the air handling company

robatherm AHUs.

Planning Notes.

May 2024

English (translation of German) – planning notes

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

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You can find the currently valid version of these instructions, and further instructions, on our website at www.robatherm.com/manuals.

This leaflet is based on the generally accepted engineering standards at the time of drafting. Since the printed version is not subject to change control, the current version must be requested from robatherm or downloaded from the Internet at www.robatherm.com before application.

Content subject to change.

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: May 2024

Contents

General remarks

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.

Intended use

Definition of the scope of application

robatherm AHUs must be used exclusively for transporting air and/or for air treatment, with any other use expressly ruled out. This includes the following functions:

- Air treatment: A process in which the condition of air is changed with respect to one or more of the following: Temperature, humidity, dust content, bacteria content, gas content, and water content.
- Filtering: Removal of particles from the airflow.
- Heating: Transfer of heat from one body or medium to another.
- Cooling: Removal of sensible and/or latent heat.
- Humidifying: Controlled increase of water vapor content of flowing or stagnant air.
- Dehumidifying: Controlled reduction of water vapor content of the air.

Transporting the air is specified using a characteristic value:

- Airflow: Conveyed air within set balance limits (e.g., air ducts).

Foreseeable misuse

WARNING

Danger from misuse

Serious personal injury or even death and damage to property can be caused by misuse of the AHUs.

AHUs are not smoke extraction units and must not be used for smoke extraction.

AHUs must not be used in environments with a potentially explosive atmosphere (e.g. explosive dusts and/or gases) and must not convey a potentially explosive atmosphere.

The roof of AHUs is not designed to support additional roof loads. AHUs are not intended as a support structure for other trades (ventilation ducts, maintenance platforms, cable trays, etc.). AHUs must not be installed directly on top of each other without a suitable support structure or additional equipment provided on site (see operating instructions “Installation and assembly”, “Roof rack frame” section).

AHUs must not be used for fall protection (e.g. fastening guardrails to the casing, fastening the fall protection to transport lugs or transport loops).

AHUs must not be used for building functions.

Combination units (two airflows combined in one unit) must not be used to treat and convey airflows that are hazardous to health.

AHUs are not suitable for applications with aggressive media.

AHUs are only suitable for stationary use.

AHUs are not intended for use in general engineering processes.

AHUs may only be installed in certain locations (see chapter "Installation site requirements", page 7).

Technical data

Technical data sheet and technical drawing

The technical data sheet and the technical drawing are provided before delivery. It is recommended to add these documents to the operating instructions.

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 consider 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 chapter "Lightning protection for weatherproof devices", page 8).
- 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.

Lightning protection for weatherproof devices

The installation site must have a suitable lightning protection system in accordance with country-specific regulations. Creating and implementing a lightning protection concept is the responsibility of an authorized specialist company.

The external lightning protection must not be installed on the AHU. When routing cables of the air handling unit, the separation distances required on-site between the cables and the external lightning protection and other hazardous lines must be maintained.

When retrofitting AHUs or upgrading existing AHUs, lightning and surge protection measures on or in the building and the existing facilities may need to be retrofitted.

In Germany, AHUs and control cabinets must be installed at least in lightning protection zone LPZ 0B (see DIN VDE 0100-443:2016-10 and DIN VDE 0100-534:2016-10). Control cabinets with complete I&C destined for Germany are equipped with a type 2 surge arrester for TN networks. For AHUs with partial I&C, overvoltage protection is included in the customer's scope of services.

No surge arrester is installed for all AHUs with destinations outside Germany.

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 ≤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:

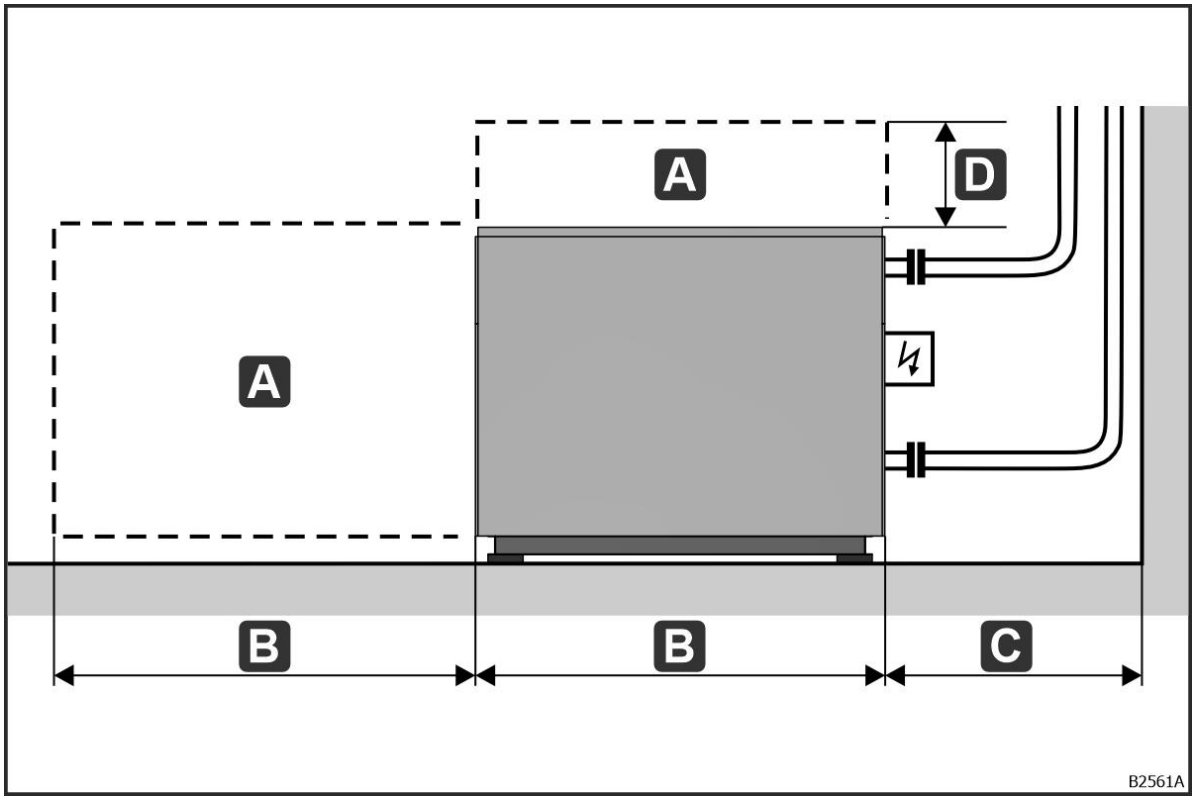


Fig. 1: AHU footprint requirements

A - revision area; B - unit width; C ≥ 875 mm; D ≥ 500 mm

- Leave ≥ 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 ≥ 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:

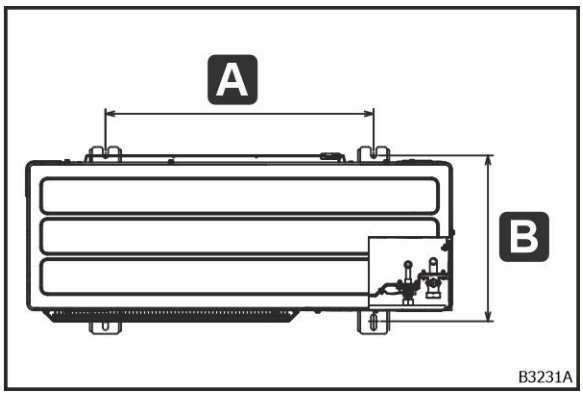


Fig. 2: Split outdoor unit mounting

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

HE-RAC hydraulics on stand

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

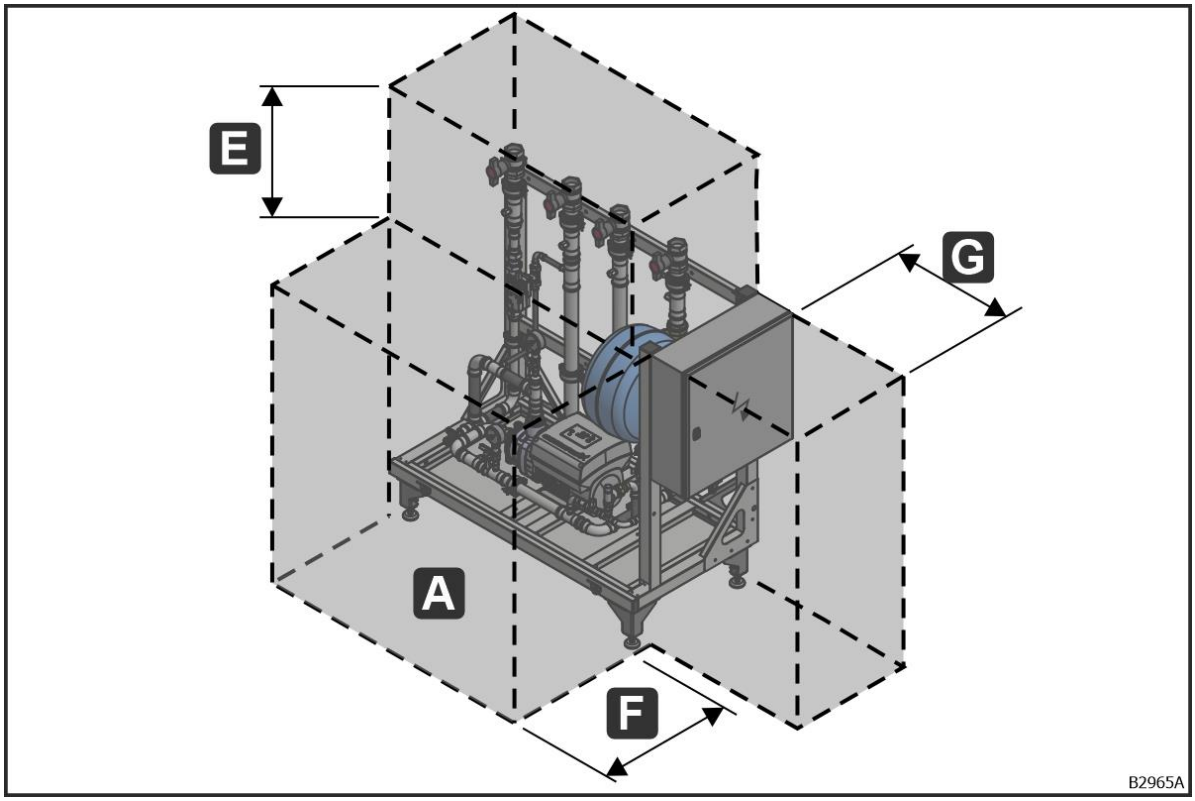


Fig. 3: Footprint requirements of HE-RAC hydraulics on stand

A - revision area; E ≥ 350 mm; F ≥ 500 mm; G - ≥ 650 mm

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

Outdoor air intake directive

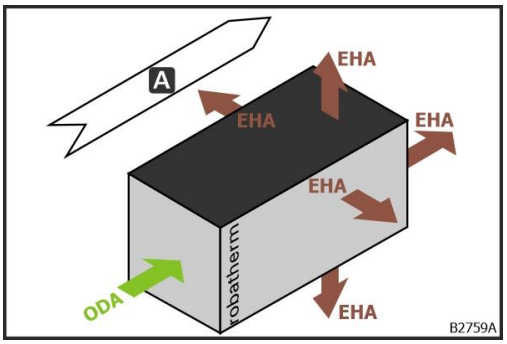
The hygienic requirement according to VDI 6022 and fire and smoke protection requirements according to the federal state ventilation system directive (German: LüAR) must be observed (see directive AHU plant engineering 2018 Section 2.5.2).

Minimum height

- The outdoor air must be drawn in at least 3 m above the ground surface (see the AHU plant engineering directive 2018 chap. 2.5.2).
- The distance of the outdoor air intake to the flat roof level is at least 0.3 m (see the AHU plant engineering directive 2018 chap. 2.5.2).
- A distance of at least 1.5-fold the maximum annual expected snow depth is recommended between the bottom of the outdoor air intake and the ground (see CEN TR 16798-4:2017 chap. 8.8.2).

Use the larger value when planning.

Wind direction



Do not arrange the outside air intake in the main wind direction of evaporation cooling systems/wet cooling towers (see CEN TR 16798-4:2017, section 8.8.2).

If the outdoor air quality is independent of the orientation, the outdoor air intake should be positioned facing the wind (A - main wind direction). This is to avoid short-circuiting the airflows.

Fig. 4: positioning of outdoor air intake

Placement

- The minimum horizontal distance of the outdoor air intake from waste collection points, frequently used parking lots, driveways, sewer vents, chimneys, and similar sources of contamination is 8 m (see CEN TR 16798-4:2017 chap. 8.8.2).
- The outdoor air intake should not be positioned on facades exposed to busy streets. If this cannot be avoided, the outdoor air intake should be located as high as possible (see CEN TR 16798-4:2017 chap. 8.8.2).
- The outdoor air intake must be located at a certain distance from the extract air outlet, depending on the EHA class and volume flow (see CEN TR 16798-4 Figure 1).

Basic requirements

- Distance to the extract air outlet: The extract air outlet must be located at a certain distance from the outdoor air intake, depending on the EHA class and volume flow (see CEN TR 16798-4 Figure 1).
- Location of the extract air outlet in the facade: Different distances apply depending on the specific location (see CEN TR 16798-4:2017 Table 3.).

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.

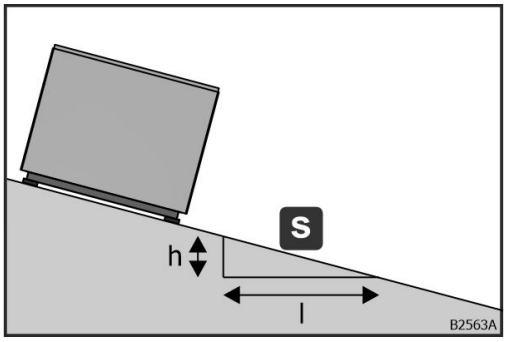
WARNING

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.

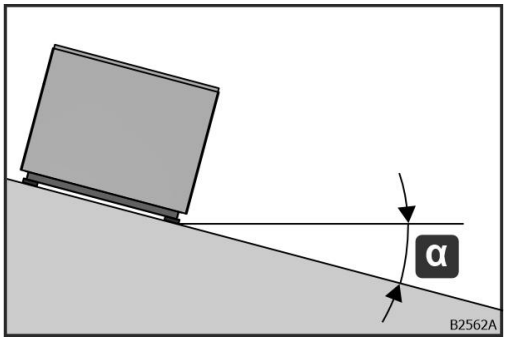
- AHUs must be secured to the foundation.
- If the center of gravity is unfavorable (e.g., height/depth ratio ≥ 2.5), further security measures (e.g., steel structure) must be taken.

AHUs must be installed on a level and stable foundation.



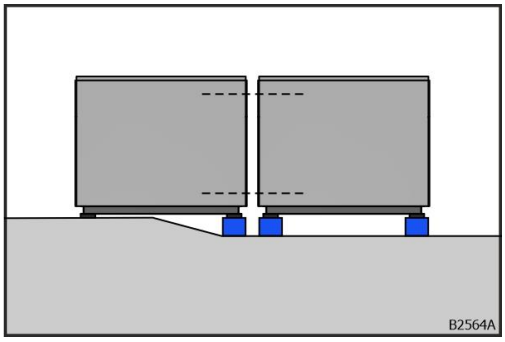
The maximum tolerance to the horizontal is s = 0.5 % (slope).

Fig. 5: Maximum incline



This corresponds to a maximum inclination angle of α = 0.3°.

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 39).
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.

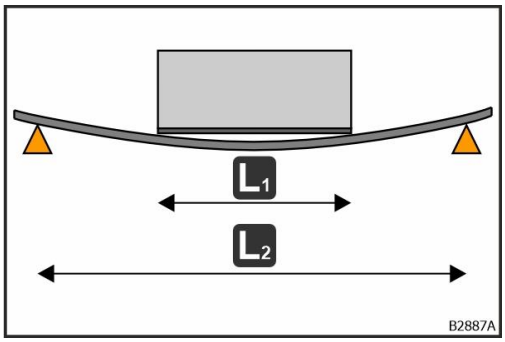


Fig. 8: Deflection of the AHU

The deflection of the AHU at the installation site must not exceed 1/500 in relation to the dimensions of the AHU (L1). 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

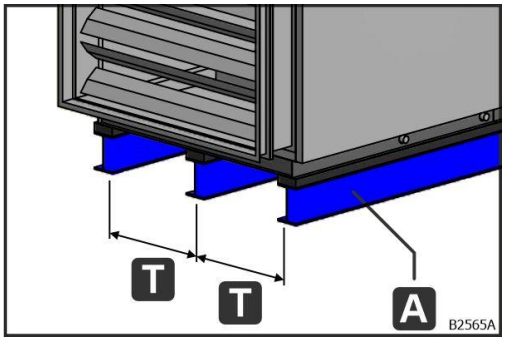


Fig. 9: Longitudinal support

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

Longitudinal support for units on DIN frames

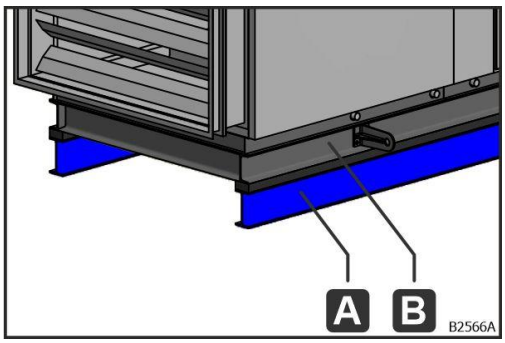


Fig. 10: Longitudinal support for units on DIN frames

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

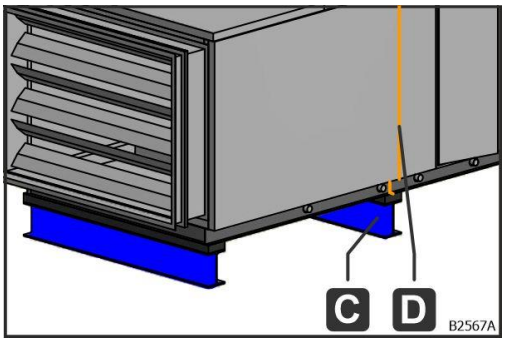


Fig. 11: Width support

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 ≥ 1.5 m (e.g., silencers).

Width support for units on DIN frames

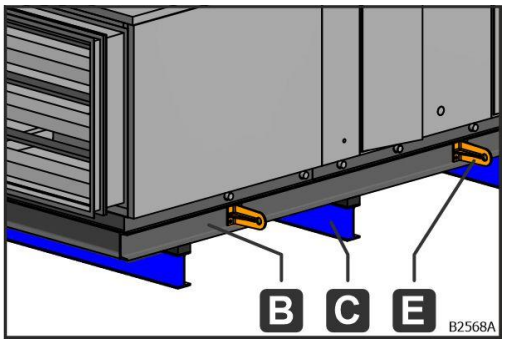


Fig. 12: Width support for units on DIN frames (identification)

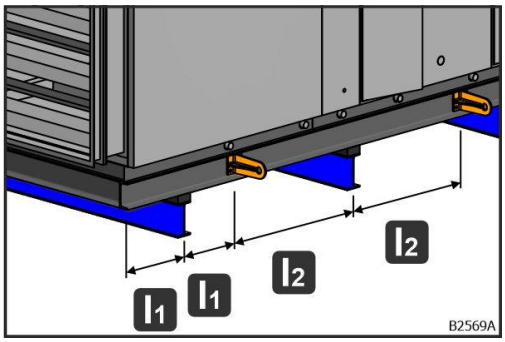


Fig. 13: Width support for units on DIN frames (dimensions)

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) (l1 - l1) and centrally between two transport loops (E) (l2 - l2).

Foundation spots

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

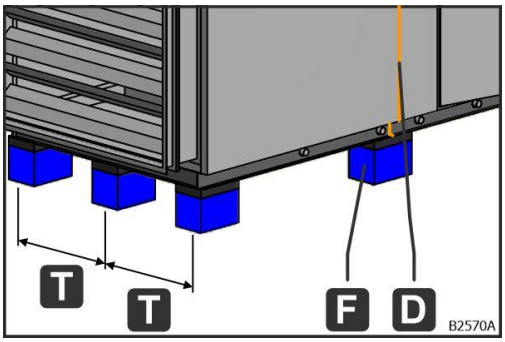


Fig. 14: Foundation spots

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 ≥ 1.5 m (e.g., silencers). The distance (T) of the on-site foundation spots (F) in the width direction must not exceed T ≤ 2.5 m. The maximum load per foundation spot (F) is 500 kg.

Foundation spot for units on DIN frame

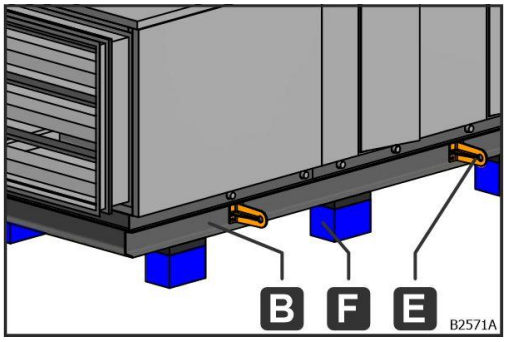


Fig. 15: Foundation spot for units on DIN frame (designations)

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) ($l_2 - l_2$).

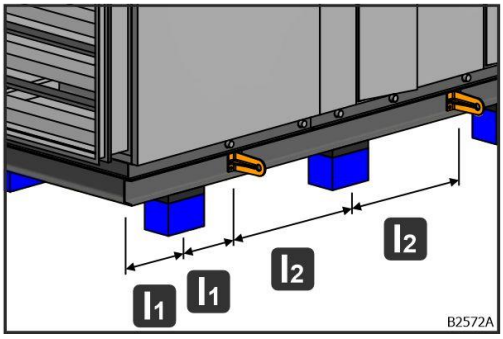


Fig. 16: Foundation spot for units on DIN frame (dimensions)

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.

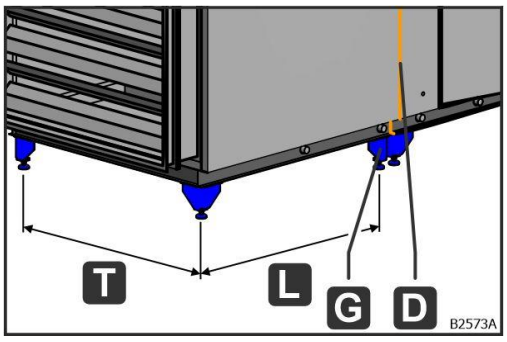


Fig. 17: Unit foot

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 ≤ 2.5 m. The maximum load per unit foot (G) is 500 kg.

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 16). 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).

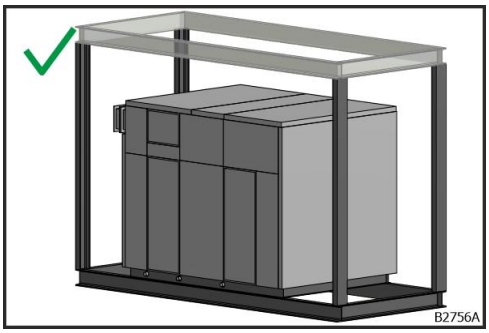


Fig. 18: Example 1

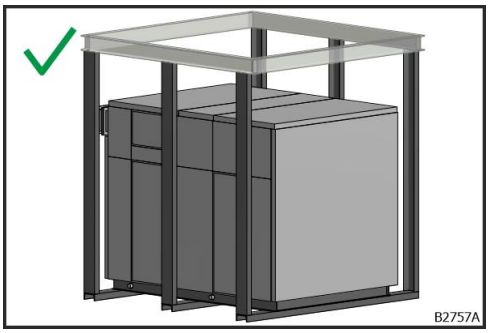


Fig. 19: Example 2

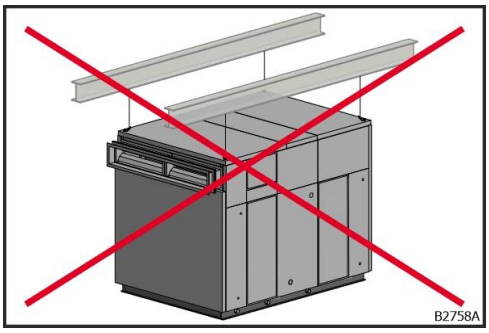


Fig. 20: Incorrect installation

Types of unloading

Individual sections are to be loaded onto the truck in such a way that they can be unloaded depending on the selected unloading method. The following types of unloading are possible:

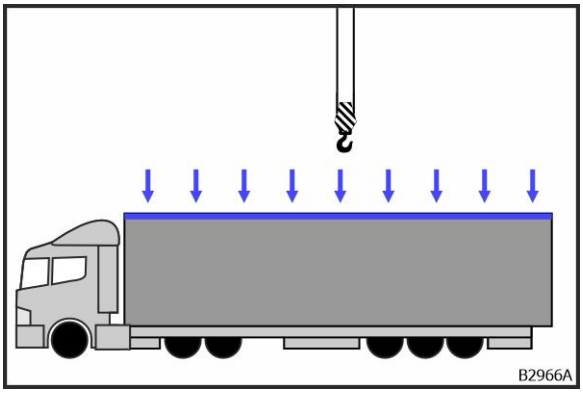


Fig. 21: Crane unloading

- Unloading via the roof by means of transport lugs see chapter "Unloading by means of transport lugs", page 23.

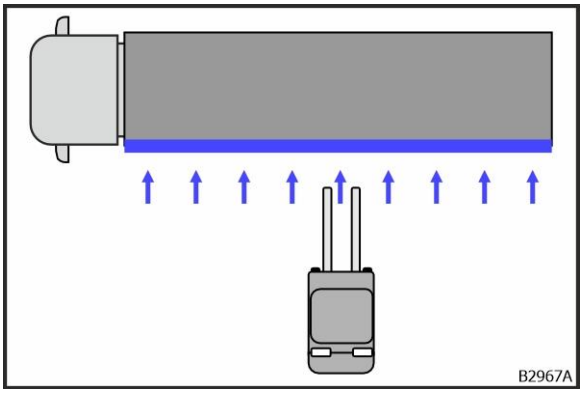


Fig. 22: Forklift unloading from the side

- Unload from the side using base frame or pallet see chapter "Forklift unloading and transport ", page 32.

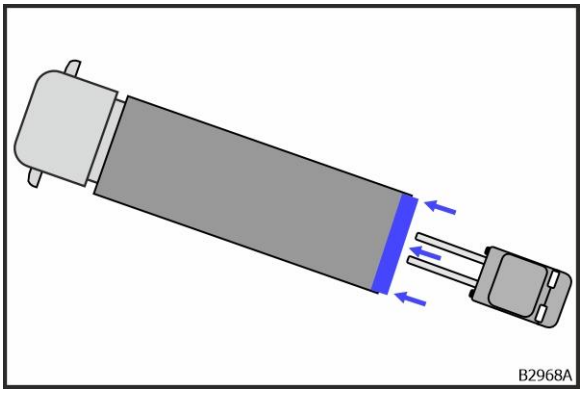


Fig. 23: Forklift unloading from the back

- Unloading via the rear end by means of base frame or pallet .

Units on DIN frame are unloaded by means of transport loops, see chapter "Unloading by means of transport loops", page 25.

Unloading sequence

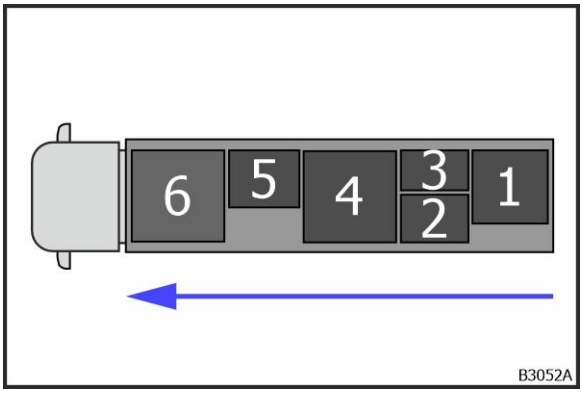


Fig. 24: Unloading sequence

Start unloading the truck from the rear.

Crane unloading and transport

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 and load 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.

WARNING

Danger to life due to loose parts falling over

Removing transport locks from loose parts before final unloading at the installation site poses a risk of fatal injury from falling over.

- When unloading by crane, attach loose parts to the crane first.
- When unloading with the forklift, first secure loose parts against falling over with suitable on-site aids (ropes, supports, ...)
- Then remove transport locks.

NOTE

Material damage due to incorrect transport

All sections are equipped with transport lugs or transport loops. Sections without their own base frame are equipped for transport with disposable pallets. Incorrect transport can cause damage to property.

- Transport the sections in such a way that the base frame/DIN frame or the squared lumber/pallet is always at the bottom and the transport lugs are always at the top.
- Unloading and transport according to these instructions.
- When unloading with a forklift, drive the forks underneath the whole delivery bloc.

Unloading by means of transport lugs

Each section is equipped with four transport lugs. The transport lugs are located in the corners on the roof of the section.

Aids for unloading by means of transport lugs

- 4x shackles for transport lugs with Ø 30 mm
- Other suitable lifting equipment

Craning of sections by means of transport lugs

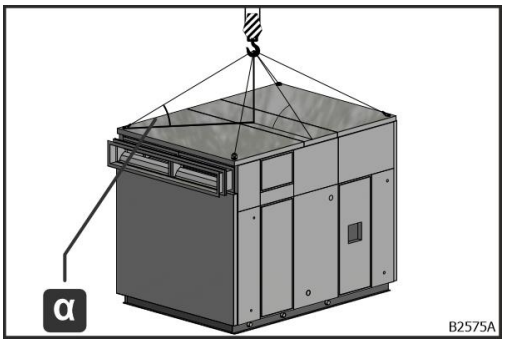


Fig. 25: Cranes with transport lugs

Attach lifting equipment to all transport lugs. The angle of inclination α between the lifting equipment and the load must be between 45° and 55°, otherwise use lifting gear.

Craning of sections with roof rack frames

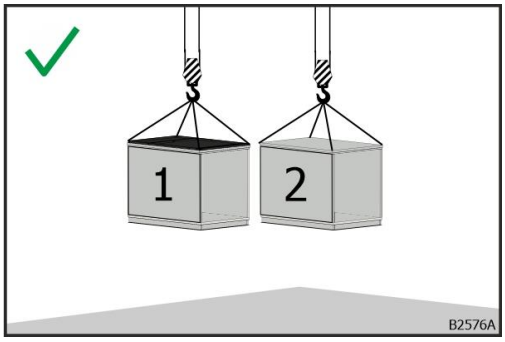


Fig. 26: Craning sections

Always crane sections individually. The upper section (2) must not be connected to the lower section (1) until the lower section (1) is at the final installation site.

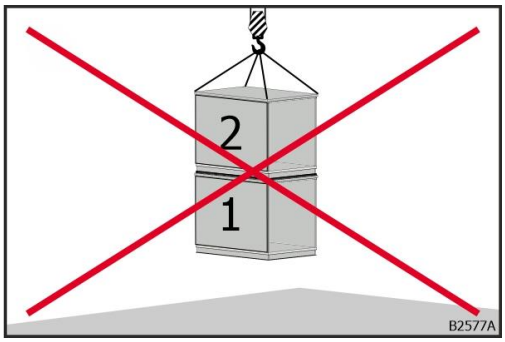


Fig. 27: Incorrect craning of sections

The roof rack frame is not designed to lift the lower section (1) together with the upper section (2).

Unloading by means of transport loops

WARNING

Danger to life due to incorrectly struck load

Due to the inclined position of the unit on DIN frame, the transport loops are not loaded evenly. There is a risk of death due to the failure of transport loops.

- Determine the center of gravity.
- Correct inclined position by changing the rope length.
- For uniform loading, use turnbuckles as lifting equipment.
- Use lifting gear.

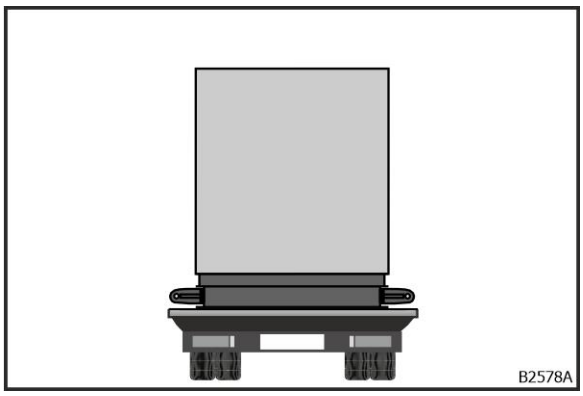


Fig. 28: Unit on DIN frame on a lorry

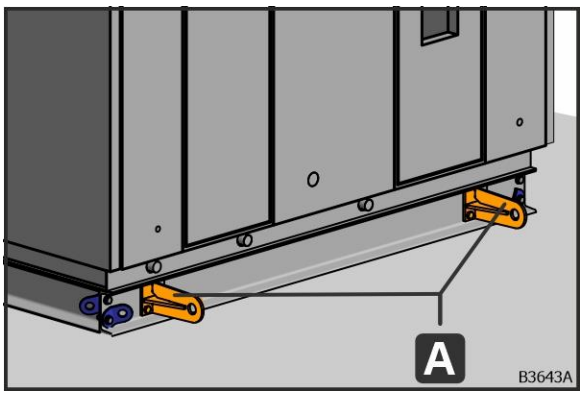


Fig. 29: Transport loops (A)

For AHUs completely mounted on a DIN frame, the transport loops (A) must be used.

The positions of the transport loops (A) on units on DIN frames are designed exclusively for transport and cannot be used for positioning the support structure (support point).

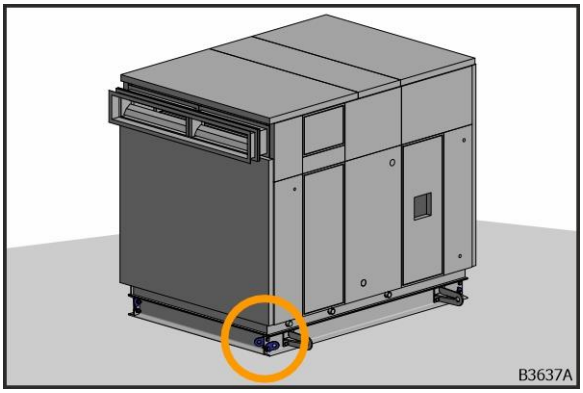


Fig. 30: Corner of the DIN frame

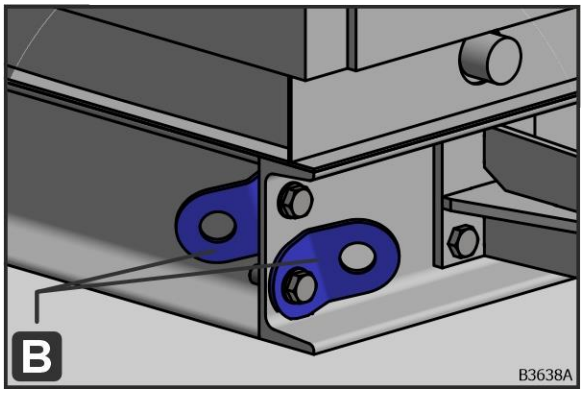


Fig. 31: Transport lugs (B) on the DIN frame

Every corner of the DIN frame is fitted with transport lugs (B). The transport lugs (B) on the DIN frame are only used to attach ropes for positioning.

Auxiliary tools for unloading units on DIN frame by means of transport loops

Traverse requirements

Use traverses with load capacity ≥transport weight. Directly connecting the crane hook to the lifting points is not permitted. Reduce the load capacity by spreading the lifting equipment in accordance with the lifting equipment table.

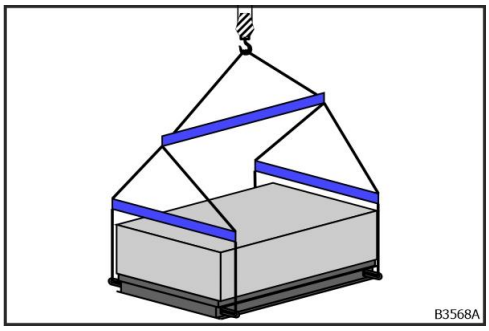


Fig. 32: Example of on-site lifting devices for 4 transport loops

In the case of units on DIN frames, it is absolutely essential that a suitable on site lifting device (e.g. loading gear) is used to ensure even load distribution across all transport loops. The traverses must have a sufficient number of lifting points. All transport loops must be used for the crane procedure. Refer to the technical drawing for the number of transport loops.

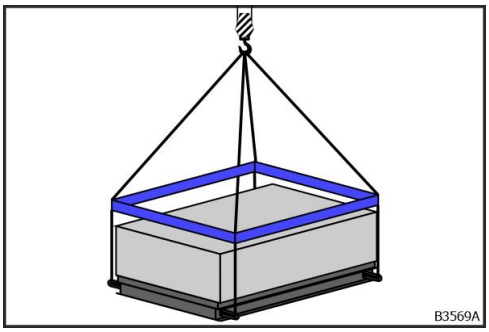


Fig. 33: Example of on-site lifting devices for 4 transport loops

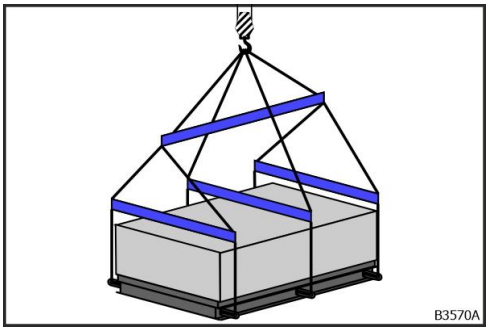


Fig. 34: Example of on-site lifting devices for 6 transport loops

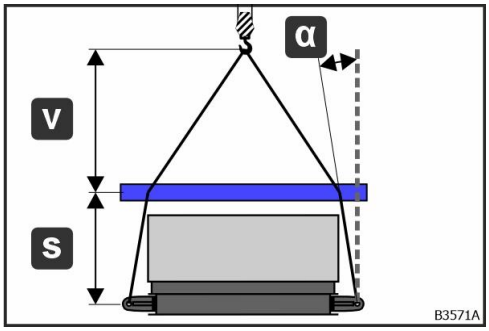


Fig. 35: Selecting the traverses

Use traverses with attachment elements that can be adjusted in width and length.

- Angle α must not be negative (α ≥ 0°).
- Choose a very small distance s.
- Choose a very large distance v.
- v > s

The width and length of the traverses must be right for the distance between the transport loops to prevent oblique pull.

Requirements for other lifting equipment

- Use chains with load tensioners to adjust the chain length.
- Polyester slings are not suitable.

Craning units on DIN frame using transport loops

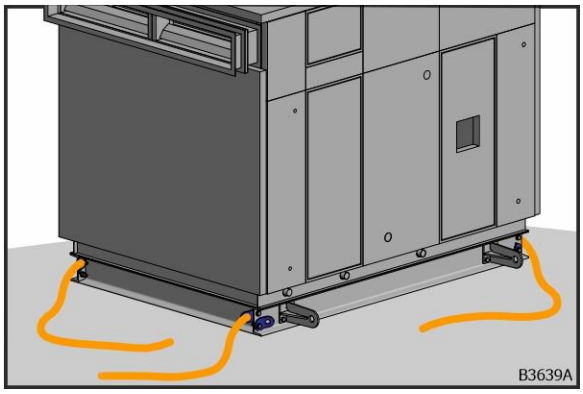


Fig. 36: Guide rope for positioning

1. Before the crane operation, attach guide ropes to each corner of the DIN frame in the transport lugs (B) for positioning.

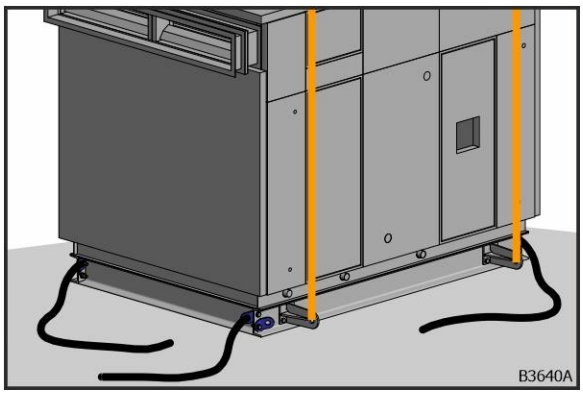


Fig. 37: Attaching the unit on DIN frame to the transport loops

2. Attach the unit on DIN frame to the transport loop (A)see chapter "Auxiliary tools for unloading units on DIN frame by means of transport loops", page 26.

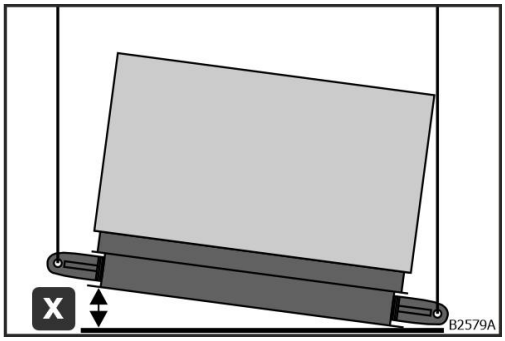


Fig. 38: Inclined position in width direction

The maximum permissible inclined position when craning units on DIN frame in the width direction is x ≤ 5 cm.

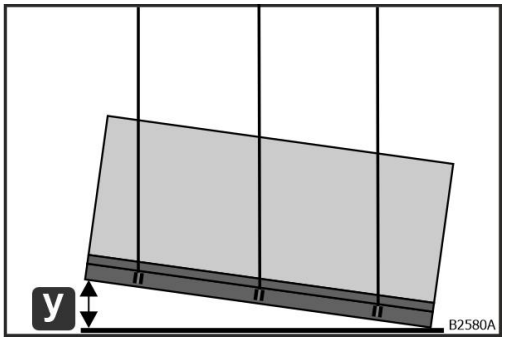


Fig. 39: Inclined position in length direction

The maximum permissible inclined position when craning DIN frame equipment in the length direction is y ≤ 30 cm

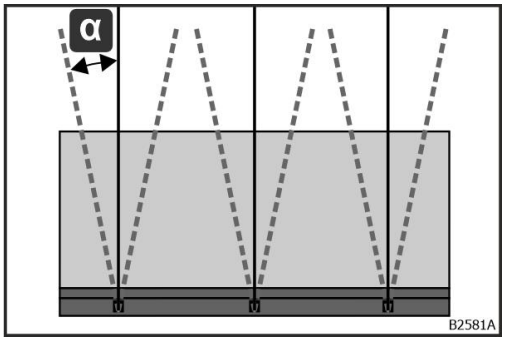


Fig. 40: Oblique pull

The maximum permissible oblique pull for lifting equipment with cranes for units on DIN frames is α ≤ 10°.

Adjust the lifting equipment so that the AHU is craned horizontally to prevent it from tipping over.

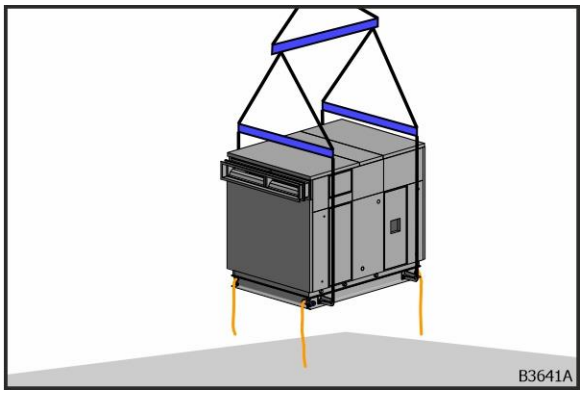


Fig. 41: Unit on DIN frame on the crane

3. Hold the guide rope.

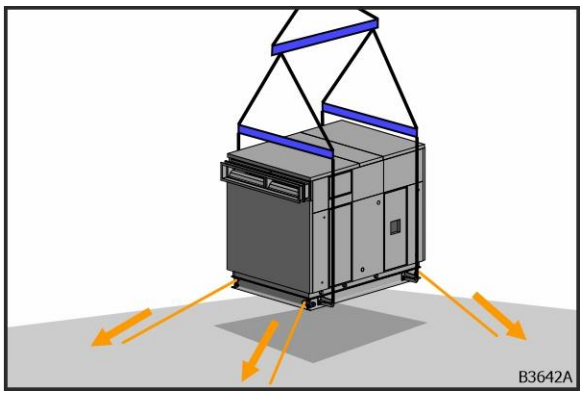


Fig. 42: Positioning using guide ropes

4. Turn and position the unit on DIN frame using the guide ropes.

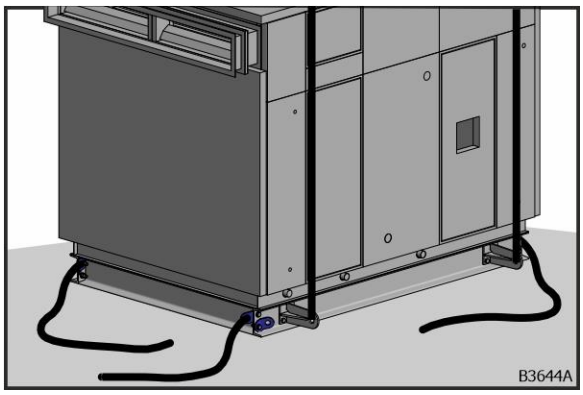


Fig. 43: Unit on DIN frame set down

5. Set down the unit on DIN frame.

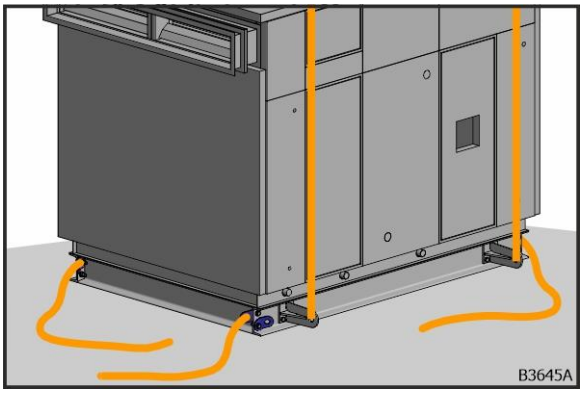


Fig. 44: Guide rope and lifting equipment

6. Remove the guide rope and lifting equipment.

Craning of rotary heat exchangers

To prevent loose rotary heat exchangers from falling over,proceed as follows:

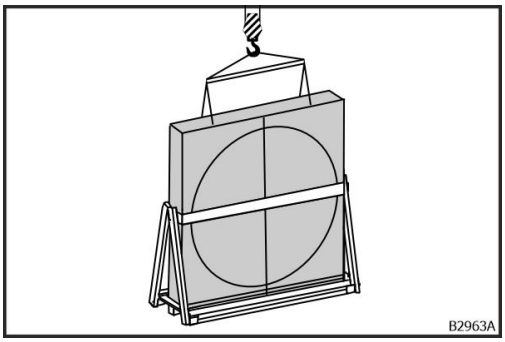


Fig. 45: Attaching the rotary heat exchanger to the crane

1. Attach the rotary heat exchanger to the crane. For slinging on the crane per rotor casing, see attachment "Hoval - Rotary heat exchanger - Instructions for installation, commissioning and scheduled maintenance" chapter "Lifting the exchanger".

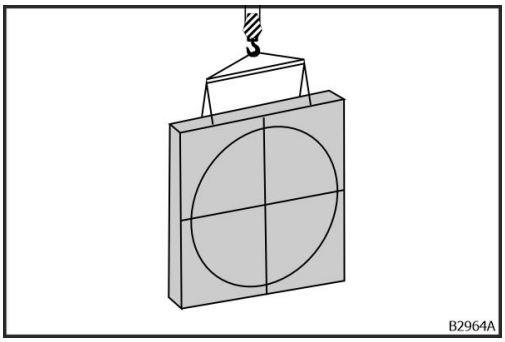


Fig. 46: Removing transport lock

2. Remove the transport lock.

➔ The rotary heat exchanger can be craned safely.

In the case of two-part rotary heat exchangers, the segments of the accumulation mass are supplied in a wooden box.

Craning hydraulics on a skid

NOTE

Material damage when craning hydraulics on a skid

When craning hydraulics on a skid, material damage can occur due to the load suspension and lifting equipment.

- Do not crane hydraulics on a skid.

Forklift unloading and transport

WARNING

Danger to life from falling objects

There is a danger to life from the delivery section falling over during unloading and transport with the forklift due to it having an offset centre of gravity or a narrow footprint.

- 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.
- For delivery sections with a narrow footprint, first secure with suitable auxiliary tools and materials provided on site to prevent falling over (rope, supports, etc.).
- Only unload the delivery section from the base frame or pallet or transport using these.
- If the centre of gravity is off-centre, reposition the forks.
- Lower the delivery section completely.
- Tilt the lifting mast slightly towards the forklift and secure the delivery section at the lifting mast to prevent it from tipping over.
- Observe the forklift safety instructions.

WARNING

Danger to life due to loose parts falling over

Removing transport locks from loose parts before final unloading at the installation site poses a risk of fatal injury from falling over.

- When unloading by crane, attach loose parts to the crane first.
- When unloading with the forklift, first secure loose parts against falling over with suitable on-site aids (ropes, supports, ...)
- Then remove transport locks.

NOTE

Material damage due to incorrect transport

All sections are equipped with transport lugs or transport loops. Sections without their own base frame are equipped for transport with disposable pallets. Incorrect transport can cause damage to property.

- Transport the sections in such a way that the base frame/DIN frame or the squared lumber/pallet is always at the bottom and the transport lugs are always at the top.
- Unloading and transport according to these instructions.
- When unloading with a forklift, drive the forks underneath the whole delivery bloc.

General remarks about forklift unloading

Delivery sections with base frames are equipped with wood beams for transport to allow the forks of the industrial truck to pass underneath.

Delivery sections without a base frame are equipped with disposable pallets for transport.

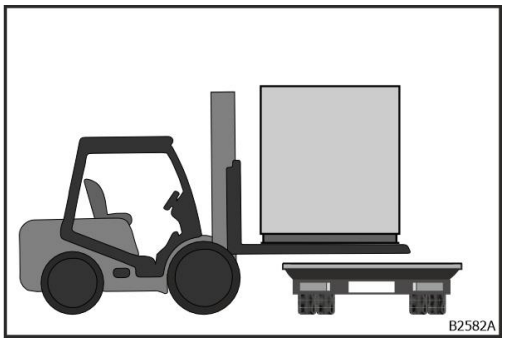


Fig. 47: Unloading with forklift

Drive the section completely underneath to avoid damage to the casing. The forks of the forklift may only engage the base frame or the pallet.

Forklift unloading of hydraulics on a skid

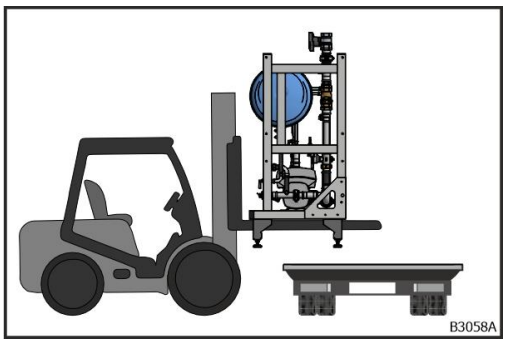


Fig. 48: Unloading hydraulics on a skid with the forklift

Fully retract hydraulics on a skid to avoid damage. The forks of the forklift may only engage the lower rack or the pallet.

Packaging and storage

Sections are packed in foil for transport. This packaging does not meet the requirements for storing the sections outdoors. The storage location must meet the requirements for the installation site for indoor units (see chapter "Installation site requirements", page 7).

If the sections are stored for an extended period, the instructions "Disabling and disposal" from chapter "Disabling" apply.

Unit assembly

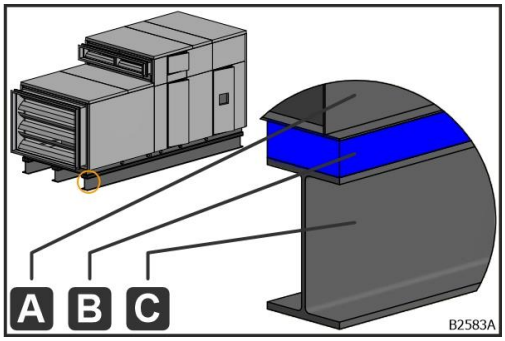
Sound reduction

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.

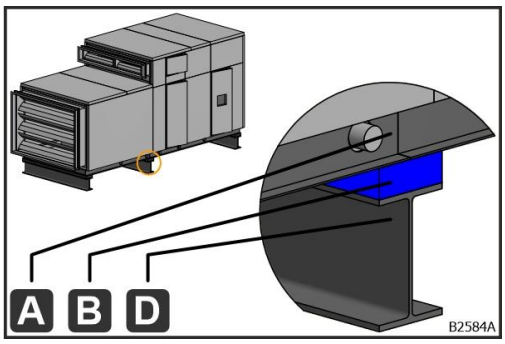
Installation on longitudinal supports



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

Fig. 49: Longitudinal support

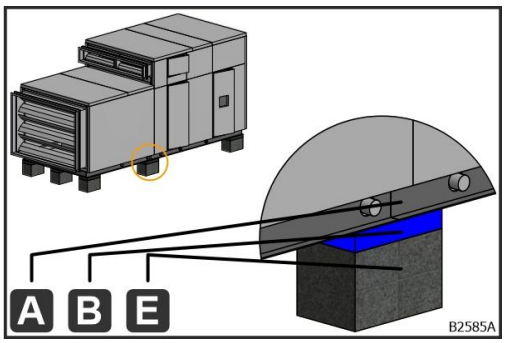
Installation on width support



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

Fig. 50: Width support

Installation on foundation spot



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

Fig. 51: Foundation spots

Fastening to on-site beams

Longitudinal support fastening

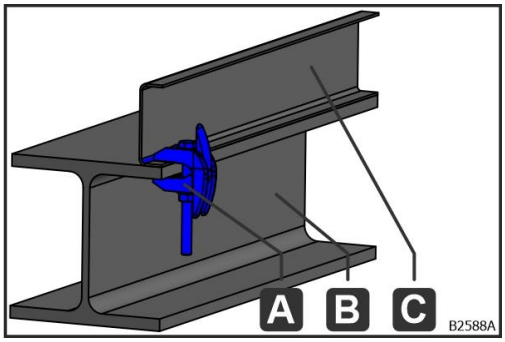


Fig. 52: Mounting with beam clamp F9 (A)

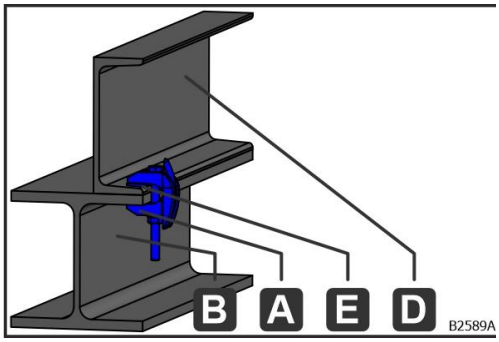


Fig. 53: Fastening with DIN 434 wedge washer (E)

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

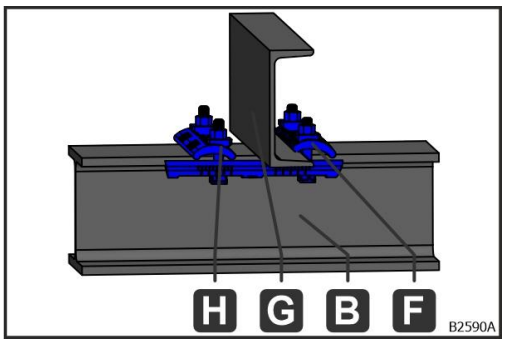


Fig. 54: Fastening with beam clamp FC (F)

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.

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

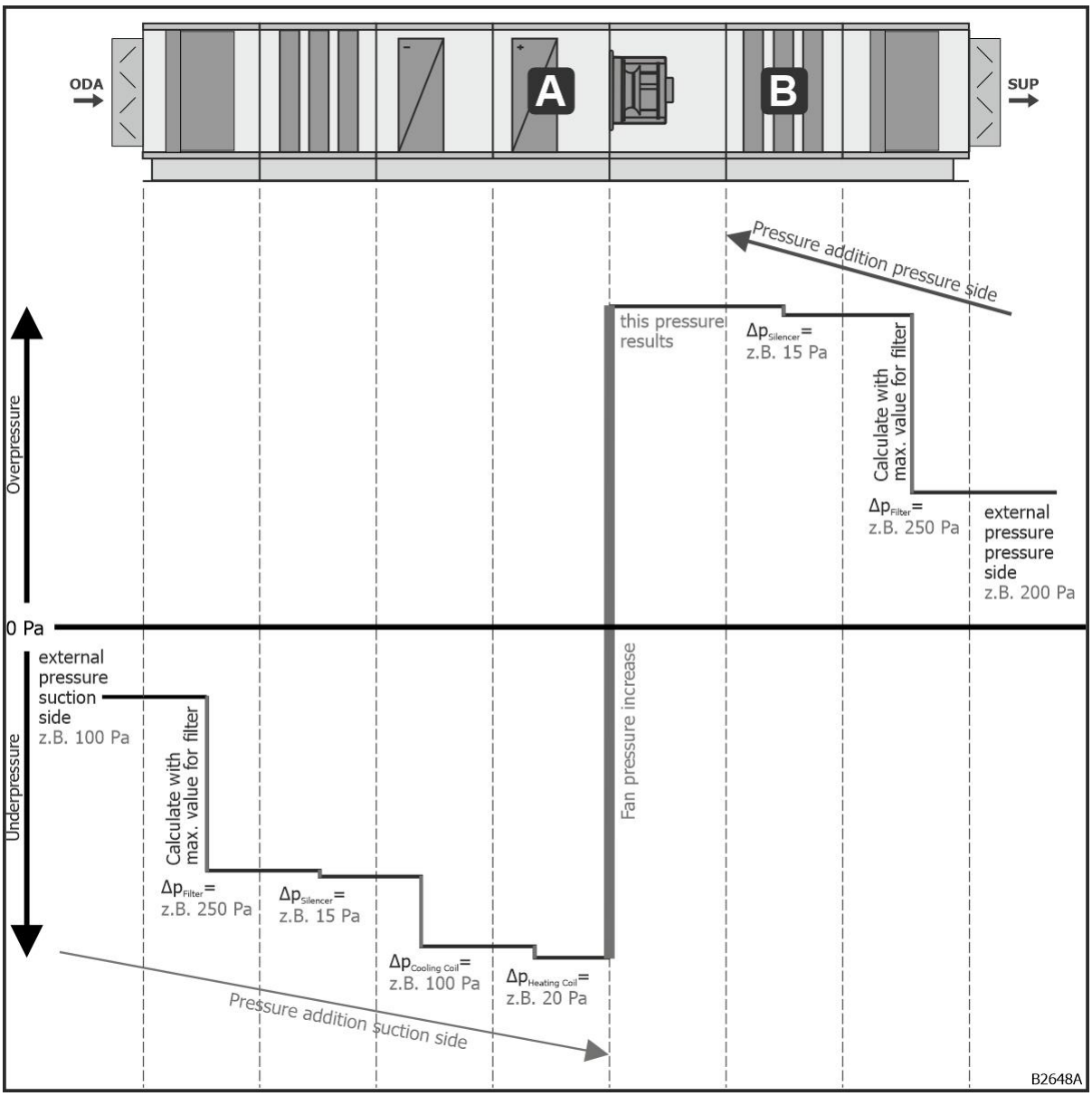


Fig. 55: Pressure curve in the AHU

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.

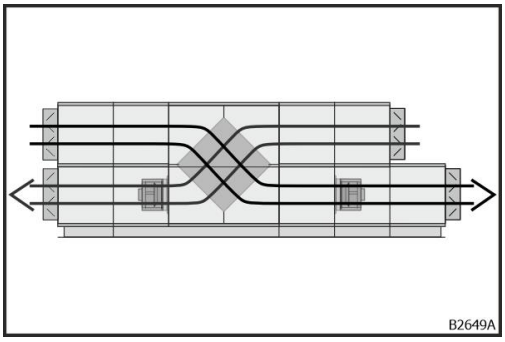


Fig. 56: Airflows in the combine unit

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

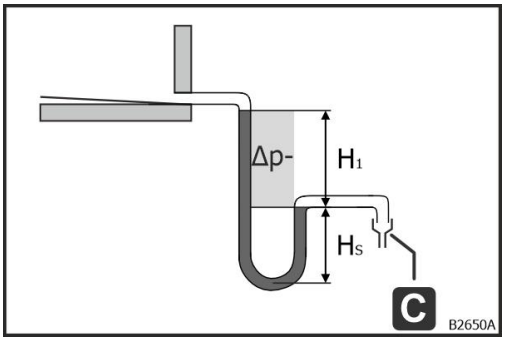
Sample calculation for heating coil (A)
This pressure and the associated siphon height apply only to the heating coil (A).
Always use the final pressure loss to calculate the filter pressure loss.

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. 57: 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 [mm] = p [Pa] / 10
H_S [mm] = p [Pa] x 0.075

p [Pa] Maximum internal pressure on the intake side of the respective component
H [mm] = H1 + HS

(Sample calculation for heating coil (A) p_1 = -485 Pa)
H [mm] = H_1 + H_S = p [Pa] / 10 + p [Pa] x 0.075
H = 485/10 + 485x0.075 = 85 [mm]

Overpressure siphon

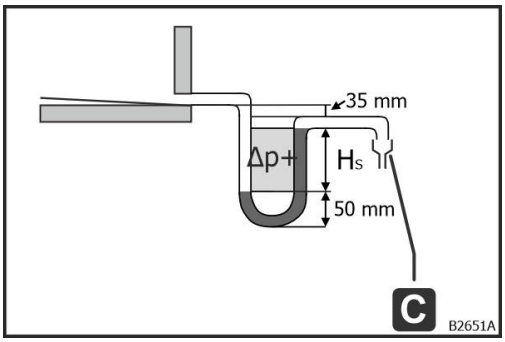
Pressure calculation, discharge side

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_2=	+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. 58: 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 [mm] = p [Pa] / 10

p [Pa] Maximum internal pressure on the discharge side of the respective component
H [mm] = 35 mm + H_S + 50 mm

(Sample calculation for silencer (B) p_2 = +465 Pa)
H = 35 + H_S + 50= 35 + 465/10 + 50 = 131 [mm]

Connecting several pan drains

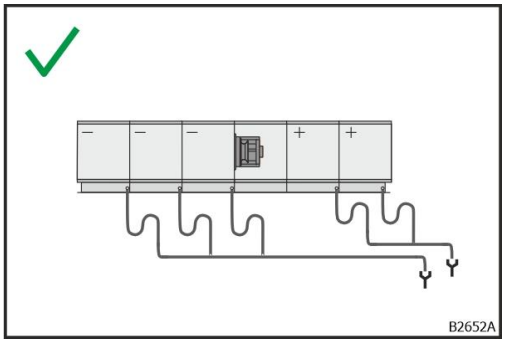


Fig. 59: Connecting several pan drains

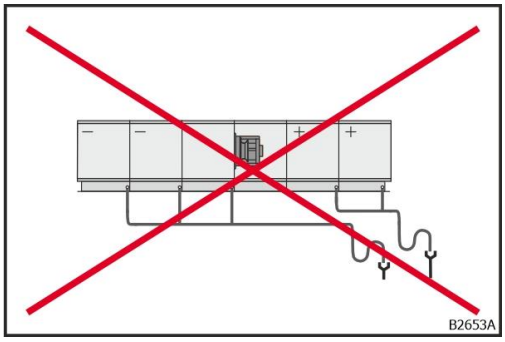


Fig. 60: Wrong connection

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.

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

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 48or see chapter "Determining the maximum permissible filling quantity of refrigerant with a refrigerant sensor", page 50.

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 48 or see chapter "Determining the maximum permissible filling quantity of refrigerant with a refrigerant sensor", page 50.

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.

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 47.

Determining the minimum required volume flow of the AHU

The minimum required volume flow [m³/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 3: 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 4: 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 48.
- see chapter "Determining the maximum permissible filling quantity of refrigerant with a refrigerant sensor", page 50.

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

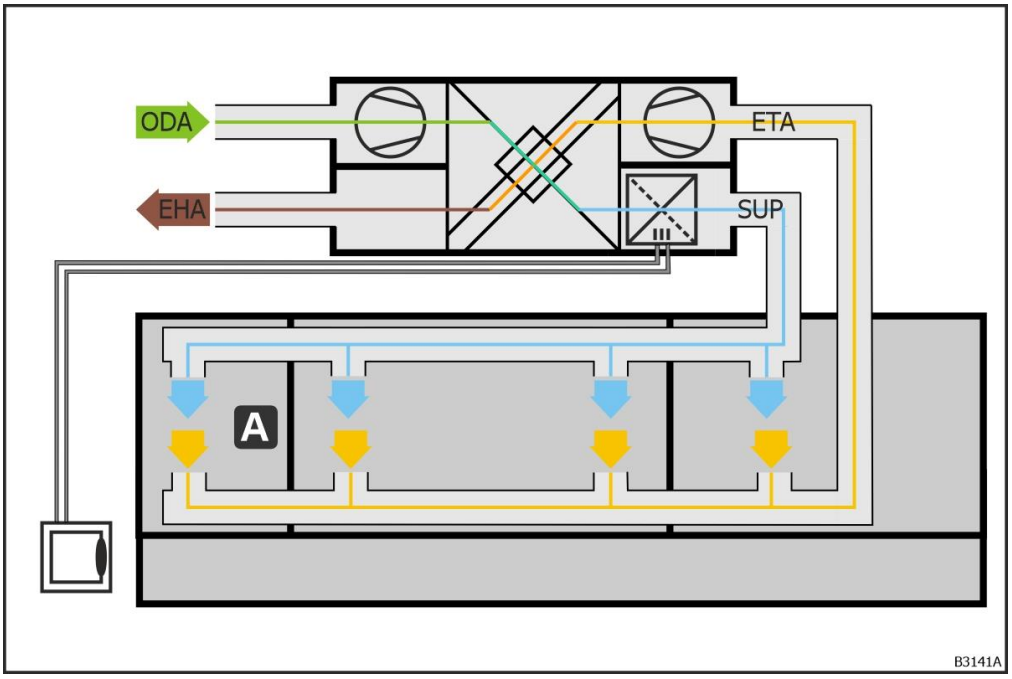


Fig. 61: AHU with split outdoor unit and ventilated spaces without a refrigerant sensor

A – smallest ventilated room

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

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

With LFL = lower explosion limit of R32 [kg/m³]

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

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 5: Air outlet height h_o

And with A = area of the smallest ventilated room [m²]

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:

	Size of the smallest ventilated room A [m²]			
m_{max} [kg]	$h_o = 0.6$ [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 6: 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 7: 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.

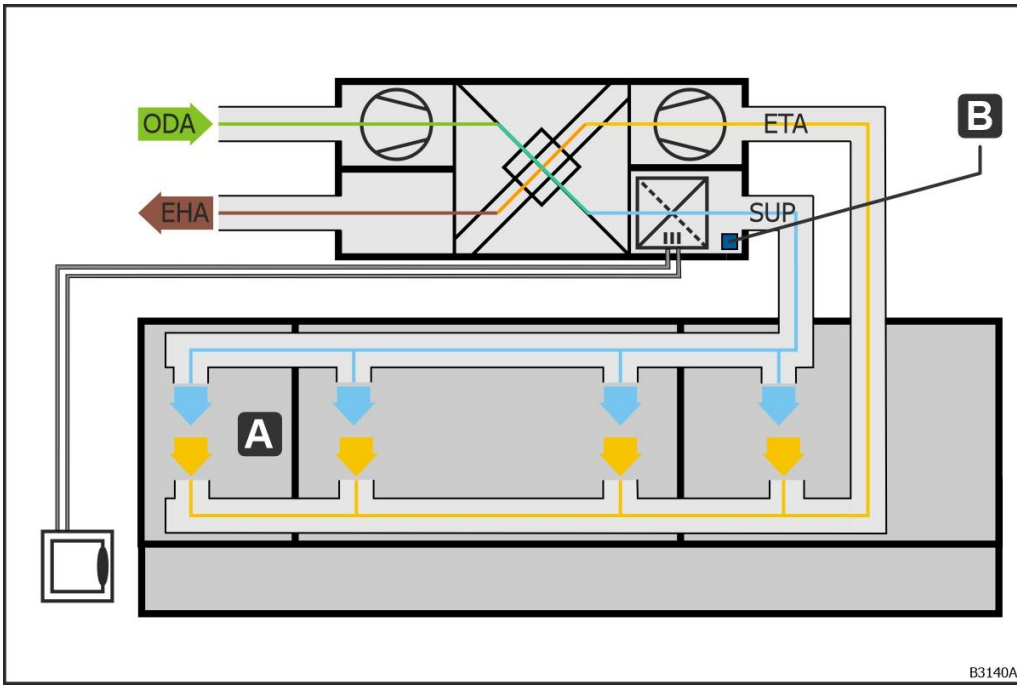


Fig. 62: AHU with split outdoor unit and ventilate rooms with refrigerant sensor
A – smallest ventilated room
B – refrigerant sensor

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/m³]

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

With H = room height [m] ≤ 2.2 [m]

And with TA = total ventilated room space [m²] 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 [m²] if

- airflow controls are not actuated.

Examples of a room height $H = 2.2\ [\mathrm{m}]$:

m_{max} [kg]	TA [m²]
2.0	6
2.8	9
4.0	12
6.3	17
6.8	21

Table 8: 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 9: Filling quantities for each Mitsubishi electric split outdoor unit for pipework distance of < 30 m

Directory

List of figures

Keyword index

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