, it excels in ease of installation. The units are completely manufactured and certified in a unique frameless design and are intended for outdoor placement. The unit boasts high resistance to weather conditions.

The primary source of heating/cooling is a heat pump. As an additional source, a water heater/cooler or an electric heater can be installed. Various configurations are offered, ranging from fully recirculating units to those allowing mixing and heat recovery. The electrical switchboard is integrated into the unit's body.

This is a fixed-size series covering capacities from 20 to 150 kW for cooling/heating and air performance from 4,000 to 30,000 m³/h. Standard delivery is plug & play, including an integrated control system and full factory testing.

1. GENERAL INFORMATION

This manual uses graphic symbols and warnings described in General.

TECHNICAL PARAMETERS

Body-A				
Nominal Airflow	[m³/h]	4000	6000	8000
Heating Capacity (1)	[kW]	20	30	40
Cooling Capacity (2)	[kW]	20	30	35
Electric Heater	[kW]	10	10	10
Water Heater (80/60°C)	[kW]	up to 60	up to 60	up to 60
Number of Compressors (Type)	[pcs]	1 (Inverter)	1 (Inverter)	1 (Inverter)
Number of Refrigerant Circuits	[pcs]	1	1	1
Refrigerant	[-]	R454C		
COP (1)	[-]	3.44	3.33	2.98
EER (1)	[-]	3.91	3.50	2.92
Dimensions (HxWxD)	[mm]	2430x2200x2648		

Body-A				
Weight	[kg]	1233	1248	1248
Sound Power Level from Casing to External Space (Cooling Mode) LwA	[dBA]	92	92	92
Sound Power Level at Discharge to Internal Space LwA	[dBA]	92	95	95
Sound Power Level at Intake and Discharge to External Space (Without Cooling System) LwA	[dBA]	94	94	94
Supply Fans – EC (Radial with Free Impeller)	[pcs]	1	2	2
Exhaust Fans – EC (Radial with Free Impeller)	[pcs]	1	1	1
External Fans – EC (Axial)	[pcs]	1	1	1
Filtration Classes	[-]	G3 / G4 / M5 / F7 / F9		
Filters – First Stage	[-]	4 pcs (592x592x48)	4 pcs (592x592x48)	4 pcs (592x592x48)
Filters – Second Stage	[-]	6 pcs (592x592x48)	6 pcs (592x592x48)	6 pcs (592x592x48)
Sensors	[-]	Temperature / Humidity / CO_2 / Smoke		
Communication	[-]	ModBus / Analog / (BACnet)		
Control System	[-]	MaR / Cloud / Room Thermostat / ModBus		

Body-A					
Power Supply	[V/Ph/Hz]	400/3/50			
Recommended Circuit Protection	[A]	63			

Body-B					
Nominal Airflow	[m³/h]	10,000	12,000	14,000	16,000
Heating Capacity (1)	[kW]	50	60	70	80
Cooling Capacity (2)	[kW]	50	55	60	65
Electric Heater	[kW]	30	30	30	30
Water Heater (80/60°C)	[kW]	up to 100	up to 100	up to 100	up to 100
Number of Compressors (Type)	[pcs]	2 (Inverter)	2 (Inverter)	2 (Inverter)	2 (Inverter)
Number of Refrigerant Circuits	[pcs]	2	2	2	2
Refrigerant	[-]	R454C			
COP (1)	[-]	3.40	3.20	3.15	2.96
EER (1)	[-]	3.64	3.33	3.20	2.91
Dimensions (HxWxD)	[mm]	2430x2200x3240			
Weight	[kg]	1680	1680	1698	1698

Body-B					
Sound Power Level from Casing to External Space (Cooling Mode) LwA	[dBA]	95	95	95	95
Sound Power Level at Discharge to Internal Space LwA	[dBA]	97	97	98	98
Sound Power Level at Intake and Discharge to External Space (Without Cooling System) LwA	[dBA]	97	97	97	97
Supply Fans – EC (Radial with Free Impeller)	[pcs]	3	3	4	4
Exhaust Fans – EC (Radial with Free Impeller)	[pcs]	2	2	2	2
External Fans – EC (Axial)	[pcs]	2	2	2	2
Filtration Classes	[-]	G3 / G4 / M5 / F7 / F9			
Filters – First Stage	[-]	6 pcs (592x592x48)	6 pcs (592x592x48)	6 pcs (592x592x48)	6 pcs (592x592x48)
Filters – Second Stage	[-]	9 pcs (592x592x48)	9 pcs (592x592x48)	9 pcs (592x592x48)	9 pcs (592x592x48)
Sensors	[-]	Temperature / Humidity / CO_2 / Smoke			
Communication	[-]	ModBus / Analog / (BACnet)			
Control System	[-]	MaR / Cloud / Room Thermostat / ModBus			

Body-B								
Power Supply	[V/Ph/Hz]	400/3/50						
Recommended Circuit Protection	[A]	100						

Body-C								
Nominal Airflow	[m³/h]	18,000	20,000	22,000	24,000	26,000	28,000	30,000
Heating Capacity (1)	[kW]	90	100	110	120	130	140	150
Cooling Capacity (2)	[kW]	90	95	100	105	125	130	140
Electric Heater	[kW]	60	60	60	60	60	60	60
Water Heater (80/60°C)	[kW]	up to 160	up to 160	up to 160	up to 160	up to 160	up to 160	up to 160
Number of Compressors (Type)	[pcs]	3 (2x Inverter, 1x ON/OFF)	3 (2x Inverter, 1x ON/OFF)	3 (2x Inverter, 1x ON/OFF)	3 (2x Inverter, 1x ON/OFF)	4 (2x Inverter, 2x ON/OFF)	4 (2x Inverter, 2x ON/OFF)	4 (2x Inverter, 2x ON/OFF)
Number of Refrigerant Circuits	[pcs]	2	2	2	2	2	2	2
Refrigerant	[-]	R454C						
COP (1)	[-]	3.38	3.30	3.17	3.04	3.20	3.24	3.15

Body-C								
EER (1)	[-]	3.37	3.24	3.19	2.88	3.02	2.98	2.91
Dimensions (HxWxD)	[mm]	2670x2200x5180						
Weight	[kg]	2602	2602	2602	2672	2712	2712	2712
Sound Power Level from Casing to External Space (Cooling Mode) LwA	[dBA]	96	96	96	96	96	96	96
Sound Power Level at Discharge to Internal Space LwA	[dBA]	102	102	102	104	104	104	104
Sound Power Level at Intake and Discharge to External Space (Without Cooling System) LwA	[dBA]	102	102	102	102	102	102	102
Supply Fans – EC (Radial with Free Impeller)	[pcs]	3	3	3	4	4	4	4

Body-C								
Exhaust Fans – EC (Radial with Free Impeller)	[pcs]	2	2	2	2	2	2	2
External Fans – EC (Axial)	[pcs]	3	3	3	4	4	4	4
Filtration Classes	[-]	G3 / G4 / M5 / F7 / F9						
Filters – First Stage	[-]	6 pcs (592x592x48)	6 pcs (592x592x48)	6 pcs (592x592x48)	6 pcs (592x592x48)	6 pcs (592x592x48)	6 pcs (592x592x48)	6 pcs (592x592x48)
Filters – Second Stage	[-]	12 pcs (592x592x48)	12 pcs (592x592x48)	12 pcs (592x592x48)	12 pcs (592x592x48)	12 pcs (592x592x48)	12 pcs (592x592x48)	12 pcs (592x592x48)
Sensors	[-]	Temperature / Humidity / CO_2 / Smoke						
Communication	[-]	ModBus / Analog / (BACnet)						
Control System	[-]	MaR / Cloud / Room Thermostat / ModBus						
Power Supply	[V/Ph/Hz]	400/3/50						

Body-C								
Recommended Circuit Protection	[A]	250						

(1) - according to EN 14511/2023

SAFETY

Please refer to Safety.

The unit must be installed in a controlled-access area.

The rooftop units comply with the following safety definitions and are marked with the CE label where applicable (see the EU Declaration for more details):

- **2014/68/EU Pressure Equipment Directive**
  - EN-378-2016
- **2006/42/EC Machinery Directive**
  Directive 2014/35/EU on low voltage considered within the Machinery Directive.
  - EN-60204-1
- **2014/30/EU Electromagnetic Compatibility (EMC) Directive**
  - EN-61000-6-1/-2/-3/-4
- **2014/53/EU Radio Equipment Directive**
  Applicable if equipped with a GSM router.
- **EU 517/2014 F-Gas Regulation**
- **2009/125/EC Ecodesign Directive**
  - EU 2016/2281 Rooftop units
- **2011/65/EU (2015/863/EU) RoHS Directive**
  Restriction of hazardous substances

PED DIRECTIVE

For equipment subject to the Pressure Equipment Directive (see EU Declaration of Conformity).

Warning:

1. **Safety pressure switches:** These components are essential to ensure that the system remains within permissible operating limits. Always check the correctness of all electrical connections before switching on the installation. Perform a test to verify that the power supply shuts off when the pressure switch reaches the set value.
2. **Installation in hazardous zones:** In areas prone to natural disasters such as earthquakes, storms, tornadoes, floods, or tidal waves, the installer or operator must ensure that necessary equipment is available according to applicable standards and regulations, as our units are not designed for operation in such conditions without appropriate measures.
3. **Fire resistance:** The equipment is not designed to withstand fire. The installation site must comply with applicable fire protection standards.
4. **Corrosive atmosphere:** If exposed to corrosive influences or products, the installer or operator must take necessary measures to protect the equipment from damage and ensure appropriate corrosion protection.
5. **Pipe support:** Ensure a sufficient number of supports for the pipes according to their size and weight under operating conditions, and design the piping to prevent water hammer effects.
6. **Safety measures for the cooling circuit:** Before performing any work on the cooling circuit, the nitrogen pressure must be released, as our units are delivered with nitrogen charge (for units not factory-filled with refrigerant).
7. **Professional qualification:** Installation and maintenance of these machines must be carried out by personnel qualified to work on refrigeration equipment.
8. **Safety regulations:** All interventions must be performed in accordance with applicable safety regulations (e.g., EN 378) and recommendations provided on labels and in manuals supplied with the unit. Unauthorized access must be prevented.
9. **Surface temperature hazard:** Any piping or other cooling circuit components that pose a risk due to their surface temperature must be insulated or marked.

FLAMMABLE GASES

The unit is factory-filled with refrigerant R454C, classified as mildly flammable (A2L). A2L / A2 / A3 gases are subject to stricter safety regulations than A1 gases. Below is a summary of standards and recommendations based on EN 378 and EN 60079-10-1, including tests and simulations related to flammability risks.

Flammability Classes

- **A1**: No flame propagation
- **A2L**: Mildly flammable
- **A2**: Flammable

- **A3**: Highly flammable

Labeling of Units with Flammable Gas

A label with the A2L logo on the product indicates the presence of mildly flammable refrigerant. It also appears on maintenance connection points.

Transport of Units with Flammable Gas

- Equipment filled with A2L refrigerant must comply with ADR regulations, specifically UN 3358.
- Transport of UN3358 is prohibited in the Eurotunnel and tunnels of category D and E.
- The transport document must state: **UN3358 Refrigerant units 2.1**.
- If more than 12 kg of refrigerant is present, the total amount must be specified.

Acceptance Inspection for Flammable Gas

- Do not approach the container with an open flame or other ignition sources.
- Store the product away from potential ignition sources.

Safety Zone

- The product is hermetically sealed and marked with the CE label.
- Proper installation and maintenance eliminate the formation of ATEX zones.

Installation of Units with Flammable Gas

- Installation in ATEX zones is prohibited.
- Ventilation openings, ignition sources, or other heat sources must not be installed near the unit, in accordance with EN 378.

Power Supply of the Unit

- Before switching on the power, verify refrigerant leak detection using appropriate equipment.

Electrical Wiring

- All cable entries must be tightly sealed to prevent water ingress and short circuits.

Maintenance and Repairs

- Before starting work, perform leak detection using appropriate equipment.
- Do not use open flames or other ignition sources near units filled with refrigerant.
- When working with R454C, follow specific precautions, such as using appropriate tools and protective equipment.

2. UNIT IDENTIFICATION

Related common documents can be found in Related Documents.

Each unit is equipped with a nameplate containing identification details for each piece and a description of its main features.

MANDÍK®	MANDÍK, a.s. 267 24 Hostomice	Dobříšská 550 Česká republika	CE
COMPACT AIR HANDLING UNIT MANDÍK TYPE-R			
Type:		RTU_060-R-M-EF-EH-1G4N-2F7N-IHR-1-1-1	
Serial Number:		0701-XXXX	
Order Number:		KCZxxxxxx	
Year of Manufacture		2025	
Weight (kg) ±5%		1680	
Dimensions (mm)	Height:	2070	
	Width:	2200	
	Length:	3250	
Nominal Output (kW)	Heating:	60	
	Cooling:	55	
Nominal Airflow (m^3/h)		12000	
Storage Temperature (°C)	MIN/MAX	-30/+50	
Power Supply		3x 400V+ PEN / 50Hz	
Nominal Current (A)		95	
Ingress Protection Rating		IP44	
Protection Class		I	
Country of Destination:		XX	

Fig. 1: Example of a nameplate

Each unit is equipped with an identification label containing the main characteristics of the refrigeration circuit.

MANDÍK®	MANDÍK, a.s. 267 24 Hostomice	Dobříšská 550 Česká republika	CE 2570
COMPACT AIR HANDLING UNIT MANDÍK TYPE-R			
Type:		RTU_060-R-M-EF-EH-1G4N-2F7N-IHR-1-1-1	
Serial Number:		0701-XXXX	
Order Number:		KCZxxxxxx	
Year of Manufacture		2025	
Nominal Output (kW)	Heating:	60	
	Cooling:	55	
Refrigerant Type		R454C _ Fluid Group 1 _ GWP 148 (A2L)	
Refrigerant Charge (kg)	Circuit 1:	7,5	
	Circuit 2:	7,5	
Storage Temperature (°C)	MIN/MAX	-30/+50	
Operating Temperature (°C)	MIN/MAX	-15/+45	
High Pressure Side (bar)	MIN/MAX	-1/28	
Low Pressure Side (bar)	MIN/MAX	-1/28	
Pressure Test (bar / Date)		33/XX.XX.XXXX	
Power Supply		3x 400V+ PEN / 50Hz	
Nominal Current (A)		95	

Fig. 2: Example of a nameplate - PED

Unit Identification Label

RTU_A-B-C-D-E-F-G-H-I-J-K

Code	Description	Options	Details
A	**Nominal Power**	020/030/040/050/060/070/080/090/100/110/120/130/140/150	Power in kW
B	**Configuration**	C/R	Cooling only / Reversible
C	**Airflow Type**	C/F/M	Circulating / Fresh air only / Fresh air mixing option
D	**Exhaust Fan**	NA/EF	None / Yes

Code	Description	Options	Details
E	**Secondary Heat Exchanger**	NA/EH/WH	None / Electric heater / Water heater
F	**First-Stage Filtration**	1G3N/1G4N/1G3M/1G4M	G3 filtration / G4 filtration / G3 filtration + status monitoring / G4 filtration + status monitoring
G	**Second-Stage Filtration**	2F5N/2F7N/2F5M/2F7M	F5 filtration / F7 filtration / F5 filtration + status monitoring / F7 filtration + status monitoring
H	**Heat Recovery**	NA/IHR	None / Refrigerant circuit heat recovery
I	**ODA Sensor**	0/1/2/3	None / Temperature / Temperature + Humidity / Temperature + Humidity + CO_2
J	**SUP Sensor**	0/1/2/3	None / Temperature / Temperature + Humidity / Temperature + Humidity + CO_2
K	**ETA Sensor**	0/1/2/3	None / Temperature / Temperature + Humidity / Temperature + Humidity + CO_2

Example of unit designation:

RTU_060-R-M-EF-EH-1G4N-2F7N-IHR-1-1-1

- *Nominal capacity of 60 kW*
- *Reversible design*
- *Allows fresh air mixing*
- *Exhaust fan*
- *Additional electric heater*
- *First-stage filtration class G4*
- *Second-stage filtration class F7*

- *Heat recovery via heat pump circuit*
- *ODA - temperature only*
- *SUP - temperature only*
- *ETA - temperature only*

Unit Dimensions

The unit is designed in a fixed dimensional series, as shown in the table below.

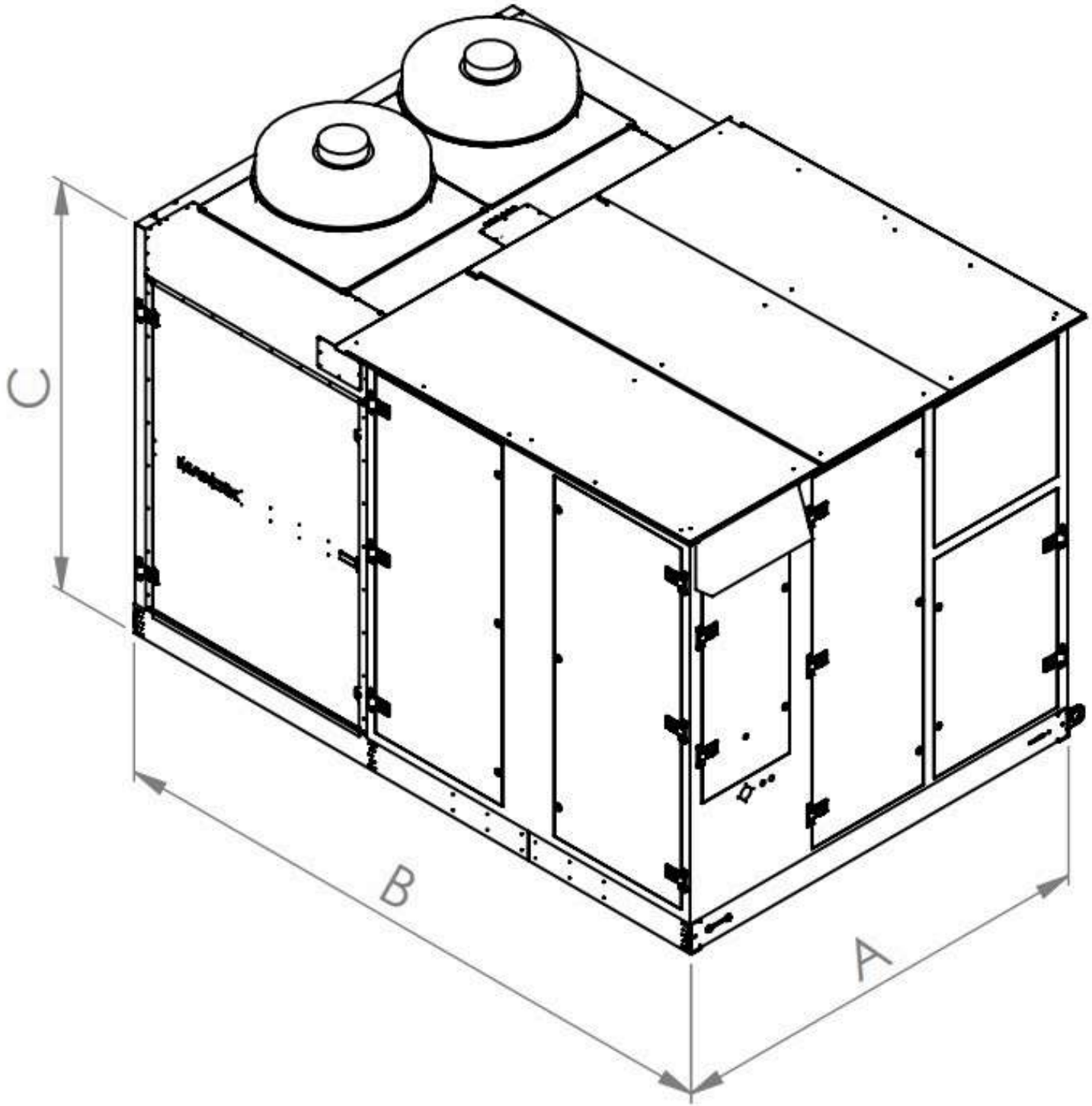
C
B
A

Fig. 3: Basic Dimensions

Unit Specifications

Unit	[-]	A	B	C
Nominal Airflow	[m³/h]	4000-8000	10,000-16,000	18,000-30,000
Nominal Heating Power	[kW]	20-40	50-80	90-150
		Unit Dimensions		
Width	[mm]	2200	2200	2200
Length	[mm]	2648	3240	5180
Height	[mm]	2430	2430	2670
Weight	[kg]	1248	1698	2712

Connection Dimensions

Fig. 4 shows the floor plan view of the RTU unit with dimensioned connection sizes.

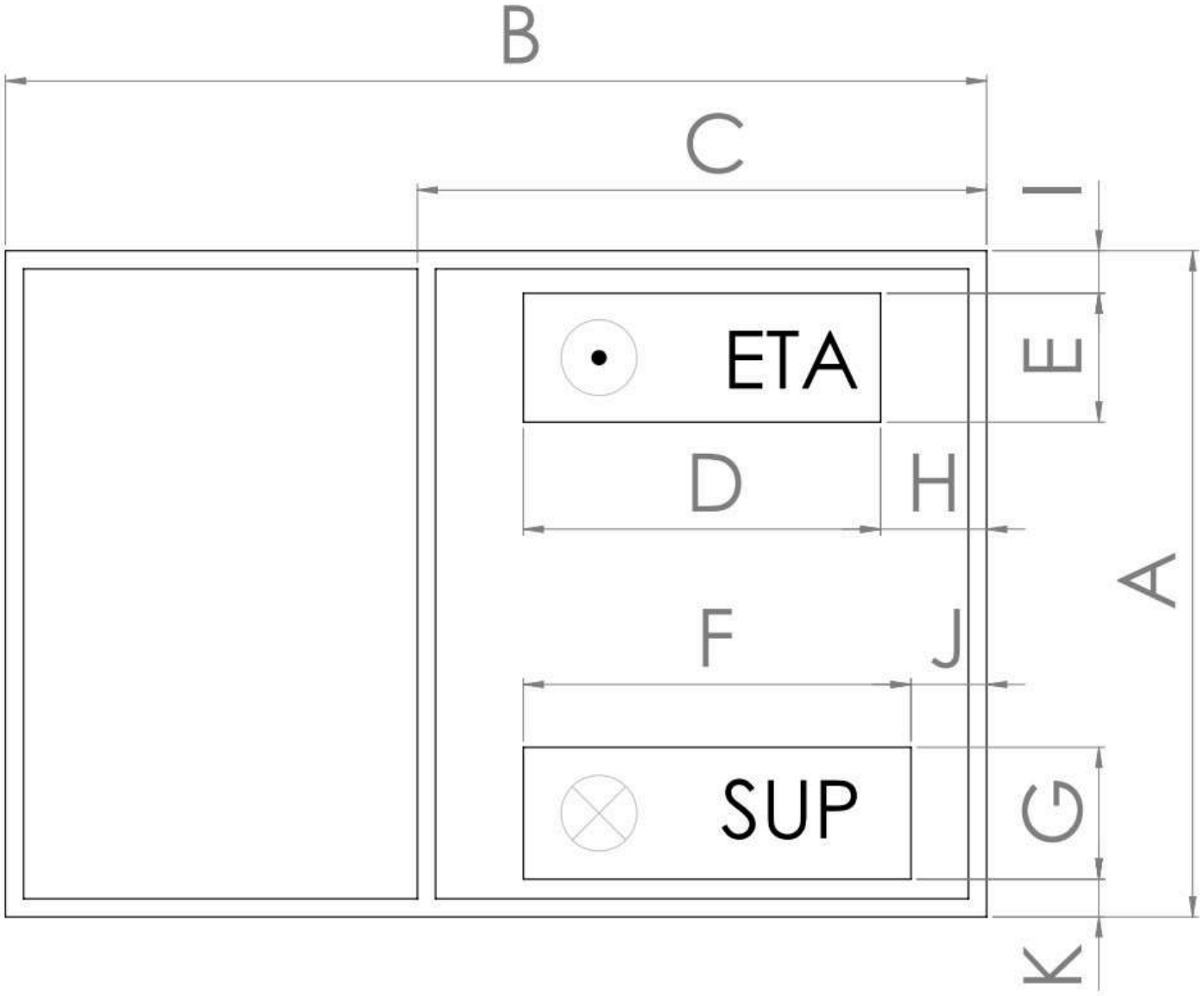

Fig. 4: Connection Dimensions of Air Ducts

Unit	[-]	A	B	C
A	[mm]	2200	2200	2200

Unit	[-]	A	B	C
B	[mm]	2648	3240	5180
C	[mm]	1288	1880	2480
D	[mm]	900	1180	2000
E	[mm]	425	425	425
F	[mm]	900	1280	1800
G	[mm]	435	435	450
H	[mm]	194	350	240
I	[mm]	141	141	125
J	[mm]	194	250	340
K	[mm]	125	125	125

3. HANDLING, TRANSPORT, AND STORAGE

- Units are delivered in compact blocks.
- Units are packaged in plastic foil.
- Units are designed for handling with forklift trucks, pallet trucks, or cranes.
- When using a forklift or pallet truck, the forks must always be positioned under the entire chamber.
- The unit can only be transported in a horizontal working position.

WARNING: The plastic foil is a transport packaging that protects the chambers during transit and must not be used for long-term storage. Temperature changes during transport may cause condensation inside the packaging, creating conditions that could lead to corrosion of materials used in the chambers (e.g., white corrosion on galvanized components). Therefore, it is essential to remove this transport packaging immediately after delivery and allow air access to the chambers to ensure surface drying.

WARNING: During transport and handling, units must only be moved using forklifts or transport belts, and relevant safety regulations (ČSN ISO 8792) must be followed. Units can only be lifted from below. When lifting with a crane, the lifting eyes in the unit frame must be used, and the straps must be spread at the top or additionally reinforced at points where the strap could cause deformation of the chamber. When transporting with a forklift, the chamber must be supported across its entire width to prevent damage to the bottom of the unit.

WARNING: When handling suspended equipment, always maintain a safe distance from the load and never stand underneath it. Keep acceleration and lifting speed within safe limits. Never leave the equipment suspended longer than absolutely necessary!

WARNING: Upon receipt, it is necessary to check whether the product has been delivered in the agreed design and scope and whether it has been damaged during transport. In case of transport damage, the recipient must record the extent of the damage on the carrier's delivery note. Failure to follow this procedure may result in the rejection of claims for damages caused during transport.

WARNING: Units must be stored in dry, dust-free areas protected from rain and snow, where the ambient temperature does not drop below +5°C. They must also be protected against mechanical damage, contamination, and corrosion caused by persistent condensation of water vapor on the unit's surface.

Permitted Handling

Transport and Handling with a Pallet Truck or Forklift

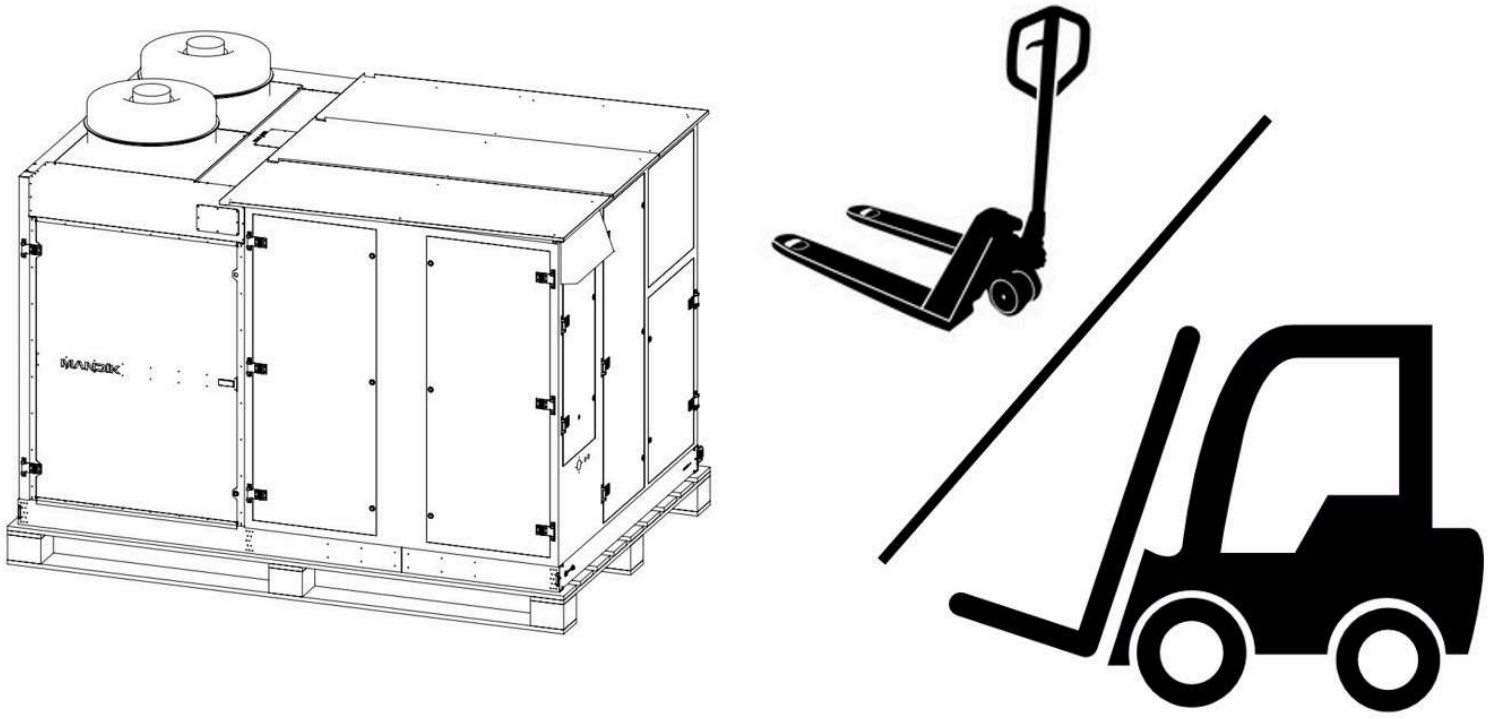

Fig. 5: Handling the Unit on a Pallet

The unit is designed for handling with forklift or pallet truck forks. When using a forklift, the forks must always be positioned under the entire unit.

WARNING: The chamber is not always weight-balanced. Handling and lifting height must be adjusted accordingly!

Transport and Handling of the Chamber with a Crane

The unit may only be lifted using the lifting eyes in the unit frame (**Fig. 7: "A"**). The process for extending the crane lifting eyes from the frame is described below.

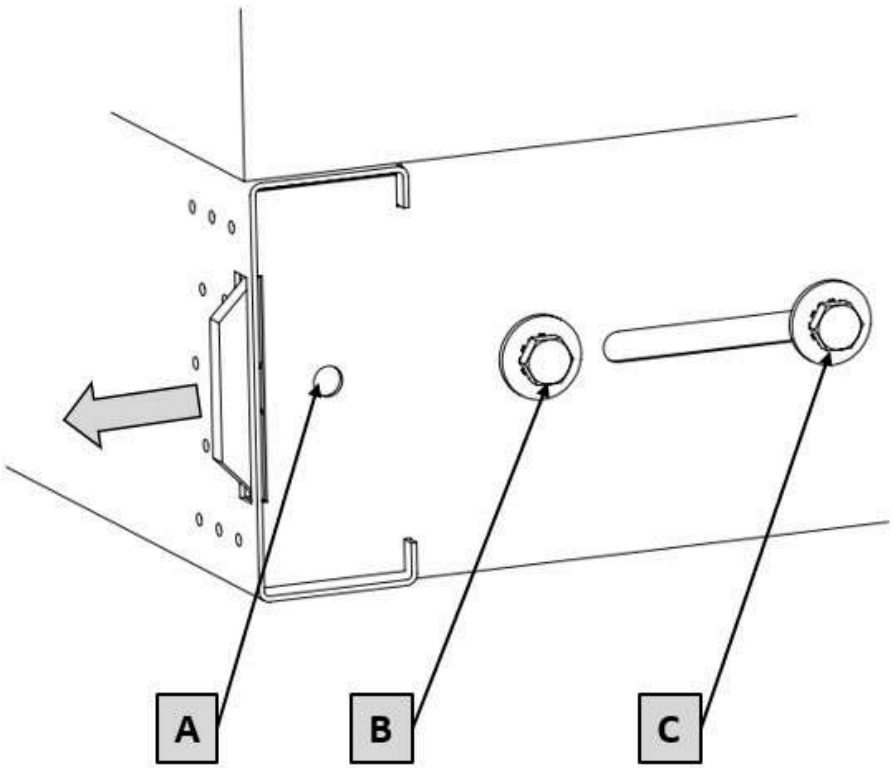

Fig. 6: Extension of the Crane Lifting Eye

To extend the crane lifting eye from the frame, first completely unscrew bolt "B", then loosen bolt "C". At this point, the eye can be extended from the frame in the direction of the arrow. Then, bolt "B" must be screwed into position "A", and both bolts must be tightened using a 17mm wrench.

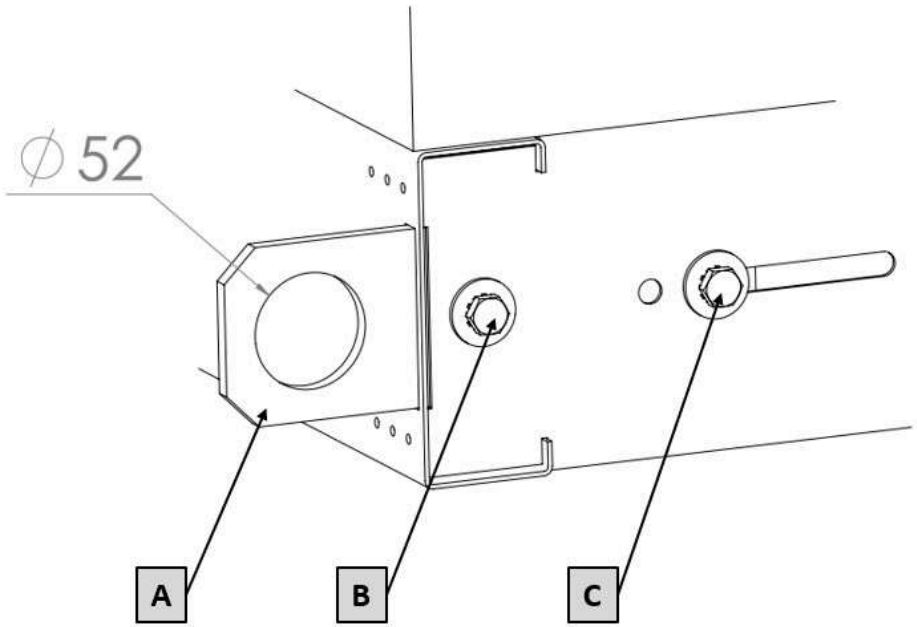

Fig. 7: Securing the Crane Lifting Eye

After positioning the unit in its final location, it is recommended for safety reasons to retract the crane lifting eyes back into the frame. The retraction process follows the reverse order of the extension process.

WARNING: The chamber is not always weight-balanced. Handling and lifting height must be adjusted accordingly!

4. ASSEMBLY AND INSTALLATION

General instructions for assembly and installation can be found in General Assembly and Installation.

- Depending on the type and size of the unit, sufficient free space must be ensured around the unit for unobstructed door opening—determined by the specific unit size.
- A walkable surface within the protective zone around the unit is required for service interventions.
- Maximum horizontal deviation of the units must be maintained within (0.5% ~ 0.3°).
- The minimum distance of flammable objects from the unit is 200 mm.

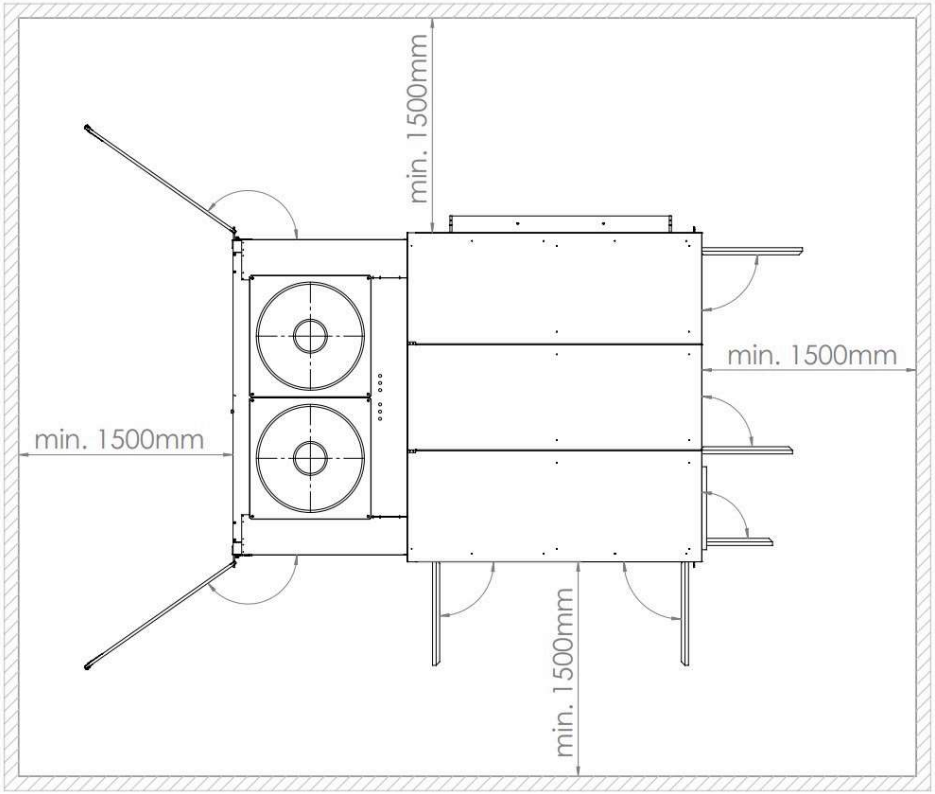

Fig. 8: Protective Zone Around the RTU

PLACING THE UNIT ON A ROOF FRAME

The frame is designed for mounting the unit on the building's roof. Independently adjustable legs allow the frame to be leveled horizontally, regardless of the roof's slope and orientation.

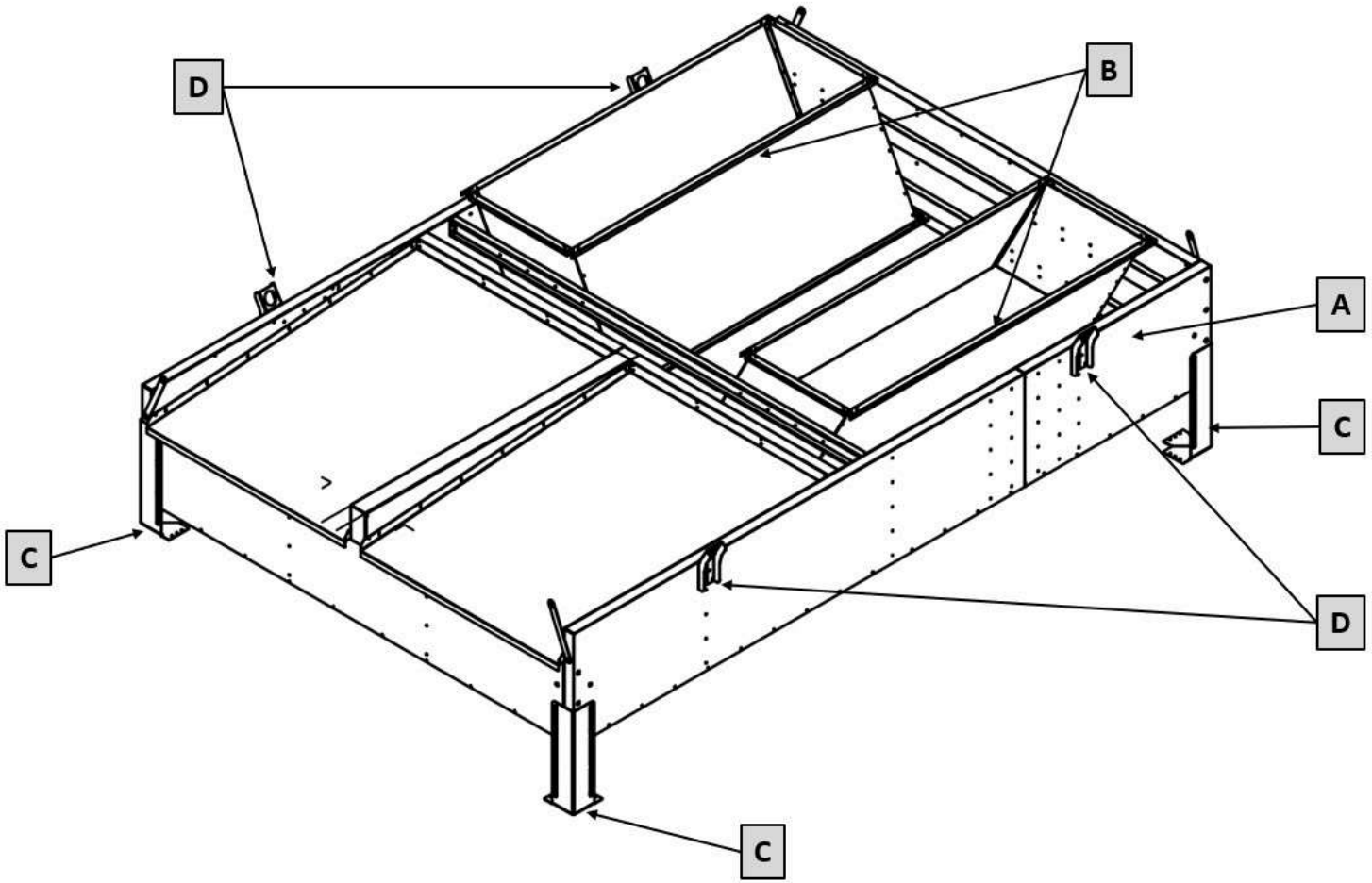

Fig. 9: Roof Frame

A – Roof frame for the RTU unit
B – Air duct flanges
C – Frame leveling legs
D – Crane lifting eyes for handling the frame

Permitted handling of units for placement is specified in Chapter 4.

- Check the positioning, slope, and stability of the frame.
- Verify the protective service zone around the unit.
- Inspect the integrity of the sealing on the contact surfaces of the air duct flanges (marked as B).
- After placing the unit, retract the crane lifting eyes using a 17mm wrench.
- The frame is made of a double-layer material with 50mm insulation thickness.
- After leveling the slope on the roof, the frame must be anchored to the building's structural support.
- Around the entire perimeter of the frame, cover plates (included in the delivery) must be attached using self-tapping screws at a maximum spacing of 200mm.
- Finally, properly install the vapor barrier foil, thermal insulation, and waterproofing foil.

The installation of the roof frame may only be carried out by a qualified person.

Here is the English translation of your text:

PLACING THE UNIT ON A FREESTANDING FRAME

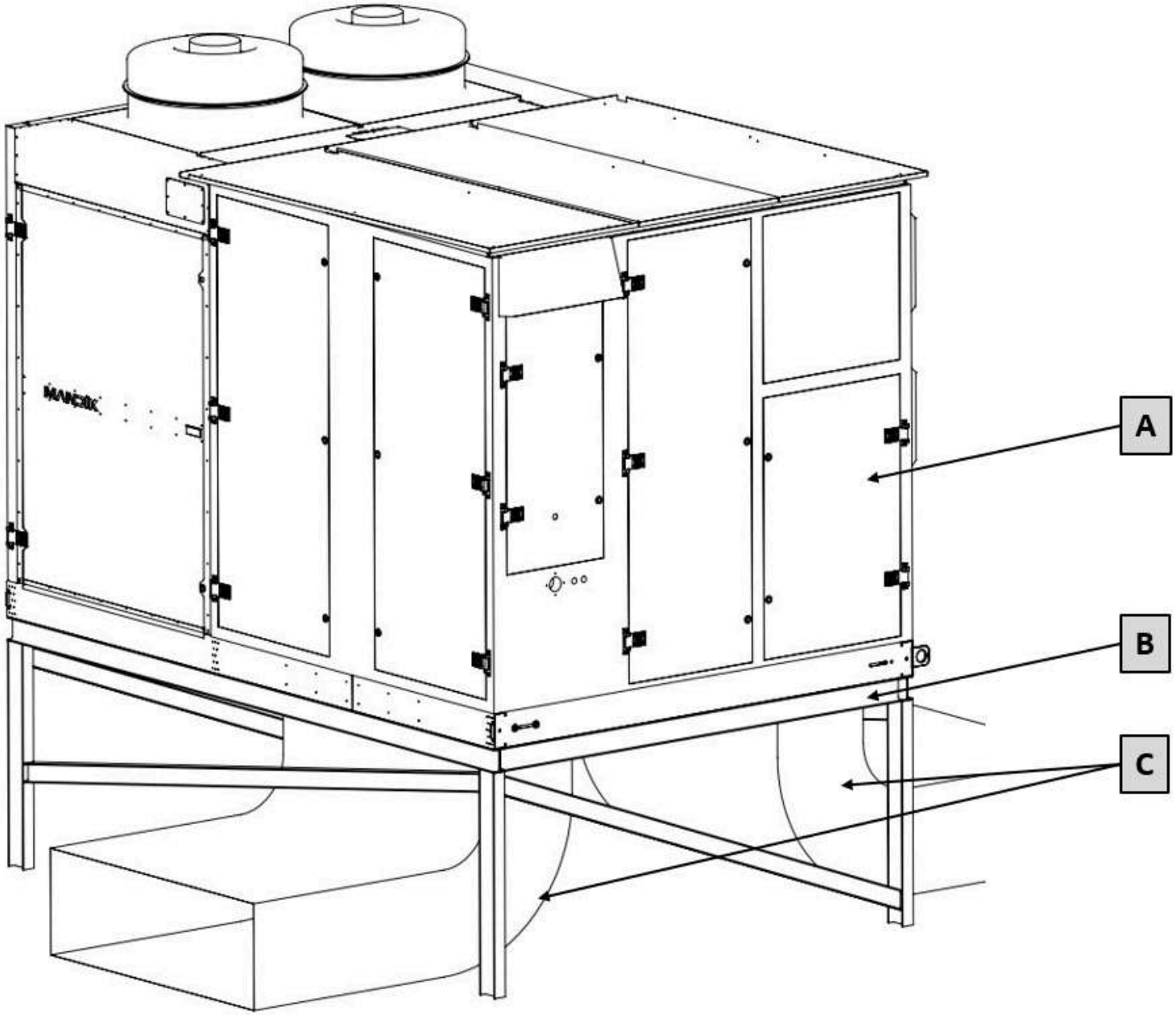

Fig. 10: RTU Unit on a Freestanding Frame

A – RTU Unit

B – Freestanding Frame Structure
C – Air Duct System (Supply/Exhaust)

Permitted handling of units for placement is specified in Chapter 4.

- Check the positioning, slope, and stability of the frame.
- Verify the protective service zone around the unit.
- Lift the unit using a forklift and place it onto the pre-prepared frame.
- The frame structure must be designed considering the weight of the specific unit.

CONNECTING THE UNIT TO THE HVAC DUCTWORK

The unit may only be connected to the air duct system using damping inserts (to prevent vibration transmission).

The air duct system must be connected without tension, meaning it should not exert its weight on the damping insert and, consequently, the unit.

The flange connection between the air duct system and the damping insert must always be properly sealed.

DESCRIPTION OF SUPPLY/EXHAUST CONNECTIONS TO THE UNIT

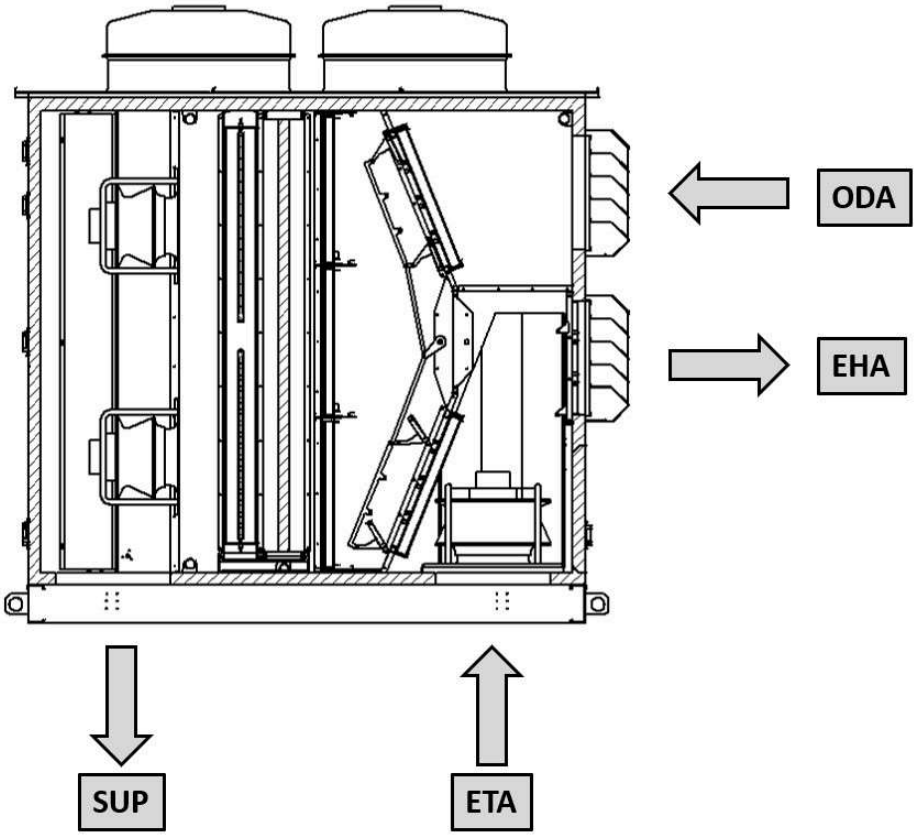

Fig. 11: RTU Unit Supply/Exhaust Connections

SUP – Supply to the room	ETA – Exhaust from the room
EHA – Waste air to the atmosphere	ODA – Fresh outdoor air

CONDENSATE DRAIN TRAP CONNECTION

The condensate drain must be connected via a siphon with a sufficient water column height to ensure flawless operation.

A siphon connected in a vacuum must always be filled with water before commissioning and after a prolonged shutdown to allow condensate drainage.

The piping after the siphon must not be directly connected to the sewer system.

The height of the unit above the floor/ground level must always be adjusted according to the required siphon height.

If the siphon is placed outdoors, its route must be heated, e.g., with an electric heating cable.

Correct Siphon Height Adjustment Based on Pressure Value

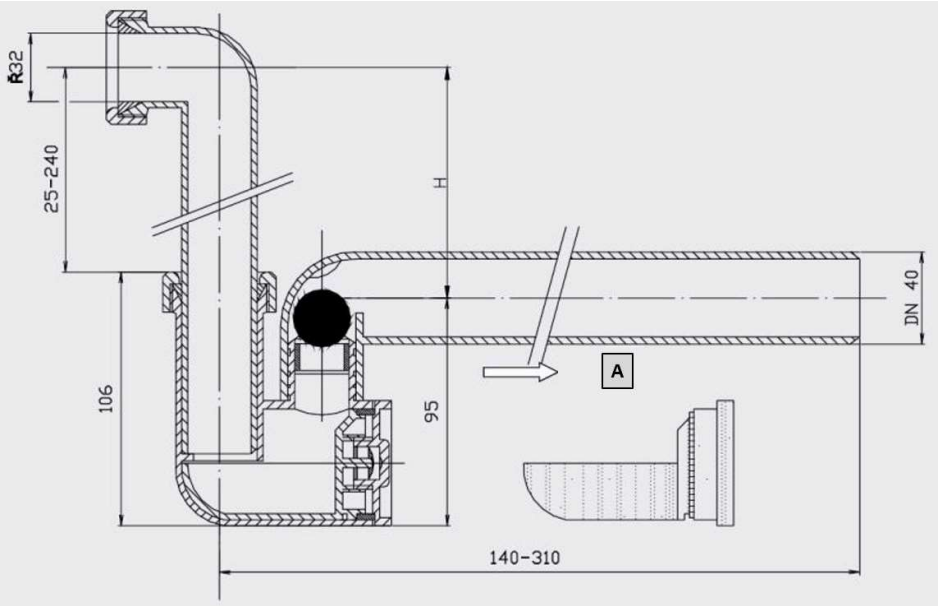

Fig. 12: Vacuum Siphon with Ball HL136NGG

A: Cleaning Insert

Can be used for vacuum up to 2300 Pa.
H = P / 10 (P = pressure value specified in the unit's technical specifications [Pa])

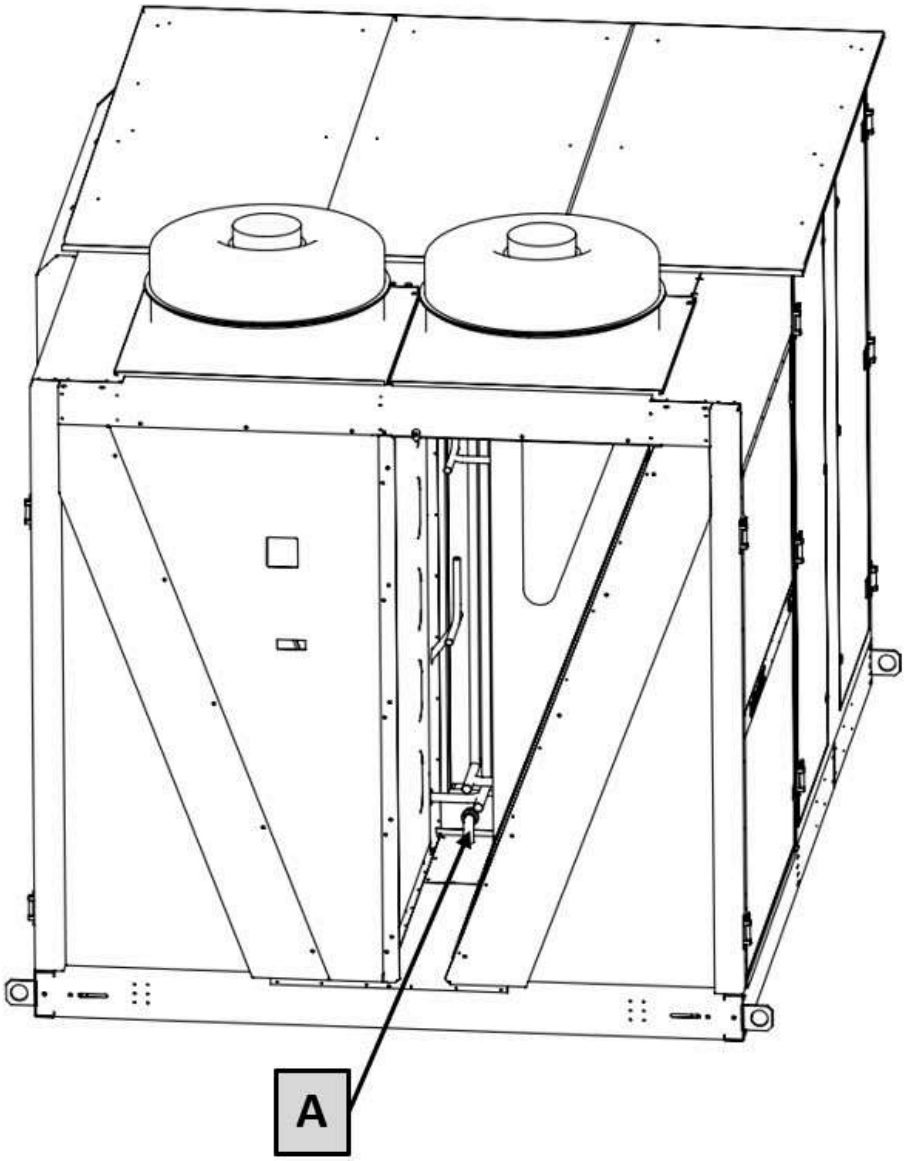

Fig. 13: Siphon Connection Point

A: Siphon Connection

CONNECTING THE WATER HEATER/COOLER

All piping must be secured independently of the heat exchangers. The piping systems for active fluids must not exert their weight or expansion forces on the unit blocks or heat exchangers. Connections must be made in such a way that pipe expansion due to temperature does not cause excessive stress on the fittings.

The connection must be tightened using two wrenches. Otherwise, there is a risk of thread deformation!

If the air vent valve is not installed, it must be placed at the highest point of the hot/cold water supply.

The heat exchanger must always be connected in counterflow!

The capillary anti-freeze thermostat is part of the unit and is already installed and connected to the control system from the factory.

The mixing node for thermal power regulation is part of the unit and is already installed and connected to the control system from the factory.

Water for the water heat exchangers must not contain impurities that cause clogging, especially corrosion products from steel and cast iron components. To prevent the formation of these impurities, chemically treated water must be used according to ČSN 07 7401 standards.

- pH value: 7 – 9
- Water hardness: 1.0 *mval/l*
- Chloride content: max. 30 *mg/l*
- Phosphate content (converted to P_2O_5): min. 15 *mg/l*

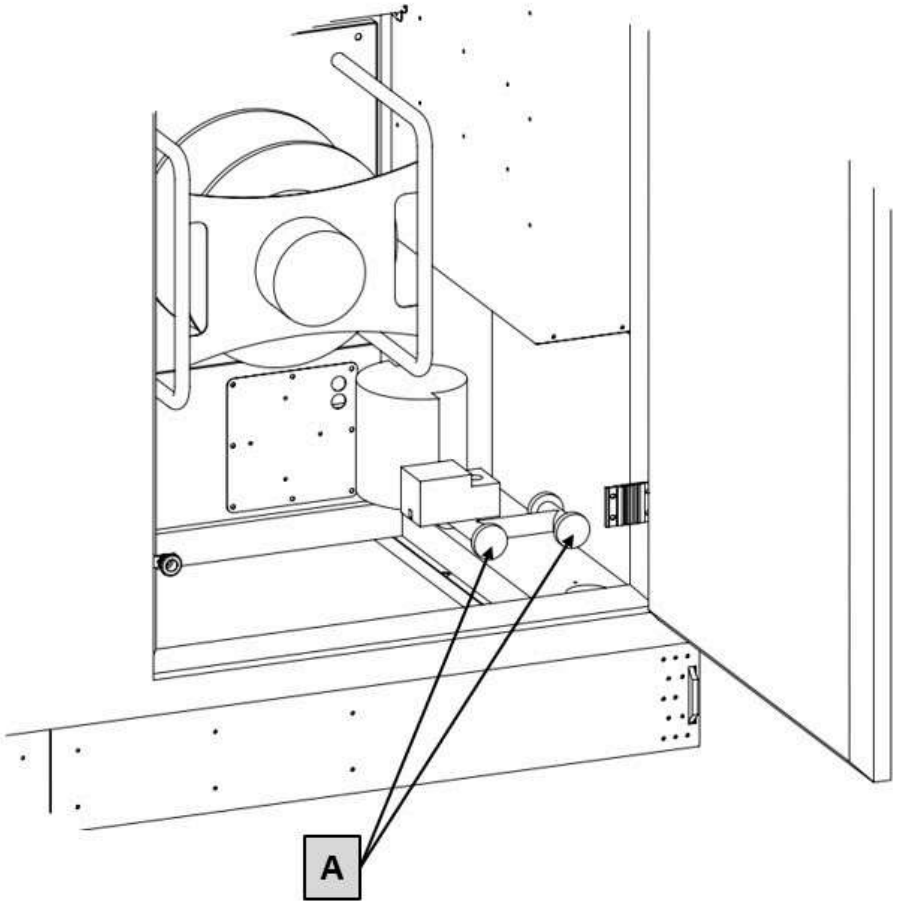

Fig. 14: Connection Points of the Water Heat Exchanger Control Node

ELECTRICAL CONNECTION

Any intervention in the electrical distribution cabinet or connection of included components may only be carried out by a qualified

professional in accordance with the applicable regulations of the country where the unit is being commissioned!

The individual components of the unit are electrically connected to the controller terminals and tested at the factory (fans, sensors, actuators, thermostats, pressure switches, electric heater, etc.).

Only the included peripherals need to be connected additionally (Room Device, Touch Panel, CO_2 Sensor, etc.). All wiring diagrams are provided in the attached project documentation of the unit "Measurement and Control KJ MANDÍK."

The main power supply for the unit is typically provided by the construction site. After routing the power cable through the gland in the electrical cabinet, it must be connected to the terminals. The main switch is located on the cabinet door, which can only be opened after turning off the main switch.

To connect the included peripherals to the terminal block, use the designated screw glands located near the power cable entry.

5. COMMISSIONING

UNIT INSPECTION BEFORE FIRST START-UP

The unit may only be commissioned by a properly instructed and trained person, in compliance with all relevant safety regulations and standards.

Before commissioning the unit, it is necessary to go through the individual steps outlined in the following sections and record these actions in appropriate protocols. These documents should be stored with the operational documentation, and a copy should be sent to the company MANDÍK, a.s. or to the service center email: service@mandik.cz.

During the inspection of individual unit components, the following step-by-step instructions can be used. This section is designed

as a protocol and can serve as a useful guide during commissioning.

LIST OF SERVICE TASKS BEFORE STARTING THE MANDÍK AIR CONDITIONING UNIT

Order number:		User:	
Date:		Commissioning technician:	
Project name:			
		Serial number:	
Address:			
Date of first start-up:		Position:	

GENERAL UNIT TASKS

Task number	Description of service task	Task completion		Measured or set value *	Notes
		YES	NO		
1.01.	Check correct unit placement according to installation instructions.				
1.02.	Check cleanliness of the internal chamber—no foreign objects or construction debris.				
1.03.	Check connection of HVAC ductwork to damping inserts according to installation instructions.				

Task number	Description of service task	Task completion		Measured or set value *	Notes
1.04.	Check readability and cleanliness of manufacturing and safety labels. Clean if necessary.				
1.05.	Check unit closure—doors, service panels.				
1.06.	Check for external or internal mechanical damage to the unit.				
1.07.	Check overall unit tightness—visually (doors, service panels, fixed panels, etc.).				
1.08.	Check cleanliness and integrity of filter inserts.				
1.09.	Check free rotation of fan impellers.				
1.10.	Check tightness of active fluid piping/mixing node connection to the heat exchanger (if a water heat exchanger is installed).				
1.11.	Check air venting of the heat exchanger (if a water heat exchanger is installed).				

GENERAL UNIT TASKS – ELECTRICAL & CONTROL SYSTEMS

Task number	Description of service task	Task completion		Measured or set value *	Notes
		YES	NO		
1.12.	Check connection and status of main power supply.				
1.13.	Check connection and status of peripherals—external sensors, remote control, etc.				

Task number	Description of service task	Task completion		Measured or set value *	Notes
1.14.	Check functionality of safety pressure sensors in the refrigerant circuit.				
1.15.					
1.16.					
1.17.					
1.18.					
1.19.					
1.20.					
1.21.					

SPECIAL TASKS:

Task number	Description of service task	Task completion		Measured or set value *	Notes
		YES	NO		
1.22.	Check tightness of the refrigerant circuit.				
1.23.					
1.24.					
1.25.					

In.....on.....		
_____		_____
Stamp and signature of service technician:		Stamp and signature of authorized representative of the equipment operator
_____		_____
Surname and service technician number in block letters		Surname of authorized representative of the operator in block letters

Record the value only if a measurement is required.

COMMISSIONING

Commissioning for RTU can be found in RTU Commissioning Tasks.

Fans must not be started when the control dampers in the duct system are closed. Pressure surges caused by testing fire or other dampers with a short closing time must be avoided.

The first test run of the unit should not exceed 30 minutes. After that, the unit and all its sections must be thoroughly inspected again.

After the first commissioning, all intake filters must be checked and, if necessary, replaced with new ones.

During the first start-up, the following checks must be performed:

General Unit Checks:

- Ensure no unusual mechanical noises are heard.
- Check for excessive vibration of the unit.
- Verify the tightness of the unit chamber and all additional penetrations through the unit casing.
- Confirm the proper functioning of all dampers.

Electric Heater:

- The airflow velocity must not drop below 1 m/s.

Water Cooler/Heater:

- Check the tightness of the hydraulic system connection to the heat exchanger.

Heat Pump:

- Ensure no unusual mechanical noises are heard.
- Check for excessive vibration of the compressors.
- Verify the tightness of the refrigerant circuit.
- Confirm the functionality of safety components.

FIRST START-UP OF THE UNIT

After completing all previous steps (installation and assembly, pre-start checks, etc.), the unit can be put into trial operation.

COMMISSIONING PROCEDURE

1. Power connection (3x400V 50Hz)
2. Turn on the main switch – rotate to the "ON" position
3. Wait at least 2 hours (to heat the compressor crankcase)
4. Manually activate cooling mode, available at: Measurement and Control System

5. Manually activate heating mode, available at: Measurement and Control System
6. Turn off the unit
7. Set the time program, available at: Measurement and Control System
8. Activate the time program or a specific mode, available at: Measurement and Control System

OPERATOR TRAINING AND UNIT HANDOVER

During training, the following steps must be followed:

- Train the user on unit operation and maintenance
- Record the training session. A copy must be sent to MANDÍK, a.s. or to the service department email service@mandik.cz
- Train the user on system control and parameter settings
- Record the system control training session. A copy must be sent to MANDÍK, a.s. or to the service department email service@mandik.cz
- Record the unit regulation session. A copy must be sent to MANDÍK, a.s. or to the service department email service@mandik.cz
- Hand over the unit to the user
- Record the unit handover session. A copy must be sent to MANDÍK, a.s. or to the service department email service@mandik.cz
- Create an operational log for the unit
- Provide documentation to the user (manufacturer manuals, electrical installation inspection reports, training protocol for operation and maintenance, system control training protocol, unit handover protocol, unit regulation protocol).

6. OPERATION AND MAINTENANCE

Instructions

General instructions for operation and maintenance can be found at General Operation and Maintenance.

Maintenance

Common service and maintenance intervals can be found at Common Service and Maintenance Intervals.

Unit Description

COMPONENTS

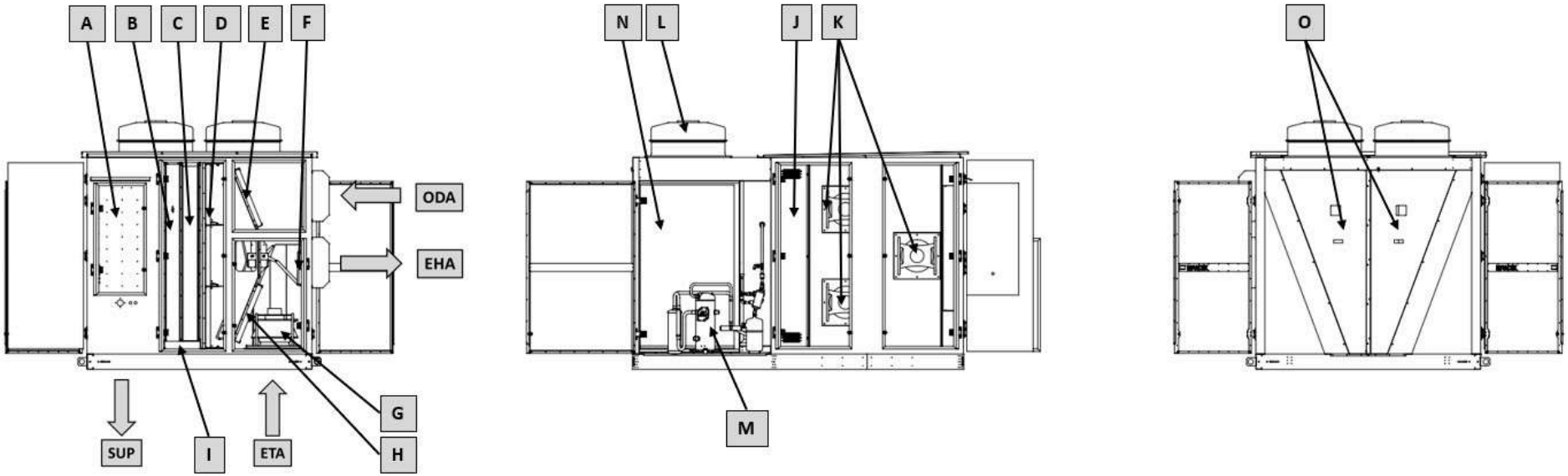

Fig. 15: Basic Description of Components

SUP – Supply air to the room	ETA – Exhaust air from the room
EHA – Waste air to the atmosphere	ODA – Fresh outdoor air
A: Main electrical cabinet	B: Electric heater or water cooler/heater
C: Internal refrigerant heat exchanger	D: Second-stage filtration
E: Fresh air filter + damper	F: Exhaust air damper
G: Exhaust fans	H: Recirculated air filter + damper
I: Condensate tray	J: Auxiliary electrical cabinet for refrigerant section
K: Supply fans	L: Axial fans for outdoor refrigerant heat exchangers
M: Refrigerant circuit machine room	N: External refrigerant heat exchanger

O: Service access to refrigerant section

REFRIGERANT CIRCUIT

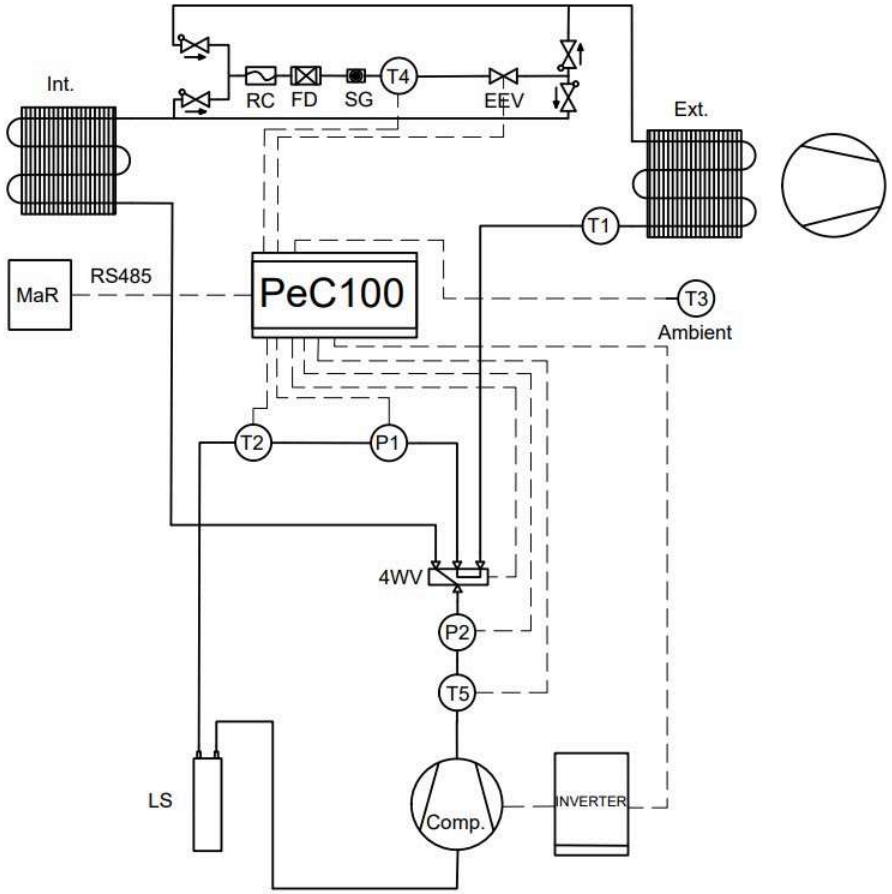

Fig. 16: Refrigerant Circuit Diagram

PeC100 – Controller	MaR – Unit measurement and control system
Int. – Internal heat exchanger	Ext. – External heat exchanger
Comp. – Compressor	Inverter – Compressor control inverter

LS: Liquid refrigerant separator	RC: Liquid refrigerant collector
FD: Filter-drier	SG: Sight glass
EEV: Expansion valve	4WV: Four-way valve
P1: Low pressure	P2: High pressure
T1: Vapor temperature at external heat exchanger	T2: Compressor suction temperature
T3: Ambient temperature	T4: Liquid refrigerant temperature
T5: Compressor discharge temperature	

After connecting the power supply, the unit must remain turned on for at least 2 hours to allow the compressor casing to warm up.

The unit is factory-filled with refrigerant R454C (GWP148-A2L).

7. APPENDICES

The appendices for the RTU air conditioning unit are:

RISK ANALYSIS

Potential Risks	Risk Source	Sub-source	Normal or Abnormal Condition	Technical Examples of Risk Mitigation	Notes
Mechanical Hazards	Weight	Unit falling	Normal	Installation according to TPM 173/25	
Mechanical Hazards	Rotating parts	Fan	Normal	Special tool required for fan access	
Mechanical Hazards	Sharp edges	Unit casing	Normal	The unit has no sharp corners	
Electrical Hazards	Short circuit	Water on electrical components, leakage	Normal	Electrical protection of circuits and components	
Electrical Hazards	Short circuit	Incorrect installation	Abnormal	Installation according to TPM 173/25	
Electrical Hazards	Electrostatic phenomena	Incorrect installation	Abnormal	Installation according to TPM 173/25	
Electrical Hazards	Overload	Dust accumulation in the fan	Normal	Maintenance according to TPM 173/25	
Electrical Hazards	Overload	Mechanical failure of the fan	Abnormal	Installation according to TPM 173/25	
Electrical Hazards	Contact with live parts	Incorrect installation	Abnormal	Installation according to TPM 173/25	
Electrical Hazards	Contact with live parts	Mechanical damage to electrical components	Abnormal	Installation according to TPM 173/25	

Potential Risks	Risk Source	Sub-source	Normal or Abnormal Condition	Technical Examples of Risk Mitigation	Notes
Electrical Hazards	Electromagnetic radiation	Low-frequency electromagnetic emissions	None		
Electrical Hazards	Electromagnetic radiation	High-frequency electromagnetic emissions	None		
Thermal Hazards	Objects with high or low temperatures	Heating medium piping	Normal	Installation according to TPM 173/25, special tool required for access	
Thermal Hazards	Heating medium leakage	Connection leak	Abnormal	Installation according to TPM 173/25	
High Pressure	High-pressure components	System leakage	Abnormal	Inspection according to TPM 173/25	
High Pressure	High-pressure components	Rupture	Abnormal	Installation according to TPM 173/25, mechanical protection of the pressure circuit	

NOTES

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