



**robatherm AHUs.**

**Installation and assembly.**

**January 2024**

**English - translation of the original instructions**

Air handling units | type RM/RL/TI-50

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To improve readability, this document does not use male, female, and non-binary pronouns (m/f/d). All pronouns apply equally to all genders.

Last modified: January 2024

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# General remarks

If the AHU is delivered in several units, they must be assembled in accordance with these instructions and properly connected to the duct system. All protective devices must be active.

If ready-to-use AHUs (complete machines) are assembled from non-operational AHUs (partly completed machines), the person responsible for this assembly must carry out conformity evaluation, issue a certificate of conformity, and attach the CE marking.

## Information about these instructions

These instructions will facilitate safe and efficient use of the AHU.



All persons working on the AHU must thoroughly read and understand these instructions before starting any kind of work.

Safe working is dependent on adhering to all safety information and instructions.

## Further information

The instructions describe all the available options. Whether and which options are available in the AHU depends on the options selected and the country for which the AHU is intended. The illustrations serve as an example and may differ.

The instructions consist of several parts and have the following structure:



Fig. 1: Parts of the instructions

#### Main operating instructions

- ➔ Transport and unloading
- ➔ Installation and assembly
- ➔ Commissioning
- ➔ Operation and incidents
- ➔ Maintenance and cleaning
- ➔ Disabling and disposal

# Security

## General risk sources

### General hazards

#### WARNING

**Risk of injury due to modifications or use of incorrect spare parts**

Serious injuries, death, and material damage can be caused by modifications or installation of incorrect spare parts.

- Use original spare parts only.
- Do not make any modifications.

#### WARNING

**Danger to life from falling!**

If a grate above an air opening is overloaded downwards ( $>400\text{kg}$ ), this will cause the structure to fail. When a person steps on the grate, the structure may fail, causing a risk to life by falling through the air opening.

- Do not exceed the maximum load ( $\leq 400\text{kg}$  or 2 persons).

#### WARNING

**Danger to life from falling!**

Removing the grates in the floor causes a risk to life from falling, as the opening in the floor is exposed.

- When working on air openings with removed grates, the customer must provide protection against falling.
- After the work, mount the grates again according to the instructions.

#### WARNING

**Risk to life from falling objects**

Risk to life from being struck by falling objects.

- Cordon off the endangered area under the opening to secure persons against falling objects.
- After the work, mount the grates again according to the instructions.

#### WARNING

**Danger to life from falling!**

When stepping on the protection roof, there is a risk to life from falling, as the protection roof is unsuitable for supporting loads.

- Do not enter the protection roof.

## WARNING



### **Danger of crushing from reaching under suspended loads**

When positioning the delivery sections for the installation and assembly of the AHU, there is a risk of crushing people or limbs if people are in the danger zone or limbs reach into the danger zone.

- Leave the danger zone.
- Do not reach under the delivery section.
- Do not stand below suspended loads.
- Wear safety footwear of a min. protection class S1 according to EN ISO 20345.
- Observe the safety regulations for the industrial truck and means of transport.

## NOTE



### **Material damage due to localized weight**

If more than one person enters the AHU at a time or localized loads are otherwise applied, pans and floors may be deformed.

- Do not let several persons enter the AHU at the same time.
- If this becomes necessary, take suitable measures to distribute the weight (e.g., grates, wooden boards, wood beams).

## Personnel qualification

The work described in this section may only be performed if the person has the following qualifications:

- Qualified person in accordance with pressure equipment regulation
- Qualified electrician
- Registered gas installer
- Refrigeration specialist
- Crane operator
- Mechanic
- Forklift driver

## What to do in case of danger

### Fire protection

#### **Solvent-welding agent (Rhenofol solvent-welding agent (THF) – tetrahydrofuran) and sealing paste (Rhenofol paste)**

Solvent-welding agents and sealing paste may contain toxic and environmentally hazardous substances. Fumes can form an explosive mixture with air. Fumes are heavier than air and spread at floor level. Ignition is possible over greater distances. During thermal decomposition, harmful gases and fumes may be generated, and explosive peroxides may be formed.

- Use self-contained respiratory protection.
- Wear chemical protective suit.
- Cool endangered tanks from a safe distance using water spray.
- Do not use a direct high-pressure water spray for extinguishing.
- For extinguishing, use carbon dioxide (CO<sub>2</sub>), extinguishing powder, or water spray. Fight larger fires with water spray or alcohol-resistant foam.
- Do not allow extinguishing water contaminated with pollutants to enter waterways or waste water system.
- Comply with the safety data sheet of the manufacturer.

## What to do in case of leaks

### **Solvent-welding agent (Rhenofol solvent-welding agent (THF) – tetrahydrofuran) and sealing paste (Rhenofol paste)**

#### Personal protection

- Avoid contact with skin, eyes, and clothing.
- Ensure good air exchange in the danger zone.
- Take precautionary measures against static discharge.
- Wear personal protective equipment (tight-fitting safety glasses with lateral guards, self-contained respiratory protection (filter type A-P2); chemical protective gloves (suitable material: butyl rubber; thickness of the glove material:  $\geq 0.7$  mm) and protective clothing).
- Comply with the safety data sheet of the manufacturer.

#### Environmental protection

- Do not allow it to enter waterways or waste water system.
- Absorb with liquid-binding material (sand, diatomaceous earth, acid binder, universal binder).
- Disposal according to official regulations. Do not dispose of the product together with domestic waste.
- In case of contamination of waterways, soil, or waste water system, inform relevant authorities.
- Comply with the safety data sheet of the manufacturer.

# Installation site requirements

The AHU must not be publicly accessible. Access to the AHU must be restricted so that only personnel with the appropriate qualifications can enter the installation site (see "Main operating instructions", "Personnel qualifications" section).

The country-specific standards for the operation and maintenance of plant rooms and control centres must be observed. The installation site must comply with the applicable building regulations. The specific functions of the AHU must be taken into account, for example, by providing ventilation and maintaining an ambient temperature of -20 °C to +40 °C.

The installation site must

- be clean.
- free of explosive dusts and/or gases.
- free of strong electromagnetic fields.
- free of aggressive media.
- have a drainage system.

The installation site of indoor units must meet the following requirements:

- must be dry.
- must be frost-free.

The installation site of weatherproof devices must meet the following requirements:

- it must be selected considering the external impact (e.g., sun, rain, snow, wind, frost) on the installation site. AHUs must be fastened to the foundation in accordance with the expected wind load. Service connections and cabling must be carried out professionally.
- It must have a suitable lightning protection system in accordance with country-specific regulations. The AHU must not be used as part of the external lightning protection system (see "Main operating instructions", chapter "Lightning protection for weatherproof devices").
- It must comply with the applicable regulations regarding protection against falls of people, tools, and materials, and suitable fall protection equipment must be in place.



## Installation site requirements for certain components

### Refrigeration technology

For AHUs with refrigeration technology, a refrigerant sensor for monitoring the installation site and suitable ventilation must be present and functional.

The installation site of refrigeration plants is defined according to EN 378.

#### **Split outdoor units with R32 refrigerant**

- The AHU is in an outdoor area (weatherproof unit).
- The split outdoor unit is in an outdoor area. For detailed information about the installation site, see appendix "Mitsubishi Electric – Planning Manual PUZ-ZM Power Inverter Outdoor Units", "Site Selection for Outdoor Units with R32" section.
- The pipelines between the AHU and the split outdoor unit are located outdoors.
- The pipelines between the AHU and the split outdoor unit are protected from inadvertent damage.
- There are no stairways or window wells near the installation site.
- There are no potential sources of ignition near the installation site.
- No operating ignition sources are permitted in the AHU or in the duct.
- The surface temperatures of the installation site, duct and inside the AHU must be  $\leq 430$  °C.

### Steam generator for electro steam humidifier

The following applies to steam generators of electro steam humidifiers:

- Permissible operation temperature: 5 to 40 °C; if necessary, ventilation (if installed in closed rooms) and/or frost protection must be provided.
- Must not be installed in rooms with underpressure.

### Hydraulic set

In the case of weatherproof AHUs with hydraulic sets, hydraulic components must be protected against frost by the customer (e.g., pipe trace heating, frost protection circuit, frost protection agents).

## Footprint requirements

AHUs have the following footprint requirements:

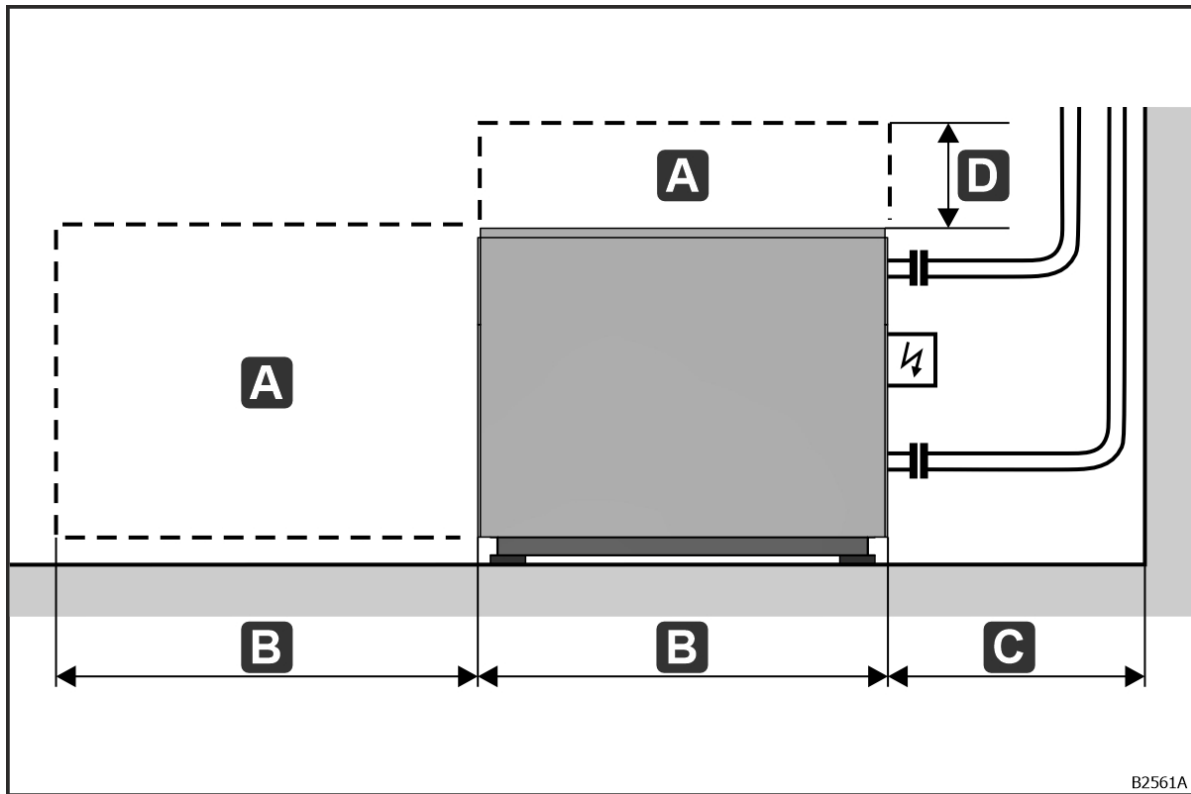


Fig. 2: AHU footprint requirements

A - revision area; B - unit width; C  $\geq$  875 mm; D  $\geq$  500 mm

- Leave  $\geq$  875 mm (C) free for connections and escape routes on all sides of the AHU.
- To replace components (e.g., coil, filter wall I - O, fan) on the operating side, leave one unit width (B) free as a revision area (A).
- Leave  $\geq$  500 mm (D) free above the AHU as a revision area (A).

### Steam generator for electro steam humidifier

For steam generators for electro steam humidifiers, observe the minimum wall clearance according to the manufacturer.

## Split outdoor units with R32 refrigerant

Split outdoor units with R32 may only be used if the following requirements are met:

For the space requirements of split outdoor units with R32, see the appendix "Mitsubishi Electric – PUZ-ZM Power Inverter Outdoor Unit Planning Manual", "Installation clearances and maintenance clearances" section.

The boreholes for fastening the split outdoor unit to the foundation have the following spacing:

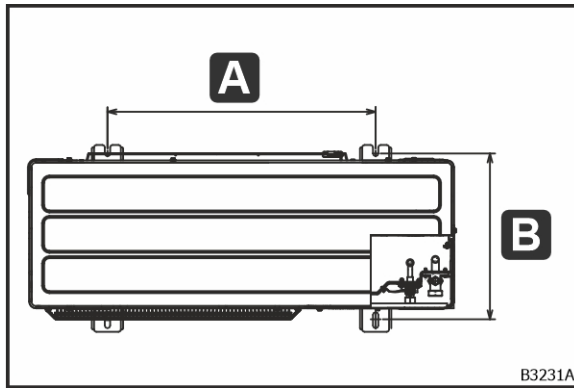


Fig. 3: Split outdoor unit mounting

<i>Power inverter type designation</i>		
<i>PUZ ZM</i>	<i>35/50</i>	<i>60/71/100/ 125/140/200/250</i>
<i>A [mm]</i>	<i>500</i>	<i>600</i>
<i>W [mm]</i>	<i>330</i>	<i>370</i>

## HE-RAC hydraulics on stand

The HE-RAC hydraulics on stand has the following footprint requirements:

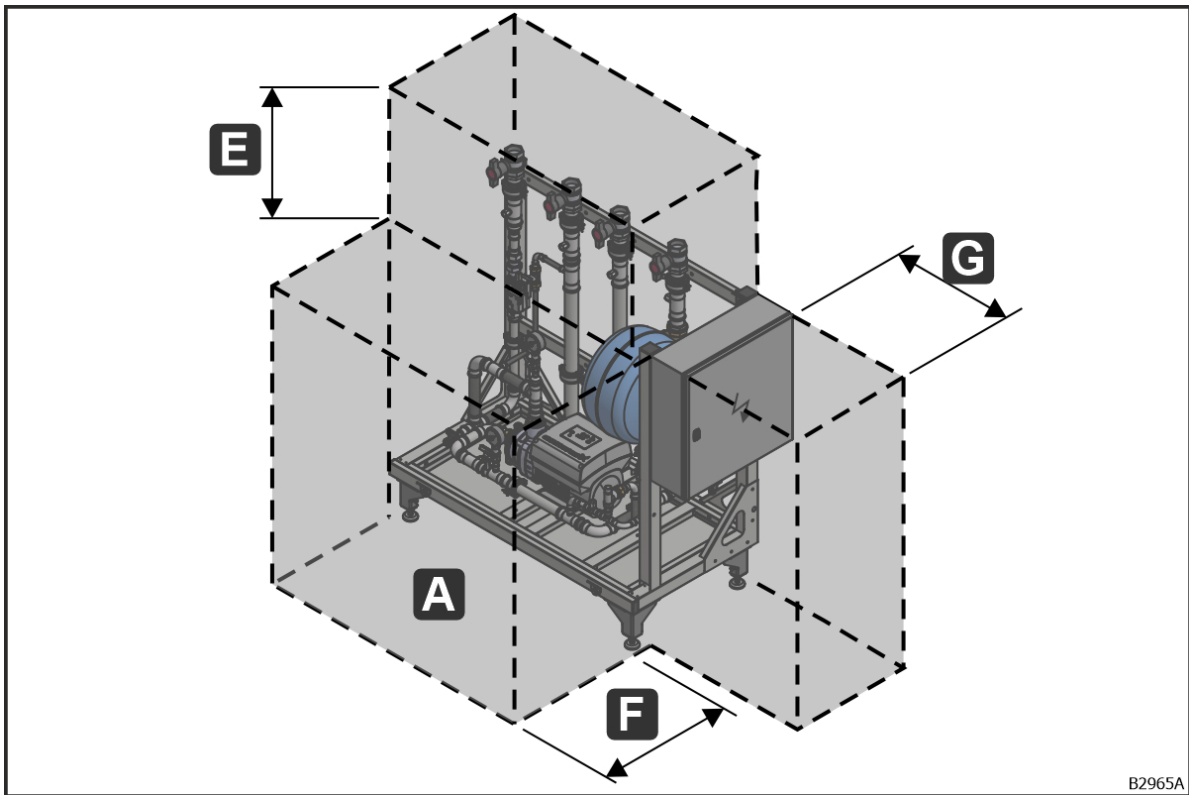


Fig. 4: Footprint requirements of HE-RAC hydraulics on stand

A - revision area;  $E \geq 350 \text{ mm}$ ;  $F \geq 500 \text{ mm}$ ;  $G \geq 650 \text{ mm}$

- Leave  $\geq 350 \text{ mm}$  (E) above the rack for the connections.
- Leave  $\geq 500 \text{ mm}$  (F) free as a revision area (A) on the operating side and  $\geq 650 \text{ mm}$  (G) in front of the control cabinet.

## Foundation

### WARNING



#### **Danger to life due to incorrect setup**

Improper use of the transport lugs and brackets for permanent fastening will result in danger to life due to the AHU falling.

- Set up the AHU on a level and stable foundation.

### WARNING

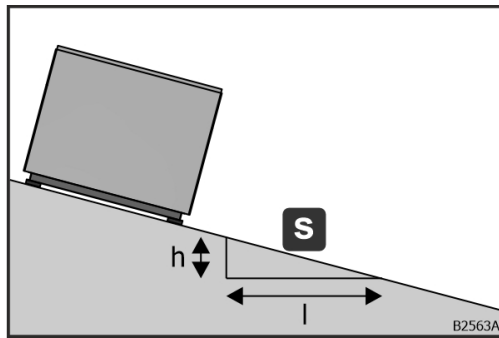


#### **Risk of death due to the AHU falling over**

If the AHU is not secured, there is a danger to life if the AHU falls over.

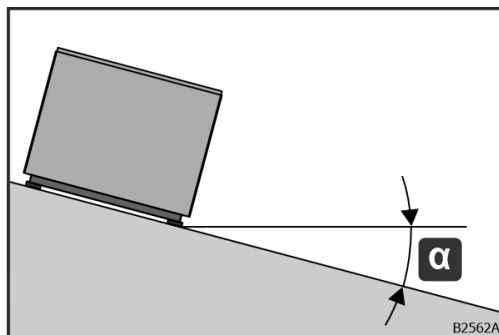
- AHUs must be secured to the foundation.
- If the center of gravity is unfavorable (e.g., height/depth ratio  $\geq 2.5$ ), further security measures (e.g., steel structure) must be taken.

AHUs must be installed on a level and stable foundation.



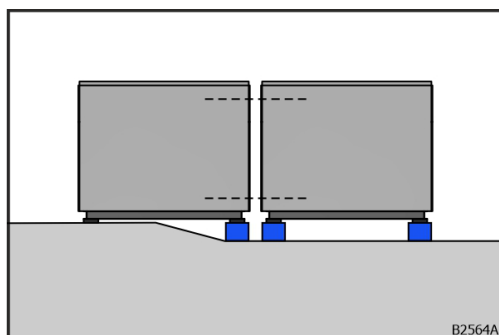
The maximum tolerance to the horizontal is  $s = 0.5 \%$  (slope).

Fig. 5: Maximum incline



This corresponds to a maximum inclination angle of  $\alpha = 0.3^\circ$ .

Fig. 6: Maximum inclination angle



The frames of the casing connection must be parallel to each other. Irregularities must be compensated by appropriate supports (e.g., sheet metal strips).

Fig. 7: Compensating unevenness

The foundation must meet the structural, acoustic and drainage (e.g. pan drain) requirements of the building. Set up the AHU with sufficient distance from the floor to achieve the required siphon height (see chapter "Condensate, drain and overflow lines", page 49).

The natural frequency of the support structure, especially in case of steel structures, must have sufficient distance to the excitation frequency of rotating components (e.g., fans, motors, pumps, compressors).

## Beam support structure

The support execution (e.g., steel or concrete) is selected on site.

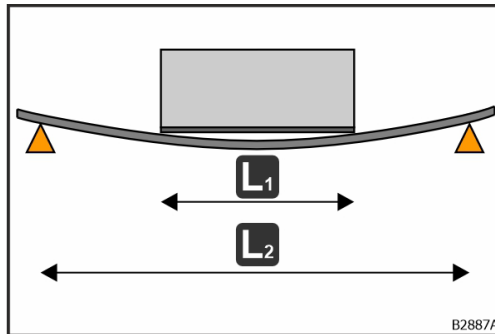


Fig. 8: Deflection of the AHU

The deflection of the AHU at the installation site must not exceed  $1/500$  in relation to the dimensions of the AHU ( $L_1$ ). If there is a higher deflection due to the on-site support structure ( $L_2$ ), the deflection of the AHU can be reduced to a maximum of  $1/500$  by additional support points between the support structure and the AHU.

A beam support structure can be implemented with longitudinal supports or width supports. Longitudinal supports are on-site supports on which the AHU rests in the longitudinal direction. Width supports are on-site supports on which the AHU rests in the width direction.

### Longitudinal support

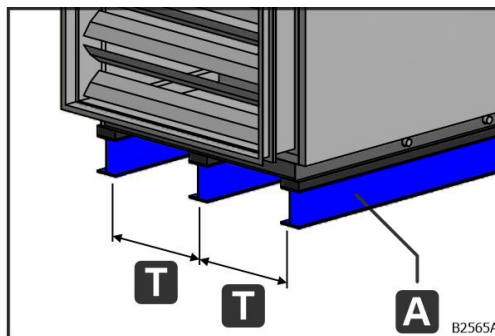


Fig. 9: Longitudinal support

The distance ( $T$ ) of the on-site longitudinal supports ( $A$ ) in the width direction must not exceed  $T \leq 2.5$  m.

### Longitudinal support for units on DIN frames

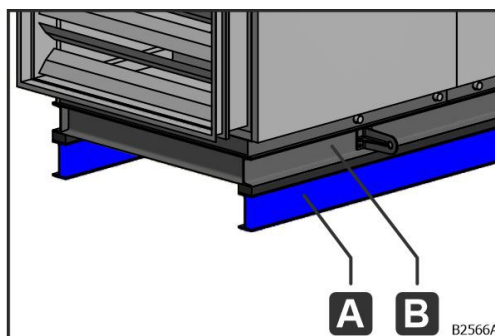


Fig. 10: Longitudinal support for units on DIN frames

For units on DIN frame, two on-site longitudinal supports ( $A$ ) are required over the entire length. The DIN frame ( $B$ ) of the AHU rests on these.

## Width support

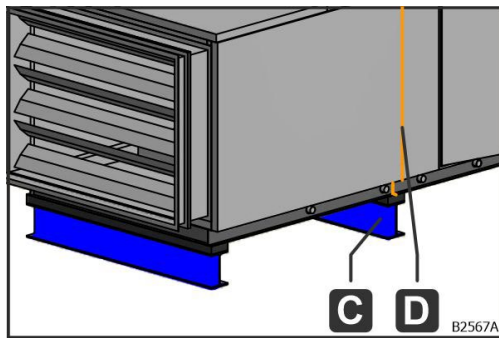


Fig. 11: Width support

The positioning of the width supports (C) depends on the AHU. A width support (C) is required at each separation point (D), for pan divisions, for heavy components (e.g., fans) and for long components  $l \geq 1.5$  m (e.g., silencers).

## Width support for units on DIN frames

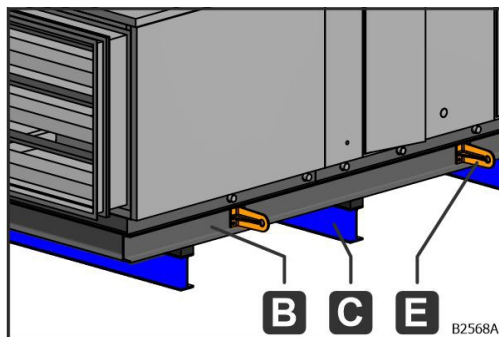


Fig. 12: Width support for units on DIN frames (identification)

The positioning of the width supports (C) depends on the AHU and the DIN frame (B). For units on DIN frame, a width support (C) is required centrally between the end of the unit and the transport loop (E) ( $l_1 - l_1$ ) and centrally between two transport loops (E) ( $l_2 - l_2$ ).

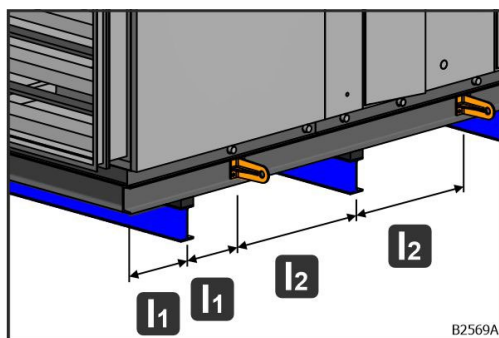


Fig. 13: Width support for units on DIN frames (dimensions)



## Foundation spots

A foundation spot is a localized support point for the installation of the AHU.

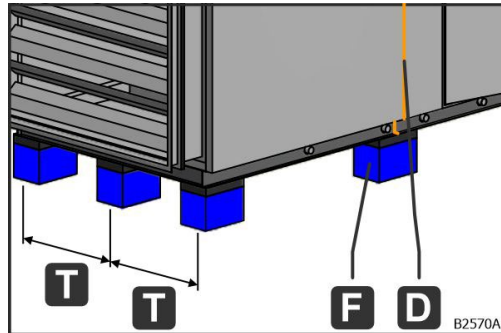


Fig. 14: Foundation spots

The positioning of the foundation spots (F) depends on the AHU. A foundation spot (F) is required at each separation point (D), at pan divisions, for heavy components (e.g., fans) and for long components of  $l \geq 1.5$  m (e.g., silencers). The distance (T) of the on-site foundation spots (F) in the width direction must not exceed  $T \leq 2.5$  m. The maximum load per foundation spot (F) is 500 kg.

### Foundation spot for units on DIN frame

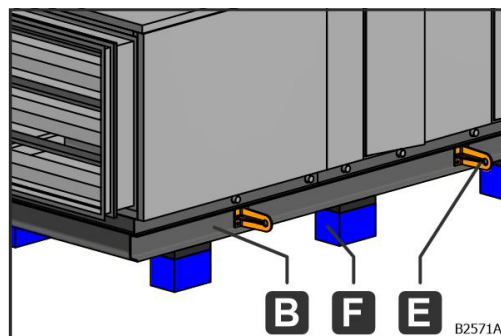


Fig. 15: Foundation spot for units on DIN frame (designations)

The positioning of the foundation spots (F) depends on the AHU and the DIN frame (B). For units on DIN frame, a foundation spot (F) is required centrally between the end of the unit and the transport loop (E) ( $l_1 - l_1$ ) and centrally between two transport loops (E) ( $l_2 - l_2$ ).

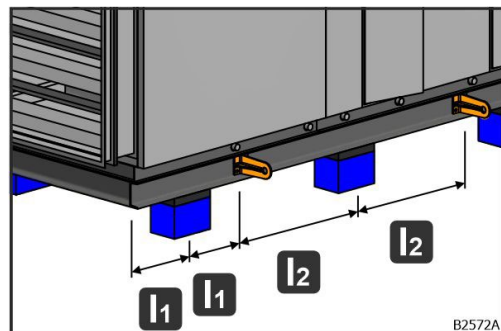
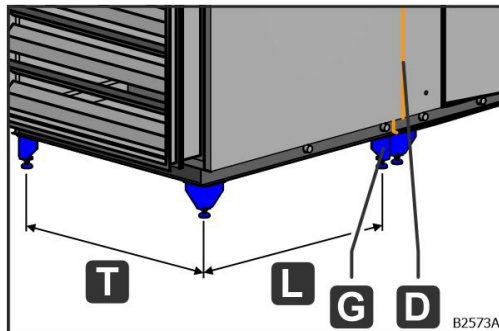


Fig. 16: Foundation spot for units on DIN frame (dimensions)

## Unit foot

Unit feet are used for elevated installation and leveling of the AHU. The unit foot is adjustable in height. The adjustment range is 100 mm.



The positioning of the unit feet (G) depends on the AHU. Four unit feet (G) must be attached per section. The maximum distance (T, L) is  $T, L \leq 2.5$  m. The maximum load per unit foot (G) is 500 kg.

Fig. 17: Unit foot

## Construction for assembly underneath the ceiling

If mounting under the ceiling, the configuration must be provided by the customer. The on-site construction must comply with the requirements for beam support structures (see chapter "Beam support structure", page 19). The on-site configuration must be carried out by a specialist, and must take into account all relevant factors (e.g., statics, load-bearing capacity, fastening, and vibrations).

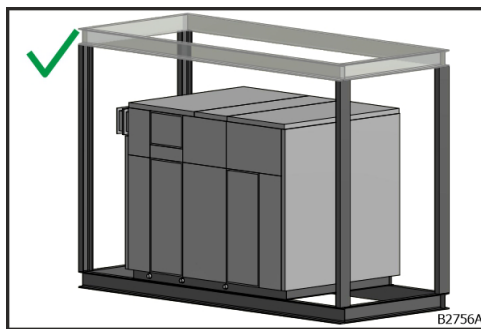


Fig. 18: Example 1

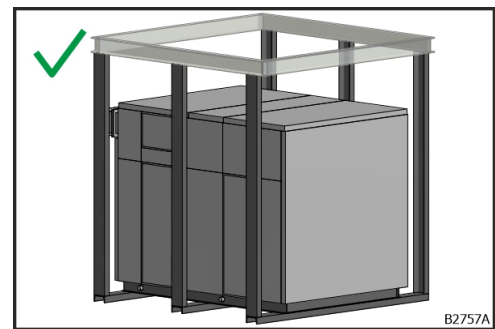


Fig. 19: Example 2



Fig. 20: Incorrect installation

# Unit assembly

## WARNING



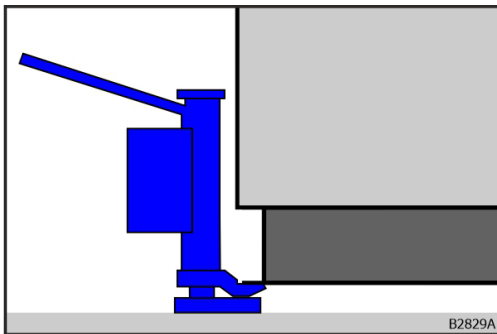
### Danger of crushing from reaching under suspended loads

When positioning the delivery sections for the installation and assembly of the AHU, there is a risk of crushing people or limbs if people are in the danger zone or limbs reach into the danger zone.

- Leave the danger zone.
- Do not reach under the delivery section.
- Do not stand below suspended loads.
- Wear safety footwear of a min. protection class S1 according to EN ISO 20345.
- Observe the safety regulations for the industrial truck and means of transport.

Check the arrangement of the sections and components and the execution according to the technical drawing before starting the unit assembly.

## Lifting jack



Always place the lifting jack on the lower edge of the base frame. Do not place the lifting jack on the edge of the panels, as this will cause deformation and damage to the panels. Make sure that the force is evenly distributed on the base frame.

Fig. 21: Lifting jack

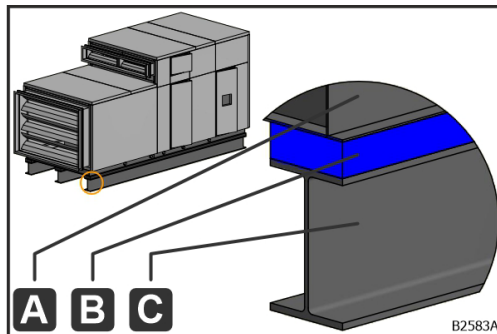
## Sound reduction

To comply with the permissible sound emission values, sound-reducing components (e.g., duct silencers, noise barriers) must be provided on the intake and discharge sides or the casing if they are not integrated or not sufficiently integrated into the AHU.

## Vibration damping

Use vibration dampers for vibration damping (e.g., Mafund, Sylomer, or Ilmod Kompri tape) in the length and width direction. Use the appropriate type depending on the load. The dimensioning of the vibration dampers is done by the customer. Use vibration dampers on all types of support points.

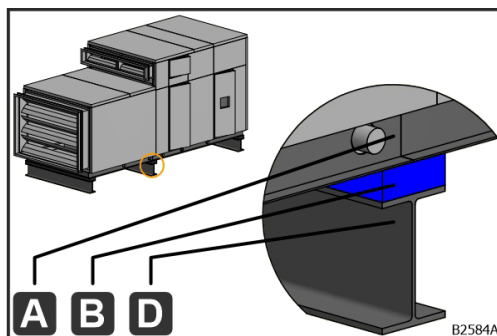
### Installation on longitudinal supports



- A base frame
- B Vibration damper
- C On-site longitudinal support

Fig. 22: Longitudinal support

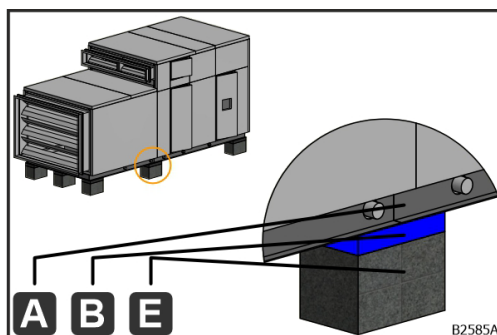
### Installation on width support



- A base frame
- B Vibration damper
- D On-site width support

Fig. 23: Width support

### Installation on foundation spot



- A base frame
- B Vibration damper
- E On-site foundation spot

Fig. 24: Foundation spots

## Casing connection

Depending on the casing construction, the following installation material is included in the delivery for the casing connection:

- Foam tape 20 x 3 mm (A)
- Washer (ISO 7093) 8.4 mm (B)
- Hexagonal nut (ISO 4032) M 8 (C)
- Hexagonal screw (ISO 4017) M 8 x 50 mm (E)
- Hexagonal screw (ISO 4017) M 8 x 80 mm (F)
- Hexagonal screw (ISO 4017) M 8 x 110 mm (G)
- Hexagonal screw (ISO 4017) M 8 x 140 mm (H)
- Hexagonal screw (ISO 4017) M 8 x 180 mm (I)
- Special self-tapping screw with pan head (similar to ISO 10666) 6.3 x 55 mm, Torx (J)

The installation material is included in the delivery section with the fan.

For weatherproof units, additional roofing membrane stripes, solvent-welding agent, and sealing paste are included.

For stainless steel housings, use only stainless steel connecting elements.

Compensate for misalignment of casing connection holes due to different compression of vibration dampers caused by weight differences of adjacent sections during casing connection.

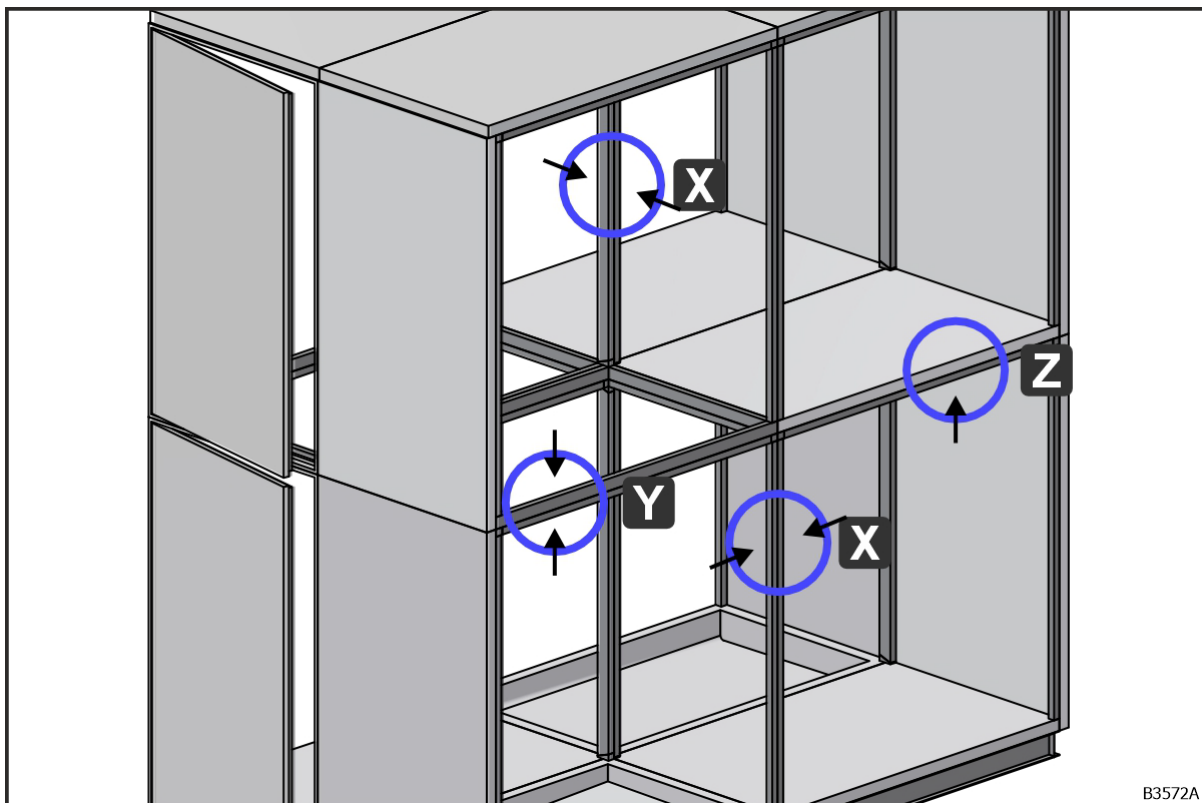


Fig. 25: Possible casing connections

X – see chapter "Casing connection of delivery sections next to each other", page 26

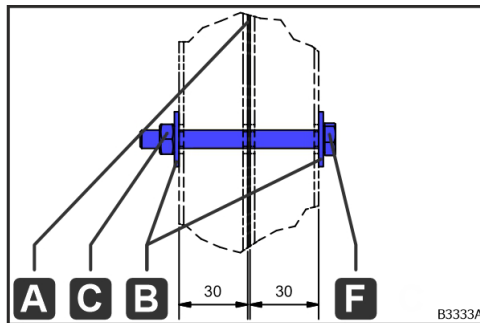
Y – see chapter "Casing connection of delivery sections on top of each other", page 29

Z – see chapter "Casing connection with unit floor in upper casing", page 31

## Casing connection of delivery sections next to each other

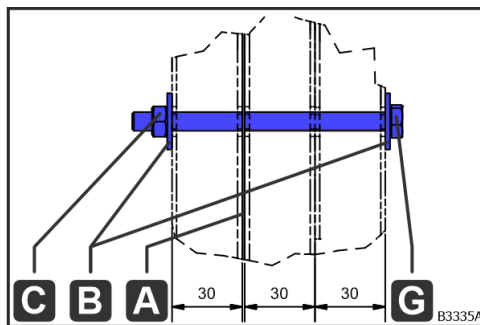
### Casing connection with through screw and nut

The screw can be inserted into the boreholes from both sides, depending on the space available. Depending on the casing construction, the following options are available for connecting the casing:



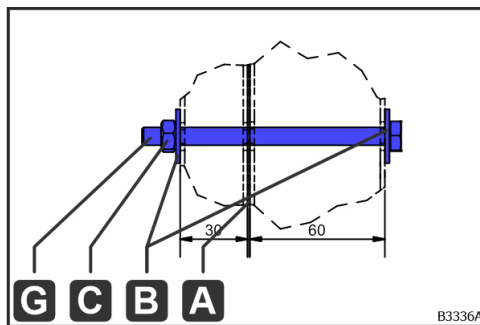
- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- F – hexagonal screw (ISO 4017) M 8 x 80 mm

Fig. 26: M 8 x 80 mm



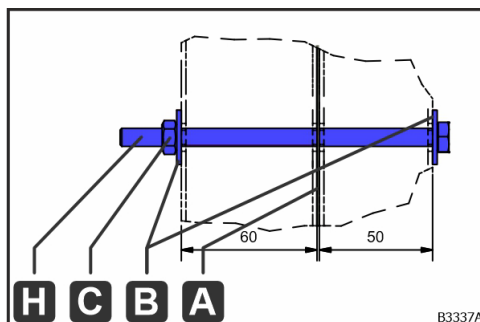
- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- G – hexagonal screw (ISO 4017) M 8 x 110 mm

Fig. 27: M 8 x 110 mm



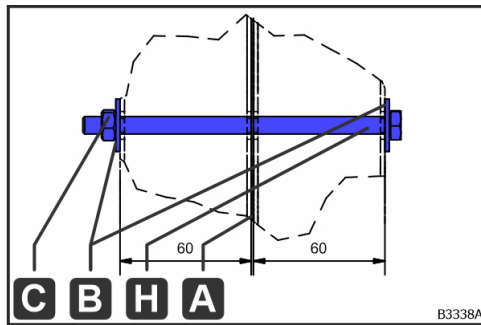
- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- G – hexagonal screw (ISO 4017) M 8 x 110 mm

Fig. 28: M 8 x 110 mm



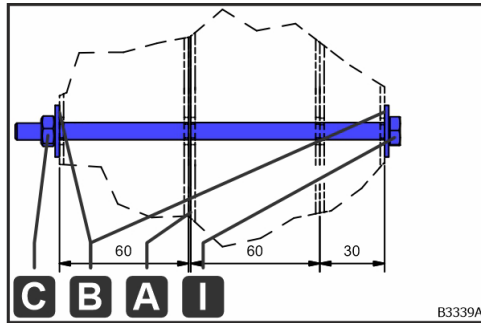
- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- H – hexagonal screw (ISO 4017) M 8 x 140 mm

Fig. 29: M 8 x 140 mm



- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- H – hexagonal screw (ISO 4017) M 8 x 140 mm

Fig. 30: M 8 x 140 mm



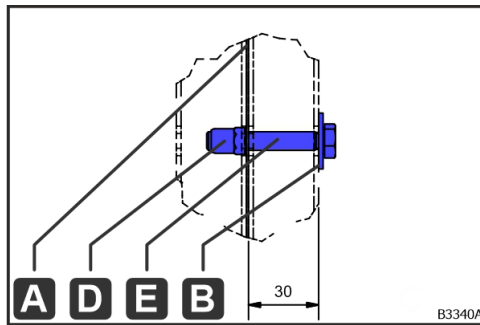
- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- I – hexagonal screw (ISO 4017) M 8 x 180 mm

Fig. 31: M 8 x 180 mm

Work steps see chapter "Casing connection with through screw and nut", page 32.

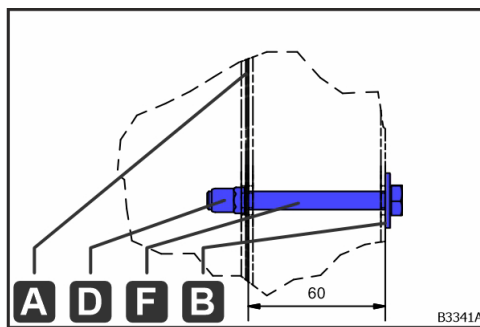
### Casing connection with rivet nut

Depending on the casing construction, the following options are available for connecting the casing:



- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- D – rivet nut M 8 hexagon fitting
- E – hexagonal screw (ISO 4017) M 8 x 50 mm

Fig. 32: M 8 x 50 mm



- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- D – rivet nut M 8 hexagon fitting
- F – hexagonal screw (ISO 4017) M 8 x 80 mm

Fig. 33: M 8 x 80 mm

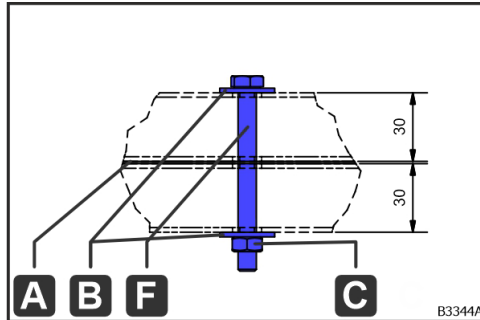
Work steps see chapter "Casing connection with rivet nut", page 35.



## Casing connection of delivery sections on top of each other

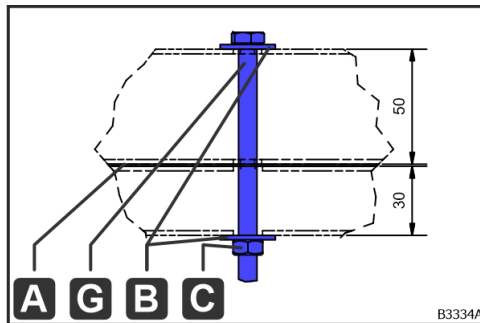
### Casing connection with through screw and nut

The screw can be inserted into the boreholes from both sides, depending on the space available. Depending on the casing construction, the following options are available for connecting the casing:



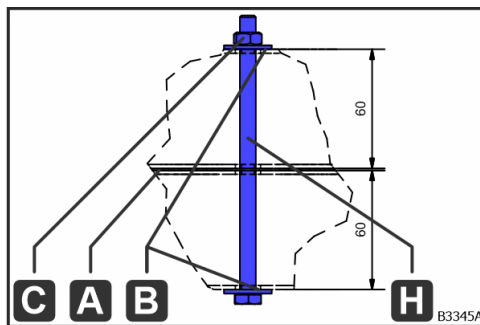
- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- F – hexagonal screw (ISO 4017) M 8 x 80 mm

Fig. 34: M 8 x 80 mm



- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- G – hexagonal screw (ISO 4017) M 8 x 110 mm

Fig. 35: M 8 x 110 mm



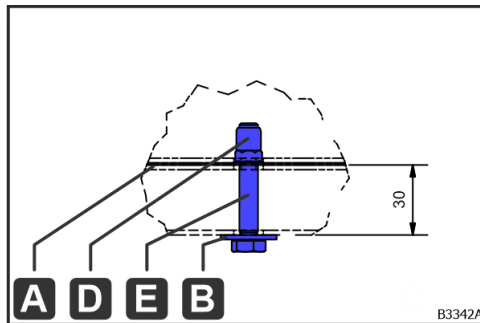
- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- C – hexagonal nut (ISO 4032) M 8
- H – hexagonal screw (ISO 4017) M 8 x 140 mm

Fig. 36: M 8 x 140 mm

Work steps see chapter "Casing connection with through screw and nut", page 32.

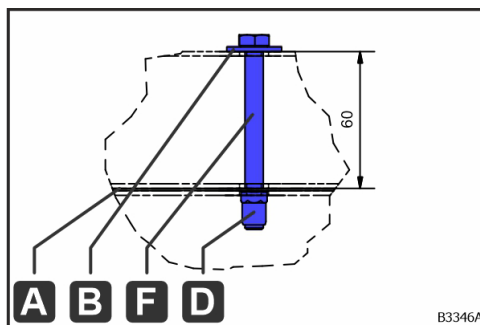
### Casing connection with rivet nut

Depending on the casing construction, the following options are available for connecting the casing:



- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- D – rivet nut M 8 hexagon fitting
- E – hexagonal screw (ISO 4017) M 8 x 50 mm

Fig. 37: M 8 x 50 mm



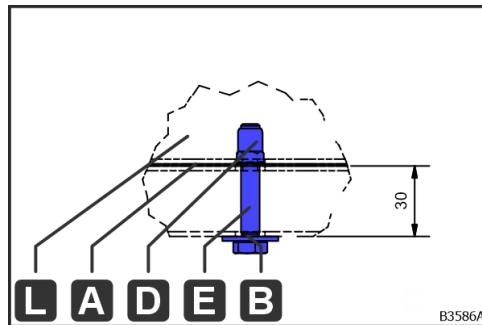
- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- D – rivet nut M 8 hexagon fitting
- F – hexagonal screw (ISO 4017) M 8 x 80 mm

Fig. 38: M 8 x 80 mm

Work steps see chapter "Casing connection with rivet nut", page 35.

### Casing connection with unit floor in upper casing

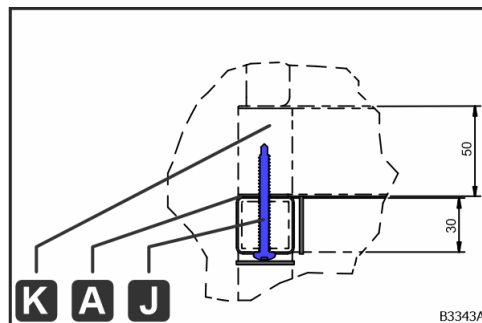
The following option is available for the casing connection of delivery sections on top of each other with unit floor in the upper casing:



- A – foam tape 20 x 3 mm
- B – washer (ISO 7093) 8.4 mm
- D – rivet nut M 8 hexagon fitting
- E – hexagonal screw (ISO 4017) M 8 x 50 mm
- L – metal tray of unit floor

Fig. 39: M 8 x 50 mm

Work steps see chapter "Casing connection with rivet nut", page 35.



- A – foam tape 20 x 3 mm
- J – special self-tapping screw with pan head (similar to ISO 10666) 6.3 x 55 mm, Torx
- K – plastic profile of unit floor

Fig. 40: special self-tapping screw with pan head

Work steps see chapter "Casing connection with unit floor in upper casing", page 38.

## Work steps

### Casing connection with through screw and nut

To connect the delivery sections with a through hexagonal screw and nut, the following steps must be carried out:

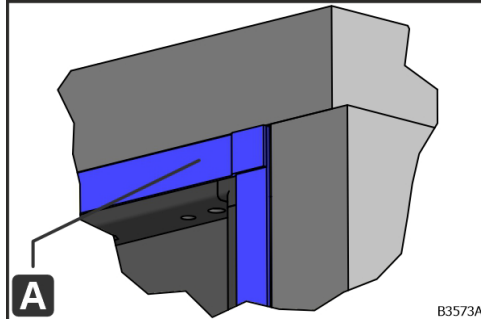


Fig. 41: Masked tube frame (30 mm)

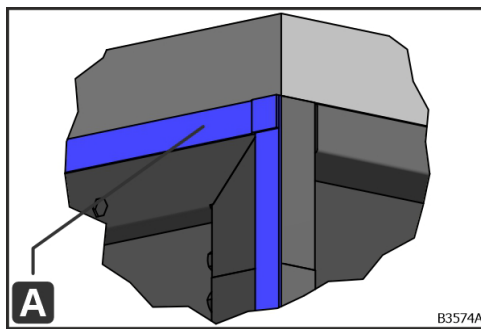


Fig. 42: Masked tube frame (60 mm)

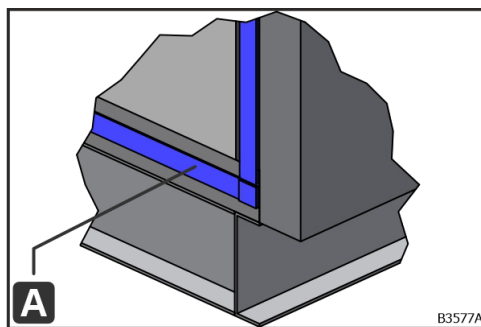


Fig. 43: Masked unit floor (50 mm)

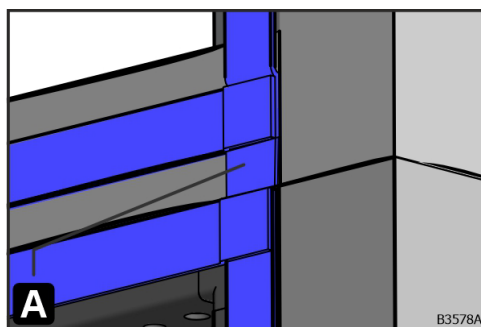


Fig. 44: Masking airflows above each other

1. Apply foam tape (A) to the tube frame all the way round each separation point on a delivery section.
  - Stick the foam tape (A) between the panel and row of holes.
  - The foam tape (A) must overlap at the corners.
2. If there is no tube frame in the floor area:
  - Stick the foam tape (A) on centrally.
  - The foam tape (A) must overlap at the corners.
3. If airflows are arranged above each other:
  - Stick the foam tape (A) on end-to-end.
  - The foam tape (A) must overlap at the corners.

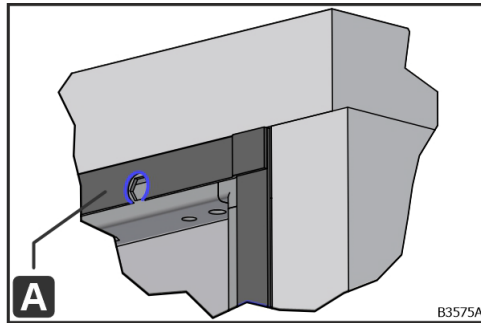


Fig. 45: Cut-out foam tape

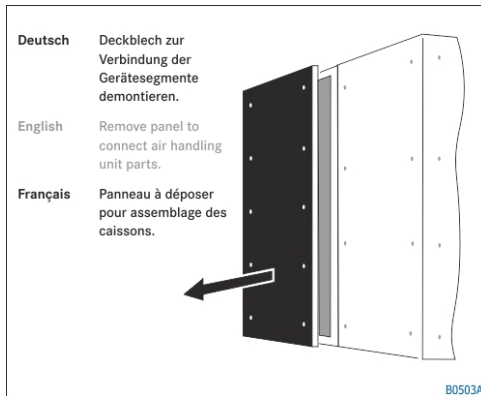


Fig. 46: Label to identify relevant panels

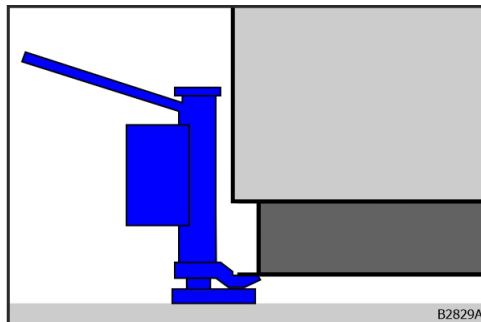


Fig. 47: Machine jack

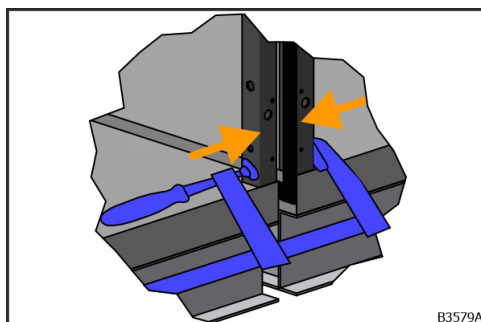


Fig. 48: Pulling the delivery sections together

4. If necessary, cut out the foam tape (A) where the boreholes are.

5. If there are no doors at the separation points, remove the panels labelled accordingly for better accessibility.

6. If necessary, lift the delivery section with a machine jack if the casing connection holes are offset.

7. If necessary, pull the delivery sections together with screw clamps at the bottom of the casing frame.

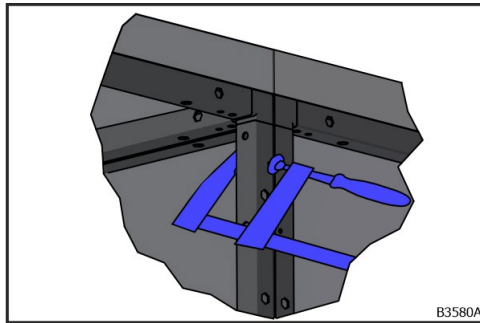


Fig. 49: Aligning the delivery sections

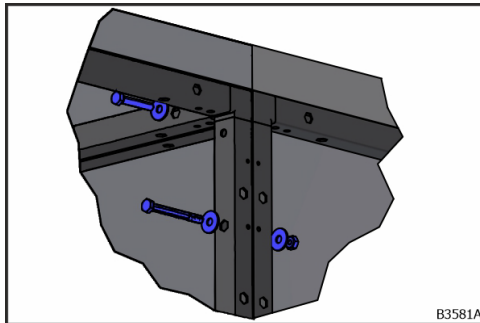


Fig. 50: Hexagonal screw, washers and hexagonal nuts

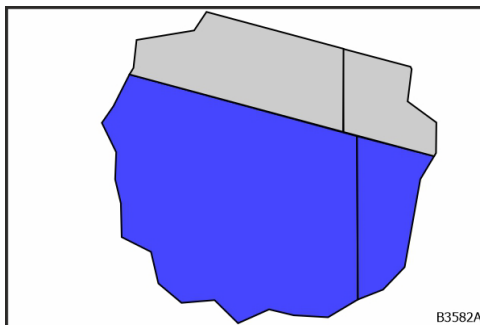


Fig. 51: Mounting the panels

8. If necessary, align the delivery sections with screw clamps on the casing frame.

9. Connect the delivery sections from inside with hexagonal screws (E, F, G, H, I), washers (B) and hexagonal nuts (C) applying a torque  $\leq 25$  Nm.

10. If applicable, mount the removed panels.

### Casing connection with rivet nut

To connect the delivery sections with a hexagonal screw and rivet nut (C), the following steps must be carried out:

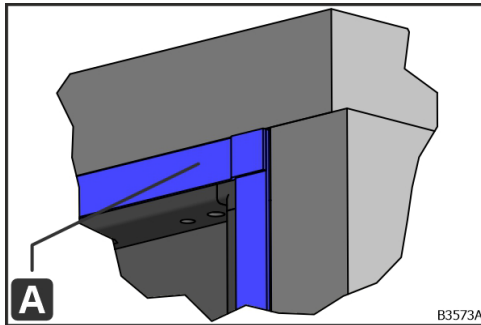


Fig. 52: Masked tube frame (30 mm)

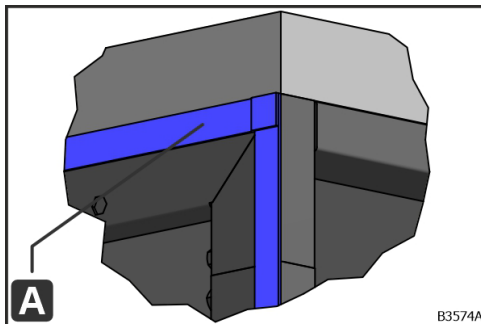


Fig. 53: Masked tube frame (60 mm)

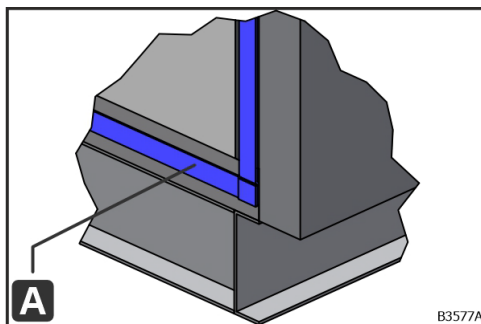


Fig. 54: Masked unit floor (50 mm)

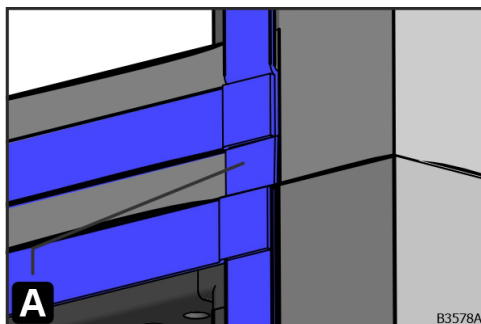


Fig. 55: Masking airflows above each other

1. Apply foam tape (A) to the tube frame all the way round each separation point on a delivery section.
  - Stick the foam tape (A) between the panel and row of holes.
  - The foam tape (A) must overlap at the corners.
  
2. If there is no tube frame in the floor area:
  - Stick the foam tape (A) on centrally.
  - The foam tape (A) must overlap at the corners.
  
3. If airflows are arranged above each other:
  - Stick the foam tape (A) on end-to-end.
  - The foam tape (A) must overlap at the corners.

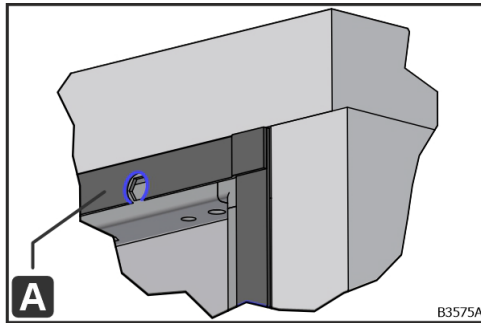


Fig. 56: Cut-out foam tape

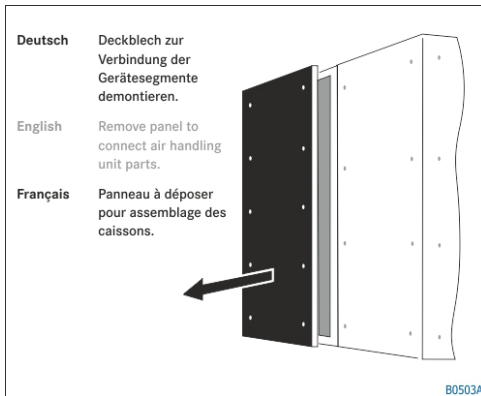


Fig. 57: Label to identify relevant panels

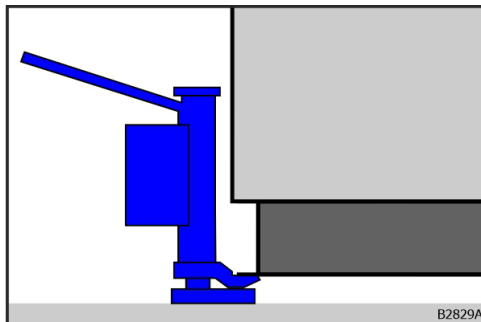


Fig. 58: Machine jack

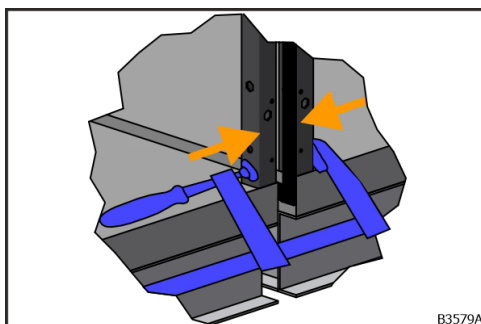


Fig. 59: Pulling the delivery sections together

4. If necessary, cut out the foam tape (A) where the boreholes are.
5. If there are no doors at the separation points, remove the panels labelled accordingly for better accessibility.
6. If necessary, lift the delivery section with a machine jack if the casing connection holes are offset.
7. If necessary, pull the delivery sections together with screw clamps at the bottom of the casing frame.



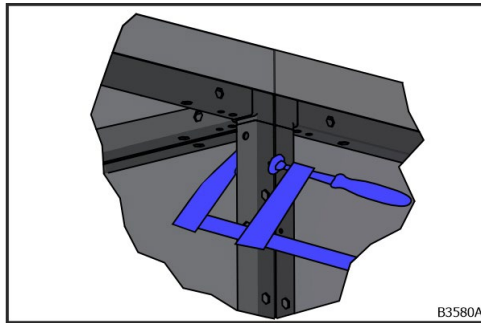


Fig. 60: Aligning the delivery sections

8. If necessary, align the delivery sections with screw clamps on the casing frame.

**NOTICE****Material damage from exceeding the maximum torque**

If screws are tightened with excessive torque, threads in plastic profiles or rivet nuts can tear out.

- Tighten the screws with the torque given in the instructions.

**NOTICE****Material damage due to incorrect positioning of the screws in the rivet nuts**

If screws are positioned incorrectly, the thread of the rivet nuts may deform.

- Position the screws by hand.

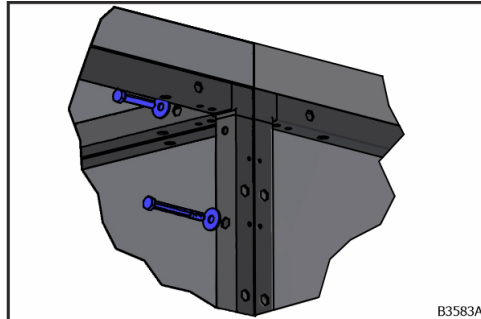


Fig. 61: Hexagonal screw and hexagonal nut

9. Position the appropriate hexagonal screws (E, F) with hexagonal nuts.
10. Screw in the hexagonal screws (E, F) a minimum of 10 mm by hand.
11. Tighten the hexagonal screws (E, F) with a torque  $\leq 25$  Nm.

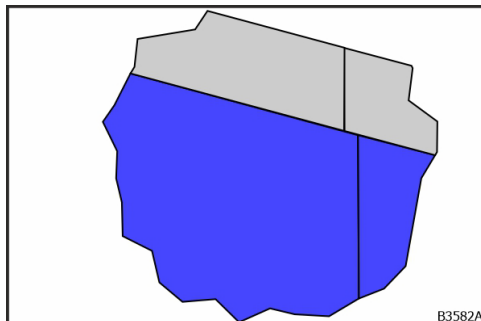


Fig. 62: Mounting the panels

12. If applicable, mount the removed panels.

### Casing connection with unit floor in upper casing

To connect the delivery sections with the plastic profiles of the drain pans, the following steps must be carried out:

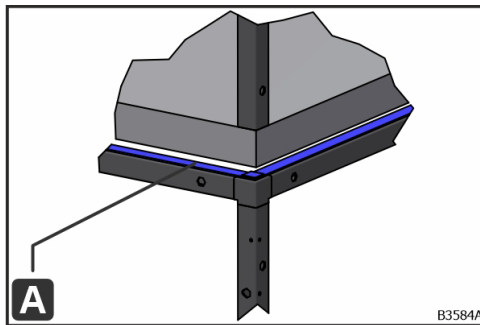


Fig. 63: Masked tube frame

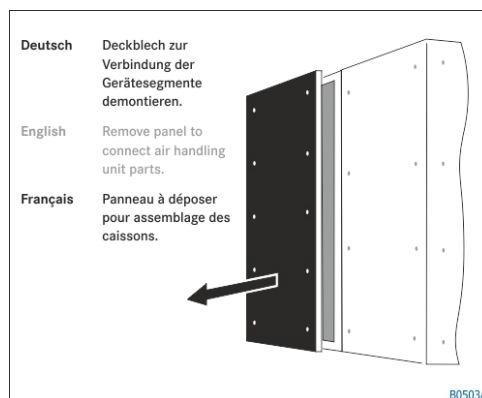


Fig. 64: Label to identify relevant panels

1. Apply foam tape (A) to the tube frame all the way round each separation point on a delivery section.
  - Stick the foam tape (A) between the panel and row of holes.
  - The foam tape (A) must overlap at the corners.
2. If there are no doors at the separation points, remove the panels labelled accordingly for better accessibility.

### NOTICE



#### Material damage from exceeding the maximum torque

If screws are tightened with excessive torque, threads in plastic profiles or rivet nuts can tear out.

- Tighten the screws with the torque given in the instructions.

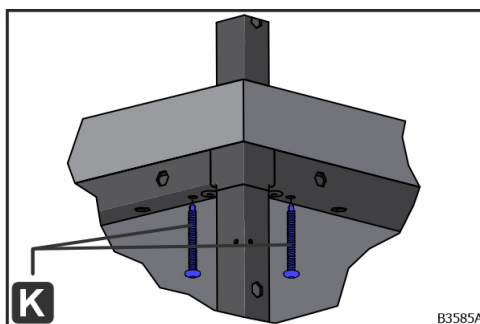


Fig. 65: Special self-tapping screw

3. Connect the delivery sections from inside with a special self-tapping screw (K) with a torque  $\leq 5 \text{ Nm}$ .

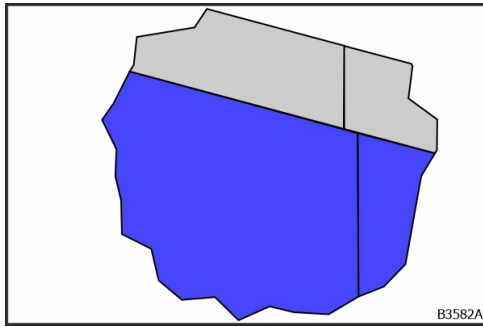


Fig. 66: Mounting the panels

4. If applicable, mount the removed panels.

## Separation points in the floor area

To ensure residue-free wiping out, separation points in the floor area downstream of the casing connection must be sealed with microbially inert joint sealant according to VDI 6022.

### **TIP**

#### **Microbially inert joint sealant according to VDI 6022**



The manufacturer of a microbially inert joint sealant proves that the requirements of VDI 6022 are met. The test procedures are described in ISO 846.

## Fastening to on-site beams

### Longitudinal support fastening

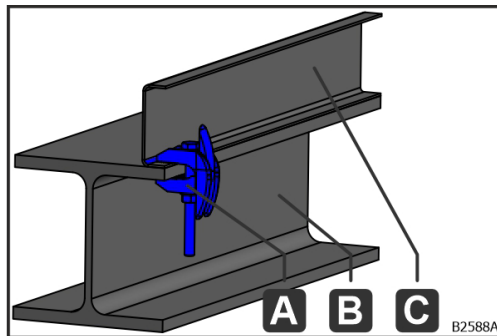


Fig. 67: Mounting with beam clamp F9 (A)

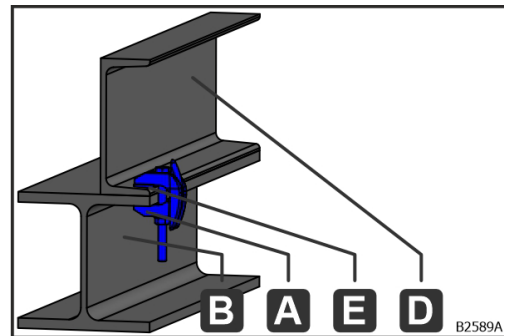


Fig. 68: Fastening with DIN 434 wedge washer (E)

F9 beam clamps (A) are recommended for fastening AHUs with on-site longitudinal supports (B). DIN 434 wedge washers (E) must be used for devices on DIN frames (D). They are used to compensate for the inclination in the flanges of the DIN frame (D).

### Width support fastening

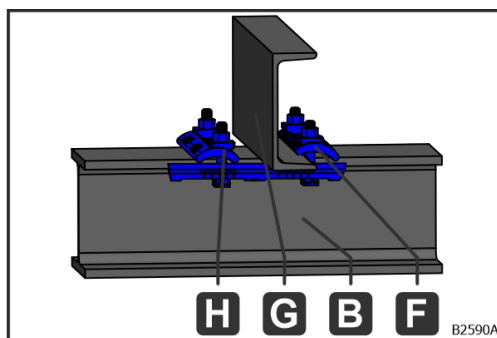


Fig. 69: Fastening with beam clamp FC (F)

- B On-site support
- F FC beam clamp
- G Base frame/DIN frame
- H Close FC beam clamp completely

FC beam clamps (F) are recommended for fastening AHUs with on-site longitudinal beams (B).

## Connection of AHUs with roof rack frame

The roof rack frame is used to install two AHUs on top of each other. The sections are only connected to each other at the final installation site.

### WARNING



#### **Danger to life from suspended loads and falling objects**

Danger to life from failing transport lugs or transport loops.

- No additional loads on in or on the delivery sections.
- Do not install any components in or on the delivery section before transporting it to the final installation site.
- Only use suitable permitted lifting equipment (rope, chains, lifting straps, turnbuckles) complying with BGV D6 (German employers' liability insurance association regulations) to transport and unload the delivery sections.
- Only attach lifting equipment to the transport lugs on the delivery sections.
- Lifting equipment must be approved for the weight of the delivery section.
- For transport lugs, the angle of inclination between the lifting equipment must be between 45° and 55°.
- For transport loops, the maximum permitted oblique pull is 10°.
- Reduce the load capacity by spreading the lifting equipment in accordance with the lifting equipment table.
- Observe the safety regulations for the conveyor vehicles and means of transport.
- Do not stand below suspended loads.

For weatherproof units with roof rack frames see chapter "Connection of weatherproof devices with roof rack frame", page 65.

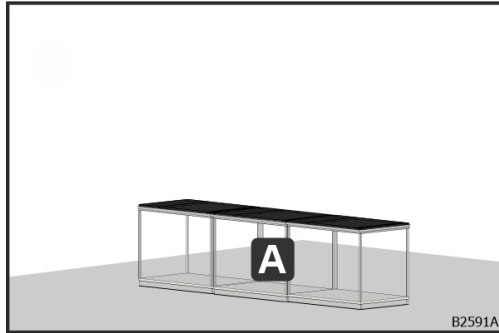


Fig. 70: Lower AHU set up

1. Set up the lower AHU (A) and fasten it to the foundation (see chapter "Foundation", page 17).

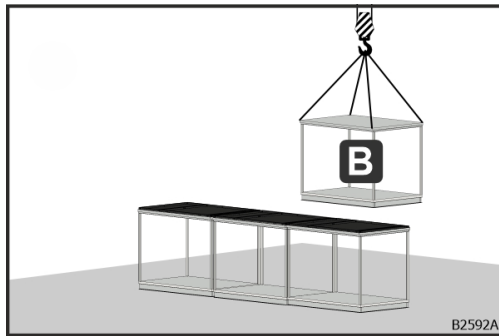


Fig. 71: Crane upper section individually

2. Place the upper AHU (B) on the roof rack frame of the lower AHU (A).

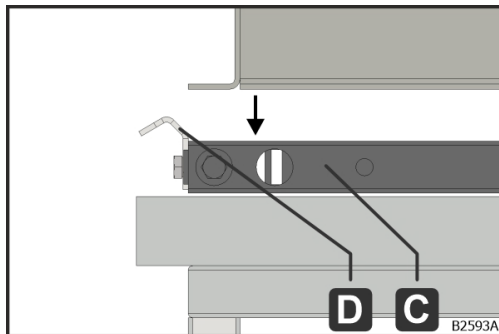


Fig. 72: Setting down the upper section

3. Roof rack brackets (D) on the roof rack frame (C) serve to guide and center the base frame of the upper AHU (B).

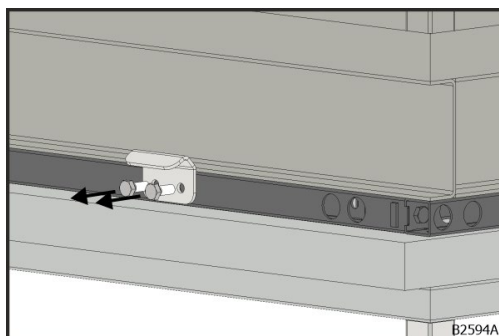
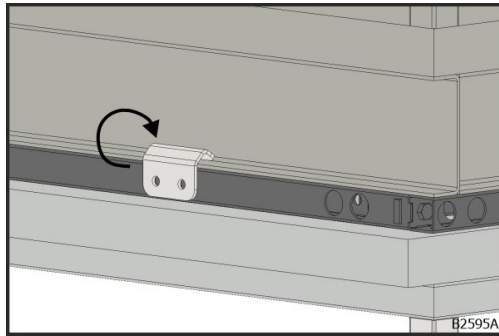


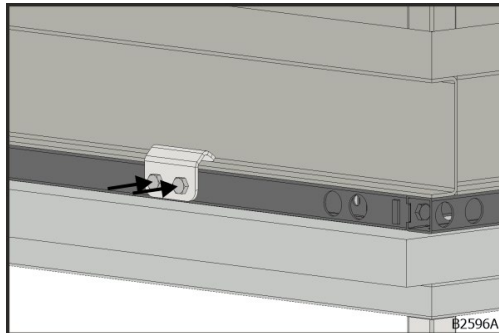
Fig. 73: Disassembling roof rack brackets

4. Remove hexagonal screws from roof rack brackets (D).



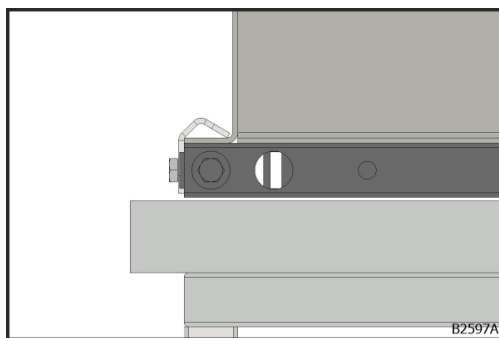
Turn the roof rack bracket (D) so that the roof-shaped tab faces the base frame.

Fig. 74: Turning roof rack brackets



Mount the roof rack bracket (D) with hexagonal screws.

Fig. 75: Roof rack bracket assembly



→ The roof rack brackets (D) fix the base frame of the upper AHU (B) to the roof rack frame (C) of the lower AHU (A).

Fig. 76: Connection of upper and lower AHU



## Transport lugs/transport loops

After assembly, remove the transport lugs and close the openings with plugs.

Remove transport loops after assembly.

## Unit connection

The ducts must be connected free of voltage. Ducts, including unit connections, must be properly insulated and protected against weather effects.

### Flexible connection

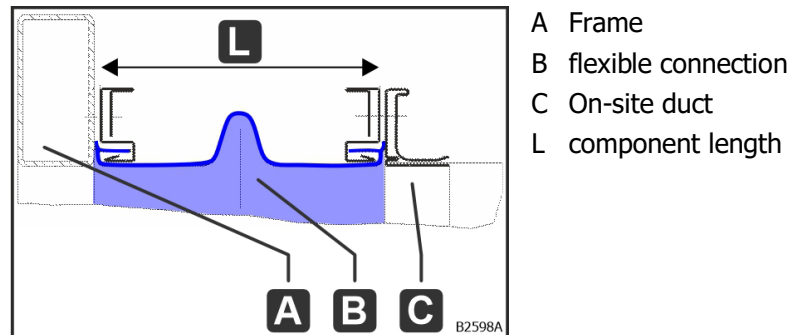
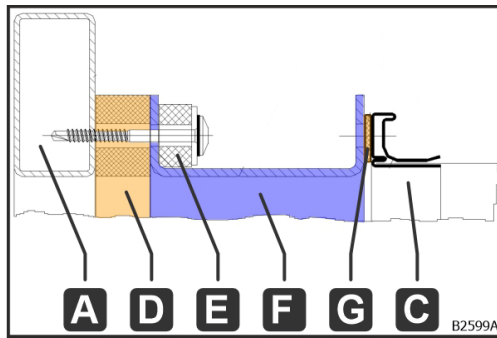


Fig. 77: Flexible connection

The component length (L) of the flexible nozzle must in no case be the stretched length. The optimum component length (L) is 100 - 120 mm.

## Sound-insulated connection



- A Frame
- C On-site duct
- D Microlen tape
- E rubber buffer
- F Unit connection frame
- G gasket

Fig. 78: Unit connection frame

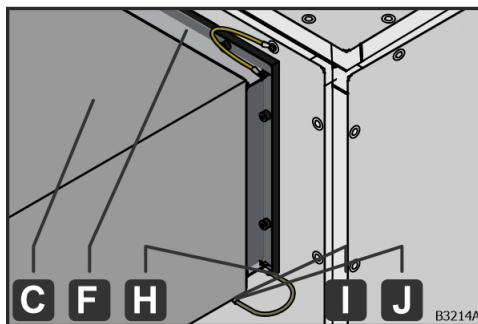


Fig. 79: sound-insulated connection with equipotential bonding conductors

1. Route the pre-assembled equipotential bonding conductor (H) of the unit connection frame (F) to the on-site duct (C).
  2. Secure the equipotential bonding conductor (H) with a toothed lock washer (J) to prevent loosening.
  3. Tighten the screw (I).
- The unit connection frame (F) is connected to the AHU and to the on-site duct (C) via the equipotential bonding conductor (H).

## Air openings down

To connect on-site ducts to downward air openings, it may be necessary to remove grating elements.

### Mounting of the grating after work on air openings downwards

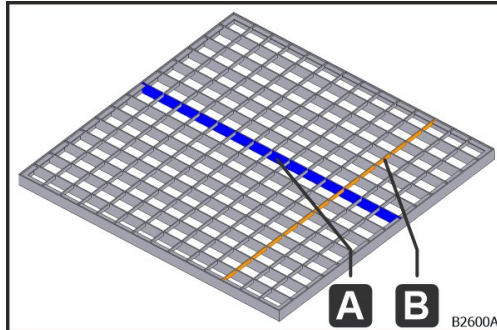


Fig. 80: A - supporting rod; B - cross rod

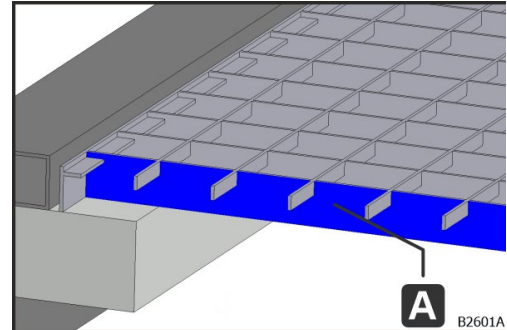


Fig. 81: A – supporting rod

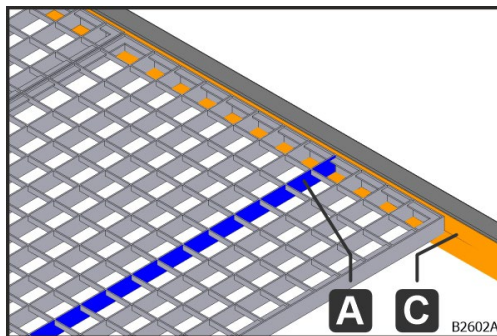


Fig. 82: A - supporting rod; C - support point

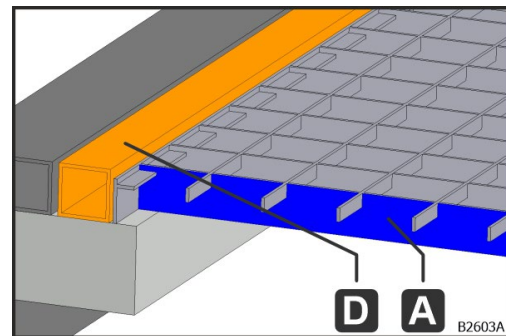


Fig. 83: A - supporting rod ; D - spacer tube

All supporting rods (A) of the individual grating elements must rest on a load-bearing substructure (e.g., support point (C)) at both ends. Spacer tubes (D) prevent the grating element from slipping.

Grating elements are available with the following dimensions:

#### Supporting rod (A) length

[Modules]	L03	L04,5	L06	L07,5	L09
[mm]	178	331	484	627	790

#### Cross rod (B) length

[Modules]	T03 - 60 mm	T06 - 60 mm	L06
[mm]	230	536	612

## Door

After completion of the unit assembly, all doors must be checked for freedom of movement and aligned if necessary. Tightening torques for screws: 3 Nm.

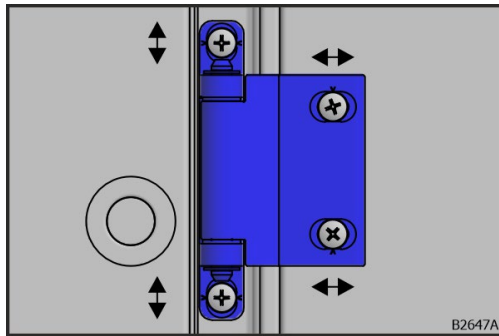


Fig. 84: Hinge of the door

- Align door leaf vertically using the slotted holes in the hinge bracket.
- Align door leaf horizontally using the slotted holes in the hinge bracket.

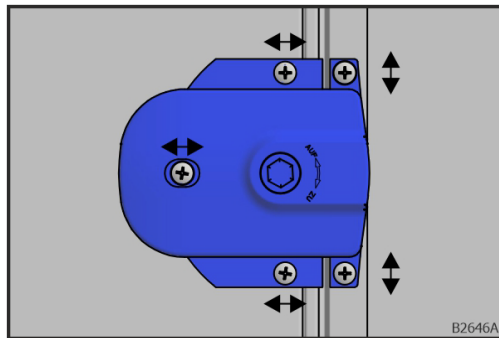


Fig. 85: External lock with key size 10 / double-bit 3

After aligning the door leaf on the hinge side, align the external latch:

- Align the locking cam bracket vertically.
- Align the lock casing horizontally.

## Condensate, drain and overflow lines

Provide all pan drains with a siphon (with backflow protection and self-filling). Dispose of wastewater properly.

### NOTE



#### **Impairment of the function of the AHU due to incorrectly connected lines.**

If the condensate, drain, or overflow lines are connected incorrectly, air and water will be drawn in and blown out through the lines. The function of individual components may be impaired.

- Each pan drain from a drain pan must be connected individually with its own siphon and a free outlet.
- The stand height of the siphon must be designed for the underpressure or overpressure of the AHU.

#### **Malfunction due to dry siphon**



Only a siphon filled with water can perform its function. A siphon may dry out after a long period of inactivity.

- Fill the siphon manually before commissioning.
- Use ball siphons for underpressure or overpressure (intake or discharge side).

## Pressure curve in the AHU

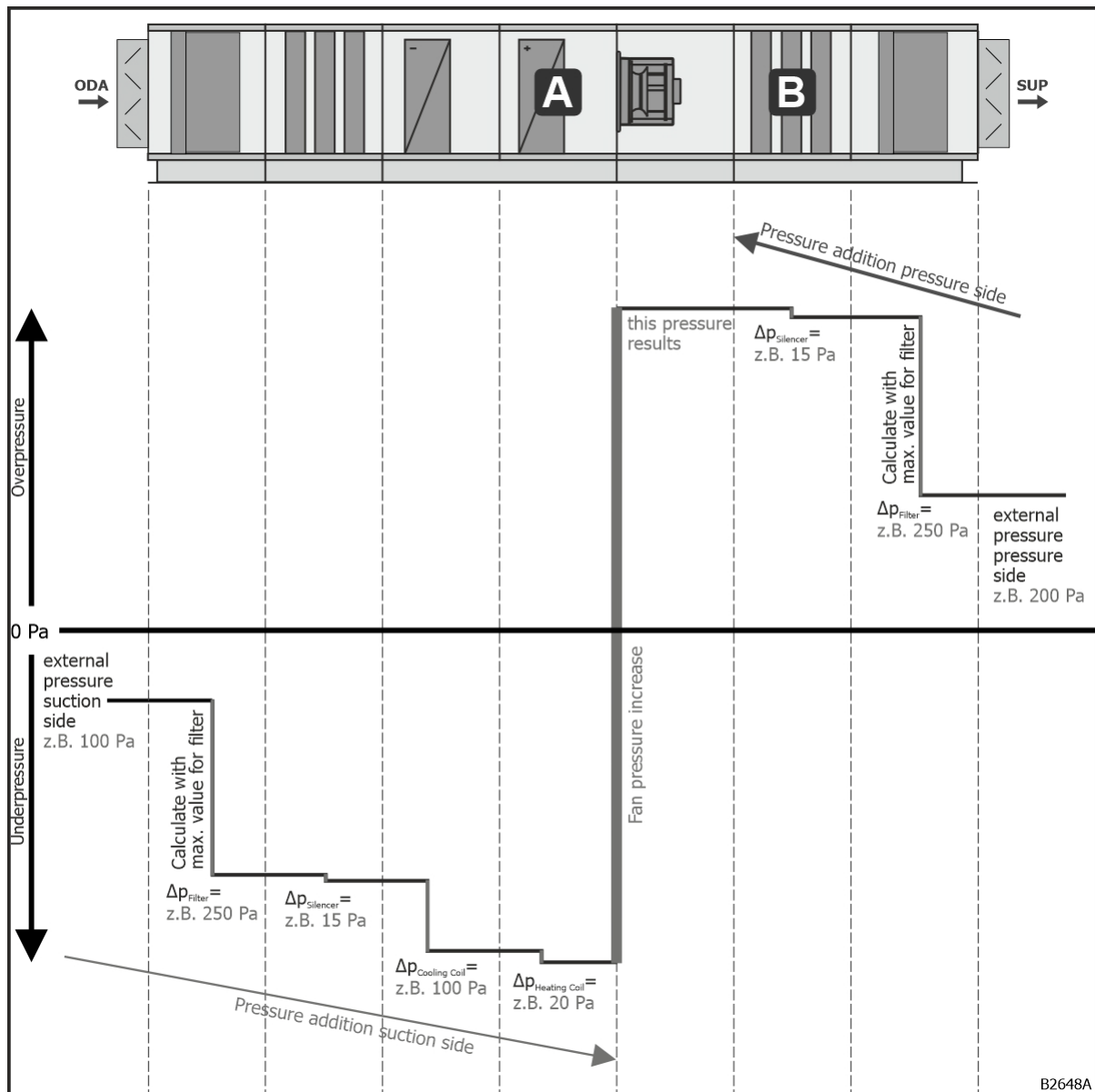


Fig. 86: Pressure curve in the AHU

To calculate the pressure in a component, depending on which part of the AHU the component under consideration is located, you need the following:

- pressure loss of individual components in the AHU (see technical data sheet), and
- the external pressure on the intake side or
- the external pressure on the discharge side.

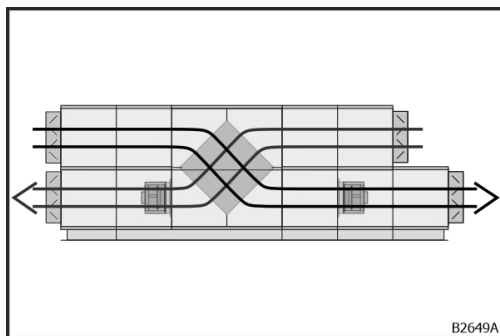


Fig. 87: Airflows in the combine unit

**TIP**

**Plate heat exchanger**



In combine units with plate heat exchangers, the airflows cross. Trace airflow jump when calculating the pressure.

## Underpressure siphon

### Pressure calculation, intake side

Sample calculation for heating coil (A)

This pressure and the associated siphon height apply only to the heating coil (A).

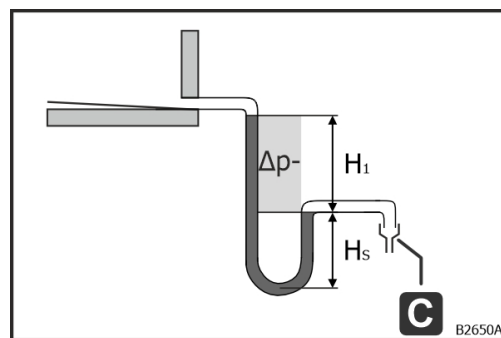
Always use the final pressure loss to calculate the filter pressure loss.

External pressure on the intake side	E.g.:	-100 Pa
Pressure loss	Filter component	E.g.:
		-250 Pa
Pressure loss	Silencer	E.g.:
		-15 Pa
Pressure loss	Cooling coil	E.g.:
		-100 Pa
Pressure loss	Heating coil	E.g.:
		-20 Pa
Total:	$p_1 =$	-485 Pa

Table 1: Pressure calculation for underpressure siphon

This pressure is used to calculate the siphon height for the underpressure siphon (on the intake side) at the heating coil (A).

### Siphon height calculation for the underpressure siphon (on the intake side)



C Free discharge at atmospheric pressure

Fig. 88: Underpressure siphon

This is a sample procedure for calculating siphon height. Use the specific heights of siphon manufacturers (see siphon data sheet).

The siphon height for an underpressure siphon is determined as follows:

$$H_1 [\text{mm}] = p [\text{Pa}] / 10$$

$$H_s [\text{mm}] = p [\text{Pa}] \times 0.075$$

$p [\text{Pa}]$  Maximum internal pressure on the intake side of the respective component

$$H [\text{mm}] = H_1 + H_s$$

(Sample calculation for heating coil (A)  $p_1 = -485 \text{ Pa}$ )

$$H [\text{mm}] = H_1 + H_s = p [\text{Pa}] / 10 + p [\text{Pa}] \times 0.075$$

$$H = 485/10 + 485 \times 0.075 = 85 [\text{mm}]$$



## Overpressure siphon

### Pressure calculation, discharge side

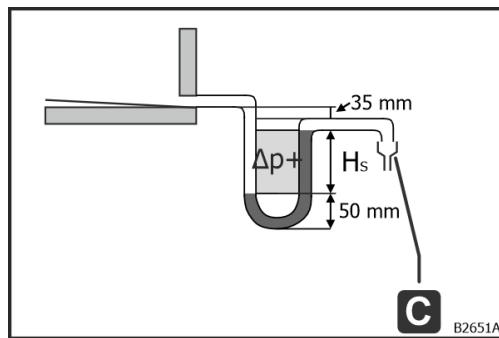
Sample calculation for silencer (B)

This pressure and the associated siphon height apply only to the silencer (B). Always use the final pressure loss to calculate the filter pressure loss.

External pressure on the discharge side	E.g.:	+200 Pa	
Pressure loss	Filter component	E.g.:	+250 Pa
Pressure loss	Silencer	E.g.:	+15 Pa
Total:	p <sub>2</sub> =	+465 Pa	

Table 2: Pressure calculation for overpressure siphon

This pressure is used to calculate the siphon height for the overpressure siphon (on the discharge side) at the silencer (B).



C Free discharge at atmospheric pressure

Fig. 89: Overpressure siphon

This is a sample procedure for calculating siphon height. Use the specific heights of siphon manufacturers (see siphon data sheet).

The siphon height for an overpressure siphon is determined as follows:

$$H_s [\text{mm}] = p [\text{Pa}] / 10$$

$p [\text{Pa}]$  Maximum internal pressure on the discharge side of the respective component

$$H [\text{mm}] = 35 \text{ mm} + H_s + 50 \text{ mm}$$

(Sample calculation for silencer (B)  $p_2 = +465 \text{ Pa}$ )

$$H = 35 + H_s + 50 = 35 + 465/10 + 50 = 131 [\text{mm}]$$

## Connecting several pan drains

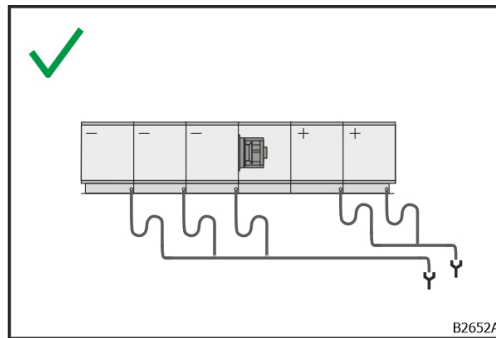


Fig. 90: Connecting several pan drains

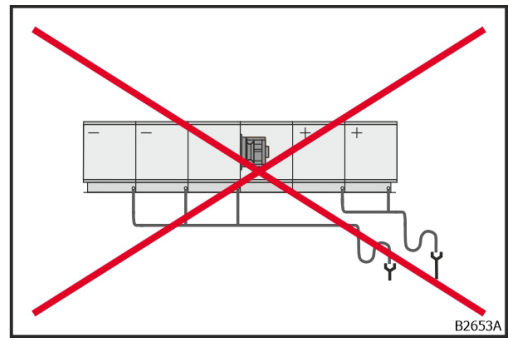


Fig. 91: Wrong connection

When connecting several pan drains, a single siphon must be connected to each pan drain. The drains can be combined downstream of the siphon. Only siphons on the discharge side or on the intake side may be connected. The combination must end in a free outlet.

## Connection of the drain and overflow lines on the circulating water spray humidifier (low pressure)

Connect the drain line of the circulating water spray humidifier (low pressure) and the pan drain of the pre-assembled pan separately to the waste water system. Do not empty the humidifier pan into the pre-assembled pan.

## Weatherproof unit

Seal openings (e.g., unit connection, control cabinet) or equip them with a weather protection device to prevent water from entering the AHU.

### Roof sealing

The roofs of the weatherproof units are covered with roofing membranes. If weatherproof units are supplied in individual sections, the separation points must be sealed in accordance with the workflow described below.

The following installation material is included in the delivery:

- Roofing membrane stripes (PVC, fibre-reinforced)
- Solvent-welding agent for roofing membrane (can)
- Sealing paste for roofing membrane (plastic flask)
- Drip edge overlapping parts
- Connecting screws (window screw JD-22 3.9 x 16 mm, with drill tip, pan-head H, galvanised)
- Depending on the casing construction:
  - Plug (grey) and plug (white)
  - Plug (grey)

The following equipment is required:

- Flat brush or similar for applying the solvent-welding agent for roofing membrane
- Sand bag or similar to weigh down
- hot air blower or similar for drying and heating
- Cloth or similar for cleaning

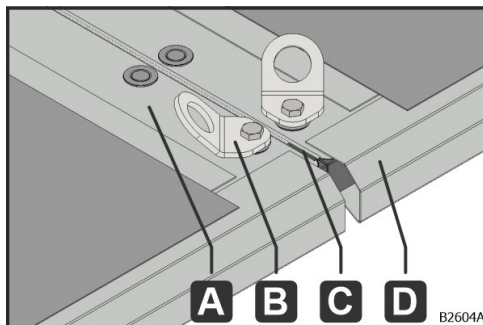


Fig. 92: Separation point before

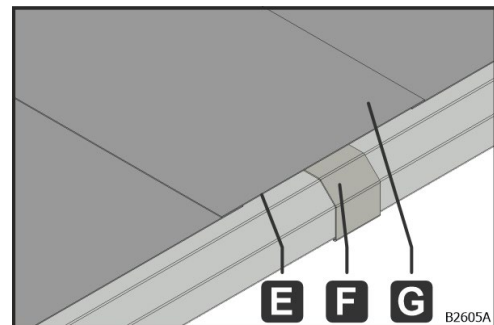


Fig. 93: Separation point after

A – panel; B – transport lug; C – separation point; D – drip edge; E – joint edge;  
F – drip edge overlapping part; G – roofing membrane stripes

**CAUTION****Risk of poisoning and fire from hazardous substances**

There is a risk of poisoning and fire during roof sealing. Solvent-welding agent (Rhenofol solvent-welding agent (TFH) – tetrahydrofuran) and sealing paste (Rhenofol paste) are highly volatile and flammable. Combined with air, vapours can produce an explosive mixture. Vapours are heavier than air and spread along the ground. Ignition is possible over long distances. Thermal decomposition can produce harmful gases and vapours and create explosive peroxides.

- Observe the safety instructions on the containers.
- Make sure the work area is well ventilated.
- Keep away from sources of ignition. No smoking.
- Take measures to prevent electrostatic charges.
- Only store in the original container. Keep the container tightly closed and store in a cool, well-ventilated location. Protect against direct sunlight.
- Avoid contact with skin, eyes and clothing.
- Avoid inhaling gas.
- Wear personal protective equipment (tight-fitting safety goggles with side protection, self-contained respiratory protection (filter type A-P2); chemical protective gloves (suitable material: butyl rubber; thickness of the glove material:  $\geq 0.7$  mm) and protective clothing).
- Do not allow to enter the waste water system or waters.
- Observe the manufacturer's safety data sheet.

Use up opened containers within 24 hours.

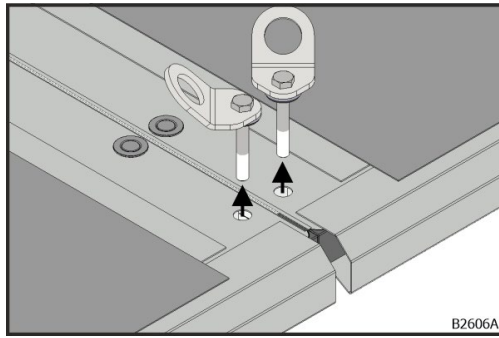
**Work steps at the separation point**

Fig. 94: Disassemble transport lugs

1. Dismantle transport lugs (B) and screws.

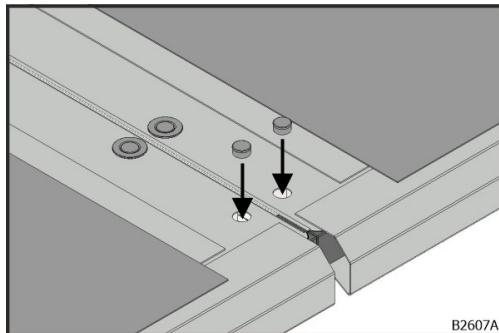


Fig. 95: Sealing holes

2. Close holes from above with plugs (gray) or plugs (gray), depending on casing construction.
3. Close holes from below with plugs (white), depending on casing construction.



Fig. 96: Cleaning

Roofing membranes and drip edges (D) next to the separation point (C) must be clean.

4. Clean soiled roofing membranes and drip edges (D) using a damp cloth.

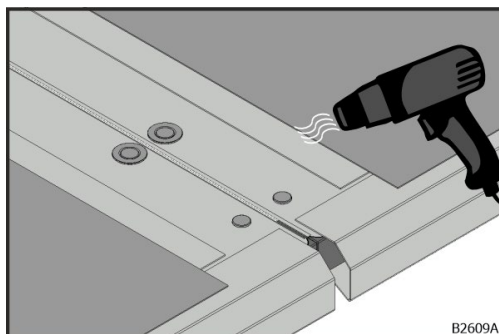


Fig. 97: Drying

Roofing membranes next to the separation point (C) must be dry.

5. Dry wet roofing membranes and drip edges (D) using hot air.

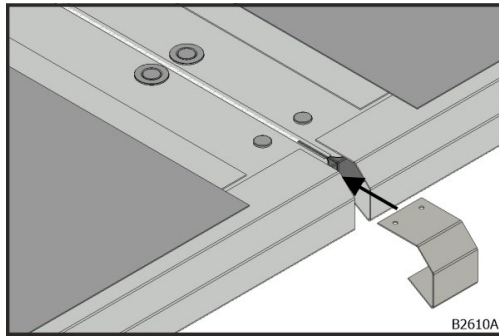


Fig. 98: Fitting drip edge overlapping part

6. Fit drip edge overlapping parts (F) over the drip edge (D) at the separation point (C).

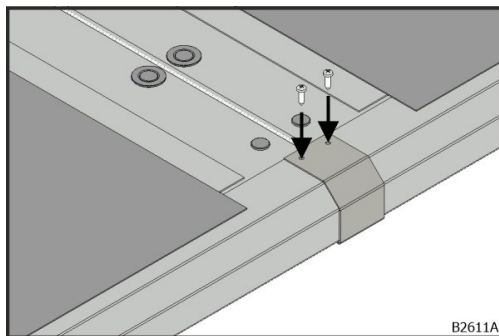


Fig. 99: Mounting drip edge overlapping part

7. Fasten drip edge overlapping parts (F) with the supplied connecting screws (window screw JD-22 3.9 x 16 mm, with drill point, binding head H, galvanized).

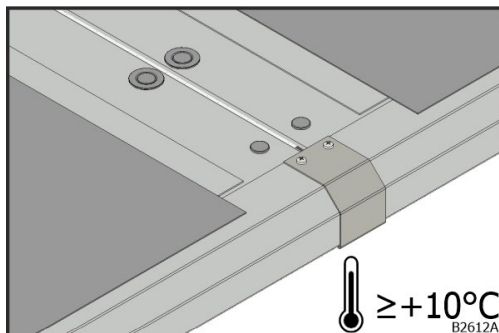


Fig. 100: Installation temperature

Installation temperature must be at least +10 °C.

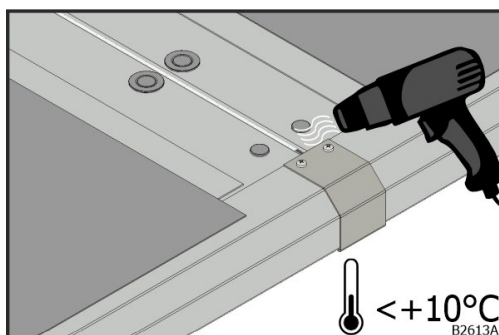


Fig. 101: Preheating

8. At temperatures below +10 °C, roofing membranes next to the separation point (C) and roofing membrane stripes (G) must be preheated with hot air.

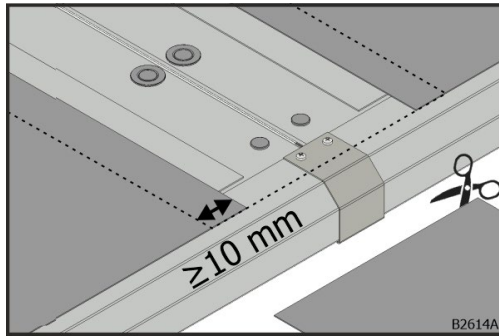


Fig. 102: Cutting roofing membrane stripes to size

9. Cut roofing membrane stripes (G) to size so that they overlap the already laid roofing membrane by at least 10 mm.

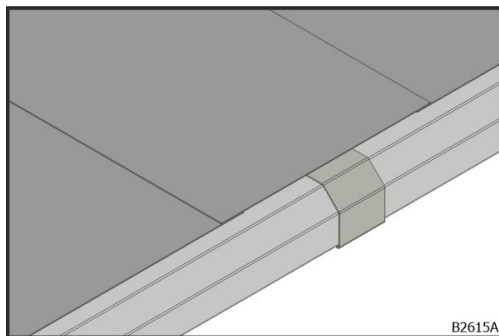


Fig. 103: Applying roofing membrane stripes

10. Apply roofing membrane strip (G).

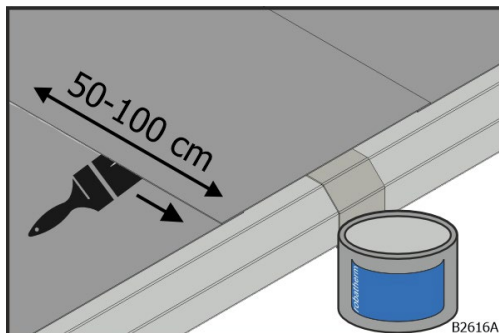


Fig. 104: Apply solvent-welding agent in sections

11. Apply solvent-welding agent with a flat brush between the roofing membrane strip (G) and the already laid roofing membrane as follows:

- In short sections of approx. 50 to 100 cm in length in the direction of laying
- Approx. 5 to 10 cm wide at drip edges (D) and drip edge overlap pieces (F) over the complete support point of the roofing membrane strip (G)

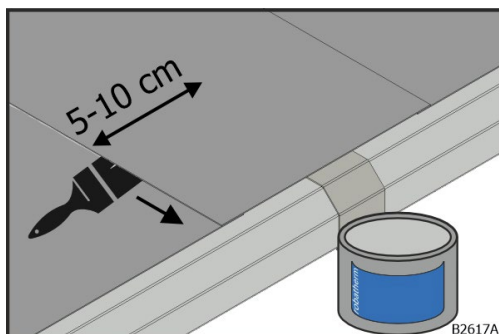


Fig. 105: Applying solvent-welding agent

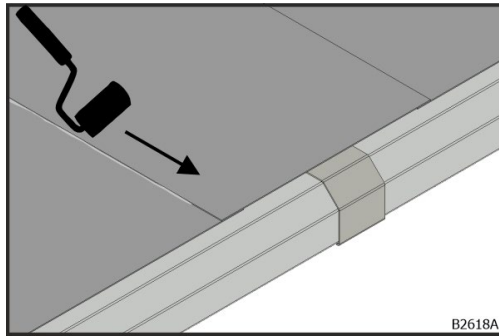


Fig. 106: Pressing

12. Press on roofing membrane strip (G) with a roller or the palm of your hand.

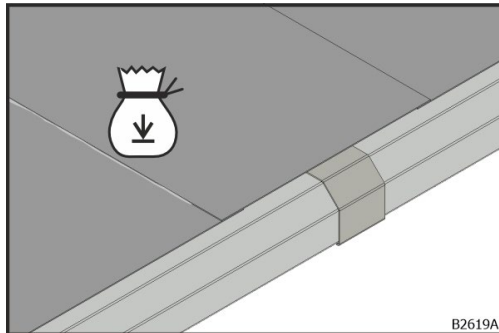


Fig. 107: Weighing down

13. Weigh down the roofing membrane strip (G) with a sand bag.

Repeat work steps 11 to 13 for the next section of the roofing membrane strip (G) of 50 to 100 cm in length.

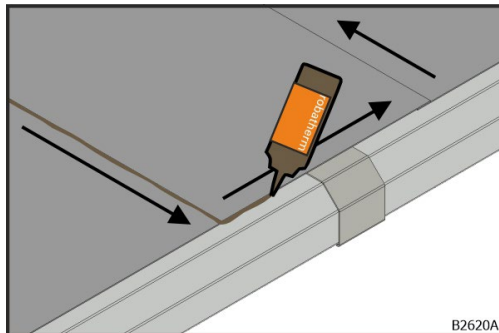


Fig. 108: Sealing paste

14. Press a thin strand of the sealing paste of the roofing membrane steadily into the joint edge.  
Sealing paste of the roofing membrane dries quickly to a dense film.

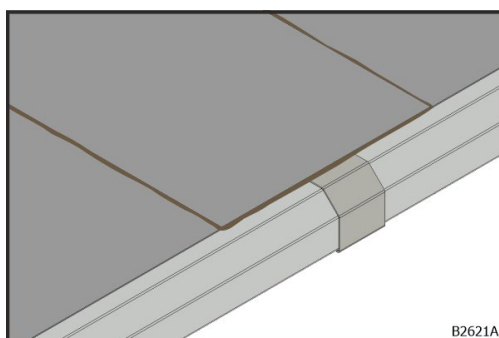


Fig. 109: Roof sealing at the separation point

- Roofing is closed at the separation point (C).



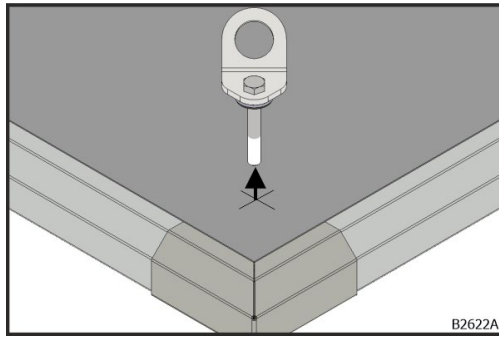
**Work steps at the corners**

Fig. 110: Disassembling transport lug

1. Dismantle transport lugs (B) and screws.

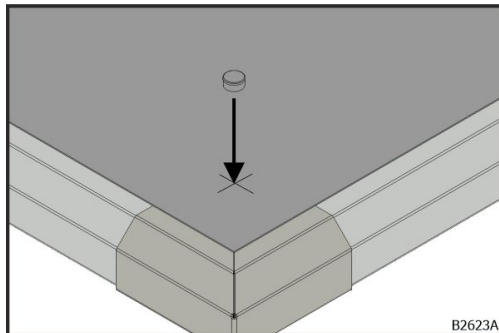


Fig. 111: Close hole

2. Close holes from above with plugs (gray) or plugs (gray), depending on casing construction.
3. Close holes from below with plugs (white), depending on casing construction.

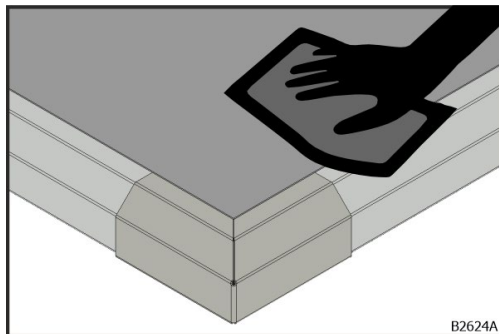


Fig. 112: Cleaning

Roofing membranes must be clean.

4. Clean soiled roofing membranes with a damp cloth.

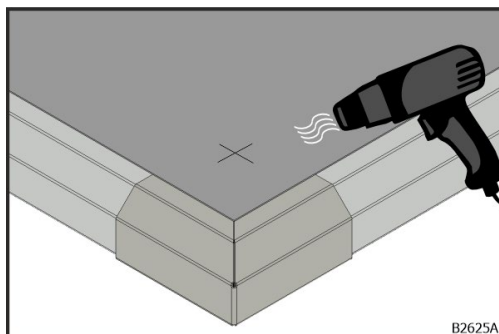
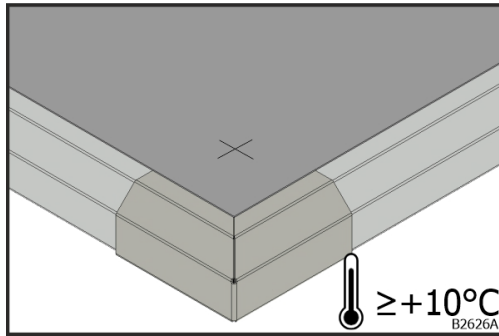


Fig. 113: Drying

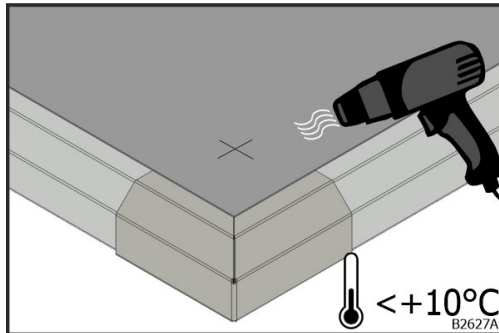
Roofing membranes must be dry.

5. Dry wet roofing membranes with hot air.



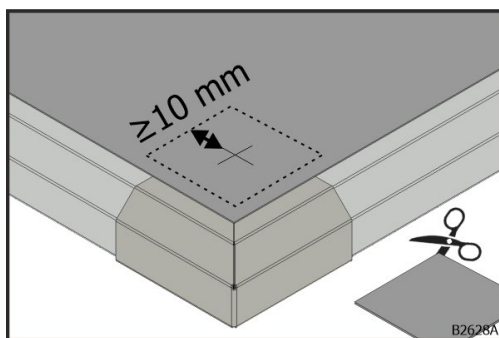
Installation temperature must be at least +10 °C.

Fig. 114: Installation temperature



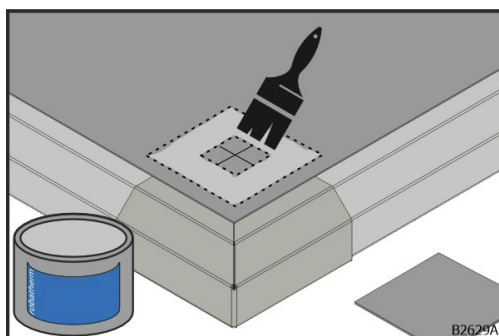
6. At temperatures below +10 °C, roofing membranes at the corner and roofing membrane stripes (G) must be preheated with hot air.

Fig. 115: Preheating



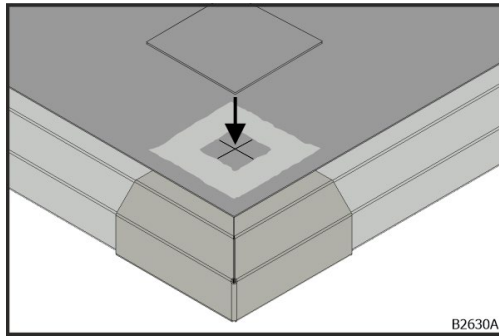
7. Cut roofing membrane stripes (G) to size so that they overlap the already laid roofing membrane by at least 10 mm.

Fig. 116: Cutting roofing membrane stripes to size



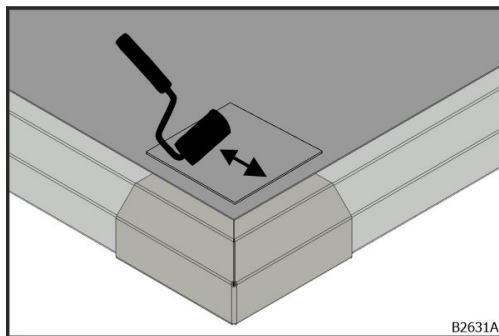
8. Apply solvent-welding agent with a flat brush in the area of the hole the size of the cutting on the already laid roofing membrane.

Fig. 117: Applying solvent-welding agent



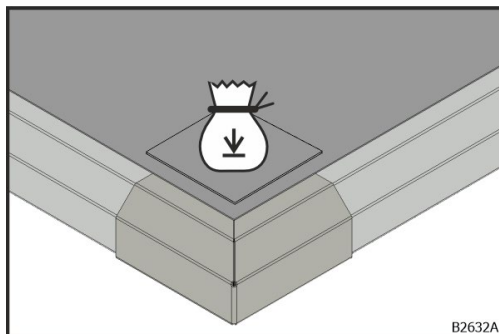
9. Apply roofing membrane strip (G).

Fig. 118: Applying roofing membrane stripes



- Press on roofing membrane strip (G) with a roller or the palm of your hand.

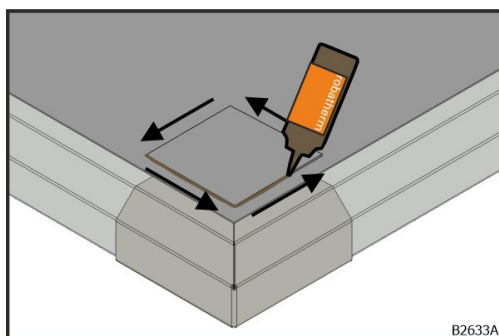
Fig. 119: Pressing



10. Weigh down the roofing membrane strip (G) with a sand bag.

Prolonged application of load on the installed roofing membrane strips (G) is unnecessary.

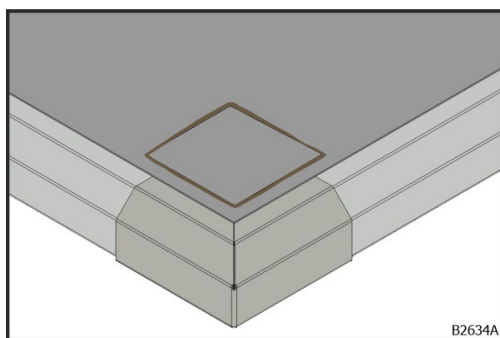
Fig. 120: Weighing down



11. Press a thin strand of the sealing paste of the roofing membrane steadily into the joint edge.

Sealing paste of the roofing membrane dries quickly to a dense film.

Fig. 121: Sealing paste



→ Roofing is closed at the corner.

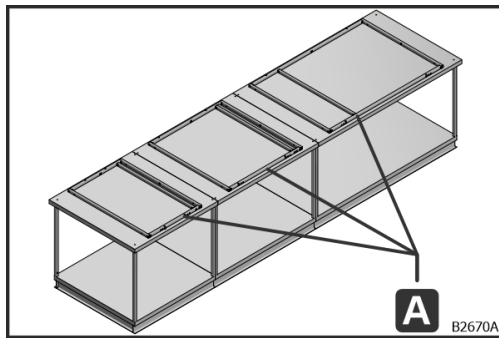
Fig. 122: Roof sealing at the corner

## Connection of weatherproof devices with roof rack frame

### Requirements

Requirements:

- Lower AHU anchored to the foundation (see chapter "Foundation", page 17).
- Transport lugs removed.
- Roof sealed at the separation points and corners (see chapter "Roof sealing", page 55).



A – main frame

Fig. 123: Mounted lower AHU with main frame

The following install material is included in the delivery:

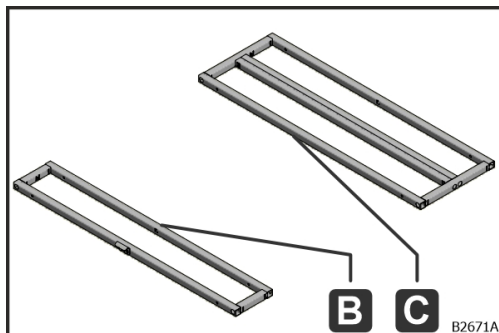


Fig. 124: Additional frame

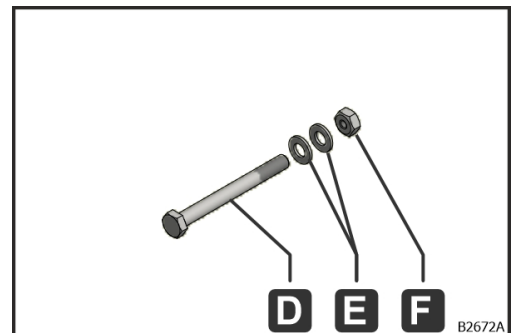


Fig. 125: Install material

B - additional frame beginning/end (204 mm); C - additional frame middle (408 mm);  
D - hexagonal screw M8x8 DIN 931 galvanized steel; E - washer form A; d1=8,4;  
d2=16 DIN 125 galvanized steel; F - hexagon nut M8 DIN 934 galvanized steel

Additional frames are delivered on a pallet or are clamped between the main frames.

## Mounting additional frames

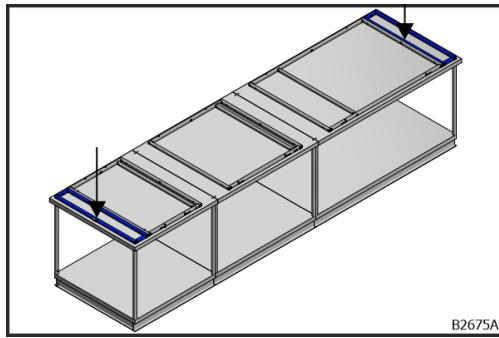


Fig. 126: Placing additional frame

1. Place the beginning/end (B) of the additional frame on the beginning/end of the AHU according to the technical drawing so that the roof rack bracket is on the outer tube.

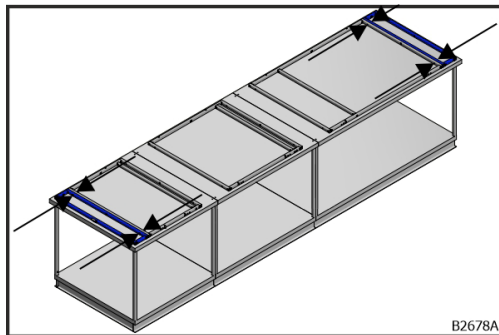


Fig. 127: Joining additional frame

2. Connect the main frame and the additional frame with hexagonal screw (D), washer (E) and hexagon nut (F).

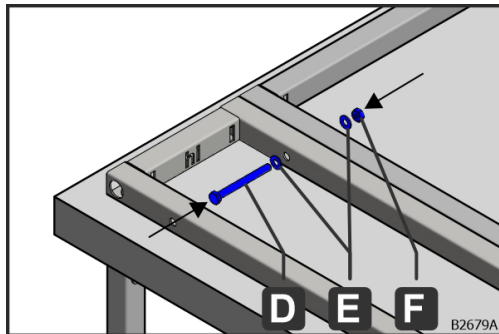


Fig. 128: Detail of the additional frame screw fitting

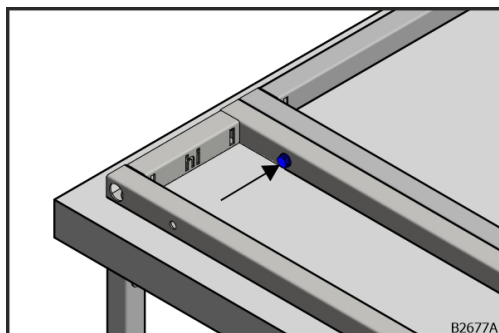


Fig. 129: Mounted additional frame

Start/end (B) of the additional frame is mounted correctly.

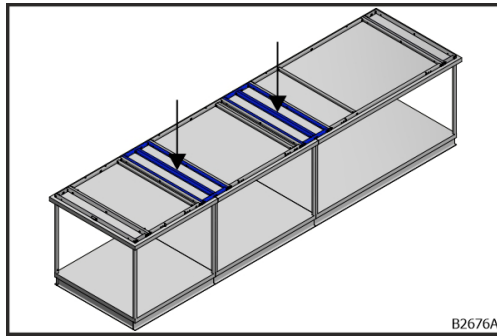


Fig. 130: Placing additional frame

3. Place the center (C) of the additional frame between two main frames (A) according to the technical drawing.

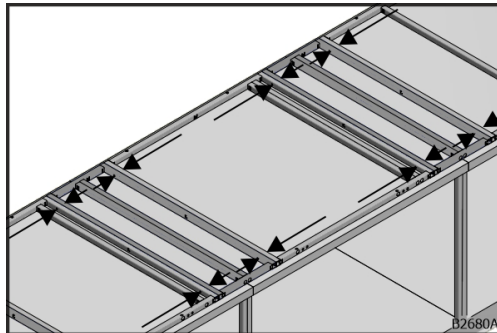


Fig. 131: Joining additional frame

4. Connect the main frame and the additional frame with hexagonal screw (D), washer (E) and hexagon nut (F).

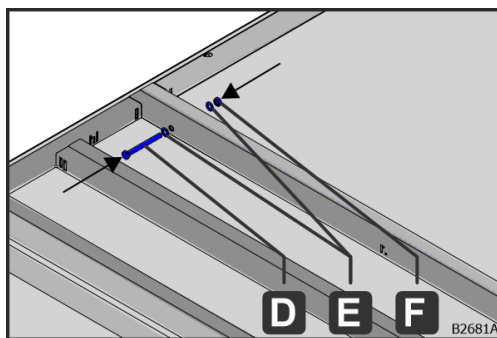


Fig. 132: Detail of the additional frame screw fitting

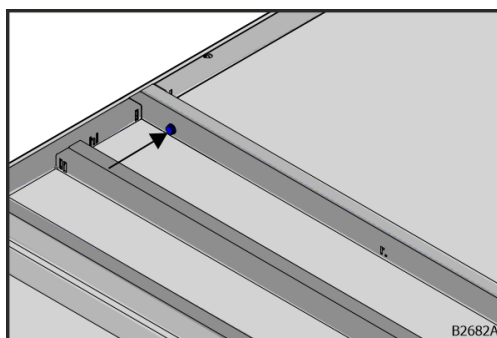


Fig. 133: Mounted additional frame

- ➔ Additional frame in the center (C) is mounted correctly.

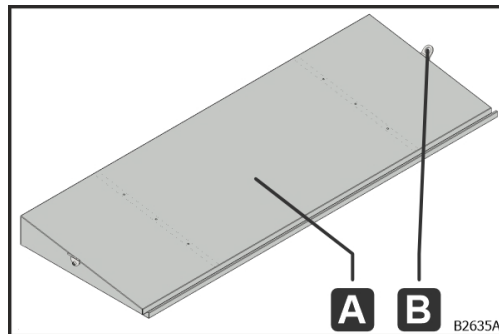
Mount upper AHU (see chapter "Connection of AHUs with roof rack frame", page 42).

## Protection roof

Weatherproof devices can be equipped with protection roofs.

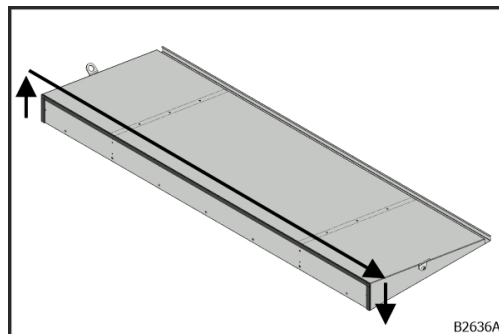
The following install material is included in the delivery:

- Protection roof with mounted transport lugs
- Foam tape, 20x4 mm, PE foam, anthracite
- Self drilling screw with lens head DIN 7504, 6.3x80 mm, Torx, galvanized steel
- Plug 13.0x11.0x5.0 PE RAL 9010/pure white

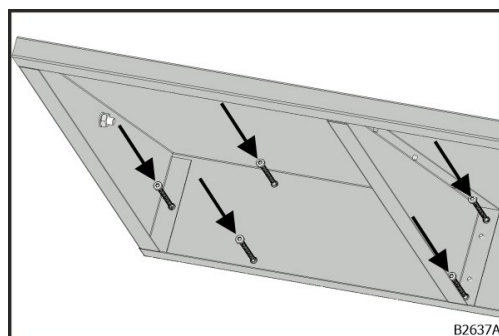


- A protection roof  
B transport lug

Fig. 134: Scope of delivery, protection roof



1. Cover protection roof sides and top with foam tape, 20x4 mm, PE foam, anthracite.



2. Insert the supplied self drilling screw with lens head DIN 7504, 6.3x80 mm, Torx, galvanized steel.

Fig. 136: Insert screws first



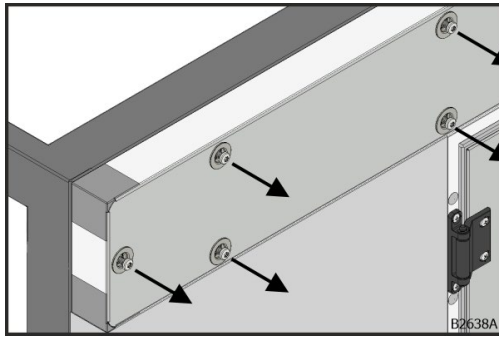


Fig. 137: Removing screws

3. Remove all screws from the corresponding panel.

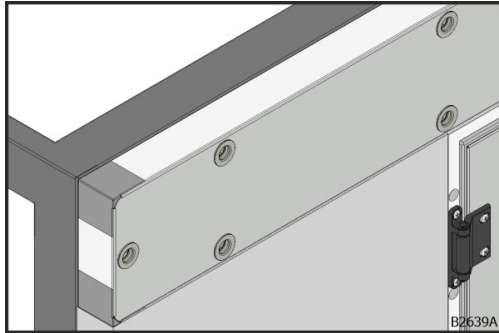


Fig. 138: Screws have been removed

→ Screws have been removed.

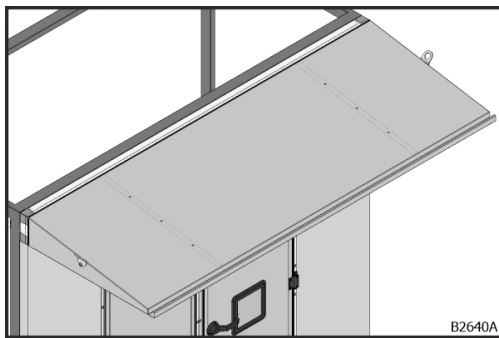


Fig. 139: Alignment

4. Align the protection roof to the panel.

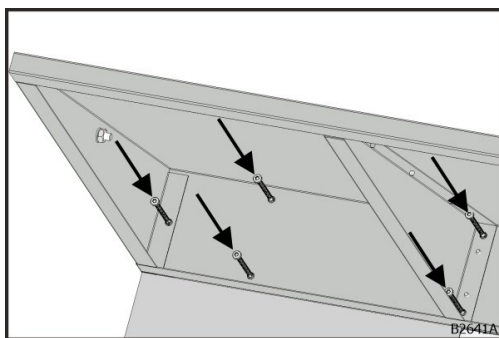
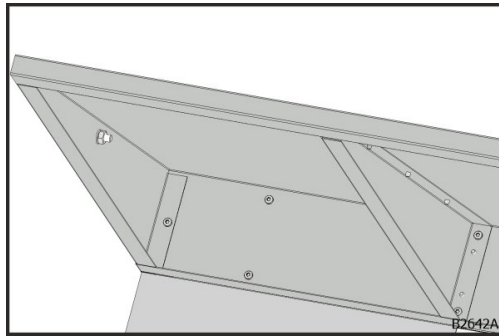


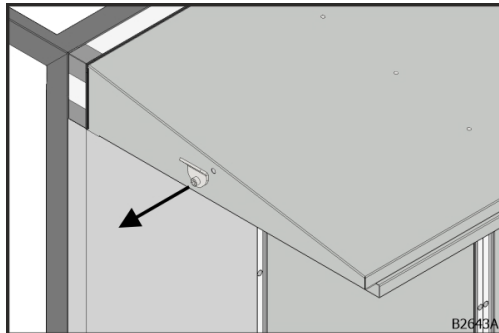
Fig. 140: Fit screws

5. Use bit extension to mount protection roof with pre-inserted self drilling screw with lens head DIN 7504, 6.3x80 mm, Torx, galvanized steel.



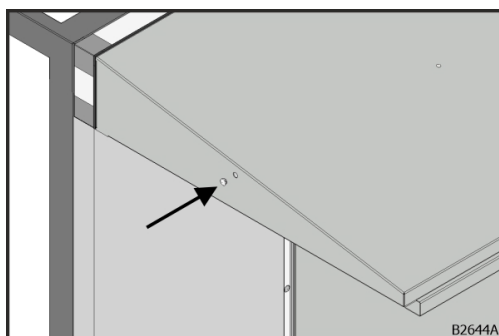
→ Self drilling screw with lens head DIN 7504, 6.3x80 mm, Torx, galvanized steel, mounted.

Fig. 141: Screws fitted



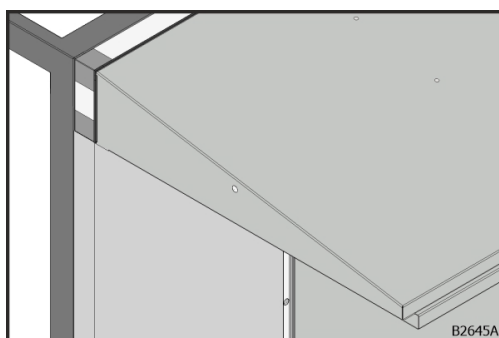
6. Disassemble transport lugs.

Fig. 142: Remove transport lugs



7. Seal holes with plugs 13.0x11.0x5.0 PE RAL 9010/pure white.

Fig. 143: Sealing holes



→ The protection roof is mounted.

Fig. 144: The protection roof is mounted

# Filter component

## Filter installation

The following installation material is included in the delivery:

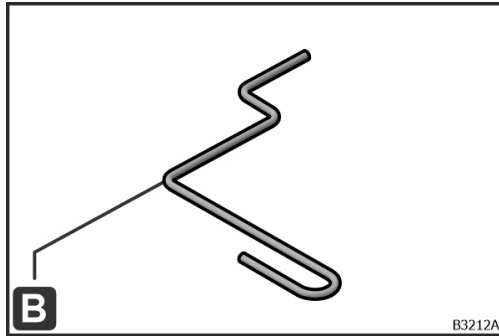


Fig. 145: installation material for filter installation

B – filter fastening spring

1. Fasten the filter in the filter mounting frame with 4 filter clamps (B) each or hand-tighten the bayonet catch.
2. Do not clamp or damage the filter.
3. Check that the filter is fitted airtight in the filter mounting frame.

## HEPA filter installation according to EN 1822

The preassembled filter component for HEPA filters according to EN 1822 consists of the following components:

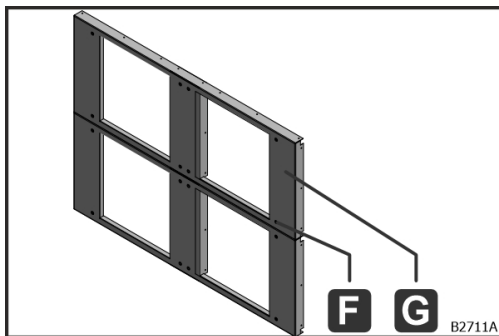


Fig. 146: F - rivet nut M8, hexagonal, V2A; G - filter wall

If robatherm AHUs are equipped with HEPA filters according to EN 1822, the following install material is included in the delivery:

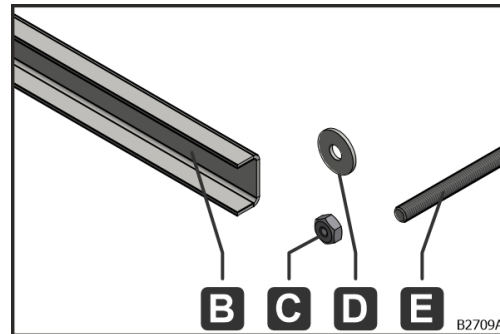
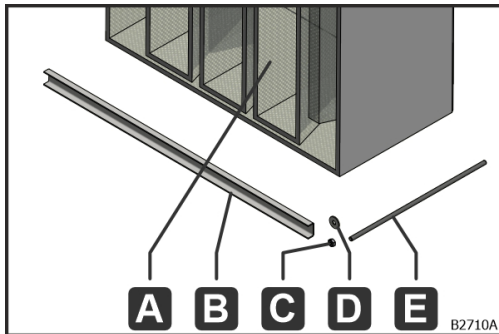


Fig. 147: Install material

A - filter; B - clamping profile; C - hexagon nut DIN 934 (EN-ISO 4032) M8 V2A; D - washer A2, DIN 9021 (EN-ISO 7093), d1=8.4mm, d2=24.0mm; E - threaded rod DIN 976, M 8 x 350 mm, grade:1.4301

### General procedure

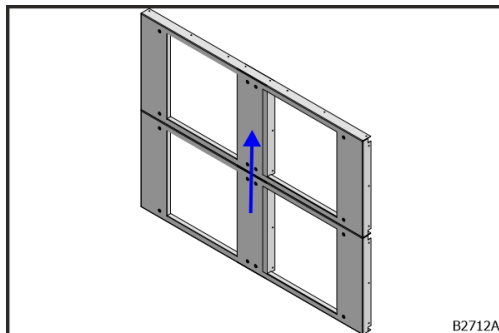


Fig. 148: Assembly sequence

- Start with the bottom row. Work from the bottom up.

### HEPA filter installation work steps according to EN 1822

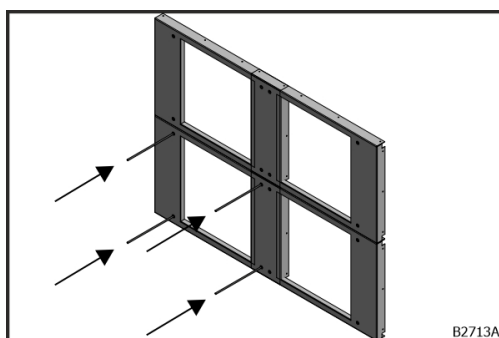


Fig. 149: Mounting threaded bolts

1. Screw 4 x threaded rods (E) into rivet nut (F) 8-10 mm deep.

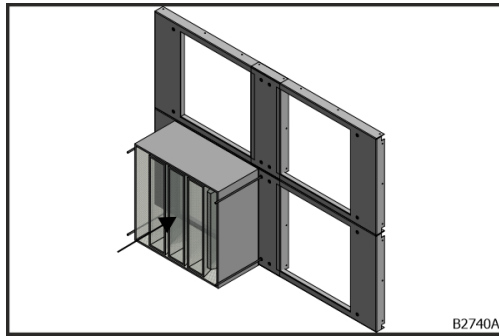


Fig. 150: Placing the filter

2. Place the filter (A) between the threaded bolts (E).

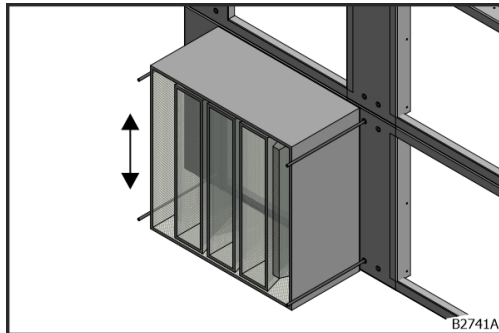


Fig. 151: Aligning the filter

3. Align the filter (A) so that the lower edge of the filter ends 1 mm above the lower edge of the filter wall (G).

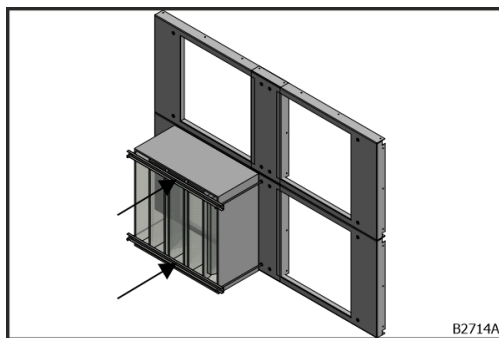


Fig. 152: Sliding clamping profiles on

4. Slide 2 x clamping profiles (B) onto threaded rods (E).

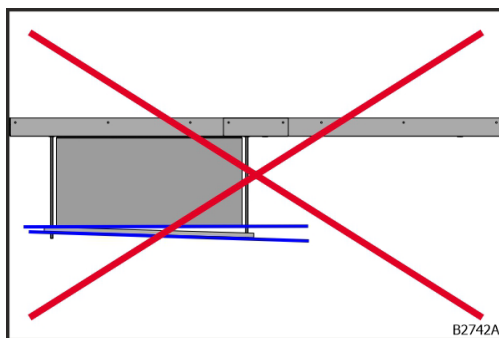


Fig. 153: Incorrect orientation of clamping profiles

5. Align the clamping profiles (B) parallel to the filter wall (G).

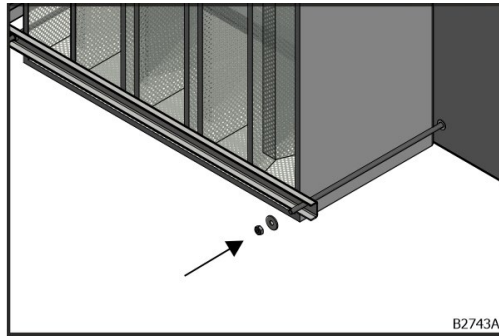


Fig. 154: Screw on washer and nut

6. Screw 4 x washer (D) and 4 x nut (C) evenly onto threaded rods (E).

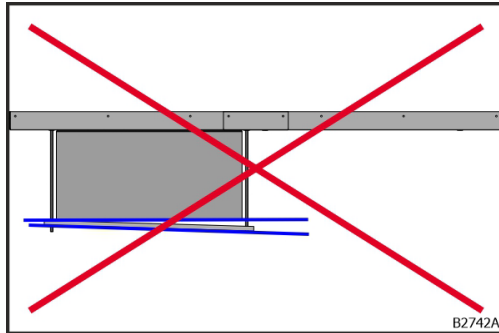


Fig. 155: Incorrect orientation of clamping profiles

7. Align the clamping profiles (B) parallel to the filter wall (G).

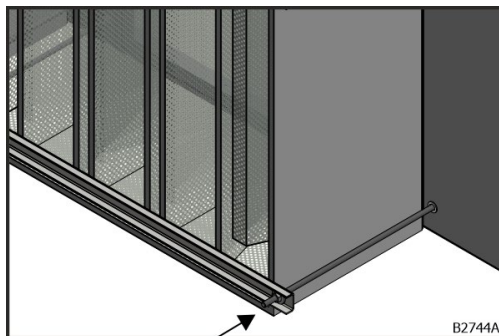


Fig. 156: Tightening torque 2 Nm

8. Fasten nuts (C) with a tightening torque of 2 Nm.

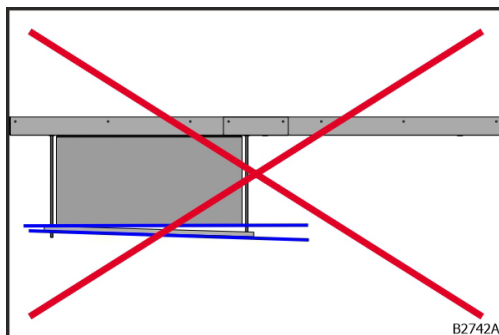
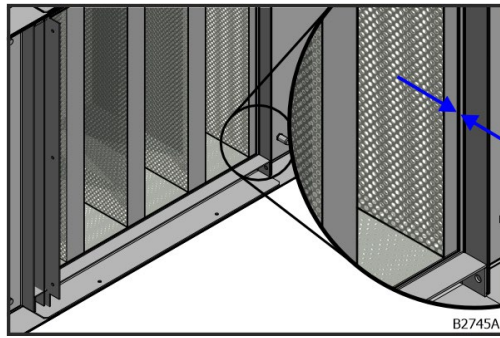


Fig. 157: Incorrect orientation of clamping profiles

9. Align the clamping profiles (B) parallel to the filter wall (G).



10. Check correct assembly: The distance between the filter and the filter wall is  $2 \pm 0.5$  mm.

Fig. 158: Mounted filter

Carry out work steps 1 - 10 for the next filter until all filters have been mounted.

## Filter monitoring

To check the degree of contamination of filters (except for activated carbon filters), it is recommended to install a differential pressure measuring device on the operating side of the AHU.

### Final pressure loss

#### Recommended final pressure loss for ISO 16890 filters

Filter class	Recommended final pressure loss (lower value)
ISO coarse	50 Pa + initial pressure loss or 3 x initial pressure loss
ISO ePM1, ISO ePM2.5, ISO ePM10	100 Pa + initial pressure loss or 3 x initial pressure loss

Table 3: Final pressure loss for ISO 16890 filters

### Final pressure loss

#### Recommended final pressure loss for ISO 16890 filters

Filter class	Recommended final pressure loss (lower value)
ISO class	50 Pa + initial pressure loss or 3x initial pressure loss
ISO ePM1, ISO ePM2.5, ISO ePM10	100 Pa + initial pressure loss or 3x initial pressure loss

Table 4: Final pressure loss for ISO 16890 filters

#### Recommended final pressure loss for EN 779 filters

Filter class	Recommended final pressure loss
G1 - G4	150 Pa
M5 - M6, F7	200 Pa
F8 - F9	300 Pa
E10 - E12, H13	500 Pa

Table 5: Final pressure loss for EN 779 filters



# Fan

## WARNING



### **Risk of injury due to impeller rotation despite the fan being switched off**

Risk of injury due to impeller rotation as a result of air movement caused by thermal conditions despite of the fan being switched off.

- Avoid backflows from the building (e.g., by closing the dampers).

## Motor removal device with lift out device

If a motor removal device with lift out device is available, the attachments, which are only fitted on site during use, must be removed before unit assembly (see "Maintenance and cleaning" operating instructions, "Motor removal device with lift out device" section).

### Bearing

The following storage conditions must be observed for the motor removal device:

- Do not store outdoors.
- Store in a dry and dust-free environment.
- Do not expose to aggressive media.
- Observe a storage temperature of -20 °C to +40 °C.

## Transport lock

### NOTE

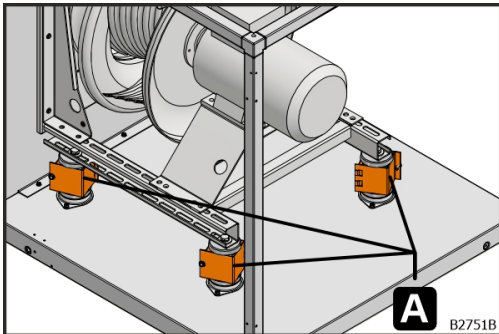


#### Damage to vibration dampers due to tensile stresses

Vibration dampers may get damaged if they are subjected to tensile stress.

- Do not apply tension to the vibration dampers when removing the transport lock.
- Perform the "Remove transport lock" steps (see chapter "Removing transport lock", page 79).

Vibration dampers are secured for transport.



A – transport lock

Fig. 159: Transport lock

## Removing transport lock

Requirements:

- The sections are set up and connected (see chapter "Casing connection", page 25)

Remove transport locks as follows:

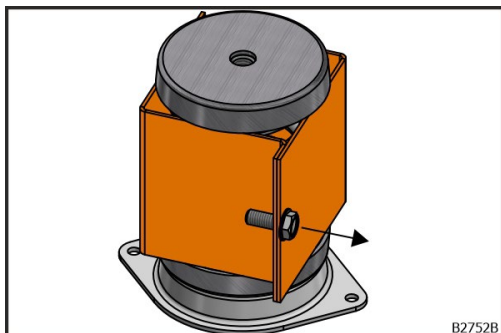


Fig. 160: Removing screws

1. Remove hexagonal screw.

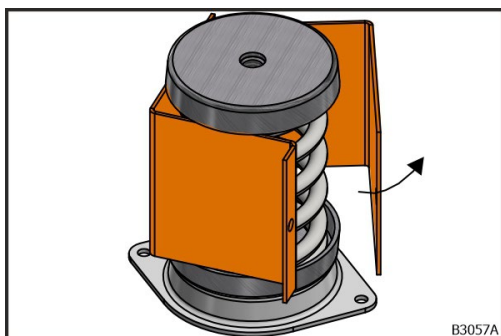


Fig. 161: Unfold transport lock

2. Fold up the two-piece transport lock.

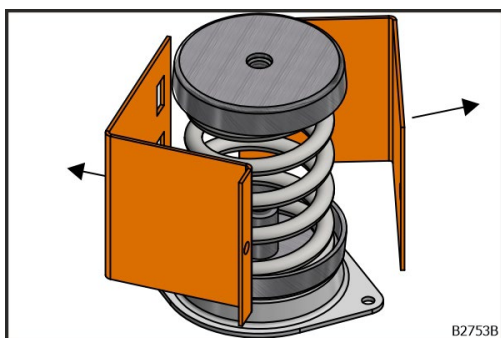


Fig. 162: Removing transport lock

3. Remove the two-piece transport lock.

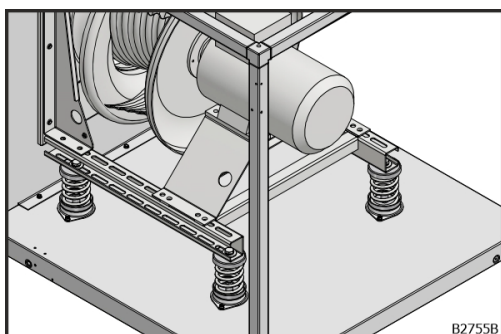
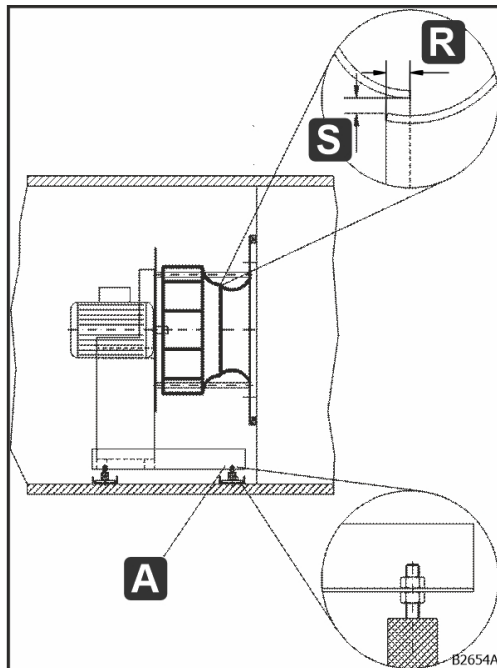


Fig. 163: Fan without transport lock

- Transport locks have been removed.

## Plug fan

Check bushings and hubs for friction-locked connection (see manufacturer's instructions).



A clearance

R gap cover

S Setting/locknut

Transport can change the circumferential gap between the impeller and the inlet nozzle. Measure the clearance (S). The gap must be present around the entire circumference and must be the same distance apart. If necessary, correct the gap on the vibration damper using the lock nut and the adjusting nut (A).

The gap overlap (R) must be approx. 1 % of the impeller diameter.

In the case of plug fan installation with flexible connections, this test is not required.

Fig. 164: Plug fan

# Heat recovery systems (HRS)

## Rotary heat exchanger

In the case of rotor casings supplied in two parts, the rotor casing must be bolted together in accordance with the rotary heat exchanger manufacturer's specifications before the accumulation mass is installed. For this purpose, it is necessary to lower the upper rotary heat exchanger case accordingly.

### Rotor assembly

If the rotor assembly is done by the customer, the connection between the rotary heat exchanger and the casing must be sealed properly (e.g., with permanently elastic joint sealant).

### Sealing strips

Check sealing strips for compression. They must be pushed as close as possible to the accumulation mass, avoiding direct grinding even under operating pressure conditions.

### Bearing

Generally, the bearing of the rotary heat exchanger is aligned in the factory. It may need to be adjusted. Follow the manufacturer's operating instructions.

### Drive

1. Open the inspection hatch at the marked rotary heat exchanger corner.
2. Check whether V-belt is sufficiently tensioned by the tensioning device. If necessary, shorten the V-belt as follows:
3. Open the joint lock.
4. Shorten endless V-belts accordingly.
5. Close the joint lock.
6. Close the inspection hatch.

## Run around coil

### Connecting run around coils

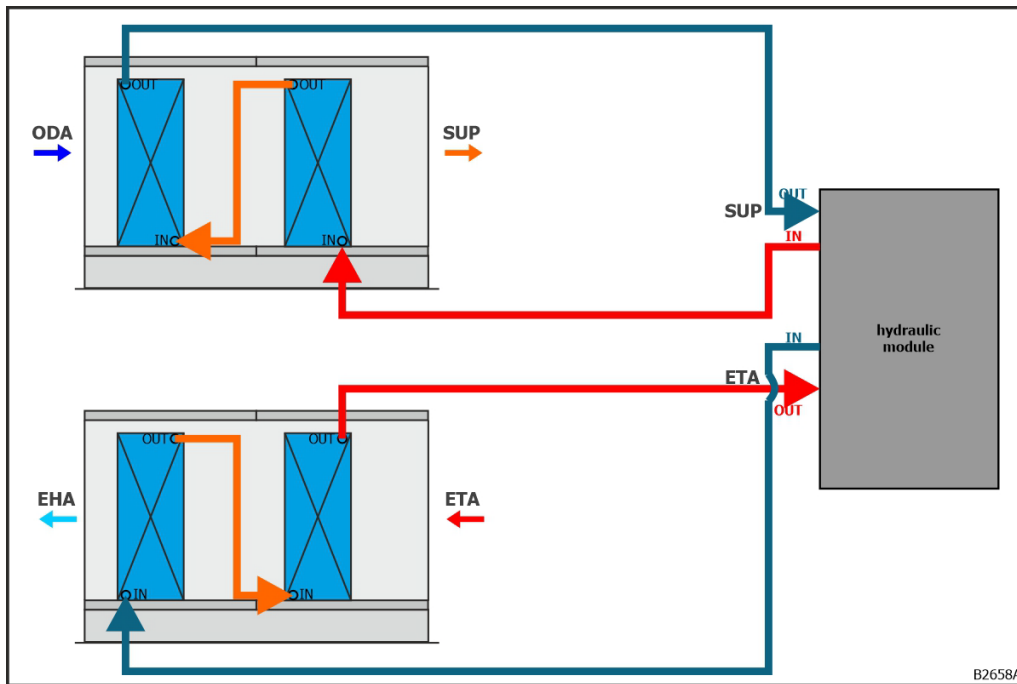


Fig. 165: The coils are to be connected according to the counterflow principle.

Information on connecting coils see chapter "Coil connection", page 84. Information on the hydraulic set see chapter "Hydraulic set", page 107.

Pipes with a risk of condensation must be fitted with diffusion-tight insulation on site.

# Heating coil, cooling coil, and electric heater

## Heating coil

To prevent the heating coil from freezing: Add frost protection agent or install air or water/condensate side frost protection monitoring depending on system design.

The hydraulic set must be filled with the coil medium specified in the technical data sheet in the appropriate concentration. Water quality according to VDI 2035. Too high glycol ratio causes reduced performance, too low glycol content can predispose to frost damage.

The filling process of the hydraulic set can be performed together with the filling of the piping system. Check connection points for leaks while filling is still in progress; retighten screw connections and packing glands if necessary.

## Steam heater

### NOTE



#### Heat damage to the AHU due to steam heater

Overheating of the steam heater causes heat damage to the AHU.

- Operate the steam heater only when the fan is running.
- Provide airflow monitoring or temperature limiters.

In the case of hydraulic sets for steam heaters, the unobstructed drainage of condensate must also be checked (all condensate shut-off valves must be open).

## Cooling coil

To prevent the cooling coil from freezing: Add frost protection agent or consider installing a preheater at the air inlet of the cooling coil.

In the case of an HE-RAC with dehumidification with run around coil: Preheating the air in the HE-RAC coil does not guarantee adequate frost protection. The cooling coil must be protected from freezing with frost protection agent.

The hydraulic set must be filled with the coil medium specified in the technical data sheet in the appropriate concentration. Water quality according to VDI 2035. Too high glycol ratio causes reduced performance, too low glycol content can predispose to frost damage.

The filling process of the hydraulic set can be performed together with the filling of the piping system. Check connection points for leaks while filling is still in progress; retighten screw connections and packing glands if necessary.

Pipes with a risk of condensation must be fitted with diffusion-tight insulation on site.

## Coil connection

Information on flushing, filling, and venting see chapter "Hydraulic set", page 107.

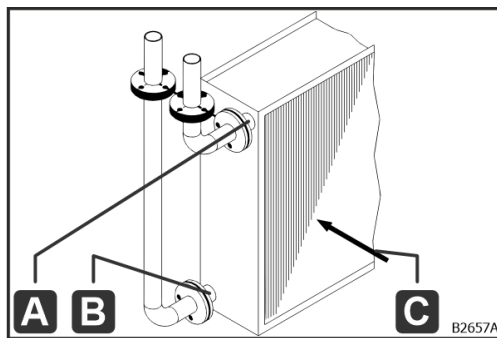
### WARNING



#### Eye injury from refrigerant-filled coils due to pressure

When opening the piping to prepare for brazing of refrigerant-filled coils, nitrogen escapes at approx. 5-10 bar. This can result in small flying parts and chips that can cause injury to the eye.

- Wear protective goggles with side protection



When connecting the heating and cooling water pipes (medium supply and medium return), ensure that the inlet and outlet connections are not mixed up (counterflow principle with water ingress at the air outlet).

- A medium return
- B medium supply
- C air direction

Fig. 166: Coil

Design and construct on-site pipework so that external loads on the coil, e.g. due to weight forces, vibrations, tension or thermal expansion, are prevented. If necessary, use expansion joints.

When tightening the on-site threaded connections of the coil, use a pipe wrench, for example, to hold them in place, otherwise the internal pipes will be twisted off and damaged.

Flange the on-site pipework so that the coil can be easily removed for maintenance or replacement purposes.

Pipes with a risk of condensation must be fitted with diffusion-tight insulation on site.



## Making a flange connection

### Requirements

Flange contact surfaces must be clean, flat and undamaged.

### Work steps

#### NOTICE



#### Material damage due to incorrect tightening of the screws

Incorrect sequence when tightening the screws may cause material damage due to stresses.

- Tighten the screws crosswise.

Tighten the flange connections with the following tightening torque using a torque wrench, depending on the nominal diameter of the screw:

Nominal diameter of screw	Tightening torque [Nm]
M10	35
M12	55
M16	120
M20	240

Table 6: Torques for flange connections

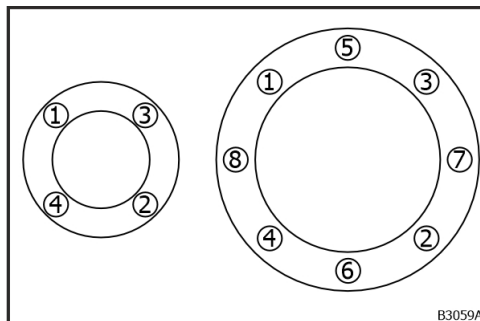


Fig. 167: tightening crosswise

The screws are tightened with a torque wrench in the sequence shown (= crosswise) in 3 passes:

1. Fix the screws crosswise with 30% of the tightening torque.
2. Tighten the screws crosswise with 60% of the tightening torque.
3. Tighten the screws crosswise with the tightening torque.

→ The flange connection has been made correctly.

4. Check the tightening torque of all screws.

## Electric heater

### WARNING



#### **Fire hazard due to incorrect positioning of the triple thermostat**

There is a danger to life from fire if the triple thermostat is positioned incorrectly.

- Install the triple thermostat according to the instructions.
- Check the functions of the triple thermostat according to the instructions.

### NOTE



#### **Damage due to thermal radiation from the electric heater**

Damage to the downstream component and parts (duct, nozzles ...) due to thermal radiation from the electric heater if the electric heater is at the end of the AHU.

- The components and parts installed downstream must be heat-resistant up to 145 °C or protected by radiation protection.
- A distance of 300 mm must be maintained between the device outlet and the first component or part installed in the duct.

### Triple thermostat with safety temperature limiter

Each electric heater must be equipped with a type-tested triple thermostat with safety temperature limiter with manual reset.

Recommendation:

Place triple thermostat in the air direction immediately after the electric heater.

### Minimum distances to components

For non-heat-resistant components, the minimum distance is 612 mm. A minimum distance of 300 mm applies to heat-resistant components. To avoid burns and damage, the connections to the duct system must be heat-resistant.

# Dampers

## Damper

### WARNING



#### Risk of death due to moving parts

Risk of death when closing fins, moving coupling bars or gears due to crushing between two moving parts.

- Attach separating protective devices (e.g., downstream grid, duct) to the damper.
- Before opening the door, switch off the AHU and secure it against restarting.
- Do not reach between the fins.

Check screw fittings and connections for tight fit.

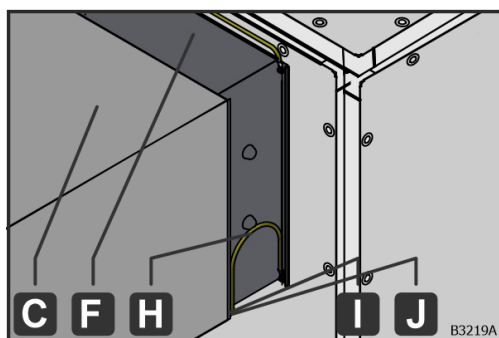


Fig. 168: damper with equipotential bonding conductor

1. Route the pre-assembled equipotential bonding conductor (H) of the damper (F) to the on-site duct (C).
  2. Secure the equipotential bonding conductor (H) with a toothed lock washer (J) to prevent loosening.
  3. Tighten the screw (I).
- The damper (F) is connected to the AHU and to the on-site duct (C) via the equipotential bonding conductor (H).

## Coupled dampers

In case of coupled dampers, check connecting bars for force-locking connection and for correct function, i.e. direction of rotation and end position of the dampers.

## Pressure relief damper

### Settings

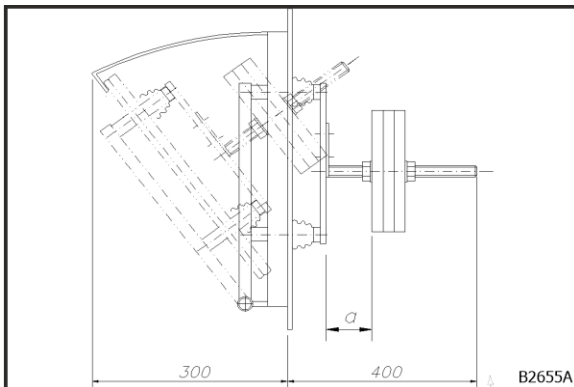


Fig. 169: Pressure relief damper

The release or contact pressure of the pressure relief damper against the unit or duct wall can be adjusted by adjusting the height, number, and distance of the weights (see chapter "Characteristic tripping or contact pressure", page 88).

The presetting is made by means of the specified a dimension.

### Characteristic tripping or contact pressure

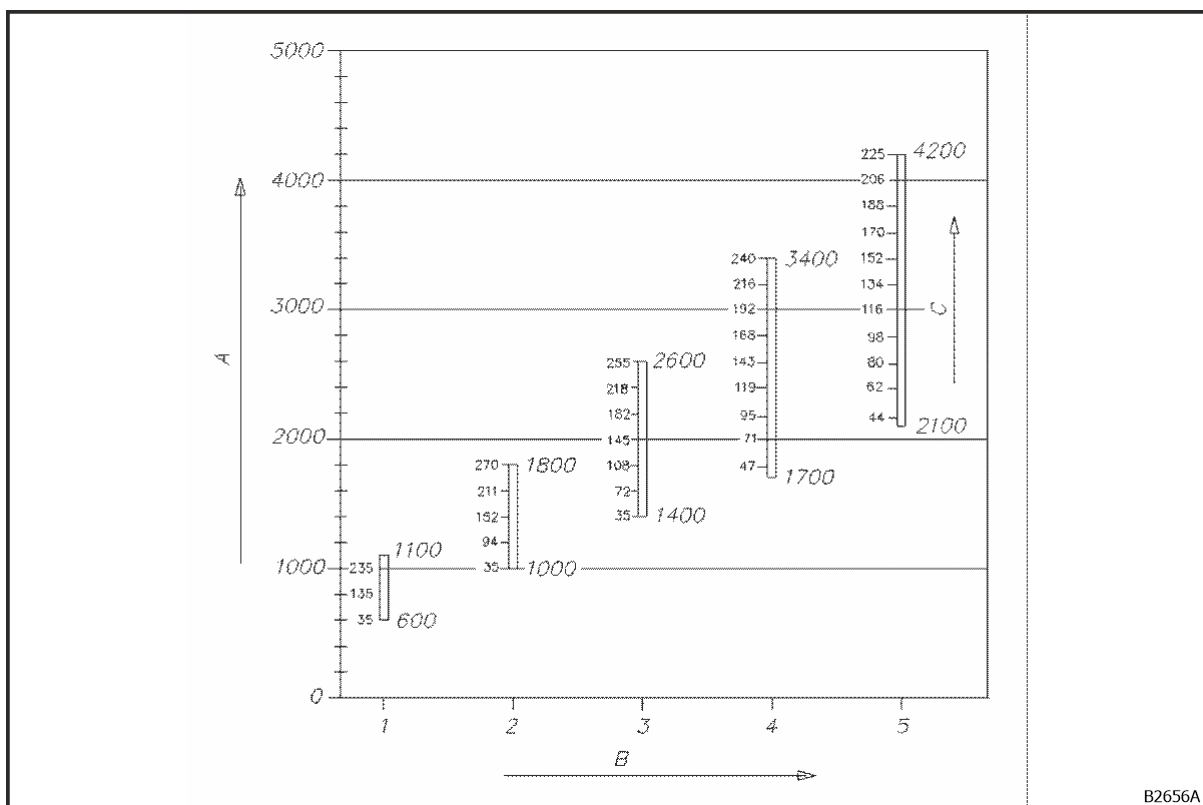


Fig. 170: Pressure relief damper characteristic

A – trigger pressure [Pa]; B – number of weight plates [piece]; C – clearance a [mm]

# Humidifier

## CAUTION



### Severe health damage due to infection and hypersensitivity reactions

When exposed to water, there is a health risk from viruses, bacteria or fungi due to poor water quality.

- Check water quality at the specified intervals.
- The total colony count of 1000 CFU/ml in the humidifier water must not be exceeded (according to DIN EN ISO 6222).
- The legionella concentration of 100 CFU/100 ml must not be exceeded (according to DIN EN ISO 11731).
- The bacterial count of *Pseudomonas aeruginosa* King B of 100 CFU/100 ml must not be exceeded.
- There must be no visible mold growth.
- If bacterial counts are too high, clean the AHU immediately.

## TIP



### Recurrent contamination

In cases of doubt or in the event of rapidly recurring high levels of contamination, it is advisable to seek the advice of a qualified institute.

## Circulating water spray humidifier (low pressure)

### Water quality

Before commissioning, it is necessary to check the quality of fresh and circulating water.

#### Fresh water

- Analysis of fresh water (can usually be obtained from local public utilities).
- Total water hardness below 7° dH
- Water quality according to VDI 6022, VDI 3803, DIN EN 13053, and the German Drinking Water Regulation

#### Circulating water

Limit values for the quality of the circulating water (recommendations according to VDI 3803 and BG Druck und Papierverarbeitung, among others):

Water quality	Normal request	Data processing areas	Sterile and clean rooms
Electr. conduction (µS/cm)	< 1.000*	< 300	< 120**
Carbonate hardness (° dH)	< 4	< 4	< 4
Chloride (g/m³)	< 180	< 180	< 180
Sulfate (g/m³)	< 150	< 100	< 100
pH value	7 to 8.5	7 to 8.5	7 to 8.5
Microbial count (CFU/ml)	< 1,000	< 100	< 10
Legionella (CFU/100ml)	< 100	< 100	< 100
Cycle of concentration	2 to 4	2 to 6***	2 to 8***

Table 7: Water quality of the circulating water

CFU = Colony Forming Units

- \*) Softening or partial desalination may be necessary; electrical conduction max. 800 µS/cm when humidifying to above 95 %r.H.
- \*\*) Full desalination necessary
- \*\*\*) Lower value without additional disinfection measures; upper value with additional measures

#### Cycle of concentration

Determination of the thickening number from the values of the fresh water analysis, as well as the recommended limit values for the water quality of the circulating water (see table "Water quality of the circulating water"):

Thickening number = recommendation value circulating water / value fresh water

Whereby the cycle of concentration must be calculated for the electrical conduction, hardness, chloride content, and sulfate content. The lowest value of the calculated thickening numbers should be in the range of the recommended limits (see table "Water quality of the circulating water"). For values below 2, additional water treatment measures should be taken. Contact a specialist water treatment company.

These determined settings are approximate values and do not replace additional monitoring of the bacterial counts.

robatherm recommends using test systems (dip slides). Observe the instructions for use.

## Fresh water pressure

The float valve is approved up to a max. operating pressure of 6 bar.

robatherm recommends fresh water pressure of at least 3 bar; if necessary, install a pressure booster system.

## Cleaning before filling

Remove foreign bodies from the humidifier tray, clean off any contamination with water and cleaning agent (non-foaming, pH value 7–9).

Thoroughly remove metal shavings, otherwise there is a risk of pitting.

## Tightness

Check external lines for tightness and re-seal if necessary.

Factory-new droplet eliminator profiles only reach their full separation performance after approx. 3 days of operation (weathering effect).

## Filling

Fill the humidifier tray to 10 to 20 mm below the overflow connection and adjust the float valve to this water level by adjusting the knurled screw.

Only fill the humidifier tray with fresh water when humidification is required.

Treated water must be removed from galvanized parts immediately. There is a risk of white rust formation.

## Disinfection

UV-C radiation can optionally be used for continuous disinfection (see chapter "UV-C technology for water disinfection", page 92).

Only use chemical disinfectants (biocides) if it has been proven that they are harmless to health in the application concentration.

### UV-C technology for water disinfection

#### WARNING



#### Damage to health from mercury

UV-C illuminants contain mercury. Mercury is toxic and dangerous to the environment.

- Avoid contact with skin and eyes. In case of contact, flush skin and eyes with plenty of water. Take off contaminated clothing.
- Do not swallow. If swallowed, induce vomiting.
- Ensure good air exchange in the danger zone.
- Comply with the safety data sheet of the manufacturer.



**CAUTION****Risk of serious injuries due to hazardous substances**

There is a risk of poisoning if the carton is damaged or if the UV-C illuminants break.

- When handling broken UV-C illuminants, follow the safety instructions for handling mercury.
- Avoid direct contact with eyes, skin, and clothing.
- Ensure excellent ventilation of the AHU and the rooms connected via the ducts.
- Keep broken pieces of UV-C illuminants in airtight packaging and dispose of properly.

**TIP****Removal of small amounts of mercury**

UV-C illuminants contain small amounts of mercury. Removal of the small amount leaked at breakage can be done with special sorbents for mercury.

**NOTICE****UV-C disinfection performance impaired by finger perspiration**

Finger perspiration leaves stains on the UV-C illuminant that burn in and impair the performance of UV-C disinfection.

- Wear cotton gloves when handling the UV-C illuminant.

For work steps for assembling the UV-C illuminant in the UV-C reactor, see appendix "Herco – UV disinfection system UVE 35 – 45 (P) digital", "Installing the lamp" section.

Without integrated control technology

Personnel qualifications

The tasks described in the section may only be carried out if the person concerned has the following qualification:

→ Qualified electrician

Work steps

To establish the electrical connection, see the appendix "Herco – UV disinfection system UVE 35 - 45 (P) digital", "Establishing the electrical connections" and the "Electrical connection" sections.

**Connection to the fresh water system**

When connecting to the fresh water system, provide a pipe disconnecter on site in accordance with EN 1717.

**Connection of the drain and overflow lines on the circulating water spray humidifier (low pressure)**

Connect the drain line of the circulating water spray humidifier (low pressure) and the pan drain of the pre-assembled pan separately to the waste water system. Do not empty the humidifier pan into the pre-assembled pan.

## **Fresh water spray humidifier (high pressure)**

### **Water quality**

#### **Fresh water**

Fully demineralized water (permeate from reverse osmosis) with max. 20 µS/cm and a total water hardness of max. 1 °dH

Water quality according to VDI 6022, VDI 3803, DIN EN 13053, and the German Drinking Water Regulation

### **Fresh water pressure**

Fresh water pressure: 2 to 8 bar

### **Tightness**

Check the screw connections on the humidifier or pump station for tightness; retighten if necessary. To do this, use a second wrench to hold it in place.

Internal screw connections must not be retightened.

### **Connection to the fresh water system**

When connecting to the fresh water system, provide a pipe disconnecter on site in accordance with EN 1717.

### **High-pressure connection**

Check that the high-pressure hose is laid without tension or abrasion; correct if necessary.

Treated water must be removed from galvanized parts immediately. There is a risk of white rust formation.

# Circulating water contact humidifier

## Disinfection

UV-C radiation can optionally be used for continuous disinfection (see chapter "UV-C technology for water disinfection", page 95).

Only use chemical disinfectants (biocides) if it has been proven that they are harmless to health in the application concentration.

### UV-C technology for water disinfection

#### WARNING



##### Damage to health from mercury

UV-C illuminants contain mercury. Mercury is toxic and dangerous to the environment.

- Avoid contact with skin and eyes. In case of contact, flush skin and eyes with plenty of water. Take off contaminated clothing.
- Do not swallow. If swallowed, induce vomiting.
- Ensure good air exchange in the danger zone.
- Comply with the safety data sheet of the manufacturer.

#### CAUTION



##### Risk of serious injuries due to hazardous substances

There is a risk of poisoning if the carton is damaged or if the UV-C illuminants break.

- When handling broken UV-C illuminants, follow the safety instructions for handling mercury.
- Avoid direct contact with eyes, skin, and clothing.
- Ensure excellent ventilation of the AHU and the rooms connected via the ducts.
- Keep broken pieces of UV-C illuminants in airtight packaging and dispose of properly.

#### TIP

##### Removal of small amounts of mercury



UV-C illuminants contain small amounts of mercury. Removal of the small amount leaked at breakage can be done with special sorbents for mercury.

#### NOTICE



##### UV-C disinfection performance impaired by finger perspiration

Finger perspiration leaves stains on the UV-C illuminant that burn in and impair the performance of UV-C disinfection.

- Wear cotton gloves when handling the UV-C illuminant.

**NOTICE****Damage to components caused by UV-C radiation**

UV-C radiation poses a risk of damage to components that are not UV-resistant.

- Components in the effective range of UV-C radiation must be UV-resistant or protected by UV-resistant shielding.

Work steps for assembling the UV-C illuminant in the pan

- See appendix "fisair – installation and maintenance manual for series HEF2", "UV illuminant for disinfection inside the water basin (for circulating water)" section or
- See appendix "fisair – installation and maintenance manual for series HEF2E", "Disinfection system – treating the water collected in the pan with an immersion UV illuminant. (For circulating water)".

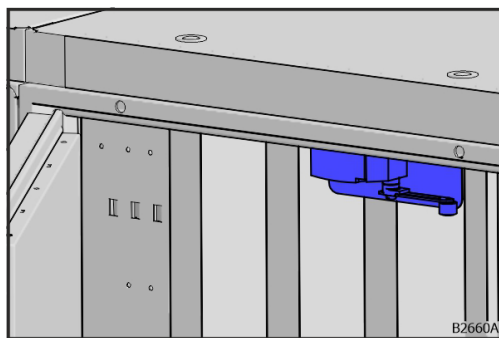
Personnel qualifications

The tasks described in the section may only be carried out if the person concerned has the following qualification:

→ Qualified electrician

Door contact switch

Set-up and function



The door contact switch interrupts the current and voltage supply of the UV-C lamp when the door is opened.

Fig. 171: Door contact switch

The inspection doors in the effective range of the UV-C radiation are equipped with door contact switches to safely switch off the UV-C illuminants in the event of unauthorised access. The door contact switches are pre-wired in terminal boxes. Where possible, the door contact switches are grouped together in a terminal box. If the structural situation in the AHU does not allow this (e.g. different delivery sections), several terminal boxes are installed accordingly.

Requirements

- Check that a door contact switch (S1, S2, S3, etc.) is installed on all inspection doors in the effective range of the UV-C radiation.

## Work steps

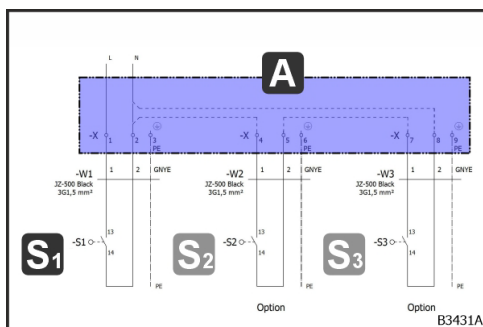


Fig. 172: Wiring diagram for door contact switches

- Wire the door contact switch (S1, S2, S3, etc.) directly to the respective switch cabinet or via an intermediate terminal box (A).
- Connect the door contact switches (S1, S2, S3, etc.) so that opening an inspection door interrupts the voltage supply to the UV-C disinfection system (NO = normally open).
- Connect several door contact switches for a UV-C system in series.

## Inspection

- Check that there is an audible click when opening or closing the inspection door.
- Check that the wiring is correct (e.g. using a multimeter).

## Electro steam humidifier

The notes compiled here represent only a part of the requirements specified by the manufacturer and are intended to provide an overview of the key requirements. Careful consideration of the manufacturer's operating instructions is mandatory.

### Water quality

- Use drinking water without chemical additives.
- Max. 40 °C.
- The limits with regard to electrical conduction must be observed.

### Fresh water pressure

If applicable, permissible water supply pressure: 1 to 10 bar.

### Connection to the fresh water system

When connecting to the fresh water system, provide a pipe disconnect on site in accordance with EN 1717.

### Hygrostat

Use the following as a guideline: Position hygrostat at least 5 x length of the humidification section away. The greatest possible distance should be aimed for. If the hygrostat is positioned unfavorably, the maximum required steam output may be exceeded. This can cause subsequent components to become soaked.

### Steam generator assembly

The rear wall of the steam generator can heat up to 70 °C.

The steam generator must be mounted vertically and horizontally plumb.

### Steam generator tubing

- Install hoses with a steady slope or gradient of 5-10%.
- Avoid sagging or kinking of the hoses.
- Fixed piping is recommended.
- Keep steam hoses as short as possible.
  - For lengths > 5 m, insulation of the steam hoses is recommended to minimize condensate losses.
  - Insulation is mandatory from 10 m in length.
- Observe minimum bending radii.
- Observe installation types of the condensate hose routing depending on the installation positions of steam lances and steam generators.
- Use condensate hose with a loop as a vapor barrier.

### Assembly of steam lances

- All steam lances must be mounted horizontally.
- Install close to the steam generator to minimize steam losses due to condensation.

# Refrigeration technology (refrigeration plant, heat pump, and split air conditioner)

## WARNING



### **Danger to life due to suffocation!**

There is a risk of suffocation if refrigerant escapes, as refrigerant is odorless and tasteless and displaces atmospheric oxygen.

- A refrigerant sensor for monitoring the installation site and suitable ventilation must be present and functional.
- Observe the safety data sheet of the refrigerant.
- Leave the danger zone.
- Ensure good air exchange in the danger zone.
- Use self-contained respiratory protection.

## WARNING



### **Danger to life from suffocation**

There is a risk of suffocation if the cooling circuit is completely emptied, as vapours, aerosols or gases can spread through the duct in the building.

- Maintain a minimum volume flow of 25% of the nominal volume flow (EN 378-1).
- Prevent ingress in places where accumulation could be hazardous (e.g. cellar, waste water system).
- Observe inspection intervals and enter them in the service booklet for refrigeration systems.

## WARNING



### **Danger to life due to harmful substances**

In conjunction with an open flame, refrigerants and compressor oils develop toxic substances that are harmful to health.

- Do not smoke in the machinery compartment.

## WARNING



### **Danger to life due to suffocation!**

When opening the piping during preparation for the brazing process, there is a risk of suffocation due to the escape of refrigerant or compressor oil.

- In case of a refrigerant leak, enter the machinery compartment only using heavy-duty respiratory protective equipment.

## WARNING



### Risk of explosion and fire

When using flammable refrigerants of safety class 2 and 3 according to ISO 817, there is a danger to life from explosion and fire.

- Observe maximum filling quantity.
- Observe the safety data sheet of the refrigerant.

### Maximum filling quantity of refrigerant



Depending on the refrigerant safety class according to ISO 817, only limited fill quantities are permitted, especially for flammable and toxic refrigerants.

- Europe: maximum fill amounts according to DIN EN 378-1 must be observed. These are determined on the basis of the access area, the installation location and the respective refrigerant safety class.
- International: maximal fill amounts are calculated according to ISO 5149.

For refrigerants with refrigerant safety class A2L, IEC 60335-2-40 must also be taken into account. For split air conditioners with refrigerant R32 see chapter "Determining the maximum permissible filling quantity of refrigerant without a refrigerant sensor", page 103 or see chapter "Determining the maximum permissible filling quantity of refrigerant with a refrigerant sensor", page 105.

In the case of direct expansion coils with external refrigeration technology, the HVAC installer is responsible for observing the maximum permissible filling quantity.

For determining the maximum filling quantity of refrigerant for split air conditioners see chapter "Determining the maximum permissible filling quantity of refrigerant without a refrigerant sensor", page 103 or see chapter "Determining the maximum permissible filling quantity of refrigerant with a refrigerant sensor", page 105.

## WARNING



### Danger to life from explosion

In the event of leakages or when handling refrigerant R32, there is a risk of explosion, as A2L refrigerants can produce a potentially explosive atmosphere.

- Avoid potential sources of ignition.
- Ventilate the room.
- Check the inside of the AHU with a refrigerant sensor before starting any work.
- Only use a tool designed for A2L refrigerant.

For all activities, the requirements of the service manual for refrigeration plants (available on request), and the applicable standards and guidelines (e.g., DIN EN 378, BGR 500, and F-Gas regulation) must be observed.



## Personnel qualification

→ Refrigeration specialist

Completion of refrigeration plants may only be carried out by the manufacturer or another specialist appointed by the manufacturer.

## Connection of the refrigerant line

### WARNING



#### **Eye injury from refrigerant-filled coils due to pressure**

When opening the piping to prepare for brazing of refrigerant-filled coils, nitrogen escapes at approx. 5-10 bar. This can result in small flying parts and chips that can cause injury to the eye.

- Wear protective goggles with side protection

Before connection, check the coils and lines for tightness; i.e., whether the factory protective gas filling is still under pressure.

In the case of direct expansion coils, after opening the coil connection lines, the nitrogen inert gas charge must escape with a hissing noise. Otherwise, there is a leakage.

The piping outside the AHU must be insulated to be diffusion-tight.

## Split outdoor units with R32 refrigerant

Split outdoor units with R32 may only be used if the following requirements are met:

- Split air conditioners comprise a closed refrigeration circuit.
- The minimum required volume flow  $V_{min}$  of the AHU must be observed see chapter "Determining the minimum required volume flow of the AHU", page 102.

### Determining the minimum required volume flow of the AHU

The minimum required volume flow [m<sup>3</sup>/h] of the AHU is calculated as follows:

$$V_{min} = 60 \cdot \frac{m_{max}}{LFL}$$

$V_{min} \left[ \frac{m^3}{h} \right]$	$m_{max} [kg]$
400	2,0
550	2.8
800	4.0
1250	6.3
1350	6.8

Table 8: Filling quantities depending on volume flow

Type designation	$m_{max} [kg]$
PUZ – ZM50	2.0
PUZ – ZM60	2.8
PUZ – ZM71	2.8
PUZ – ZM100	4.0
PUZ – ZM125	4.0
PUZ – ZM140	4.0
PUZ – ZM200	6.3
PUZ – ZM250	6.8

Table 9: Filling quantities for each Mitsubishi electric split outdoor unit for pipework distance of < 30 m

For calculating the maximum permissible filling quantities  $m_{max}$

- see chapter "Determining the maximum permissible filling quantity of refrigerant without a refrigerant sensor", page 103.
- see chapter "Determining the maximum permissible filling quantity of refrigerant with a refrigerant sensor", page 105.

### Determining the maximum permissible filling quantity of refrigerant without a refrigerant sensor

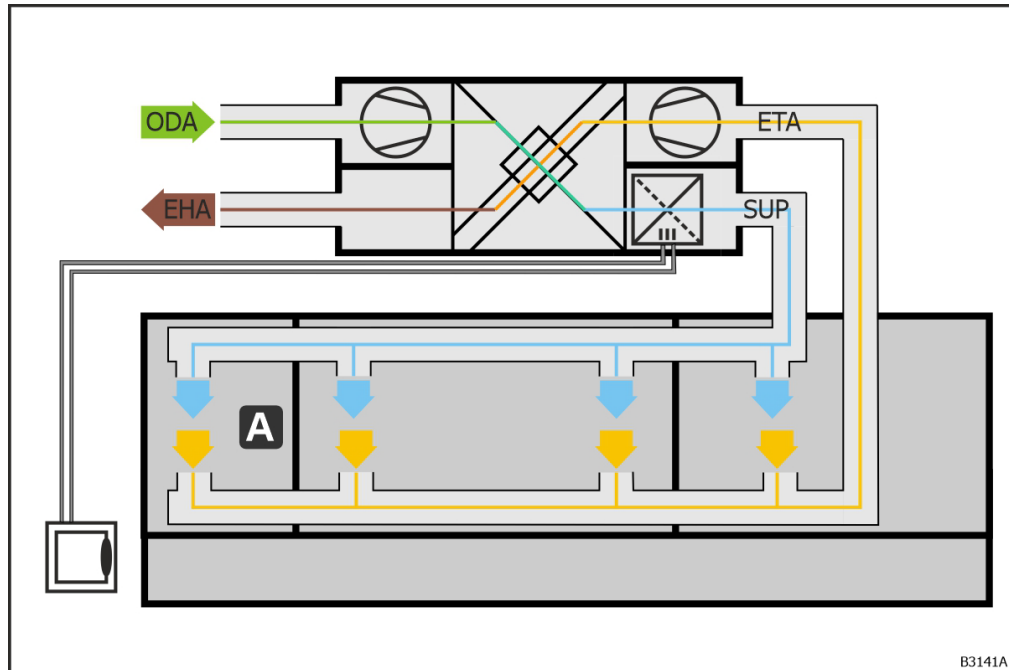


Fig. 173: AHU with split outdoor unit and ventilated spaces without a refrigerant sensor

A – smallest ventilated room

$m_{max}$  = maximum permissible filling quantity [kg] of a cooling circuit

$$m_{max} = 2.5LFL^{1.25} \cdot h_o \cdot A^{0.5} \leq 15.96 \text{ [kg]}$$

With  $LFL$  = lower explosion limit of R32 [kg/m<sup>3</sup>]

$$LFL = 0.307 \left[ \frac{\text{kg}}{\text{m}^3} \right]$$

With  $h_o$  = air outlet height [m] in the smallest ventilated room

$h_o$ [m]	Air outlet height
0.6	Floor
1.0	Window
1.8	Wall
2.2	Surface

Table 10: Air outlet height  $h_o$

And with  $A$  = area of the smallest ventilated room [m<sup>2</sup>]

When calculating the maximum permissible filling quantity based on the room size, the cooling circuit with the largest filling quantity should always be used if there are several split outdoor units.

Examples:

$m_{max}$ [kg]	Size of the smallest ventilated room $A$ [m <sup>2</sup> ]			
	$h_o = 0.6$ [m]	$h_o = 1.0$ [m]	$h_o = 1.8$ [m]	$h_o = 2.2$ [m]
2.0	34	13	4	3
2.8	67	24	8	5
4.0	137	49	16	11
6.3	338	122	38	26
6.8	394	142	44	30

Table 11: Filling quantities and volume flow in relation to room size and air outlet without a refrigerant sensor

Type designation	$m_{max}$ [kg]
PUZ – ZM50	2.0
PUZ – ZM60	2.8
PUZ – ZM71	2.8
PUZ – ZM100	4.0
PUZ – ZM125	4.0
PUZ – ZM140	4.0
PUZ – ZM200	6.3
PUZ – ZM250	6.8

Table 12: Filling quantities for each Mitsubishi electric split outdoor unit for pipework distance of < 30 m

### Determining the maximum permissible filling quantity of refrigerant with a refrigerant sensor

If a refrigerant sensor (B) is installed near the coil, the maximum permissible filling quantity increases in relation to the room size. The air outlet height  $h_o$  is not taken into account.

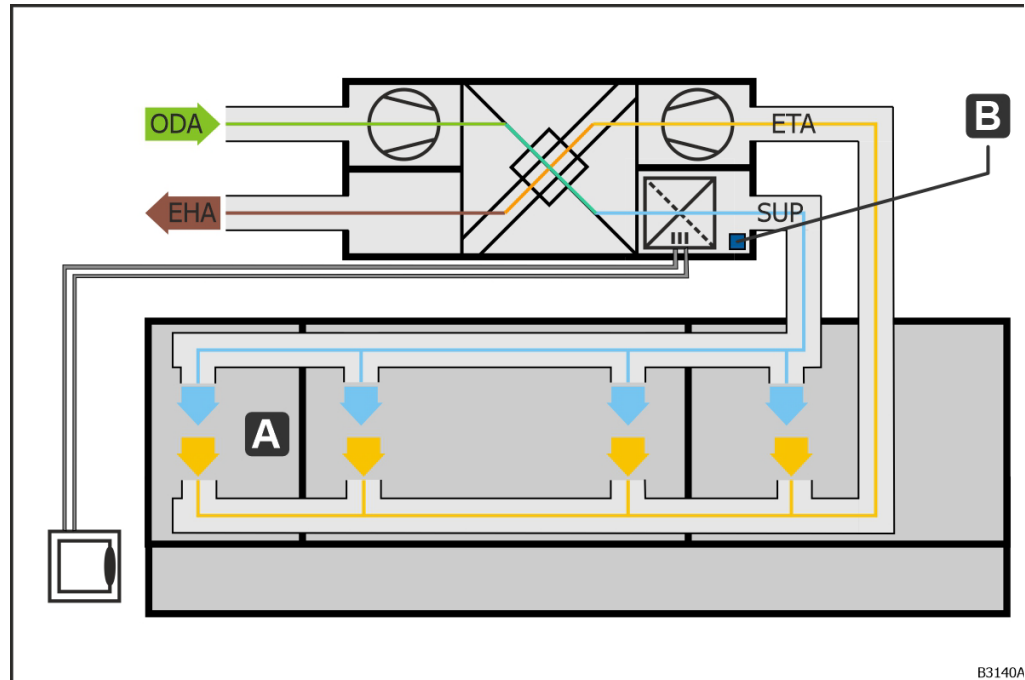


Fig. 174: AHU with split outdoor unit and ventilate rooms with refrigerant sensor

A – smallest ventilated room

B – refrigerant sensor

$m_{max}$  = maximum permissible filling quantity [kg] of a cooling circuit

$$m_{max} = 0.5 \cdot LFL \cdot H \cdot TA \leq 15.96 \text{ [kg]}$$

With  $LFL$  = lower explosion limit of R32 [kg/m<sup>3</sup>]

$$LFL = 0.307 \left[ \frac{\text{kg}}{\text{m}^3} \right]$$

With  $H$  = room height [m]  $\leq 2.2$  [m]

And with  $TA$  = total ventilated room space [m<sup>2</sup>] if:

- no airflow control present or
- airflow controls are opened when there is a detector alarm.

Or with  $TA = A$  = area of the smallest ventilated room [m<sup>2</sup>] if

- airflow controls are not actuated.

Examples of a room height  $H = 2.2$  [m]:

$m_{max}$ [kg]	$TA$ [m <sup>2</sup> ]
2.0	6
2.8	9
4.0	12
6.3	17
6.8	21

Table 13: Filling quantities and volume flow in relation to room size with a refrigerant sensor

Type designation	$m_{max}$ [kg]
PUZ – ZM50	2.0
PUZ – ZM60	2.8
PUZ – ZM71	2.8
PUZ – ZM100	4.0
PUZ – ZM125	4.0
PUZ – ZM140	4.0
PUZ – ZM200	6.3
PUZ – ZM250	6.8

Table 14: Filling quantities for each Mitsubishi electric split outdoor unit for pipework distance of < 30 m

# Hydraulic set

Do not exceed approved pressure rating.

Observe technical data sheet.

In the case of a run around coil, the amount of frost protection agent must be selected depending on the lowest outside air temperature (observe the manufacturer's information).

If no condensate pan is provided underneath a (HE-)RAC heating coil, the HRS system may only be operated if no condensate is produced.

Hydraulic sets have a variety of potential sources of ignition and may only be used in safe areas. Operation is only permitted with frost protection provided by the customer (e.g. sufficient quantity of antifreeze) in order to prevent frost damage due to leakage.

## Making a flange connection

To make a flange connection see chapter "Making a flange connection", page 85.

## Inspection

Check for:

- proper installation of all parts
- correct connection of flow and medium return (counterflow principle)
- tight fit of all screw connections and stuffing-box seals
- Movement of all valves, slides, and flaps

## Flushing

### NOTE



#### Material damage due to inadequate flushing

If there is no or insufficient system flushing, oil residues may remain in the coil (lubrication during the production process). Water/frost protection mixtures have lipophilic properties, which dissolves the oil in the mixture. Subsequently, an oil/water/frost protection mixture circulates inside the system and damages seals that are not oil-resistant.

- Flush the system according to VDI 2035. Oil residues are dissolved during the flushing process.
- In closed system circuits (e.g., RAC/ HE-RAC circuits) use oil-resistant seals.

The system must be flushed in accordance with VDI 2035 (removal of contamination). The oil residues must be dissolved during the flushing process, otherwise they will remain in the system.

## Filling

The hydraulic set must be filled with the coil medium specified in the technical data sheet in the appropriate concentration. Water quality according to VDI 2035. Too high glycol ratio causes reduced performance, too low glycol content can predispose to frost damage.

The filling process of the hydraulic set can be performed together with the filling of the piping system. Check connection points for leaks while filling is still in progress; retighten screw connections and packing glands if necessary.

## Exhaust ventilating

### NOTE



#### Material damage due to inadequate venting

If systems are not properly vented, air pockets will form which can lead to reduced performance or pump damage.

- Exhaust ventilate the system according to VDI 2035 during system filling at the highest point of the system.

The hydraulic set must be exhaust ventilate at the highest point of the system during system filling in accordance with VDI 2035.

- Open venting devices of the system.
- For vertical multi-stage centrifugal pumps, also open a separate vent screw.



## **Pressure test**

Optionally, proceed according to DIN 4753, part 1.  
Observe the approved pressure range.

## **Hydraulic system**

Optionally, perform hydraulic commissioning by adjusting and balancing pressures (e.g., by means of a pressure regulating device).

# Direct firing

## Combustion chamber

Observe requirements according to DIN 4794, DIN 4755, and DVGW worksheet G600.

### Connections

In the case of on-site burners, approval must be requested from robatherm for the purpose of checking compatibility with the selected combustion chamber.

Assembly of the oil or gas burner according to the manufacturer's instructions.

Connect the burner to the gas or oil line. Make sure that the connection is deenergized. The operating instructions of the burner manufacturer must be strictly observed. Gas type and gas pressure must be suitable for the control line.

The prerequisite for achieving the nominal heat output is compliance with the gas-side supply pressure (see data sheet). The nominal heat output may not be achieved if the supply pressure falls below the specified value under operating conditions.

Assembly and wire all sensors (e.g., room thermostats).

Each installation must be equipped with an emergency switch.

### Chimney

Make connection to the chimney in accordance with the applicable regulations. The exhaust system must comply with local building and official regulations.

### Condensate combustion chamber

Follow the instructions of the respective combustion chamber supplier. These are part of the supplied documentation. With oil, condensation should be avoided. The condensate connection must be made in such a way that any condensate produced is drained off in accordance with local regulations.

## Direct gas-fired heater

When assembling the device, in addition to the points listed here, any conditions imposed by the approval authority, all local regulations and the requirement of the DVGW and TRGI must be strictly observed.

### Connections

Connect the gas control line to the gas line. Make sure that the connection is deenergized. Gas type and gas pressure must be suitable for the control line.

The prerequisite for achieving the nominal heat output is compliance with the gas-side supply pressure (see data sheet). The nominal heat output may not be achieved if the supply pressure falls below the specified value under operating conditions.

Guide drain valve into non-hazardous area.

Assembly and wire all sensors (e.g., room thermostats).

Each installation must be equipped with an emergency switch.

### Tightness

Check the gas line, connections and gas control system for tightness using a test device.

# Control system

## Field devices

Check field devices for proper installation.

Check electrical connections on the control cabinet and the field units.

For connecting the door contact switches see chapter "Door contact switch", page 114.

## Duct smoke detector

Duct smoke detectors are supplied loose and installed on site:

- Determine the position of the duct smoke detector (see appendix "Duct smoke detector data sheet", "Installation instructions and positioning" section).
- Install the duct smoke detector (see appendix "Duct smoke detector data sheet", "Assembly" section).
- Connect the duct smoke detector electrically (see appendix "Duct smoke detector data sheet", "Electrical connection" section). Providing the cables with clearly legible labelling (as specified in the cable list) in the switch cabinet of the AHU and, if necessary, taking other circuit-related measures takes place on site. If fire or smoke dampers provided on site are connected to the AHU switch cabinet, the cables for the fire or smoke damper in the switch cabinet must be provided on site with clearly legible labelling (as specified in the cable list; voltage supply and evaluation of two potential-free signals in 24 V).
- If smoke detectors control customer-side fire or smoke dampers that are not connected to the AHU switch cabinet, a smoke detector suitable for this purpose with DIBt (German Institute of Civil Engineering) approval is required. The HVAC installer is solely responsible for the appropriate selection of the smoke detector. In this case, the voltage supply to the fire or smoke dampers must be routed via the smoke detector contact provided for this purpose without decoupling. This floating contact is provided on a transfer terminal strip in the AHU switch cabinet, but can also be used directly on the smoke detector.

# UV-C technology

## WARNING



### Damage to health from mercury

UV-C illuminants contain mercury. Mercury is toxic and dangerous to the environment.

- Avoid contact with skin and eyes. In case of contact, flush skin and eyes with plenty of water. Take off contaminated clothing.
- Do not swallow. If swallowed, induce vomiting.
- Ensure good air exchange in the danger zone.
- Comply with the safety data sheet of the manufacturer.

## CAUTION



### Risk of serious injuries due to hazardous substances

There is a risk of poisoning if the carton is damaged or if the UV-C illuminants break.

- When handling broken UV-C illuminants, follow the safety instructions for handling mercury.
- Avoid direct contact with eyes, skin, and clothing.
- Ensure excellent ventilation of the AHU and the rooms connected via the ducts.
- Keep broken pieces of UV-C illuminants in airtight packaging and dispose of properly.

## TIP



### Removal of small amounts of mercury

UV-C illuminants contain small amounts of mercury. Removal of the small amount leaked at breakage can be done with special sorbents for mercury.

## UV-C technology for air and surface disinfection

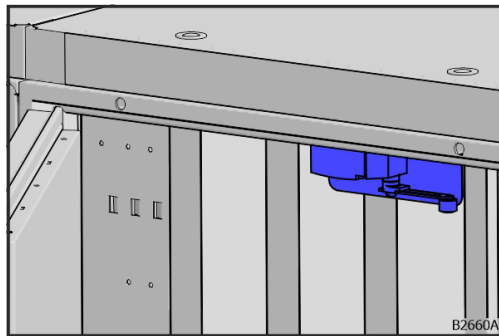
### Personnel qualification

The work described in this section may only be performed if the person has the following qualifications:

- Qualified electrician

### Door contact switch

#### Set-up and function



The door contact switch interrupts the current and voltage supply of the UV-C lamp when the door is opened.

Fig. 175: Door contact switch

The inspection doors in the effective range of the UV-C radiation are equipped with door contact switches to safely switch off the UV-C illuminants in the event of unauthorised access. The door contact switches are pre-wired in terminal boxes. Where possible, the door contact switches are grouped together in a terminal box. If the structural situation in the AHU does not allow this (e.g. different delivery sections), several terminal boxes are installed accordingly.

#### Requirements

- Check that a door contact switch (S1, S2, S3, etc.) is installed on all inspection doors in the effective range of the UV-C radiation.

## Work steps

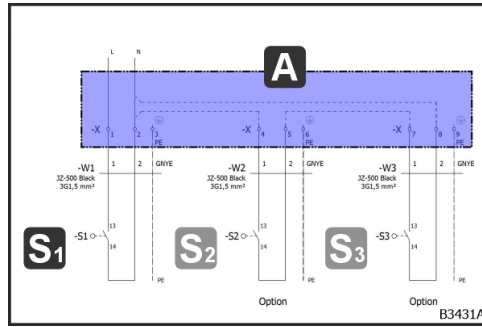


Fig. 176: Wiring diagram for door contact switches

- Wire the door contact switch (S1, S2, S3, etc.) directly to the respective switch cabinet or via an intermediate terminal box (A).
- Connect the door contact switches (S1, S2, S3, etc.) so that opening an inspection door interrupts the voltage supply to the UV-C disinfection system (NO = normally open).
- Connect several door contact switches for a UV-C system in series.

## Inspection

- Check that there is an audible click when opening or closing the inspection door.
- Check that the wiring is correct (e.g. using a multimeter).

## Installing UV-C illuminants

### NOTICE



#### **UV-C disinfection performance impaired by finger perspiration**

Finger perspiration leaves stains on the UV-C illuminant that burn in and impair the performance of UV-C disinfection.

- Wear cotton gloves when handling the UV-C illuminant.

### NOTICE



#### **Damage to components caused by UV-C radiation**

UV-C radiation poses a risk of damage to components that are not UV-resistant.

- Components in the effective range of UV-C radiation must be UV-resistant or protected by UV-resistant shielding.

#### **UV-C technology for air disinfection**

To assemble UV-C illuminants see appendix "Light progress – UV-DUCT-SQ SB-SQ operating instructions", "Maintenance" section.

#### **UV-C technology for surface disinfection**

To assemble UV-C illuminants see appendix "Light progress – UV-STICK...AL-SCR operating instructions", "Maintenance" section.

## Without integrated control technology

#### **UV-C technology for air disinfection**

To establish the electrical connection, see the appendix "Light progress – Master-SM operating instructions", "Electrical connection" section and "Wiring diagram" section.

#### **UV-C technology for surface disinfection**

To establish the electrical connection, see the appendix "Light progress – Master-16-MA operating instructions", "Electrical connections" section and "Wiring diagram" section.



# Final cleaning

After completing installation and assembly, check all components for contamination in accordance with VDI 6022 and clean if necessary before commissioning. In particular, metal chips must be removed carefully, as they can lead to corrosion.

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