



# WEGER

quality air, quality life

**INSTALLATION AND  
OPERATING MANUAL  
FOR  
WEGER AIR HANDLING UNITS**

**ENGLISH**

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*Please read carefully and keep for future reference.*



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**Always observe all relevant standards  
and statutory regulations.**

Subject to changes without prior notice

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## 1. General information

The installation and operating manual forms part of the scope of delivery of your product and must be filed near the unit where it is accessible at all times. All persons carrying out work on the machine must have read this manual and adhere to all instructions. For work on unit elements and built-in assemblies that are not covered in this document, refer to the separate manual.

### 1.1. Unit series

WEGER produces units for a wide range of applications.  
 This manual applies to the following series:

#### Series:

|                |             |
|----------------|-------------|
| DIWER EVO      | DIWER TE PU |
| DIWER EVO PU   | DIWER       |
| DIWER EVO DP80 | DIWER PU    |
| DIWER TE       |             |

#### Design:

| Series:        | Profile             | Panelling             | Insulation                       | Sealing               |
|----------------|---------------------|-----------------------|----------------------------------|-----------------------|
| DIWER EVO      | thermally decoupled | with plastic frame    | Rock wool                        | PUR foam (sprayed on) |
| DIWER EVO PU   | thermally decoupled | with plastic frame    | PU foam                          | PUR foam (sprayed on) |
| DIWER EVO DP80 | thermally decoupled | with plastic frame    | 40 mm rock wool + 40 mm PU board | PUR foam (sprayed on) |
| DIWER TE       | thermally decoupled | without plastic frame | Rock wool                        | Hollow seal (clamped) |
| DIWER TE PU    | thermally decoupled | without plastic frame | PU foam                          | Hollow seal (clamped) |
| DIWER          | not decoupled       | without plastic frame | Rock wool                        | Hollow seal (clamped) |
| DIWER PU       | not decoupled       | without plastic frame | PU foam                          | Hollow seal (clamped) |

## Model box details according to DIN EN 1886 (July 2009)

| <i>Series</i>  | <i>Thermal insulation</i> | <i>Heat bridge factor</i> | <i>Housing leakage</i> | <i>Mechanical stability</i> | <i>Filter bypass leakage</i> |
|----------------|---------------------------|---------------------------|------------------------|-----------------------------|------------------------------|
| DIWER EVO DP80 | T1                        | TB1                       | L1                     | D1                          | G1 – F9                      |
| DIWER EVO      | T2                        | TB1                       | L1                     | D2                          | G1 – F9                      |
| DIWER EVO PU   | T2                        | TB2                       | L1                     | D1                          | G1 – F9                      |
| DIWER TE       | T2                        | TB3                       | L1                     | D2                          | G1 – F9                      |
| DIWER TE PU    | T2                        | TB3                       | L1                     | D1                          | G1 – F9                      |
| DIWER          | T3                        | TB3                       | L1                     | D2                          | G1 – F9                      |
| DIWER PU       | T3                        | TB3                       | L1                     | D1                          | G1 – F9                      |

Each of the above series is available in versions HG = hygiene; WF = weather-proof.

The models of the DIWER series are also available as an ATEX unit.

## 1.2. ATEX units



In accordance with the ATEX Directive 94/9/EC, units bearing the "Ex" mark (ATEX units) may be operated in potentially explosive atmospheres as specified on the type plate and in the technical data sheet.

### **Important!**

**Units bearing the "Ex" mark must not be modified or extended in any way without the manufacturer's written consent.**

### **ATEX units must not be operated near:**

- High-frequency sources (e.g. transmitter stations)
- High-power light sources (e.g. laser light)
- Ionising radiation sources (e.g. X-ray machines)
- Ultrasound sources (e.g. ultrasonic echo devices)



**Already installed units must be upgraded to the relevant ATEX class. The following components might be affected by such an upgrade:**

- Electronic components (lamps, electric motors, switches, etc.) must be approved for operation under ATEX conditions and labelled accordingly.
- The cabling of ATEX units must conform to the relevant standards. In particular, proper potential equalization must be guaranteed.
- ATEX units for outdoor installation must be equipped with a suitable lightning protection system and all metal parts of the construction (ladders, work platforms, etc.) must be connected to a ground conductor.
- Depending on the processed air composition, one must take into account that temperatures in the ducting of ATEX units might increase to 110 °C, which might be sufficient to cause spontaneous ignition.
- In ATEX units for indoor installation, all electrically conductive parts must be properly earthed (potential equalization) in order to prevent ignition by lightning strikes.

**Possible ignition sources:**

- Mechanically produced sparks caused by incorrectly operated fans
- Static electricity (caused by cleaning with conventional cloth)
- Hot surfaces
- Electrostatic charge of persons
- Lightning strikes
- Tools that do not conform to EN 1127-1
- Wiring



***Non-compliance with the instructions below or with the applicable national and international safety regulations might result in serious or even fatal injury and damage to property.***

**Do not commission ATEX units until the following requirements are met:**



- Conditions of use in accordance with the purpose for which the unit is intended
- No substances nearby that are prone to spontaneous combustion e.g. pyrophoric substances under EN 1127
- Constant and adequate ventilation of the installation site (mechanical equipment room) in the case of ATEX units without a specified exterior Ex zone so that unavoidable leakage to the exterior of the unit does not result in an explosive atmosphere

### 1.2.1. Explosion protection

The following instructions must be strictly adhered to:



- Ensure that there is no potentially explosive atmosphere near the machine (absence of ignition sources)
- Use only tools that conform to EN 1127-1 in order to prevent sparks
- Prior to any maintenance or repair work, shut down the power supply to the unit.

#### Identification

The "Ex" rating plate of the unit is attached to the fan chamber!

The rating information distinguishes between **inside** (processed atmosphere) and **outside** (atmosphere in room of installation). The air handling unit must only be operated under conditions as specified on the "Ex" rating plate.

Example: the air handling unit is classified as follows (information on "Ex" rating plate:

**Ex II 2G c IIB T4 inside ; Ex II 3G c IIB T3 outside**

#### Codes:

- Ex = Explosion protection (class)
- I = Equipment group (underground)
- II = Equipment category (above ground)
- 1 = Protection category 1 (zone 0)
- 2 = Protection category 2 (zone 1)
- 3 = Protection category 3 (zone 2)
- G = Gas
- IIA = Substances with low ignition susceptibility
- IIB = Substances with medium ignition susceptibility
- IIC = Substances with high ignition susceptibility
- T1 = Max. surface temperature 450° C
- T2 = Max. surface temperature 300° C
- T3 = Max. surface temperature 200° C
- T4 = Max. surface temperature 135° C
- T5 = Max. surface temperature 100° C
- T6 = Max. surface temperature 85° C

Gases and vapours are classified in three explosion groups (IIA, IIB and IIC), based on their ignition susceptibility whereby substances in group IIA are less likely to explode than substances in group IIC.

## 2. Safety

The air handling unit has been designed and manufactured according to best engineering practice and in compliance with the generally recognised safety standards. It meets all relevant safety requirements. In the event of improper operation or operation for a purpose other than the intended, there is however a risk of serious or even fatal injury to persons and a risk of damage to the unit and other property.

In the interest of your safety and the safety of others, please carefully read these safety instructions prior to assembling and commissioning the air handling unit!

The unit must only be operated for the intended purpose and if it is in proper working order. The machine operator must be aware of all risks associated with the unit. Defects or faults that might impair the safety of the unit must be eliminated without delay.

**All work in connection with the assembly, installation and commissioning of the unit must be carried out by specially trained technicians.**

For work on unit elements and assemblies that are not covered in this document, refer to the separate manual.

The pressure vessels integrated into the unit must undergo regular tests to be carried out by an approved refrigeration contractor.

Before assembling, installing or commissioning the unit, all persons involved in these tasks must have carefully read this installation and operating manual. A copy of this installation and operating manual must be kept near the unit where it is accessible at all times. Compliance with the instructions in this document ensures trouble-free operation of the unit.

The unit forms part of an air-conditioning plant and must only be operated after installation in and in conjunction with the overall plant.

### 2.1. Intended use

All information on signs attached to the unit and all instructions in this manual must be strictly adhered to.

The unit must only be used for the handling of air, including filtration, heating, cooling, humidifying, dehumidifying and conveying. Any other use is strictly prohibited.

## 2.2. Statutory regulations

**It is the responsibility of the unit operator to ensure compliance with all relevant statutory regulations, including the following standards:**

- ☞ **DIN EN 378** - Refrigerating systems and heat pumps –. Safety and environmental requirements - Obligation on owner to maintain a system logbook. It must cover the following items:
  - Details of all maintenance and repair work
  - Quantity and type of refrigerant (new, reconditioned, recycled)
  - Quantity of drained-off refrigerant
  - Results of analyses of reconditioned refrigerant
  - Origin of reconditioned refrigerant
  - Modifications to unit, replacement of components
  - Results of all routine checks and tests and exceptional events such as prolonged standstill times
- ☞ **EU Regulation 2037/2000 on Ozone Depleting Substances and German Chemical Ozone Layer Ordinance (ChemOzonSchichtV)** – Obligation on unit owner to ensure regular inspection and maintenance by specialist technician and minimum one annual test for leakage, using suitable devices. Leaks must be repaired without delay.
- ☞ **Local hygiene plan** – Where air handling units are operated in sensitive areas such as medical facilities and clean room, all requirements laid down in the local hygiene plan such as cleaning intervals, detergents and disinfectant specifications must be adhered to.
- ☞ **VDI 6022** – Ventilation and indoor-air quality – Hygiene requirements for ventilation and air-conditioning systems and units – Specific requirements for the operation and maintenance of air-conditioning systems used in rooms frequented by people.
- ☞ **National water protection legislation** – Compliance with disposal regulations for cleaning water
- ☞ **Applicable waste management legislation** – Filters must be disposed according to the applicable waste management regulations.
- ☞ Compliance with **Ordinance on industrial Safety and Health**.
- ☞ Compliance with **applicable personal protection equipment regulations**.
- ☞ Compliance with **applicable statutory regulations regarding occupational safety and explosion protection**.

## 2.3. Safety symbols and signal words

The safety instructions in this document are classified according to their probability of occurrence and the damage they might cause. Based on this classification, they are accompanied by specific signal words and symbols.



High risk; non-compliance results in serious or even fatal injury



Medium risk; non-compliance might result in serious or even fatal injury



Low risk; non-compliance results may result in minor injury



An exclamation mark on a red square indicates that there is a risk of damage to property and the environment.

## 2.4. Safety instructions

All work in connection with the assembly, installation and commissioning of the unit must be carried out by specially trained technicians.

Protective equipment: Protective gloves, safety goggles, protective clothing, breathing apparatus

### 2.4.1. Risks during loading/unloading and transportation



- Risk of serious injury from dislodged loads.  
Do not stand under suspended loads.

### 2.4.2. Risks posed by doors



- Risk of injury to hands from crushing by suction side doors:  
Keep hands away from doors.
- Risk of injury from impact or crushing when pressure side doors are inadvertently opened due to a failure of the door lock.  
Only open the doors when the fan is not in operation.

### 2.4.3. Risks posed by fans

**After a power failure, the fan is automatically restarted when the power returns!**



- Risk of fatal injury from fan impeller:  
Keep clear of the impeller. Remove all objects from the impeller range. De-energize the unit and wait until the fan has come to a halt.
- Risk of serious or even fatal injury from fan suction catching clothing and hair:  
Never wear loose clothing. Tie up long hair. De-energize the unit and wait until the fan has come to a halt.
- Risk of fatal injury from rupturing impeller when maximum permissible operating speed is exceeded:  
Operate the fan only within the permissible operating speed range.
- Risk of fatal injury from fan impeller:  
Before performing any maintenance work, shut down the fan and de-energize it.



- Risk of injury from cutting: while the unit is running, never reach into rotating fan parts such as rotors, etc.  
Wait until all rotating parts have come to a halt.

#### 2.4.4. Risks from electric power



- Risk of electric shock with possibly fatal consequences from contact with powered components:  
Before carrying out any work on the unit, always de-energize it.
- Risk of electric shock with possibly fatal consequences. Certain circuits, electrical parts and electronic components of the fan might remain powered for a few minutes after the unit has been disconnected from the power supply.  
After shutting down the unit, wait for at least 2 minutes before starting work on or near electrical components.
- Risk of electric shock with possibly fatal consequences from potential-free contacts that might remain energized after the unit has been disconnected from the power supply.  
Only touch potential-free contacts after you have established that they are fully de-energized!
- Risk of electric shock with potentially fatal consequences from contact with powered components such as lighting devices of electrical parts, power sockets, MCR equipment and safety circuits:  
Only touch electrically powered components after you have established that they are fully de-energized!
- Risk of electric shock from electrostatic charge of housing:  
Earth the device.
- Risk of electric shock from short-circuits when connecting electrical components:  
Prior to commissioning, check all cables for damage, in particular for damage to the insulation; ensure that all cables are connected properly.
- Risk of electric shock during wet cleaning of powered unit:  
Before cleaning the unit, de-energize it.

#### 2.4.5. Risks posed by dampers, including air flow control and shut-off dampers



- Risk of injury to fingers from crushing when dampers are operated:  
Keep hands away from dampers.
- Risk of injury to hands by closing multi-leaf dampers:  
Keep hands away from dampers; operate the unit only if it is fully connected to the duct system.

## 2.4.6. Risks from process chemicals / materials

**According to DIN EN 375, the refrigerants used in the unit are classified in flammability and toxicity class A1 (non-toxic, non-flammable)!**

### **WARNING**

- Risk of poisoning, chemical burns and allergic reactions caused by process chemicals such as anti-freeze agents, refrigerants, etc.:  
Always observe the handling instructions of the manufacturer. Avoid skin contact with process chemicals and take all necessary safety precautions (e.g. wearing of protective gloves, eye protection, etc.).
- Risk of poisoning and chemical burns during filling, venting and emptying of brine container:  
Avoid skin contact with process chemicals and take all necessary safety precautions (e.g. wearing of protective gloves, eye protection, face mask, etc.).
- Risk of poisoning from inhalation of toxic vapours released by fire:  
Keep clear of danger zone and take all necessary safety precautions (e.g. wearing of face mask, etc.).
- Risk of poisoning from refrigerant gases released at high temperature!  
When carrying soldering or welding work on refrigerant circuit components, always wear protective gloves and breathing apparatus with filter. If there is leakage, do not smoke and keep naked flames away from unit.
- Risk of allergic reaction from contact (skin contact, inhalation, ingestion) with refrigerant:  
Avoid contact with refrigerant and take all necessary safety precautions (e.g. wearing protective gloves and eye protection).

### **CAUTION**

- Risk to health from refrigerant and cooling water splashes or spray mist:  
Avoid skin and eye contact, do not inhale or ingest. For all work on the cooling water circuit, wear protective gloves and eye protection!

## 2.4.7. Risks posed by steam heaters

### **WARNING**

- Risk of scalding by hot steam (>100°) released at high pressure:  
When working on the steam piping system or the humidifier, ensure that there is no steam pressure and that the system has fully cooled down.
- Risk of injury from burns caused by highly flammable descaling agents:  
Protect descaling agents such as formic acid from heat and direct sunlight.  
When cleaning the steam humidifier or its components and lines, keep ignition sources away from the descaling agent;  
do not smoke!



- Risk of serious damage to eyes and chemical burns to skin from descaling agents:  
When handling descaling agents, always wear safety goggles and protective gloves. Do not inhale vapours and ensure proper room ventilation!

 **CAUTION**

- Risk of serious eye irritation from descaling agents:  
When handling descaling agents, always wear safety goggles!

#### 2.4.8. Risks from hot/cold components and media

 **WARNING**

- Risk of injury from frostbite when touching cold components such as cold water lines, refrigerant pipes, cooler or intake chamber. Pipelines pose a serious risk of injury from scalding:  
Keep clear of danger area and take suitable safety precautions, e.g. wearing protective gloves. When the unit is shut down, ensure that there is no condensate left in the pipes and that the heating medium supply line is closed.
- Risk of scalding from escaping hot water when fittings at the heat exchanger, the hot water heater or the heat recovery unit are opened.  
Before carrying out any work on the heat exchanger, close the shut-off valves in the feed and return lines and let the unit cool down!

 **CAUTION**

- Risk of injury from burns when touching heating, compressor, oil trap, vapour humidifier, steam lance and any associated lines.  
These parts remain hot for some time after the unit has been shut down!

#### 2.4.9. Risks from filter dust and other contaminants

 **WARNING**

- Risk of poisoning by hazardous substances when inhaling dust released from dust filter or other components:  
Wear the personal protection equipment made available by the unit owner (protective gloves, breathing apparatus with filter).
- Risk of poisoning by hazardous substances when coming into contact or inhaling contaminants that collect in the unit:  
Regularly clean the unit. Always wear protective clothing.

## 2.4.10. Risk of explosion (ATEX units)



### Risk of explosion:

- When conveying potentially explosive air and gases.  
Keep ignition sources away from ATEX units. Only use tools conforming to EN 1127-1 to prevent sparks.
- From electrostatic charging of unit:  
All electrical, non-conductive connections must be equipped with potential equalization connections. The unit must be connected to an earthing conductor.
- From sparks produced by fan operated at a speed outside the permissible range in a potentially explosive atmosphere.  
Never exceed the maximum permissible fan speed.
- When the unit is shut down, the concentration level of the gas/air in the system increases.  
Keep all ignition sources away from the unit.

## 2.4.11. Risk of damage to property and the environment

**Do not make unauthorised modifications to the unit. Only use original spare parts.  
Operate the unit only with the permissible parameter settings.**

### Unloading and transport



- Serious damage to property from dropping loads;  
please observe the instructions in section 3 "Delivery of product".
- Serious damage to heat exchanger connections, panelling and other mounted components from force impact during moving of unit elements;  
always move the unit elements by their base frame.
- Risk of damage to components from heavy impact, e.g. when attempting to dislodge a part with a hammer, etc:  
Components that rest on the foundation must only be moved by shifting.

### Risks caused by fans



- Risk of mechanical damage to fan unit, due to critical input speed and operation within resonance range:  
The frequency range of the speed-controlled drives must be determined, bridged and noted down during commissioning. Observe the instructions regarding overall pressure increase, maximum permissible speed and direction of rotation of the fan in the fan chamber.
- Risk of damage to fan due to excessive power to motor, resulting in excessive fan speed:  
Constantly monitor the power consumption of the motor.

#### Risks from electric power

 **NOTICE**

- Risk of damage to motor from insufficient motor protection, unsuitable safety fuses and faulty automatic circuit breakers:  
Protect the motor according to DIN EN 60204 / DIN VDE 0113.

#### Risk of damage from improper handling of dampers

 **NOTICE**

- Risk of destruction of unit elements from incorrectly operated dampers (underpressure or overpressure).  
Monitor and test the damper regulation system.
- Risk of damage to unit and ducts as unit works against closed dampers:  
Prior to performing a test run or starting the unit, close all unit doors and open the dampers.

#### Risks in connection with process chemicals

 **NOTICE**

- Risk of damage to the environment from process chemicals:  
Observe information from manufacturer.
- Risk of damage to the environment from escaping refrigerant from direct evaporator or condenser in the event of fire or leakage.  
Constantly monitor the refrigerant levels in the unit.
- Risk of damage to the environment from anti-freeze agent.  
Adhere to statutory disposal regulations.

## 2.5. Emergency procedures

### 2.5.1. Fire fighting

Strictly adhere to all statutory fire safety regulations.

If the air-conditioning unit forms part of a fume extraction plant, adhere to all regulations governing the plant operation.

In the event of a fire, disconnect all power phases of the unit. Close the multi-leaf dampers to shut off the oxygen supply to stop the fire from spreading.

### 2.5.2. Emergency procedures in the event of accidental release of hazardous substances

During a fire, certain components of the unit might release hazardous substances. There is also a risk of fumes escaping from the unit.

Keep clear of the danger area and wear heavy-duty breathing apparatus.

Unit components filled with water might begin to leak. Keep clear of the danger area.

## 3. Delivery of product

All instructions on the unit and in this manual must be strictly adhered to.

Upon delivery, inspect the product for damage caused during transport and ensure that the delivery is complete. Record any damage or missing parts on the transport dockets. Complaints regarding obvious transport damage or incomplete deliveries cannot be considered if made too late.

On the construction site, protect the unit against dirt, impact and the elements. We strongly recommend storing the unit indoors, or at least under a roof and to install and commission it as soon as possible. When covering components, prevent condensation. Storage under plastic tarpaulins can lead to white rust. If components with rotating parts such as fans, motors, rotary heat exchangers, pumps, etc. are temporarily stored on site or shut down for more than two weeks, loosen the V-belts and turn the rotating parts and shafts every 10 to 12 days to prevent damage to the bearings. Damage to bearings caused by non-compliance with the above instructions is not covered by our warranty.

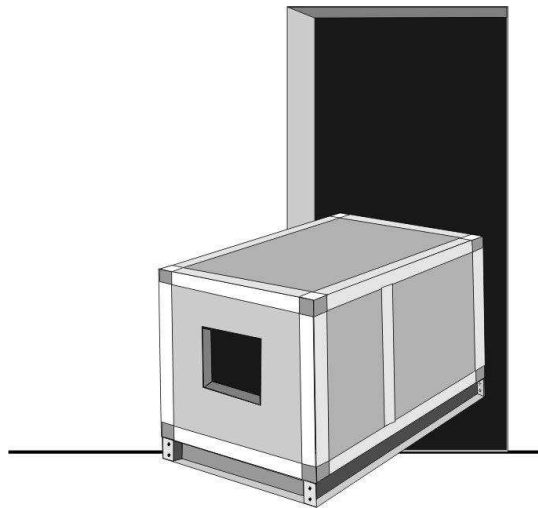
### 3.1. Unloading / transport to location of installation

The unit is shipped as a fully assembled machine or in parts. For unloading, lift the unit by its base profile or base frame.

- Risk of serious injury or damage to property from dropping loads.
- Observe the safety instructions of the transport equipment and lifting gear.
- Do not stand under suspended loads.

When installing the unit in the plant, do not place it or any of its components at an angle or upside down. Keep the fan parts in an upright position to prevent shearing damage to the vibration dampers.

Correct installation of unit:



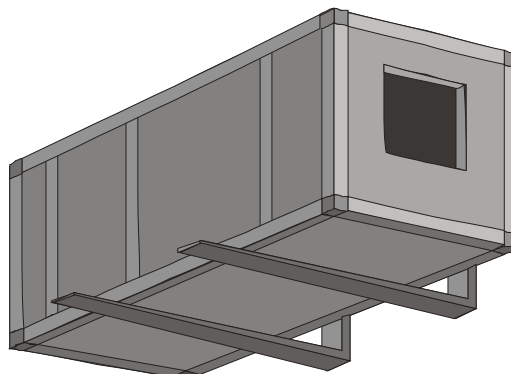
Never lift the unit by the heat exchanger connections, elastic pieces or other mounted components.

Do not climb onto the unit. If this cannot be avoided, distribute your weight by using planks.

### 3.2. Unloading by forklift truck or lifting trolley

Ensure that the unit's base profile or frame is fully placed on the arms of the lift truck and that the centre of gravity is located between the two fork arms.

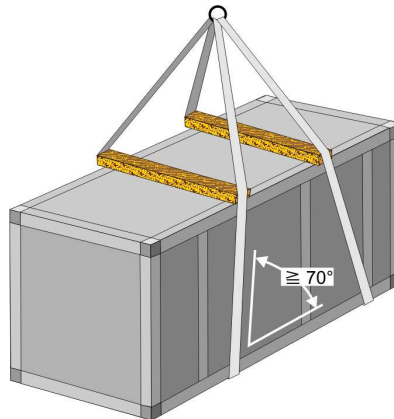
When removing the truck forks, avoid damaging the profiles.



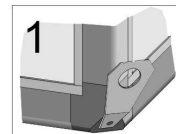
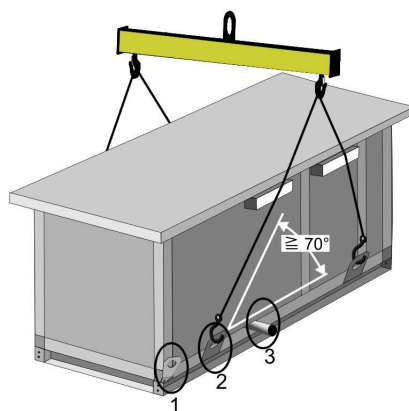
### 3.3. Unloading by crane

Unloading and transporting by crane is particularly recommended for weatherproof units. Use only suitable and approved tackle and lifting equipment (cables, lifting straps, etc.). Protect the unit roof, side panels, connections and mounted components with spacers to prevent damage. Transport the unit elements by lifting them by the crane loops provided. Never attach the lifting tackle to the upper corner connections.

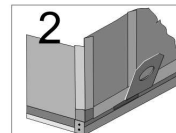
Observe figure and above instructions!



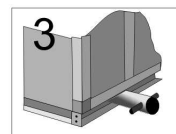
Our units can be equipped with 3 different types of lifting points for choice of the customer.



**Option 1:**  
Crane lifting point at corner bracket

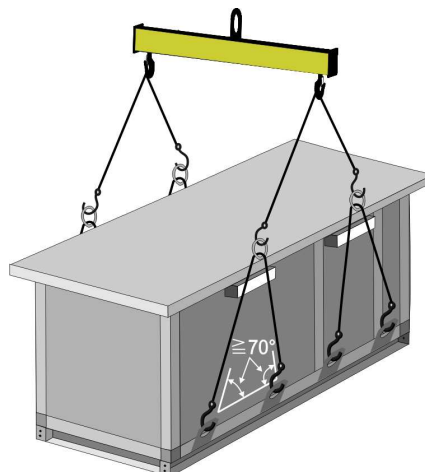


**Option 2:**  
Crane lifting point at base frame



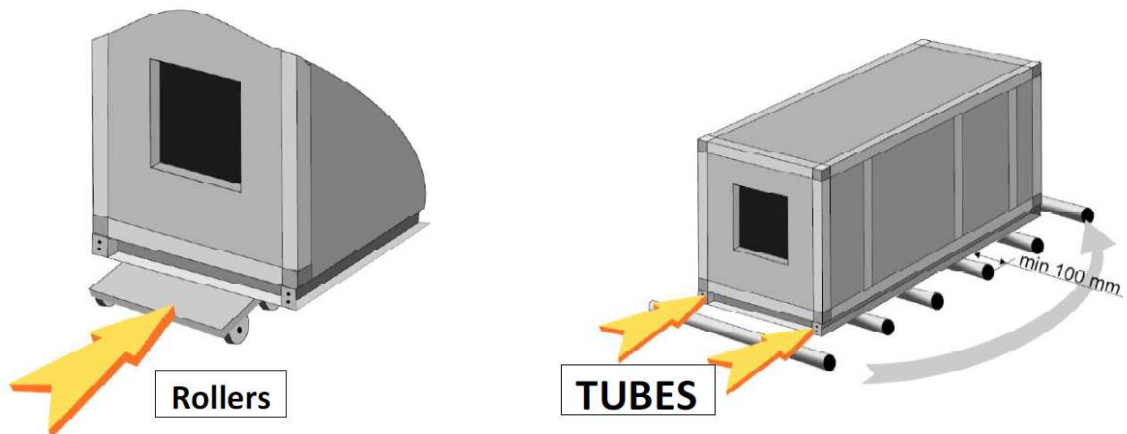
**Option 3:**  
Tube through base frame

Heavy unit elements are equipped with 8 lifting points. For details, see figure.



### 3.4. Positioning by hand

When moving the unit elements into position, never apply force on the heat exchanger connections, panelling or other mounted parts. Always move the unit by its base frame. Never attempt to move the unit elements using a hammer or other heavy implement.

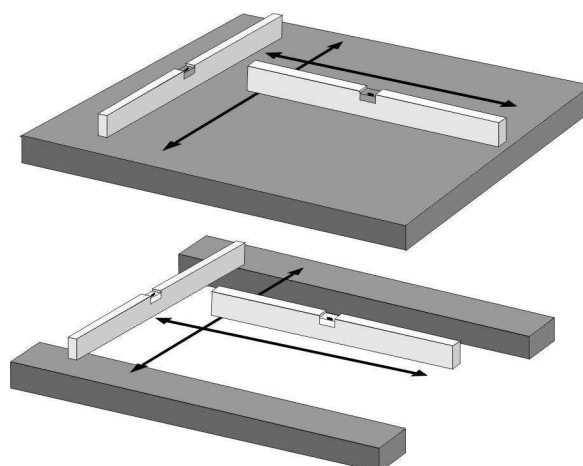


## 4. Installation of unit

### 4.1. Foundation / base frame

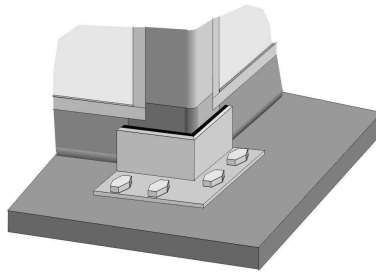
As the unit must be accessible for maintenance, keep an area of minimum the width of the unit + 300 mm free on all sides to facilitate the exchange of built-in components. The foundation must meet the relevant static and sound propagation requirements and must feature a proper drain for water. It must be level and smooth. The resonance frequency of the support structure must be distinctly different from the excitation frequency of the rotating machine components (fan, motor, pumps, etc.).

Suitable foundations: Solid concrete foundation, strip foundation or steel girder construction. When using strip foundation of steel girders, ensure that the unit elements with a base frame (base profile) are positioned properly on the support structure. The rigidity of steel girder constructions must be suitable for the size and weight of the unit. For standard units without feet, the clearance from the ground must not exceed 150 mm.



## 4.2. Structural vibration insulation

To prevent structural vibration, we recommend placing cork pads, Mafund sheets, tico pads or resistant vibration damping mats under the unit. In certain cases, it is advisable to install vibration dampers. The absorption properties of these materials must be suitable to achieve optimised structural vibration insulation, depending on the actual load. For weights, please refer to the technical data sheet. To prevent the propagation of structural vibration, never screw the units directly to the foundation. We recommend securing the unit with angle brackets to prevent shifting.



An uneven foundation might cause malfunction of the unit and jammed doors. WEGER shall not be liable for damage caused by installation on an uneven surface. Roof-mounted central units are subject to the German Construction Contract Procedures VOB, part C and DIN 18379 as they form part of the technical building services. They are designed and produced according to best engineering practice and do not constitute part of the actual building structure. According to EN 13053 and VDI 3803, the base of the unit must not substitute a proper roof construction. The air handling unit must not fulfil any structural function in the building, such as sealing or heat insulation.

## 4.3. Installation of unit

Air handling units for operating theatres must be installed adjacent to the operating theatres.

The unit must be positioned so that there is sufficient space for operating part to access it for servicing and repair. For details, see section 4.1. Foundation / base frame

**Roof frames and weatherproof units must never be used to replace a proper roof structure!**

Roof-mounted units (weatherproof models) are protected by a separate weather roof made in sheet metal. The weather roof is installed at the factory. The joints must be prepared and sealed as described in section 5.3.3.

Any defects to the coating caused during installation must be repaired.



**! NOTICE****Lightning protection**

Roof-mounted ATEX units must be protected by a proper lightning conductor that conforms to the relevant statutory regulations (e.g. DIN VDE 0185). Lightning that strikes explosive atmospheres always causes a fire. Lightning strikes and the resulting high temperatures form an ignition source. Risk of fire

**Hot surface**

Take into account that certain ducting (e.g. near the heater) might reach temperatures of up to 110°C, depending on the atmosphere. Such high temperature can cause spontaneous ignition. Risk of fire

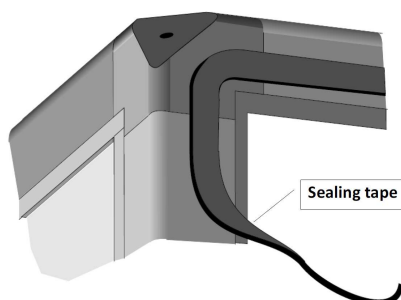
## 5. Assembly of unit

For assembly/disassembly, observe all instructions for your various unit elements in this manual. The unit must be assembled/disassembled by authorised specialist technicians in accordance with the German Industrial Health and Safety Ordinance.

### 5.1. Preparation of unit assembly

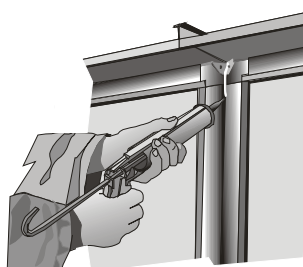
Two standard units that are not designed for installation one on top of the other must be positioned side by side.

To close the gaps between the unit sections, seal them with the supplied sealing tape before tightening the screw connections. Prior to applying the sealing tape, clean and degrease the relevant surfaces.



In hygiene units, seal the grooves of the section joints at the inside of the base with a sealant that is resistant to disinfectants. This must be done in the course of the machine assembly on site.

In weatherproof units, the gaps between the individual unit sections must be sealed after assembly with the supplied sealant.

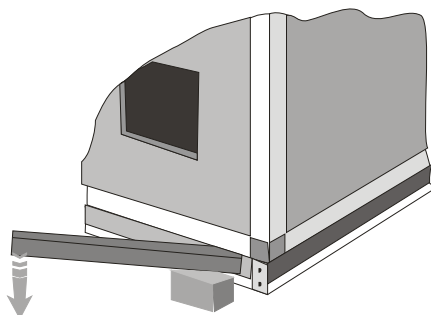


## 5.2. Alignment of unit section

- The individual sections must be aligned with each other both vertically and horizontally.
- The distances between adjacent sections must be as small as possible.

### Note!

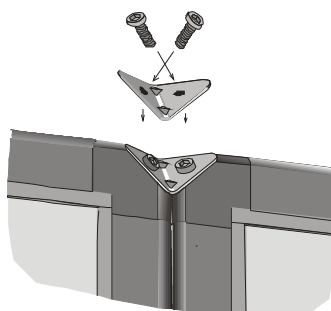
- When moving the unit sections into position, never apply force to the heat exchanger connections, panelling or other mounted parts. Always move the unit by its base frame.
- Never attempt to move the unit sections using a hammer or other heavy implement. Unit elements placed on the foundation must only be shifted but not lifted.
- To position the unit sections / component properly, we recommend using rods as levers acting on the base frame.



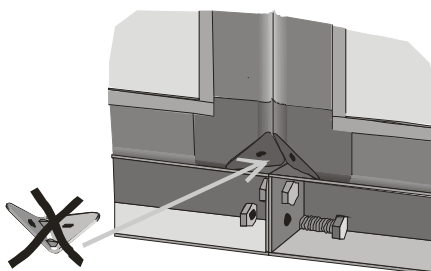
## 5.3. Connection of unit sections

### 5.3.1. Connection with external corner brackets

Connect the corners of the unit elements with the supplied corner brackets and M10 x 20 Allen head screws. Top corner brackets are not required for units with a weatherproof roof.



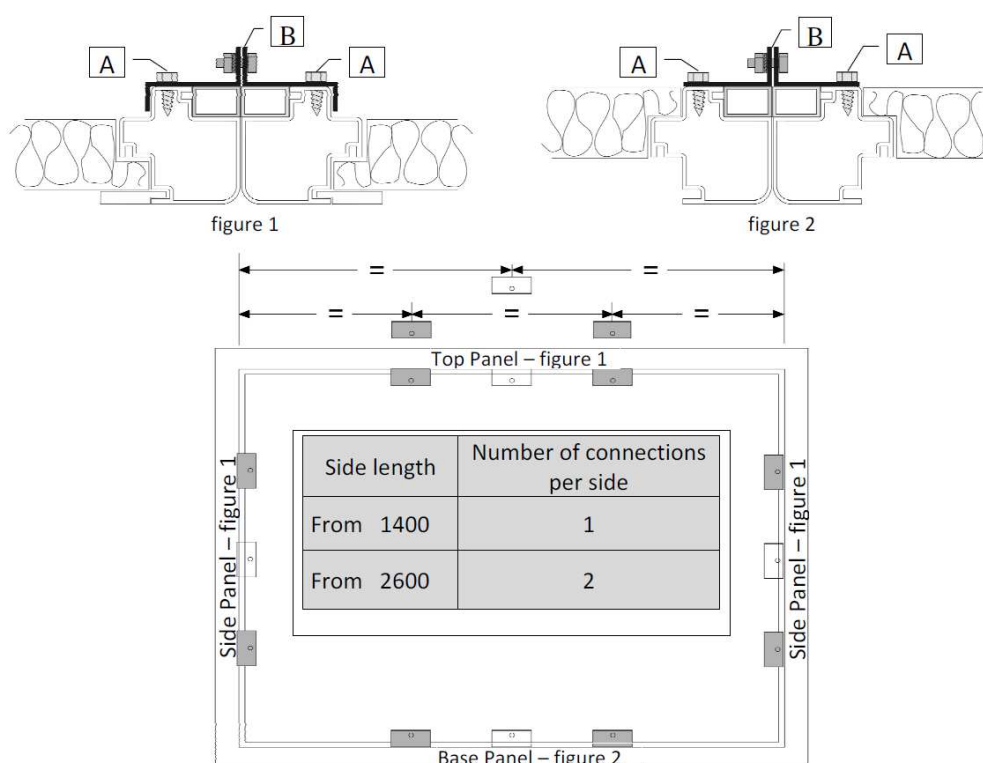
For the connection of the unit elements at the base frame, use the supplied M8 x 30 or M10 x 30 hex head screws. No brackets are used at these points.



### 5.3.2. Connection of unit sections from the inside with internal brackets

In large units, the sections must also be connected to each other by means of internal brackets mounted at the side. In large units, the sections must also be connected to each other by means of internal brackets mounted around the unit, at the sides, top and base of the sections. Install 2 brackets per connection and secure them with screws **(A)** to the unit frame. Tighten the screws **(B)** to pull the unit sections together.

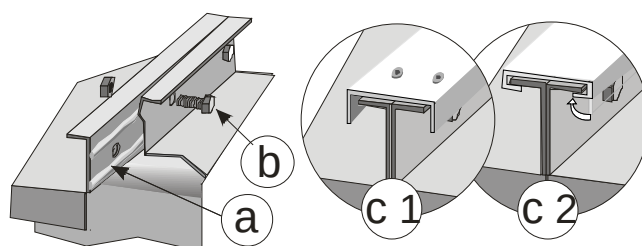
Number and position of connections per unit side



### 5.3.3. Roof joint connections for outdoor units

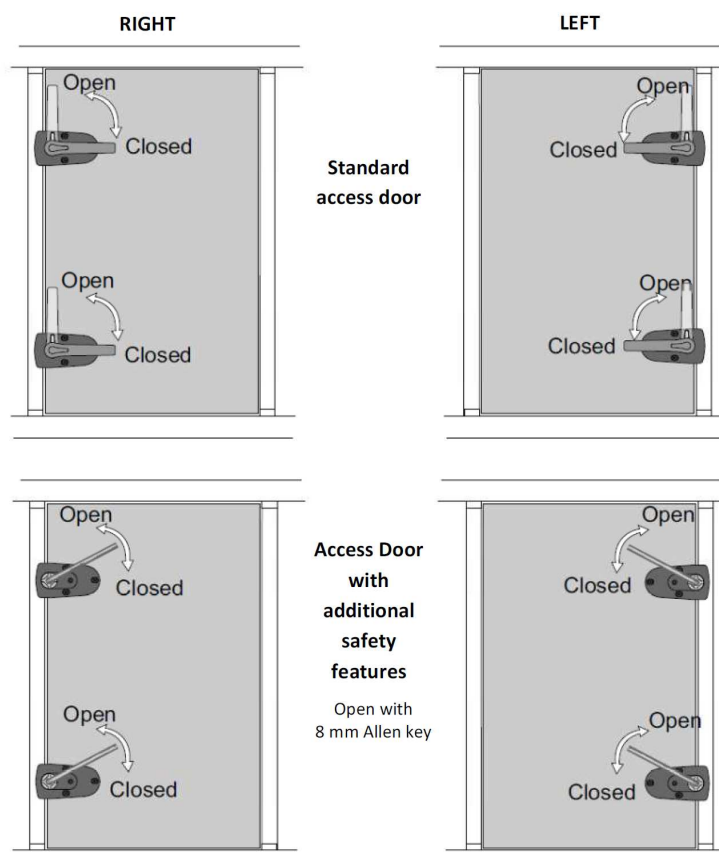
Clean and degrease the roof joining points. Then:

- (a)** Seal the connecting points above and below the holes with putty.
- (b)** Connect the joining parts with the supplied screws (see figure).
- (c)** Cover the joints with the supplied strips and secure them with rivets.
- (c1)** Alternatively, bend back the edges **(c2)**.



## 5.4. Alignment of doors

Should the access doors not close properly, adjust the closing force at the locking lever or the hinge as required.



### 5.4.1. Adjustment of standard locking levers

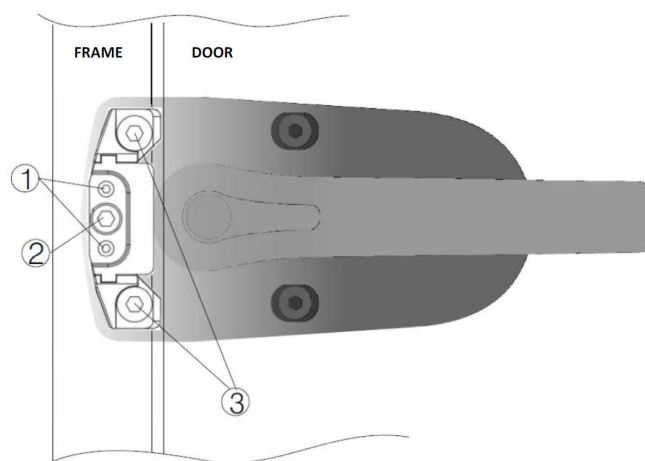
The clamping piece of the locking lever can be adjusted with the adjusting screw in order to correct the closing force of the door.



### 5.4.2. Adjustment at locking lever – MFG 150

Turn the adjusting screws **1** and the locking screw **2** to adjust the clamping piece at the unit frame. This allows for the adjustment of the closing force of the door.

For vertical adjustment, slide the clamping piece in its recess. To do this, loosen the screws **3** and tighten them again after adjustment.



Special safety doors do not feature levers and can only be opened with a tool (8 mm Allen key).

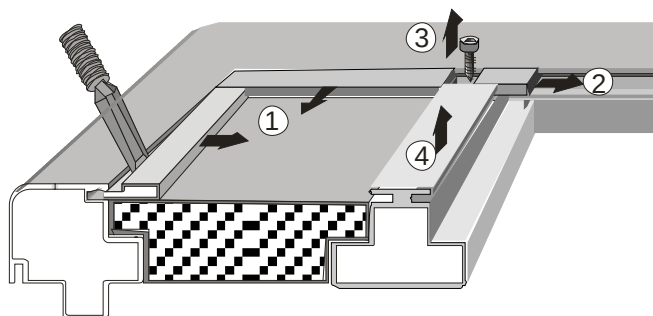
### 5.4.3. Adjustment at hinge

1. Loosen the locking screw.
2. To reduce or increase the closing force of the door, adjust the eccentric hinge bearing by turning it.
3. Tighten the locking screw.



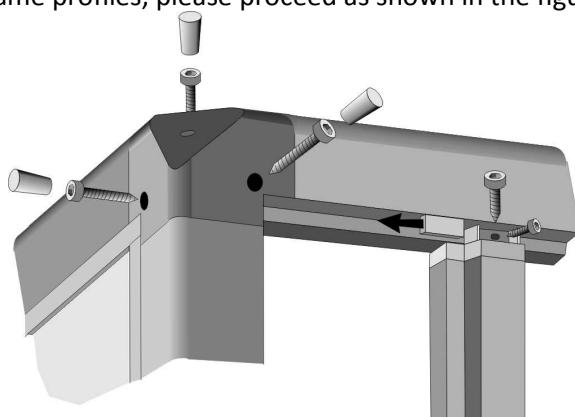
## 5.5. Dismantling of panels and panelling profiles

1. Using a chisel, lever out the clamping bar and remove the panel.  
**Do not damage the clamping bar!**
2. Move the clamping blocks by approx. 35 mm to the side.
3. Loosen the screw.
4. The panelling profile can now be removed.



## 5.6. Dismantling of frame profiles

To remove the frame profiles, please proceed as shown in the figure below.



## 5.7. Pre-assembled units

In units or unit sections that are equipped with plastic clamping pieces (each approx. 30 cm long) instead of clamping bars, the panels are only pre-assembled and the actual clamping bars are supplied separately with the unit. This option is chosen in the following cases:

- The customer has ordered units or unit elements as pre-assembled units, as these units are larger than the access opening on site. The customer can thus disassemble the unit on site, transport the sections to the installation site and reassemble the unit.
- If certain connecting points between individual unit sections are no longer accessible, although they need to be screwed together from the inside, the adjacent panels are only pre-assembled so that they can be easily removed to make the connections. Subsequently, the panels must be permanently installed.

Pre-assembled panels must always be removed in order to ensure that they are properly positioned and that the seals are in place. After you have established that the seal is in its correct position, install and secure the panels on all sides with the supplied clamping bars. Please note that pre-assembled units or unit sections must be dismantled and fully assembled by specially trained technical personnel.

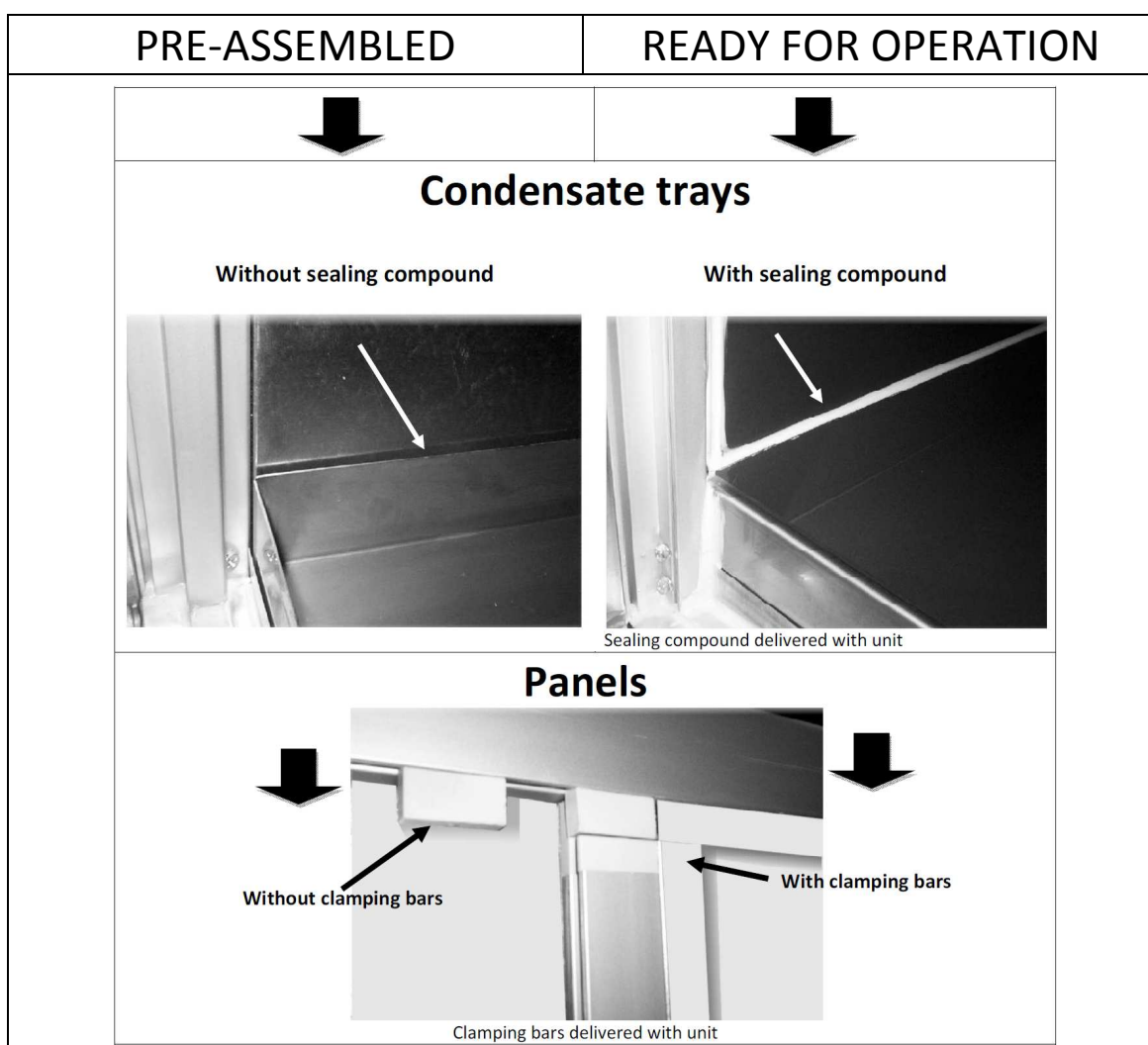
**For the dismantling and assembly of pre-assembled units and unit sections, observe the following instructions:**

- During dismantling, all unit components must be properly labelled to ensure that they can be installed in the correct position.

### CAUTION

All unit sections with coolers, humidifiers of any type and other built-in components that might be affected by condensation or exposed to other liquids must be carefully sealed from the inside.

All panels must be secured on all sides with the supplied clamping bars.



**WEGER shall not be liable for damage caused by incorrect or incomplete assembly of pre-assembled units or unit elements.**

## 6. Connections and operation

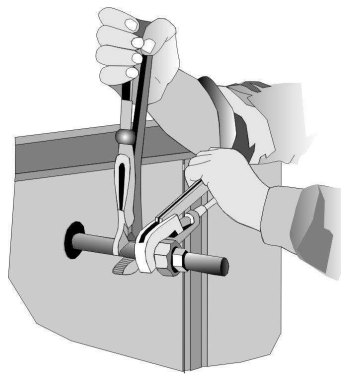
**The electrical, hydraulic and air connections must be carried out by suitably trained technicians. This also applies to the operation of the unit.**

All connections, e.g. for hot water, cold water, steam and potable water to the air handling unit must be installed in such a way that the connecting points of the individual components are easily accessible so that these can be removed.

### 6.1. Connection of heat exchanger

Before connecting the heat exchangers, carefully clean the duct system.

To avoid damage to the heat exchanger connections, hold the fittings with a pipe wrench.



The heat exchangers must be connected so that they are not exposed to mechanical stress from the pipeline system. The connecting adapters must not be exposed to any mechanical or static load. In addition, take suitable measures to protect the heat exchanger against vibration and the effects of thermal elongation between the air-conditioning unit and the pipeline system.

When laying the pipes, ensure that they do not obstruct access to the heat exchangers for maintenance and removal.

#### **Permissible sealing material for threaded sleeves:**

- For steam accumulators: special sealing paste
- For water-glycol mixtures: Teflon tape; do not use hemp

For the connection of the heat exchanger, observe the instructions on the unit. Unless specified otherwise, the heat exchanger work according to the cross counterflow principle. On request, the heat exchangers are equipped with additional threaded nipples for bleeding and emptying. The respective valves can be connected to these nipples.

If the heat exchanger is not equipped with nipples for bleeding and emptying, these can be installed in the connecting lines provided on site.

#### **Additional requirements for air coolers with dehumidifier**

It is not permissible to connect water drains directly to the waste water system (see VDI 6022).



## 6.2. Connection of steam heater

Ensure proper drainage of condensate. To ensure proper control for partial load operation, each steam battery must be equipped with a separate condensate drain.

## 6.3. Connection of refrigerant line

Observe the instructions in section 6.1.

Prior to connection, the exchanger and lines must be tested for leakage (to determine whether the shielding gas is still pressurised).

## 6.4. Condensate drain

Install a siphon at each drain adapter. The effective head in mm must correspond to the maximum static internal pressure of the unit (hydrostatic head) + 15 mm.

Example:

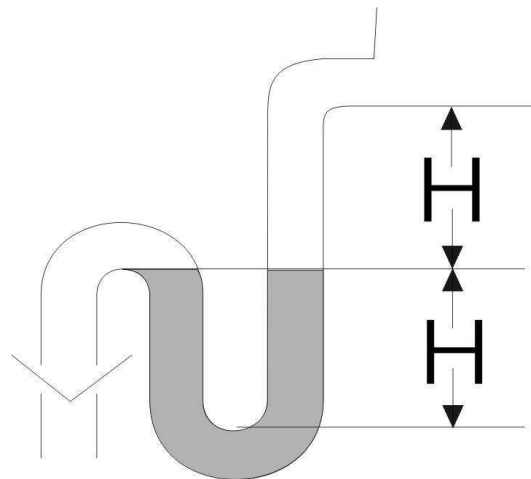
Total effective pressure = 1196 Pa (see data sheet)

Dynamic effective pressure =  $2 \times 83$  Pa (see data sheet)

Total effective pressure - dynamic effective pressure =  $P_{\text{stat}} = 1030$  Pa

1 mm hydrostatic head = 9.81 Pa

$$H = 1030 / 9.81 + 15 \text{ mm} \\ = 120 \text{ mm}$$



The connecting line for condensate must have a diameter of minimum 40 mm and be equipped with a siphon with backflow protection. It must feature an exposed outlet to the waste water system but must not be directly connected to it. Outlets at different pressure levels must be equipped with separate siphons.

## 6.5. Air duct connections

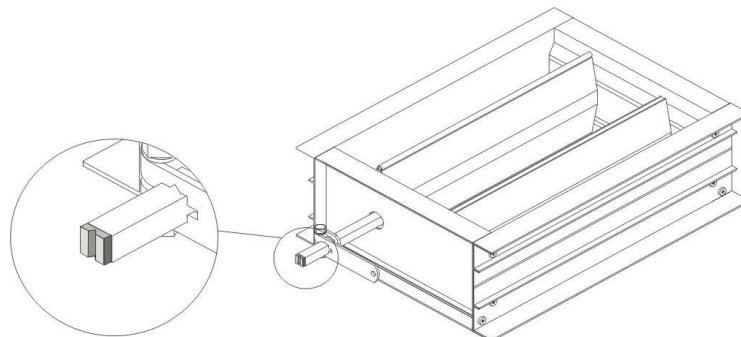
The air duct connections to the unit must be free of stress and air-tight. To prevent propagation of structural vibration, we recommend installing elastic connecting adapters or insulating connecting frames that are mounted without stress between the unit and the duct.



**Risk of injury from electric shock! Install all necessary earthing conductors/potential equalization equipment.**

## 6.6. Multi-leaf dampers

The position of the damper leaves is indicated by the notch on the leaf drive shaft. When the leaves are closed, the notch is parallel to the damper frame.



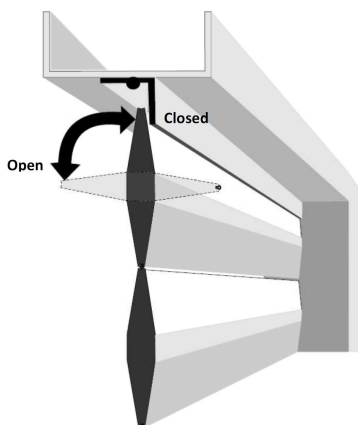
Extra tight dampers for room classes H1, H2 and H3 must be equipped with two end position switches.

**Never drill through the damper, as this could damage the gear wheels, impairing the damper function.**

When the unit is switched on, the dampers must never be fully closed.

### Direction of rotation of damper leaves

As the leaf pivot is off-centre, observe the direction of rotation of the leaves when installing the damper leaf drive.



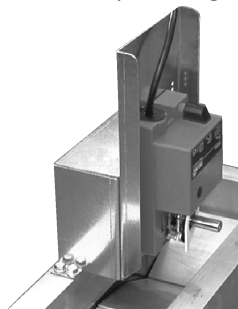
With incorrect direction of rotation, the damper cannot be fully closed and is therefore not tight.

### Adapter H for actuator motor

The adapter allows for the operation of the supplied damper leaves (bypass and recirculating air) by means of a conventional rotary actuator motor installed in the air handling unit or a duct. The maximum transferred torque is 20 Nm.

The adapter (with actuator motor) is screwed onto the baffle plate along the side wall of the multi-leaf damper. For this purpose, a section of the damper flange is cut out so that the adapter gear wheel can be installed and connected.

When installing the actuator motor, ensure that the electric cables don't obstruct the operation of the damper. The adapter can also be retrofitted into the multi-leaf damper. To do this, cut out the respective section in the damper flange.

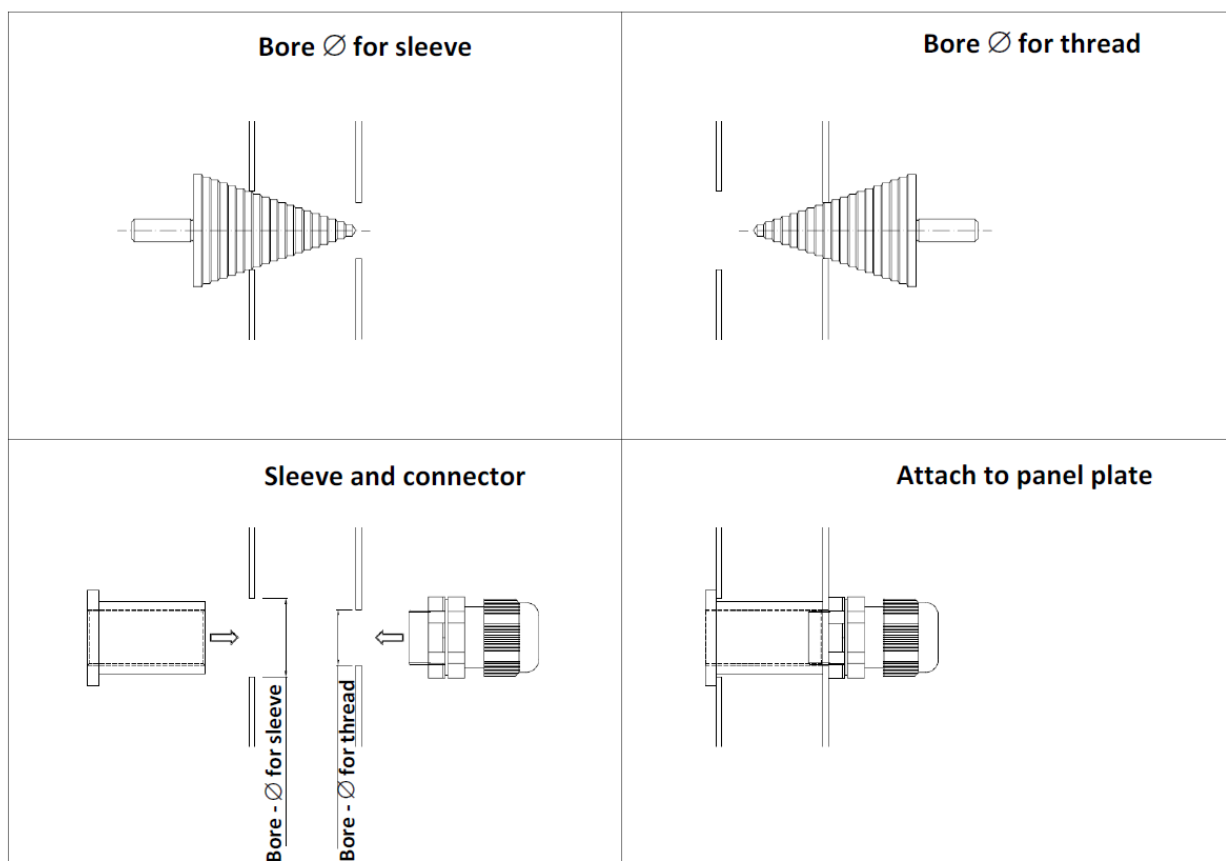


## 6.7. Electrical connections

All work on the electrical system of the unit must be performed by qualified electricians and in compliance with the applicable international standards and statutory regulations. To install the power cables to the electrical components located inside the unit (e.g. fan drive motor, electrical actuator motors, lighting system, etc.), drill the unit panelling at appropriate locations. Install cable glands. The cable glands must be air-tight.

### 6.7.1 Holes for cables and glands

Hole diameters for cable glands in Sandwich panels



| Hole Ø for cable glands (in mm) |                    |                 |                    |                 |
|---------------------------------|--------------------|-----------------|--------------------|-----------------|
| Size                            | Nominal Ø - thread | Hole Ø - thread | Nominal Ø - sleeve | Hole Ø - sleeve |
|                                 |                    |                 |                    |                 |
| <b>M 16</b>                     | 16                 | <b>17</b>       | 22                 | <b>23</b>       |
| <b>M 20</b>                     | 20                 | <b>21</b>       | 26                 | <b>27</b>       |
| <b>M 25</b>                     | 25                 | <b>26</b>       | 31                 | <b>32</b>       |
| <b>M 32</b>                     | 32                 | <b>33</b>       | 38                 | <b>39</b>       |
| <b>M 40</b>                     | 40                 | <b>41</b>       | 48                 | <b>49</b>       |
| <b>M 50</b>                     | 50                 | <b>51</b>       | 56                 | <b>57</b>       |
| <b>M 63</b>                     | 63                 | <b>64</b>       | 70                 | <b>69</b>       |

### 6.7.2. Motor connection

To protect the motor against overload, short circuits, incorrect connection, phase failure, incorrect mains voltage as well as irregular run-up and run-down, we recommend installing motor protection units. These are the only devices recognised as suitable under the WEGER warranty terms and conditions.

The motors must always be operated with overcurrent protection set to 1.05 times the rated current of the motor. Otherwise, windings could be damaged, and such damage would not be covered by warranty.

Make sure that the motor circuit breaker is suitable for the motor by referring the rated current specified on the rating plate of the motor. (For motors in ATEX units, observe VDE 0105 and VDE 0171.)

Single speed motors up to 4.0 kW are designed for direct start-up. Motors with a power rating of more than 4.0 kW are designed for star delta start-up. Multi-speed motors with a power rating of more than 4.0 kW should always be started at the lowest speed.

Prior to commissioning the unit and after prolonged standstill/storage, we recommend testing the insulation resistance of the windings. At an ambient temperature of 25 °C, the insulation resistance should be greater than 5 mega ohm. If the measured resistance is below this value, it is likely that the winding contains moisture. In this case, have the windings dried in a specialist workshop.

The motors must be connected with great diligence. Always refer to the type plate and the wiring diagram in the terminal box of the respective motor.

After the motor has been connected, perform a test run. All motor parameters (e.g. current consumption per phase, rotational speed, etc.) must be measured and compared with the values on the motor type plate and the enclosed documentation. In the event of deviations, identify and eliminate their cause.

#### Note

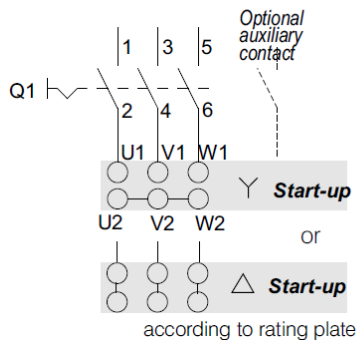
**Defective motors must be returned to the manufacturer in order to identify the cause of the damage or defect.**

For the installation, always observe the wiring diagrams of the motor manufacturer.

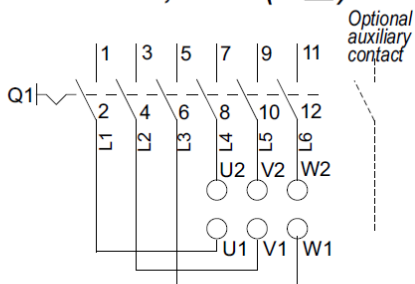
## Repair switch (Wiring diagram)

### Single-speed motors

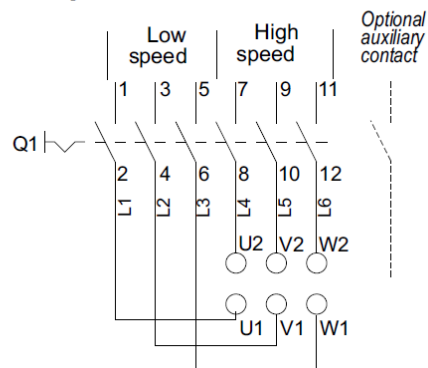
Up to 4 kW



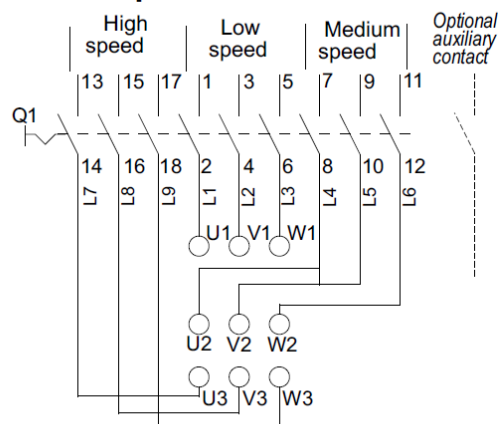
over 5,5 kW (Y/Δ)



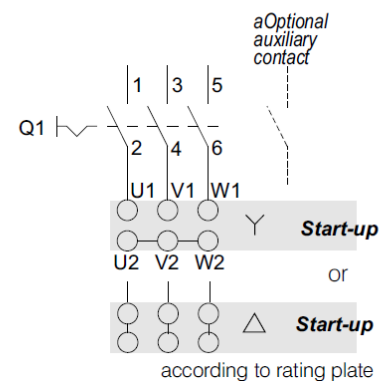
### Two-speed motors



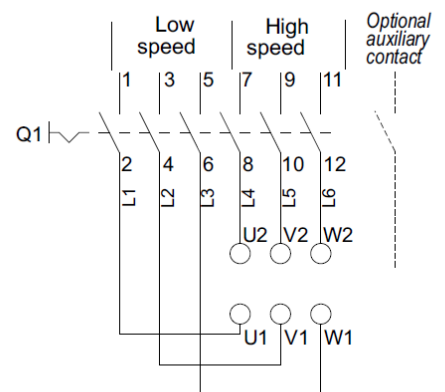
### Three speed motors



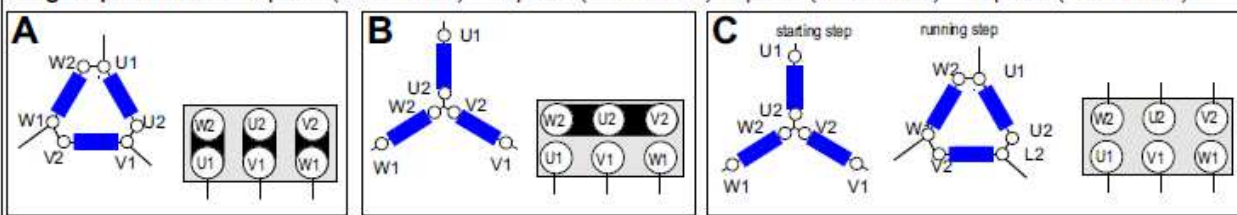
### FC operation without bypass



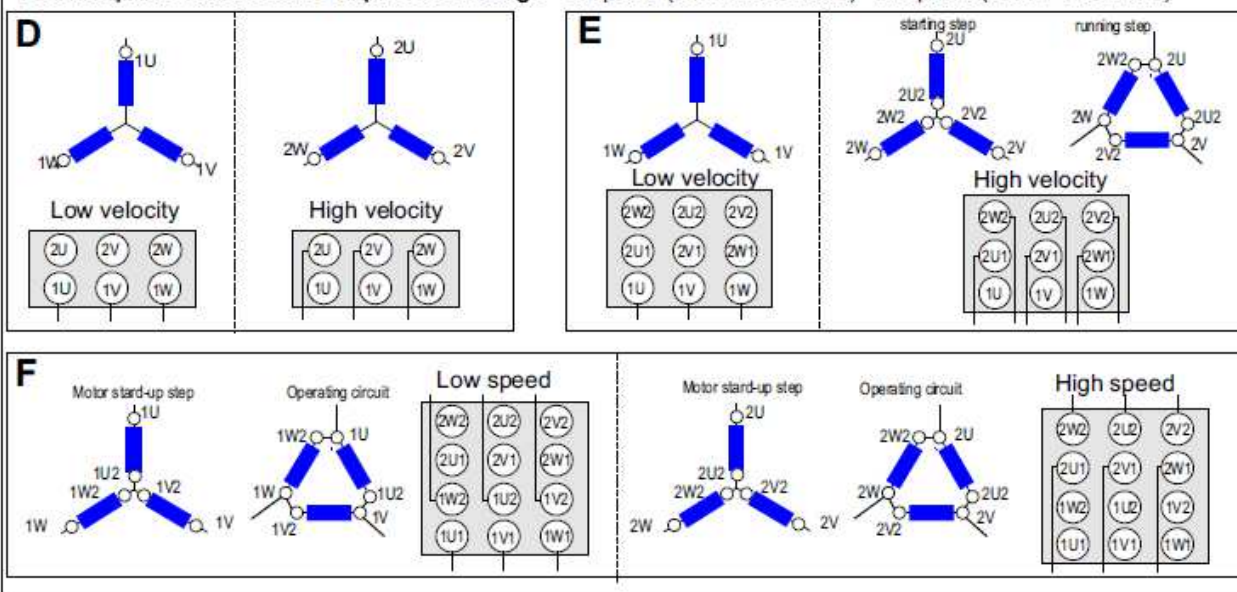
### FC operation with bypass



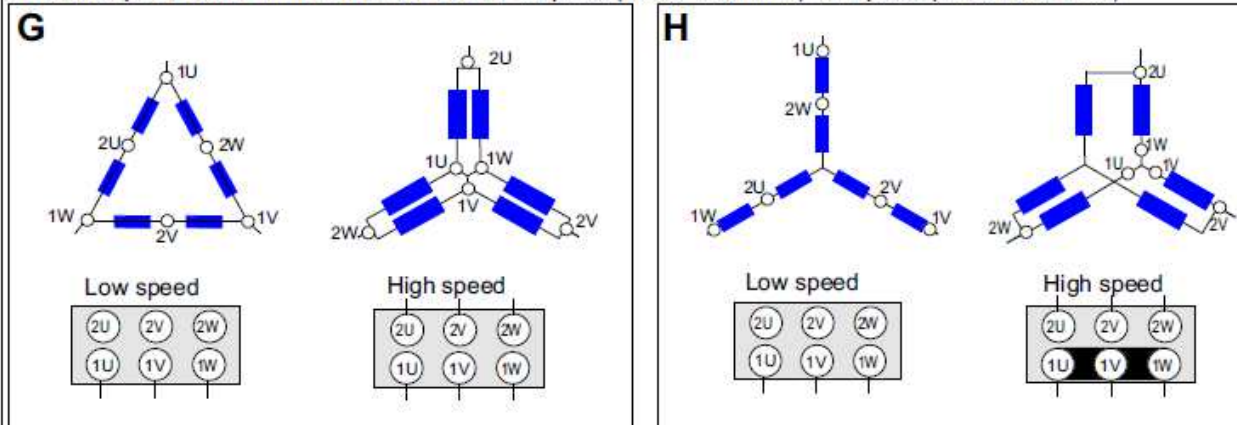
**Single speed motor** 2 poles (3000 1/min) 6 poles (1000 1/min) 4 poles (1500 1/min) 8 poles ( 750 1/min)



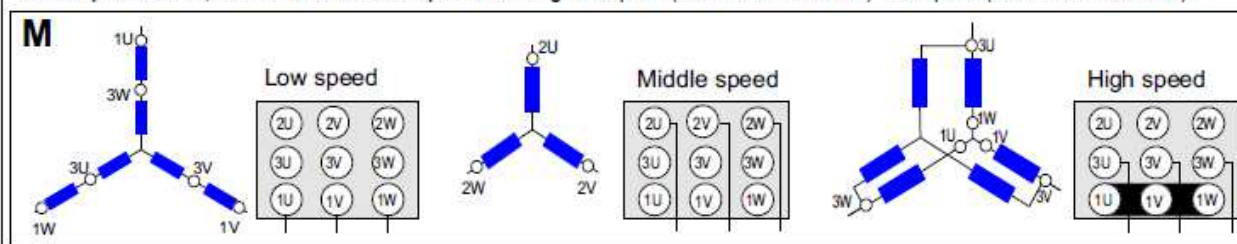
**Double speed motors with 2 separate windings** 4/6 poles (1500/1000 1/min) 6/8 poles (1000/ 750 1/min)



**Double speed motor with Dahlander circuit** 4/8 poles (1500/ 750 1/min) 2/4 poles (3000/1500 1/min)

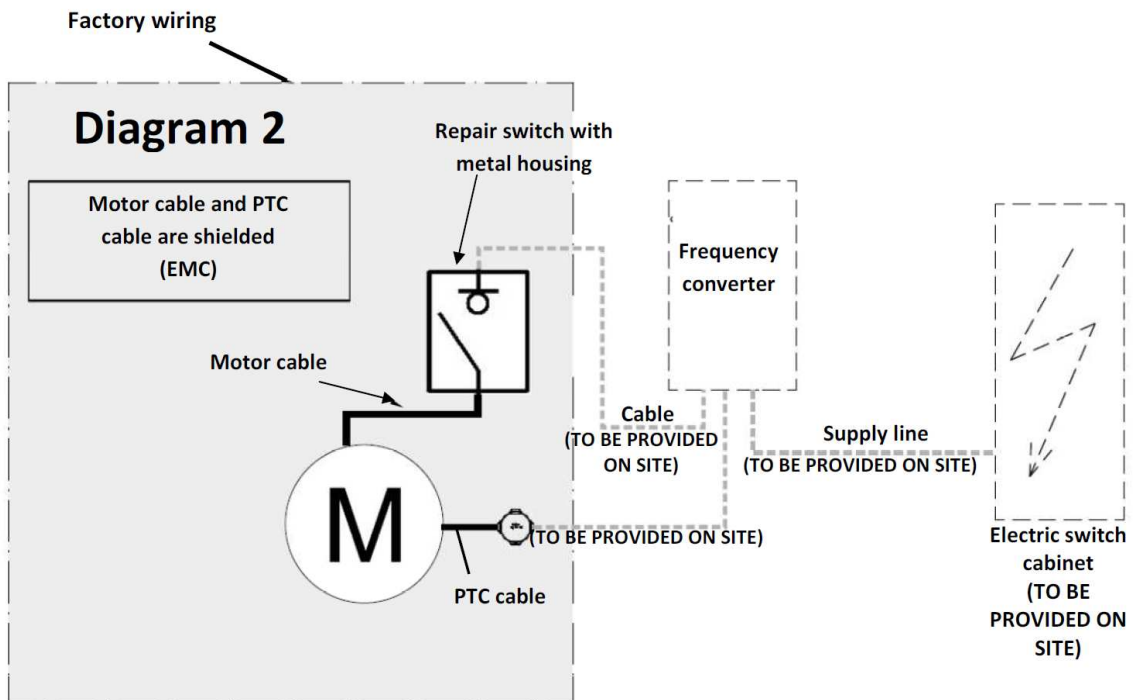
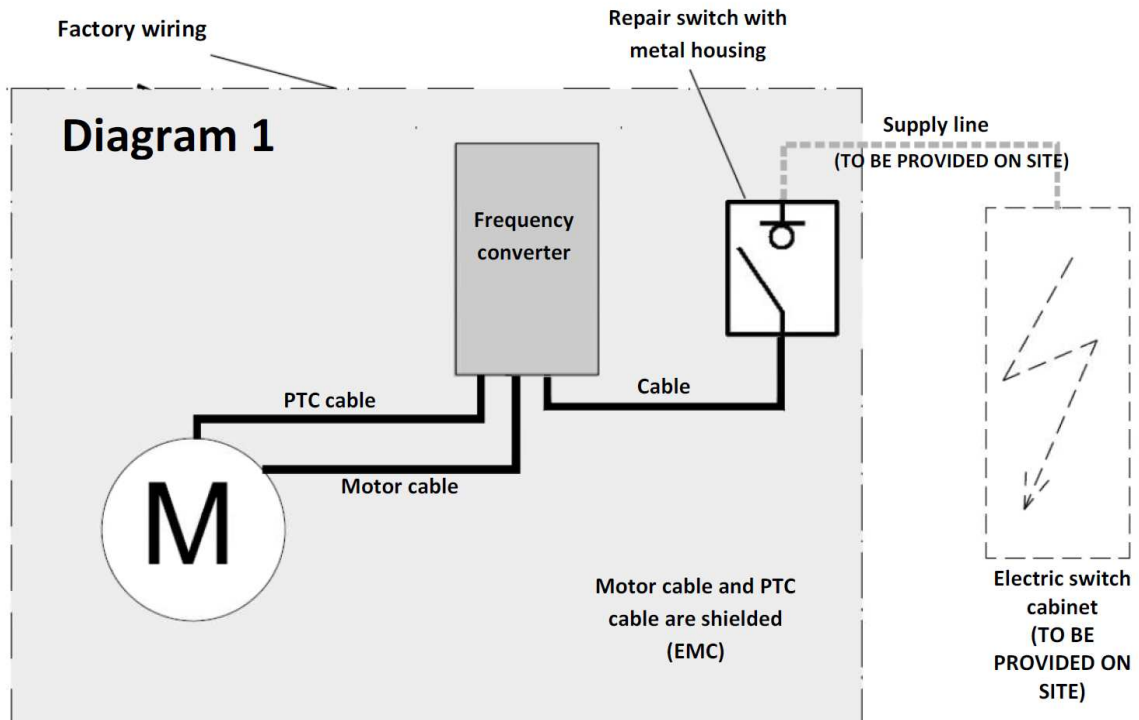


**Three speed motors, Dahlander circuit and separate winding** 4/6/8 poles (1500/1000/ 750 1/min) 2/4/6 poles (3000/1500/1000 1/min)





## Wiring for frequency converter operation:



### **NOTICE**

The repair switch must not be used as an ON/OFF switch, as it is intended only as an interval switch for maintenance purposes. Before actuating this switch, always shut down the frequency converter in order to prevent damage to the control unit.

## 6.8. Frost protection

The frost protection equipment must be inspected prior to the start of the cold seasons:

- Test thermostat function and settings (standard temperature setting: +5°C to +8 °C).
- Check all parts containing water or refrigerant for leakage.
- Check the condensate drain and siphon. Fill the siphon.
- Clean the condensate tray.
- Clean the fins with a soft brush or vacuum cleaner. Do not clean the fins with compressed air.
- Check all connections and pipeline systems for tightness.

## 6.9. Potential equalization / earthing

**In order to prevent ignition sources caused by electrostatic charging, all non-conductive connecting points must be equipped with potential equalization connections (flexible connections, fan-motor unit). The entire unit must be earthed.**

## 6.10. Motor overload protection

Protect the motor according to DIN EN 60204 / DIN VDE 0113 against overload.

**Safety fuses and automatic circuit breakers do not provide adequate protection of the motor.**

**Damage to the unit caused by insufficient motor protection is not covered by the manufacturer's warranty.**

## 6.11. Filters

When installing bag filters, ensure that the joint between the filter frame and the installation wall is air-tight. Ensure that the filter pockets are not clamped or damaged, and that all filter pockets can align themselves freely in the air flow.

At the filter side facing the door, there must be sufficient space so that the filter can be easily removed and installed.

After changing a filter, attach and complete the filter label.

When using filters, observe the following:

- Filters must be stored in a dry and dust-free room.
- Do not use filters whose expiry date has lapsed.
- Ensure that the newly installed air filter is not inadvertently contaminated by dust from the old air filter.



 **NOTICE**

**Handle the filters with care as they tear easily.**

**Change the filter according to the instructions in the applicable technical data sheets, and latest when the pressure drop has reached the preset final pressure loss.**

## 7. Commissioning and maintenance

### **Maintenance intervals for air handling units**

Air handling units are machines that require regular servicing. The specified maintenance intervals are approximate intervals based on air with an average contamination load, following VDI 6022. For highly contaminated air, the maintenance intervals must be shortened accordingly. Regular maintenance does not release the owner from his responsibility of regular testing of the unit and inspection of the unit for damage.

### **Cleaning and maintenance**

- The individual components of the air handling units must be accessible for cleaning, etc. from the inlet and outlet side. In units with a head clearance of < 1.6 m, it must be possible to remove these components safely (see DIN 1946).
- Remove visible dirt with an industrial vacuum cleaner (dry cleaning).
- Remove other dirt with a damp cloth:
- If necessary, use grease- or oil-dissolving detergents (concentrated neutral detergent with pH between 8 and 9).
- Treat galvanized parts with preservation spray.
- Regularly lubricate moving parts such as door levers and hinges with a lubrication spray.
- Regularly treat seals on doors, etc. with talcum powder or Vaseline.
- Repair any damage to the coating, including areas that show signs of corrosion, with repair paint.

All parts of the wet section of the air cooler should be cleaned.

Air-conditioning units must only be operated according to applicable capacity and performance specifications.

Clean the unit thoroughly to remove all construction dust and other dirt.

Prior to shipping, each unit is carefully inspected at our factory. It is however necessary to check the following again prior to commissioning:

- Are all pressure side access doors equipped with door catches?
- Are the multi-leaf dampers in their operating position?

Can the fan and/or the motor be moved easily by hand (unobstructed rotation)?

**! NOTICE**

Before commissioning the units, remove the transport securing devices from the vibration dampers that might otherwise obstruct the fan.

See also safety sign attached to the machine.

*Vor Inbetriebnahme der Geräte  
Transportsicherung bei den  
Schwingungsdämpfern entfernen !!*

*Make sure that the spring isolators move freely  
and that any transport packing has been  
removed before the commissioning procedure !!*

*Prima della messa in funzione della macchina,  
rimuovere dagli ammortizzatori le sicurezze  
per il trasporto !!*

*Avant la mise en service, retirer la sécurité de  
transport du terminal à les montures.*

**Disinfectants**

Use only alcohol-based disinfectants approved in the country of operation of the unit (e.g. approved by RKI, VAH, DGKH).

**Restart of unit after maintenance**

After the maintenance and disinfection tasks have been completed, inspect the unit for dirt and contamination before restarting it. Ensure that potentially hazardous and odorous substances cannot enter the supply air.

**Maintenance of ATEX units**

Air handling units bearing the "Ex" mark must be commissioned by authorised specialist technicians. Commissioning must only take place after it has been established that the plant into which the air handling unit is incorporated conforms to the European Machinery Directive. For commissioning all information in chapter 6 of this manual and information concerning specific parts or assemblies must be taken into account. Prior to commissioning, and also before carrying out any maintenance tasks, ensure that all conductive components of the unit are connected to an earthing conductor.

The ATEX classification of the unit is noted on the type plate and determines its use.

## 7.1. Housing

Before commissioning the unit, thoroughly clean the inside of the housing and inspect it for damage. The method of cleaning (e.g. broom-clean, sterile, etc.) is determined by the site conditions, operating requirements and other specifications.

Inspect the doors for tightness. Test the locks to ensure that they are working properly and adjust them, if necessary.

## 7.2. Fan motor

Check the fan motors as follows:

- V-belt correctly tensioned and aligned with pulleys?
- Securing screws of pulleys properly tightened?
- Vibration dampers unobstructed? Fan parts with spring vibration dampers are secured with transport securing devices (marked in red). These must be removed prior to commissioning.
- Check the motor connection and the supply voltage.
- Have the protective earthing conductor tested on site by a qualified electrician.
- Close all access doors and check that they are properly closed.
- Fan parts with spring vibration dampers are secured with transport securing devices (marked in red). These must be removed prior to commissioning.
- Check the unit for damage, dirt and corrosion and clean it, if necessary. Check all securing screws for proper fixture and retighten them, if necessary.
- Check the flexible connectors for leakage.
- Check the vibration damper function.
- Check the bearings by measuring the temperature and listening to unusual noises.
- Replace defective bearings without delay.
- If there are unusual grinding noises, the bearing is defective. Always replace bearings in pairs. The fan bearing is lubricated for life (unless it features lube points). Bearings with lube points must be lubricated at prescribed intervals. Use the following lubricants: SKF 28, MOBILUX 3 or equivalent product
- If the bearing is equipped with lubrication nipples, lubricate them at the prescribed interval. For lubricant quantities, grades and intervals, refer to the manufacturer's instructions.

### Operating conditions and lubrication intervals:

| Ambient conditions: | Temperature [°C] | Lubrication interval |
|---------------------|------------------|----------------------|
| Clean               | <=50             | 6 – 12 months        |
|                     | 50 ... 70        | 2 – 4 months         |
|                     | 70 ... 100       | 2 – 6 months         |
|                     | >=100            | Weekly               |
| Dusty               | <=70             | 1 – 4 weeks          |
|                     | 70 ... 100       | 1 – 2 weeks          |
|                     | >=100            | 1 – 7 days           |
| Very humid          |                  | Weekly               |

**! NOTICE**

Please observe the information on the type plate and in the technical documentation.

To prevent damage, do not exceed the maximum permissible fan speed and the maximum permissible motor power.

Therefore always adhere to the instructions of the manufacturer.

Information regarding overall pressure increase, maximum permissible speed and direction of rotation of the fan can be found on the label attached to the fan chamber.

### 7.2.1. Free-running wheels

**! WARNING**

**Risk of serious or even fatal injury from rupturing impeller!**

- Operate the fan only to the permissible maximum speed as indicated on the fan/impeller type plate. Exceeding the maximum permissible speed results in high kinetic energy (mass x rotational speed) that can cause injury and damage.

The operating limits specified on the type plate apply to an atmospheric density of  $\rho = 1.2 \text{ kg/m}^3$ .

When operating the motors without temperature monitors, you must install a motor circuit breaker.

- Always keep a safe distance from the fan, in particular at the suction side. Notwithstanding the guard, loose clothing might be caught by the suction generated by the fan, causing injury.

#### Operating conditions

- Do not operate the fan in a potentially explosive atmosphere, as sparks can cause explosion.
- Observe the instructions of the motor manufacturer.  
Never exceed the maximum permissible operating speed (see fan/impeller type plate and safety instructions). The maximum permissible speed applies to continuous operation S1. If frequent switching is required, only use a soft start using a frequency converter. For units without frequency converter, start the machine through a Star/Delta circuit. Do not run the fan within the resonance range of the impeller to prevent irreparable damage. Set the speed control so that the resonance range is run through quickly.

#### Commissioning

- Before commissioning the unit, check the following:
  - Are all electrical connections in place and properly connected?
  - Is the motor protection device correctly set? For Star/Delta circuits where the phase current is fed through the motor protection device, set the current to 58% of the rated current. This means that the motor protection device is not to be installed in front of the switching device in the mains line, but between the motor terminals U1, V1 and W1.
- Commission the unit only, after the following tasks have been completed:
  - Check all safety instructions and strictly adhere to them. All persons are outside the range of the impeller so that there is no risk of injury.
  - Monitor the current consumption. If the current consumption is higher than the value on the motor rating plate, immediately shut down the fan.
  - Check the direction of rotation (observe arrow on the impeller base plate of the fan housing).

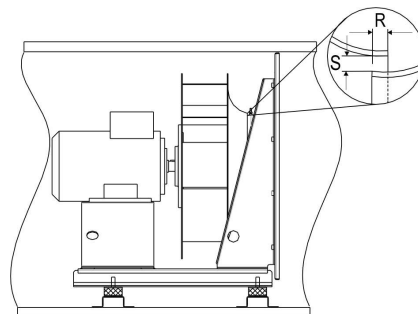
- Check whether the impeller is running smoothly without excessive vibration.
- Determine the resonance range of the impeller. If the resonance range of the impeller overlaps with the operating range, make the necessary adjustments at the frequency converter to ensure that the resonance range is run through quickly. Excessive vibration due to imbalance, caused for example by transport damage, incorrect handling of the components or operation within the resonance range can cause serious damage to the unit.
- Avoid frequent starting and stopping.
- Measure the gap (S). This gap must be of the same width along the entire circumference. The gap overlap (R) must correspond to approx. 1% of the impeller diameter. (See figure A.)

### Maintenance and repair

- Every 12 months, check the fan for mechanical vibration according to DIN ISO 14694. The maximum permissible vibration rate is 2.8 mm/s (measured at the bearing plate of the motor bearing at the impeller side).
- Depending on the application and the conveyed medium, the impeller and the housing are exposed to normal wear. Deposits on the impeller can cause imbalance and thus damage (risk of total failure).
  - The impeller might even rupture, posing a risk of fatal injury!
  - For the maintenance of the motor, observe the instructions of the motor manufacturer.
- For all maintenance and repair work, observe the following:
  - Do not bend the fan blades, as this could result imbalance!
- After (re)installation of the impeller, the entire rotating unit must be balanced according to DIN ISO 1940-1.
- If there is any damage (e.g. to windings), please contact our service department.
- Check the impeller, and in particular the welds, for cracks.

### Cleaning

- Regular inspection and cleaning are necessary in order to prevent imbalance.
  - Clean the flow area of the fan.
- The maintenance intervals are determined by the level of contamination of the impeller.
- Clean the entire fan with a damp cleaning cloth.
- Do not use aggressive detergents or products that might damage the paintwork.
- Never use a high-pressure washer or water jet.
- If water has entered the motor:
  - Allow the winding to dry before starting the unit.
  - Replace the ball bearings of the motor.
- Wet cleaning can result in fatal injury from electric shock!



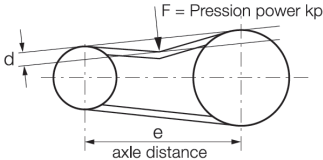
## 7.2.2. V-belt drive

The V-belt drive is a low-maintenance assembly which is however crucial for the proper operation of the unit. The belt tension and alignment affect the service life of the belt and also of the fan/motor bearings. It is therefore very important that the V-belt is regularly checked for proper tensioning and alignment.

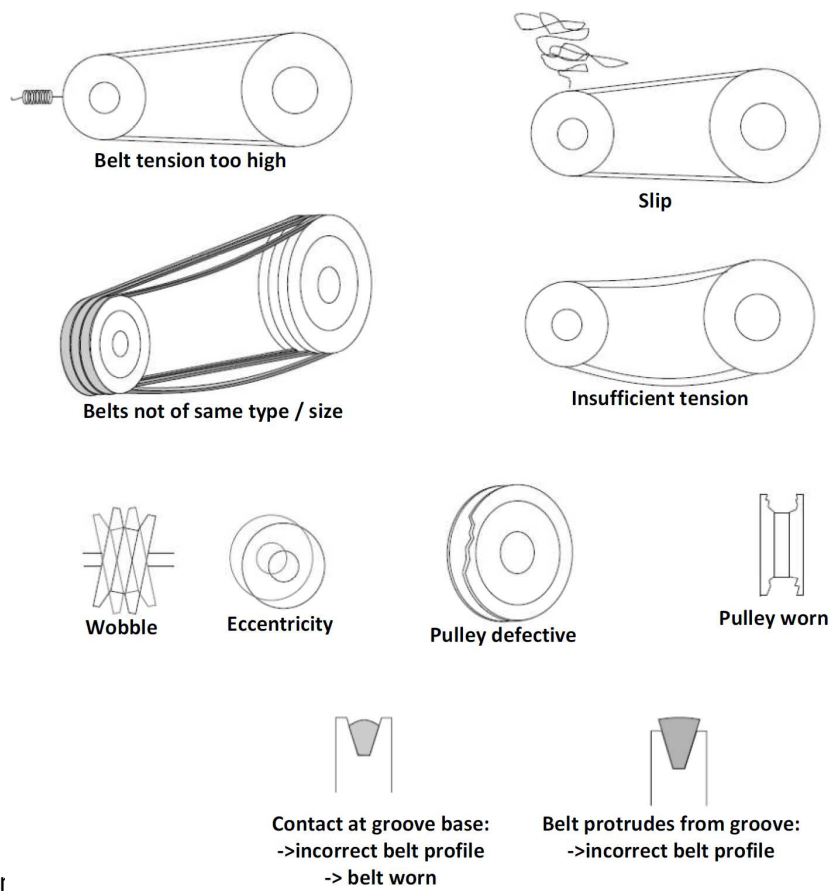
See also the instruction sign attached to the unit.

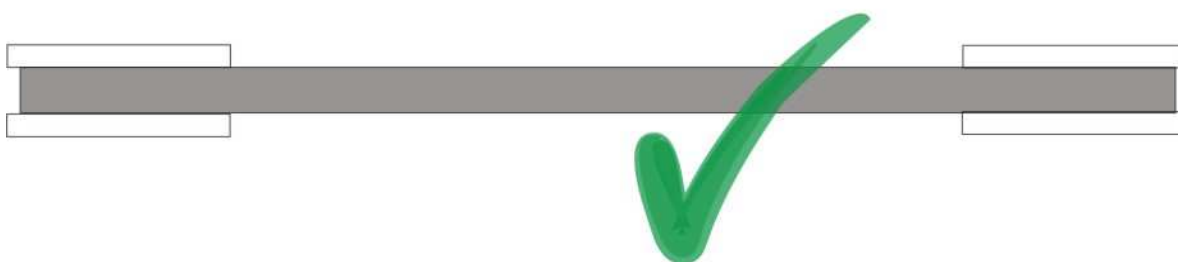
# Fan

- Before opening the inspection door, turn off the motor and wait for fan stop.
- If the bearings are regreaseable, regrease it periodical.
- Check the bearing (max 80° C).
- Check the belt tensioning periodically.

|                                                 |                                                                         |                                                                                     |
|-------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Deflection<br>Belt profile<br>SPZ<br>SPA<br>SPB | $d = e \times 0,016$<br>Power F/kp<br>1,8...2,6<br>2,6...3,8<br>5,1 7,5 |  |
|-------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------|

Avoid any of the following:





### IMPORTANT:

The V-belt drive is defective:

- If Pulleys are not properly aligned to each other.
- If Pulleys are not parallel to each other.
- If Pulleys are at angles to each other.

**Protect the V-belt drive against dirt and moisture.**

### Retightening of the V-belt

To tighten the V-belt, adjust the distance between the motor and the fan by moving the motor. Depending on the size of the unit, the following equipment is provided for this purpose:

- Motor on motor mounting plate with central adjusting screw
- Motor on tilting rocker
- Motor on rails on which it can be moved

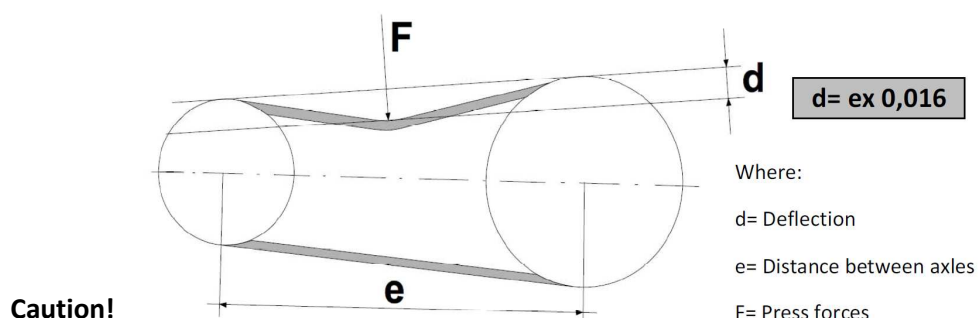
To adjust the motor position, loosen the lock screws (lock nuts) and turn the adjusting screw as required. Ensure that the pulleys are properly aligned to each other. After the adjustment is completed, tighten all screws (nuts) and replace the belt guard (if removed).

### Instructions for the adjustment of the belt tension:

For the fine adjustment of the belt tension, use a belt tension measuring device; for correct settings, see the table below. If no measuring device is on hand, follow the instructions below that allow you to adjust the belt tension relatively accurately:

#### Settings based on belt profile:

| Belt type | Force |       | F/kp |
|-----------|-------|-------|------|
| SPZ       | 1,8   | ..... | 2,6  |
| SPA       | 2,6   | ..... | 3,8  |
| SPB       | 5,1   | ..... | 7,5  |



If the belt is too tight, the bearings of the fan and/or the motor might be damaged. If the belt tension is too low, the V-belt is exposed to excessive wear and the machine's efficiency is impaired.

### Replacement of the V-belts

When changing the V-belts, loosen the belt tensioning device until the belts can be easily removed. Before installing the new belts, clean the pulleys.

Ensure that the new belt can be mounted on the pulleys without the need of force. Tension the belts as described above.

In machines with multiple V-belts, always replace the entire set of V-belts together.

Further ensure that all belts are of the same length. Before tightening the belts, ensure that their slack sections are in the same position.

## 7.2.3. Flat belt drive

To ensure trouble-free operation of the flat belt drive, ensure the following:

- The pulleys are clean.
- The shafts are parallel to each other.
- The vertices of the pulley curves must be aligned to each other.
- The belt is running in the correct direction.
- The pulleys must be aligned in all directions

### Installation and tensioning

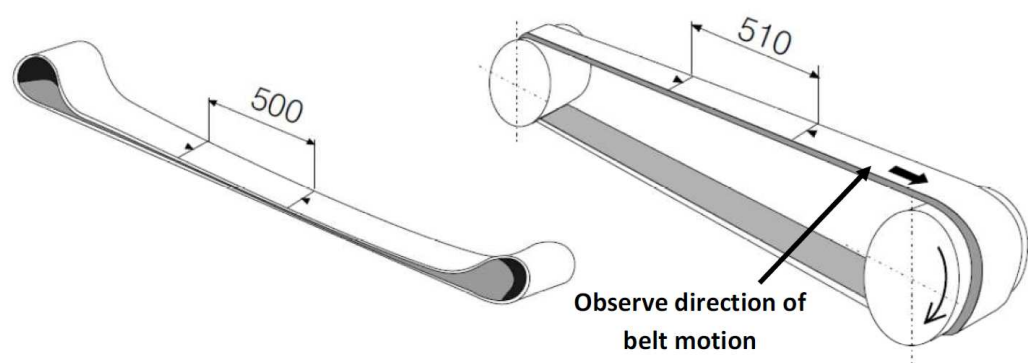
Unless already in place, mark to measuring points 500 mm apart from each other on the slack flat belt.

Mount the flat belt and stretch it until the distance between the two measuring marks has increased by the required factor (e.g. by 2% = 510 mm).

During tensioning, turn the drive by hand and prevent the belt from slipping by adjusting the motor slide position. After tensioning, recheck the pulley alignment.

After prolonged standstill, the drive should be loosened to protect the drive, bearings and the belt. After one hour of operating time the tension and alignment of the flat belt and pulleys must be checked and adjusted if necessary.

After one hour operating time control the tension and the alignment and if necessary regulate it again.





**Disassembly and reinstallation**

Before loosening the belt, measure the distance between the measuring marks. If necessary, mark new measuring points, measure the distance and only then loosen the belt.

When reinstalling the belt, tension it as described above until the previous elongation is reached.

This is important to prevent extra load on the axles, which generally results in damage to the bearings.

**Maintenance**

Flat belts with a synthetic finish must not be treated with belt spray or belt resin. If necessary, wash the flat belt with warm water and a conventional detergent.

## 7.3. Filters

**Flat filters**

Monitor the filter load with a differential pressure gauge. If the final pressure loss specified in the data sheet is reached, clean or replace the filter.

**Bag filters**

Monitor the filter load with a differential pressure gauge. If the final pressure loss specified in the data sheet is reached, replace the filter. Bag filters of grade EU 5 and higher cannot be cleaned. These filters must always be replaced after they have reached the end of their service life. Change the filter according to the instructions in the applicable standards, or latest when the pressure drop has reached the preset final pressure loss.

**Important!**

Before installing the new filter cartridges, carefully clean all filter parts. Check the filter cassettes and guides for leakage and seal them, if necessary.

**Absolute filters**

Replace the filter cartridges when the final pressure drop specified in the data sheet is reached. When installing the new cartridges, ensure that the filter clamps are tightened equally. We recommend performing a fit test.

**Automatic roll filters**

For automatic roll filters, observe the maintenance instructions of the manufacturer. As a rule, replace the filter roll when it is spent. Normally, the operator is told by a warning signal that the roll needs to be replaced. Check the gear oil level every 6 months.

**Activated carbon filters**

In contrast to other filters, high contamination of activated carbon filters does not result in a pressure loss. The filter must be replaced when it is saturated.

To monitor the saturation level, weigh the filter. If the weight is increased by approx. 10-20%, the filter is saturated and must be replaced. The weight of the filter should be checked every 3 to 4 weeks.

**Commissioning checklist**

- Is the filter correctly positioned in the frame?
- Is the filter properly secured to the frame?
- Does the filter correspond to the filter type specified in the data sheet?
- For automatic roll filters: does the conveyor motor work properly?
- For filters with differential pressure monitoring: are the differential pressure measuring instruments filled with the supplied measuring medium and are the indicators correctly configured?

## 7.4. Heat exchanger

- Check the heat exchanger connections for leakage.
- Ensure that all tray drains are equipped with siphons.

The siphon must be designed so that it prevents drying out, and with reference to the actual static pressure.(refer to 6.4. for details) Never connect the siphon directly to the waste water system.

**FREON**

In units with direct evaporators or air-cooled condenser batteries, the system must be filled with a refrigerant. In this case, the installation of the system and the pipelines must be performed by a qualified refrigeration technician.

During maintenance, check the evaporator for ice and leakage.

**Pumped cold water, pumped hot water**

Standard heating and cooling batteries are filled with water to which an anti-freeze agent and a corrosion inhibitor are added.

- Open the bleeder valve.
- Open the water valve slightly so that the battery is filled slowly with water. This prevents thermal stress on the system.
- As soon as the battery is filled, close the bleeder valve.
- Open the water valve fully and switch on the fan.
- Bleed the entire pipeline system.

**Steam**

- Open the bleeder valve and the drain valve at the condensate drain.
- Open the steam valve by a little until steam escapes at the valve.
- Close the drain valve and the bleeder valve and fully open the steam valve.

During operation, regularly check the bleeder valve.

**Caution!**

During prolonged standstill, ensure that no condensate is left in the pipes. In units with heaters that have a feed temperature of over 90 °C, shut down the heating medium supply before shutting down the unit. The fan should have a follow-up time of minimum 3 minutes.

In units with electric heating batteries, ensure that they are connected correctly. To prevent overheating of the components, set the fan run-on time to minimum 3 to 5 minutes.

**Water, water-glycol mixture, steam**

Apart from regular cleaning, heat exchangers require no maintenance. Check the heat exchanger every 3 to 4 months for dust deposits and clean it, if necessary.

For prolonged shutdown, empty the exchangers. After (re)filling, always bleed the heat exchangers.

**Cleaning**

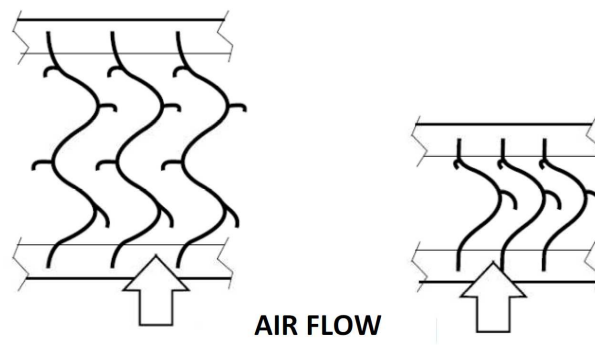
If there is a lot of dust, clean the heat exchanger from the dust air side with a vacuum cleaner. If this is not sufficient to remove the dust deposits, pull out the heat exchanger to clean it with water. If the exchanger fins are made from aluminium or copper, do not clean them with a water jet.

Galvanized steel batteries may be cleaned with a steam jet cleaner. If necessary, use a soft brush. Take great care to prevent damage to the fins.

Remove any corrosion visible on the heat exchanger (derusting, sanding) and cover the affected areas with zinc paint.

**General maintenance****Demister**

Check the demister fins at least once a year for dirt. If they are dirty, remove the demister from the unit and clean it. Reinstall it in the correct position.



The siphon must be designed with reference to the actual static pressure and so that it prevents drying out (Refer to 6.4. for details). Never connect the siphon directly to the waste water system.

**Condensate tray**

Regularly check the tray, drain and siphon for dirt and clean them, if necessary.

**Frost protection**

Prior to the start of the cold season, test the frost protection system.

**Electric air heater**

Check the heater for dirt and clean it, if required. Check the power connections and test the thermostats.

To prevent overheating of the components, set the fanrun-on time to minimum 3 to 5 minutes.

## 7.5. Humidifier

The water fed to the humidifier must meet the microbiological quality requirements laid down in the Drinking Water Regulations. Ensure that the water can under no circumstances be fed back to the drinking water distribution network.

It is not permissible to connect water drains directly to the waste water system

The humidifier must be automatically shut down as soon as the air handling unit is switched off or is otherwise de-energized.

A supply line control system must ensure that the humidifier chamber is run dry before the humidifier is shut down.

In units with humidifiers, ensure that no condensate is produced downstream of the humidifiers in the event of an air handling unit failure or if there is insufficient supply air flow. In such a case, the relative air humidity in the supply line system must not exceed 90%.

### 7.5.1. Surface humidifier

#### **Pump**

The pump is maintenance-free. Defective pumps must be replaced. For a long service life of the pump, ensure the following:

- Never let the pump run dry.
- Prevent solids from entering the pump.
- Avoid prolonged standstill.
- We recommend switching on the pump every 2 days for approx. 2 minutes.

If the unit is to be shut down for more than 48 hours, the surface humidifier must be emptied and cleaned.

The fresh water supply must be adjusted so that the volumetric flow rate is lower than the maximum overflow rate at all times and under all operating conditions.

### 7.5.2. Steam humidifier

For the maintenance of the steam humidifiers, follow the instructions of the manufacturer. In general, these devices are virtually maintenance-free, requiring only regular checks of the demister and the tray.

Take suitable measures to ensure that there is no condensation even in the event of a failure of the air handling unit or if the supply air flow rate is too low.

To prevent condensation in the air duct system, configure the supply fan to run with sufficiently long lead-in and Run-on times before/after switching the humidifier on/off (recommended time: 10 minutes).

### 7.5.3. Air washer

For the maintenance of the air washers, follow the instructions of the manufacturer.

### 7.5.4. Commissioning of contact humidifier

#### 1. Recirculating water model (standard model)

The **WEGER** surface humidifier is equipped with a tray (V2A) that feeds the water to the drain. The water is fed to the humidifier through a mechanical float valve (2). The external ½" fresh water connection (1) must be equipped with a ball valve. We recommend installing a water filter in the supply line. The float valve is designed for an operating pressure of 1 to 3 bar. At the pressure side of the pump, install the following manual control valves: one valve for the control of the supply flow rate to the humidifier tube (6), one valve for the desludging (4) and one valve serving as a bypass (13) for pump cooling.

The level switch (12) prevents dry-running of the pump.

Depending on the water quality, surface humidifiers should be emptied and cleaned regularly. We recommend emptying the surface humidifiers once a day. Only refill the humidifiers when humidification is actually required.

#### **Water quality:**

As water evaporates, mineral deposits consisting mainly of calcium and magnesium are formed on the humidifier cells. Over time, these deposits might block the cells and contaminate the tray.

#### **Mechanical float valve (2):**

Prior to commissioning, adjust the float valve as follows: Turn the adjusting screw to lower or lift the floater. Adjust the floater position so that the float valve is opened before the water level drops below the pump intake piece.

The float valve must close before the water level reaches the overflow level.

#### **Pump (3):**

Refer to the pump manual supplied with the unit.

Never let the pump run dry.

#### **Dry-run protection - level switch (12):**

The level switch must be configured to ensure that the pump is instantly stopped when it starts to run dry.

#### **Manual control valve for flow control (6):**

The evaporation rate depends directly on the quality of the supply air. This determines of course how much water is evaporated.

Adjust the evaporation rate so that the humidifier cells are well soaked. There must however be no visible run-off at the cell surface.

#### **Manual control valve in bypass (13):**

This valve is used to control the pump cooling and should be opened by approx. 30% so that there is sufficient cooling water recirculation. Proper cooling prolongs the service life of the pump.

#### Manual control valve for desludging (4):

A certain part of the water in the system must be drained off in order to ensure that fresh water is continuously fed to the circuit. This manual control valve is used to adjust the desludging rate.

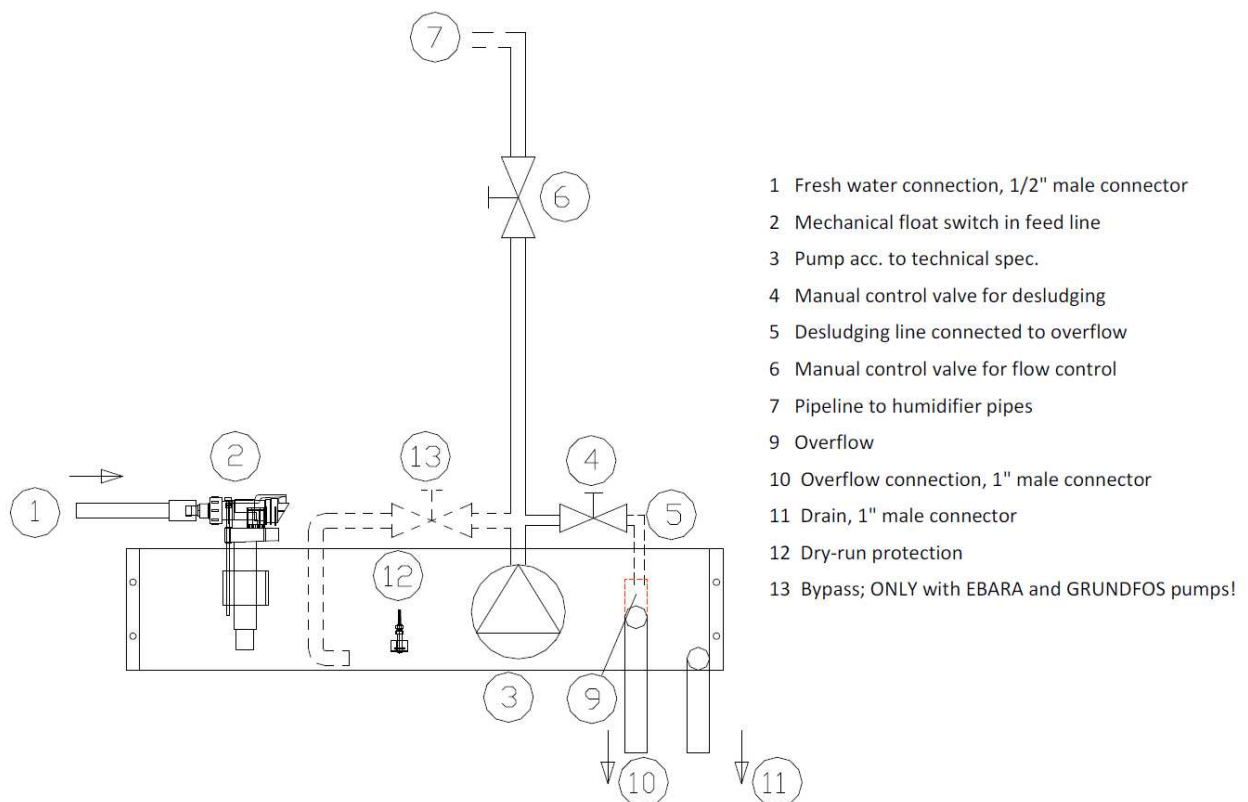
It is **important** that the cells and the tray are checked approx. 2 weeks after commissioning. If required, increase or reduce the desludging rate. Subsequent checks (and adjustments) must be performed at least on a monthly basis.

#### Drain (11):

The drain (1" male thread) must be equipped by the operator with a stop valve and siphon. The siphon outlet end must be open and must feed the water to the waste water system.

#### Overflow (10):

The overflow (1" male thread) must be equipped by the operator with a siphon. The siphon outlet end must be open (no stop valve) and must feed the water to the waste water system. The overflow must never be blocked.



## 2. Fresh water operation

### WEGER components:

|                     |                                                           |
|---------------------|-----------------------------------------------------------|
| Supply line:        | TACO Setter<br>solenoid valve open/closed                 |
| Humidifier control: | Manual, by means of flow meter + controller (TACO Setter) |
| Supply connection:  | ½" male connector                                         |
| Outlet line:        | 1½" male connector                                        |

**Components provided by customer:**

Fresh water humidifiers are normally connected to the drinking water supply system. Ensure that the humidifier is pressurised with a water pressure of 2 to 3 bar. This pressure level must never be exceeded, irrespective of the operating conditions.

Also ensure that the maximum possible supply rate does not exceed the maximum possible outlet rate through the available drain.

For safety reasons, we recommend installing a pressure controller, a water filter and stop valve in the supply line.

The drain must be fitted with a suitable siphon. The siphon outlet end must be open and must feed the water to the waste water system. Ensure that there is free drainage under all operating conditions.

**Function:**

When commissioning the humidifier, adjust the humidification rate using the flow meter and the controller (manual adjustment).

The fresh water is fed through a distribution pipe to the contact humidifiers where it is released in droplets to humidify the air flowing through the duct.

Excess water is collected and drained off. To reduce operating costs, do not feed too much water to the humidifiers. For proper operation, it is sufficient if the contact humidifiers are properly soaked. Avoid run-offs.

To tune up humidification, open the solenoid valve. To shut down humidification, close the solenoid valve. We recommend operating the fan with a follow-up time to dry the cells.

**Important**

- The water overflow must be equipped with a siphon. Depending on the application, a siphon must also be installed at the tray drain. The siphons must provide for proper pressure equalization between the machine chamber and the drain system.
- If the surface humidifier is to be shut down for more than 48 hours, empty and clean it.

**Water quality for humidification**

The quality of the water is a major factor for proper humidification. Depending on the carbon hardness of the fresh water and the impact of a unit failure, it might be necessary to treat the water for humidification.

The water must conform to the following quality standards:

|                           |                                               |
|---------------------------|-----------------------------------------------|
| Appearance                | clear, colourless, no cloudiness or sediments |
| pH                        | 7...8.5                                       |
| Conductivity              | max. 800 µS/cm                                |
| Total hardness            | max. 4 °dH                                    |
| Carbon hardness           | max. 4 °dH                                    |
| Total salt content        | max. 600 g/m <sup>3</sup>                     |
| Chlorides                 | max. 150 g/m <sup>3</sup>                     |
| Sulphates                 | max. 290 g/m <sup>3</sup>                     |
| Iron                      | max. 0.05 g/m <sup>3</sup>                    |
| Manganese                 | max. 0.1 g/m <sup>3</sup>                     |
| Aggressive carbon dioxide | 0 g/m <sup>3</sup>                            |
| KMnO <sub>4</sub>         | max. 20 g/m <sup>3</sup>                      |

If the above water quality parameter values cannot be met, WEGER cannot guarantee proper operation of the unit.

Depending on the water hardness and the impact of a unit failure, it might be necessary to treat the water for humidification:

| Impact of unit failure | low  |       |       | medium |       |       | high |       |       |
|------------------------|------|-------|-------|--------|-------|-------|------|-------|-------|
|                        | 0-10 | 10-20 | 20-40 | 0-10   | 10-20 | 20-40 | 0-10 | 10-20 | 20-40 |
| Total hardness °dH     | X    |       |       | X      |       |       |      |       |       |
| Untreated water        | X    |       |       | X      |       |       |      |       |       |
| Injection method       |      | X     |       |        | X     |       |      |       | X     |
| Ion exchange method    |      |       | X     |        |       | X     |      | X     |       |
| Decarbonisation        |      |       |       |        |       |       |      |       | X     |
| Desludging             | X    | X     | X     | X      | X     | X     | X    | X     | X     |
| Periodic descaling     | X    |       |       | X      |       |       |      |       |       |

#### Conversion table for hardness units

1 °dH = 1.780 °fH (French degree of hardness)

1 °dH = 1.250 °e (English degree of hardness)

(°dH = German degree of hardness)

## 7.6. Silencer

The silencer baffles are maintenance-free. During major overhauls, check the baffles for dust and clean them with a vacuum cleaner, if necessary.

**The surfaces of the bafflers must not be damaged.**

## 7.7. Multi-leaf dampers

According to Standard H6020, extra tight dampers for room classes H1, H2 and H3 must be equipped with two end position switches.

Air control dampers are generally maintenance-free. If the leaves are stiff, check them for proper fit. The leaves must not be stressed. During major overhauls, clean the leaves with water or compressed air. Should the leaves be stiff, apply a little silicon spray to the lateral leaf bearings.

## 7.8. Weather guards

Check the weather guards once a month for dirt and damage. Remove leaves, paper, etc. that might obstruct air intake.



## 7.9. Heat recovery unit

### 7.9.1. Plate exchangers

Plate exchangers do not contain any moving parts and are thus virtually maintenance-free. It is recommended to clean the exchanger regularly and to check the water level in the condensate tray.

Should the plate exchanger be equipped with a bypass damper, check and clean the damper regularly. Should the damper be stiff, apply a little silicon spray to the lateral leaf bearings.

### 7.9.2. Closed-loop system (run around Coils)

To service the closed-loop system, follow the instructions for heat exchangers.

### 7.9.3. Rotary heat exchanger (thermal Wheel)

Regularly check the drive unit, following the instructions of the manufacturer. The heat storage medium is self-cleaning.

If necessary, clean the rotor with compressed air or a steam jet cleaner. If there are grease deposits, clean the heat exchanger with a conventional grease-dissolving detergent.

Blades in segmented rotors must be retightened every 6 months.

### 7.9.4. Heat tube

Similar to a plate heat exchanger, the heat tube does not contain any moving parts.

Maintenance is thus limited to regular cleaning of the housing.

In addition, perform the maintenance task for the tray and the demister described in section 6.1. Should the heat tube be equipped with a bypass damper, check and clean the valve regularly. Should the damper be stiff, apply a little silicon spray to the lateral leaf bearings.

## 7.10. ATEX units

For maintenance work on the air handling unit, follow the instructions in the operating manuals of the individual devices / overall unit.

WEGER devices are designed for minimum maintenance and many are maintenance-free. The specified maintenance intervals are guide intervals only and need to be adjusted, depending on the actual application and air quality.

Non-compliance with the operating and maintenance instructions shall void the manufacturer warranty.

In the event of a failure of shut-down of the air intake fans, and if the relative air humidity exceeds 86%, the air humidifiers must be switched off automatically and independently of the unit operation control.



For maintenance and cleaning work on ATEX units, observe the following:

- Use only tools that conform to EN 1127-1.
- Avoid all ignition sources (see section 1.2.).
- To prevent electrostatic charging, always clean the unit with a damp cloth.
- All work on the de-energized unit must be performed by authorised specialist technicians in accordance with the German Industrial Health and Safety Ordinance.
- Never perform any work on the unit under explosive atmosphere conditions.
- Avoid all ignition sources.
- To prevent electrostatic charging, wear electrically conductive footwear (conforming to BGR 132).
- First shut down the unit mechanically and then de-energize it (i.e. disconnect it from all power sources). Secure the unit against inadvertent restart and then open the housing.
- During standstill, the concentration levels of the processed atmosphere inside the unit might be elevated, causing an increased risk of explosion.

## 7.11. Test run

After all work on the air handling unit and before switching it on, the operator in charge of the unit must ensure that there are no persons standing inside the unit or in its danger area. After all checks are completed and the unit is ready for operation, perform a test run.

### NOTICE

**During the test run, the unit must be connected to the overall system. Close all unit doors and open the dampers. Do not operate the fan against closed dampers.**

During the test run, check the following:

- Direction of rotation of fan
- Actual current consumption of all motor phases; compare the actual values with the values on the rating plate.
- If the measured current consumption is too high, there is a wiring fault. Immediately shut down the unit.
- Measure the volumetric flow rate and the differential pressure.
- If the air flow rate does not correspond to the unit rating, proceed as follows:

#### **a) Insufficient volumetric air flow**

Increase the fan speed by changing the belt pulleys, or increasing the inverter output frequency (Hz).

### NOTICE

**When increasing the fan speed, do not exceed the rated current of the motor. Risk of damage to motor!**

If it is not possible to reach the required volumetric air flow without exceeding the rated current of the motor, replace the motor with a more powerful one.

**b) Excessive volumetric air flow**

Reduce the fan speed by changing the belt pulleys or reducing the inverter Output Frequency (Hz)

 **NOTICE**

**In the event of excessive volumetric air flow, there is a risk of damage to the motor from overload.**

Always notify WEGER of any modifications made to the unit.

## 8. Shutdown and decommissioning

### 8.1. Prolonged shutdown / decommissioning

If the unit is to be shut down for a prolonged period of time, proceed as follows:

- Disconnect energy supply (electric power, pressure, temperature, etc.).
- Drain the water from the heat exchanger.
- In units with integrated control cabinet, we recommend leaving the control cabinet heater switched on.
- Turn the rotating parts of the fan from time to time by hand to prevent seizing.
- Before restarting the unit, perform all commissioning tasks in this manual.

### 8.2. Dismantling and disposal

Proceed as follows:

- Have the unit dismantled by an authorised specialist contractor.
- All process chemicals and substances in the unit (water, oil, refrigerant) must be collected and disposed of separately according to the applicable statutory regulations.
- Separate metal and plastic parts for recycling according to the applicable statutory waste disposal regulations.

## 9. Maintenance schedules for unit components

| Assembly                 | Component                         | Task       |          |         | Service |         |           |                |          |
|--------------------------|-----------------------------------|------------|----------|---------|---------|---------|-----------|----------------|----------|
|                          |                                   | Inspection | Cleaning | Service | weekly  | monthly | quarterly | every 6 months | annually |
| ATEX unit                | all components                    | x          | x        | x       |         | x       |           |                |          |
| Fan/motor assembly       | General                           | x          | x        |         | x       |         |           |                |          |
|                          | Elastic connections               | x          |          |         |         | x       |           |                |          |
|                          | Vibration damper                  | x          |          |         |         |         |           | x              |          |
|                          | Fan bearing                       | x          |          | x       |         | x       |           |                |          |
|                          | Motor bearing                     | x          |          | x       |         | x       |           |                |          |
|                          | Belt drive                        | x          |          |         |         | x       |           |                |          |
|                          | Belt tension                      | x          |          | x       |         | x       |           |                |          |
|                          | Current consumption (measurement) | x          |          |         |         | x       |           |                |          |
|                          | Safety guard                      | x          |          |         |         | x       |           |                |          |
| Filters                  | Cassette filter                   | x          | x        | x       | x       |         |           |                |          |
|                          | Envelope filter                   | x          | x        | x       | x       |         |           |                |          |
|                          | Absolute filter                   | x          | x        | x       | x       |         |           |                |          |
|                          | Automatic roll filter             | x          |          | x       |         | x       |           |                |          |
|                          | Activated carbon filter           | x          | x        | x       | x       |         |           |                |          |
| Heat exchanger           | Fins                              | x          | x        |         |         |         | x         |                |          |
|                          | Condensate tray/drain             | x          | x        |         |         | x       |           |                |          |
|                          | Demister                          | x          | x        |         |         |         | x         |                |          |
| Electric heating battery | Electric heating battery          | x          | x        |         |         |         | x         |                |          |
| Humidifier               | Pump                              | x          |          |         |         |         | x         |                |          |
|                          | Water connections                 | x          |          |         |         | x       |           |                |          |
|                          | Descaling                         |            | x        |         |         |         |           |                | x        |
|                          | Tray                              | x          | x        |         |         | x       |           |                |          |
|                          | Cell packs                        | x          | x        | x       |         | x       |           |                |          |
|                          | Nozzles                           | x          | x        |         |         | x       |           |                |          |
| Silencer                 | Baffles                           |            | x        |         |         |         |           |                | x        |
| Heat recovery unit       | Plate exchanger                   | x          |          | x       |         |         |           |                | x        |
|                          | Thermal Wheel                     | x          | x        | x       |         | x       |           |                | x        |
|                          | Heat tube                         | x          | x        |         |         |         |           |                | x        |
|                          | Closed-loop system                | x          | x        |         |         |         |           |                | x        |
| Damper                   | Damper                            | x          | x        |         |         |         |           | x              |          |
| Weather guard            | Weather guard                     | x          | x        |         |         |         |           | x              |          |

## Notes

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## Notes

This image shows a full page of blank graph paper. The grid consists of thin, light gray horizontal and vertical lines that intersect to form small squares across the entire surface. There are no margins, text, or other markings on the paper.