

# KA

## Modular air handling units

Installation, operation and maintenance manual



## CONTENT

<b>1.</b>	<b>GENERAL INFORMATION .....</b>	<b>3</b>
1.1	Information about manufacturer.....	3
1.2	Unit naming .....	3
1.3	General description .....	4
1.4	Declarations regarding the air handling unit.....	5
1.5	Dangers and warnings.....	6
1.6	Symbols.....	7
1.7	Personnel requirements, assignments and responsibilities .....	8
1.8	Operation and control.....	9
1.9	Annexes, responsibility and intended use.....	9
<b>2.</b>	<b>INSTALLATION .....</b>	<b>11</b>
2.1	Loading and transport.....	11
2.2	Mounting.....	13
2.3	Assembly.....	16
2.3.1	Joining of unit modules .....	16
2.3.2	Mounting of roof .....	18
2.3.3	Connection of ducting .....	19
2.3.4	Connection of piping .....	20
2.3.5	Connection of syphons .....	23
2.3.6	Connection of electrical installation.....	27
2.3.7	Vibration and structure-borne noise .....	27
<b>3.</b>	<b>COMMISSIONING AND MAINTENANCE .....</b>	<b>28</b>
3.1	General instructions .....	28
3.2	Schedule for control and maintenance .....	29
3.3	Fan.....	30
3.3.1	Electric motor connection and frequency converter set-up.....	30
3.3.2	Connection of EC fan .....	32
3.4	Filter .....	35
3.4.1	Bag or cassette filter .....	36
3.4.2	Dirty side removable cassette filter.....	37
3.4.3	Metal filter.....	38
3.4.4	Active charcoal filter.....	39
3.4.5	Absolute filter .....	40
3.5	Heat recovery units .....	41
3.5.1	Plate heat exchanger.....	41
3.5.2	Rotary heat exchanger.....	42
3.5.3	Run around coil.....	43
3.6	Control damper .....	44
3.7	Heating and cooling coils .....	45
3.7.1	Frost protection .....	45
3.7.2	Water heating coil .....	46
3.7.3	Water cooling coil.....	47
3.7.4	Direct expansion (DX) .....	48
3.7.5	Droplet eliminator .....	50
3.7.6	Steam heating coil .....	51
3.7.7	Electric air heater .....	53
3.7.8	Indirect gas heating coil.....	54
3.8	Sound attenuator.....	57
3.9	Humidifiers.....	57
3.9.1	Steam humidifier.....	57
3.9.2	Honeycomb humidifier.....	58
3.9.3	High pressure humidifier.....	62
3.10	Electric control cabinet .....	63
<b>4.</b>	<b>REMOVAL AND DISPOSAL.....</b>	<b>63</b>

## 1. GENERAL INFORMATION

### 1.1 Information about manufacturer

These instructions apply to all KA air handling units supplied by Systemair d.o.o., Slovenia.

#### Manufacturer and supplier details:

##### Systemair d.o.o.

Špelina ulica 2

2000 Maribor

Slovenija

**Responsible person:** Anton Zupančič

#### Service and technical support:

##### Systemair d.o.o.

Brnčičeva 41c

1000 LJUBLJANA

Slovenija

tel: + 386 1 200 73 81

fax: + 386 1 423 33 46

e-mail: servis@systemair.si

### 1.2 Unit naming

The meanings of the different elements of the KA air handling unit code are provided in the following schematic.

## KA HSI-2-2-S-R-50F-TB2-L2

	<b>Air leakage class</b>	<b>L2</b>	
	<b>Thermal break class</b>	<b>TB2</b> <b>TB3</b>	
	<b>Panel execution</b>	<b>50F</b> <b>50P</b>	50 mm fully glued 50 mm partially glued
	<b>Service side</b>	<b>L</b> <b>R</b> <b>T</b> <b>B</b>	Left Right Top Bottom
	<b>Design</b>	<b>S</b> <b>E</b> <b>I</b> <b>D</b> <b>P</b> <b>C</b>	Supply Extract In-line Double stage Parallel Stacked
	<b>Cross section</b>		Width-Hight
	<b>Installation</b>	<b>I</b> <b>O</b>	Indoor Outdoor
	<b>Execution</b>	<b>S</b> <b>H</b> <b>P</b>	Standard Hygienic Corrosion resistant
	<b>Profile type</b>	<b>H</b>	THOR 50 mm profile
	<b>Product name</b>		

### 1.3 General description

KA air handling units are modular devices that may be manufactured for a number of combinations of different cross section dimensions, functional unit assemblies, material combinations, sizes and types of control. Depending on the particular version, KA air handling units are designed for comfort ventilation, clean room ventilation, indoor pool ventilation, ventilation of industrial premises, and areas with an explosive atmosphere.

The variety of available dimensions, shapes and constructions of KA air handling units allows them to be installed indoors on the floor, on a platform, or below the ceiling; they may also be installed outdoors.

The casing of an air handling unit of the normal or hygienic type consists of a thermally insulated and sound-insulated aluminium frame, thermally insulated and sound-insulated sheet covers at the bottom, top and sides, a door on the service side, and a steel base frame to which legs can be fitted if so required. The thickness of the air handling unit casing wall is 50 mm.

#### Comfort units

With a normal type of air handling unit, all the interior and exterior casing walls are made of ZM-coated galvanised steel sheet as the standard. The whole bottom of the unit is sealed on the inside between the frame and panels. The fastening material is of galvanized steel quality.

#### Hygienic units

As a standard, the front and back walls and the ceiling are made of painted steel sheet, while the bottom, guide rails and all partition walls are made of 1.4301 stainless steel sheet. All the joints between the frame and panels are sealed in the inside with clean-room-grade putty. The fastening material is of A2 or Ruspert quality.

#### Casing technical properties according to EN 1886

Mechanical stability	D1
Thermal transmittance factor	T2
Thermal bridge factor	TB2 or TB3
Casing air leakage class (+700 Pa)	L2
Casing air leakage class (-400 Pa)	L2
Filter bypass leakage class	F9





#### Casing sound attenuation

Casing with fully glued panels:

Hz	125	250	500	1000	2000	4000	8000
De dB	15	12	16	13	27	32	41

## 1.4 Declarations regarding the air handling unit


DECLARATION OF CONFORMITY	DECLARATION OF INCORPORATION
The declaration of conformity is issued for the device supplied together with the control system and for which manufacturer also makes first commissioning.	The declaration of incorporation is issued for a device supplied without a control system. <b>The declaration of conformity for this device must be issued by the company which assigned the device and put it into operation.</b>
	



### Caution

The declaration of conformity or the declaration of incorporation shall be attached separately to each device.

If the customer makes changes or adds components to the device, he must issue a new EC declaration of conformity and a new CE sign for the machine.

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Tel: +386 1 200 73 50, Fax: +386 1 4233 346  
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**ES IZJAVA O SKLADNOSTI - primer**  
**CE DECLARATION OF CONFORMITY - example**

Proizvajalec / Manufacturer  
**SYSTEMAIR d.o.o.**  
Špelina ulica 2, SI-2000 MARIBOR

Proizvod: / Product:  
**KLIMATSKA NAPRAVA / AIR HANDLING UNIT**

TIP – MODEL: / TYPE:  
.....

Tovarniška številka: / Manufacturers number:  
.....

Ustrezno zahtevam naslednjih predpisov:  
Is in conformity with the provisions of the following regulations:

Direktiva Evropske skupnosti o varnosti strojev 2006/42/EC  
Machinery Directive 2006/42/EC 05/16/EC

Direktiva Evropske skupnosti o nizki napetosti 2014/35/EU  
Low Voltage Directive 2014/35/EU


Direktiva Evropske skupnosti o elektromagnetni združljivosti 2014/30/EU  
EMC Directive 2014/30/EC

in izpolnjuje zahteve naslednjih standardov:  
and comply with the requirements of the following standards:

SIST EN ISO 12100:2011, SIST EN 60335-2-40 : 2003, SIST EN ISO 13857: 2008,  
SIST EN 1037 : 1999+A1:2008, SIST EN 60034-1 : 2010, SIST EN 14121: 2009


Izjava o skladnosti velja le za popoje, za katere je klimatska naprava dobavljena in vgrajena v objekti skladno s priloženimi navodili za vgradnjo. Zavezanec ne velja za komponente, ki so dodane in za aktivnosti, ki so na napravi izvedene naknadno.  
The declaration applies only for the conditions it was delivered in and included in the leaflet in accordance with the included installation instructions. The insurance does not cover components that are added or actions carried out subsequently.

Leto, ko je bil CE znak nameščen na proizvod:  
Year of affixing of CE mark:  
Ljubljana, 05.08.2016

 *Direktor*  
*Tone Zupančič*

SYSTEMAIR d.o.o., Špelina ulica 2, SI-2000 MARIBOR  
Davčna številka: SI80763812, Matična številka: 1683420,  
Transakcijski račun: NLB 02045-0014890467 IBAN SI56020450014890467 SWIFT: LJBSIZXX

Example of declaration of conformity

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Tel: +386 1 200 73 50, Fax: +386 1 4233 346  
Email: [info@systemair.si](mailto:info@systemair.si), [www.systemair.si](http://www.systemair.si)

**ES IZJAVA O VGRADNJI - primer**  
**CE DECLARATION OF INCORPORATION - example**

Proizvajalec / Manufacturer  
**SYSTEMAIR d.o.o.**  
Špelina ulica 2, SI-2000 MARIBOR

Proizvod: / Product:  
**KLIMATSKA NAPRAVA / AIR HANDLING UNIT**

TIP – MODEL: / TYPE:  
.....

Tovarniška številka: / Manufacturers number:  
.....

Ustrezno zahtevam naslednjih predpisov:  
Is in conformity with the provisions of the following regulations:

Direktiva Evropske skupnosti o varnosti strojev 2006/42/EC  
Machinery Directive 2006/42/EC 05/16/EC

Direktiva Evropske skupnosti o nizki napetosti 2014/35/EU  
Low Voltage Directive 2014/35/EU


Direktiva Evropske skupnosti o elektromagnetni združljivosti 2014/30/EU  
EMC Directive 2014/30/EC

in izpolnjuje zahteve naslednjih standardov:  
and comply with the requirements of the following standards:

SIST EN ISO 12100:2011, SIST EN ISO 13857: 2008, SIST EN 60034-1 : 2010

Proizvod ni kompleten in ne sme biti dan v delovanje, dokler proizvod, v katerega se ga bo vgradilo, ne bo deklariran skladno s določbami direktiv.  
The product is incomplete and must not be put in to service until the product into which it is to be incorporated has been declared in conformity with the provisions of the Directives.

Ljubljana, 06.02.2017

 *Direktor*  
*Tone Zupančič*

SYSTEMAIR d.o.o., Špelina ulica 2, SI-2000 MARIBOR  
Davčna številka: SI80763812, Matična številka: 1683420,  
Transakcijski račun: NLB 02045-0014890467 IBAN SI56020450014890467 SWIFT: LJBSIZXX

Example of declaration of incorporation



## 1.5 Dangers and warnings

- The intended use, operational conditions, inlet and outlet parameters, composition of the functions, dimensions, shape, place of installation, dimensions of shipment units, method of transport and handling at the place of installation, as well as the control system variant and other specifications, are determined and confirmed at the time of placing the order.
- A KA air handling unit may only be installed, inspected, commissioned and maintained by qualified professionals, and such professionals must observe both the statutorily prescribed and local safety and other legal regulations in force at the time of the installation, operation and maintenance of the unit.
- In the process of installing, commissioning and maintaining the KA air handling unit, the functional elements of the manufacturer's instructions must be followed.
- Prior to any intervention in the unit, the entire unit must be isolated from the power supply by means of the main switch on the electric control cabinet.
- Upon the completion of work on or inside the unit, the unit must be cleaned and restored to the condition prior to the intervention.
- The instructions, electric diagrams and other data must be kept accessible to the personnel operating the unit.
- The air handling unit may only be used for the intended use and under the operating conditions determined in the confirmation of the order according to which the unit was manufactured.



### Caution

Any other use deviating from the so-determined intended use relieves the manufacturer of any obligation or liability.

- Systemair d.o.o, the manufacturer of the KA air handling unit, does not accept any liability in the event the directions indicated in these instructions are not adhered to while installing, commissioning, operating, testing or maintaining the air handling unit, or in the event of any alterations to the unit's electrical or mechanical elements by any person without the manufacturer's consent, unless such alterations have been explicitly allowed by the manufacturer. Any unauthorised intervention in the unit will also result in the warranty being void.
- The KA air handling unit manufacturer, Systemair d.o.o., does not accept liability for any damage suffered by persons or property as a direct or indirect consequence of non-compliance with the provisions of these instructions, or non-compliance with the safety at work regulations or other legal regulations in force.
- The KA air handling unit manufacturer, Systemair d.o.o., reserves the right to modify these instructions without prior notice or this giving rise to any obligation.




### Caution










It is highly advisable that the commissioning of the unit is done after all construction and cleaning of the construction site is finished.  
Commissioning of the unit before this might result in the filters, unit and duct system being affected by dust.

## 1.6 Symbols

### Functional section symbols

	fan section		frost protection section
	compressor section		heat exchanger section with glycol heat exchanger – heating section
	heating coil section – water		heat exchanger section with glycol heat exchanger – cooling section
	heating coil section – steam		heat recovery section with plate heat exchanger
	heating coil section – electric		heat recovery section with rotary heat exchanger
	heating coil section – gas		heat recovery section with heat pipe exchanger
	condenser section		silencer
	heating / cooling circuit		empty section
	spray humidifier section		electric cabinet
	steam humidifier section with steam generator		cooling coil section with water cooler
	steam humidifier section with system prepared steam		cooling coil section with direct gas expansion
	contact humidifier with recirculation water		droplet eliminator
	contact humidifier with direct water		Filter section
	damper		

## Danger and warning symbols

	Warning – danger of injury due to rotating parts		The frost protection cover must be freely removable - pay attention to the pipe installation!
	Warning – danger of contact with live electric components		Safety chain on the inside of the door. Return the chain to the safety position before closing!
	Warning – hot surfaces		Non-compliance with the instructions indicated in the warning signs may result in risk of injury and property damage.
	Opening doors during operation prohibited		Connection of electrical connectors.
	Turn off the main switch prior to opening the casing		

## 1.7 Personnel requirements, assignments and responsibilities

QUALIFICATION	DECLARATION OF INCORPORATION
<b>Truck driver</b>	Responsible for transporting the device from the factory to the system owner. Must have a truck driving test. Makes sure that all elements are fixed and properly supported during transportation. Is responsible for any damage done prior to unloading of the cargo.
<b>Forklift driver</b>	Responsible for moving pallets with modules. Must have a forklift driving test and written permission from the system owner.
<b>Crane driver</b>	Responsible for moving pallets and modules from the transport vehicle and to the place of operation. Must have a crane driving test, be mentally and physically able to operate the crane independently and prove to the system owner the required type of skill.
<b>HVAC technician</b>	Is responsible for the installation and completion of all professional work in connection with mechanical installations. Must have in-depth knowledge and skills related to the required mechanical systems. Must have experience with the work in question, understand the potential hazards associated with the work and how to avoid it.
<b>Electrician technician</b>	Is responsible for the installation and completion of all professional work in connection with electrical installations. Must have in-depth knowledge and skills related to the required hardware systems. Must have experience with the work in question, understand the potential hazards associated with the work and how to avoid it.
<b>Network administrator</b>	Designs, installs, configures and maintains IT infrastructure in companies or organizations.



## 1.8 Operation and control

The unit shall be furnished for fully automatic operation. The modifications of parameters via the hand-held terminal buttons and screen must be limited in the control system. An alternative may be a controller linked to a central monitoring system that enables the selection of parameters via a PC, tablet or smart phone.

Different implementations of the control system are available:

- Air handling units manufactured in the factory without a control system. The complete control system is to be implemented by the customer; the customer is also responsible for commissioning the unit, providing the control system operation and maintenance instructions, training the operating personnel, issuing the declaration of conformity for the entire unit, and affixing the CE label on the device.
- Air handling units manufactured in the factory, including the integration and wiring of some of the control system elements, such as control damper drives, frequency converters, service switches, interior lighting, etc. The complete control system is to be implemented by the customer; the customer is also responsible for commissioning the unit, providing the control system operation and maintenance instructions, training the operating personnel, issuing the declaration of conformity for the entire unit, and affixing the CE label on the device.
- Air handling units manufactured in the factory, including the implementation of the control system either in the factory or on the site of installation, including the commissioning, training of operating personnel, and issuing the control system operating and maintenance instructions. The manufacturer issues the declaration of conformity for the entire unit and provides the CE label for the device.

## 1.9 Annexes, responsibility and intended use

### Drawings, diagrams, instructions for use, maintenance and repairs

The dimensions, shape and technical data of the unit are made separately for each device. They are printed on paper and delivered to the customer upon delivery of the device in a separate envelope or sent electronically by email.

#### Following instructions and documents are constituent parts of the unit:

- User manual (transport, installation, commissioning and maintenance, security warnings),
- Data from the selection program – confirmed by the customer when ordering,
- Position of the component in the device – taped on each supplied section.

#### Supplied with delivery:

- Declaration of conformity or declaration of incorporation,
- Additional drawings for assembly of added elements,
- Instructions for use of the built-in functional components (which are not described in these instructions),
- Unpacking instructions,
- List of enclosed non-installed equipment,
- Quality protocol.

#### Supplied with delivery if a unit with a control system is ordered:

- Electrical plan of the built-in electrical control cabinet,
- Instructions for use of the built-in controller or control system,
- Control test,
- Electric control cabinet protocol.

### The responsibility of the operator for the operation, control and maintenance of the unit

Upon the commissioning and acceptance of the operating unit from the installer, the unit operates fully automatically. The operating indications and error indications are displayed via the control system display and signal lights on the electric control cabinet, or on the separate hand-held terminal. As an alternative, the controller may be linked to a central monitoring system and new parameters can be set via a PC, tablet or smart phone. Operators do not need to open the service doors in order to operate the unit.

### Intended use and application options

- KA air handling units are designed to transport and treat air in a temperature range from -20 °C to +80 °C.
- At altitudes up to 1,000 m above sea level, the normal operating range of the fans and their electric motors is up to +40 °C.
- Units for **comfort** ventilation (KA HS ...) of premises such as offices, classrooms, hotels, shops, apartments and similar locations where a high level of comfort is required.
- **Hygienic**-type air handling units (KA HH ...) for the ventilation of clean rooms such as operating theatres and similar premises in health care facilities, rooms in the pharmaceutical industry and the electronics manufacturing industry, and other rooms with similar requirements.
- **Explosion-proof** air handling unit versions (KA HS ... **Ex** or KA HH ... **Ex**) for the ventilation of rooms with an explosive atmosphere. In case of such unit, separate additional guidelines are added.
- **Indoor** air handling unit versions (KA HSI ... ; KA HHI ...) for installation indoors – on the floor, on a platform or under the ceiling.
- **Outdoor** air handling unit versions (KA HSO ... ; KA HHO ...) for installation outdoors.

### Uses other than the intended use



#### Caution

In the event the unit needs to operate at temperatures exceeding +40 °C or at altitudes exceeding 1000 m above sea level, such must be specified in the order. Similarly, any other conditions deviating from the conditions of intended use must also be specified in the order.

- At altitudes above 1000 m above sea level and at temperatures in the range from +40 °C to +60 °C, a reduction in the electric motor capacity should be taken into account, in accordance with the instructions of the motor manufacturer.
- In cases where the air temperature exceeds +60 °C, special versions of the fans and its electric motors should be applied.
- When so requested, air handling units suitable for air temperatures up to +100 °C are also available.
- Indoor versions of air handling units designed for indoor installation cannot be installed outdoors.
- Standard and hygienic air handling unit versions cannot be used in environments requiring corrosion protection levels exceeding those provided by the materials specified as standard and determined in accordance with the minimum requirements of the relevant standards, or by the materials and solutions specified by the customer at the time of ordering the unit.
- Explosion-proof versions of air handling units may not be used in such environments and for such purposes that do not correspond to the explosion-protection level specified on the unit nameplate. In case of such unit, separate additional guidelines are added.
- The unit's inside-outside pressure differential may not exceed 2000 Pa.
- Prior to commissioning the unit, all the ducts must be installed and all the guards and protection devices must be in place to prevent access to the rotating parts of the fans.
- During operation, all the service doors must be closed and locked.
- Do not operate the unit without installing filters.
- Do not operate the unit when external dampers are in closed position.

## 2. INSTALLATION

### 2.1 Loading and transport

Air handling units may be delivered as a single compact package (shipment unit) or in several compact packages (shipment units) to be assembled on site. They are delivered on transport pallets or on base frames. Loading, unloading and moving shipment units on site may be carried out with a forklift or a crane, by applying appropriate hoisting slings.

Individual compact packages (shipment units) or the parts thereof must be protected so as to prevent damage thereto during unloading or transport due to tipping over, sliding or uncontrolled drops from the transport vehicle, and to prevent threats to the safety and health of exposed persons.

On site, individual compact packages or assemblies of the air handling unit should be moved to the mounting site with all the necessary guards and protection devices (stabilisers along diagonals, wooden supports or transport pallets under the base frame, protection foils, etc.).



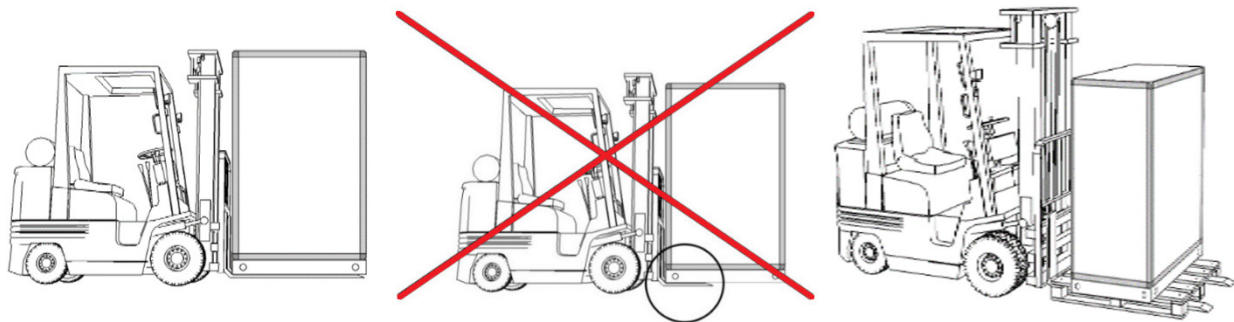
#### Caution

Movement of the equipment during transport can only be carried out via the bottom base frame and transport pallet, without applying any pressure on the casing.

#### Unloading and moving with a forklift

The forklift forks must be long enough to avoid damage to the bottom surface of the shipment unit and to prevent the shipment unit from falling off the forks. In the case of shipment units with base frames, the forks must extend from the front side to the back side of the frame section.

In the case of shipment units without base frames but mounted on transport pallets, the forks must extend long enough beyond the unit's centre of gravity to prevent the risk of the unit falling off the forks.



#### Unloading and hoisting with a crane

A compact shipment unit of an air handling unit may only be hoisted with a crane applying a base frame or a transport pallet positioned under the unit.

Appropriate hoisting beams with sufficient distance between the hoisting points should be used so as to prevent the hoisting slings from damaging the casing, the gutter or the handles, hinges, piping connections or other accessories (pressure gauges, pressure transducers, etc.) on the service side, or the electric control cabinet.

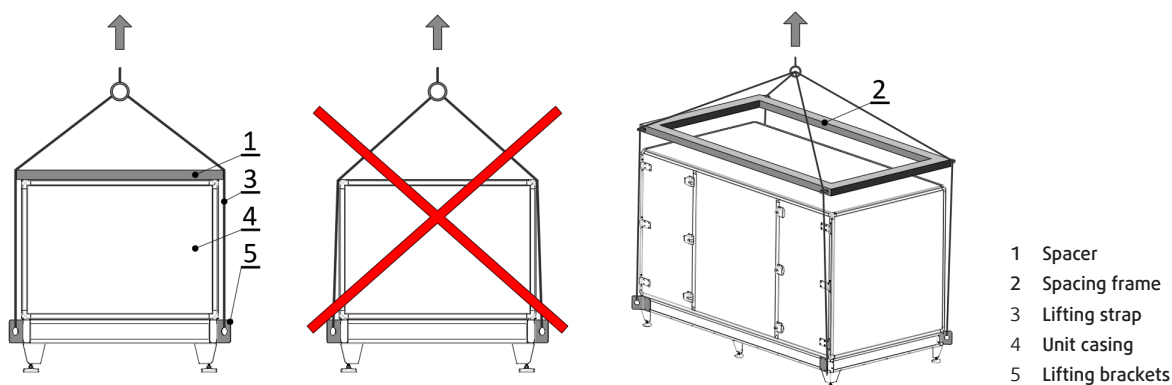
### Delivery units with base frame

Lifting brackets are provided for lifting on the base frame of each individual unit. For lifting, use suitable lifting straps and use brackets with sufficient lifting grip spacing or use spacer supports long enough to ensure that the straps do not press against the casing of the delivered unit.



#### Caution

The lifting brackets are only removed when the units are in place, just before joining. In the event of relocation, the brackets must be reassembled.



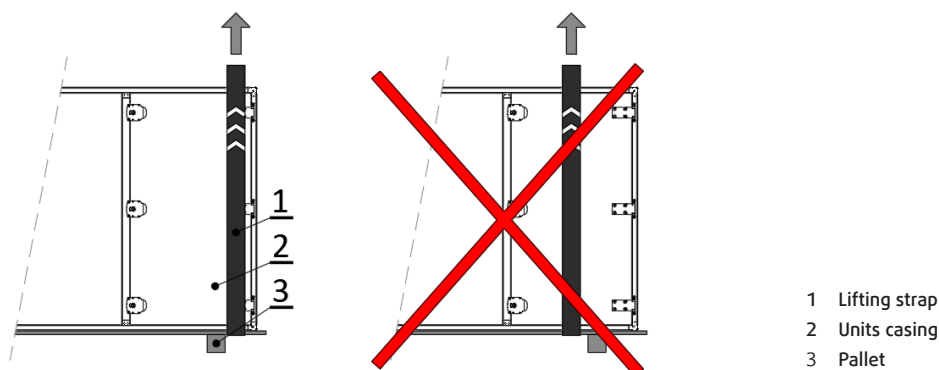
### Delivery of units without a base frame

Apply appropriate lifting stripes and lifting beams with sufficient distance between the hoisting points or adequate spacer supports in order to prevent the stripes from pressing against the shipment unit casing.



#### Caution

Place the lifting straps under the pallet on the outside of the support and secure them against slipping off the pallet.



### High and short shipment units

Some shipment units, e.g. a section with a rotary heat exchanger, a heat exchanger, etc., may be of significant height with very small length. Extra attention should be devoted to preventing such shipment units from tipping over. In the factory, such shipment units are protected so as to prevent the risk of their tipping over during transport and storage and endangering exposed persons.



#### Caution

High and short shipment units must be protected against tipping over. They may only be transported in the vertical position!

## Storage before installation

Until installation, air handling units must be stored indoors, in dry areas, or be protected against the elements or other damage in some other appropriate manner. Remove the plastic foil wrapping and cover the equipment with a waterproof canvas or similar cover, and ensure adequate clearance between the cover and the equipment casing. This is necessary to facilitate sufficient air circulation in order to avoid air humidity condensation and the consequent corrosion of the external surfaces.



### Caution

Until connecting the equipment to the ducting, protect the air inlet and outlet openings against the ingress of dust or other pollutants.

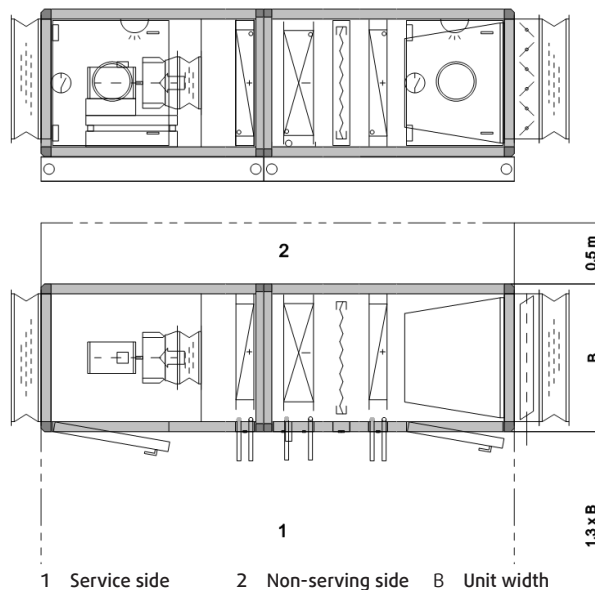
The allowable storage temperature ranges from  $-25^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ .

## 2.2 Mounting

### Clear the space in front of and above the unit

In placing the equipment on the site, provide a clear area in front of the air handling unit in order to enable servicing, control and, when necessary, the drawing out and replacement of fans and heat exchangers; the width of the area should at least equal the external width of the air handling unit. In any event, the width of the clear area in front of air handling unit must not be less than 900 mm. In the event the electric control cabinet is positioned on top of the air handling unit, a free space at least 700 mm in height must be provided between the unit's top edge and the ceiling of the room in order to enable safe access to the cabinet.

In order to facilitate the assembly and joining of shipment units, a clear space of at least 500 mm in width is also recommended at the back side of the unit.



### Caution

Where not practicable, the method of joining shipment units must be specified in the order.

The access to shipment unit joining points from the inside the unit casing must be specified.

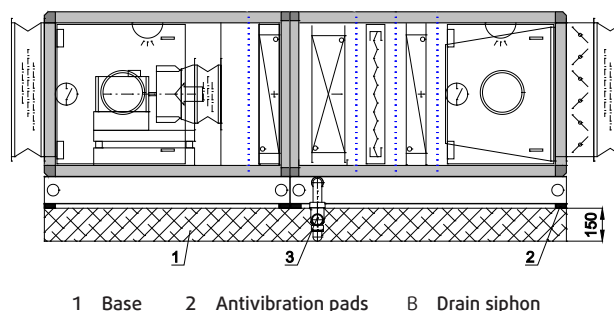
### The foundation for the unit

The supporting surface must be flat, horizontal, free of vibrations and capable of supporting the load created by the air handling unit. The weight of the entire air handling unit and its individual shipment units are listed in the technical documentation accompanying the equipment. Air ducts must be sound insulated and may not be fixed directly on concrete beams, structural timberwork or other critical structural elements.

In the event of mounting on elevated support platforms, means for safe access and servicing must be provided.

In the case of acoustically demanding buildings, the foundation slab should be isolated from the rest of the building structure by means of structural noise insulation of appropriate thickness, depending on the air handling unit mass and excitation frequency, as well as the insulation material's natural frequency.

In the case of units that include a spray humidifier section, all the other sections should be mounted on a special steel base or provided an appropriate foundation.





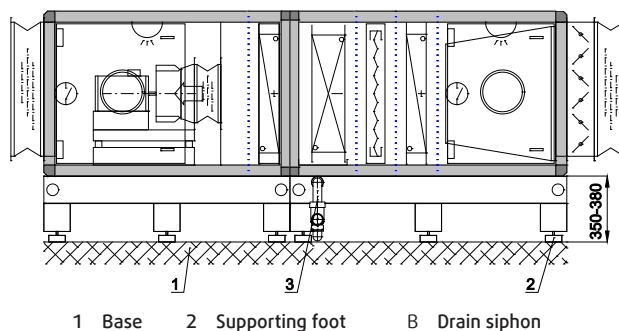
### Caution

The minimum foundation height is determined by the elevation of the drain syphon for the sections (namely 150 mm).

### Mounting of unit without a foundation

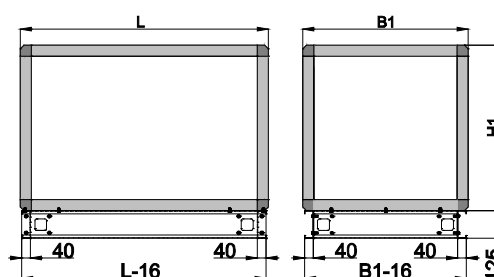
The foundation may be substituted by purpose-built legs with a level-adjustment screw system with an adjustment range of 30 mm.

Due to siphon installation, there is also possibility of 250 mm base frame when feet or foundation is not an option.



### Base frame

The base frame is always fixed to the bottom of the air handling unit in the factory. The frame construction depends on the version and size of the air handling unit. The dimensions and construction are furnished to the customer at the time of delivery in printed form in a separate envelope or in electronic form by e-mail. Standard frame height is 125 mm, optional 250 mm.



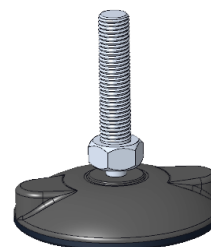
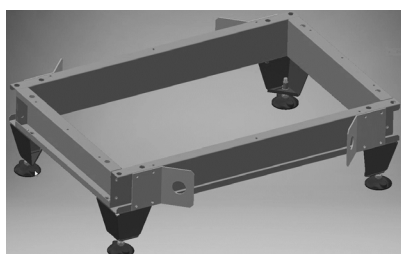
### Supporting legs and adjustable feet



### Caution

Supporting legs with adjustable feet are not designed for pulling or pushing of device across the ground. All movements require lifting. Before installing and connecting the unit, the transport screws must be removed and replaced with a adjustable feet.

Supporting legs are made of galvanized sheet metal and already mounted on the supporting frame. To protect the adjustable feet, a transport screw M12 x 30 mm is mounted on the feet during transport. The screw on the adjustable feet is adjustable in the range of 30 mm.



### Mounting of an outdoor-type unit

Mount the air handling unit on a foundation of adequate height. In determining the foundation height, observe all the factors that may affect the operation of the unit: the mounting site, the depth of snow cover, requirements for the intake air quality, the position of the intake and extract duct connections, the types of connectors for heat exchanger piping, the laying of electric cables, etc.



**Caution**

The foundation height for an outdoor unit should not be less than 500 mm.

Design the foundation so as to protect the unit or sections thereof against sliding or tipping over under wind loads. To this end, carry out a check of wind forces.

Upon joining and interconnecting individual compact units, affix the roof elements onto the air handling unit top according to the equipment design documents, and ensure that the joints are sealed against water. In the event the roof elements have been affixed in the factory, mounting on site is not necessary; however, sealing the joints against water is necessary in this case as well.

Also ensure sealing against water at all the vertical joints of compact shipment units.

The joints between the intake and extract air ducting connections and the ducts must be watertight. In the case intake air into and extract air out of the air handling unit run through ducts, the joints between the duct connections and the ducts must be watertight, as well.

For air handling units installed on the roof or at an elevation, provide safe access with a platform if necessary. The platform in front of the unit service side or around the unit should be constructed so as to avoid the build-up of snow in front of the intake air opening in winter, which might lead to excessive snow ingress into the unit.

The platform must ensure safe climbing to and descending from the unit and safe maintenance.

## 2.3 Assembly

### 2.3.1 Joining of unit modules

- Deliver the shipment unit to a location as close as possible to the mounting location. With a manual forklift, hoist the shipment unit so as to align its bottom with the foundation's top surface.
- Slide the shipment unit into its position on the foundation, using stripes or some other appropriate method. You may need to apply heavy or extra-heavy furniture hauling trolleys.

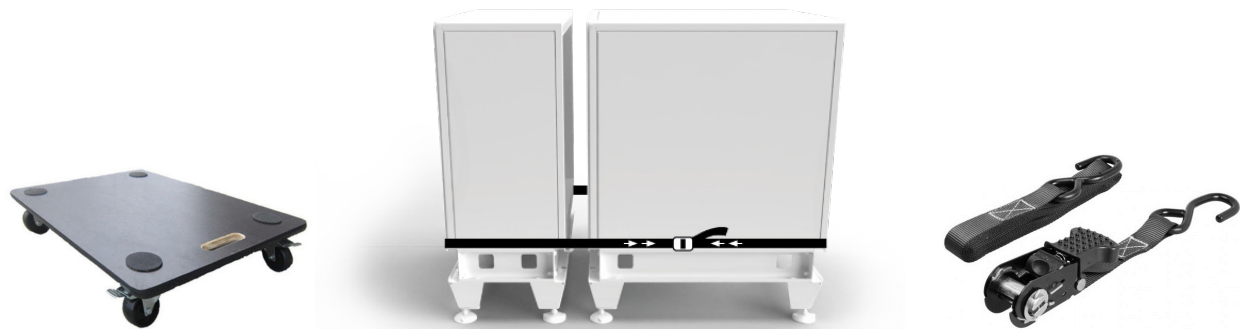


#### Caution

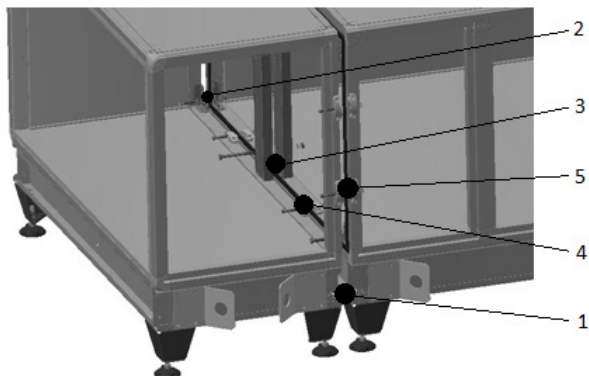
Fastening connections are not intended for pulling of modules together. Pulling is done by means of slings.

Tightening is required on the bottom of the unit near base frame or bottom profiles.

- Apply sealing tape on the shipment unit's joining surfaces (connecting profiles). Slide and press the shipment units together by means of slings. We recommend slings with brackets, applied so as to prevent damage to the casings.



- Tighten the thread connections on all the joining elements.



There are several options of joining you can find in your unit:

1	Joining of base frames	Always
2	Joining of corner reinforcements	Larger units
3	Joining of vertical reinforcements	Larger units
4	Joining of internal connecting elements (vertically and horizontally)	Depending on size and execution
5	Joining of external connecting elements (only vertically)	Small units and depending on execution

#### [1] Joining of base frames

Always use this connection primarily.



#### Fastening material

For one connection following fastening material is always supplied:

- 1x Screw DIN 933 Zn M8 x 70
- 1x Nut DIN 934 M8 Zn
- 2x Washer DIN 9021 8,4 Zn

## [2] Joining of corner reinforcements



### Fastening material

For one connection following fastening material is always supplied:

- 1x Screw DIN 933 Zn M10 x 40
- 1x Nut DIN 934 M10 Zn
- 2x Washer DIN 9021 10,5 Zn

The supplied material is the same whether it is a large or small reinforcement.

## [3] Joining of vertical reinforcements



### Fastening material

For one connection following fastening material is always supplied:

- 1x Screw DIN 933 Zn M10 x 80
- 1x Nut DIN 934 M10 Zn
- 2x Washer DIN 9021 10,5 Zn

## Joining of connecting elements



### Fastening material

For one connection following fastening material is always supplied (above left):

- 1x Screw DIN 933 Zn M8 x 40
- 1x Nut DIN 934 M8 Zn

For one connection following fastening material is always supplied (above right):

- 1x Screw DIN 933 Zn M8 x 70
- 1x Nut DIN 934 M8 Zn
- 2x Washer DIN 9021 8,4 Zn



### 2.3.2 Mounting of roof

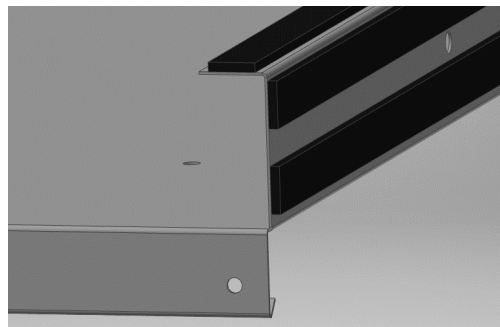
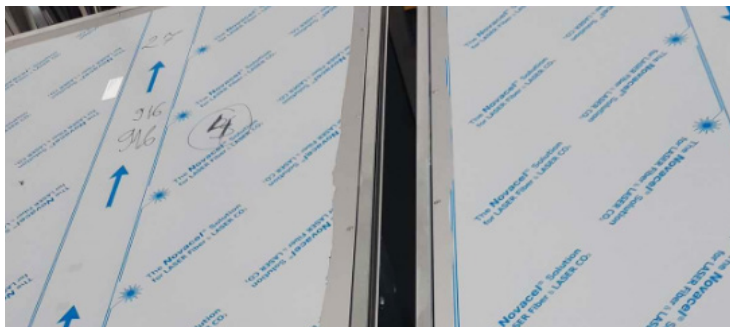


#### Caution

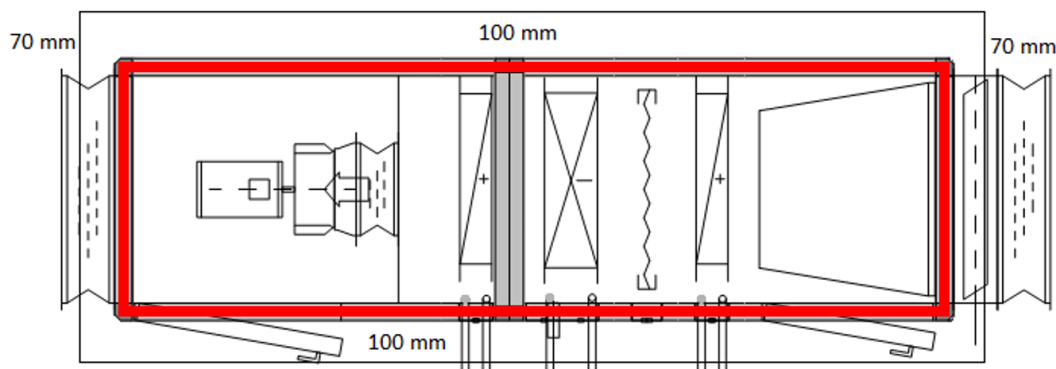
If possible, avoid walking on the roof with point force during installation. Use boards for more uniform force distribution

Make sure that the screws are always screwed perpendicular to the drilling plane and that the correct torque is used.

- Remove the protective foil from the roof and panels.



- Apply the supplied 15 x 3 mm gasket 3 times in length to each part of the roof bent upwards in a "C" shape.
- After connecting the unit, apply the supplied 15 x 3 mm gasket on the entire device along the upper outer profiles (red area in the picture below).
- Lay parts of the roof on the connected unit and position them so that the roof leans over the unit 100 mm at the front and rear and 70 mm at the connections.



- Fasten the roof parts together with supplied special screws with a rubber washer.



#### Fastening material

For one connection following fastening material is always supplied:

- 1x Screw DIN 933 A2 M6 x 25
- 1x Nut DIN934 M6 A2
- 2x Washer DIN 9021 6,3 A2 + Ø22/Ø6,7x3 EPDM



- Fasten the roof to the unit with supplied special self-tapping screws with a rubber washer.



#### Fastening material

For one connection following fastening material is always supplied:

- 1x Screw DIN 7504 K 410 HP 6,3 x 25
- 1x EPDM 22



- Attach the sealing plates to the sides of the device where the two roofs meet and screw them on. Since the left and right pieces are different, make sure that the »L« from cover always looks in the other direction than »C« from the roof and the gap between the pieces of the roof is always covered.



- Clean the roof of the drill chips and dirt accumulated during installation.

### 2.3.3 Connection of ducting



#### Caution

In all cases, the air handling unit must be connected to the ducting by means of flexible connections. The flexible connections should always be almost fully stretched (50-90%).

In the case of a centrifugal fan, the dimensions of the duct should be similar to those of the air outlet opening onto the fan, in order to avoid or minimise losses due to turbulence.

In special cases, e.g. with vertical duct runs, buoyancy effects may induce an air flow that drives (rotates) a fan impeller even with the drive motor off. The rotating impeller poses a risk of injury during repair or maintenance works. This danger can be prevented by applying motor drives with counter-springs that automatically shut the dampers also in the event of power supply failure.

### 2.3.4 Connection of piping

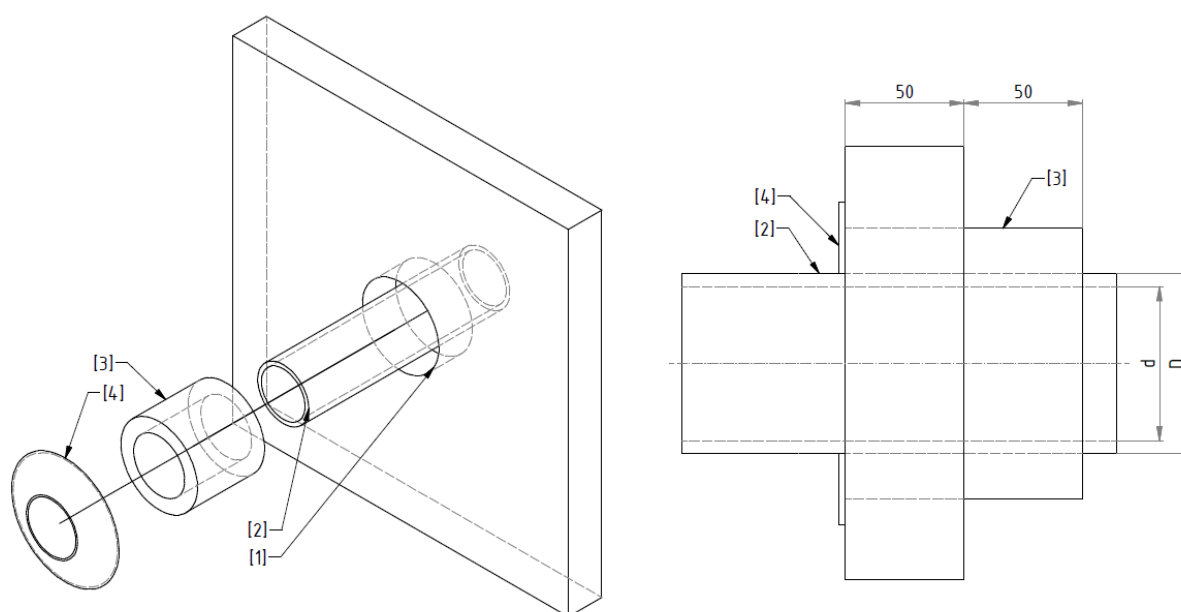
Heat exchangers must be connected to the piping in a manner that enables the free opening of the service doors of adjacent sections and allows the dismantling and drawing out of heat exchanger components when necessary for maintenance or replacement purposes.

In order to allow condensate discharge from the pan in the event of negative pressure in the unit, respectively, or in order to prevent air leakage from the unit into the drain pipe in the event of positive pressure in the unit, a negative pressure or positive pressure syphon must be installed.



#### Caution

If the pipe connections are terminated on the inside of the device, a hole must be drilled in the fixed panel to connect the connections to the external manifolds.



- [1] The point where you want to make a passage is to be located on the panel, and a hole is drilled through it with a hole saw with dimension as close as possible according to the table below (see the "Hole" column).
- [2] The piping is mounted through the hole as centered as possible.
- [3] An insulating tube is mounted on the pipe through the hole according to the table below (see column "Insulation"). The length of the tube must be at least 100 mm so that the pipe on the outside covers the panel flat and no insulation is visible. The inner tube faces inside at least 50 mm.
- [4] On the outside, a rubber rosette is attached to the tube according to the table below (see column "Rubber"). The rosette is glued to the panel from the outside and must be aligned with the panel.
- After connecting the external installation, the external pipes must be thermally insulated up to the rubber rosette.

Dimension		Coper tube			Steel tube		
DN		Insulation	Hole	Rubber	Insulation	Hole	Rubber
mm	inch	mm	mm	mm	mm	mm	mm
10	3/8	12 x 19	44	10/75	18 x 19	51	15/75
15	1/2	15 x 19	51	15/75	22 x 19	56	20/90
20	3/4	22 x 19	56	20/90	28 x 19	65	25/90
25	1	28 x 19	65	25/90	35 x 19	70	30/90
32	1 1/4	35 x 19	70	30/90	42 x 19	79	40/110
40	1 1/2	42 x 19	79	40/110	48 x 19	79	45/116
50	2	54 x 19	92	50/100	60 x 19	92	56/131
65	2 1/5	64 x 19	102	60/130	76 x 19	111	71/142
80	3	76 x 19	111	71/142	89 x 19	121	82/150
100	4	108 x 19	140	100/170	114 x 19	152	112/180



### Connection of piping to hydraulic cycle

To connect the unit to the hydraulic circuit, apply threaded joints (fittings) or flanged joints for a nominal pressure of 16 bar, depending on the piping size.

For outdoor units with empty chamber, install the hydraulic circuit in the empty chamber next to heating or cooling coil. Observe the chapter above for pipe installation through the panels.

#### Make sure to connect the piping installations properly and observe the following:

- Heat transfer medium and air must move in a counterflow configuration.
- The pipes of the heating or cooling system and the connections of the direct evaporator must not impede the extraction of droplet eliminator as well as the antifreeze protection frame from unit, if it is installed in the immediate vicinity.
- When tightening piping connections, apply counter-force by means of an appropriate tool (a pipe wrench with pads) to avoid damaging the heat exchanger tubing system.
- Connect the heat exchanger by means of a dismantable threaded joint or a pair of flanges. Do not apply welding joints.
- Connect the heat exchanger two piping connections to the hydraulic circuit so as to ensure the air and heat transfer medium counterflow. The air inlet into the heat exchanger should be closer to the return pipe – in the case of both horizontal air flow and vertical air flow.
- The pump may be mounted in either the horizontal or in the vertical section of the piping; however, the pump axis must always be horizontal.
- The control valve may be installed in the supply pipe or return pipe; however, the distance between the supply pipe and the return pipe and the distance between the control valve and the bypass pipe should preferably not be less than 500 mm.
- Upstream from the heat exchanger supply pipe end, install a dirt trap to protect the control valve and the circulation pump.
- Downstream from the connection shut-off valve, as well as at the heat exchanger inlet and outlet, install temperature sensors.
- At the lowest point of the piping installation, install a heat transfer medium draining valve to facilitate heat exchanger draining.
- At the highest point of the piping system, make provisions for venting, to ensure an unobstructed flow of the transfer medium through the heat exchanger (as a rule, the heat exchangers are factory-fitted with venting / draining valve at the highest / lowest point of the collector or distribution pipe).
- Clean any filing debris and other dirt from the piping system



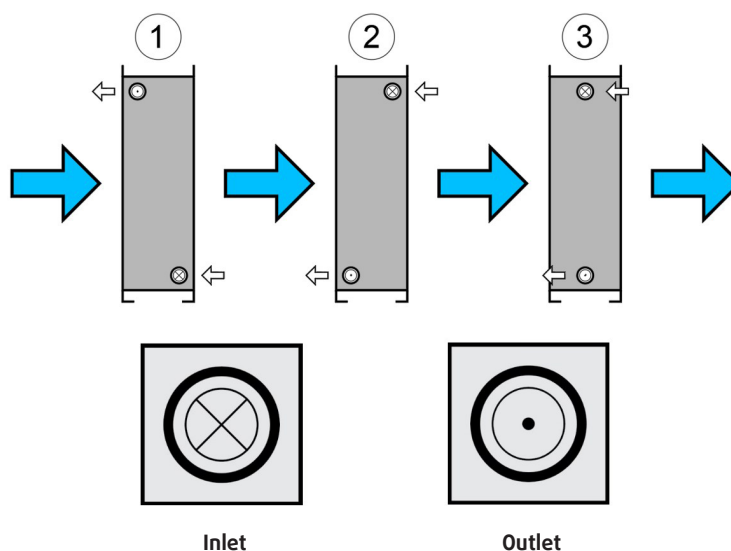
#### Caution

Improper connection of hydraulic cycle can result in lower heat exchanger efficiency.

The direction of the connections is mostly tied in the counterflow direction with respect to the direction of the air.

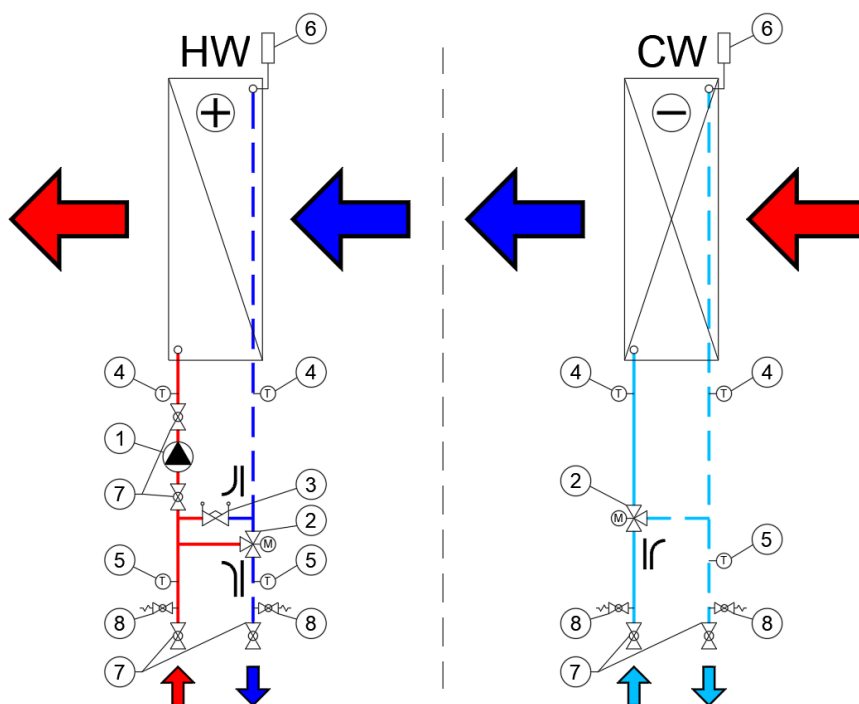
The figure below shows the connections according to the medium:

- 1 – Water (heating and cooling)
- 2 – Freon (heating, cooling or combination)
- 3 – Steam (heating)



## Example of hydraulic circle

- HW – heating coil  
 CW – cooling coil  
 1 – circulation pump  
 2 – 3-way valve  
 3 – balancing valve  
 4 – thermometer  
 5 – thermometer (optional)  
 6 – venting valve  
 7 – ball valve  
 8 – drain valve



### Caution

3-way valve for cooling hydraulic cycle can be mounted on the inlet or outlet. It is important to install it with the required flow direction.

### 2.3.5 Connection of syphons



#### Caution

Discharge pipes from the negative pressure or positive pressure syphons may not be connected directly to the sewage plumbing. The discharge of condensate into sewage plumbing must be arranged so that water condensate freely discharges into a funnel-shaped collector and from there into the sewage plumbing.

In no event may a negative pressure syphon and a positive pressure syphon be connected to a common discharge pipe.

The syphon should be installed outside the unit. Discharge pipes must run such that they are pitched a min. 2% towards the outlet.

The installation of a smaller syphon can result in a sudden leakage of air and water.

Overpressure or underpressure may occur in the section where condensate drainage is required.

$$P_{a+} > P_0$$

Section has overpressure

$$P_{a-} > P_0$$

Section has underpressure



#### Caution

In the case of separate drains at the cooling register and the water droplet eliminator, the drains must be connected and only then a syphon installed. The connecting pipes are not supplied by the device manufacturer.

Be sure to fill the syphon with water before unit Commissioning.

#### Standard syphon

The figure below shows an example of a syphon in disassembled form and a complete overpressure syphon on a single drain and with combined drains (exit over base frame).



#### Caution

Vertical pipes must be cut in height according to the instructions below.



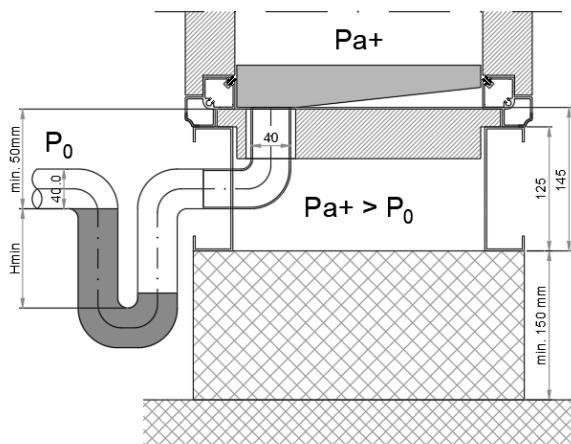
#### Caution

The 125 mm base frame is not sufficient for standard. A concrete base with a minimum height of 150 mm, additional feet, or a unit base frame with a height of 250 mm is required.

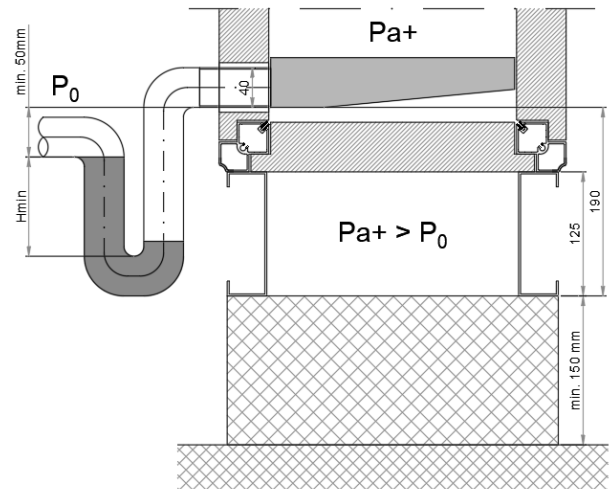
A quick calculation of the syphon height with respect to underpressure or overpressure in the condensation section:

	$P_{a+} > P_0$	$P_{a-} < P_0$	
$\Delta P$	$H_{min}$	$H_{min}$	$H_{min} / 2$
$P_a$	mm	mm	mm
200	30	30	15
400	50	50	25
600	70	70	35
800	90	90	45
1000	110	110	55
1200	130	130	65

### Overpressure connection



Drain over bottom panel

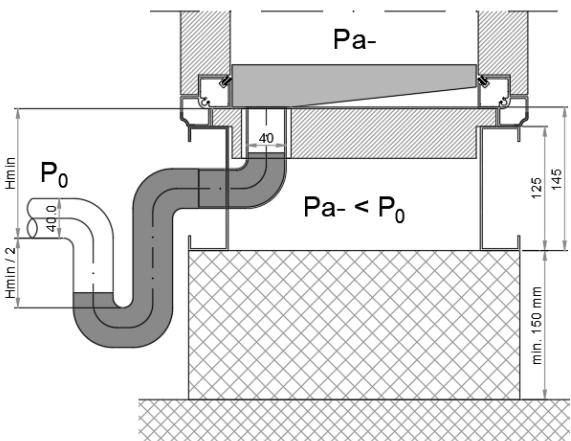


Drain over side panel

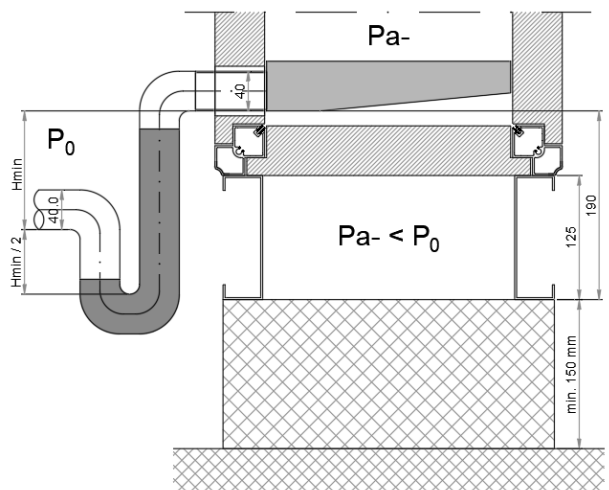
$H_{min}$  depends on the maximum overpressure ( $P_{a+}$ ) in the condensation section.

$$H_{min} = \frac{\Delta P}{10} + 10 = \frac{P_{a+} - P_0}{10} + 10 [mm]$$

### Underpressure connection



Drain over bottom panel



Drain over side panel

$H_{min}$  depends on the maximum underpressure ( $P_{a-}$ ) in the condensation section.

$$H_{min} = \frac{\Delta P}{10} + 10 = \frac{P_0 - P_{a-}}{10} + 10 [mm]$$

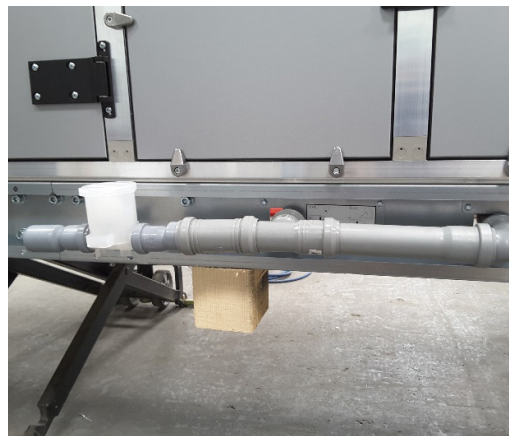
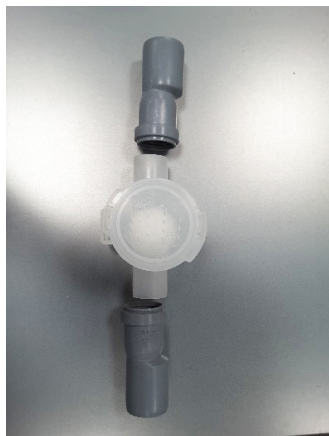
## Ball syphon

The figure below shows an example of a syphon in disassembled form and a complete syphon on a single drain and with combined drains (exit over base frame).



### Caution

The connection piece for direct connection to the device is not supplied by the manufacturer.

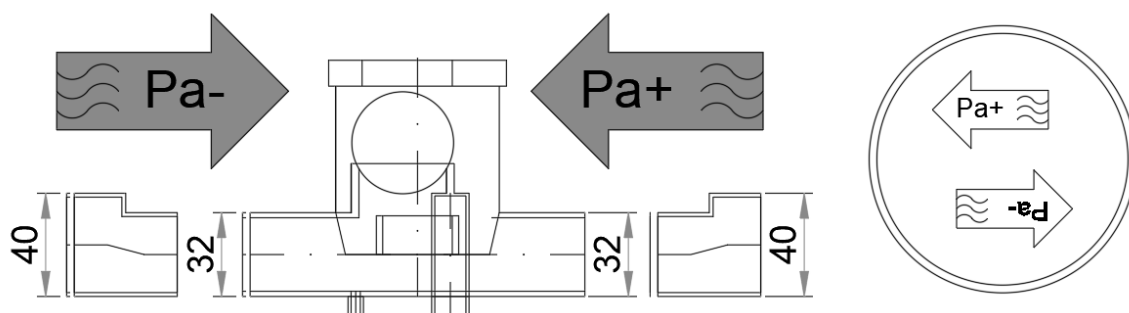


The package includes a siphon and two reducing pieces DN 40/30.



### Caution

It is important to watch how you turn syphon. The arrow on the cap should point in the direction of water outflow. In case of overpressure in the section, look at the arrow  $P_{a+}$ . In case of underpressure in the section, look at the arrow  $P_{a-}$ .



### Caution

The syphon connection is suitable for a base frame of 125 mm at any time at overpressure, if only  $H_{min} > 60$  mm. In the case of a underpressure, the height of the base of 125 mm corresponds to underpressure of 700 Pa, or  $H_{min} = 80$  mm.

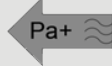
A quick calculation of the syphon height with respect to underpressure or overpressure in the condensation section:

	$P_{a+} > P_0$	$P_{a-} < P_0$
$\Delta P$	$H_{min}$	$H_{min}$
Pa	mm	mm
200	30	30
400	50	50
600	70	70
800	90	90
1000	110	110
1200	130	130

## Overpressure connection

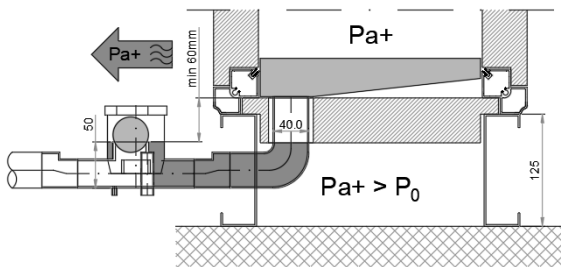
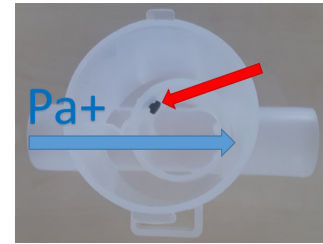


### Caution

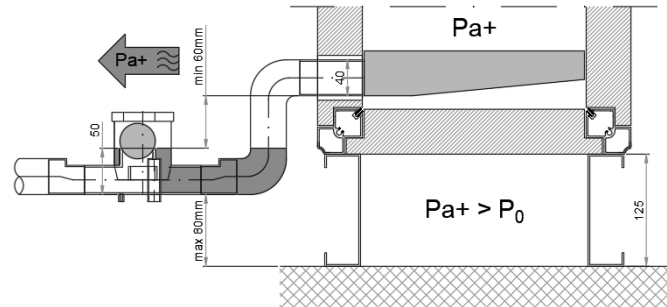


Shows direction of the drainage flow in overpressure section.

When syphon is connected in overpressure, the plastic black button has to be removed.



Drain over bottom panel



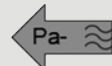
Drain over side panel

$H_{min}$  is a minimum of 60 mm regardless of the overpressure in the device.

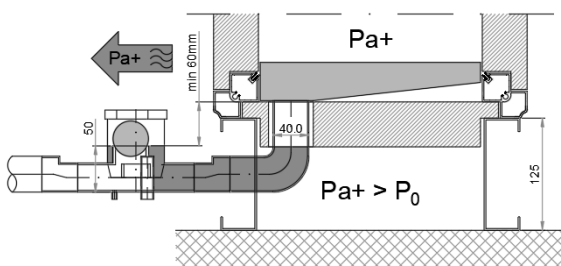
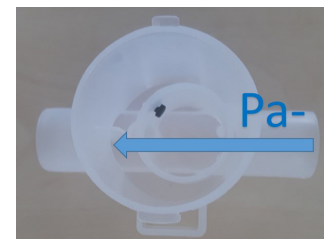
## Underpressure connection



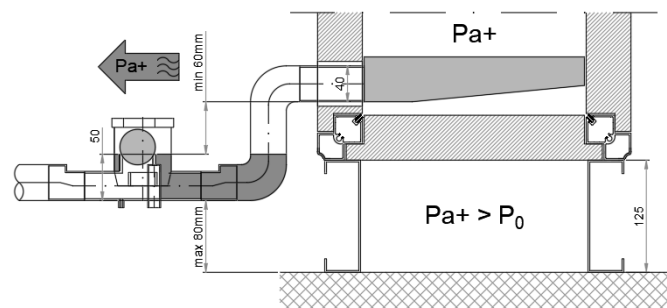
### Caution



Shows direction of the drainage flow in underpressure section.



Drain over bottom panel



Drain over side panel

$H_{min}$  depends on the maximum underpressure ( $Pa_-$ ) in the condensation section.

$$H_{min} = \frac{\Delta P}{10} + 10 = \frac{P_0 - Pa_-}{10} + 10 \text{ [mm]}$$



### 2.3.6 Connection of electrical installation

Electrical installations must be connected so as not to prevent or hinder the checking, servicing or replacement of functional components. Connection must be carried out in accordance with the design documents, the manufacturer's guidelines and the provisions of the technical regulations and standards.

The installer and user should be aware of the risks arising from lightning. The installation of overvoltage protection devices, which safely divert high voltage energy in the event of a lightning strike to earth, must be implemented in accordance with local regulations.

The penetration of power and control cables through the casings or internal partition walls must be carried out so as to ensure the protection of cables from damage in contact with sharp metal sheet edges. All the penetrations must be airtight. For penetrations of cables through partition walls and other structural elements inside the casing, membrane rubber fittings or cable glands of appropriate sizes must be applied. In most cases, the holes for such fittings are punched and the fittings are installed in the factory.

For penetrations of cables through casing walls, cable glands and custom-made extension pieces must be applied. For penetrations of cables through two casing walls, e.g. in the case of stacked or parallel units, apply combinations of rubber fittings and stiff PVC tubes or cable glands and custom-made extension pieces.

Power cord size according to the electrical power and length can be determined in the table below.



#### Caution

Electric power is provided for three-phase current.

Sensors, actuators and other external measuring equipment can be connected with a 0.75 m<sup>2</sup> cable.

Power kW (3p)	Current A	1.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>	4 mm <sup>2</sup>	6 mm <sup>2</sup>	10 mm <sup>2</sup>	16 mm <sup>2</sup>	25 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	70 mm <sup>2</sup>	95 mm <sup>2</sup>
1,5	2.3	100 m	165 m	265 m	395 m	-	-	-	-	-	-	-
3	4.6	33 m	84 m	135 m	200 m	335 m	530 m	-	-	-	-	-
4,5	6.8	30 m	57 m	90 m	130 m	225 m	355 m	565 m	-	-	-	-
6	9	25 m	43 m	68 m	100 m	170 m	265 m	430 m	595 m	-	-	-
7,5	11.5	20 m	34 m	54 m	80 m	135 m	210 m	340 m	470 m	630 m	-	-
9	13.5	17 m	29 m	45 m	66 m	110 m	180 m	285 m	395 m	520 m	-	-
10,5	16	14 m	24 m	39 m	56 m	96 m	155 m	245 m	335 m	450 m	-	-
12	18	-	21 m	34 m	49 m	84 m	135 m	210 m	295 m	395 m	580 m	-
13,5	20	-	19 m	30 m	44 m	75 m	120 m	190 m	260 m	350 m	515 m	-
15	23	-	-	27 m	39 m	68 m	105 m	170 m	235 m	315 m	460 m	630 m
18	27	-	-	23 m	32 m	56 m	90 m	140 m	195 m	260 m	385 m	530 m
21	32	-	-	-	28 m	48 m	76 m	120 m	170 m	225 m	330 m	460 m
24	36	-	-	-	-	42 m	67 m	105 m	145 m	195 m	290 m	400 m
27	41	-	-	-	-	38 m	60 m	94 m	130 m	175 m	255 m	355 m
30	45	-	-	-	-	34 m	54 m	84 m	120 m	155 m	230 m	320 m
36	55	-	-	-	-	-	45 m	70 m	92 m	130 m	190 m	265 m
42	64	-	-	-	-	-	38 m	60 m	84 m	110 m	165 m	230 m
48	73	-	-	-	-	-	-	53 m	74 m	99 m	145 m	200 m
54	82	-	-	-	-	-	-	47 m	65 m	88 m	125 m	175 m
60	91	-	-	-	-	-	-	-	59 m	79 m	115 m	160 m

## Connection of electrical installations with quick connectors between moduls

Before mechanically connecting the device housing to the factory-fitted electrical control cabinet, control system elements and wiring, connect the electrical cables and wires using the quick connectors. All connectors where the connectors need to be connected are marked with a sticker.

All cables, wires and also connectors are numbered. Connect the male and female part of the connector with the same number.

In the case of the unit with a factory-made electrical control cabinet, which is intended for independent, separate installation and the elements of the control system are installed and electrically connected in the factory, all cables or conductors are connected to terminals in a plastic electrical distribution cabinet located on the outside of the housing. All terminals are appropriately marked for connection to an electrical control cabinet. Prior to the mechanical connection of the supply units, it is also necessary to connect the electrical cables and wires at the joints of the supply units with the help of quick connectors.



### 2.3.7 Vibration and structure-borne noise

Reduction of vibration transmission to the building is possible by connecting the device to the duct network via flexible connections and by placing the device on appropriate vibration isolators.

To mitigate structural noise, we recommend using rubber or an elastomeric pads under the device. To keep unit properly aligned and working, carefully check the air conditioning alignment (opening and closing the door, connecting the modules).



#### Caution

We recommend that the anti-vibration pads, including the material and layout plan, are selected and determined through a professional company.

#### Preventing of structure-borne noise

Anti-vibration elements or anti-noise layer under the unit can help reduce the transmission of vibrations from the unit to the load-bearing structure:

- If the unit is to be installed on a flat floor without special sound insulation requirements on the structure, we recommend placing rubber or elastomeric pads between the unit and the base.
- For sound insulation, compare the requirement with the sound power level of the unit (see data sheet) and determine the necessary measures, advised to be determined by the acoustic engineer.

#### Risk of injury

The anti-vibration elements or the anti-noise layer must not affect the safety of the construction of the device. Ensure the following:

- Use a sufficient number of anti-vibration elements and anti-noise layers and install them correctly, otherwise the base may slip.
- Note that different unit modules differ in weight; this must not cause any height differences in the whole unit.

### 3. COMMISSIONING AND MAINTENANCE



#### Caution

The unit commissioning may only be carried out by a qualified professional. Before starting up the air handling unit, check all the electrical connections and unit control settings.

#### 3.1 General instructions

##### Before maintenance

- The power supply must be switched off completely and the service switch must be switched off and locked.
- Due to the frequency converter, it is necessary to wait at least 15 minutes.
- It is necessary to check whether all rotating parts are stationary (fan, belts, rotary heat exchanger, blinds).
- It is necessary to check whether the temperature in the heat exchangers and hydraulic systems has adapted to the ambient temperature.
- The PM motor shaft must be blocked. External influences on motor rotation generate electric current.
- The unit must not be in an explosive atmosphere during service.
- Protective clothing and footwear are required (helmet, mask for changing filters, gloves and shoes...).
- All service accessories is required: tools, service switch lock key...
- As the entire electrical installation is switched off during servicing, external, separate lighting is required.
- A special key is required to open and close the service door.



##### During maintenance

- Check the condition of the section. In case of dirt or corrosion, immediate cleaning is required.
- Check the gasket at the contact of the panel or door and casing. If the gasket is damaged or detached, it must be completely removed, the surface cleaned and gasket replaced.

##### After maintenance

- Clean any dirt from maintenance.
- Check that all mechanical and electrical components are in place and securely fastened.
- Make sure that no one is in the danger area of the device or its surroundings.
- Make sure you have removed all tools or other objects from the device.
- Close the service door and lock the handle locks.

### 3.2 Schedule for control and maintenance

ACTIVITY	Time interval (months)						COMMENT
	1/2	1	3	6	12	24	
CASING							
Inspection of soiling, damage and corrosion					X		
FAN							
Inspection of soiling, damage and corrosion				X			
Clean the fan parts in contact with air					X		
FILTER							
Check for a pressure drop		X					
Inspection of contamination and damage			X				
Replace the filters					X		
PLATE HEAT EXCHANGER							
Inspection of soiling, damage and corrosion			X				
Inspect the sealing of the air partition walls			X				
Carry out a functional test of the syphon.			X				
Cleaning				X			
ROTARY HEAT EXCHANGER							
Check the drive operation.			X				
Inspection of soiling, damage and corrosion					X		
Inspect the sealing of the air partition walls					X		
CONTROL DAMPER							
Inspection of soiling, damage and corrosion					X		
WATER HEATING COIL (ALSO RUN AROUND COIL)							
Inspection of soiling, damage and corrosion			X				
WATER COOLING COIL (ALSO RUN AROUND COIL)							
Inspection of soiling, damage and corrosion			X				
Carry out a functional test of the syphon			X				
Cleaning				X			
DIRECT EXPANSION (DX)							
Inspection of soiling, damage and corrosion			X				
Carry out a functional test of the syphon			X				
Cleaning				X			
DROPLET ELIMINATOR							
Inspection of soiling, damage and corrosion			X				
Carry out a functional test of the syphon			X				
Cleaning				X			
SOUND ATTENUATOR							
Inspection of soiling, damage and corrosion					X		
STEAM HUMIDIFIER							
Inspection of condensate draining from chamber		X					Cleaning if necessary
Inspection of soiling, damage and corrosion			X				
Inspection of condensate draining			X				
Cleaning with a cleaning agent				X			Desinfection if necessary
Inspection of oper. and cleanliness of the dirt traps				X			
Inspection of build-up of deposits on the distributor				X			
Inspection of operation of the control valve				X			
HONEYCOMB HUMIDIFIER							
Cleaning if shut down for more than 48 hours	If necessary						Clean with cleaning agent
Measuring of bacteria count in the humidifier water*	X						
Inspection of soiling, damage and corrosion		X					
Inspection of droplet eliminator		X					
Inspection of deposits on the spray nozzles		X					
Inspection of deposits of precipitates (muck, algae, etc.) at the bottom of the humidifier tank		X					
Inspection of deposits of dirt and scale in the circulating pump suction connection		X					
Inspection of operation of the electrical conductivity measurement elements		X					
Inspection of operation of the sterilisation device.		X					
Inspection of oper. and cleanliness of the dirt traps				X			
Inspection of operation of the bleed-off device				X			

\* if the bacteria count > 1000 CFU/ml , the water tank must be washed with cleaning agents, rinsed, dried and, if necessary, disinfected.



#### Caution

Hygienic inspection is organized according to hygienic requirements. Cleaning the unit with cleaning agent always includes rinsing with water, drying and if necessary, disinfection. Inspection and cleaning of the component with added water droplet eliminator also includes inspection and cleaning of eliminator.

### 3.3 Fan



#### Caution

See also section 3.1 General instructions.

#### 3.3.1 Electric motor connection and frequency converter set-up



#### Caution

The motor and frequency converter are factory set.

- Prior to Commissioning, check the congruence of the connection parameters as stated on the electrical consumer nameplates or in the electrical diagram posted in the air handling unit control cabinet with the parameters of the mains power supply installation.
- Electric motor connection may only be carried out by a qualified professional in accordance with the applicable technical regulations and standards and with the electrical installation design documents for the site where the air handling unit comprising the fan section is to be installed, as well as with the electric motor manufacturer's instructions. Electric motors must be grounded.
- If a fan section within an air handling unit is not fitted with a repair switch, connect the electric motor to the mains supply via a device that allows the isolation of all the poles from the mains supply, with a clearance of 3 mm between the contacts in the open state.
- Integrate an automatic switch (contactor) and thermal guard in the electric motor energising circuit.
- Electric motors up to 7.5 kW may be started directly – their wiring is indicated on the motor nameplate.
- In cases of electric motors of higher powers, apply a star-delta starting circuit: from the standstill up to nearly nominal rotating speed, the motor is driven in the star configuration, then it is switched to the delta configuration.
- For starting dual speed electric motors, apply a combined Y/YY (Dahlander) or a Y/Y configuration.
- Electric motors must be fitted with thermal guard, which is to be selected by taking into account the nominal current and which must protect the motor against current overloading and the resulting overheating.

#### Motor connection

- Step 1: First, connect the grounding cable
  - Step 2: Connect the wires with staples in a star or delta connection. See the nameplate for more information.
- 
- Use a screened/armoured motor cable to comply with EMC emission specifications (or install the cable in metal conduit).
  - Keep the motor cable as short as possible to reduce the noise level and leakage currents.



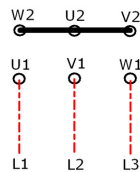
#### Caution

All types of standard three-phase asynchronous motors can be connected to a frequency converter.

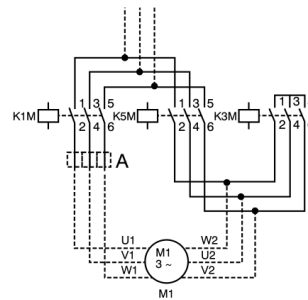
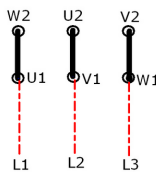
**On figure below:**

- Star connection                      up to 3 kW (left),  
 Delta connection                    3 to 7,5 kW (middle),  
 Delta-star connection              above 7,5 kW (right).

**STAR CONNECTION**



**DELTA CONNECTION**

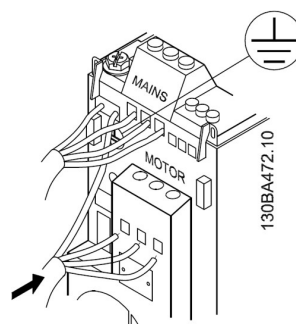
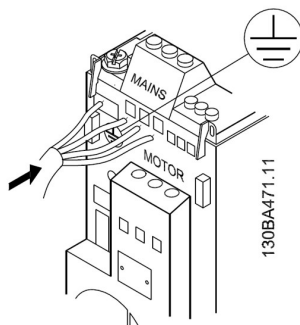


**Connection of the frequency converter power supply**

- Step 1: First, connect the grounding cable
- Step 2: Connect electric supply cables to L1/L, L2 and L3/N.

**On figure below:**

- Connection of grounding cable (left),
- Connection of ground cable, line power and motor wires (middle),
- Three-phase and single-phase connection (right).



L1/L	L2	L3/N
3 x 200-240 V/ 3 x 380-480 V		
L1/L	L2	L3/N
1 x 200-240 V		

For the three-phase connection, connect the wires to all three terminals.

For the single-phase connection, connect the wires to terminals L1/L and L3/N.

For proper installation according to EMC, use an optional split panel.

**Motor cables**

- Use a screened/armoured motor cable to comply with EMC emission specifications (or install the cable in metal conduit).
- Keep the motor cable as short as possible to reduce the noise level and leakage currents.
- Connect the motor cable screen/armour to both the decoupling plate of the frequency converter and to the metal of the motor. (Same applies to both ends of metal conduit if used instead of screen.)
- Make the screen connections with the largest possible surface area (cable clamp or by using an EMC cable gland). This is done by using the supplied installation devices in the frequency converter.
- Avoid terminating the screen by twisting the ends (pigtailed), as this will spoil high frequency screening effects.
- If it is necessary to break the continuity of the screen to install a motor isolator or motor relay, the continuity must be maintained with the lowest possible HF impedance.

**Cable shielding**

Do not install cables with twisted ends. Such cables destroy the shielding effect at higher frequencies. If it is necessary to split the shield due to the installation of a motor isolator or motor relay, the shield must continue with the lowest possible high frequency impedance.



### Cable length and cross-section

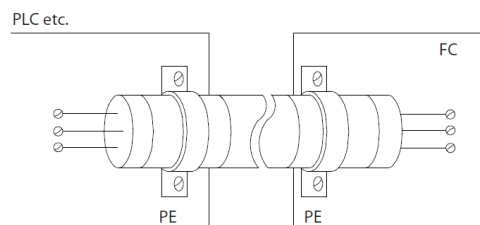
The frequency converter has been tested with a given length of cable and a given cross-section of that cable. If the cross-section is increased, the cable capacitance - and thus the leakage current - may increase, and the cable length must be reduced correspondingly.

### Grounding of shielded / reinforced control cables

In a general sense, the control cables must be braided / reinforced and the shield must be connected at both ends to the metal housing of the unit using a cable clamp.

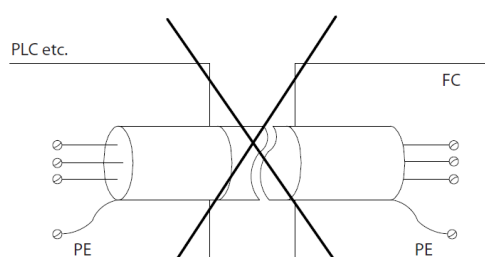
#### Correct grounding

Control cables and cables for serial communication must have cable clamps at both ends for the best possible electrical contact.



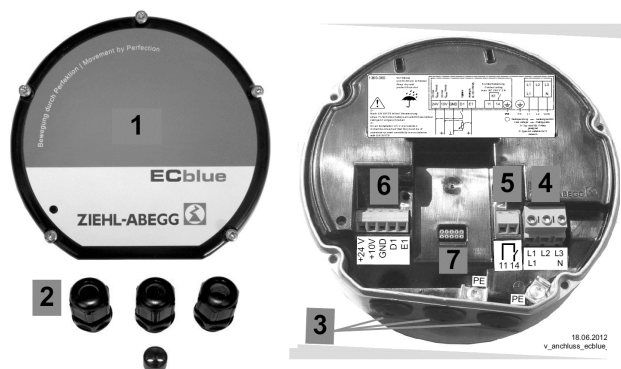
#### Incorrect grounding

Do not use cables with twisted ends. They increase the array impedance at higher frequencies.



### 3.3.2 Connection of EC fan

#### Connection of Ziehl-Abegg ECblue

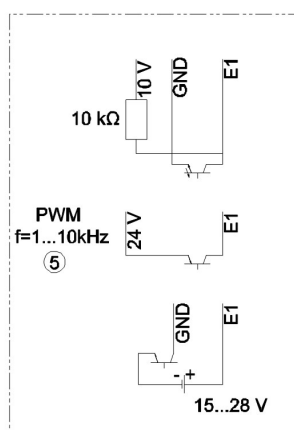
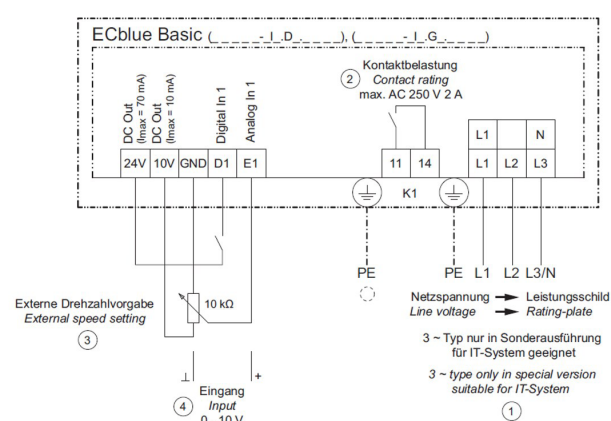


- 1 Cover of controller housing
- 2 Cable glands + seal insert for two cables (applicable only if necessary)  
- motor size "D": 3 x M16 + 1 x seal insert with two holes 5 mm  
- motor size "G": 3 x M20 + 1 x seal insert with two holes 6 mm
- 3 Cable entry points with plastic fastener
- 4 Mains connection
- 5 Connection alarm relay
- 6 Connection controls

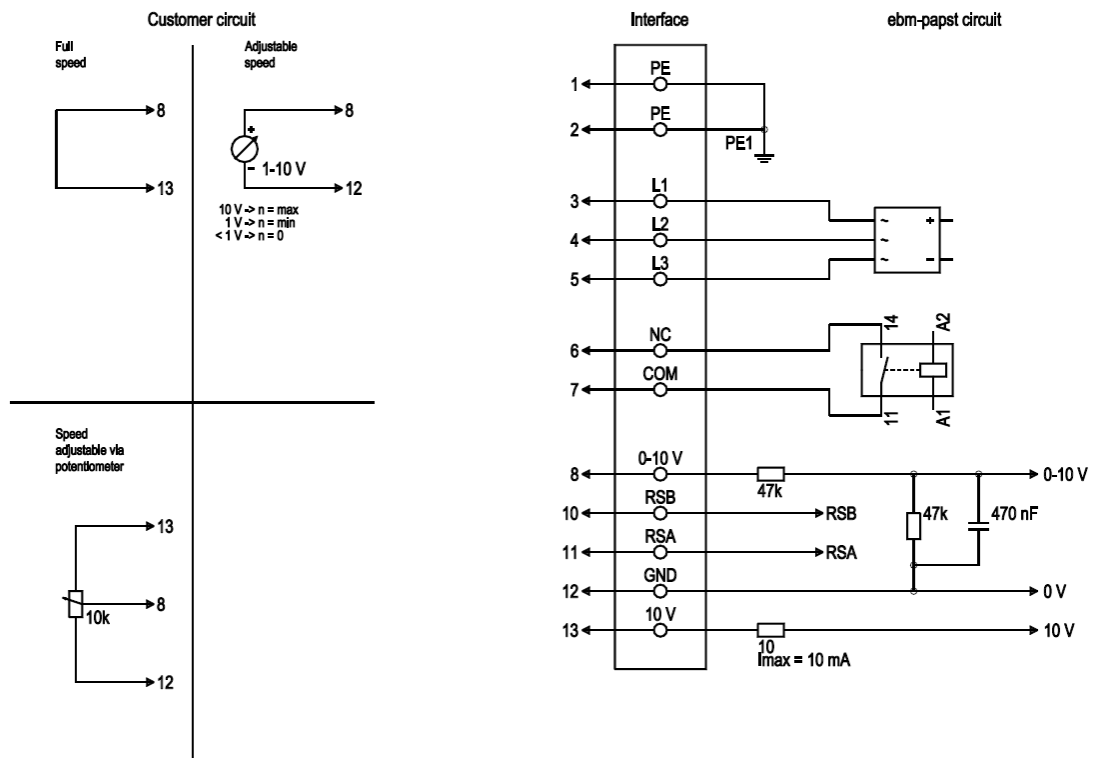
+24V	Power supply +24V
+10V	Power supply +10V
GND	Grounding
D1	Digital input (if we connect + 24V to D1 we activate the start condition)
E1	Analog input (0-10V)

7 Slot for add-on module

#### Connection of EBM paps



## Wiring diagram



1,2	PE	green/yellow	Protective earth
3	L1	Black	Power supply
4	L2	Black	Power supply
5	L3	Black	Power supply
6	NC	White 1	Status relay, floating status contact, break for failure, contact rating 250 VAC / 2 A (AC1) / min. 10 mA; reinforced insulation on supply side and basic insulation on control interface side
7	COM	White 2	Status relay, floating status contact, break for failure, contact rating 250 VAC / 2 A (AC1) / min. 10 mA; reinforced insulation on supply side and basic insulation on control interface side
8	0-10V	Yellow	Analog input (set value), 0-10 V, $R_i = 100\text{ k}\Omega$ , adjustable curve, SELV
10	RSB	Brown	RS485 interface for MODBUS, RSB; SELV
11	RSA	White	RS485 interface for MODBUS, RSA; SELV
12	GND	Blue	Reference ground for control interface, SELV
13	+10	Red	Fixed voltage output 10 VDC, +10 V $\pm 3\%$ , max. 10 mA, short-circuit-proof power supply for external devices (e.g. pot), SELV

### Check before commissioning

- The mounting of the fan on the frame and the mounting of the electric motor on the tensioning bracket,
- the parallelism of the motor drive shaft and of the fan shaft; in the case of deviation, adjust the electric motor by means of the tensioning bracket, and once the adjustment has been completed, firmly tighten all the screws,
- the mounting of the rotor on the shaft and its free rotation in the casing,
- the mounting of the vibration isolators,
- the correct installation of the grounding,
- the correct installation of the electrical connections and their operation (fuse sizes, contactors, thermal protection),
- for the presence of any tools or other foreign materials in the section,
- the mounting of all the covers and doors.
- Thermal protection is essential for the safety of the electric motor, therefore, before starting the motor, check if it has the correct settings for the nominal current of the motor, and check its operation. Once this test has been successfully completed, seal the thermal protection device.

## Commissioning

- Before checking the correct fan installation and operation, switch off the repair switch of the fan section in which you intend to intervene, or alternatively switch off the main switch on the air handling unit electric control cabinet, and lock the switch in the off position, to break the current supply circuit to the drive electric motor.
- Prior to starting the electric motor, remove any mechanical interlocks on vibration isolators.
- The fan must not be operated if the door of the fan unit is open.
- By means of a pulse start, check the correct direction of the fan rotation. The rotor must rotate in the direction of the arrow on its casing. In the event of an incorrect direction of rotation, switch two phases on the contactor. The procedure for checking the direction of rotation must be carried out with the fan section door closed. Observe the direction of rotation through the service door inspection window, with the lamp in the section on.
- After the first start, measure the electric motor current. If the electric current is less than or equal to the nominal current, you may proceed to set up the air volume flow rate.
- The air volume flow rate is adjusted by changing the position (opening or closing) of the control dampers. Once the air volume flow rate is set up, measure the electric motor current again. An electric current lower than or equal to the nominal current indicates the correct operation of the fan section. If the motor current exceeds the nominal value, shut down the electric motor and establish the cause of its incorrect operation.

## Causes and corrections

The possible causes are the following: an incorrect motor connection, an incorrect supply voltage, an incorrect supply frequency, incorrect electric leads, an incorrectly selected size of the electric motor, incorrect pressure drops, an excess air volume flow rate.

In order to correct the air volume flow rate, reduce the electric motor revolutions by means changing the pulley on the motor and/or the pulley on the fan. In order to correct the pressure levels, adjust the control dampers.

After remedying all the causes of incorrect operation, measure the electric motor current again. An electric current lower than or equal to the nominal current indicates the correct operation of the fan section.

For rooms with an excess supply air, any failure of the intake air fan must result in the automatic shutdown of the discharge air fan, too, in order to prevent any reversal of the air flow from the room to the neighbouring rooms. If excess discharge air is required, the interlock logic of the preceding sentence is reversed.

In the case of the use of air recirculation in hygienic-type air handling units, check whether there are any hygienic-toxicological concerns associated with the contamination of the supply air by harmful gases, i.e. whether the use of air recirculation is allowable at all.



### Caution

During operation, all the covers and service doors of the section must be kept closed at all times. The fan may not operate with the fan section door open.

Prior to any intervention in the fan section, switch off the repair switch on the fan section in which you intend to intervene, and lock the switch in the off position, in order to break the current supply circuit to the drive electric motor. Proper maintenance is also a prerequisite for safe unit operation. Regularly check the tightness of all the threaded joints, electrical connection terminals, grounding and section casing sealing.

Overloads and excessive temperatures may damage the bearings and lead to excessive operating noise. Replace damaged bearings.

With proper maintenance, approx. 20,000 hours of service life of the bearings can be achieved at a minimum; the specific service life value is quoted by the fan manufacturer.

## Check monthly

- The mounting of the rotor on the shaft,
- the tightness of all the threaded joints,
- the rotor run,
- the vibration isolators of the fan-electric motor assembly,
- the flexible connections, and
- the shaft bearings; if axial shifts of shafts in the bearings are detected, consult the fan manufacturer and remedy the fault.

**Caution**

Keep the inner and outer surface of the inspection glass clean. If you notice fouling, thoroughly clean the glass immediately.

**3.4 Filter****Caution**

See also section 3.1 General instructions.

By appropriately setting the air handling unit control system, make sure that the relative humidity in the second filtering stage does not exceed 90% and the relative humidity in the first filtering stage or in the stage upstream thereof does not exceed 80% for three consecutive days.

Irregular replacement of filter cartridges causes dust to enter unit and its components. As a result, the effectiveness of the operation is reduced and damage to the device and system can occur.

- For smooth operation, inspect the filter medium and replace the cartridges in good time. The frequency of changing the filter medium depends on the air flow, air pollution and the degree of filtration of the filter medium.
- Replace all the filters of a particular filter stage or filter unit at the same time. Replacement of an individual filter in a filter stage is only allowable in the event of filter damage, provided that no more than 6 months have passed from the previous replacement.
- The pressure difference in front of and behind the filter medium must not be more than 30 Pa above the recommended final value.
- Following insertion into the filter frame, filter cassettes must not be damaged.
- When replacing the filters, be careful not to contaminate the new filters with dust from old filters or in any other manner.
- Store new filters such that they are protected from dust and against damage.
- Do not use filters whose shelf life, as specified by the filter manufacturer, has expired.
- Only use filters that are in compliance with the EN 16890-1 standard, as demonstrated by the manufacturer.
- Handle contaminated filters in accordance with environmental protection regulations.
- In the case of outdoor-type air handling units, the filter in the first filtering (pre-filter) stage may become clogged by snow in extreme weather conditions. Filters may also freeze. In such an event, immediately clean or replace the filters.
- In order to measure the pressure drop, apply the following instruments: A U tube, inclined tube manometer or an electronic manometer with acoustic or light signalling. Connect the manometers to the measurement ports upstream of and downstream of the filter, which are provided on the service side on the section external wall, except in the case of outdoor-type air handling units, where these ports are provided inside the casing.
- Keep the inner and outer surface of the inspection glass clean. If you notice fouling, thoroughly clean the glass immediately.
- Insert only clean and undamaged filters.

Comparison of minimum filter classes between EN 779 and ISO 16890 and values of recommended final pressure drops:

EN 779	ISO 16890
G4	coarse 60%
M5	ePM10 60%
M6	ePM2,5 50%
F7	ePM1 60%
F8	ePM1 75%
F9	ePM1 85%

Filter class	Recommended final pressure drop
G1 - G4	150 Pa
M5 - F7	200 Pa
F8 - F9	300 Pa
E10 - H13	500 Pa

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

### Number of filtering cells per cross section with different air handling unit sizes

SIZE	2 - 1	2 - 1,5	3 - 1,5	4 - 1,5	2 - 2	3 - 2	4 - 2	5 - 2	2 - 3	3 - 3	4 - 3	5 - 3	6 - 3	2 - 4	3 - 4	4 - 4	5 - 4	6 - 4	7 - 4	8 - 4
592 x 592					1	1	2	2	1	1	2	2	3	2	2	4	4	6	6	8
592 x 287	1								1	1	2	2	3							
287 x 592						1		1		1		1			2		2		2	
287 x 287										1		1								
592 x 490		1	1	2																
287 x 490			1																	
SIZE	3 - 5	4 - 5	5 - 5	6 - 5	7 - 5	8 - 5	9 - 5	10 - 5	3 - 6	4 - 6	5 - 6	6 - 6	7 - 6	8 - 6	9 - 6	10 - 6	12 - 6	4 - 7	5 - 7	6 - 7
592 x 592	2	4	4	6	6	8	8	10	3	6	6	9	9	12	12	15	18	6	6	9
592 x 287	1	2	2	3	3	4	4	5										2	2	3
287 x 592	2		2		2		2		3		3		3		3				3	
287 x 287	1		1		1		1												1	
SIZE	7 - 7	8 - 7	9 - 7	10 - 7	12 - 7	4 - 8	5 - 8	6 - 8	7 - 8	8 - 8	9 - 8	10 - 8	12 - 8	5 - 9	6 - 9	7 - 9	8 - 9	9 - 9	10 - 9	12 - 9
592 x 592	9	12	12	15	18	8	8	12	12	16	16	20	24	8	12	12	16	16	20	24
592 x 287	3	4	4	5	6									2	3	3	4	4	5	6
287 x 592	3		3				4		4		4			4		4		4		
287 x 287	1		1											1		1		1		

#### 3.4.1 Bag or cassette filter



##### Caution

During operation, all the covers and service doors of the section must be kept closed at all times. The fan may not operate with the fan section door open.

#### Commissioning

If not already installed, insert the filter cassettes into the support frame:

- insert the filter cassettes into the support frame,
- with one level (the entire cross section) filled with filter cassettes, press the cassettes by means of the lock profile against the guide, which has sealing tape applied,
- repeat the procedure until the entire cross section of the section casing is filled,
- check the connection of the pressure measuring hoses to the pressure measurement ports and connect the hoses if necessary.

#### Maintenance

The filters must retain their filtering efficiency throughout their service life. In order to guarantee their performance in terms of maintaining air quality, regularly check the following, for each filter stage:

- the pressure drop
- the accumulated hours of operation
- the visual appearance of filters (cracks in the filtering medium, leakage between the filters and the filter frame).



##### Caution

In the event of noticeable contamination, cracking in the filtering medium or leakage between the filters and the frame, replace the filters regardless of the current pressure drop or hours of operation.

Time to replace filters:

- when the allowable final pressure drop is achieved,
- when the replacement interval has expired,
- when the filter performance, in mechanical or hygienic terms, is no longer adequate,
- if the filters become contaminated following air handling unit installation or reconstruction,
- if requested by the sanitary inspection.

### Replace the filters:

- Loosen the closing profiles,
- slide out the contaminated filter cassettes,
- clean the section casing if necessary,
- inspect the condition of the sealing tape on the sealing contact surface and repair or replace the tape if necessary,
- insert clean and undamaged filters.



#### Caution

For filter sections higher than 1900 mm, the door is divided by height. To replace the filters at the place of the partition profile, it is necessary to unscrew it and screw it back after replacement.



### 3.4.2 Dirty side removable cassette filter



#### Caution

See also section 3.1 General instructions and 3.4 Filter.  
See the values in the selection program data and on the nameplate.

### Commissioning

If not already installed, insert the bag filters into the support frame:

- check that the sealing tape is applied on the bag filter frame,
- insert the bag filter in such a way that the bags hang freely through the frame opening and are not compressed, pinched or damaged,
- in each frame corner, insert a wire spring to press the filter bag against the sealing tape on the frame,
- when installing and joining shipment units, observe the rule of inserting the filters into the frame so as to ensure that the air flow presses them against the sealing tape on the frame. Any air flow acting in the direction opposite to the direction of the acting wire springs is not allowable,
- check the connection of the pressure measuring hoses to the pressure measurement ports and connect the hoses if necessary.

### Maintenance

Replace the filters:

- filters may only be replaced from the non-filtered air side,
- remove the wire springs / loosen the block profiles,
- slide out the bag filters,
- clean the section casing if necessary,
- inspect the condition of the sealing tape on the sealing contact surface and repair or replace the tape if necessary,
- insert clean and undamaged filters.



### 3.4.3 Metal filter



#### Caution

See also section 3.1 General instructions and 3.4 Filter.  
See the values in the selection program data and on the nameplate.

#### Commissioning

If not already installed, insert the filter cassettes into the frame:

- insert the cassettes one next to another, until the entire cross section of the section is filled,
- check that sealing tape is applied on the section service door,
- check the installation of the pan under the metal filter,
- check the connection of the pressure measuring hoses to the pressure measurement ports and connect the hoses if necessary.

#### Maintenance

Replace the filter cassettes:

- slide out the filter cassettes,
- drain / clean the pan below the filter,
- clean the section casing if necessary,
- insert clean filter cassettes,
- check the connection of the pressure measuring hoses to the pressure measurement ports and connect the hoses if necessary.

A soiled metal frame may be washed in hot water with cleaning agent added, observing the cleaning agent manufacturer's instructions and ensuring the proper water temperature.

Cleaned cells may be impregnated with BA or MA viscose, by means of soaking or spraying.

### 3.4.4 Active charcoal filter



#### Caution

See also section 3.1 General instructions and 3.4 Filter.  
See the values in the selection program data and on the nameplate.



#### Commissioning

If not already installed, insert the filter cassettes into the support plate:

- push the filter cassette against the support plate until the locks engage in the holes, and rotate the cassette in the direction opposite the arrow on the cassette,
- repeat the procedure to fill all the openings on all the support plates,
- check the air tightness of the filter frame-casing joints,
- check the air tightness of the support plate-filter frame joints,
- check the air tightness of the filter cassette-support plate joints.

#### Maintenance

Replace the filter cassettes:

- rotate the filter cassette in the direction of the arrow and pry it out of the support plate,
- repeat the procedure to remove all the filter cassettes,
- clean the section casing if necessary,
- insert new cassettes in the opposite direction and in the reverse order,
- check the air tightness of the filter frame-casing joints,
- check the air tightness of the support plate-filter frame joints,
- check the air tightness of the filter cassette-support plate joints.

Under normal air ventilation conditions, relative humidity does not have a large effect on the adsorption capacity of activated carbon.

### 3.4.5 Absolute filter



#### Caution

See also section 3.1 General instructions and 3.4 Filter.  
See the values in the selection program data and on the nameplate.  
Absolute filters are always included and separately packaged.



#### Commissioning

If not already installed, insert the filter cassettes into the support plate:

- check that the sealing tape is applied on the filter support frame,
- insert the absolute filter and make sure the filter casing sits tightly on the sealing tape, with the filter compact part oriented in the direction of the air flow,
- insert, in each corner, the special lock with a self-clinching nut and screw in the screw with an adjustable stud; press the compact filter frame (seal) against the filter frame,
- absolute filters must be mounted in the absolute filter frame in the direction ensuring that air flow presses the filters against the seal; air flow in the opposite direction is not allowed,
- check the connection of the pressure measuring hoses to the pressure measurement ports and connect the hoses if necessary.

#### Maintenance

Replace the filter cassettes:

- rotate the filter cassette in the direction of the arrow and pry it out of the support plate,
- repeat the procedure to remove all the filter cassettes,
- clean the section casing if necessary,
- insert new cassettes in the opposite direction and in the reverse order,
- check the air tightness of the filter frame-casing joints,
- check the air tightness of the support plate-filter frame joints,
- check the air tightness of the filter cassette-support plate joints.

## 3.5 Heat recovery units

### 3.5.1 Plate heat exchanger



#### Caution

See also section 3.1 General instructions.  
See the values in the selection program data and on the nameplate.

#### Commissioning

- Prior to starting the section up, check the tightness of the threaded joints and tighten them if required. Also check the correct installation and connection of the control dampers with the damper electric motor drive, as well as the damper operation.
- Make sure to allow for unobstructed removal of the water droplet eliminator from the air handling unit casing.
- Make sure to install an adequately-sized syphon in the condensate collection and draining pan discharge pipe. The instructions for the construction, installation and connection of syphons are provided in Section 2.3.5 Connection of syphon.

#### Maintenance

Regularly clean the plate heat exchanger. Fouling of the insert increases the pressure drop and decreases the efficiency.

A simple way to check for plate heat exchanger fouling is to remove the covers on the service side and inspect the cleanliness of the insert front surfaces, and, with the aid of a torch lamp, also the cleanliness of the air channels through the insert.

If the insert contamination consists of dry dust, the insert can be cleaned without disassembly through the service openings:

- With compressed air (a maximum of 10 bar of pressure); in this operation, the use of personal protective equipment is obligatory.
- If the insert contamination consists of greasy or sticky debris, slide out the insert from the heat exchanger section casing and clean it with a jet of hot water (temperature up to 90 °C, a maximum pressure of 6 bar) with an appropriate cleaning agent added.
- The contamination may also be removed by means of soaking in warm water with a detergent added.

#### Disassemble the insert from the casing:

- Remove the partition profiles on the service side by undoing the mounting screws,
- remove the rubber gasket,
- undo the top guide profile mounting screws, while only loosening the side guiding profiles, and then remove the top guide profile,
- slide out the insert from the section casing,
- replace the cleaned inserts in the section in the reverse order of the mentioned steps.



#### Caution

Since the insert filler material is made of a very thin aluminium foil, be careful not to damage the front surfaces of the insert when disassembling.  
With any maintenance or inspection intervention, also clean the condensate discharge at the bottom of the pan and top up the water in the syphon.

### 3.5.2 Rotary heat exchanger



#### Caution

See also section 3.1 General instructions.

See the values in the selection program data and on the nameplate.

Mount and install the heat exchanger in accordance with the manufacturer's instructions, which are appended to these instructions.

All the electrical installations and wiring must be carried out by an authorised and qualified professional in accordance with the heat exchanger manufacturer's instructions and applicable regulations.

#### Commissioning

Before Commissioning, check the following:

- the correct mounting of the rotary heat exchanger in the casing,
- the tightness of the threaded joints,
- the air tightness / positioning of the sealing rings between the rotor and the casing,
- the free rotation of the rotor,
- the adequate tension of the drive belt,
- the operation of the motor drive and the settings of the frequency converter parameters,
- the operation of the rotation monitoring magnet,
- clean any debris from the section.

Parameters for setting the frequency converter VLT Micro Drive FC-51:

Parameter	Description	Value
1-20	Motor power	Motor data plate
1-22	Motor voltage	Motor data plate
1-23	Motor frequency	Motor data plate
1-24	Motor current	Motor data plate
1-25	Motor r.p.m.	Motor data plate
1-73	Flying start	1 - enabled
4-12	Lim. Min Hz	20 Hz
4-14	Lim. Max Hz	50 Hz

#### Maintenance

The rotary heat exchanger has a self-cleaning design, so there is no need to filter incoming air, except in the event it carries extremely coarse or sticky dust particles.

The honeycomb structure may be cleaned with compressed air, water, steam or special cleaning agents. Clean it manually or by means of the installed cleaning nozzles. Pressures of up to 150 bar can be applied.



#### Caution

The humidity transfer rotors may not be cleaned with water or steam.

### 3.5.3 Run around coil



#### Caution

See also section 3.1 General instructions.

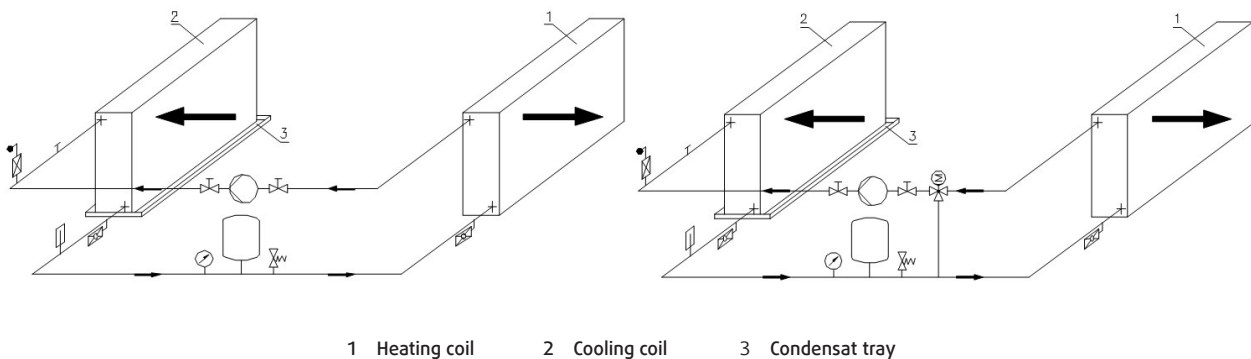
See the values in the selection program data and on the nameplate.

For Commissioning and maintenance of coils see also sections 3.7.2 Water heating coil and 3.7.3 Water cooling coil.

In preparing the water-antifreeze mixture, follow the instructions and prepare the mixture of the specified concentration, since too high a concentration reduces the heat exchanger thermal power, while too low a concentration poses a risk of inadequate protection against freezing at low operating temperatures.

#### Commissioning (Hydraulic circle)

- Make sure to properly connect the heat exchangers: they must be connected in a counter-flow configuration (air inlet side = medium outlet side).
- The circulation pump must meet the design specifications.
- Install venting and draining valves at appropriate points.
- In order to avoid the risk of condensate freezing on the fin package, the medium temperature at the inlet of the heat exchanger in the extract air flow may not be less than  $-3\text{ }^{\circ}\text{C}$ .
- Connect the hydraulic circuit in accordance with the design specifications and applicable safety regulations. The hydraulic circuit must be fitted with an appropriately sized and installed expansion vessel and a safety valve, as well as with all other necessary elements, depending on the method of control. Figure presents a hydraulic circuit without controls (left) and a hydraulic circuit with controls (right).



#### Maintenance (Hydraulic circle)

- Regularly check the operation of the circulating pump and make sure to keep the piping between the heat exchangers properly vented.
- Twice a year, check the operation of the control system.
- At the beginning of the winter season, check the anti-freezing capability of the medium and replace it if necessary. Replace the medium every two years.



### 3.6 Control damper



#### Caution

See also section 3.1 General instructions.

#### For standard item temperature stability check the values below:

- Gear: -15 °C to +80 °C.
- Sealing tape: -20 °C to +70 °C.

#### Commissioning

Control dampers are mounted on the casing from the outside or from the inside, depending on the project specifications, the customer's requirements and the air handling unit version.

- Two or more control dampers can be linked to a common drive by means of a lever mechanism (ball joints, drive levers and rods).
- When installing and linking the dampers, make sure to provide space for the movement of the motor drive and the lever mechanism.
- Prior to starting the section up, check the correct opening and closing of the damper, in particular in the case of dampers with a common drive.
- Before commissioning of the fan, check external dampers are fully open.
- On the outside, protect the control dampers with ducts or protection mesh if not factory protected.
- Mount and start the motor drive in accordance with the manufacturer's instructions and electric control cabinet start-up instructions.
- The required capacity of the motor drive depends on the control damper size and on the pressure differential across the damper. The required rotating torque is stated in the section technical sizing calculation. For safety factor use a minimum of 20% reserve.

#### Maintenance

In the case of outdoor-type air handling units, in extreme weather conditions (low temperatures combined with thick fog, wet snow), the protection mesh on the intake air suction section may freeze. In such an event, clean the mesh by mechanical means or defrosting.

Check the following:

- the condition of the gears and blades,
- the tightness of the threaded joints on ball joints and drive levers,
- whether the damper blades open and close correctly and
- whether the motor drive is firmly mounted.

### 3.7 Heating and cooling coils



#### Caution

See also section 3.1 General instructions.

We suggest that the piping is made in such a way that in the case of maintenance or replacement of the register, emptying the system and dismantling the piping is as easy as possible.

#### Filling of water piping:

- Partially open the transfer medium supply valve and wait for the blade register to uniformly warm up / cool down.
- Fully open the transfer medium supply valve.
- Vent the system.
- Start the fan.

#### Draining of water piping:

- Close the transfer medium supply valve.
- Slowly open the draining valve until the pressure is released from the heat exchanger, then fully open the draining valve and the venting valve.

#### 3.7.1 Frost protection

The protection of the heating coil against freezing is always carried out with a contact temperature sensor mounted on the return pipe of the heating fluid and with automatic regulation. The contact sensor must be set to 14 °C.

As an option, a capillary thermostat with a capillary mounted in a frame over the entire cross-section of the air conditioner can be installed. The thermostat must be set to 5 °C.

#### As the temperature drops below the set value, the thermostat and the automatic control system must carry out the

- Stop the fan,
- close the outdoor air intake control damper,
- fully open the heating medium valve and
- start the circulation pump.



#### Caution

In the case of air handling units that include a cooling coil, preheater and reheater, anti-frost protection at the preheater is sufficient.

In the event of a prolonged interruption of the power supply (or unit shut-down) or an interruption of the heating medium supply, drain the heating coil to prevent it from freezing. In order to absolutely prevent the risk of freezing, dry the tube bank by blowing it with compressed air after draining.

If the automatic control of the air handling unit is supplied by Systemair, the anti-frost protection is integrated in the unit in the factory; if the control system is implemented by the customer or another installer, arrangements for heating coil anti-frost protection are obligatory.

The type, connection, operation and maintenance of the capillary thermostat are specified in the operating instructions for the electrical control cabinet, regardless of whether the air conditioning control is manufactured by Systemair or determined and manufactured by the customer.

### 3.7.2 Water heating coil



#### Caution

See also section 3.1 General instructions and 3.7 Heating and cooling coils.

In the event of high heating medium temperatures (above 70 °C), arrangements must be provided to protect the fan electric motor from overheating during unit idling; this is achieved by automatically shutting off the supply of the heating medium into the heating coil and continued operation of the fan for a certain period of time (3 to 5 min) after unit operation has stopped.

#### Check before Commissioning

- The tightness of the threaded joints; tighten them if required,
- the proper functioning of the heat exchanger automatic anti-frost protection,
- the tightness of the piping joints,
- the proper functioning of the automatic shut-off of the supply of the heating medium into the heat exchanger at a heating medium temperature of 70 °C, to protect the electric motor against overheating.

#### Maintenance

In order to ensure smooth performance of the heat exchangers, the following operations should be carried out regularly:

- Check that the water connections are leakage-free and that the air joints are firmly mounted and leakage-free.
- Check the venting fan operation. In the event of disturbances in the medium flow through the heat exchanger or the formation of air cushions, vent the piping system.
- Check the operation of the heat exchanger automatic anti-frost protection.
- Periodically check the operation of the automatic shut-off of the supply of the heating medium into the heat exchanger with the unit stopped.
- Check the continued operation of the fan (for 3 to 5 min) after the unit is stopped to protect the electric motor against overheating.
- Regularly check the heating coil blades for dust build-up. Dust or scale build-up on blades reduces the heat exchanger capacity. Clean the blades at regular time intervals – approx. every 500 hours of operation.

To clean the blades, blow them with compressed air in the direction opposite the air flow direction.

If such cleaning proves insufficient, disconnect the heating coil, slide it out, and wash with low-pressure water or steam. Do not use high-pressure water or steam in order to avoid deforming the aluminium blades. If washing with water, the pressure thereof must not exceed 15 bar and the jet must be directed strictly parallel to the blades. Exposure to a water jet at an angle will damage the blades. This applies even more so to the blades at the edge, since these are even more fragile.



#### Caution

Under no circumstances should you attempt to clean the blades with a hard object.

### 3.7.3 Water cooling coil



#### Caution

See also section 3.1 General instructions and 3.7 Heating and cooling coils.  
Be sure to install a properly sized syphon on the drain pipe to collect and drain the condensate.  
Instructions for the construction, installation and connection are given in section 2.3.5 – Connection of syphon.

#### Check before Commissioning

- The tightness of the threaded joints; tighten them if required,
- the tightness of the piping joints.

#### Cooling coil anti-frost protection

The cooling circuit is filled with water:

- anti-frost protection relies on the anti-frost protection of the heating coil, which must be installed upstream of the cooling coil, or
- anti-frost protection relies on full draining of the system before the cold (winter) season, during which the system is to be shut down.

The cooling circuit is filled with a glycol/water mixture:

- anti-frost protection relies on the correct concentration of the glycol/water mixture. When handling glycol, follow the directions on the glycol safety data sheet.

#### Maintenance

In order to ensure smooth performance of the heat exchangers, the following operations should be carried out regularly:

- Check that the water connections are leakage-free and that the air joints are firmly mounted and leakage-free.
- Check the venting fan operation. In the event of disturbances in the medium flow through the heat exchanger or the formation of air cushions, vent the piping system.
- Check the adequacy of the cooling coil anti-frost protection.
- Regularly check the heat exchanger's blades for dust build-up. Dust or scale build-up on blades reduces the heat exchanger capacity. Clean the blades at regular time intervals – approx. every 500 hours of operation.

To clean the blades, blow them with compressed air in the direction opposite the air flow direction.

If such cleaning proves insufficient, disconnect the heating coil, slide it out, and wash with low-pressure water or steam. Do not use high-pressure water or steam in order to avoid deforming the aluminium blades. If washing with water, the pressure thereof must not exceed 15 bar and the jet must be directed strictly parallel to the blades. Exposure to a water jet at an angle will damage the blades. This applies even more so to the blades at the edge, since these are even more fragile.



#### Caution

Under no circumstances should you attempt to clean the blades with a hard object.

### 3.7.4 Direct expansion (DX)



#### Caution

See also section 3.1 General instructions.

In the case of air handling units of the hygienic type, with an internal height  $H > 1565$  mm, where the direct expansion coil must be slid out from the unit casing regularly for cleaning and disinfection, the DX coil must be connected to the cooling medium piping outside of the casing, and in such a manner that allows the disconnection of the cooling coil, its free sliding out from the casing, and, after cleaning, its replacement in the casing and leak-free reconnection to the system.

Be sure to install a properly sized syphon on the drain pipe to collect and drain the condensate.

Instructions for the construction, installation and connection are given in section 2.3.5 – Connection of syphon.

#### Piping connections

- Coolant and air must move in a counterflow configuration.
- Connect the piping and fittings so as to allow free access to the cooling coil and its sliding out for inspection and maintenance, without hindering access to adjacent sections.
- When tightening piping connections, apply counter-force by means of an appropriate tool (a pipe wrench with pads) to avoid damaging the DX tubing system.
- Considering the direction of air flow, connect the DX coil piping so that the air inlet into the DX coil is closer to the return pipe – in the case of either horizontal air flow or vertical air flow, to ensure medium and air counterflow.
- The most common method of joining is soldering; however, joining with quick couplers is preferable in order to reduce the costs of in-service blade cleaning. The thermal insulation of the evaporator extract pipe must provide a vapour barrier in accordance with applicable standards.
- In installing the thermostat expansion valve, follow the manufacturer's instructions; install the valve on the horizontal pipe leg, as close as practicable to the DX, upstream of the pressure equalisation and at a proper inclination considering the pipe thickness. The sensor must be insulated to avoid the interference effects of the surrounding air. The same applies to the valve sensor and pressure equalisation. We recommend the use of valves with external pressure equalisation in order to avoid the interference effects of the pressure drop across the evaporator.
- The distributor head must be mounted in a vertical position; if this is not practicable, make sure to install a Venturi head.
- Since the evaporator is not fitted with automatic blade defrosting, arrange the electric installation so as to block the compressor if the DX fan is not running. If larger variations of intake air temperatures are anticipated (larger proportions of ambient air), which in turn means DX operation at low power compared to the nominal power, we recommend the application of cooling power modulation by means of a hot bypass to prevent the blades from freezing.
- Clean any filing debris and other dirt from the piping system.

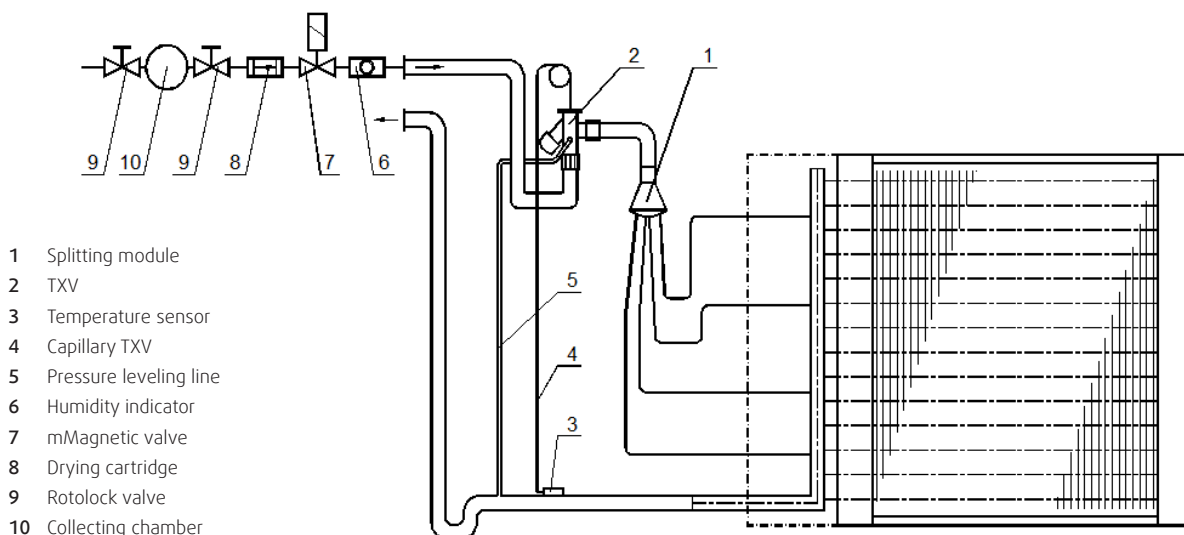
In addition to the thermal expansion valve, the essential equipment for the integration of the DUF in the compressor-condenser section includes:

- a drying cartridge,
- a solenoid valve (high-pressure – low-pressure limit),
- an inspection glass,
- a collector container, particularly in the cases of long pipes.



#### Caution

When planning the layout of piping, consider the oil recovery and other phenomena associated with Freon flow.



### Caution

Connection of the cooling system and filling with coolant may only be carried out by a qualified professional.

Connection should be made with copper pipes, which should be cleaned, dried and blown with dry nitrogen and plugged at both ends.

When selecting the combination, make sure to properly match the compressor and the DX section with other cooling circuit elements.

When installing, pay attention to the following:

- the maximum allowable distance between the DX section and the remaining part of the cooling circuit is 25 m,
- discharge pipes should be laid along the shortest route with the minimum practicable number of elbows (elbow radius  $R > 3.5 d$  - pipe diameter).

### Check before Commissioning

- The implementation of the electrical connections in accordance with the electrical wiring design document,
- the condensate discharge line,
- the tightness of the soldered joints,
- that the pressure testing and drying of the Freon lines has been successfully completed, as well as their connection to the air-cooled condenser and filling with coolant,
- the setup of the cooling system protection elements, such as the high-pressure/low-pressure protection switch, according to the specified levels. This also applies to the condensation pressure control switch.
- the correct volume of Freon (no droplets in the inspection glass),
- the dry condition of the unit (the inspection glass - colour indicator; dry - wet, in accordance with the manufacturer's instructions),
- the correct evaporation and condensation pressure.

Upon commissioning, make sure that the electric heater in the sump sufficiently heats the Freon to evaporate any liquid fraction of Freon (either by keeping the heater on permanently even with the unit shut down or by turning it on in advance before the unit commissioning).

### Medium filling

- Prior to filling the system, extract the air from it. Keep doing this until the piping system is dry and an adequate vacuum is achieved (see: filling of cooling systems).
- The system is usually filled through the suction connection on the compressor - larger compressors are fitted with a special connection. Upon releasing Freon from the cylinder into the system, start the compressor and keep filling until the specified evaporation pressure is reached and no more bubbles are seen in the inspection glass.



### Medium draining

- Shut off the isolating valves in the compressor-condenser section and evacuate Freon from the DX coil through the special valve (using the evacuation equipment in accordance with the Montreal Protocol).
- Disassemble the thermostat valve insert. In the case quick couplings are being used, disconnect them; if not, unsolder the DX coil to allow its dismounting.

### Maintenance

For smooth performance of the DX coil, the following operations should be carried out regularly:

- check the soldered joints,
- check the system pressure,
- periodically check the inspection glass for the appearance of bubbles and humidity,
- check the cooling circuit protection elements – mechanical and electrical,
- in the event of prolonged interruption of operation, check the performance of the compressor sump heater,
- check the operation of the DX fan,
- regularly check the DX blades for dust build-up. Dust or scale build-up on the blades reduces the heat exchanger capacity. Clean the blades at regular time intervals – approx. every 500 hours of operation.

To clean the blades, blow them with compressed air in the direction opposite to the air flow direction.

If such cleaning proves insufficient, disconnect the heat exchanger, slide it out and wash with low-pressure water or steam. Do not use high-pressure water or steam in order to avoid deforming the aluminium blades. If washing with water, the pressure thereof must not exceed 15 bar and the jet must be directed strictly parallel to the blades. Exposure to a water jet at an angle will damage the blades. This applies even more so to the blades at the edge, since these are even more fragile.



#### Caution

Under no circumstances should you attempt to clean the blades with a hard object.

### 3.7.5 Droplet eliminator



#### Caution

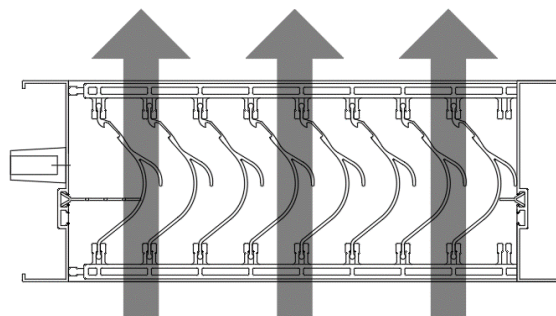
See also section 3.1 General instructions.

No piping (e.g. cooling system piping, electrical cable conduits, etc.) is to be laid through the eliminator blades in such a manner so as to spread the blades apart.

The blades are to be free of water scale and other salt build-up. Regularly check the soiling of the blades (once a year), and clean or replace the eliminator if necessary.

Be sure to install a properly sized syphon on the drain pipe to collect and drain the condensate.

Instructions for the construction, installation and connection are given in section 2.3.5 – Connection of syphon.



Correct air flow direction is illustrated in figure.

## Maintenance

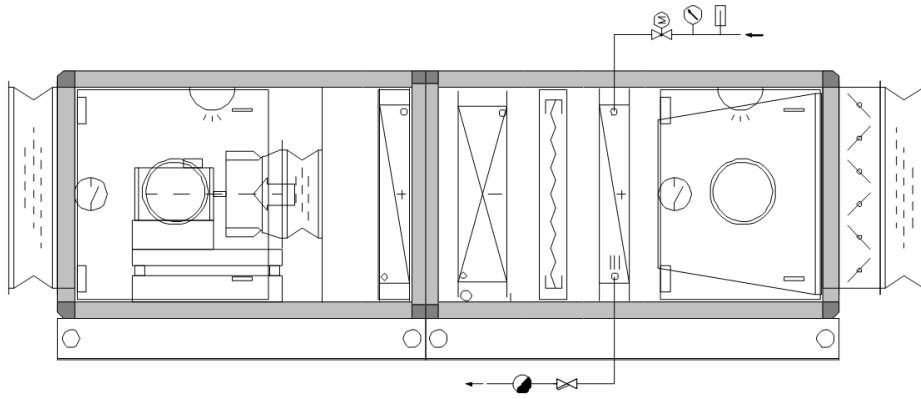
Regularly check the soiling of the blades, and clean or replace the eliminator if necessary, as follows:

- Slide the eliminator out.
- Clean the blades with a scale removal agent.
- Check the sealing and replace them if necessary.
- Insert the eliminator back into the casing.

### 3.7.6 Steam heating coil

#### Piping connection

- Steam and air must move in a counterflow configuration.
- Mount the steam heating coil in a vertical position – with the fin package tubing running vertically. Connect the steam supply on the top, with the pipe pitched towards the heating coil. The connection pipes and pipe fittings must not restrict heater thermal expansion.
- Considering the direction of the air flow, connect the heat exchanger piping so that air inlet into the heat exchanger is closer to the return pipe, to ensure steam-air counterflow.
- To facilitate dismounting, connect the heating coil by means of two pairs of flanges. Do not apply welding joints.
- Downstream from the connection shut-off valve, as well as at the heat exchanger inlet and outlet, install temperature sensors.
- Install a liquid draining valve at the lowest point of the piping installation. This will facilitate heating coil draining. At the highest point of the piping system, make provisions for venting, to ensure an unobstructed flow of steam through the heat exchanger.
- Provide for uniform temperature and incoming air distribution across the heat exchanger cross section, to avoid damaging the steam register due to water hammer effects in the parts of tubing exposed to higher thermal stress. At lower temperatures, there may be a risk of condensate freezing in certain parts of the heat exchanger.
- Due to the risk of water hammer, do not attempt, under any circumstances, to cold-start the steam heating coil or control its operation by flooding its internal surface. Such operation may also result in markedly non-uniform distribution of the outlet air temperature.  
Subcooled condensate in the flooded heating coil section causes large stresses in the structure and water hammer. This is particularly likely to occur at low inlet air temperatures. As steam comes into contact with subcooled condensate, steam bubbles abruptly collapse and cause implosions.
- Ensure safe, continuous and prompt draining of the condensate by properly pitching the condensate pipe towards the condensate collector. The condensate collector must be mounted so as to prevent the retention of condensate in the heating coil. It must always be installed below the lowest point of the steam heating coil. The diameter of the pipe connecting the condensate collector to the heating coil must not in any case be less than the diameter of the condensate collector pipe, in order to avoid the phenomenon of subsequent evaporation. Follow the condensate collector manufacturer's instructions for correct sizing and installation of the condensate collector. Only use float-type condensate collectors with continuous condensate discharge.
- In the case of automatic air temperature control, there is a risk of problems in the steam heating coil due to a drop in the pressure differential in the condensate collector. In order to avoid this, installation of an additional gravity condensate pump is recommended. With configurations featuring modulated steam preheaters, use of a gravity condensate pump is mandatory.
- In order to ensure smooth operation of the steam heating coil, make sure to supply it with dry saturated steam. Use of superheated steam results in decreased efficiency, while water droplets in wet steam damage pipe walls. The steam composition must meet the requirements of the applicable standards. Pay particular attention to the oxygen and carbon dioxide content, which may corrode and erode the heating coil tubes. Regularly check the steam quality in accordance with SIST EN 1861.



### Check before commissioning

- The tightness of the threaded joints; tighten them if required,
- the proper functioning of the heating coil automatic anti-frost protection, before the heating coil is filled with the heat transfer medium,
- the tightness of the piping joints,
- the proper functioning of the automatic shut-off of the supply of heating medium into the heating coil at a heating medium temperature above 70 °C, to protect the electric motor against overheating,
- the proper functioning of the automatic condensate discharge pot.

### Medium filling

- Partially open the steam valve and wait until steam begins to emerge from the draining and venting valve.
- Close the draining and venting valve and fully open the steam valve.



### Caution

Take care of possible very high medium temperature when draining.

### Medium draining

- Close the steam supply valve and open the draining valve.
- Once draining is finished, open the steam valve once again to let all the condensate drain from the section – until steam emerges.
- Close the steam valve.
- Let the draining valve open until the next restart.
- Upon draining the heat exchanger, dry the tube bank by blowing it with compressed air to absolutely prevent the risk of freezing of any residue of heating medium or condensate.

### Protection against the fan motor overheating

In the event of high steam temperatures, arrangements must be provided to protect the fan electric motor from overheating during unit idling; this is achieved by automatically shutting off the supply of the heating medium into the heating coil and continued operation of the fan for a certain period of time (3 to 5 min) after the unit operation has stopped.

## Maintenance

In order to ensure smooth performance of heat exchangers, the following operations should be carried out regularly:

- Check that the steam and water connections are leakage-free and that air joints are firmly mounted and leakage-free.
- Check the venting fan operation. In the event of disturbances in the medium flow through the heat exchanger or the formation of air cushions, vent the piping system.
- Check the operation of the heat exchanger automatic anti-frost protection.
- Periodically check the operation of the automatic shut-off of the supply of steam into the heat exchanger with the unit stopped.
- Check the continued operation of the fan (for 3 to 5 min) after the unit is stopped to protect the electric motor against overheating.
- Regularly check the heating coil blades for dust build-up. Dust or scale build-up on blades reduces the heat exchanger capacity. Clean the blades at regular time intervals – approx. every 500 hours of operation. To clean the blades, blow them with compressed air in the direction opposite to the air flow direction. If such cleaning proves insufficient, disconnect the heating coil, slide it out and wash with low-pressure water or steam. Do not use high-pressure water or steam in order to avoid deforming the aluminium blades. If washing with water, the pressure thereof must not exceed 15 bar and the jet must be directed strictly perpendicular to the blades. Exposure to a water jet at an angle will damage the blades. This applies even more so to the blades at the edge, since these are even more fragile. Under no circumstances should you attempt to clean with a hard object.
- Periodically check the proper operation of the automatic condensate discharge pot.
- Regularly clean the condensate discharge lines.

### 3.7.7 Electric air heater



#### Caution

See also section 3.1 General instructions.

The connection of the electric air heater must be carried out by a qualified professional in accordance with the applicable regulations.

Connection, commissioning and maintenance to be carried out according to the manufacturer's instructions.



#### Connection

- Any functional section containing temperature-sensitive materials should be separated from the electric air heater section by an empty section at least 300 mm in length.
- The air velocity through the electric air heater must not be less than 1,5 m/s; the air inflow must be evenly distributed across the entire cross section.
- The maximum operating air temperature is 50 °C.
- Connection terminals in the electric air heater connection box are accessible from the section service side.
- Lead the electric cables into the connection box through the cable glands and make sure the cable run does not obstruct the servicing of the adjacent functional sections.
- The electric heating elements are connected to the mains voltage of 3 x 230 V or 3 x 400 V, and achieve surface temperatures depending on air velocity from 200 up to 500 °C during operation.
- An air handling unit that includes an electric air heater section must be fitted with an air flow control function.
- The electric air heater may only be switched on after the fan has started and built up an adequate air flow.
- After the electric air heater has been switched off, the fan must continue to run for 3 to 5 minutes to cool down the electric heating elements.
- The safety temperature limiter and safety thermostat sensors must always be installed in the upper part of the electric air heater section – above the electric heating elements, where the temperature reaches the highest levels in the event of air flow interruption.
- The electric air heater is not waterproof, therefore, the electric air heater section must not be installed in a location exposed to water or water steam.

## Maintenance

Once a month, check the following:

- how well the electric connections are attached,
- the installation of the temperature safety limiter and thermostat sensors,
- the operation of the temperature safety limiter and safety thermostat,
- the operation of the air flow control equipment,
- the operation of the relays for starting the fan in advance and delayed stopping of the fan,
- the proper mounting and attachment of the guards to protect against contact (the service cover, the connection box cover, the protection mesh, etc.).

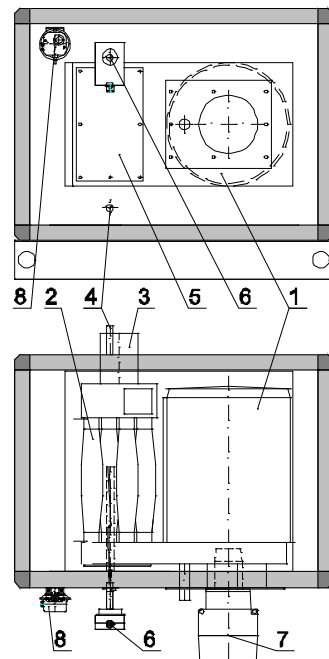
### 3.7.8 Indirect gas heating coil



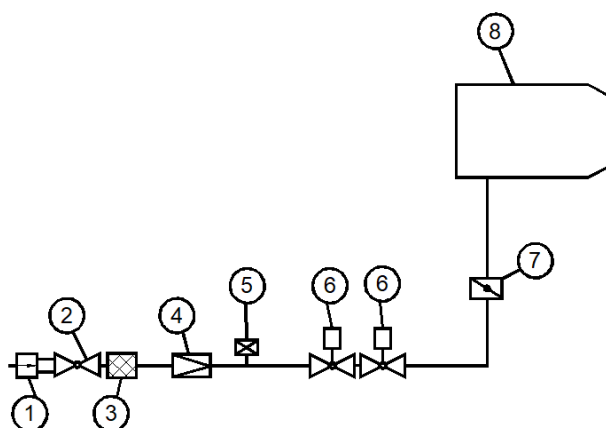
#### Caution

See also section 3.1 General instructions.

The gas connection, commissioning and maintenance of the gas burner may only be carried out by an authorized and professionally qualified person in accordance with the instructions of the gas burner manufacturer and in accordance with the approved design and applicable regulations.



- 1 Combustion chamber
- 2 Tube exchanger
- 3 Smoke exhaust connection
- 4 Flue gas condensate drain connection
- 5 Audit door
- 6 Safety thermostat and safety temperature limiter
- 7 Gas burner with stepless control of heating power
- 8 Pressure switch



- 1 Thermal protection
- 2 Shut-off ball valve
- 3 Gas filter
- 4 Gas pressure controller
- 5 Gas pressure switch
- 6 Magnetic valve for gas
- 7 Throttle valve for gas
- 8 Gas burner

## Connection

- The indirect gas heating coil section must always be located in the positive pressure part of the air handling unit – downstream from the supply fan, to prevent the mixing of supply air and flue gases in the event of a heat exchanger defect.
- The heat exchanger is installed into its casing on guide rails that facilitate its sliding out from the section in the event of defect or damage. For this purpose, provide a clearance space on the unit service side of a width equal to or greater than the external width of the air handling unit.
- Upstream and downstream of the gas heater section, the installation of empty sections is specified/planned, with a modular length of min. 600 mm, with access into the interior to enable checking the condition of the gas heater.
- Discharge from the pan must be led through the section bottom into a syphon and acid neutralisation unit into the sewage system.
- The condensate drain connection, located in the inspection opening at the bottom back part of the tube register collector, must be led through the back wall of the section casing.
- The safety pressure switch, the safety thermostat, the temperature limiter and the operating thermostat must be installed outside the section casing. In the case of an outdoor unit, protect these elements, as well as the burner, by installing them in a waterproof and thermally insulated protection chamber.
- The gas burner must be fixed to the combustion chamber rim from the outer side of the section casing. For this purpose, apply flanges adapted to the size and type of gas burner.
- In the case of indoor air handling units, make the necessary provisions for adequate inflow of combustion air, natural ventilation of the room and extraction of flue gases.
- In the case of outdoor units that are exposed to weather elements (wind, rain, snow, etc.), the gas burner must be installed in a waterproof and thermally insulated protection chamber, which, on its bottom side, must be fitted with an opening to freely supply combustion air. The protection chamber must be large enough to also accommodate the safety pressure switch, the safety thermostat, the temperature limiter and the operating thermostat. The chamber must have enough capacity (to the left and to the right of the gas burner) to allow the installation of the gas supply train.
- In designing the method for the extraction of flue gases, consult a competent chimney-sweeping service. Where the supply of a section with a stack is ordered, the stack must be sized and constructed in accordance with the applicable regulations, laws and standards. To facilitate obtaining consent from a chimney-sweep service, design documents should be drawn up for the stack, including the solutions for the extraction and neutralisation of the flue gas condensate.
- Connect the gas heater to the stack in accordance with the requirements applicable to stacks for gas-fired installations. The joint between the stack connection and the stack tube must be waterproof to prevent uncontrolled discharge of condensate in the event of flue gas condensation.
- The gas heater stack connection does not need to maintain a natural draft.
- Electric cables must not be run inside the section casing. In the case of an outdoor unit, a gas burner protection chamber may be utilised to accommodate cables, provided that the cables do not obstruct the servicing of the equipment; alternatively, cables may run on the free outer surfaces of the casing (back wall, bottom, etc.), in agreement with the designer or the customer.
- The gas supply line must be arranged so as not to obstruct the servicing of the unit's functional sections and to allow any functional element to be slid out of the casing of the air handling unit as necessary.
- In the gas heating coil section design, the free circulation of air must be ensured between the unit interior and the environment, for cooling purposes. Fit the opening in the ceiling or on the side with a spring-driven damper and install a duct leading from the damper to the open air. The damper and the duct must be thermally insulated; the insulation material must be non-combustible. In the event of power supply failure or any other fault that may result in the abrupt failure of unit interior cooling or its overheating, the damper must open and allow natural cooling of the gas heating coil.
- The sealing between the casing frame and the panels of the left and right adjacent sections and the sealing of the joints between the left and right sections and the gas heating coil must be provided by means of a ceramic fibre sealing tape 19 x 5 mm, resistant to temperatures in a range from -20 to +1200°C. In the case of putty sealing, apply a high resistance grade glue-sealing paste, stable at temperatures in a range from -40 to +250 °C, and, on a short-term basis, to +300°C.
- All the electric cables, cable glands and protection tubes installed inside the casings of the left and right sections adjacent to the gas heating coil section must have insulation resistant to high temperatures.
- For the purposes of filtering air immediately upstream of the gas heating coil, apply a metal filter with no EPDM sealing tape and with no bottom pan (unless greases are to be filtered out).

- In order to isolate the casing of the gas heating coil section from the noise and vibrations generated by the fan section upstream, apply a flexible connection made of a non-combustible material resistant to high temperatures.
- In order to isolate vibrations generated by the fan section upstream of the gas heating coil section, apply spring vibration isolators.
- In order to equalise the electric potentials of the fan upstream and the gas heating coil, apply a non-insulated Cu conductor.

### Commissioning

- The volume flow rate of the air passing along the combustion chamber and the heat exchanger tube register may not drop under the minimum value mandatory for the cooling of the heat exchanger walls. Therefore, check the following before commissioning:
- the installation and operation of the heat exchanger outlet air temperature monitoring thermostat in a range from 50 °C to 60 °C,
- the installation and operation of the damper electric motor and its limit switch; in the event of a power supply failure or any other fault that may result in the abrupt failure of unit interior cooling or its overheating, the damper must open and allow natural cooling of the gas heating coil,
- the stopping and blocking of the restarting of the gas burner by the motor drive limit switch when the heat exchanger cooling control damper reaches an 80% closed position,
- the installation and operation of the safety air flow rate gauge, the function of which is to stop the gas burner in the event of an inadequate air flow rate along the heat exchanger,
- the operation of the monitoring pressure switch, the function of which is to stop the gas burner in the event of excessive positive pressure in the combustion chamber,
- the installation and operation of the protection thermostat, the function of which is to automatically stop the gas burner in the event the air temperature in the chamber above the heat exchanger exceeds approx. 70 °C,
- the installation and operation of the safety thermostat (temperature limiter), the function of which is to stop the gas burner and block it in the event the air temperature around the heat exchanger exceeds approx. 90 °C; in order to restart the gas burner, manual intervention must be required,
- the installation and operation of the time relay, the function of which is to prolong the operation of the supply fan after the gas burner is stopped,
- the sealing of the heat exchanger and the extraction of flue gases.

### Maintenance

Once a month, check the following:

- the operation of the heat exchanger outlet air temperature monitoring thermostat in a range from 50 °C to 60 °C,
- the operation of the damper electric motor drive and its limit switch,
- the operation of the stopping/blocking of the restarting of the gas burner by the motor drive limit switch when the heat exchanger cooling control damper reaches an 80% closed position,
- the operation of the time relay, the function of which is to prolong the operation of the supply fan after the gas burner is stopped,
- the operation of the safety air flow rate gauge, the function of which is to stop the gas burner in the event of an inadequate air flow rate along the heat exchanger,
- the operation of the monitoring pressure switch, the function of which is to stop the gas burner in the event of excessive positive pressure in the combustion chamber,
- the operation of the protection thermostat, the function of which is to automatically stop the gas burner in the event the air temperature in the chamber surrounding the heat exchanger exceeds 70 °C,
- the operation of the safety thermostat (limiter), the function of which is to automatically stop and block the gas burner in the event the air temperature in the chamber surrounding the heat exchanger exceeds 90 °C,
- the sealing of the heat exchanger and the extraction of flue gases.



### 3.8 Sound attenuator



#### Caution

See also section 3.1 General instructions.  
Every single splitter can be removed from the section.

#### Commissioning

In the case of cabling or joining sections, the removable panel on the section can be removed and the splitters removed. After the work is done, the splitters are returned and the section is restored to its original condition.

#### Maintenance

Splitters and section must be checked for dirt, damage and corrosion. In case of damage or soiling, cleaning is required. A vacuum cleaner can be used to clean dust and dirt.

### 3.9 Humidifiers

#### 3.9.1 Steam humidifier



#### Caution

See also section 3.1 General instructions.  
The steam used for the steam humidifier must not contain any substances harmful to health. Water for steam production must correspond at least to the quality of drinking water.  
Connection, commissioning and maintenance to be carried out according to the manufacturer's instructions.  
Use syphons resistant to medium of at least 100 °C.  
Be sure to install a properly sized syphon on the drain pipe to collect and drain the condensate.  
Instructions for the construction, installation and connection are given in section 2.3.5 – Connection of syphon.

#### Commissioning

The steam distributor is mounted into the air handling unit casing in such a manner so as to provide the required clear space around it and the required length of the empty humidifying chamber in the direction of air flow, as well as to ensure the uniform distribution of steam across the entire air handling unit cross section.

- The air handling unit control system must ensure that the relative humidity within the air handling system never exceeds 90%.
- The steam humidifier may only start operating after the air flow achieves appropriate velocity and temperature.
- The steam humidifier must stop operating even before the fan is stopped, or in the event of an interruption of the air flow due to an interruption in the operation of the air handling unit, in the event of relative humidity exceeding 90% or for any other reason.

#### Maintenance

Maintenance to be carried out according to the manufacturer's instructions and maintenance schedule.

### 3.9.2 Honeycomb humidifier



#### Caution

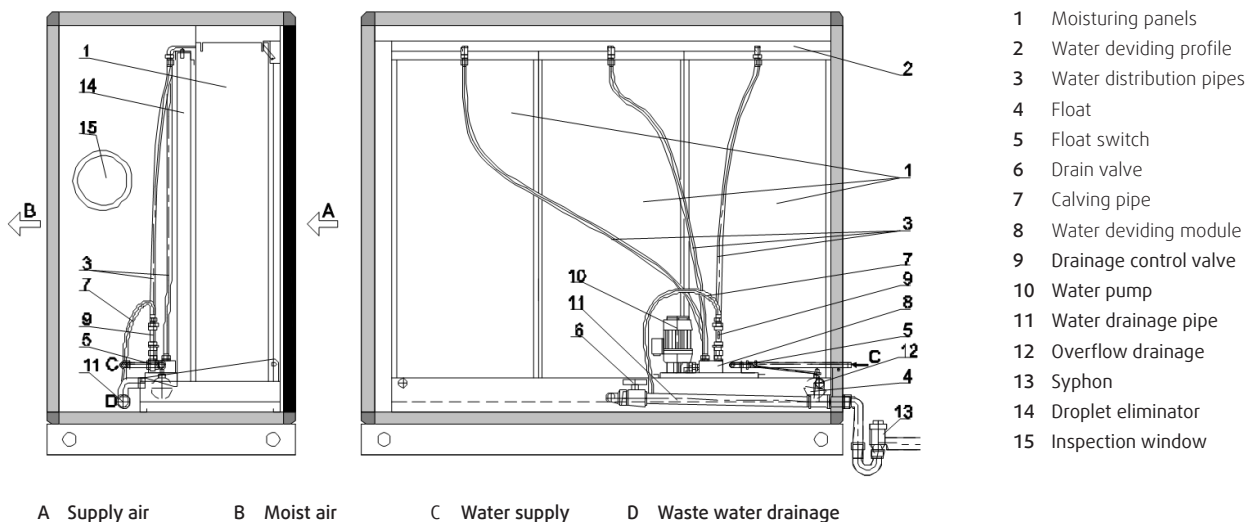
See also section 3.1 General instructions.

Connection, commissioning and maintenance to be carried out according to the manufacturer's instructions.

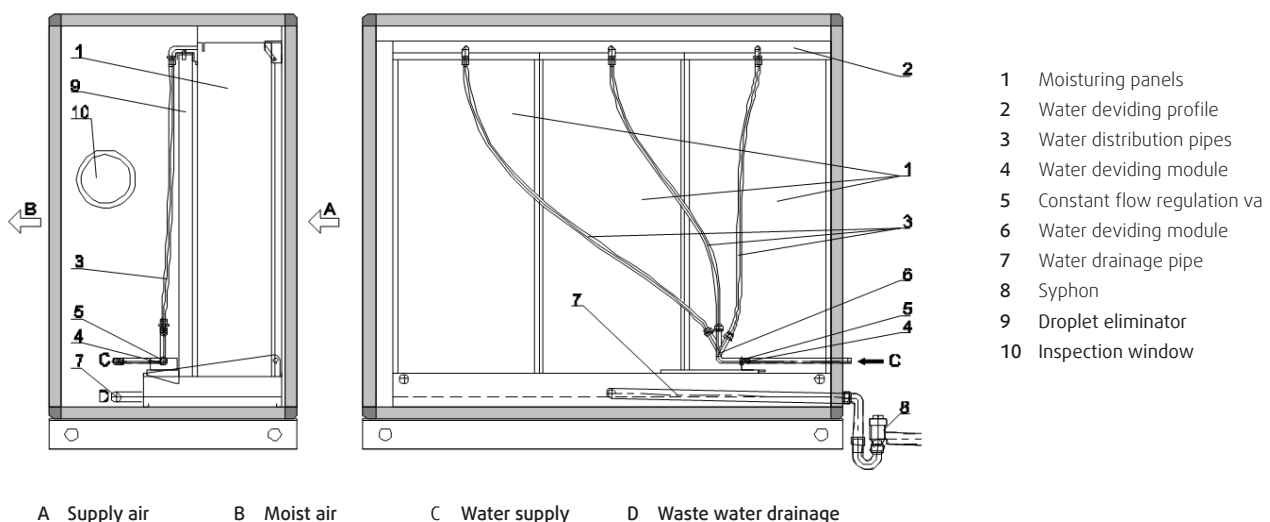
Be sure to install a properly sized syphon on the drain pipe to collect and drain the condensate.

Instructions for the construction, installation and connection are given in section 2.3.5 – Connection of syphon.

#### Humidifier with circulating water



#### Humidifier with direct water



#### Water consumption

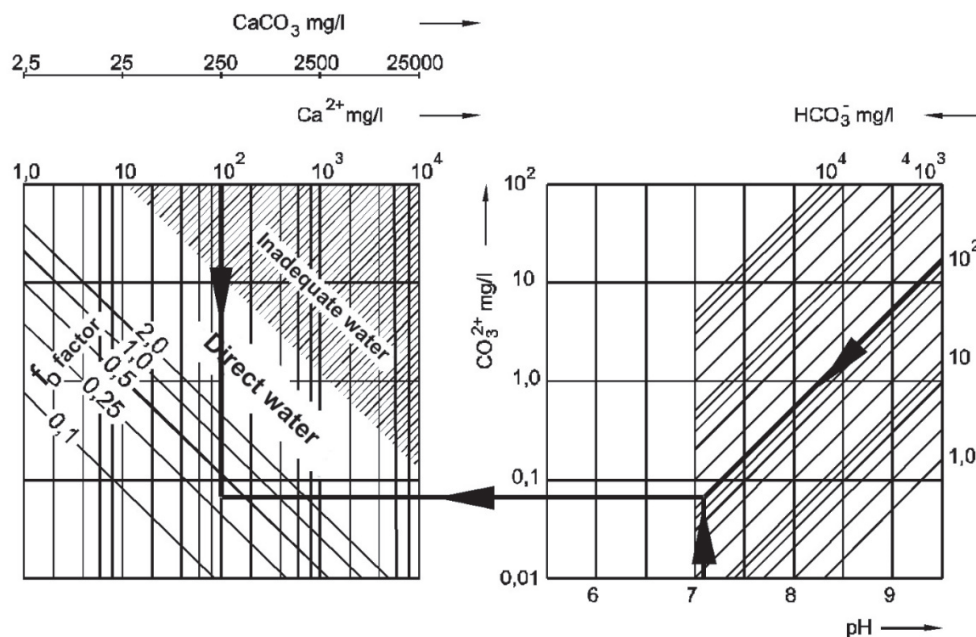
##### Circulating water system:

The total water consumption is the sum of the absorbed water (E) and the bleed-off water (O).

Water bleed-off is necessary to maintain appropriate mineral and salt content levels in the humidifier section reservoir water.

## Bleed-off factor

With a given water quality, the bleed-off factor ( $f_o$ ) is determined by means of the water quality diagram.



If the water bleed-off factor,  $f_o$ , exceeds 2, the application of a direct water system is recommended, or the water quality should be improved.

## Direct water system:

$$E = (V \times 60 \times 1.2 \times (X_2 - X_1)) / 1000$$

$$O = f_o \times E$$

$$S = E + O$$

**E** - amount of absorbed water (l/min)

**O** - amount of bleed-off water (l/min)

**S** - total water consumption (l/min)

**V** - volumetric air flow rate (m<sup>3</sup>/h)

**1.2** - standard air specific mass (kg/m<sup>3</sup>)

**X<sub>2</sub>** - outlet air humidity (g/kg)

**X<sub>1</sub>** - inlet air humidity (g/kg)

**f<sub>o</sub>** - bleed-off factor

**60** - conversion factor ((m<sup>3</sup>/s) to (m<sup>3</sup>/min))

**1000** - conversion factor ((g/min) to (l/min))

## Example calculation:

$V = 2.8$  m<sup>3</sup>/s

pH = 7.1

Calcium concentration

( $\text{Ca}^{2+}$ ) = 100 mg/l (100 ppm)

Bicarbonate concentration

( $\text{HCO}_3^-$ ) = 100 mg/l (100 ppm)

Inlet air humidity ( $x_1$ ) = 2 g/kg

Outlet air humidity ( $x_2$ ) = 9 g/kg

From the water quality diagram: ( $f_o$ ) = 0.3

$$E = (2.8 \times 60 \times 1.2 \times (9 - 2)) / 1000 = 1.41 \text{ l/min}$$

$$O = 0.3 \times 1.41 = 0.42 \text{ l/min}$$

$$S = 1.41 + 0.42 = 1.83 \text{ l/min}$$

## Commissioning

- On the humidified air outlet side, provide the humidifier section with a service space 300-300 mm in width.
- Upon installation, seal all the gaps to the casing.
- Connect the water supply and drain from the humidifier with a syphon.



## Caution

As regards microbiological parameters, the filling supply water must meet the requirements for potable water and the requirements of the applicable regulations.

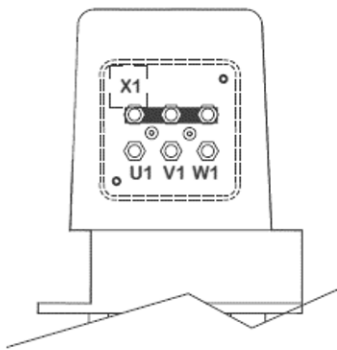
### Water piping connections:

- shut-off valve (not included in scope of standard equipment)
- 500 µm water filter (if the water contains coarse particles)\*
- solenoid valve (not included in scope of standard equipment – only for direct water)
- constant flow rate valve (only for direct water)

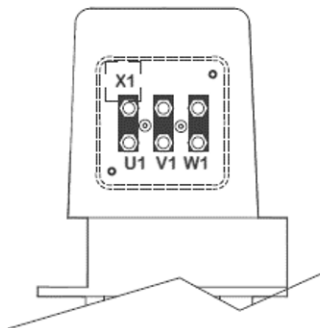
### The extraction of water:

In order to facilitate water bleed-off from the humidifier section under negative pressure, an appropriate negative pressure syphon must be provided.

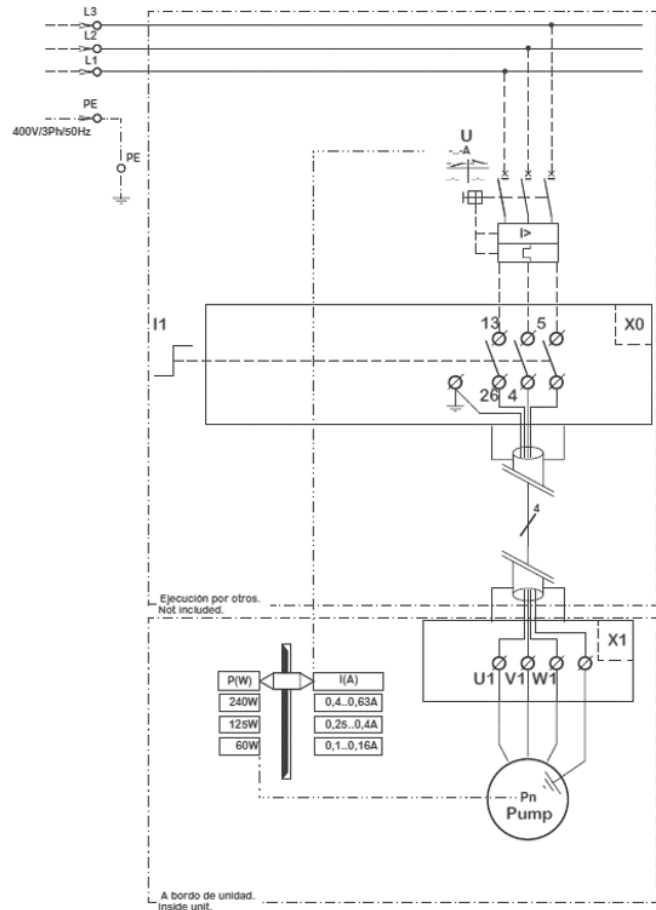
### Control:



Star connection: 400 V / 3p / 50 Hz



Delta connection: 230 V / 1p / 50 Hz



Wiring diagram for 3-phase pump

## Maintenance

- Maintain the honeycomb humidifier section so as to prevent the growth and reproduction of microorganisms on any component of the air handling unit / ventilation system.
- At a minimum, the water in the humidifier tank must meet the quality requirements for potable water. In order to avoid the build-up of lime deposits on the water droplet eliminator, total water hardness should not exceed 7°dH.
- Prevent the growth of bacteria by means of an appropriate sterilisation system or by means of regular and appropriate cleaning.
- The bacteria count in the circulating water should not exceed the standard 1000 CFU/ml level at an incubation temperature of 20°C ± 1°C and 36 °C ± 1°C.
- Avoid the occurrence of Legionella bacteria in the humidifier water. The total count of such bacteria should not exceed 1 CFU/ml.
- The total count of aerobic bacteria and Legionella bacteria should not exceed the level allowable according to the regulations in force in the region where the unit containing the particular honeycomb humidifier section is installed. Check the count of bacteria in water in accordance with the applicable regulations.
- Apply a physical or chemical method of disinfection. The selected method must be effective and not harmful to health.
- The relative humidity of air within the system should not exceed 90%.
- The addition of chemicals to water for honeycomb humidification must not compromise air quality.
- In selecting the process, consult hygiene experts.
- Prior to starting up the humidification function, make sure to start the humidifier water supply (start the pump) to the humidifier cassettes – 15 min before starting the fan. This will, according to the manufacturer's recommendations, ensure full wetting of the humidifier cassettes.
- The duration of the humidifier operation, from the start to the shutdown, should be, at a minimum, 10 to 15 min. The same amount of time should also pass between the shutdown and the next restart of the humidifier. If the humidifier runs in a sequence of short intervals, some parts of the humidifier may be neither fully wet nor fully dry. According to the manufacturer's declaration, this may result in a fishlike odour.
- Once there is no longer a demand for humidifying and the honeycomb humidifier section is shut down (the water supply is shut off), the air handling unit / fan may not be stopped until the humidifier cassettes are dry. The necessary prolonged time of operation of the air handling unit is 20 minutes at a minimum.
- If the honeycomb humidifier is to be out of operation for at least 24 hours, drain the water from the humidifier tank. We recommended the installation of equipment for automatic water draining and drying.
- When the air handling unit is out of operation, the humidifier section, the honeycomb humidifier and the syphon must be cleaned of all lime deposits and dirt. If the unit is not cleaned, particles of dirt harden and cause early defects in the pump upon its restarting.
- In the event odours (e.g. a rotten egg odour) are present in the humidifier (and in turn, in the supply air), this indicates the presence of bacteria in the water or humidifying cassettes. In such an event, shut down the air handling unit, drain the water from the humidifier section, slide out the cassettes and disinfect the cassettes, the water tank and the section casing.
- Carry out a microbiological analysis of the supply water. If the presence of bacteria is established, disinfect the water.
- If dust of organic origin is present in the air entering the honeycomb humidifier, upgrade the filtration to class F7.
- Set the appropriate rate of the honeycomb humidifier bleed-off. To this end, carry out a chemical analysis of the supply water to obtain the necessary data, as follows:
  - CaCO<sub>3</sub> content (mg/l), Ca<sup>+</sup> content (mg/l), HCO<sub>3</sub><sup>-</sup> content (mg/l), pH value. From the water quality diagram (provided in the honeycomb humidifier manufacturer's instructions), determine the bleed-off factor, f<sub>0</sub>. For a particular unit, calculate the bleed-off water volume according to the following formula:
  - $O = f_0 \times E$ , where:
  - E is the amount of absorbed water (l/min)
  - O is the amount of bleed-off water (l/min)
- Set the bleed-off water flow rate by means of the bleed-off valve by turning the valve knob to the corresponding number (to the left or to the right), then check the bleed-off water flow rate (capture the bleed-off water in a container of a known capacity, not less than 1 litre, and measure the container filling time). Repeat this procedure until the correct bleed-off rate is achieved.

- Set the appropriate rate of the honeycomb humidifier bleed-off. To this end, carry out a chemical analysis of the supply water to obtain the necessary data, as follows:  
CaCO<sub>3</sub> content (mg/l), Ca<sup>+</sup> content (mg/l), HCO<sub>3</sub><sup>-</sup> content (mg/l), pH value. From the water quality diagram (provided in the honeycomb humidifier manufacturer's instructions), determine the bleed-off factor, f<sub>0</sub>. For a particular unit, calculate the bleed-off water volume according to the following formula:

**$O = f_0 \times E$** , where:

**E** is the amount of absorbed water (l/min)

**O** is the amount of bleed-off water (l/min)

- Set the bleed-off water flow rate by means of the bleed-off valve by turning the valve knob to the corresponding number (to the left or to the right), then check the bleed-off water flow rate (capture the bleed-off water in a container of a known capacity, not less than 1 litre, and measure the container filling time). Repeat this procedure until the correct bleed-off rate is achieved.



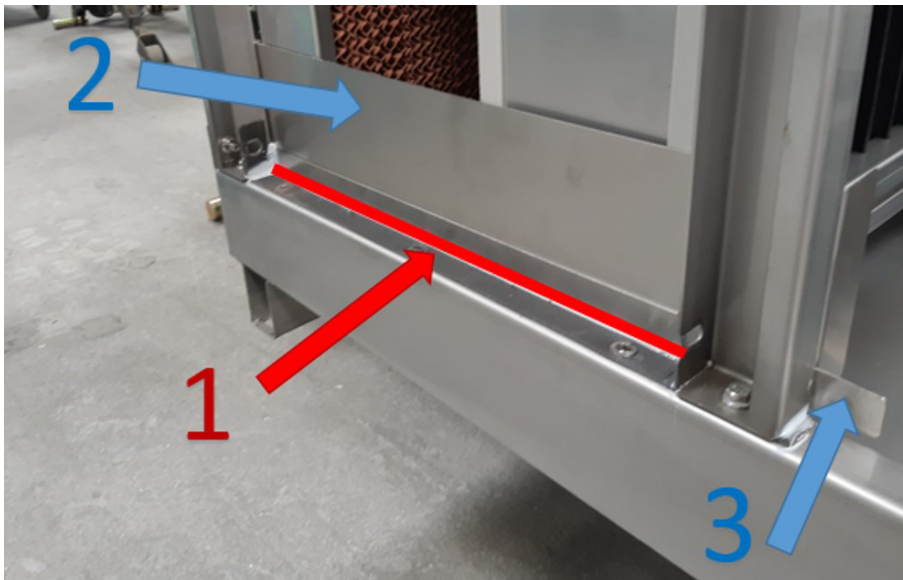
#### Caution

Keep the inner and outer surface of the inspection glass clean. If you notice fouling, thoroughly clean the glass immediately.

When honeycomb or droplet eliminator needs to be removed or replaced:

- fixed panel has to be removed,
- sealant on the external side has to be cut (1)
- two plate sheets have to be removed (2 and 3).

**After maintenance they have to be readjusted to starting position.**



### 3.9.3 High pressure humidifier



#### Caution

Technical data, dimensional data, layout and maintenance are added to the ordered air unit as an attachment.

### 3.10 Electric control cabinet



#### Caution

See also section 3.1 General instructions.

The electric control cabinet consists of a connection part and a measuring part, which are mechanically separated from each other. It consists of the following basic elements: cabinet sinks, door with point closing and lock, elements for flow protection, separation and KS protection and measuring equipment.

An electric control cabinet may be installed inside the air handling unit casing, on the unit casing, on a separate pedestal next to the unit or on the machine room wall. The site of the installation of the electric control cabinet is determined at the time of placing the order, according to the customer's request.

#### **Electric control cabinet inside the air handling unit casing**

The electric control cabinet is installed in an empty section in such a manner that it does not obstruct the inflow of air to the adjacent functional elements or the maintenance thereof.

#### **An electric control cabinet on the air handling unit casing**

An electric control cabinet is installed on the outer wall of a fixed panel in such a manner that the cabinet itself and the electric cables do not obstruct access to the unit's interior or access to the functional elements for operational and maintenance purposes.

#### **An electric control cabinet on a separate pedestal next to the air handling unit**

The scope of supply from Systemair d.o.o. is the electric control cabinet itself, the wiring between the air handling unit and the electric control cabinet, and start-up, if so specified in the order confirmation.

In such an arrangement, Systemair d.o.o. does not carry out the mounting of the electric control cabinet or any required construction works (penetrations, cable trays, laying of the power supply and control cables from the air handling unit to the electric control cabinet, etc.). These are the responsibility of the customer.

An electric control cabinet on the machine room wall

The scope of supply from Systemair d.o.o. may include the electric control cabinet itself, the wiring between the air handling unit and the electric control cabinet, and the start-up, if so specified in the order confirmation.

In such an arrangement, Systemair d.o.o. does not carry out the mounting of the electric control cabinet or any required construction works (penetrations, cable trays, laying of power supply and control cables from the air handling unit to the electric control cabinet, etc.). These are the responsibility of the customer.

## 4. REMOVAL AND DISPOSAL



#### Caution

See also section 3.1 General instructions.

At the end of unit's service life, the device must be removed from use and decommissioned in accordance with applicable environmental regulations and legislation. Disassembly of the unit may only be performed by an authorized company.

All substances (eg oils, refrigerant, batteries) must be disposed of in accordance with local regulations.

All metal and plastic parts must be separated and sent for recycling.







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