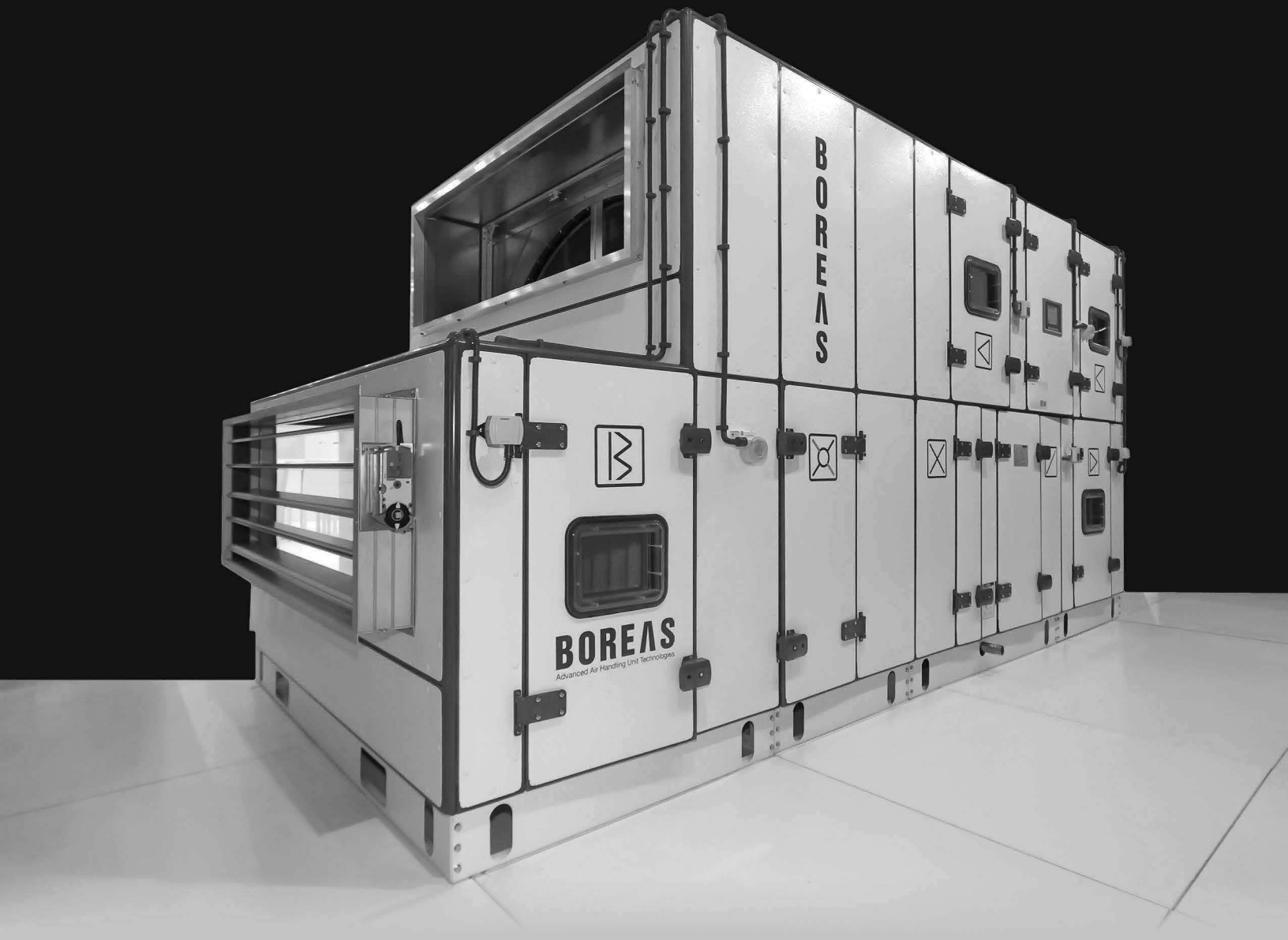
BOREAS 5TH GENERATION AIR HANDLING UNIT

Installation Commissioning Maintenance Manual



BOREAS
Advanced HVAC Systems and Technologies

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1 GENERAL CONSIDERATIONS

The BOREAS 5th Generation Air Handling Unit installation, commissioning, and maintenance manual was prepared to provide extensive information on the unit's technical specifications, transport, installation, commissioning, and operational maintenance. Anyone who is to work on the unit should read this manual in advance and carefully follow the instructions given. TEKNOKLİMA does not hold any responsibility for malfunctions to the unit that are caused by a failure to follow the warnings specified in this manual. In the event that users make any modifications, alterations on the unit within the knowledge and approval of TEKNOKLİMA during the warranty period, the warranty scope shall be deemed null and void.

1.1 USE IN ACCORDANCE WITH INSTRUCTIONS

The BOREAS 5th Generation Air Handling Unit manufactured by TEKNOKLİMA is used for the ventilation of spaces; filtration, heating-cooling of air, heat recovery, humidification and dehumidification depending on design specifications and the cell types selected. TEKNOKLİMA does not permit the use and operation of its Air Handling Unit for other purposes than that listed. Any malfunctions that arise from use for purposes other than that listed above are outside the scope of the warranty. Some examples are: using air handling unit cells as shelter, using air handling unit framework as scaffolding in construction sites, and using air handling unit cells as storage areas.

1.2 PLANT ROOM

Sufficient maintenance spaces and clearances should be left in the area where the Air Handling Unit will be installed, for operation and service actions. It is recommended that the floor is smooth and easily cleaned, to prevent the accumulation of dirt and dust. The space should be illuminated, ventilated, humidity and temperature controlled. An area equal to the depth of the heat exchanger (Heating-Cooling Exchanger, Plate-Rotary Heat Recovery Units) should be left as a minimum in sections where heat exchangers are located, for maintenance work. (See 6.1 Unit Installation).

1.3 TRANSPORT AND STORAGE

The BOREAS 5th Generation Air Handling Unit is prepared for shipping in cells, and by applying appropriate packaging and transport methods on each cell. To facilitate easy horizontal and vertical handling of cells, cell feet have forklift transport holes and winch handling rings as standard. The use of these is recommended during handling. Damages that may arise otherwise fall outside the scope of the warranty. If the air handling unit must be stored for longer than 3 months, the following procedures must be followed:

- The packaging of units should be removed in order to facilitate free ventilation with the purpose of eliminating moisture from condensation inside the packaging, and the units should be repackaged after a period of 1-2 hours.
- Fans included within the fan and aspirator cells should be manually rotated once a month. If it includes a belt and wheel mechanism, the belt should be left loose.
- If the air handling unit includes rotary type heat recovery, the rotor should be manually rotated once a month.
- The dampers should be manually moved once a month.
- The service doors of chambers should be opened and closed once a month to avoid damage to seals.
- If the air handling unit includes a power or automation panel the board cover should be opened to allow free ventilation.
- Care should be taken to ensure that the plugs on the collector intakes and discharges of heat exchangers are in place. If the plug is absent for any reason, the plug should be procured by contacting the TEKNOKLİMA Technical Service
- Storage conditions should be ensured for all cells, to protect cells from outdoor conditions. If storage in outdoor space is unavoidable, the unit cells must be subjected to additional packaging to prevent direct impact of outdoor conditions.
- Air handling unit cells should not be stacked. If stacking is unavoidable, each cell should be placed within am individual cage or case.

Figure 1 Correct Stacking of Cells

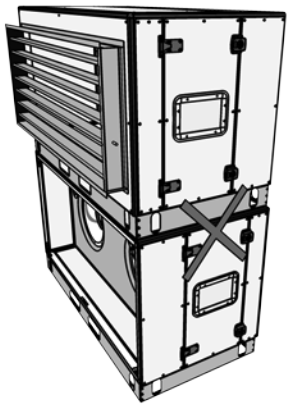


Figure 2 Incorrect Stacking of Cells

1.4 INSTALLATION

The cells that make up the BOREAS 5th Generation Air Handling Unit are manufactured and shipped separately. These cells are assembled in the manner specified in this manual, making up the air handling unit. After the cell assembly is complete, the cable installation must also be completed.

1.5 BEFORE COMMISSIONING

The BOREAS 5th Generation Air Handling Unit should be commissioned after all installation procedures included in this manual have been completed and the unit has been checked. It is suggested that the final checks and commissioning be carried out by the TEKNOKLİMA Technical Service or its authorized installation teams. It is suggested that the maintenance and repair circuit breaker be installed on the unit's power supply line, and in close proximity to the unit.

1.6 FREEZE PROTECTION

It is recommended that the unit not be brought offline at low temperatures, to avoid freezing of the unit's moveable parts. The use of a freeze-free thermostat with automatic reset for the water heating exchanger is recommended. This enables freeze protection during operation. If the unit must be brought offline, it is strongly recommended that the water within the water exchangers be purged.

2 SAFETY WARNINGS

Failure to obey the following warnings and relevant national and international safety instructions may cause serious work accidents, human injuries, and even deaths.

If the unit is to be serviced, this must be carried out by authorized teams, and the following precautions must be taken. The unit should not be serviced otherwise.

- All electrical connections to the unit must be cut.

- The necessary precautions must be taken and the unit locked against resuming during service.
- Care should be taken to ensure that the unit's moving parts such as fan, rotary heat recovery unit, compressor, pump, etc. have been stopped and that they will not resume during servicing.
- In cooling and heating cells where a high temperature differential can occur, the expected temperature difference between the inside of the cell and the ambient temperature should be around 10°C.
- The service personnel must wear protective equipment.

The following warnings must be followed when restarting the unit after the completion of the service.

- Care must be taken to ensure that there is no living creature within the unit.
- Care must be taken to ensure that no service equipment has been forgotten within the unit. Care must also be taken to ensure that there are no parts that had not been fixed in place after being removed.
- Care must be taken to ensure that door locks are closed particularly on positive pressure fan cells, and that there are no people near the door during initial start-up.
- If air dampers are manually controlled, care must be taken to ensure that they are in their on position.

All procedures specified above must be carried out by authorized TEKNOKLİMA personnel or by specialist personnel approved by TEKNOKLİMA.

3 EMERGENCY MEASURES

In emergencies caused by the unit or by environmental conditions, exact adherence to the following warnings is of utmost importance.

- If smoke is issuing from the unit, the unit's main power supply must be disconnected immediately.
- If a mechanical friction sound is heard during the unit's operation, the unit's main power supply must be disconnected and the TEKNOKLİMA Technical Service informed."
- If dust or unidentified particles issue from the unit's discharge line to the space, the unit must be stopped and its filters must be serviced urgently. The unit must not be restarted without replacing filters.

- If there is water overflow from the unit, the unit's cooling circuit must be shut off, and care must be taken to ensure that the drainage line is clear.

4 MAINTENANCE AND CLEANING MEASURES

4.1 MAINTENANCE INTERVALS

The BOREAS 5th Generation Air Handling Unit requires regular maintenance for uninterrupted and long service. The unit's parts which require periodic maintenance are the following:

4.1.1 Filter

Filters can be used optionally at the fresh air intake and return air intakes of the air handling unit. As these filters clean the air, they have a direct impact on the cleanliness and consequently the efficiency of the equipment within the unit. The use of differential pressure switches is recommended for checking the dirtiness of these filters. The recommended filter replacement values according to the EN 13503 standard are as follows:

- 150 Pa for panel filters (G2-3-4)
- 250 Pa for bag filters (F5-6-7)
- 300 Pa for bag filters (F8-9)

Washing and subsequent reuse of filters is not recommended. While they may appear to conform visually and in terms of pressure loss, the filter pores will be damaged by the washing, and will not perform their filtration function.

Failure to replace filters at the periods specified above will lead to the following:

- The problem of insufficient air flow from the unit will occur due to the extra air side pressure drop that will occur at the air side of the filter.
- Sufficient filtration will not occur, due to clogging of filter pores, which will cause a deterioration in the conditions of comfort.
- If the accumulation on the surface reaches the point where the filter is clogged, the passage of air through the filter will not be possible. In this case, vacuum will be formed in the cells that come after the filter, and if the vacuum level exceeds the limits specified in En 1886 tests, there will be risk of caving in unit panels.

4.1.2 Heat Exchangers

The following types of heat exchangers can be used optionally in the BOREAS 5th Generation Air Handling Unit:

- Direct Expansion Refrigerant Heat Exchanger
- Water Heating – Cooling Heat Exchanger
- Plate Type Heat Recovery Unit Heat Exchanger

- Rotary Type Heat Recovery Unit Heat Exchanger
- Heat Pipe Type Heat Recovery Unit Heat Exchanger
- Run Around Type Heat Recovery Unit Heat Exchanger

There is a possibility of occlusion due to the accumulation of dust between the fins of heat exchangers. Periodic cleaning of heat exchanger surfaces with pressurized water or air every 3 months is recommended. The following problems may occur unless heat exchanger surfaces are cleaned:

- Air side pressure drop values of heat exchangers will exceed design specifications due to clogging. If this value exceeds the limit of the fan or motor, sufficient air flow can not be achieved. This will cause a deterioration in the conditions of comfort as well as a drop in the unit's efficiency.
- Dust particles accumulating on the heat exchanger create a resistance between the air and the heat transfer surface area and negatively affect heat transfer efficiency. This will lead to a drop in unit efficiency, and a failure to achieve the desired conditions in the environment.

4.1.3 Fans

The following types of fans can be used optionally in the BOREAS 5th Generation Air Handling Unit:

- Forward Curved Dense Blade Fans
- Backward Curved Rare Blade Fans
- Direct Coupled Plug Fans
- Direct Coupled EC Plug Fans
- Fan Surface (Multiple Fan Application in Air Flow Cross section).

An overall cleaning of fan wheels every 4 months is recommended to avoid the accumulation of dirt and dust. A mechanical friction test should also be performed during operation. In belt and wheel fans, belt tension should be checked and wheel adjustment performed after initial start-up and at periodical maintenance intervals.

4.1.4 Automation or Power Panel

The automation system is offered as an option in the BOREAS 5th Generation Air Handling Unit. Since it contains all power and control equipment, the automation panel is sensitive to dust and ambient temperature. Therefore the panel should be checked every 2 months for dust accumulation and the correct temperature. The panels are equipped with filtered ventilation fans as a standard. Replacing these filters every 2 months is critical in terms of balancing the temperature within the panel.

4.1.5 Cleaning Inside the Unit

The smooth interior surface of the BOREAS 5th Generation Air Handling Unit makes cleaning inside the unit very easy. It should be cleaned every 3 months to avoid accumulation of dirt and dust, using only alcohol based disinfectants approved for the country in question. The cleaning interval may change by ± 1 month depending on the level of contamination of the environment where the unit is used.

4.1.6 Draining System

A high level of condensation may occur in cooling cells, depending on the conditions of the environment where the air handling unit will operate. The water thus formed must be quickly and safely transferred from the unit to the draining system. A clogging in this system will lead to accumulation of water within the unit, and cause the unit to malfunction by damaging its internal and electronic components. Therefore draining outlets should be checked for cleanness every month.

4.1.7 Drop Eliminator

A drop eliminator is used after the cooling exchanger as standard equipment, to prevent water droplets formed by water vapour condensing on heat exchanger surfaces in cooling cells from being detached by the motion of air and carried over to other cells. The drop eliminator should be checked and cleaned every 3 months, and protected against accumulated dust and dirt. The drop eliminator should be installed by paying attention to the flow direction label on the drop eliminator.

Equipment	1 Month	2 Months	3 Months	4 Months
Filter			x	
Heat Exchangers			x	
Fans				x
Automation Panel		x		
Unit Interior			x	
Draining System	x			
Drop Eliminator			x	

Table 1 Maintenance Check-list Spare Part Delivery / Customer Services / Repairs

Changes that need to be made on the unit must be made only by authorized TEKNOKLİMA personnel or by specialist personnel approved by TEKNOKLİMA for the unit. It is recommended that the spare parts used be the same brand and model as used in the unit. The unit operation instructions contained in this document must be followed in full, for commissioning the unit following spare part replacement and repair. The list of recommended spare parts is the following.

Sequence Number	Material Name
1	G4 Panel Filter
2	F5-F9 Bag Filter
3	Electrical Motor
4	Belt
5	Damper Motor
6	Fan Bearing
7	Electrical Control Panel
8	Service Door Seal

Table 2 List of Spare Parts

5 DELIVERY

The unit must be visually inspected and checked for any visible damage before accepting delivery of the unit. The unit is delivered shrink wrapped with all equipment mounted, in the form of a finished cell as in technical selection printouts. If damage is observed during the visual inspection, immediately note it on the waybill and make sure the waybill is approved by the driver. Take an image of the damage and inform the TEKNOKLİMA Logistics Department.

5.1 UNLOADING THE UNIT FROM THE TRUCK AND HANDLING

The BOREAS 5th Generation Air Handling Unit is equipped with handling rings for connecting winch rings and transport holes for carriage by forklift.

Persons should not stand below suspended loads during the carriage of Air Handling Unit cells.

5.1.1 Unloading the Unit From the Truck and Carrying the Unit Using a Winch

The slings, ropes, and chains that will be used while unloading the unit from the transport truck and carrying the unit must be in compliance with the *Lifting Operations and Lifting Equipment Regulations*. Tie the haulage ropes on the carrying rings found on the corners of the unit legs and make sure they are tight. The center of weight of the unit along its width is on roughly the middle point. The use of rope support apparatus that is larger than the width of the unit is recommended to prevent the ropes from damaging the unit.

5.1.2 Unloading the Unit From the Truck and Carrying the Unit Using a Forklift

Make sure that the forklift forks pass through the forklift holes found on the unit legs and under the entire bottom section. Otherwise, the drainage pan and bottom covering panels located on the underside of the unit can be damaged. Forklift transport holes are found as a standard on both sides of unit legs. These holes are positioned by reference to the unit's centre of mass.

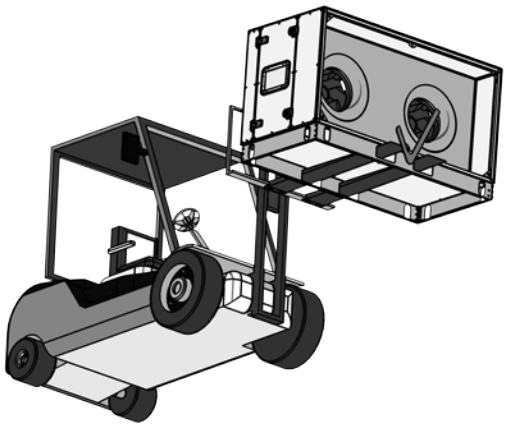


Figure 3 Correct Carriage with Forklift

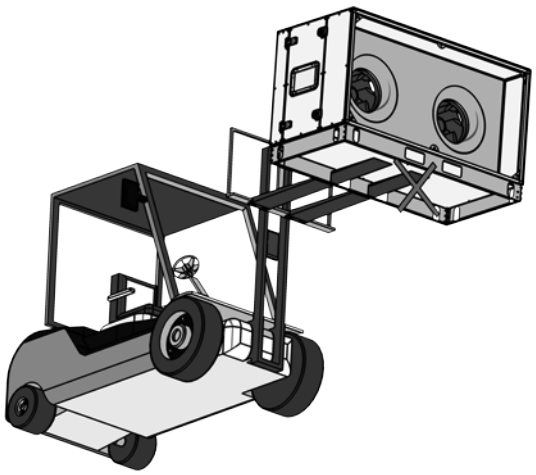


Figure 4 Incorrect Carriage with Forklift

6 ASSEMBLY AND INSTALLATION

6.1 INSTALLATION OF THE UNIT

The BOREAS 5th Generation Air Handling Unit must not be used as any structural part of the structure, in the section of the machinery room where it will be installed. If the unit is used in a way that is assumes functions such as the roof, wall, and load bearing system of the area where it is located, the product warranty becomes void.

The BOREAS 5th Generation Air Handling Unit is manufactured in the form of cells, depending on project selections. The air handling unit is formed by mounting these cells at connecting holes. Therefore, it is of the highest importance for the floor on which the unit will be positioned and assembled be flat and level. If the floor can not be corrected, the unit should be levelled using appropriate balancing equipment (chuck etc.) (Figure 3).

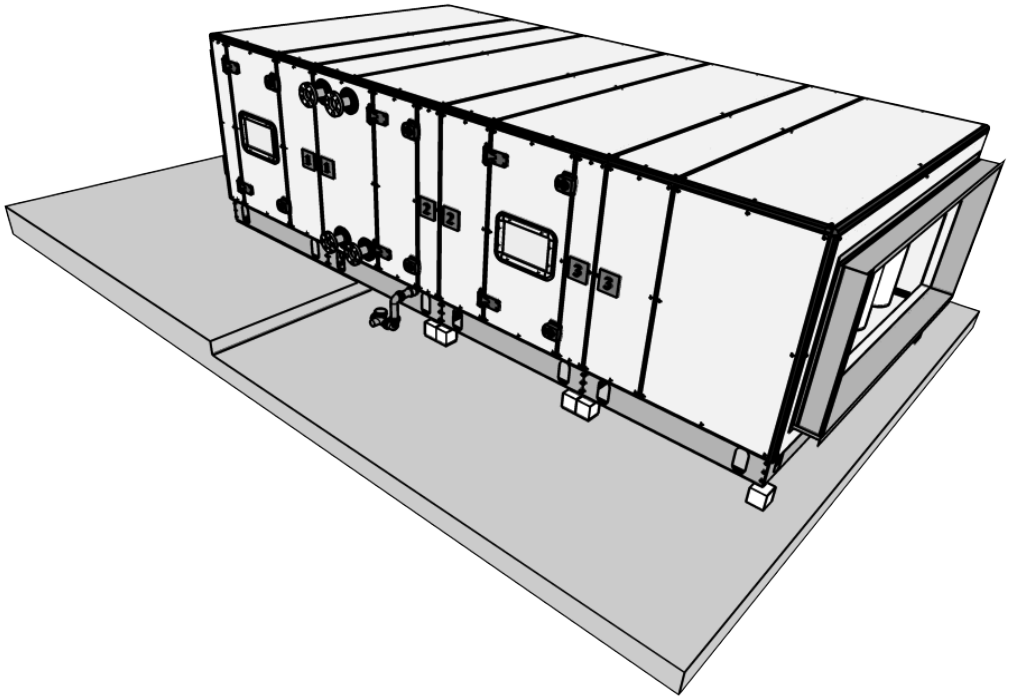


Figure 5 Levelling the Air Handling Unit Using Chucks

Care should be taken to ensure that adequate clearances are left around the unit, to facilitate servicing the Air Handling Unit on site. These clearances are:

- The width of the unit + 30 cm for the service side
- A minimum of 50 cm for the side opposite the service side
- A minimum of 70 cm for the top side of the unit.

Observing these clearances is very important with respect to convenience of service.

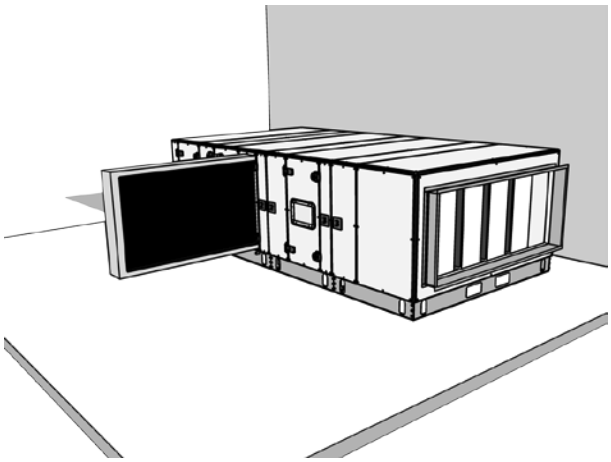


Figure 6 Service Clearance

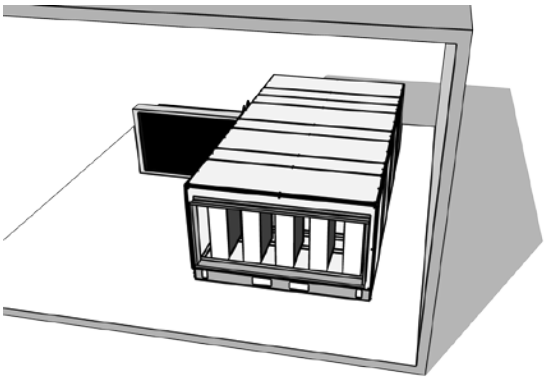


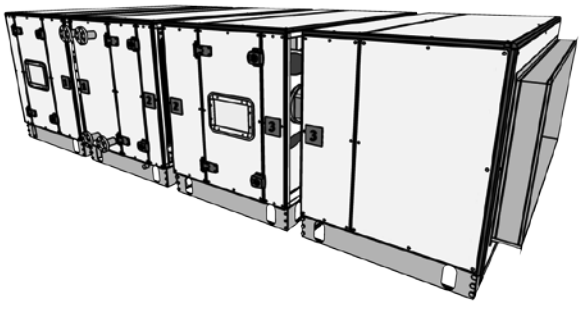
Figure 7 Service Clearance

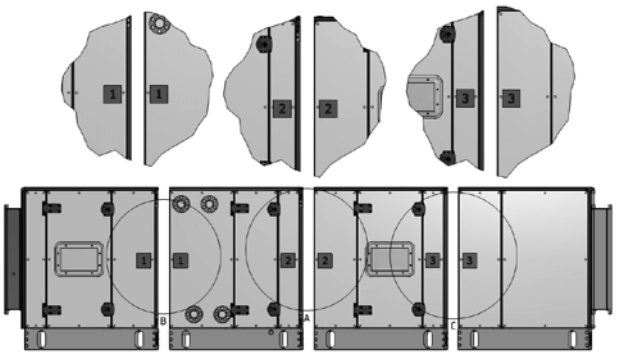
It will be beneficial to use rubber based vibration absorbing materials between the unit base and the floor, before assembling the Air Handling Unit. One piece of material should be placed at each corner of each cell. We recommend that you contact the TEKNOKLİMA Technical Department since the thicknesses of rubber material will vary depending on unit specifications.

6.2 CELL CONNECTIONS IN UNIT

The connecting equipment needed for cell to unit connection are delivered pre-mounted on the cells. As explained in Figure 5, after the unit has been precisely levelled the hole axes of cell connection pieces will align with one another. Connecting holes found on cell connection pieces have been designed as horizontal or vertical almond holes. This increases mounting tolerance. Before the cells are assembled, hermetic seals (3x30 mm EPDM Single Sided Adhesive Seal) should be applied to connecting surfaces of cells, after cleaning the surfaces of oil and dirt. Application of this seal is very important in terms of air leakage.

- Care should be taken to ensure that the floor on which the air handling unit will be installed is level.
- Care should be taken to ensure that the floor on which the air handling unit will be installed is clean, this area will be difficult to clean after the installation.
- There are number tags on each cell for information purposes, which indicate the cells that come before and after it. The cells must be arranged according to these numbers.





- *Figure 8 Cell Connection Labels*

- Make sure that the clearances specified in Figure 6-7 be left to facilitate service work around the air handling unit.

- 3x30 mm EPDM seal must be applied to cells' profile surfaces as shown in Figure 9. Make sure profile surfaces have been cleaned of oil and dust before applying the seal.

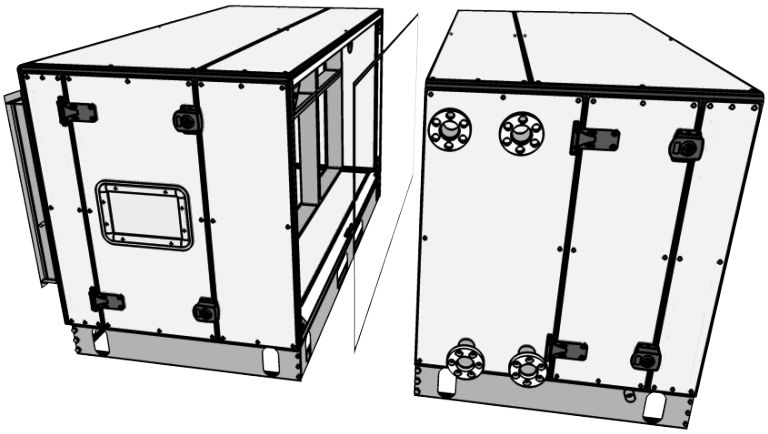


Figure 9 Sealing of Cell Connection

- After the sealing process, the hole axes of cell connection pieces must be aligned and the cells connected using M8 nut and bolt.

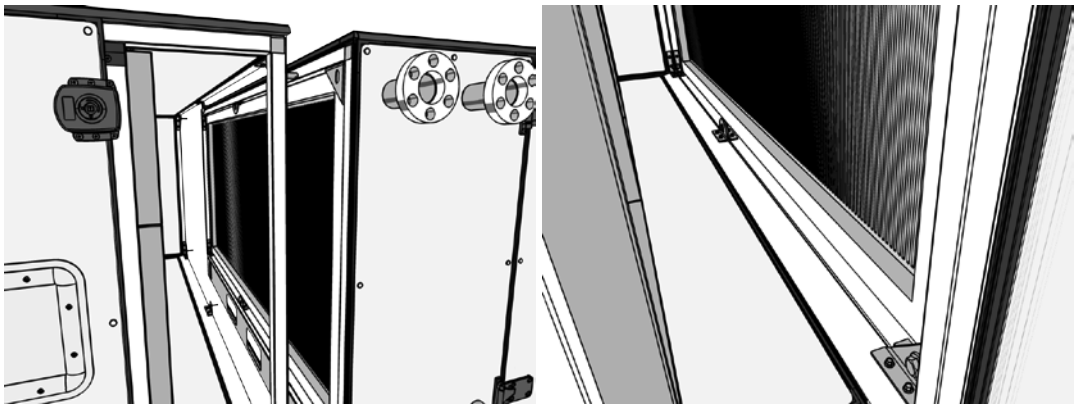


Figure 10 Mounting the Cell Connecting Piece

6.3 AIR DUCT CONNECTION

Pipe bends for connection are found for duct connections on dampers and flanges. It is important for connections to be made over these bends. Before making the connection, 3x30 mm EPDM seal must be applied to these bends in order to prevent air leaks.

- Dampers and flanges **must not** be made to bear the load of ducts **under any conditions**. Instead, the duct weight should be born by fixed supports on the ceiling or floor. (Figure 12)
- Duct connections with sharp turns should not be used on unit joints. A straight line should be used for a certain distance L, which should be followed by a bend, as in Figure 11. This distance L can be taken as 2.5-3 times the duct cross section.
- Sealing must be used between the duct and damper and flange connecting surfaces. (Figure 11)

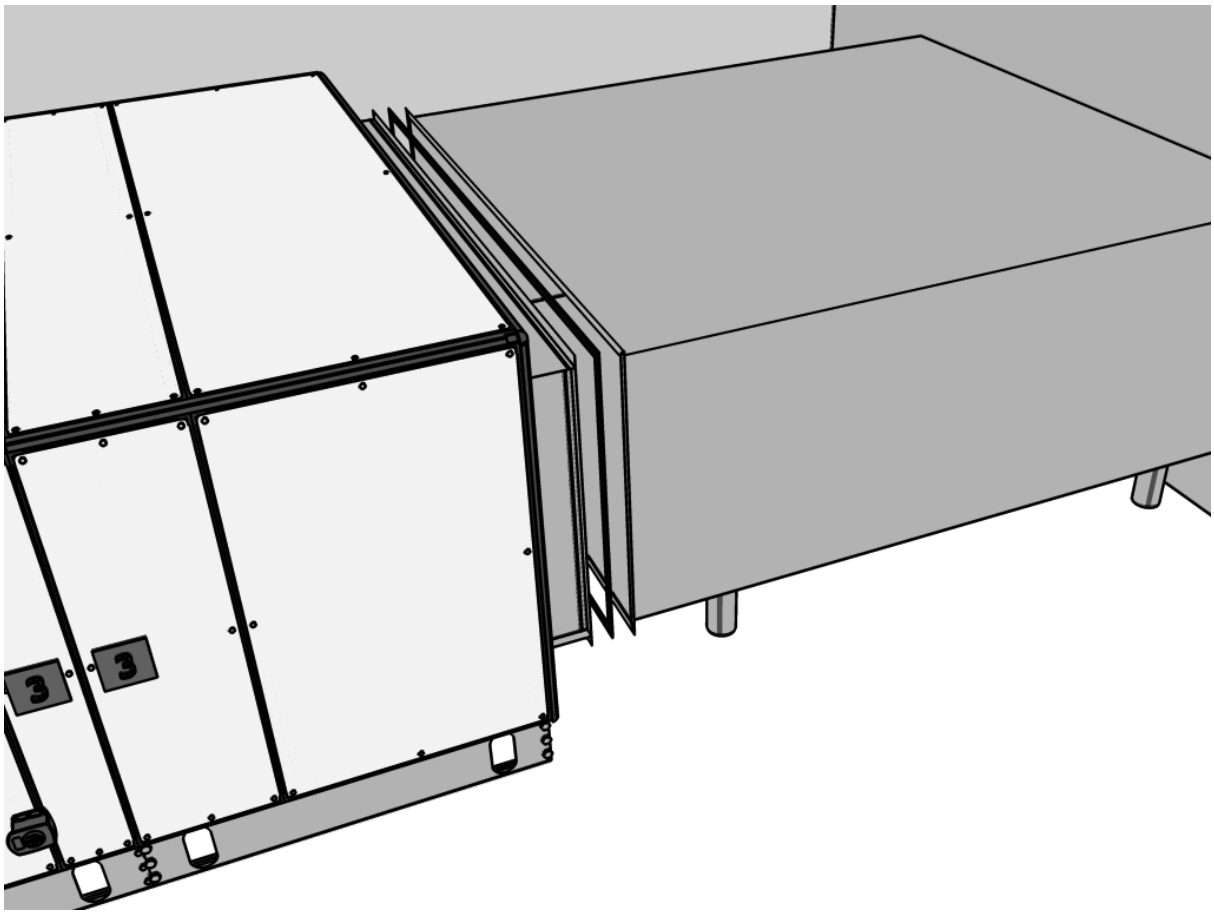


Figure 11 Sealing of Duct Connection

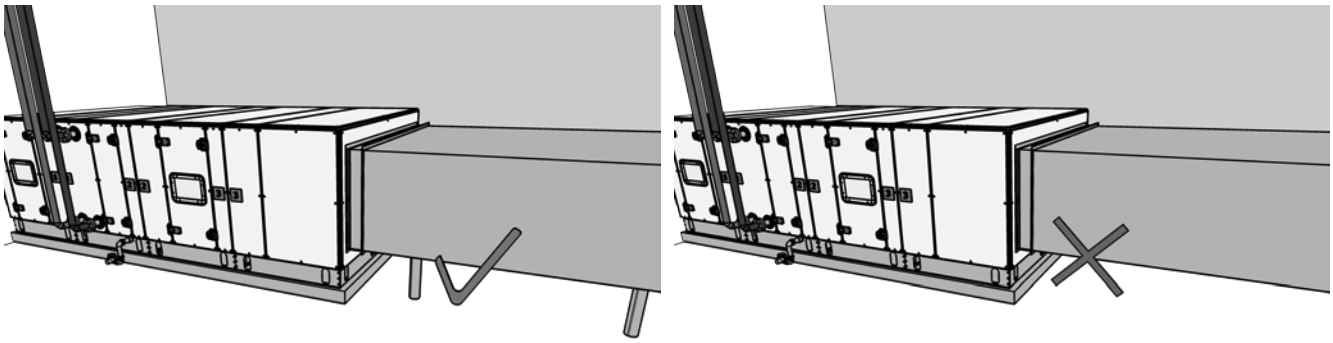


Figure 12 Method of Duct Connection

6.4 HEAT EXCHANGER CONNECTION

6.4.1 Water Heating and Cooling Heat Exchanger

The air handling unit may come with a water heating or water cooling heat exchanger depending on project selections. These need to be connected to the water installation for their water supply. The water inlet and outlet lines of heating or cooling heat exchangers have been labelled on the unit, with the water inlet on the air discharge side (Figure 13), and it is important for the assembly to be made according to these markings. Incorrect connections will lead to loss of capacity in the heat exchanger.

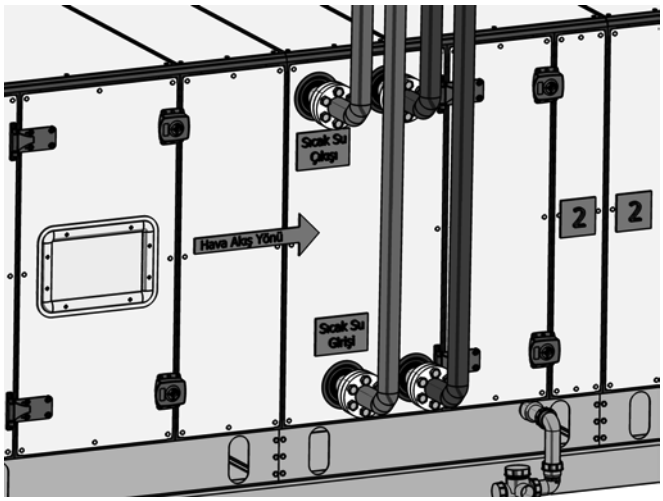


Figure 13 Direction of Connection of Exchanger Pipe

Recommendations:

- If a motor driven valve is to be used for flow control, it is recommended that the installation be carried out by the manufacturer of the motor driven valve, and according to installation warnings.
- The maximum recommended difference between the pipe diameter of the selected motor driven van and the diameter of the heat exchanger collector pipe is one module.

- The use of pipe flanges is recommended to connect heat exchangers to the water supply installation. (Figure 14)

Warnings:

- The weight of the water supply pipes should be born by brackets, in such a way that they do not affect heat exchanger pipes. Otherwise, leaks may occur in joints of heat exchanger pipes.
- While the heat exchanger junctions are being tightened , they must be counter tightened due to the turning risk of the pipe on the inside.

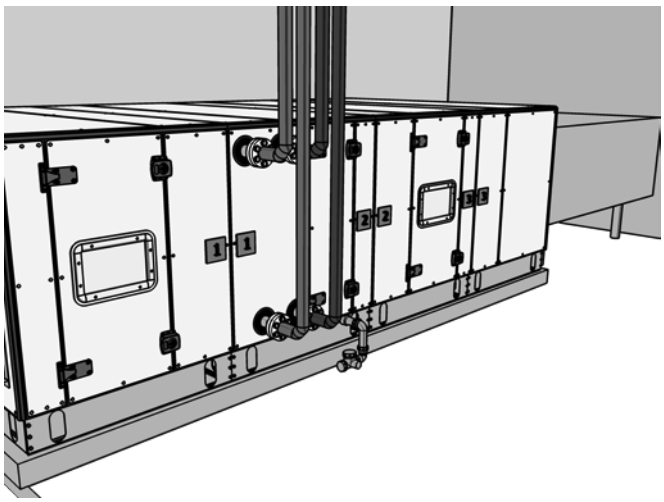


Figure 14 Exchanger Connection

6.4.2 DX Heat Exchanger (Dx-Direct Expansion Heat Exchanger)

The refrigerant input and output lines of direct expansion heat exchangers are labelled on the unit, it is important that the installation be carried out according to these labels. Connections of the DX heat exchanger to the AHU-KIT and the VRF Outdoor Unit must be made by the TEKNOKLİMA Technical Service or authorized personnel.

WARNING: CAUTION! AN EXCLUSIVE DRAINAGE LINE MUST BE MADE FOR THE AIR HANDLING UNIT DRAINAGE CONNECTION. THE CONNECTION TO THE DRAIN MUST BE MADE NOT DIRECTLY, BUT THROUGH A SIPHON. **THE AIR HANDLING UNIT MUST NEVER BE DIRECTLY CONNECTED TO THE SEWAGE LINE!**

6.5 CONNECTION OF CONDENSATE AND DRAINAGE LINE

The drainage line found on the unit must be connected to the sewage mains using the trap supplied with the unit. (Figure 15) This is great importance for the drainage of the high volume of water that will be formed within the unit. The height of the permanent platform that will be built below the unit is very important for achieving the required siphoning height. If this height is not calculated

properly, the unit can not drain water even if the trap system is applied. This calculation is described on the label attached to the relevant cell. You can request information regarding this calculation from the TEKNOKLİMA Technical service if required.

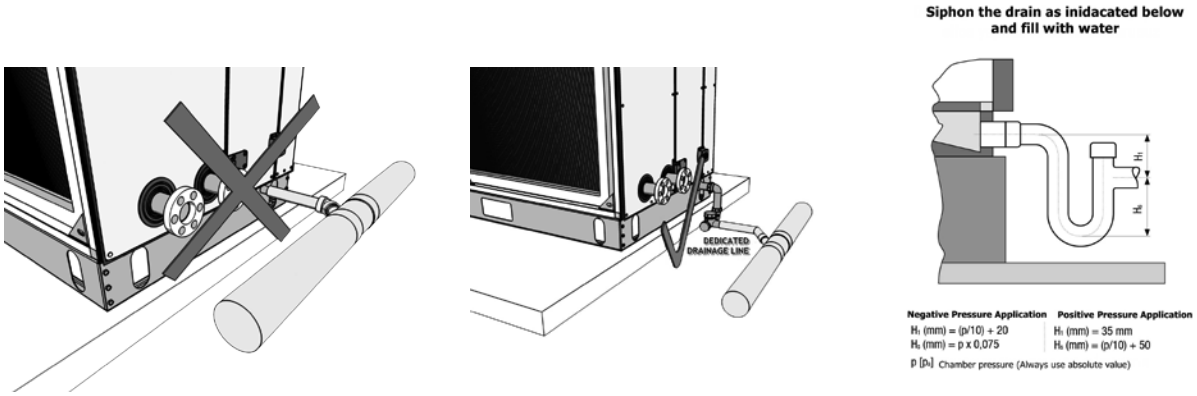


Figure 15 Installation of the Drainage Line

6.6 ELECTRICAL CONNECTION

6.6.1 Air Handling Unit without Panel

Air handling units without automation systems come with motor connections already made. Motor connection cables have been moved within a terminal box on the exterior surface of the fan cell, for power supply. The power supply is made within the terminal box. If the air handling unit includes the following cells which require power connection;

- Electrical heater cell
- High Pressure Humidifier Cell (Pump Power Connection)
- Wick Humidifier Cell (Pump Power Connection)
- Steam Humidifier Cell (Pump Power Connection)
- Rotary Heat Recovery Chamber
- Run Around Heat Recovery Cell (Pump Power Connection)

a terminal box is mounted for power connection, as in the motor cell. Power ratings are indicated on information tags on each cell.

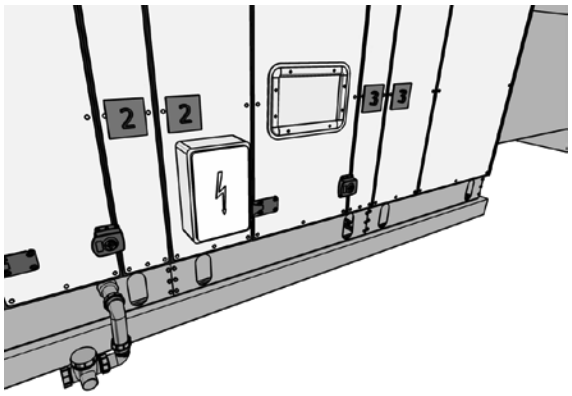


Figure 16 Electrical Connection Terminal

WARNING: ELECTRICAL WORK MUST ONLY BE PERFORMED BY LICENSED AND QUALIFIED PERSONNEL!

6.6.2 Air Handling Unit with Panel

In air handling units with automation systems, all power and signal connections are carried over the MCC and DCC panel. Therefore it is sufficient to connect only the main power supply to the panel. The distribution of power and signal to air handling unit cells is made over the panel. Cable connection terminals are used for cable conduit between air handling unit cells.

WARNING: BE SURE TO READ THE AUTOMATION PANEL PROJECT DOCUMENTS AND EXPLANATIONS BEFORE MAKING ELECTRICAL CONNECTIONS!

6.7 Rotary Heat Recovery Unit

Rotary units with diameters of 2400 mm and more are delivered in a semi-assembled state after being installed on the air handling units, since they would otherwise exceed dimension limits for shipping. The installation must be carried out according to the installation guide sent by the manufacturing firm. If the product installation manual is unavailable for any reason, you need to request it from the TEKNOKLİMA Technical Service.

Rotary units with diameters of less than 2400 mm come pre-installed within the air handling unit. Installation is not required for these units.

6.8 Installation Connection for Wick Humidifier Cell

The following installation connections must be made for the wick humidifier cell (Figure 17):

- The drainage system installation connection is used in cases where the water within the humidifier pool must be completely drained. Connecting the drain to the sewage line is recommended.
- The overflow system installation connection is used to drain excess water in case there is an uncontrolled increase in the amount of water in the humidifier pool. Connecting the drain to the sewage line is recommended.

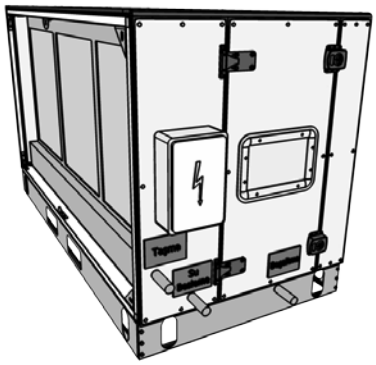


Figure 17 Installation Connections for Wick Humidifier

- The supply system drainage connection is used for adding water to the water in the pool when needed, with the help of a mechanical float valve. Properties of the water used are given in Table 3.

6.9 Installation Connection for High Pressure Humidifier Cell

- The drainage system installation connection is used in cases where the water within the humidifier pool must be completely drained.
- The overflow system installation connection is used to drain excess water in case there is an uncontrolled increase in the amount of water in the humidifier pool.
- The supply system drainage connection is used for adding water to the water in the pool when needed, with the help of a mechanical float valve. Properties of the water used are given in Table 3.

Property	Normal Requirement
Electrical Conductivity (µS/cm)	<1000
Carbonate Hardness (◦dH)	<4
Chloride (g/m³)	<180
Sulphate (g/m³)	<150
pH Value	7 – 8.5
Inlet pressure (bar)	2<

Table 3 Properties of Water to be Used in Humidification System

6.10 Steam Humidifier Cell Connection

6.10.1 Ready Steam Systems

These are the systems at the plant, which utilize ready steam (Figure 18).

- Making a connection between the steam line and diffuser is sufficient, in cases where steam diffusers come pre-installed on the unit.
- Be sure to use steel clamps on the steam hose and diffuser connection, otherwise steam leakages may occur.

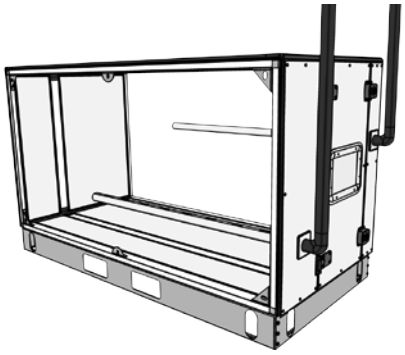


Figure 18 Steam Installation Connection

6.10.2 Packaged Steam Humidifier Systems

Systems where steam is generated and used with packaged steam units. (Figure 19)

- The unit will be delivered with all connections pre-installed on the Air Handling Unit. Make the steam humidifier water supply connection according to the manufacturing firm's instructions. If you can not find the user manual, contact TEKNOKLİMA Technical Service.
- Make electrical connections according to the manufacturing firm's recommendations.

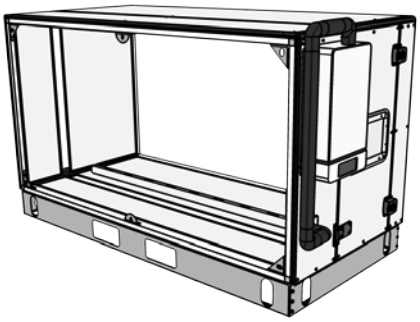


Figure 19 Steam Humidifier Connection

6.11 FINAL CLEANING

After all assembly work has been completed, all unit components should be checked against contamination.

WARNING: THE INTERIOR OF THE UNIT MUST BE CHECKED FOR THE PRESENCE OF METAL SHAVINGS FOLLOWING THE FIELD INSTALLATION. METAL SHAVINGS CAUSE CORROSION!

6.12 Access Door Adjustment

Access doors, after all assembly and cleaning procedures have been completed, must be controlled. Door adjustments may be compromised during transport and assembly.

- The access door hinges can be adjusted by moving them with the adjustment screw up and down at the profile connection, and left and right at the door connection.
- Adjustment can be made to the right and left at the section where the handle is attached to the door, and up and down where the door bolt is attached to the profile.

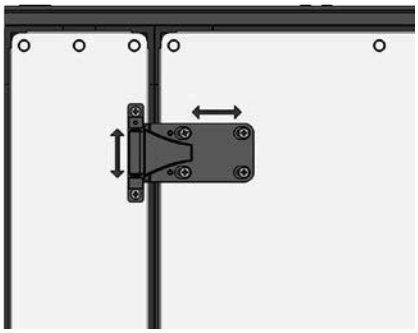


Figure 20 Hinge Adjustment

7 Commissioning and Maintenance

7.1 Fans and Motors

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of fans and motors.

The following fan types and their lower versions can be used in the BOREAS 5th Generation Air Handling Unit.

- Backward Inclined Dense Blade Fans (Power Transmission via Belt and Wheel System)
- Forward Inclined Rare Blade Fans (Power Transmission via Belt and Wheel System)
- Forward Inclined Rare Blade Direct Coupled Fans (Plug Fans + Frequency Converter)
- Forward Inclined Rare Blade Direct Coupled Fans (EC-Plug Fans)

7.1.1 Initial Start-up

It is of critical importance that the following are considered before initial start-up. Failure to adhere to these warnings may result in malfunctions in the unit.

- Remove the vibration attenuating stabilizer.
- Make sure there are no objects that can be moved around by air, such as tools, small parts etc. within the unit and ductwork, and if there are any such objects, do not start the unit before removing them.

- The clearance measurement between the fan propeller and the air intake section may have changed during transport and assembly. Check this clearance measurement (A) before starting the unit. This measurement must be even throughout the circumference of the fan suction funnel. The distance (D) between the fan tunnel to the suction tunnel should not be more than 1% of the fan diameter.

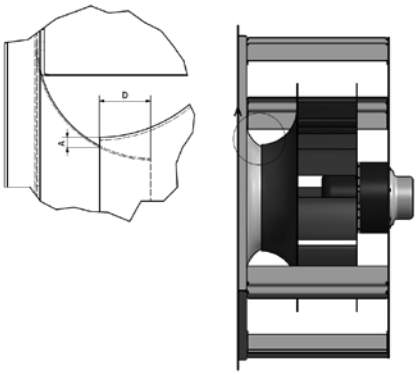
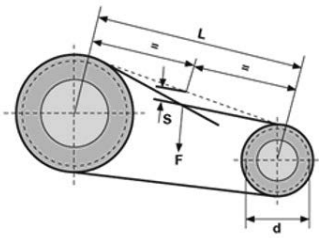


Figure 21 Fan Suction Funnel Measurement



PROFILE	EFFICIENT DIAMETER OF SMALLER WHEEL (mm)	STRETCHING FORCE F (kg)
SPZ	67 - 95 100 - 140	10 - 15 15 - 20
SPA	100 - 132 140 - 200	20 - 27 28 - 35
SPB	160 - 224 236 - 315	35 - 50 50 - 65
SPC	224 - 355 275 - 560	60 - 90 90 - 120

F(kg) Stretching Force L(m) Axial spacing
S(mm) = L(m) / 16 Belt flexion

Table 4 Wheel Tension Setting Table

- If a belt and wheel mechanism is used for power transmission;
    - Check the belt tension. (Table 4)
    - Check the alignment of the wheels. (Tolerance < 5 mm/m)
    - Check the tightness of bushing connections.
- Make sure all service doors of the air handling unit are closed. Make sure no one stands behind the door during initial start-up in positive pressure cells.
- Make sure air intake dampers are in the open position.
- Start the motor for a short time (no more than 5 seconds) and check the direction of rotation from the arrow symbol on the unit. If the unit is rotating in the wrong direction, alter the direction electrical connections of the motor.
- When fans reach design rpm values, measure the three phase current drawn. The result of this measurement must not exceed the rated values of the motor. If it exceeds these values, this means that system is drawing excessive current, and you should stop the motor immediately. Check the external pressure, volumetric flow rate and the rpm. Make sure that dampers are operational. If the problem persists, call the TEKNOKLİMA Technical Service.
- Measuring the rate of vibration would be beneficial after starting the unit. If the measurement yields a figure which exceeds the permissible limits for the rate of vibration, stop the unit and notify the TEKNOKLİMA Technical Service.

Installation	Machine Group	Good	Acceptable	Not Permissible

Constant, < 15 kW	K	0.7 mm/s	1.8 mm/s	4.5 mm/s
Sabit, ≥ 15 kW	M	1.1 mm/s	2.8 mm/s	7.1 mm/s
With Vibration Insulation	T	2.8 mm/s	7.1 mm/s	18 mm/s

Table 5 Vibration Reference Values

7.1.2 Maintenance

Maintenance should be carried out on fans at every four months. Cleaning agents in the pH range of 7-9 should be used.

Periodical Maintenance on Fans:

- Check whether fans conform to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check the balance of fans and the connections of fan blades.
- Check for mechanical friction sounds or oscillation on fan and motor bearings.
- Check the connections of vibration attenuators. Also check whether the fan complex is balanced according to its centre of mass on vibration attenuators.
- Check the clearance between the fan impeller and funnel. (Figure 21)
- Check the leads of pressure sensors in the fan cell.
- Check for tears in the flexible connector.
- Check for deflection in the fan motor base system.

Required Maintenance on Fans:

Periodical Maintenance on Motors:

- Check whether motors conform to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check the current, voltage, and phase symmetry. Make sure access doors are closed and unit's duct connections have been completed before attempting this procedure.
- Check the tightness of motor connecting cables, if loose, tighten.
- Check for contamination in cable ducts, clean with pressurized air or vacuum cleaner if necessary.
- Check grounding connections.

Required Maintenance on Motors:

- Replace motor bearings when their useful life has expired.
- Lubricate motor bearings at intervals determined by the manufacturer.

WARNING: CHECK AND READJUST BELT TENSIONS AND WHEEL ALIGNMENT 1 WEEK AFTER THE INITIAL START-UP OF THE AIR HANDLING UNIT!

Periodic Maintenance of the Belt and Wheel Mechanism:

- Check the belts and wheels physically for wear and tear.
- Check the alignment of wheels.
- Check bushing connections.

Required Maintenance of the Belt and Wheel Mechanism:

- Replace belts
- Align wheels
- Adjust belt tension

7.2 AIR FILTERS

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of air filters.

The following filter types can be used in the BOREAS 5th Generation Air Handling Unit:

- Panel Filter (G3-G4)

- Bag Filter (F5-F6-F7-F8-F9)
- Rigid Bag Filter (F5-F6-F7-F8-F9)
- Metallic Filter
- Carbon Filter (Cartridge, Panel)

7.2.1 Initial Start-up

All filters are mounted in filter frames with class F9 efficiency according to results of EN 1886 filter leakage testing.

It is recommended that filters be checked and monitored for contamination using pressure differential switches.

7.2.2 Maintenance

It is recommended that filters be checked every three months. Contamination alarms should be checked and monitored on a weekly basis. The recommended filter replacement pressure values are given in Table 6.

WARNING: PANEL FILTERS MUST BE INSTALLED ON THE UNIT DURING THE INITIAL START-UP OF THE AIR HANDLING UNIT!
IT IS RECOMMENDED THAT BAG FILTERS BE INSTALLED FOLLOWING INITIAL START-UP.

Filter Class	Recommended Replacement Pressure Value
G1 – G4	150 Pa
F5 – F6 – F7	200 Pa
F8 – F9	300 Pa

Table 6 Filter Replacement Pressure Values According to EN 13503

Contact with the dust on the filter may cause various respiratory conditions. For this reason, protective masks, gloves, and safety goggles must be used during maintenance.

Periodical Maintenance on the Air Filter:

- Check whether filters conform to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check the filter pressure differences on the pressure differential switch.
- Check the filter seal and rail system for leakages.
- It is strongly recommended that filters be replaced once a year, even if they have not reached contamination limits.

7.3 WATER HEATING HEAT EXCHANGER

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of heat exchangers.

7.3.1 Initial Start-up

The heating system may be designed according to a 90-70°C etc. high temperature water regime. For this reason, use cold water during filling, purging, and air extraction procedures. Otherwise, there is risk of scalding. Do not contact hot surfaces.

- Care must be taken to ensure that pressure limits provided for the heat exchanger are not exceeded.
- Freeze free thermostats must be used in water heaters against the risk of freezing. The use of antifreeze added water is used in the system is recommended.
- Care must be taken to ensure that the input and return lines have been connected correctly according to the unit labels.
- Water with a suitable glycol/water ratio should be used in the system. A high percentage of glycol will cause a drop in performance while a low percentage will lead to increased risk of freezing.
- After the system is filled with water, the air must be extracted from the highest section of the line. The purger needed for this can be found on the heat exchanger.
- Check flange bushing connections for leakages after commissioning.

7.3.2 Maintenance

It is recommended that maintenance procedures be carried out every three months. These maintenance procedures are of critical importance for both heating efficiency and the total efficiency of the system.

Care should be taken with the following issues with respect to cleaning:

- The fins should be protected from damage.
- Pressurized air should be applied in the direction counter to the air current in fin cleaning.
- If some areas can not be accessed when the unit is assembled, the heat exchanger should be removed by disconnecting the necessary connections.
- High pressure cleaning machines should not be used.
- Cleaning agents in the pH range of 7-9 should be used.

WARNING: IF THE HEAT EXCHANGER WILL NOT BE USED FOR A LONG TIME, PURGE THE WATER WITHIN THE HEAT EXCHANGER. OTHERWISE, DAMAGES MAY OCCUR DUE TO FREEZING.

Periodic Maintenance of the Water Heater Heat Exchanger:

- Check whether the heat exchanger conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Extract air.
- Check the input and return lines for leakages.
- Check freeze free thermostat connections and verify its correct operation.

7.4 WATER COOLING HEAT EXCHANGER

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of heat exchangers.

7.4.1 Initial Start-up

- Care must be taken to ensure that pressure limits provided for the heat exchanger are not exceeded.
- Care must be taken to ensure that the input and return lines have been connected correctly according to the unit labels.
- After the system is filled with water, the air must be extracted from the highest section of the line. The purger needed for this can be found on the heat exchanger.
- Check flange bushing connections for leakages after commissioning.

7.4.2 Maintenance

It is recommended that maintenance procedures be carried out every three months. These maintenance procedures are of critical importance for both cooling efficiency and the total efficiency of the system.

Care should be taken with the following issues with respect to cleaning:

- The fins should be protected from damage.
- Pressurized air should be applied in the direction counter to the air current in fin cleaning.
- If some areas can not be accessed when the unit is assembled, the heat exchanger should be removed by disconnecting the necessary connections.
- High pressure cleaning machines should not be used.
- Cleaning agents in the pH range of 7-9 should be used.

WARNING: IF THE HEAT EXCHANGER WILL NOT BE USED FOR A LONG TIME, PURGE THE WATER WITHIN THE HEAT EXCHANGER. OTHERWISE, THE WATER MAY FREEZE AND DAMAGE THE EXCHANGER.

Periodic Maintenance of the Water Cooler Heat Exchanger:

- Check whether the heat exchanger conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Extract air.
- Check the input and return lines for leakages.
- Check fin surfaces, if there are any dents, straighten using a fin comb.
- Check the drain pan for contamination, and check the drain time.
- Check whether the draining line works correctly.
- Check the contamination of the drop eliminator, verify that it has been correctly positioned

7.5 DIRECT EXPANSION COOLING HEAT EXCHANGER AND COOLING SYSTEM

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the direct expansion heat exchanger.

Contact with the refrigerant may cause freezing of the skin and extremities. Therefore prevent contact with the refrigerant, and use protective equipment to protect against the effects of the refrigerant.

Since refrigerant is has no odour and taste, leaks are difficult to detect. Leakages may cause difficulty breathing and suffocation due to the decrease of oxygen in the environment. Therefore, gas masks must be worn while entering machine rooms in case of leakage.

7.5.1 Initial Start-up

The DX heat exchanger and the VRF outdoor unit connection must be carried out by TEKNOKLİMA Technical Service or experts authorized by the TEKNOKLİMA Technical Service.

Full commissioning of the cooling system may only be carried out by TEKNOKLİMA Technical Service or experts authorized by the TEKNOKLİMA Technical Service. The unit may be damaged in case of any authorized action.

- The unit must be subjected to testing after the completion of the unit's entire gas system installation.
- All unit connections must be completed before initial start-up. (Copper pipe connections, Expansion valve connections, etc.)
- Make sure gas cut-off valves are open. (Liquid Line, Suction Line, Discharge Line, Compressor Input-Output)

7.5.2 Maintenance

It is recommended that maintenance procedures be carried out every three months. These maintenance procedures are of critical importance for both cooling efficiency and the total efficiency of the system.

The cell in which the heat exchanger is located has a high temperature differential with the environment. For this reason, do not enter the cell until the temperature difference has dropped to approximately 10°C.

Periodic Maintenance of the Direct Expansion Cooler Heat Exchanger:

- Check whether the heat exchanger conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check fin surfaces, if there are any dents, straighten using a fin comb.
- Check for frost deposits on the surface. If frost deposits occur, call the TEKNOKLİMA Technical Service.
- Check the expansion valve.
- If the gas needs to be removed or added, the refrigerant must be prevented from leaking into the atmosphere.

7.6 THE DRAINING SYSTEM

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the draining system.

The uninterrupted and problem-free operation of the draining system is critical in preventing flooding within the unit.

7.6.1 Commissioning

The calculation and application of the correct trap height is of critical importance for proper operation of the draining system. For this reason, the trap height should be implemented as described in Section 6.3.

Care must be taken to ensure that the system is filled with water before commissioning, if it is not, then it must be completely filled with water.

- The unit's connection to the draining system must be checked, and care must be taken to ensure there are no leakages.
- Care must be taken to ensure that the draining system has a sufficient angle of inclination.

7.6.2 Maintenance

The draining system should be checked once a month.

Periodical Maintenance on the Draining System:

- Check whether the draining system conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- The water drainage time should be checked; if it is too slow, the pipe is clogged or there is a problem with the angle of inclination.
- The trap should be removed and cleaned every three months.
- The accumulation of grime within the drain pan should be prevented, and the pan should be cleaned on a monthly basis using cleaning agents with a pH range of 7-9.

7.7 DROP ELIMINATOR

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the drop eliminator.

7.7.1 Initial Start-up

The position of the drop eliminator with respect to the direction of air flow is of critical importance for the correct functioning of the drop eliminator. For this reason, make sure that the drop eliminator has been correctly installed according to the label indicating the direction of air flow.

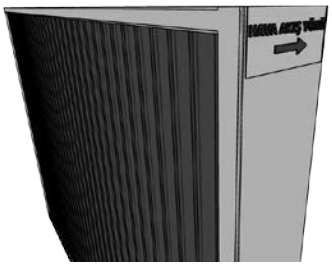


Figure 22 Direction of Installation of Drop Eliminator

- Verify the correct direction of the drop eliminator installation according to the label indicating the direction of air flow.
- Verify that the drop eliminator moves smoothly on the rail mechanism.
- Verify that there is no gap between the drop eliminator discharge and the drain pan.

WARNING: MAKE SURE THAT THE DROP ELIMINATOR HAS BEEN CORRECTLY INSTALLED ACCORDING TO THE LABEL INDICATING THE DIRECTION OF AIR FLOW!

7.7.2 Maintenance

The drop eliminator should be subjected to periodical maintenance at every three months.

Periodical Maintenance on the Drop Eliminator:

- Check whether the drop eliminator conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- The grime which forms on drop eliminator profiles should be cleaned using pressurized water.

7.8 HEAT PIPE HEAT RECOVERY HEAT EXCHANGER

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the heat pipe heat recovery heat exchanger.

7.8.1 Initial Start-up

The heat recovery heat exchanger system comes pre-filled with R134a refrigerant. Since the unit operates on the principle of evaporation and condensation of gas within a closed circuit, it has no moving parts.

- Check coil fins for damages.
- Check bypass sheets around the coil frame; there should be no gaps.

7.8.2 Maintenance

It is recommended that maintenance procedures be carried out every three months. These maintenance procedures are of critical importance for both heating recovery efficiency and the total efficiency of the system.

Periodic Maintenance of the Heat Pipe Heat recovery Heat Exchanger:

- Check whether the heat exchanger conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check fin surfaces, if there are any dents, straighten using a fin comb.

7.9 ROTARY TYPE HEAT RECOVERY UNIT HEAT EXCHANGER

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the rotary type heat recovery heat exchanger.

Measures must be taken to prevent sudden starting of the rotary type heat recovery unit. The unit can cause injuries due to its revolving parts.

7.9.1 Initial Start-up

- Make sure there are no parts which prevent the rotation of the rotor. Turn the rotor once manually in the direction of rotation before initial start-up.
- Check the tightness of the hermetic seals found in the central body of the rotor. Make sure it does not come into contact with the rotor surface in a way that will damage it.
- Check the rotor bearing, heed warnings set forth in the manufacturer firm’s user manual.
- Verify that the rotary V belt has sufficient tension. Unlock the belt tightening joint for adjustment, relock after adjusting to the required tension.
- Lengthening may occur in the V belt due to operating and environmental conditions. For this reason, check belt tension after 350 hours of operation.

- Make electrical supply connections of the rotary drive motor by heeding the warnings in the manufacturing firm's user manual. All provisions stated under the heading of 2. GENERAL SAFETY must be applied during this procedure.
- Check the direction of rotation of the rotor against the label indicating the direction of rotation. If the unit is rotating in the wrong direction, stop the unit and alter the directions of electrical connections of the motor.

7.9.2 Maintenance

It is recommended that maintenance procedures be carried out every three months. These maintenance procedures are of critical importance for both heating recovery efficiency and the total efficiency of the system.

Periodical Maintenance of the Rotary Type Heat recovery Heat Exchanger:

- Check whether the heat exchanger conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check the tightness of the hermetic seals found in the central body of the rotor, and check that it does not contact the rotor surface.
- Check fin surfaces, if there are any dents, straighten using a straightening comb.
- Check belt tension (every 350 hours), readjust in case of loosening. If there is visible wear on the belt, replace the belt.
- Check the rotary surface for shifting. Check the balance of the rotor.
- If there is a friction sound on the rotary bearing, replace it.
- Be sure to replace hermetic seals if there is wear on the seals.

7.10 PLATE TYPE HEAT RECOVERY UNIT HEAT EXCHANGER

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the plate type heat recovery heat exchanger.

7.10.1 Initial Start-up

- Make sure there are no dents or tears on the surface of the Aluminum plate. If there is tearing, do not start the unit, and notify the TEKNOKLİMA Technical Service Department.
- Make sure that the unit will be operated within a pressure range which does not exceed the maximum pressure limits (900 Pa – may vary depending on the model) declared by the manufacturer of the plate type heat recovery unit.
- If there is a bypass damper, make sure that the dampers are in their operational positions by checking against the labels on dampers which indicate position. The plate type heat recovery damper must be in the open position and the bypass damper must be in the closed position during normal operation.

7.10.2 Maintenance

It is recommended that maintenance procedures be carried out every three months. These maintenance procedures are of critical importance for both heating recovery efficiency and the total efficiency of the system.

Periodical Maintenance of the Plate Type Heat recovery Heat Exchanger:

- Check whether the heat exchanger conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check the correct operation of the draining system, if there is one.
- Check for dents or tears on Aluminum surfaces.
- Make sure to service plate type heat recovery cell filters.
- Check the surfaces for freezing at low ambient temperatures. If freezing occurs, take measures to prevent it. (E.g. pre-heating, bypass damper application.)

7.11 RUN AROUND TYPE HEAT RECOVERY HEAT EXCHANGER

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the run around type heat recovery heat exchanger.

7.11.1 Initial Start-up

- Check for dents on heat exchanger surfaces. If there are any, straighten with a straightening comb.
- Mae sure that power connections of the circulation pipe have been made as specified in the manufacturer firm's user manual.
- Make sure that sufficient amounts of water (completely full) and glycol are added to the system.
- Make sure gas cut-off valves on the installation are in the open position.
- Power the pump and check the direction of rotation against the label indicating the direction of rotation.
- After initial start-up, extract air from the system using the purger installed on the heat exchanger.

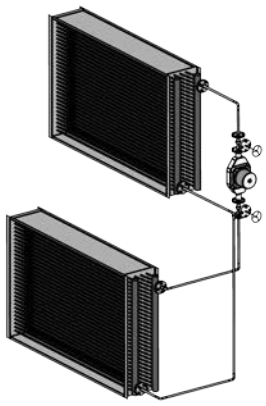


Figure 23 Installation of the Run Around Type Heat Recovery Unit

- Make sure there are no water leakages in pipe connections after initial start-up. Eliminate any leaks and top up with water.

7.11.2 Maintenance

It is recommended that maintenance procedures be carried out every three months. These maintenance procedures are of critical importance for both heating recovery efficiency and the total efficiency of the system.

Periodical Maintenance of the Run Around Type Heat recovery Heat Exchanger:

- Check whether the heat exchanger conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check the correct operation of the draining system.
- Check to ensure there is no air in the system. If there is air, eliminate it by extracting with the purger.
- Make sure the pump does not generate mechanical friction sounds during the pump's operation.
- Check the installation for water leaks. Eliminate any leaks and top up with water.

7.12 WICK HUMIDIFIER SYSTEM

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the wick humidifier system.

7.12.1 Initial Start-up

- Make sure that power connections of the circulation pipe have been made as specified in the manufacturer firm's user manual.
- Make sure that the water supply valve is in the open, the water overflow valve is in the open, the water draining valve is in the closed, and the pump cut-off valves are in the open positions.
- Make sure that the float valve system is operational.
- Make sure that the installation line to which the water overflow is connected is operational.
- Power the pump and check the direction of rotation against the label indicating the direction of rotation. If the direction is incorrect, reverse electrical connection terminals.
- Make sure there are no water leakages in the installation after initial start-up.
- Make sure that wick surfaces are evenly moistened. Otherwise, notify the TEKNOKLİMA Technical Service Department.

7.12.2 Maintenance

It is recommended that maintenance procedures be carried out every month. These maintenance procedures are important since they affect the unit's capacity for humidification.

Periodical Maintenance on the Wick Humidifier System:

- Make sure that wick surfaces are evenly moistened.
- Check for any odours within the cell. If odour is present, the wicks should be replaced. Notify the TEKNOKLİMA Technical Service Department.
- Check the installation for leaks.
- Make sure that drainage lines are functional.

7.13 HIGH PRESSURE HUMIDIFIER SYSTEM

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the high pressure humidifier system.

Properties of the circulation water that should be used in the system have been provided in Table 3.

7.13.1 Initial Start-up

- Make sure that the pan within the cell is clean.
- Care must be taken to ensure that there are no metal shavings within the cell. Any metal shavings will lead to rapid corrosion.
- Make sure that the valves on the supply line are open.
- Make sure that the pump's electrical connections are made in accordance with the information provided by the pump manufactuer.
- Make sure cut-off valves on the water installation are in the open position.
- Bring the pump online.

7.13.2 Maintenance

It is recommended that maintenance procedures be carried out every month. These maintenance procedures are important since they affect the unit's capacity for humidification.

Periodical Maintenance on the High Pressure Humidifier System:

- Check whether the high pressure humidifier cell conform to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Clean inside the drain pan.
- If slippery surfaces can be detected by hand on the cell surface, the cell interior must be cleaned and disinfected.
- The pipe lines must be checked for leaks, and any leaks must be promptly eliminated.
- The circulation pump must be checked against mechanical friction.

7.14 STEAM HUMIDIFIER SYSTEM

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the steam humidifier system.

7.14.1 Initial Start-up

- Make sure that connections of steam hoses to the diffuser are correct and tight.
- If ready steam is used in the system, bring the steam valves in the open position and ensure steam flow.
- If the system uses a packaged steam generating device, make sure its electrical connections have been made. Bring the unit online in accordance with the manufacturer firm's user manual.

7.14.2 Maintenance

It is recommended that maintenance procedures be carried out every month. These maintenance procedures are important since they affect the unit's capacity for humidification.

Periodical Maintenance on the Steam Humidifier System:

- Check steam hoses against leaks.
- Clean steam nozzles on diffusers.
- Check the water supply line against leaks.

WARNING: DO NOT OPEN THE CELL DOOR, DO NOT INTERFERE WITH THE UNIT, DO NOT DISCONNECT STEAM HOSES WHEN THE STEAM HUMIDIFIER SYSTEM IS ONLINE!

7.15 THE ELECTRICAL HEATER SYSTEM

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the electrical heating system.

WARNING: ELECTRICAL WORK MUST ONLY BE PERFORMED BY LICENSED AND QUALIFIED PERSONNEL!

The following safety measures must be taken in electrical heater cells.

- Air flow control
- High temperature control
- Control of the open-closed status of access door

7.15.1 Initial Start-up

- Make sure that the cable and cable diameters applied are suitable for the power ratings and distances specified by the manufacturing firm.
- Check electrical connections over the terminal box found on the cell.
- Make sure the access door is closed.
- Make sure the air flow control and high temperature controls are online. The electrical heater must not be brought online if there is no air flow. If a high temperature hazard occurs while it is online, it should be brought offline and air flow over it must be continued.
- Power the electrical heater.

7.15.2 Maintenance

It is recommended that maintenance procedures be carried out every month.

Periodical Maintenance on the Electrical Heater System:

- Check whether the electrical heater cell conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Make sure the air flow control, high temperature controls, and door position sensors are functional.
- Check for any burns within the cell.

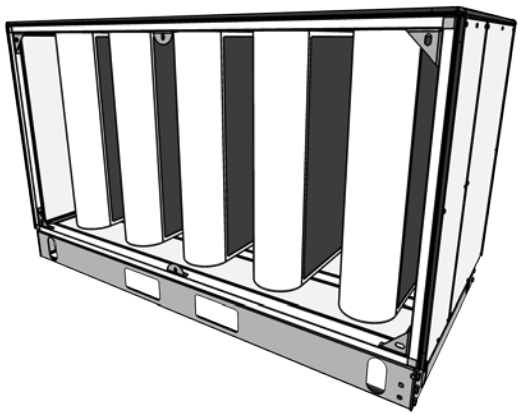
7.16 SILENCER SYSTEM

All provisions stated under the heading of 2. GENERAL SAFETY must be applied during the commissioning and maintenance of the silencer system.

7.16.1 Initial Start-up

- Check for any tears on silencer surfaces.

- Check the silencer air directing surfaces for



dents.

Figure 22 Silencer Cell

7.16.2 Maintenance

It is recommended that maintenance procedures be carried out every three months.

Periodical Maintenance on the Silencer System:

- Check whether the silencer cell conforms to hygiene standards, and check for accumulated dust, corrosion, and damages.
- Check silencer surfaces for tears, be sure to replace if there are any torn sections.
- Clean silencer surfaces.

8 TROUBLESHOOTING

Please find in the table below the basic problems that you may encounter with the unit and their solutions. In case of any malfunctions other than those listed below, you should definitely inform TEKNOKLİMA Technical Service. Please disconnect the power line until the service teams arrives.

	INDICATION	PROBLEM
NORMAL FUNCTION	Insufficient Cooling in the Environment	• During the initial start up, the system performs checks for position of the dampers, air flow, outdoor and ambient air temperature, then starts the cooling circuit. These checks take time between 5-15 minutes. If these take longer than that, please inform TEKNOKLİMA Technical Service.
	Insufficient Air Supply in the Environment	• Please make sure the air dampers installed on the unit or in the ductwork are open. • Check the ductwork pressures. If there is a discrepancy from the project's design data in the elevation direction, the fan or the motor could be insufficient.
	There is Odor in the Environment	• Check whether there is enough level of water in the drainage line. • Make sure the drainage line is not connected directly to the sewage line. • Make sure the filters has been replaced on time. • Make sure there is not any dead animals inside the unit or in the ductwork.
	Water Droplets in the Environment	• Please check whether the air flow meets the design specifications. • Make sure the drop eliminator has been installed in the correct direction as per the assembly direction label after the cooling exchanger.
CHECK AGAIN	Air Handling Unit Does Not Operate	• Make sure there is power in the supply line. • Make sure the main switch on the panel of the unit is on.
	Insufficient Heating and Cooling Performance	• Check the level of dirtiness of the filters and the inner equipment. • Check whether the flow rate of cold and hot water suppliers are suited for the design specifications of the project. • Check if there is any air leakages that can be detected by hand.

9 COMMISSIONING REQUEST FORM

The fields that have been provided in the following form must be completed in full in order for the unit to be commissioned. Otherwise it will not be possible to commission and adjust the unit.

BOREAS 5TH GENERATION AIR HANDLING UNIT COMMISSIONING REQUEST FORM

Dear Sir or Madam,

Please send us the following form after properly fill out the fields below.

Date of Filling:

Make and Model of the Unit:

Number of Units:

Name and Address of the Facility in which the Unit is Installed:

IMPLEMENTATION	YES	NO	OTHER
1- Is the Unit installed on a base?			
2- Are there enough space around the unit for servicing as indicated in the Installation, Commissioning and Maintenance Manual?			
3- Have ductwork connections been performed as indicated in the Installation, Commissioning and Maintenance Manual?			
4- Have the electrical connections been installed as indicated in the Installation, Commissioning and Maintenance Manual?			
5- Have the draining system of the unit been installed as indicated in the Installation, Commissioning and Maintenance Manual?			
6- Are there any dents on the surface of the unit? Please photograph their locations, if any.			
7- Has the waterworks that is required for heating and cooling been installed?			

Date of Commissioning Request:	……../……../20…..
Name of the Company Requesting Commissioning:	Stamp / Signature
Full Name of the Authorized Person Making the Request:	
Phone Number of the Authorized Person Making the Request:	