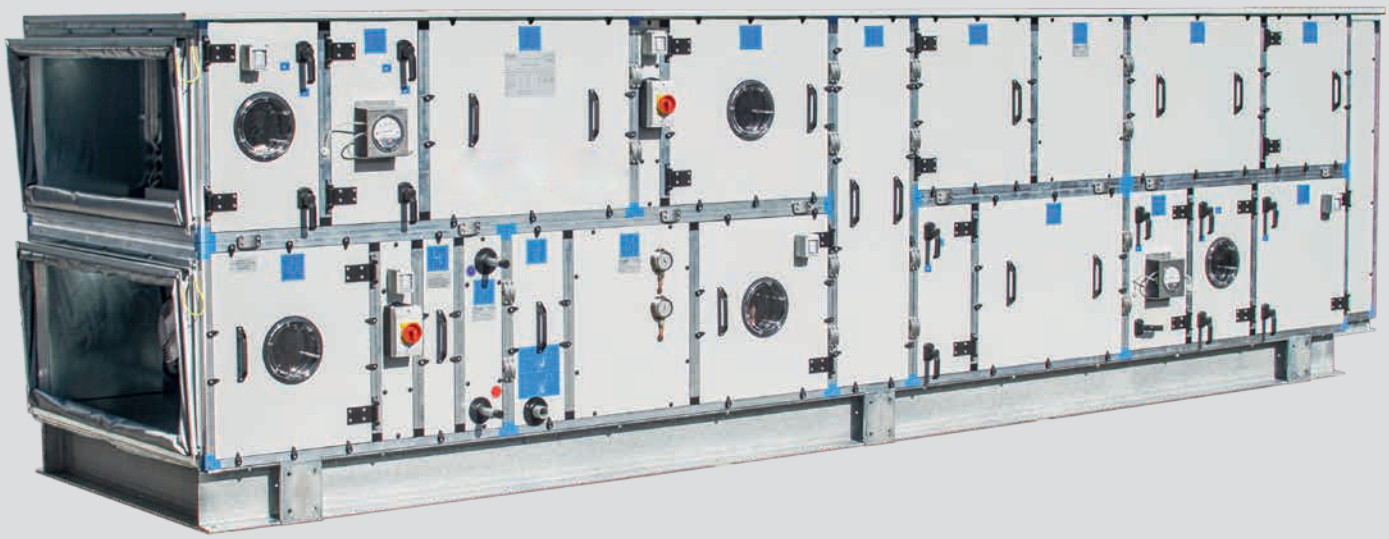
inductair
air & water systems



TECHNICAL MANUAL

We care about healthy air

Modular air handling units

Service and maintenance manual

Service and maintenance manual

1 General

- Prior to performing any work on the unit, please study the maintenance and service manual carefully.
- Please note, that some components from other manufacturers, such as fans, filters, recuperators, etc. require additional installation and commissioning, and are accompanied by independent maintenance instructions, which are to be stored and made available to the persons responsible for service and maintenance.

2 Warnings & Tips

- The air handling unit may only be commissioned and maintained by trained personnel, who must observe engineering standards and local safety regulations.
- The air handling unit shall only be used for the purpose and under the operating conditions specified in the technical sheets, generated by the selection software AirCalc++.
- The unit manufacturer shall not be held liable in case of failure to observe the information provided in the instructions or in cases of alterations of electrical or mechanical components without prior approval by the manufacturer.
- During operation ensure that the safety chain on the fan section door is secured – see Figure 1.
- The overpressure doors and de-mounting service covers are attached to the housing by blocators. To remove / attach the blocators use imbus key size 4 – see Figure 2.
- Please observe the hazard warning signs – see Figure 3.

Figure 1

Figure 2

High voltage

Machinery pinch points

Figure 3

3 Functional sections

3.1 Fan section

- Prior to any intervention into the fan section, switch off the repair switch of the relevant fan section, and lock it in the off position to disconnect the power supply to the drive electric motor.
- Once a month, check the belt's tension and the parallelism of the electric motor and fan shaft, and the running plane of the drive belt(s).
- Tension the belt(s) by means of the tensioning device in accordance with the belt manufacturer's instructions.
- Replace damaged bearings. If maintained according the manufacturer's instructions, all bearings are guaranteed a minimum service life of 30,000 hours.
- Prior to maintenance of the electric motor, observe the motor manufacturer's instructions.
- In case of fan replacement, or cleaning and disinfection, remove the fan from the housing by loosening the bolts on the rails, using a wrench – see Figure 4 - and loosen the bolts for fixing of the flexible connection – see Figure 5.

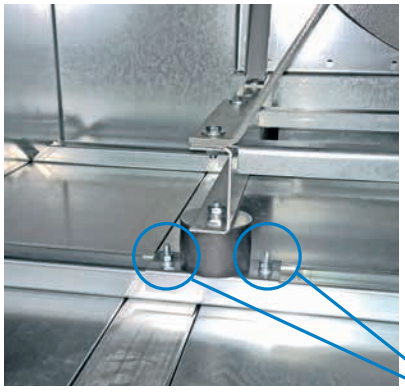


Figure 4

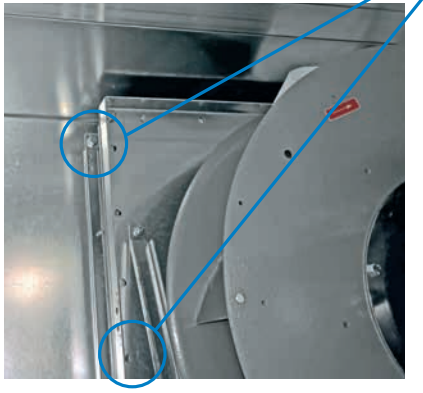


Figure 5

3.2 Heater section with water heater

- To ensure proper function of the heat exchangers, regularly carry out the following operations:
- Check the tightness of all water connections and air tightness of ducts.
- Check the operation of the bleeding valve. In an event of disturbed medium flow through the exchanger, or presence of air in the circuit, bleed the piping system.
- Check for proper operation of the heater automatic anti-freezing protection.
- Periodically check for proper operation of the heating medium supply automatic shut-off upon unit shut-down.
- To prevent overheating of the electric motor, check that the fan operates (3 to 5 minutes) following shut-down of the unit.
- Regularly check for dust build-up on the heater fins. Dust or scale build-up on the fins reduces the capacity of the heat exchanger. Periodically – approximately every 500 hours of operation – clean the fins by means of an industrial vacuum cleaner. If this is not sufficient, blow compressed air (maximum recommended pressure: 6 bar) in the direction opposite to the air flow direction.
- If this cleaning method is not sufficient, dismount the heater and wash it with low pressure water or steam. To avoid deformation of the aluminium fins do not use high pressure water or steam. When washing with water, the water pressure must not exceed 6 bar, and the water jet must be strictly perpendicular to the fin surfaces. A water jet applied at an angle will damage the fins, In particular the more sensitive fins along the edges. Never use any hard object for cleaning.

3.3 Heater section with steam heater

- See common checklist in this document.

3.4 Heater section with electric heater

- See common checklist in this document. Ensure that the heater has cooled down before inspection and cleaning.

3.5 Heater section with indirect gas heater

- Maintain the indirect gas heater in accordance with the manufacturer's instructions.
- Prior to any intervention in the interior of the indirect gas heater section, in the gas burner, the burner train or the stack, shut the entire air handling unit down by switching off the main switch, located on the electric control cabinet. Lock the switch in the off position and let the unit cool down.
- Prior to startup, clean the device interior and firmly tighten all electric connections, check the presence and proper positioning of the thermostat sensors, check the tightness of the gas installation, seal all air joints and attach guards (covers, duct flanges, protection grilles etc.).

3.6 Humidifying section with steam humidifier

- Steam applied for humidifying must not contain substances harmful to human health.

3.7 Humidifying section with contact humidifier

- Maintain the contact humidifier in accordance with the manufacturer's instructions.
- Maintain the contact humidifier section so as to prevent the growth and reproduction of microorganisms on any air handling unit section surfaces, and in the ventilation system as a whole.
- The humidifier section water pool must meet the minimum quality criteria for potable water. To avoid the build-up of scale in the droplet eliminator, the total water hardness must not exceed 7° dH.
- The bacterial load of the recirculation water must not exceed the standard level (1000 CFU/ml at incubation temperatures 20°C - 1°C and 36 °C - 1°C).
- Avoid the presence of Legionella type bacteria in the spray humidifier section water pool. The total count of these bacteria must not exceed 1 CFU/ml.
- Apply a physical or chemical method of disinfection. The selected method must be effective and not harmful to human health.
- Relative air humidity in the system should not exceed 90%.
- Prior to starting the humidifying function - fan, let the humidifier water supply pump run for 15 minutes. According to the humidifier manufacturer's recommendations, this ensures full wetting of the humidifier cartridges.
- The minimum humidifier operation time from start to shutdown should be 10 to 15 minutes. Allow a period of the same duration from shutdown to the next start. Once the humidifier has been shutdown (water supply to the humidifier is shut off), the air handling unit should not be shut down before the humidifier cartridges dry out. If the contact humidifier is to remain out of operation for 24 hours or more, drain the water from the humidifier pan. Installation of automatic water draining and section drying equipment is recommended.
- Carry out a microbiological analysis of the supply water. If the presence of bacteria is established, disinfect the supply water.
- Set the humidifier blowdown operation properly. For this purpose, obtain the required data from an analysis of the water supply: CaCO3 quantity (mg/l), Ca+ quantity (mg/l), HCO3- quantity (mg/l), pH value. Determine the blowdown factor from the water quality diagram provided in the contact humidifier manufacturer›s instructions.

3.8 Humidifying section with high-pressure humidifier

- Observe the maintenance instructions provided by the manufacturer of the high-pressure humidifier. See also the water quality requirements in chapter 3.9.2 of the Connection, start-up and commissioning manual.

3.9 Cooling section with water cooler

- See common checklist in this document and instructions in chapter 3.2. Heater section with water heater.

3.10 Water droplet eliminator

- See common checklist in this document.

3.11 Cooling section with direct evaporator

- See common checklist in this document.

3.12 Cooling plant

- Observe separate instructions for safe operation, starting and maintenance of cooling equipment.

3.13 Control damper

- See common checklist in this document.

3.14 Filter section (bag or panel filter)

- Prior to installing new filters, always check for complete, uniform and air-tight mounting of the sealing tape on the sealing seat between the filter and its frame.
- Only use filters declared conformant with the SIST EN 779 standard by their manufacturers.
- Handle contaminated filters in compliance with applicable environment protection regulations.
- The required frequency of filter cleaning or replacement depends on the air flow rate and contamination.

3.15 Metal filter section

- A contaminated metal filter cartridge may be washed in hot water with added cleaning agent, observing the manufacturer's instructions for water temperature and type of cleaning agent.
- The required frequency of filter cleaning or replacement depends on the contamination of the air flow.

3.16 Active carbon filter section

- The required frequency of filter cleaning or replacement depends on the contamination of the air flow.

3.17 Absolute filter section

- See common checklist for filters in this document.
- A safety officer or other qualified individual should always be consulted for recommendations before any work is performed on HEPA filters.
- The filters may have collected microorganisms throughout their lifetime: service and maintenance personnel should not be exposed to them. Be sure to wear personal protection.
- The required frequency of filter cleaning or replacement depends on the contamination of the air flow.
- Carefully inspect filters before and after installation for signs of damage.
- Before replacement of a filter, the AHU filter section must be cleaned with an appropriate sterilizing agent.
- Observe local precautions for handling hazardous waste.
- Before sliding the new filter into place assure the filter sealing flange and guiding profiles are cleaned carefully.
- The fixing elements should be cleaned with an appropriate sterilizing agent before they are attached to the new filters.
- Recommended force to be applied for the correct tightening on absolute filter cell is 20N (+/- 10%) for every cm linear of seal. To assure this use a torque wrench.

3.18 Fin recuperator section

Fin recuperator - Heater

- See chapter 3.2 Heater section with water heater.

Fin recuperator - Cooler

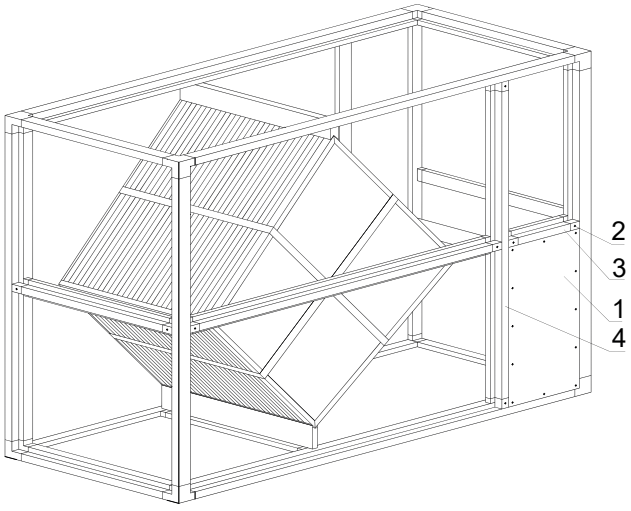
- See chapter 3.2 Heater section with water heater and 3.9 Cooling section with water cooler.
- Regularly check the operation of the circulation pump unit and proper bleeding of the heat exchanger interconnection piping.
- At the beginning of the winter period, check the resistance to freezing of the transfer medium and replace it if necessary. Regularly replace the medium every two years.

3.19 Frost protection

- The type, connection, operation and maintenance specifications for the frost sensor are provided in the control system instructions, irrespective of the supplier of the air handling unit controls (Lindab, the customer or a third person).

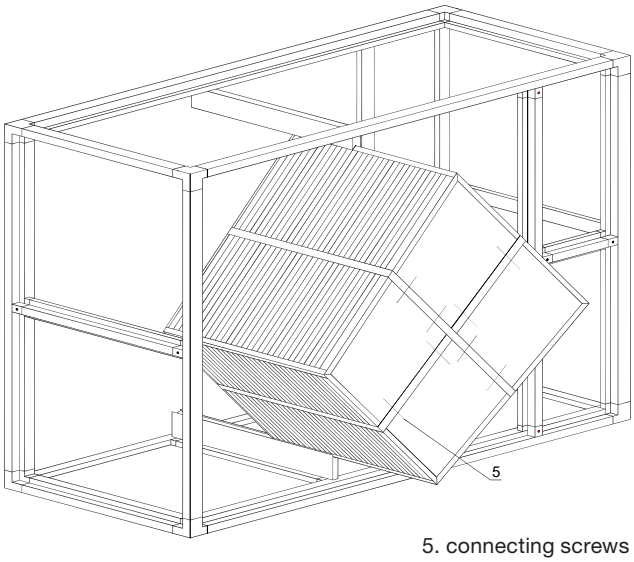
3.20 Plate recuperator section

- Regularly clean the plate recuperator, preferrably by means of an industrial vacuum cleaner.
- In the case of dry dust fouling, the insert can be cleaned without dismounting, by blowing it with compressed air (maximum pressure: 6 bar) through the servicing openings; always wear personal protection equipment during such an operation. If fouled with greasy or sticky debris, the insert must be withdrawn from the recuperator section housing and cleaned by means of a hot water jet (maximum temperature: 90 °C) with the addition of an appropriate cleaning detergent.
- During cleaning and dismounting be careful not to damage the insert face surface, as the insert filler is made of very thin aluminium foil.
- The sequence of dismounting an insert from the section housing is as follows – Figure 6a, 6b:



1. servicing cover
2. fixing screw
3. horizontal partition section
4. vertical partition section
5. connecting screws

Figure 6a



5. connecting screws

Figure 6b

- Remove the servicing covers (Pos. 1),
- Remove the partition sections on the servicing side, by:
  - removing the plastic caps (Figure 7)
  - unscrewing the fixing screws (Figure 8)

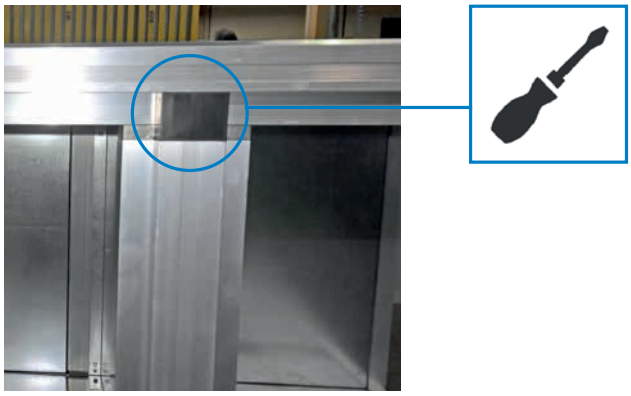


Figure 7

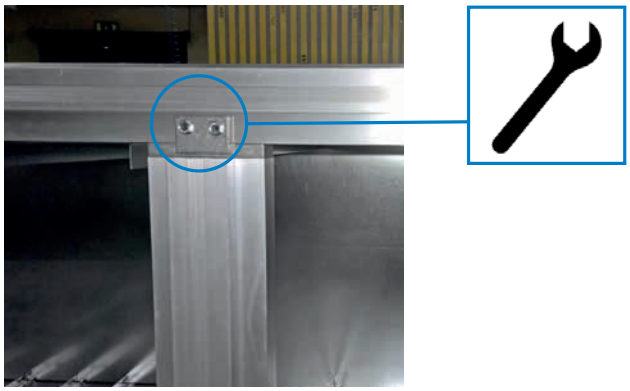


Figure 8

- Unscrew all guide fixing screws and remove all guides (Figure 9).
- Draw the insert out of the section housing. Use a fork-lift for heavier sections.
- If necessary, unscrew the connecting screws (see Position 5 on Figure 6) and dismount the exchanger.

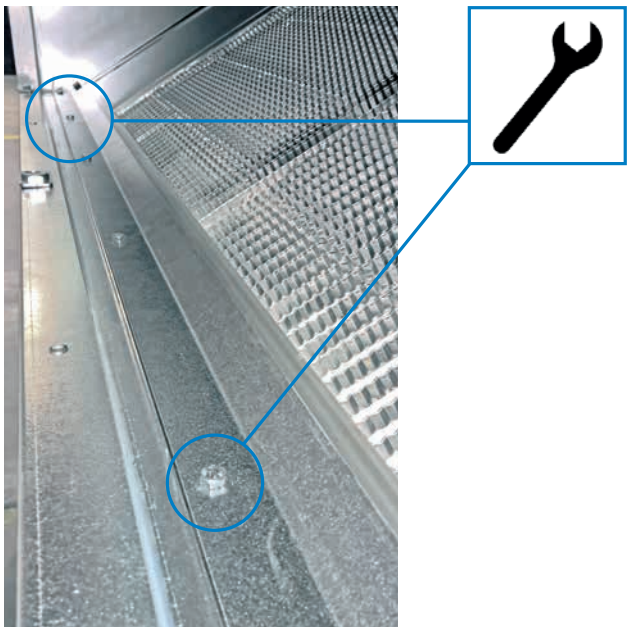


Figure 9

- After cleaning, install the inserts back into the section in the opposite order.

3.21 Double plate recuperator section

- For maintenance see chapter 3.20 Plate recuperator section.

3.22 Rotational regenerator section

- The regenerator matrix structure may be cleaned by means of air, water, steam or special cleaning agents.
- The following procedure is recommended for cleaning of the matrix:
- For a small amount of easily removable dirt, use a vacuum cleaner.
- For heavier dirt use compressed air (maximum pressure: 6 bar), with caution.
- Firmly attached dirt in the rotor is most easily removed by use of hot water (maximum temperature: 90°C) and a mild detergent. The detergent may be removed with high-pressure water (maximum pressure: 6 bar), with the nozzle held 50-100 mm from the matrix.
- The rotary heat exchanger is either driven by a power belt or by a round belt.
- The powerbelt (Figure 10) is made of links that can easily be added or removed without any tools. By simply twisting the belt, it is possible to open it and remove links to shorten the belt until the correct length and belt tension is obtained. Belt tension should be 1-2% (i.e. belt length 1-2% shorter than travelled length).
- The round belt is delivered welded together. If adjustment is needed the belt must be cut, shortened and joined together again with a special joining pin, which is attached on the casing (see Figure 11). Belt tension should be 4-6%.
- Check the tightness between the rotor and the housing. If necesary, adjust brush sealing by unscrewing the screws on the plastic guide and pushing the brush sealing more closely to the matrix. Then fix the screws again. (Figure 12)

Figure 10

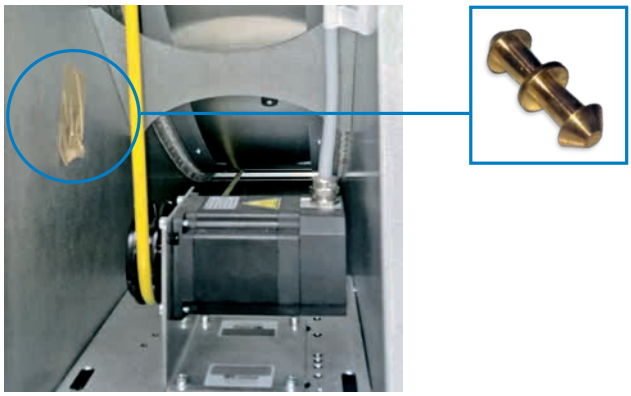


Figure 11

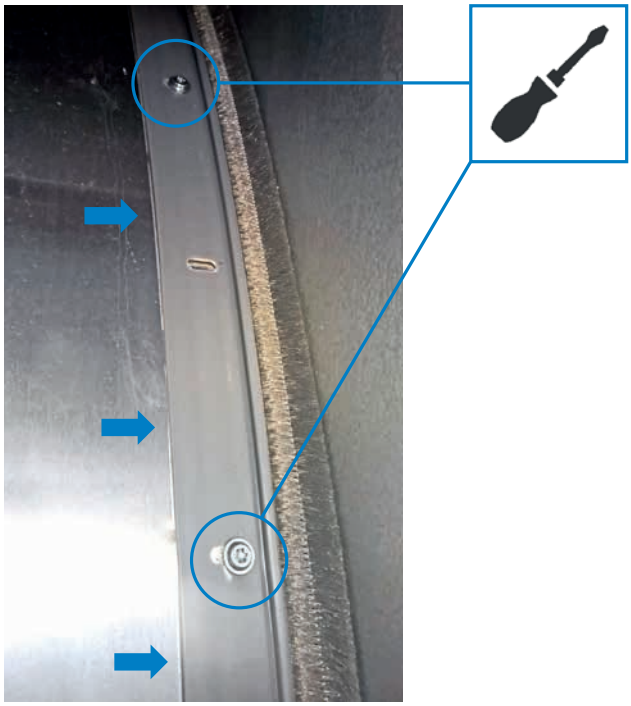


Figure 12

4 Maintenance and cleaning of the hygienic type air handling units

- Hygienic type air handling units are designed specifically to handle the air in clean rooms, hospitals, surgical operating rooms, laboratories, farmacy sites, etc.

4.1 Maintenance schedule

- For maintenance and cleaning the VDI 6022 standard must be observed. In case of highly contaminated air the recommended frequency must be reduced and adjusted to actual conditions.

4.2 Cleaning and maintenance

- Larger debris and dirt must be removed by use of an industrial vacuum cleaner. For other dirt apply wet sheets with mild and non-toxic detergent in normal concentrations. Use cleaning accessories which do not damage the unit's surface.
- Use personal protection equipment.
- All installed parts (fans, motors, filters, heat exchangers, etc) are mounted on rails to ensure easy removal from the housing. Before cleaning all installed parts must be carefully removed. After cleaning and disinfection remove all the cleaning tools and loose debris, ensure that all seals are installed, particularly the door seals. In case any seals are damaged, remove and replace them with new ones.
- All unit parts which were removed for cleansing and disinfection should be re-inserted in accordance with the manufacturer's instructions.

4.3 Disinfectants

- Do not apply corrosive disinfectants.
- Use disinfectants recomended and listed by the Robert Koch Institute (RKI) and the Vereinigung Angewandte Hygiene (Association for Applied Hygiene - VAH).
- Observe the disinfectant manufacturer's instructions for proper mixing, concentration, temperature of use, reaction times and compatibility with the surfaces to be cleaned.
- After disinfection, all seals, cable tubes, caps and similar shall be checked and replaced if damaged.

4.4 Unit re-comissioning

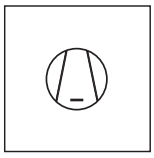
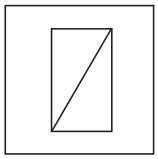
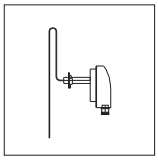
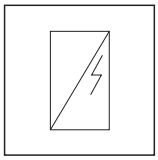
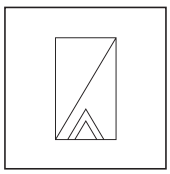
- After the cleaning and disinfection and prior to re-comissioning, the unit must be inspected. Check for the presence of poisonous or unpleasant smelling fumes, which may occur in case of insufficient cleaning.

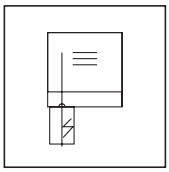
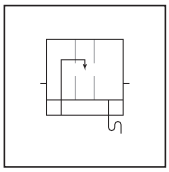
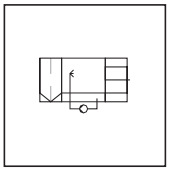
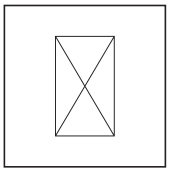
4.5 Tightness check

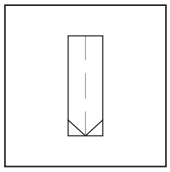
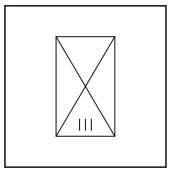
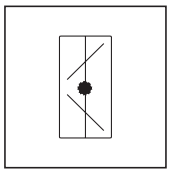
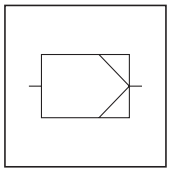
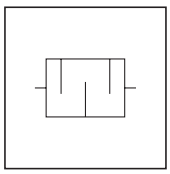
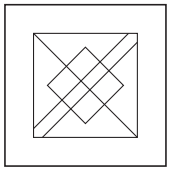
- In units where the contamination of the inlet air with the outlet air is not allowed, regular unit tightness tests must be carried out. This does not apply to units with a fin recuperator section, in which complete separation of air flow is ensured.

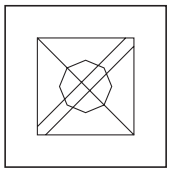
5 Maintenance check list

- Strictly observe the maintenance schedule below. With respect to the maintenance and cleaning of the units also observe the recommendations defined in the VDI 6022 standard.
- A**TTENTION**: Maintenance and cleaning of hygienic type air handling units may only be performed by qualified maintenance personnel.

Section	Checking and maintenance shedule	Minimum time interval (months)				
		1	3	6	12	24
Housing						
	Check the door seals, the tightness of duct connections and that the roof is watertight.				x	
	Inspect for contamination, damage and corrosion of the housing interior.				x	
	Check that the air intake is free of obstacles.					
	Clean and ensure a hygienic condition.				x	
Fan						
	Check bearings and anti vibration damper.				x	
	Check the belt drive.				x	
	Inspect for contamination, damage and corrosion.			x		
	Clean and ensure a hygienic condition.				x	
Water heater						
	Air vent the coil, check for leakage.				x	
	Inspect for contamination, damage and corrosion.			x		
	Clean and ensure a hygienic condition.				x	
Anti-frost protection						
	Inspect for contamination, damage and corrosion.			x		
	Inspect electrical and safety eqipment.			x		
	Clean and ensure a hygienic condition.					
Electrical heater						
	Inspect for contamination, damage and corrosion (before annual startup).			x		
	Inspect electrical and safety eqipment.			x		
	Clean and ensure a hygienic condition.				x	
Gas heater						
	Inspect for contamination, damage and corrosion.		x			
	Inspect electrical and safety eqipment.			x		
	Inspect tightness of the heat exchanger.				x	
	Clean and ensure a hygienic condition.				x	

Section	Checking and maintenance shedule	Minimum time interval (months)				
		1	3	6	12	24
Steam humidifier						
	Inspect for contamination, damage and corrosion.	x				
	Wash with cleaning agent, flush and dry the humidifier chamber, disinfect if necessary.			x		
	Check for condensate precipitation in the humidifier chamber – clean the humidifier.		x			
	Inspect the dirt traps for condition and function.			x		
	Check the condensate drain.		x			
	Test the control valve function.			x		
	Clean and ensure a hygienic condition.	x				
Contact humidifier						
	Inspect for contamination, damage and corrosion.	x				
	Check the bacterial load of the humidifier water supply.		x			
	Inspect atomiser nozzles for deposits.		x			
	Inspect dirt traps for condition and function.			x		
	Check the recirculation pump and the inlet pipe for dirt.		x			
	Functional test of the sterilisation system.		x			
	Clean the air humidifier.		x			
	Clean and ensure a hygienic condition.	x				
High-pressure humidifier						
	Inspect for contamination, damage and corrosion.	x				
	Wash with cleaning agent, flush and dry the humidifier chamber, disinfect if necessary.			x		
	Check the spray register for deposits.			x		
	Check the mist eliminator for deposits.			x		
	Check the condensate drain.			x		
	Clean and ensure a hygienic condition.	x				
Water cooler						
	Inspect for contamination, damage and corrosion.		x			
	Inspect the coil for lekage and air vent the coil.			x		
	Inspect the drip tray for function and test the siphon. If required, the siphon should be filled with water.		x			
	Clean and ensure a hygienic condition.		x			

Section	Checking and maintenance shedule	Minimum time interval (months)				
		1	3	6	12	24
Droplet eliminator						
	Inspect for contamination, damage and corrosion.	x				
	Inspect the driptray for contamination, corrosion and function.			x		
	Clean and ensure a hygienic condition.			x		
Direct expansion coil						
	Inspect for contamination, damage and corrosion.		x			
	Inspect the coil distributer piping.			x		
	Inspect the drip tray and test the siphon function.		x			
	Clean and ensure a hygienic condition.		x			
Damper						
	Inspect for contamination, damage and corrosion.					x
	Check the motor drive.				x	
	Check the seals and bearings.					x
	Clean and ensure a hygienic condition.				x	
Filter						
	Inspect for contamination and damage.		x			
	Check the differential pressure.		x			
	Replacement of the filter stage < F9				x	
	Replacement of the filter stage ≥ F9					x
	Clean and ensure a hygienic condition.			x		
Sound attenuator						
	Inspect for contamination, damage and corrosion.				x	
	Clean and ensure a hygienic condition.				x	
Plate recuperator, Double plate recuperator						
	Inspect for contamination, damage and corrosion.			x		
	Check the housing seals.				x	
	Inspect the drip tray and test the siphon function.			x		
	Check the damper function.				x	
	Clean and ensure a hygienic condition.				x	

Section	Checking and maintenance shedule	Minimum time interval (months)				
		1	3	6	12	24
Rotational regenerator						
	Inspect for contamination, damage and corrosion.			x		
	Inspect for tightness between the rotor and the housing.				x	
	Check the rotation of the rotor.			x		
	Check the motor and bearing, and the drive and controller functions.				x	
	Check the belt - if it slides, adjust the belt tension.				x	
	Clean and ensure a hygienic condition.				x	

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