Indoor air and process ventilation units

# Transport, assembly, commissioning and maintenance manual

## Air handling unit series HYD

## Rox-Klimatechnik GmbH

English version-Englische Version
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Note: This manual covers all matters for the transport, assembly, commissioning and maintenance of air handling units from Rox-Klimatechnik GmbH and is adapted to the current state of technology at the time of its creation. Since the printed version is not subject to change control, the latest version must be requested from Rox-Klimatechnik GmbH before use.

In the present document you will find important information regarding the safe, proper handling of ROX air handling units of the series HYD. This transport, commissioning, assembly and maintenance manual is intended for installation companies, operators, company technicians, technical staff or instructed persons as well as HVAC technicians. This manual must always be available at the installation location of the air handling unit. Anyone working with or on the air handling unit must read, understand and use this transport, assembly, commissioning and maintenance unit, and especially the safety instructions.

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# 1 Introduction

## 1.1 Air handling unit series HYD

ROX air handling units are produced for air flow volumes $q_V$ = 900 m³/h to $q_V$ = 100,000 m³/h. There are 16 standard sizes available. In addition, the construction enables any desired special sizes and the production of large air handling units with air flow volumes $q_V$ > 100.000 m³/h. There are two different designs for the casing of the air handling units. On the one hand there is HYD LC and there is HYD STANDARD on the other. The HYD LC casing is distinguished by its special thermal isolation, whereby the casing classes T2 and TB2 in accordance with DIN EN 1886 are achieved. In the following, the ROX air handling units and their specific areas of application are presented:

- ROX air handling unit series HYD:

Air handling units of this series are used for the ventilation and air conditioning of buildings and industrial processes. Volumetric flow $q_V$ = 900 – 100,000 m³/h.

ROX air handling units series HYD with heat recovery:

Air handling unites can be produced with all types of heat recovery. Heat recovery systems which can be integrated in the air handling units are circulation unit systems, rotary heat exchangers, plate heat exchangers, heat pipes and heat pumps.

- ROX roof air handling units, series HYD:

Roof air handling units are configured for every special application. Air handling units can be equipped with cooling machinery, gas furnaces, directly-fired air heaters, regulating equipment, switch cabinets, etc. The roof air handling units are plug-in units with special roof frames for roof installation.

- ROX air dehumidifying systems, series HYD:

Many production processes require the supply of air with special conditions regarding the humidity and temperature. Rox-Klimatechnik GmbH makes all the necessary means available for this.

- ROX hygienic compact units, series HYD:

HYD air handling units satisfy the highest demands on hygiene and can be produced for all room classes according to DIN 1946 T4.

## 1.2 General notes and information

**Assembly and commissioning**

Air handling units from Rox-Klimatechnik GmbH must be assembled properly and used under strict adherence to the instructions. If the assembly and commissioning take place in a manner contrary to our specifications and a defect/damage which has a causal connection

with an improper modification, reworking or other handling, all claims for compensation or warranty are null and void.

The customer must the, in the case of a complaint, provide verification that the improper assembly and commissioning were not responsible for the appearance of a defect.

The instructions in this transport, assembly, commissioning and maintenance manual must be observed without fail!

**Expert personnel**

Transport, assembly, commissioning and maintenance work may only be performed by trained, expert personnel. Any person who is assigned with work on the air handling unit must have read and understood this operating manual in its entirety, especially the safety information. In addition, the risk assessment must also be observed.

**Intended use**

Air handling units from Rox-Klimatechnik GmbH may only be used for handling air as intended, in other words, for the transport, filtering, mixing, heating, cooling, heat recovery, humidifying and dehumidifying of air. The air handling units are not suitable for the transport of corrosive, aggressive or abrasive media.

**Operating method and operating parameters**

The operation of air handling units in accordance with the operating methods and operating parameters specified in the technical data sheets for the heating, cooling, humidifying, dehumidifying, mixing, filtering and transport of air ensures the safety and economical operation of the system. Rox-Klimatechnik GmbH assumes no liability for any unintended use which goes beyond these applications. The intended use also entails adherence to the transport, assembly, commissioning and maintenance manual as well as the adherence to the inspection and maintenance intervals designed in accordance with standards and directives (see section 4) and the risk assessment from Rox-Klimatechnik GmbH.

**Warranty claims**

Prerequisite for warranty claims is that

- the mentioned work is performed on the basis of this manual and other provided documentation,
- appropriately trained expert personnel are assigned with work (see above),
- the safety instructions are observed and
- only original spare parts from the manufacturer are used.

Structural modifications of the air handling unit on the customer's own authority are not permitted and render the warranty null and void.

**Technical changes**

The manufacturer reserves the right to technical changes which serve for the improvement of the air handling units in regard to the images and specifications of this transport, assembly, commissioning and maintenance manual.

**Measurement and automatic control systems**

The freely programmable microprocessor control system installed in the switch cabinet power element is adapted for the optimised regulation strategy for the application in DDC technology. The control system is normally installed and programmed prior to delivery. The air handling unit must have passed a test run with a test log prior to delivery. Operating, maintenance and fault messages are displayed on the control panel. Operating status messages take place through indicator lamps in the controller of the switch panel of the air handling unit.

The commissioning at the place of installation must be performed by personnel from Rox-Klimatechnik GmbH.

The actuators and sensors for the control system of the air handling unit are installed in the casing at the factory. Additional duct and room sensors for the air handling unit are included for on-site installation and must be installed on-site by the system manufacturer.

The control system must be designed so that additional functions (e.g. fire dampers) can be integrated. Further detailed information about the operation of the control system can be gathered from the separate document "Automatic control systems user's manual".

**Limitations of use**

The limitations of use of air handling units from Rox-Klimatechnik GmbH are as follows:

| | |
|---|---|
| Operating state: | -20°C to +35°C. |
| Standstill: | -30°C to +60°C. |
| Max. differential pressure: | 2500 Pa. |
| Max. fan speed: | see technical data sheets and type plates. |
| Max. operating pressure (medium): | see technical data sheets and type plates. |
| Max. operating temperatures: | see technical data sheets and type plates. |
| Max. currents and voltages: | see technical data sheets and type plates. |

**Assembly of components**

If the delivery of the air handling unit takes place in multiple components, they must be assembled together in accordance with this transport, assembly, commissioning and maintenance manual and all safety equipment must be installed and activated (see section 3).

## 1.3 General safety instructions

### Safety instructions before working on the air handling unit

Work on the air handling unit may only take place once the following points have been fulfilled:

- The current supply is disconnected at all poles.
- In the case of frequency converters, a wait time of least 15 minutes must be observed due to residual voltage.
- Wait until all moving parts are stationary, especially fan impeller, motor, belt drive, etc. Wait at least five minutes after switching off.
- Wait until the temperatures of the heat exchanger and control system groups have returned to environmental temperature.
- Pressurised systems may only be worked on in a depressurised state.
- Special equipment must be attached to secure against switching on (e.g. lockable service switch).
- Secure the air handling unit against unintentional restarting (hang lock and "Do not switch on" warning sign on the switch).
- Wear personal protective equipment and observe all special safety instructions in the following sections as well as those in the risk assessment.

### Safety instructions after working on the air handling unit

After working on the air handling unit it must be ensured that

- all safety equipment is installed and activated, which means that the fan safeguard (protective grating, reach-in guard) is locked and
- no one is in the danger areas (e.g. within the air handling unit).

### Areas at risk of explosion

According to EC Directive 94/9/EC, the air handling unit may only be commissioned if the following points are fulfilled:

- The application conditions are appropriate for the intended use.
- No materials which have a tendency towards self-ignition, such as pyrophoric substances, may be used in the near vicinity in accordance with EN 1127–1.
- Permanent and sufficient ventilation of the installation room (technology centre) must be assured with ATEX units.
- No explosive atmospheres may form as a result of system-based unit leakage.

According to EC Directive 94/9/EC, air handling units may not be used in the vicinity of:

- High-frequency sources (e.g. transmitter systems),
- powerful light sources (e.g. laser radiation),
- ionising sources of radiation (e.g. x-ray tubes) and/or
- ultrasonic sources (e.g. ultrasonic echo testing equipment).
-

**Additional safety instructions**

In addition to these general safety instructions, the following must also be observed:

- special instructions for the description of activities,
- VDE regulations,
- national accident prevent regulations (especially for electrical equipment, devices, cooling systems),
- internal regulations and
- standards and directives.

**Safety equipment on the air handling unit**

Depending on the unit equipment:

- the flaps and doors must be secured with switch cabinet locks or locking handles,
- the fan chambers must be secured with protective grating and
- the V-belt drive must be secured by a V-belt guard.

### 1.3.1 Declaration of conformity and conformity procedure

**Declaration of conformity and/or incorporation**

The declaration of conformity or the declaration of incorporation is only valid if the equipment is used in accordance with the transport, assembly, commissioning and maintenance manual. The following must be observed:

- Please observe the type plate on the air handling unit and the operating instructions of the accompanying accessories without fail.
- Limitations of use/ restrictions for the built-in parts/ components can be gathered from their respective documentation as well as the technology of the current respective version of the design software.
- For any use in corrosive or aggressive areas, the warranty settlement extends to the adherence to the agreed materials.
- For process air applications the possible tolerance-based deviations of the air values must be given additional consideration.
- Limitations of use for ROX special units for process air systems are available on request.
- When there is the risk of freezing, always use anti-freeze protection and anti-freeze for heating and cooling media.

**in the sense of EC Machinery Directive 2006/42/EC, Annex II A:**

**Declaration of conformity for air handling units**

**1. Identification/explanation:**

Only air handling units which are ready for operation and use, meaning completely assembled and functional units with integrated control system and control unit and, for example, integrated heating and/or cooling or complete

regulation groups for heating and/or cooling media are subjected to the conformity assessment process and receive a CE mark.

This also applies for air handling units which do not require a control unit or cooling and/or heating for the operation of the unit. Accordingly, this only pertains to air handling units which only have to be connected to the duct network and energy supply.

In these cases delivery takes place with CE mark and certificate of conformity. The applicable directives and standards must be listed in the certificate of conformity.

In the sense of the Machinery Directive, an air handling is a device or machine which is either ready for use or a partial or incomplete machine which is not ready for use.

**2. Requirements for the manufacturer:**

Linked systems ("an assembly of machinery which are arranged and controlled so that function as a whole") must be provided with a CE mark by the manufacturer in accordance with EC Directive 2006/42/EC and additional Directives which must be taken into consideration (e.g. Low-Voltage Directory). In practice, the systems are usually assembled from multiple machines, parts of machines or safety components of different origins.

**ense of EC Machinery Directive 2006/42/EC, Annex II B:**

**Declaration of Incorporation for air handling units**

**1. Identification/explanation:**

An air handling unit in the sense of the Machinery Directive is either machine ready for use a partial or incomplete machine as a which is not ready for use.
An incomplete machine, unlike a machine, cannot fulfil any specific function. It is only intended for integration in another incomplete machine and/or system in order to create a machine.

These non-operational air handling units, meaning these incomplete machines which are not ready for operation are not provided with a CE marking.

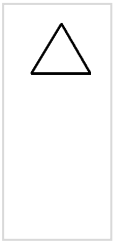
The CE marking as well as the Declaration of Conformity can and may only be performed by the system manufacturer and/or the party who commissions the system after the completion of the entire unit and/or the entire system.

**2. Requirements for the manufacturer:**

With air handling units which do not apply as a complete machine in the sense of EC Directive 2006/42/EC, the delivery is performed with a Declaration of Incorporation and assembly instructions (Annex VI). In addition, technical documentation (risk analysis) must be created in accordance with Annex VII Part B. The Declaration of Incorporation and the assembly instructions must be included with the device. The risk analysis, evaluation and assessment must be carried out in accordance with Annex VII Part B and must be kept and saved within the company for at least 10

years. On request, these documents must be presented at any time, however, they must not necessarily be attached to the air handling unit.

#### 1.3.1.1 Standards and directives



In the following, all relevant harmonised standards, national directives and technical specifications which have a direct bearing on the transport, assembly, commissioning and maintenance of ROX air handling units are categorically summarised. These standards, directives and specifications must always be taken into consideration for all activities which are related to this transport, assembly, commissioning and maintenance manual.

**Harmonised standards for the assurance of personal safety and protection of health**

- DIN EN 12100-1 : Safety of machinery - Basic terminology, methodology
- DIN EN 12100-2 : Safety of machinery - Technical principles
- DIN EN ISO 13857 : Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs
- DIN EN 13849-1 : Safety of machinery - Safety-related parts of control systems - Part1: General principles for design (for HVAC air handling units with control system and control unit)
- DIN EN 953 : Safety of Machinery - Guards - General requirements for the design and construction of fixed and movable guards
- DIN EN 60034-1 : Rotating electrical machines - Part 1: Rating and performance
- DIN EN 60204-1 : Safety of machinery - Electrical equipment of machinery

**National directives and specifications for the assurance of personal safety and health protection**

- VBG 5 : Power-driven equipment
- VBG 5 DA : Power-driven equipment - Arrangement
- VDMA 24167 : Fans - Safety requirements

**Harmonised standards for HVAC air handling units**

- DIN EN 1886 : Ventilation for buildings - Air handling units - Mechanical properties and measurement processes
- DIN EN 13053 : Ventilation for buildings - Air handling units - Ratings for units, components and sections

**National directives and specifications for HVAC air handling units**

- DIN 1946-4 : Ventilation and air conditioning - Part 4: Ventilation in buildings and rooms of health care.
- VDI 6022-1 : Hygiene requirements for ventilation and air-conditioning systems
- VDI 3803 : Central air conditioning systems - Structural and technical requirements
- RLT 01 : General requirements for HVAC units

**Harmonised standards for integrated cooling systems and heat pumps**

- DIN EN 378-1 : Refrigerating systems and heat pumps - Safety and environmental requirements - Part 1: Basic requirements, definitions, classification and selection criteria
- DIN EN 378-2 : Refrigerating systems and heat pumps - Safety and environmental requirements - Part 2: Design, construction, testing, marking and documentation
- DIN EN 378-3 : Refrigerating systems and heat pumps - Safety and environmental requirements - Part 3: Installation site and personal protection
- DIN EN 378-4 : Refrigerating systems and heat pumps - Safety and environmental requirements - Part 4: Operation, maintenance, repair and recovery
- EC Regulation 303/2008: Chemical-climate protection regulation
- EC Regulation 842/2006: Fluorinated greenhouse gases

**National directives and specifications for integrated cooling systems and heat pumps**

- DIN 2405-1 : Pipelines in cooling systems and cooling equipment identification

**Harmonised standards for HVAC air handling units in accordance with EC Explosion Protection Directive 94/9/EC**
**(ATEX 100a)**

- DIN EN 13463-1 : Non-electrical equipment for use in potentially explosive atmospheres - Part 1: Basic method and requirements
- DIN EN 13463-5 : Non-electrical equipment for use in potentially explosive atmospheres - Part 5: Protection by construction safety
- DIN EN 60079-0 : Electrical equipment for explosive atmospheres - Part 0: General requirements
- DIN EN 1127-1 : Explosive atmospheres - Explosion protection - Part 1: Basic concepts and methodology

**National directives and specifications for HVAC air handling units in accordance with EC Explosion Protection Directive 94/9/EC**

- RLT 02 : Explosion protection requirements for air handling units
- VDMA 24169-1 : Air handling unit - Design-related explosion protection measures for fans

**Harmonised standards for HVAC air handling units in accordance with Low-Voltage Directive 2006/95/EC**

- DIN EN 60204-1 : Safety of machinery - Electrical equipment of machinery
- DIN EN 60335-1 : Safety of electrical appliances for household use and similar purposes - Part 1: General requirements

**Harmonised standards for HVAC air handling units in accordance with EMC Directive 89/336/EEC, 92/31/EEC and 2004/108/EC**

- DIN EN 61000-6-1 : Electromagnetic compatibility (EMC) - Part 6.1: Generic standards - Immunity for residential, commercial and light industrial environments
- DIN EN 61000-6-2 : Electromagnetic compatibility (EMC) - Part 6.2: Generic standards; Interference resistance for industrial environment
- DIN EN 61000-6-3 : Electromagnetic compatibility (EMC) - Part 6.3: Generic standards; Generic standard Interference emission for residential, commercial and light industrial environments
- DIN EN 61000-6-4 : Electromagnetic compatibility (EMC) - Part 6.4: Generic standards; Generic standard interference emission for industrial environment
- DIN EN 55011 : Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

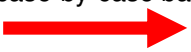
**National directives and specifications for HVAC air handling units in accordance with EMC Directive 89/336/EEC, 92/31/EEC and 2004/108/EC**

VDE 0100-710 : Erection of low voltage installations - Requirements for special installations or locations - Medical locations

**Pressure Equipment Device Directive 97/23/EC**

Heaters and coolers for use with refrigerants as well as integrated cooling systems are normally not subject to the pressure equipment device directive.

The use and conformity with the Pressure Equipment Device Directive 97/23/EC must be checked on a case-by-case basis, especially during the installation of fully functional cooling systems.



Conformity assessment process
Pressure testing

**Harmonised standards - Gas Equipment Directive 90/396/EC**

- DIN EN 525 : Non-domestic direct gas-fired force convection air heaters without heat exchanger (net heat input ≤ 300kW)
- DIN EN 1020 : Gas-fired air heaters (net heat input > 300kW)
- DIN EN 746-2 : Industrial thermal processing equipment - Safety requirements for combustion and fuel handling systems

**National directives and specifications - Gas Equipment Directive 90/396/EC**

- DIN 4794-3 : Stationary fan-assisted air heaters; gas fired air heaters with interchange of heat, requirements, testing
- DVGW VP 112 : Gas quality symbol

→ EC type examination (manufacturer)

**Building Products Directive 98/0167EEC and 96/68/EEC (smoke extraction)**

- DIN EN 12101-3 : Smoke and heat control systems - Part 3: Specification for powered smoke and heat exhaust ventilators
- DIN EN 1363-1 : Fire resistance tests: Part 1: General requirements
- DIN EN 1366-8 : Fire resistance tests for installations Part 8: Smoke extraction ducts

**National directives**

- RLT 04 : Ventilation systems with smoke extraction function
- DIN 18232-5 : Smoke and heat control installations - Powered smoke exhaust systems
  Requirements and design

### 1.3.2 Explosion protection

**Air handling units according to ATEX Directive 94/9/EC**

Air handling units with special requirements in regard to the explosion protection in accordance with ATEX Directive 94/9/EC must be expressly identified as such.

The installation location of the air handling units may only be determined in accordance with the identification and in adherence to this transport, assembly, commissioning and maintenance manual.

If necessary, a separate manual for air handling units from Rox-Klimatechnik GmbH can be created in accordance with ATEX Directive 94/9/EC.

The identification of air handling units according to ATEX Directive 94/9/EC takes place on the basis of the following description of the groups of equipment, the ignition protection types, the explosion classes and the temperature classes according to ATEX Directive 94/9/EC.

The identification must take place inside (conveyed air) and outside of the air handling unit (machine room).

In the following sections the special identification according to ATEX Directive 94/9/EC is explained in greater detail.

In the process, the groups of equipment, the ignition protection types and the temperature classes according to ATEX Directive 94/9/EC are addressed in particular.

### 1.3.2.1 Groups of equipment according to ATEX

**Figure 1.11** shows the groups of equipment and the equipment categories according to ATEX Directive 94/9/EC.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Equipment group | I (Mining) | | Equipment group | | II (Other areas at risk of explosion, other than mining) | | | |
| Equipment category | M1 Very high measure of safety | M2 High measure of safety | 1 Very high measure of safety | | 2 High measure of safety | | 3 Normal measure of safety | |
| Sufficient safety | through 2 safety measures / with 2 errors | Must be switched off on appearance of explosive atmosphere | through 2 safety measures / with 2 errors | | With frequent equipment faults / with 1 error | | With fault-free operation | |
| Equipment groups, equipment categories according to 94/9/EC (Atex 100a) D: Dust ; Gas | | | D | G | G | D | G | D |

Illustration 1.1: Equipment groups and equipment categories according to ATEX Directive 94/9/EC

### 1.3.2.2 Types of ignition protection according to ATEX

In **Figure 1.2** the ignition protection types, the corresponding symbols, the identification, the application and the use according to ATEX Directive 94/9/EC are shown.

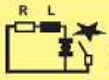
| Zündschutzart | allg. Anforderungen | Druckfeste Kapselung | Erhöhte Sicherheit | Eigensicherheit | Überdruck-kapselung | Verguss-kapselung | Öl-kapselung | Sand-kapselung | Zündschutzart "n" |
|---|---|---|---|---|---|---|---|---|---|
| Symbol | |  |  |  |  |  |  |  | |
| Kennzeichnung | | EEx **d** | EEx **e** | EEx **i** | EEx **p** | EEx **m** | EEx **o** | EEx **q** | EEx **n** :**** |
| Schutzprinzip | | Übertragung einer Explosion nach außen wird ausge-schlossen | Vermeidung von Funken und Temperaturen | Energie-begrenzung von Funken und Temperaturen | Ex-Atmosphäre wird von der Zündquelle ferngehalten | Ex-Atmosphäre wird von der Zündquelle ferngehalten | Ex-Atmosphäre wird von der Zündquelle ferngehalten | Übertragung einer Explosion nach außen wird ausge-schlossen | verschiedene Schutz-prinzipien für Zone 2 |
| Einsatz | | 1 oder 2 | 1 oder 2 | 0, 1 oder 2*** | 1 oder 2 | 1 oder 2 | 1 oder 2 | 1 oder 2 | 2 |
| CENELEC | EN 50014 | EN 50018 | EN 50019 | EN 50020* EN 50039** | EN 50016** | EN 50028 | EN 50015 | EN 50017 | EN 50021 |
| Anwendung | alle Anwendungen | Schaltgeräte, Steuerungen, Motoren, Befehls- und Meldegeräte, Leistungs-elektronik | Abzweig- und Verbindungs-kästen, Gehäuse, Motoren, Leuchten, Klemmen | Mess-, Steuer-, und Regeltechnik Sensoren, Aktoren, Instrument-ierung | Schalt- und Steuer-schränke, Motoren, Mess- und Analysegeräte, Rechner | Spulen von Relais und Motoren, Elektronik, Magnetventile, Anschluss-systeme | Transfor-matoren, Relais, Anlauf-steuerungen, Schaltgeräte | Transfor-matoren, Relais, Kondensatoren | alle Anwendungen für Zone 2 |
| | * Geräte, ** Systeme, ***ia Einsatz in Zone 0, 1, und 2; ***ib Einsatz in Zone 1 und 2 | | | | | | | | |
| | **** nA = nicht funkend, nC = funkende Betriebsmittel (geeigneter Schutz), nR = schwadensichere Gehäuse. | | | | | | | | |

Illustration 1.2: Ignition protection types, symbols and identification according to ATEX Directive 94/9/EC

### 1.3.2.3 Explosion groups and temperature classes

The explosion groups (see **Figure 1.3**) and the temperature classes and maximum surface temperatures (see **Figure 1.4**) according to ATEX Directive 94/9/EC are presented in the following. The temperature classes are divided into six different ranges. In the process, the range spans from temperature class T6 = 85°C up to temperature class T1 = 450°C. In addition, various chemicals, such as acetone, ethane, benzol, benzine, etc. are differentiated between. The explosion groups are divided

into four classes, which are identified with I, IIA, IIB and IIC.

| Explosion group | T1 | T2 | T3 | T4 | T5 | T6 |
|---|---|---|---|---|---|---|
| I | Methane | | | | | |
| IIA | Acetone<br>Ethane<br>Ethyl acetate<br>Ammonia<br>Benzol (pure)<br>Acetic acid<br>Carbon monoxide<br>Methane<br>Methanol<br>Propane<br>Toluol | Ethyl alcohol<br>i-Amyl acetate<br>n-Butane<br>n-Butyl alcohol | Benzine<br>Diesel fuel<br>Heating oils<br>n-Hexane<br>Aircraft fuel | Acetaldehyde<br>Ethyl ether | | |
| IIB | City gas (illuminating gas) | Ethylene | | | | |
| IIC | Hydrogen | Acetylene | | | | Carbon disulphide |

Illustration 1.3: Explosion groups according to ATEX Directive 94/9/EC

| Temperature class | Maximum surface temperature |
|---|---|
| T1 | 450°C |
| T2 | 300°C |
| T3 | 200°C |
| T4 | 135°C |
| T5 | 100°C |
| T6 | 85°C |

Illustration 1.4: Temperature classes and maximum surface temperatures according to ATEX Directive 94/9/EC

### 1.3.2.4 Ignition sources


**Identification and approval according to ATEX**

Fans may only be operated in potentially explosive atmospheres with appropriate identification and approval for the zone in which they are used. Mechanically generated sparks must be prevented through the selection of appropriate material combinations and careful adjustment of the nozzle gap. The maximum permissible speed of the fan may not be exceeded.

Electrical and electronic components, such as electromotors, lamps, switches, etc. may also only be operated in potentially explosive atmospheres with appropriate identification and with authorised for the respective zone with an approval.

For roof air handling units with explosion protection, professional lighting protection must be installed. Hot surfaces, flames and hot gases as well as particles can also be ignition sources.

When replacing the filter, only filter media which is appropriate for use in potentially explosive air may be used.
In the case of unauthorised conversions or those on one's own authority, as well as modifications of the unit, the manufacturer's warranty becomes null and void along with the Declaration of Conformity in the sense of ATEX Directive 94/9/EC.

### 1.3.3 Emergencies

**Equipment fire**

In case of fire, the air handling unit must be switched off immediately. The local fire regulation must be adhered to in general. In case of fire, the current supply of the air handling unit must be disconnected immediately at all poles. Jointed flaps and fire protection flaps must be closed in order to shut off oxygen supply and prevent the spread of fire. Firefighting and first aid measures must be initiated immediately. The fire brigade must be informed. Air handling units which are used for qualified smoke extraction or are switched from external locations in case of fire are subject to correspondingly exceptional rules.

**Protection of persons takes precedence over protection of property.**

On inhalation of fire gases, severe health damage or even death can occur. In case of fire, materials which are used can develop toxicologically questionable substances. Use heavy respiratory protective equipment.

Severe health and property damage can occur from the bursting of pressure tanks and pipelines in the case of fire. Do not remain in the immediate danger area!

## 1.4 General maintenance, cleaning and disinfection instructions

**Maintenance**

Air handling units require regular maintenance. The maintenance intervals and the detailed descriptions can be gathered from the respective rules and specifications (see VDI 6022 page 1). In addition, the most important activities are summarised in a checklist for this transport, assembly, commissioning and maintenance manual from Rox-Klimatechnik Gmbh in section 11. Regular maintenance does not relieve the operator of their duty of care to check the air handling unit for proper function and damages. During any maintenance work on the HVAC system the risk assessment from Rox-Klimatechnik GmbH must be observed without fail.

**Functional check**

A functional check of the safety measures should take place on a regular basis. (Normal operation).

All equipment chambers must be subjected to the following checks on a semi-annual basis:

- Inspection for soiling, damage and corrosion,
- If necessary, cleaning of the chambers, visual inspections of the insulation for external damage,

- Check outlets and closures for ease of movement and tightness,
- Tightness checks of the flexible ductwork connections and
- Lubrication of moving parts, if not prohibited.

**Standards and directives**

The maintenance work on all components of air handling systems should always be performed in accordance with VDMA 24186 (ventilation systems) and VDMA 24176 (heating systems. Maintenance, service and cleaning work on the air handling unit are not permitted while it is in operation.

In addition, the instructions for hygienic inspection according to Directive VDI 6022 page 1 must be observed, which are summarised following the VDI Directive in section 11.

**Casing**

The following measures must be carried out on the casing:

- Allow heavy soiling to dry and remove with an appropriate industrial vacuum cleaner.
- Disinfecting cleaning takes place with appropriate agents and country-specific approval.
- The technical data sheets and safety data sheets of the used agents must be checked for suitability and compatibility in the air handling unit for all cleaning work.
- Treat galvanised parts with preserving agents.
- All moving parts, such as hinges and rotary bolts, must be treated with appropriate lubricants.
- Protective clothing must be worn.

**Disinfectant**

Permissible disinfectant: e.g. Dismozon pur or Bacillocid rasant.

| | | |
|---|---|---|
| Manufacturer/supplier | e.g.: | BODE CHEMIE GmbH & Co.<br>Melanchthonstrasse 27<br>D-22525 Hamburg (Germany) |

The names of additional manufacturers and suppliers can be requested from Rox-Klimatechnik GmbH.

**Maintenance, cleaning and disinfection instructions**

Observance of the special section "Cleaning and disinfection of fan chambers" under 5.2.2.

After performing maintenance, cleaning and disinfection work, sufficient cleanliness must be ensured before recommissioning the air handling unit - if necessary, clean again.

## 1.5 Delivery inspection

**Delivery inspection**

After delivery of the air handing unit an immediate inspection for possible transport damages must be carried out (transfer of risk on delivery at the place of installation = unloaded lorry). In case of damage, inform Rox-Klimatechnik GmbH in Weitefeld and the responsible transport company immediately. Visible damage must be reported immediately. Damage which is not immediately visible must be reported within one week. In the case of non-observance, Rox-Klimatechnik GmbH is not liable. Rox-Klimatechnik Gmbh is also not liable for damages on the basis of improper unloading of the air handling unit.

Deliveries must be check for completeness according to the delivery paperwork. In the case of missing parts, the customer service department of Rox-Klimatechnik GmbH must be informed immediately.

Customer service contact information:
Rox-Klimatechnik GmbH
Customer service
Langenbacher Straße 25
57586 Weitefeld
Germany

Telephone: +49 (0) 2743 / 807-154
Fax: +49 (0) 2743 / 807-153
E-mail: info@rox-online.de

## 1.6 Warranty

**Written notification**

Faults and/or damages to the air handling unit must be reported immediately after their occurrence in writing to Rox-Klimatechnik GmbH. No third-party companies may be commissioned with the rectification of faults and/or damages to the air handling unit without the approval of Rox-Klimatechnik GmbH. In this case, both the regulation of extent of damage and the liability are excluded. This also applies for non-observance of the transport, assembly, commissioning and maintenance manual.

# 2 Transport and packing

## 2.1 On-site transport

### Transport to the place of installation

Air handling units from Rox-Klimatechnik GmbH are loaded properly at the factory and delivered to the respective place of installation. The delivery takes place via lorry. The air handling units are packed in weather-resistant foil, as necessary.

Depending on customer wishes, the air handling units been delivered with the unit firmly attached to the base frame or they are delivered on wooden pallets for the existing frame or on-site foundation.

### Transport at the place of installation

For crane transport at the place of installation, appropriate auxiliary equipment must be provided (see **Figure 2.1**). The sequence of component transport at the place of installation is determined by the assembly of an air handling unit, which consists of multiple components. Units for outdoor installation can be equipped with a galvanised base frame with square casings for the crane transport and appropriate transport tubes with locking screws.

### Unit base frames and film packaging

The unit base frames made of galvanised steel sheet are provided with openings with the diameter $d_a$ = 55 mm for the acceptance of on-site transport tubes with the diameter $d_i$ = 40 mm. These transport tubes should be at least l = 2x120 mm longer than the unit width and must have safeguards for the rope and air handling unit, for example (see **Figure 2.1**).

Any film packing must be opened immediately after receipt of the air handling unit in order to prevent condensate and white rust formation, as long as the air handling unit is in an area protected from dirt and weather influences.

Should the air handling unit be stored temporarily, it must be ensured that the equipment is protected from the weather, kept dry and clean and protected from external influences. The danger of condensate formation must be excluded through appropriate ventilation measures both during the intermediate storage and during transport.

### Consignment note and bill of delivery

On receipt of the merchandise, it must be inspected for integrity and completeness. Missing parts and damage must be immediately noted on the consignment note and confirmed by the deliverer. The modalities of the accident claim must be described in detail on the bill of delivery. In the case of non-observance, liability for defects becomes null and void. Rox-Klimatechnik GmbH

assumes no responsibility whatsoever for soiling and damage, vandalism and theft of equipment and/or equipment components at the place of installation.

## 2.2 Safety regulations

**Regulations for safety and health protection**

- BGV D6: Accident prevention regulations, crane.
- VBG 9a: Accident prevention regulations; load-bearing equipment in lifting operation.
- BGV A1: Accident prevention regulations; General provisions.

## 2.3 Unloading air handling units with base frame

The unit base frames made of galvanised steel sheet have openings with the diameter $d_a$ = 55 mm for the acceptance of transport tubes with the diameter $d_i$ = 40 mm.

**Max. load: $F_{max}$ = 22.5 kN; m = 2,25 t, Rope angle α ≥ 45°.**

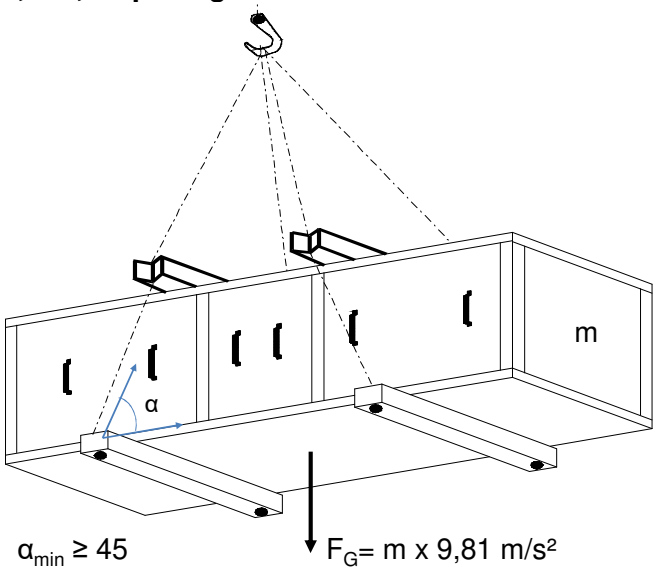



Illustration 2.1: Auxiliary equipment for the transport of the air handling unit using a crane.

## 2.4 Unloading air handling units without base frame

When unloading and during transport with forklifts, forks must be used which extend completely across the bottom of the air handling unit. Air handling units may only be transported with the forks under the base frame or the pallet.

Appropriate zinc extensions must be attached to forklifts with forks that are too short.

# 3 Assembly of air handling units

## 3.1 General instructions for unit assembly

For the removal of heat exchangers for for the fan disassembly, an assembly and work area which is at least the width of the unit must be kept clear.

## 3.2 Foundation/base frame

A smooth, level foundation made of concrete or an even substructure enable the proper assembly of the individual unit components. The accessibility of the doors, the possibility of expansion of installation elements and the inspection walls as well as the faultless seal at the component connections require the exact alignment of components. This also applies if elastic parts, such as rubber, cork, etc., are used between the air handling unit and foundation for additional structure-borne noise attenuation.

When determining the height of the foundation, the necessary siphon height must be taken into consideration (see section 3.5). All structural parts must be made of Sendzimir galvanised steel. The floor support pad of the air handling unit has no edges, so that there is also the possibility of structure-borne noise insulation with insulating strips (see section 3.3) without on-site foundation. 333The surface quality inside and out for air humidifiers, air handling units must be weather-proof and have a hygienic design, in accordance with the quality provisions of standards and directives (see section 1.3.1.1). Air handling units for outdoor installation are additional installed with a rear-ventilated hood (see **Figure 3.16**).

## 3.3 Structure-borne noise attenuation

As already mentioned in section 3.2, structure-borne sound and vibration attenuation must be provided through an appropriate support pad between the base frame and foundation, e.g. PU rubber strips.

## 3.4 Potential equalisation, earthing, lightning protection

The air handling units from Rox-Klimatechnik GmbH may only be commissioned once the unit and all electrical equipment have been earthed. The earthing, the potential equalisation and the protective system must be tested for proper function. Each unit must be tested on an individual bases and current instructions regarding lightning strikes must be followed. In addition, the risk assessment must also be observed.

## 3.5 Air handling unit drainage

For the assurance of a fault-free water flow and for the avoidance of the intake of infiltrating air, all condensate outlets and other water discharge points must each be connected with a siphon from Rox-Klimatechnik GmbH. The ROX siphon type SN for water discharge in the vacuum area (suction-side from the fan) fills independently and prevents the suctioning of air during pressure surges (see **Figure 3.1**). At water discharge points in the vacuum area the water seal must be assured with the fillable ROX siphon type DS (see **Figure 3.2**).

Illustration 3.1: Siphon type SN

Illustration 3.2: Siphon type DS

The siphon height depends on the pressure head $P_L$ = H (mmWS). Each siphon must discharge freely through a funnel of the collecting line.

Horizontal discharge lines must have a sufficient diameter, declines and venting for fault-free water discharge (gravity water discharge) (see **Figure 3.3**).

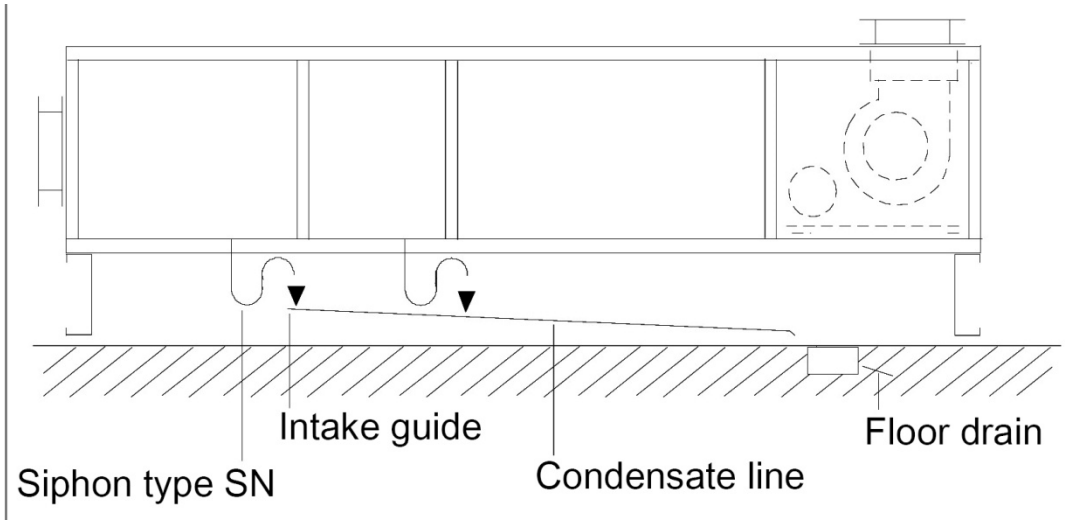



Illustration 3.3: Representation of the air handling unit water discharge

In **Figure 3.4** both the type SN and type DS siphons are shown on the real air handling unit from Rox-Klimatechnik GmbH. The siphons are located on the control side. If necessary, the siphons can be reordered from Rox-Klimatechnik GmbH in Weitefeld. In case of enquiries, please contact customer service (see section 7).

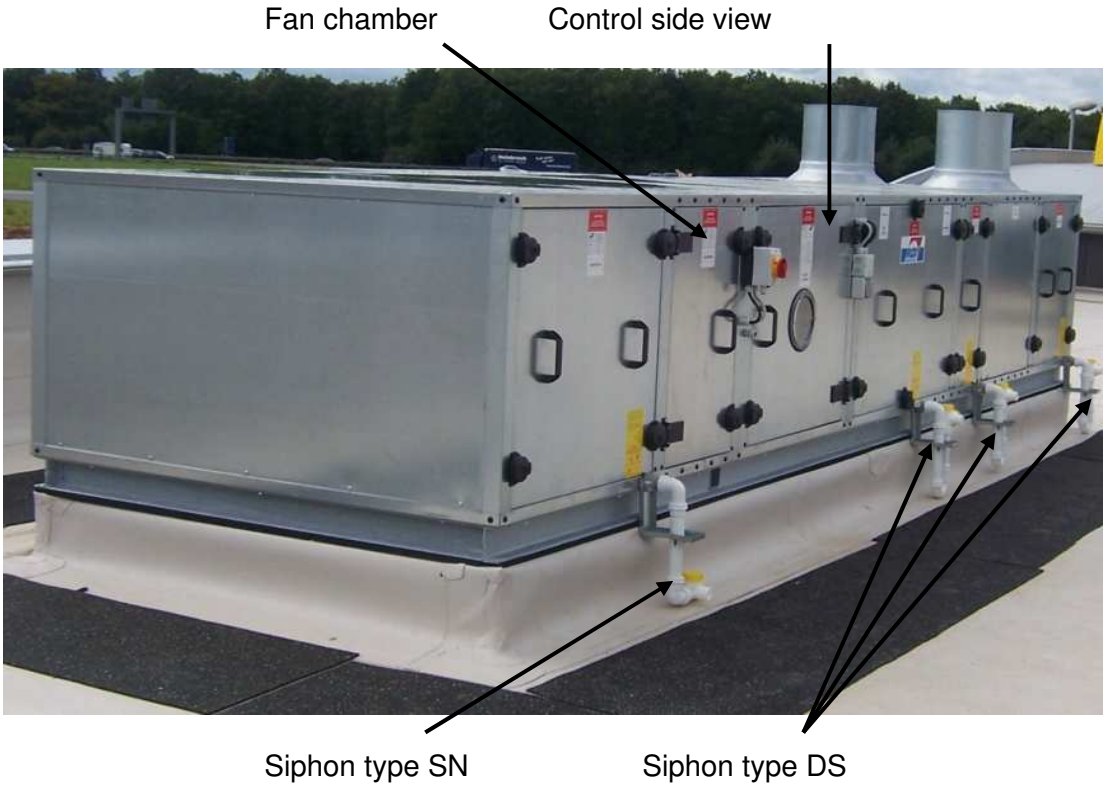



Illustration 3.4: Representation of ROX siphon types SN and DS

## 3.6 Assembly

Air handling units from Rox-Klimatechnik GmbH which consist of multiple components must be tightly connected:

a) Before the assembly, the joint side must be adhered with the sealing strip provided by ROX. The parts are then pushed together.

b) The components are to be screwed to the joint profiles (see section 3.6.1). Unit parts arranged on top of one another receive splice plates (see section 3.6.2).

c) Contact points of the components must be sealed with a permanently plastic sealant within the unit. Air handling units for outdoor installation must be sealed for weather resistance at the contact points both inside and out.

### 3.6.1 Component bond with joint profiles

The component connect to the unit joint side takes place as shown in Figure 3.5. In this case, the joint profile is fastened with the appropriate hexagon screws (M8x25), appropriate lock washers (A8) and appropriate hexagon nuts (M8).

A seal in the form of the OWA tape is adhered between the joint profiles. The number of screws depends on the unit height.

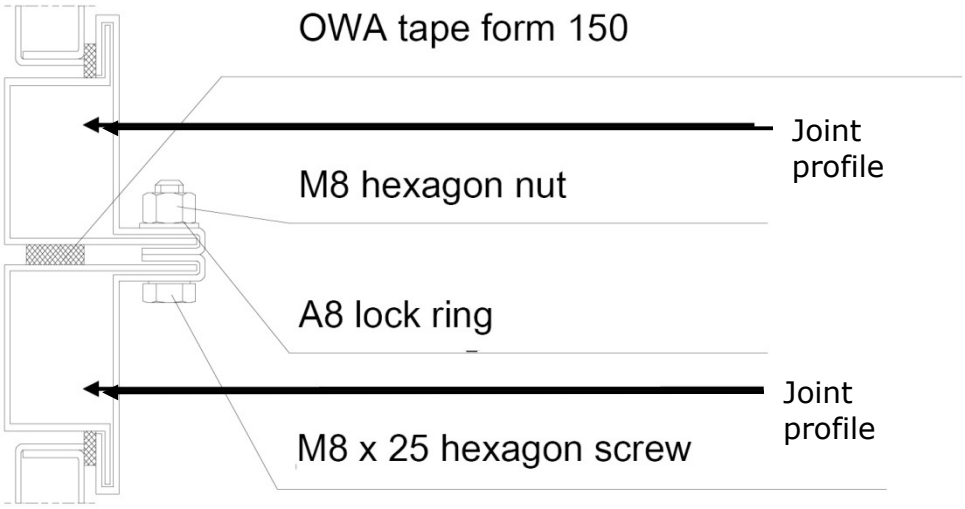



Illustration 3.5: Representation of the component connection with joint profiles

The necessary assembly material is included with the air handling units from Rox-Klimatechnik GmbH.

### 3.6.2 Horizontal component bond

**Horizontal component bond**

The horizontal component connection takes place as shown in **Figure 3.6**.

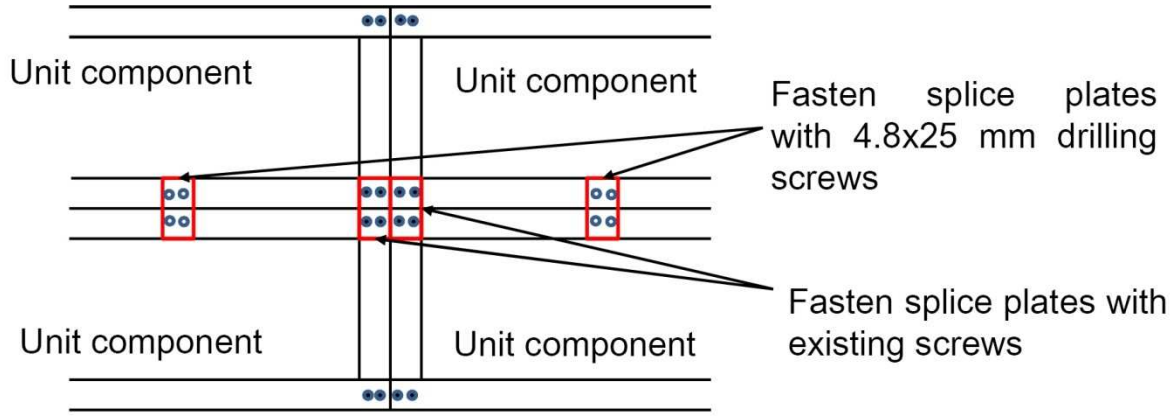



Illustration 3.6: Representation of the horizontal component connection

### 3.6.3 Base frame bond at contact points

**Base frame**
The screw connection of the base frame, as shown in **Figure 3.7**, must be carried out with caution. The base frame is designed with a "negative tolerance" (see **Figure 3.8**).

During the assembly it must be ensured that the casing is not damaged by forcefully pulling together the base frame.

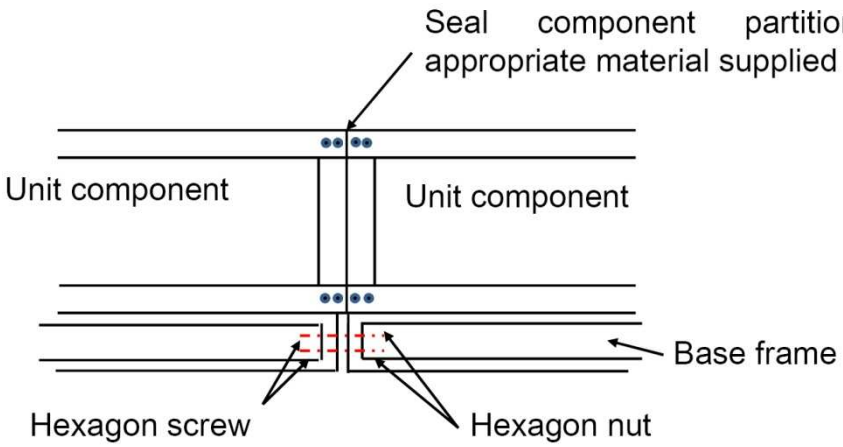



Illustration 3.7: Representation of the base frame connection at the contact points

**Recommendation**

For the optimal "rear ventilation" of the underside of the air handling unit, we recommend planning for a base frame and/or support feet. Otherwise the possibility of condensation cannot be entirely eliminated with unfavourable operating conditions.

**Negative tolerance**

In **Figure 3.8** the negative tolerance between the base frame and component separation of the air handling unit from Rox-Klimatechnik GmbH is shown.

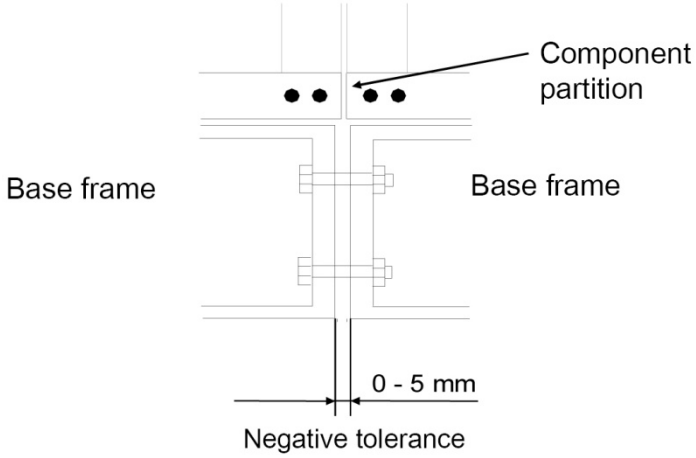



Illustration 3.8: Representation of the negative tolerance on the base frame

## 3.7 Hood assembly sequence

**Figure 3.9** to **Figure 3.12** show guidelines for the assembly of the hood with the help of cap profiles on the air handling unit. In the process, the assembly on the air handling unit end differs from assembly with separated hood.

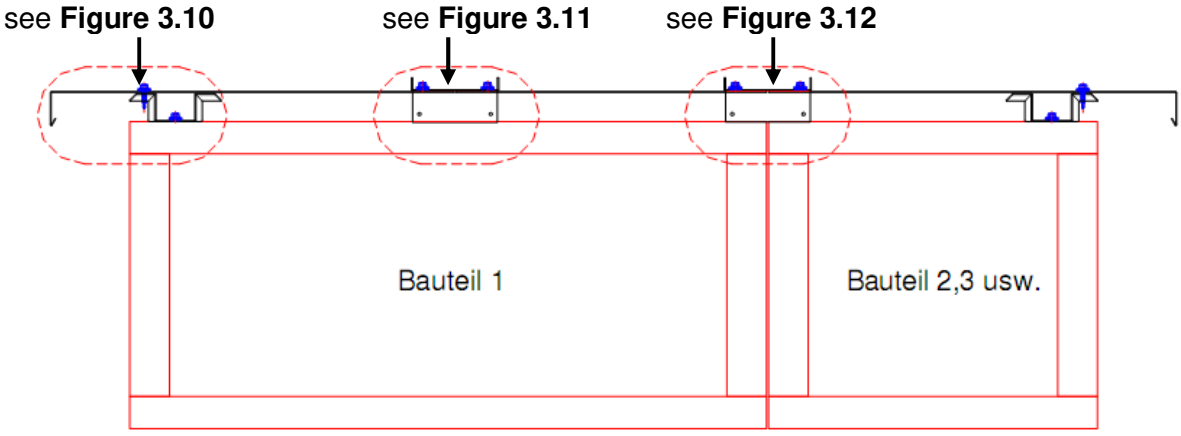



Illustration 3.9: Representation of the mounted hood on the air handling unit, series HYD

**Assembly on the air handling unit end**

The cap profiles are screwed on the air handling unit roof in accordance with the specification with facade drilling screws (see **Figure 3.13**) and then sealed all the way around. The edge and/or cap profile is screwed on with a clearance of 57 mm (see **Figure 3.10**). The result is a profile clearance of 23/31 mm to the air handling unit end.

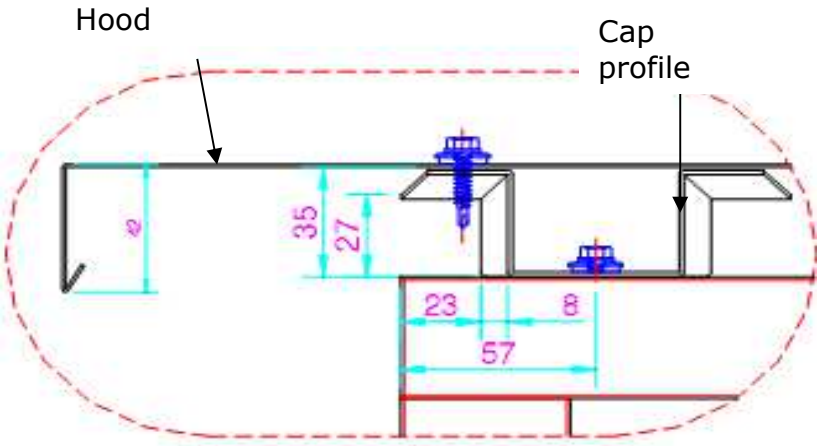



Figure 3.10: Sectional representation of the mounted hood

It must be ensured that the profile with the higher side (35 mm) is positioned on the control side of the air handling unit.

**Assembly of the separated hood**

In **Figure 3.11** the procedure for the assembly of the separated hood on the connected air handling unit is shown. Both facade drilling screws (see **Figure 3.13**) and panhead drilling screws are used (see **Figure 3.14)**. If the hood is separated on a continuous air handling unit,

it must be joined in the centre within a cap profile (see **Figure 3.11**) and covered from above with a butt connector.

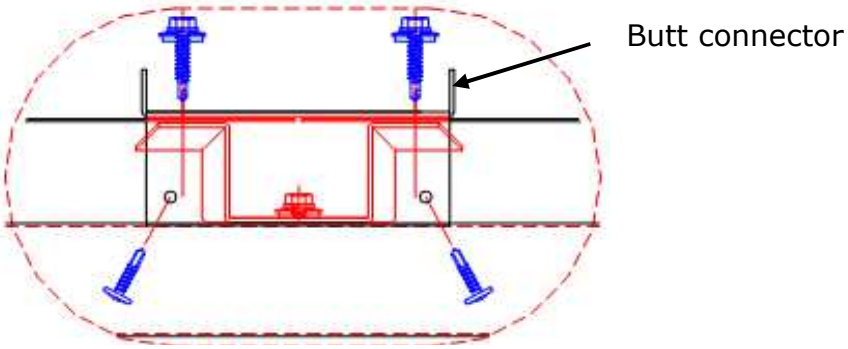



Figure 3.11: Assembly of the separated hood on the continuous air handling unit

It is screwed together with the hood using panhead drilling screws (see **Figure 3.14**). The butt connector is screwed onto the cap profiles from above with facade drilling screws with sealing washers (see **Figure 3.13**) and then sealed all the way around.

Assembly material: sealing material as well as alu butyl tape 1.5 mm x 50 mm 2H

**Air handling unit joint**

If the hood is also separated at an air handling unit joint (see **Figure 3.12**), cap profiles are screwed on with 81 mm spacing.

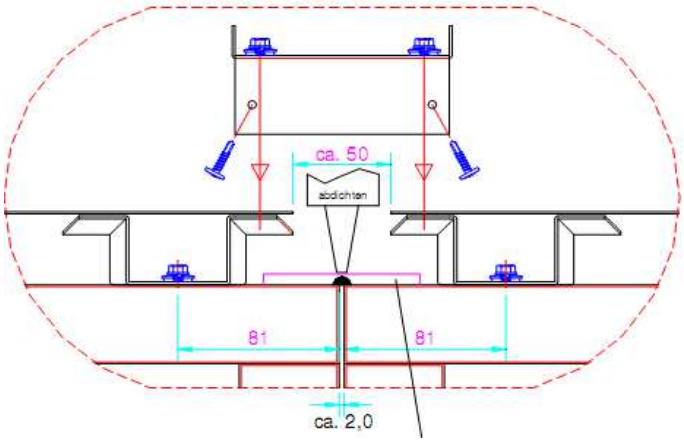



Figure 3.12: Assembly of the separated hood on the separated air handling unit

The result is a profile clearance of 47/55 mm to the air handling unit joint. The hood is recessed so that there is a gap of approx. 50 mm in the air handling unit joint area. With this gap the air handling unit joint is sealed from above and then completely adhered in Batuband. The further procedure can be read on page 25.

**Facade drilling screw**

The drilling screw which is to be used and must be fit with plastic caps is shown in **Figure 3.13**.

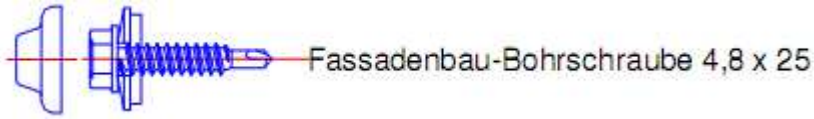



Figure 3.13: Facade construction drilling screw

**Panhead drilling screw**

**Figure 3.14** shows the panhead drilling screw which is to be used.

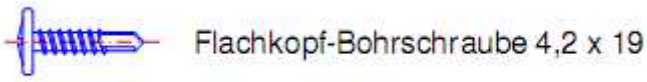



Figure 3.14: Panhead drilling screw

**Figure 3.15** shows a hood of an air handling unit from Rox-Klimatechnik GmbH.

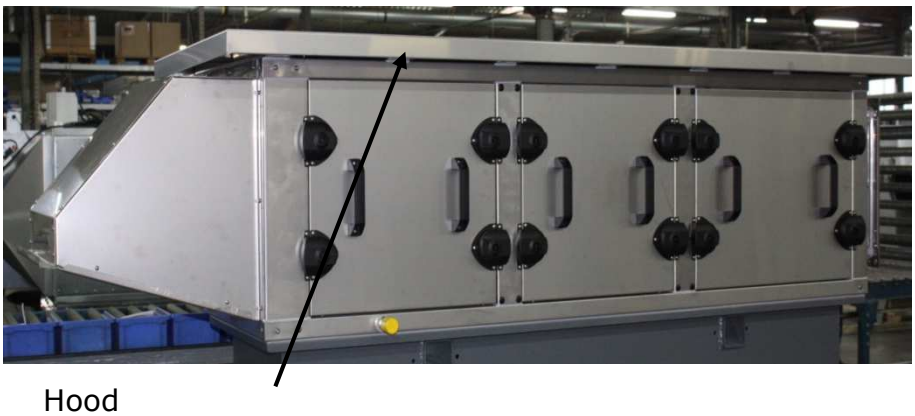



Figure 3.15: Air handling unit series HYD with hood

## 3.8 Application of the air handling unit seal for outdoor installation

**Work process**

- Carefully clean all shell divisions and component dividers.
- Then seal gaps with accompanying sealant and
- adhere Alu Butyl tape 1.5 x 50 mm 2H centred over this seal.

**Application of the air handling unit hood seal**

**Figure 3.16** shows the air handling unit hood seal with outdoor installation of air handling units from Rox-Klimatechnik GmbH. The application of the air handling unit hood seal requires a high level of precision and care so that the seal can be assured. Necessary assembly material is included with the air handling units.

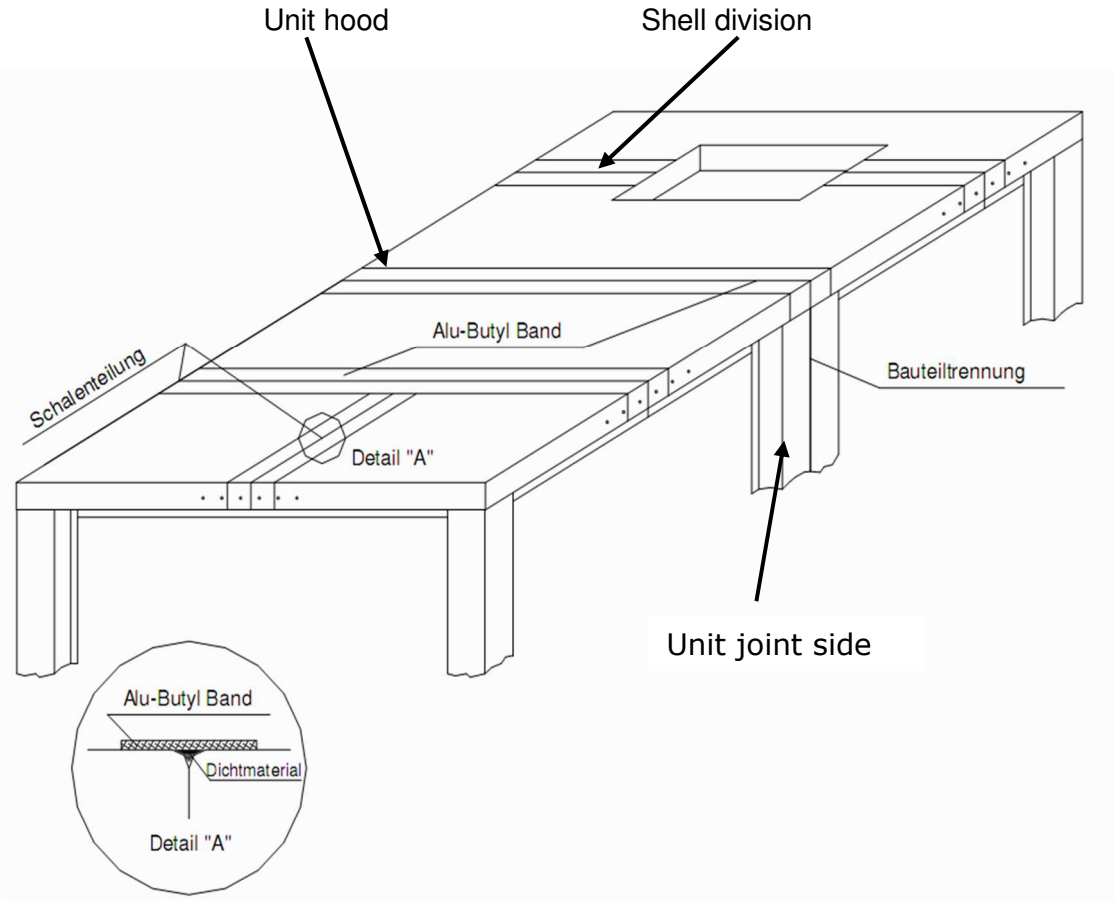



Figure 3.16: Application of the unit hood seal for outdoor installation of air handling units

# 4 General description, assembly and connection of the components

## 4.1 Casing

### Air ducts and insulation supports

The air ducts must be connected air-tight and without tension to the air handling unit through the insulation supports.

### Cleaning the structure

The double-shelled HYD casing construction enables good internal cleaning. Depending on the number and position of the filters, the contamination of parts can vary greatly. Components before the first filter stage and the exhaust air units, therefore, require more frequent cleaning. General cleaning instructions in the scope of the hygienic inspection according to VDI 6022 page 1 can be found in section 11.

### Fan chamber

The fan casings and/or fan chambers may only be opened and entered after the fans are stationary and the motors are secured against restarting. This precautionary measure must also be taken before opening other unit parts!

### Pressure-side inspection doors

Pressure-side inspection doors are equipped with an appropriate safety catch (see **Figure 4.1**).

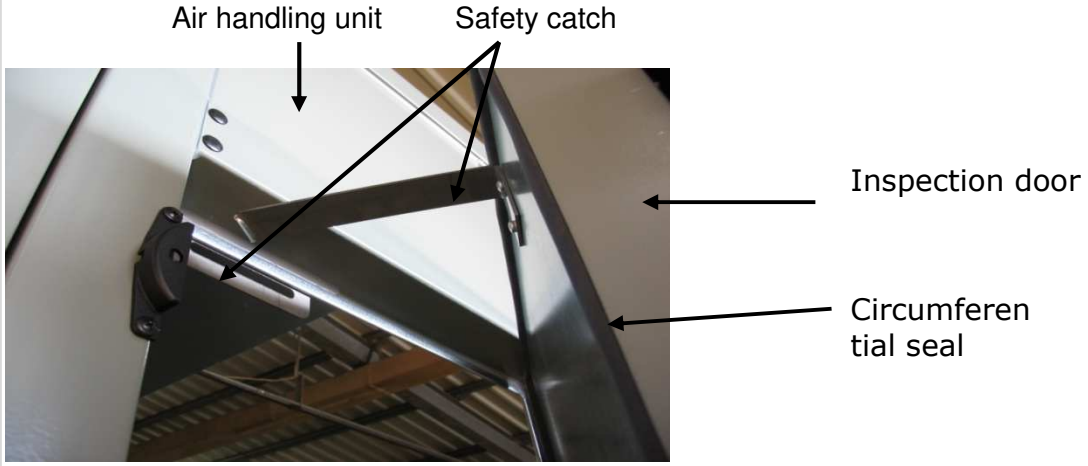



Illustration 4.1: Representation of the safety catch on the inspection door

### Pressure surges and/or high overpressure and vacuum pressure

The casing construction is suitable for the foreseen operating pressures. Pressure surges or impermissibly high vacuum or over pressures from closed louvre valves or fire protection flaps must be avoided.

**Closures and rotary bolts**

The doors and/or inspection openings are sealed using adjustable closures or rotary bolts. The circumferential seals must be inspected and replaced as necessary.

**Inspection doors**

In **Figure 4.2** a revision door with a circumferential EPDM foam rubber seal is shown. Figure **4.3** shows the 2-D hinge as well as the rotary bolt used by Rox-Klimatechnik GmbH. The respective assembly and adjustment instructions as well as the 2-D hinges and 3-D hinges are addressed in section 4.1.3 and 4.1.4.

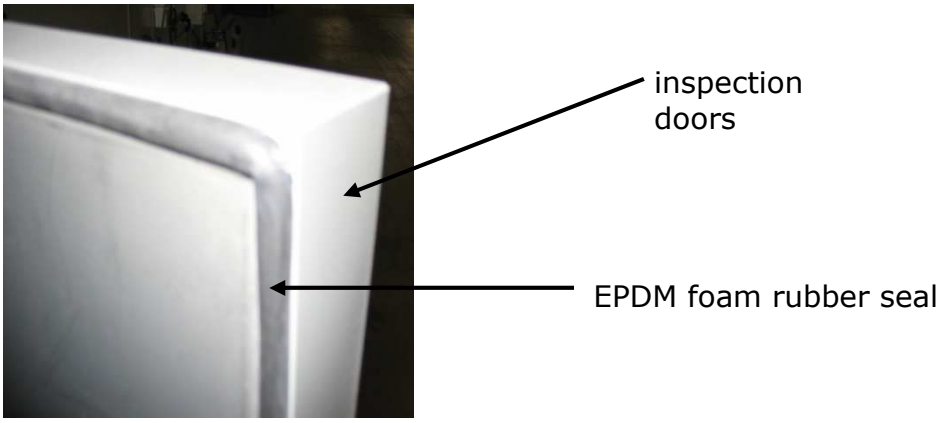



Illustration 4.2: Representation of the inspection door

**2-D hinges and rotary bolt**

2-D hinges are height-adjustable and can be used for adjusting the inspection doors.

a)

Illustration 4.3: Representation of the rotary bold and the 2-D hinge

**Plastics used in and on the air handling unit**

According to the state of technology, plastics, such as seals, droplet separators, flaps, filters, etc., are use on the casing construction and installation elements, if applicable. Therefore, the maximum temperature within the casing may

not exceed +60°C. Particular attention must be paid to the air heater and its control system when the plant and anti-freeze protection circuit are shut off.

**Certifications and unit series**

The casings are tested by an independent organisation (TÜV SÜD AG) and certified according to EUROVENT. There are two unit series available. They are identified as HYD STANDARD or HYD LC. The HYD LC casing is distinguished by its especially high thermal bridging factors $k_b$ and low thermal transfer U. The following table shows the respective thermal characteristics and all other characteristics of the type examinations.

**Characteristics of the casing in accordance with DIN EN 1886**

In **Table 4.1** the characteristics of the casing in accordance with DIN EN 1886 are shown.

| | HYD STANDARD | HYD LC |
|---|---|---|
| Mechanical strength (casing class) | D1 | D1 |
| Airtightness (tightness class) | L1 | L1 |
| Filter-bypass leakage (filter class) | F9 | F9 |
| Thermal transfer (casing class) | T2 | T2 |
| Thermal bridging factor (casing class) | TB3 | TB2 |

Table 4.1: Representation of the characteristics of the casing in accordance with DIN EN 1886

In **Table 4.2** the insert attenuation $D_e$ of the casing is shown.

| Average octave frequencies f in Hz | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|---|---|---|---|---|---|---|---|
| Insert attenuation $D_e$ HYD Standard | 12 | 16 | 12 | 13 | 18 | 34 | 38 |
| Insert attenuation $D_e$ HYD LC | 13 | 12 | 11 | 19 | 24 | 34 | 39 |

Table 4.2: Representation of the insert attenuation $D_e$ of the casing in accordance with DIN EN 1886

### 4.1.1 Duct connection to casing

**Elastic supports and potential equalisation**

In order to prevent structure-born sound transfer to the connected duct network, the connection to the casing must be made tension-free using elastic supports. During the assembly, the earthing, the protective system and the potential equalisation must be professionally connected. **Figure 4.4** shows insulation supports from Rox-Klimatechnik GmbH mounted on the air handling unit.

The respective air duct network is connected here.

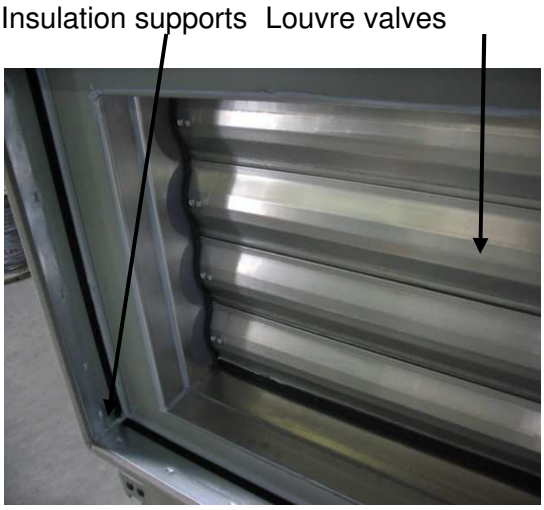



Illustration 4.4: Representation of the insulation support and the louvre valve

**Canvas connection**

If the air ducts are mounted on the casing using canvas connections, the following rule must be observed: Installation length < length before bending.

### 4.1.2 Assembly and routeing to the casing

**Connections on the casing**

The connections must take place tension-free and decoupled. They must be made in such a way that no vibrations from the casing can be transferred to the duct system and vice versa.

**Venting and emptying**

Closing connections when can simultaneous serve for measurement purposes must be provided near the supply and return connections to ensure proper venting and emptying.

**Removal of heat exchangers**

The ducts should generally be routed so that the removal of heat exchangers is as easy as possible and access to all inspection doors and walls remains.

### 4.1.3 Assembly and adjustment instructions for the 2-D hinge joints

The 2-D hinge is equipped with a locking screw which is loosened for the adjustment and then be retightened (see **Figure 4.5**). The height adjustment is achieved by turning the hinge pin, whereas

the adjustment of the door angle is accomplished by loosening the screws (see **Figure. 4.6**).

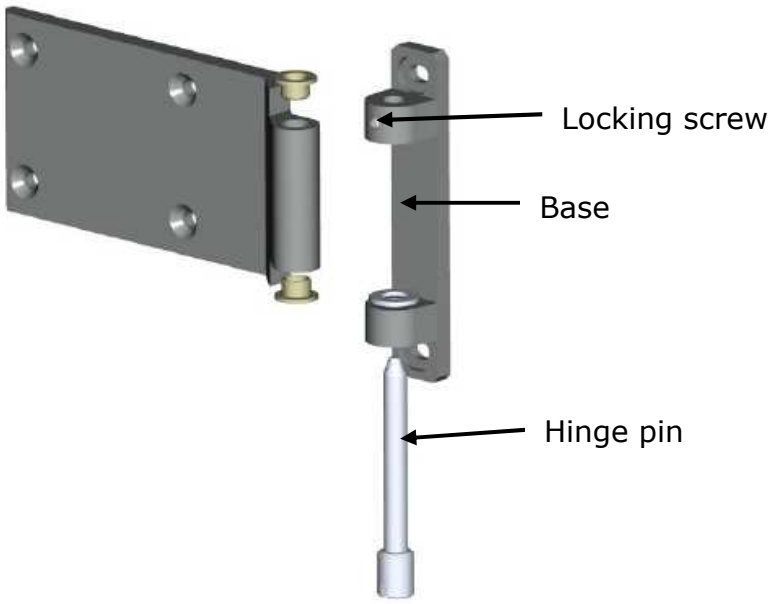



Illustration 4.5: Representation of the 2-D hinge

After completion of the adjustment, the screws must be retightened.

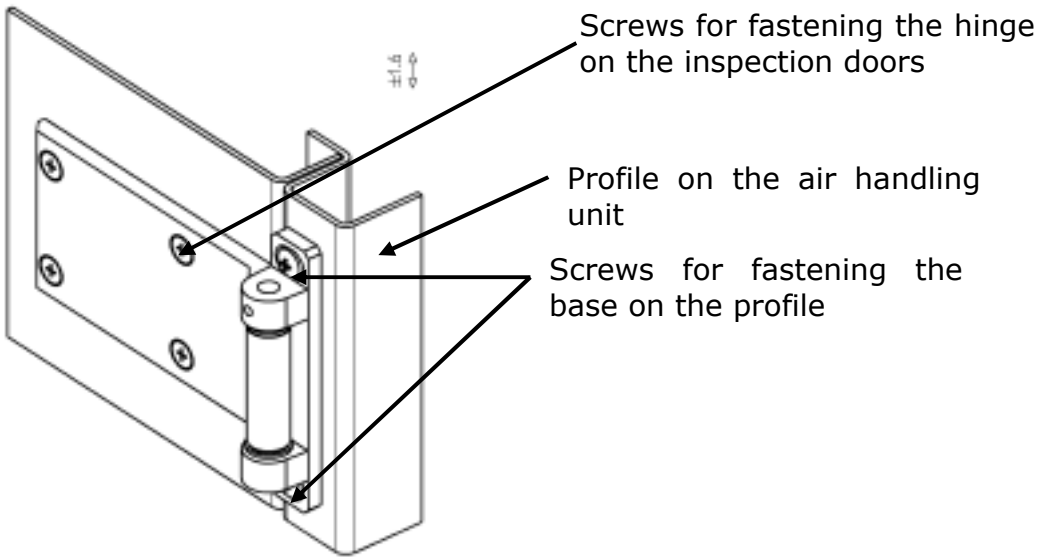



Illustration 4.6: Representation of the mounted 2-D hinge

### 4.1.4 Assembly and adjustment instructions for the 3-D hinge joints

The mounting and adjustment instructions for the 3-D hinges take place in accordance with the instructions laid out for the 2-D hinges. In this case, however, the depth of the 3-D hinge can be adjusted with additional screws.

In **Figure 4.7** the 3-D hinge used by Rox-Klimatechnik GmbH is shown. Depending on the customer wishes, a corresponding plastic cap can be placed over the hinge. The 3-D hinges are mounted with a riveting

nuts in both the profile and the inspection door. The tightness of the inspection doors depends on the mounting and adjustment of the 3-D hinges. Special care must be taken in this case.

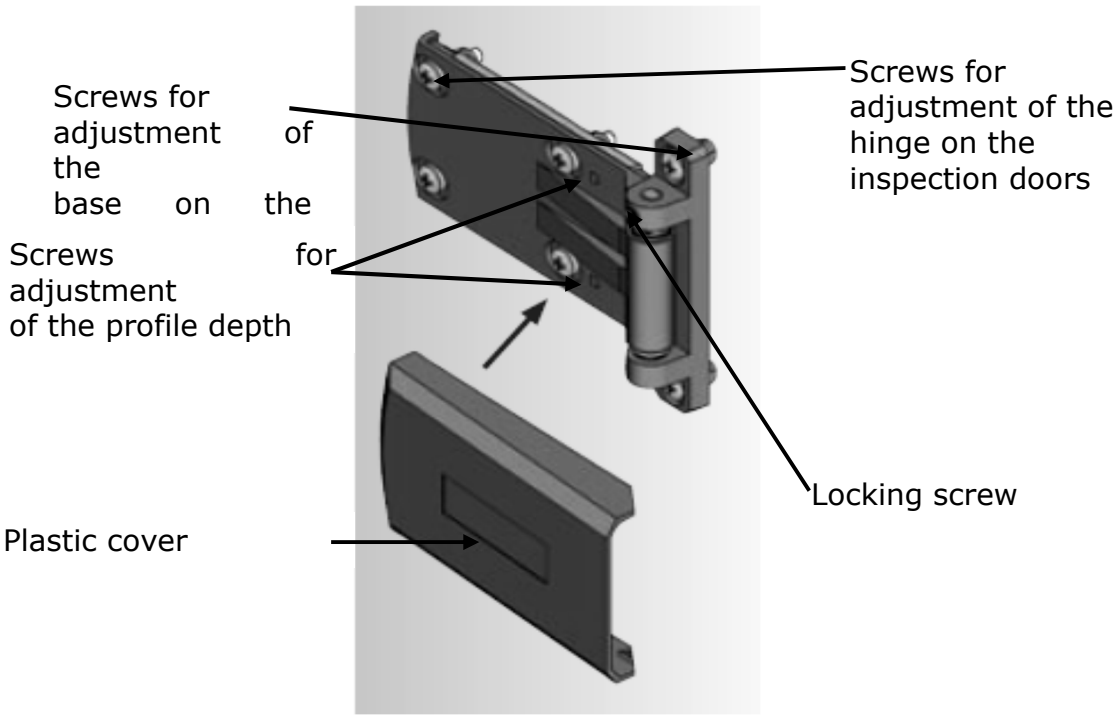



Illustration 4.7: Representation of the 3-D hinge

## 4.2 Louvre valves

**General notes**

Air regulating and shut-off flaps in accordance with DIN EN 1751 must be selected. The outside air intake flaps and flaps for air handling units for outdoor installation must be installed on the inside. The flow speed may not exceed 8 m/s (except for circulating air or bypass flaps). The spatial requirement and/or the possibility for attachment of flap actuators (e.g. connections leading outward) must be planned for. The tightness class and the material must correspond to the requirements of DIN EN1946 T 4 and must be adapted to the application.

## 4.3 Air filter

Sufficient air filtering and regular filter changes reduce the dust content of the air and prevent contamination of air handling units and duct systems. Filters which are used for too long diminish the air quality through odours. The penetration of moisture in the filter must also be prevented for hygienic reasons. In addition, dirty filters can also increase the energy requirement of fans considerably.

**Installation**

- Filter inserts are fastened in the installation frame with tension clamps.

- Do not jam or damage filter inserts.
- Ensure the airtight seating of the air filter in the installation frame.
- Only use approved filter media for ROX air handling units!

**Manometer installation**

With the installation of an inclined pipe or U-pip manometer, the filter contamination is checked through the differential pressure. On reaching the recommended end pressure, cleaning and/or replacement of the filter is necessary (see Table 5.1). For multi-stage units the differential pressure must be read in the highest stage.

If the manometers are not preinstalled, proceed as following for the installation:

1. Screw the manometer onto the unit door.
2. Fill manometer liquid up to calibration point 0.
3. Push the manometer tubes with the accompanying sleeves from inside through the two-shell casing wall. Slide the two free tube ends, which are provided with pull relief, onto the manometer connections.
4. Test the function by switching on the fan.

Differential pressure manometers, contactors and electrical sensors must be tested for function. If necessary, refill the measurement liquid.

**Special filters**

Special filters, such as active carbon filters or roll filters, must be maintained according to the separate maintenance instructions from the manufacturer.

## 4.4 Heat exchanger

**Connections**

The connections must be made tension-free at the heat exchangers. The bleeding and draining must be provided for at a suitable place in the pipe system. For heat exchangers comprised of multiple series of pipes, the return connection is always on the air intake side in regard to the direction of air flow. The piping and the corresponding insulation must be installed so that they do not hinder the opening of the air handling unit door and/or inspection walls.

**Fan heater (air/liquid)**

Air heaters made of copper-aluminium or steel are used for the thermal transfer: Air heaters made of copper-aluminium are used up to 110℃ with water as a heat carrier; steel fan heaters are used up to 150℃ with water or steam as a heat carrier. The air duct can be arranged horizontally or vertically.

With a heat carrier supply temperature above 100℃ in combination with steel heat exchangers, throttle control and heat carrier inclination above 40K must be avoided, because impermissibly high thermal stress can otherwise occur. The connection ports are attached at the highest and lowest point of the heat exchanger in order to enable the emptying and bleeding through the pipeline.
Maximum operating conditions:

Heater made of copper-aluminium:
- max. temperature 110°C
- max. pressure 16 bar
- Heat carrier - water

Heaters made of steel:
- max. temperature 150°C
- max. pressure 8 bar

Higher pressures and temperatures available on request.

### 4.4.1 General notes

**Water connection**

The water connection on the heat exchanger must be checked for accuracy and the bleeding of the system must be performed. The return must, based on the direction of air flow, always be positioned in front (counterfow). For this purpose, different possibilities are shown in **Figure 4.8** to **Figure 4.10**.

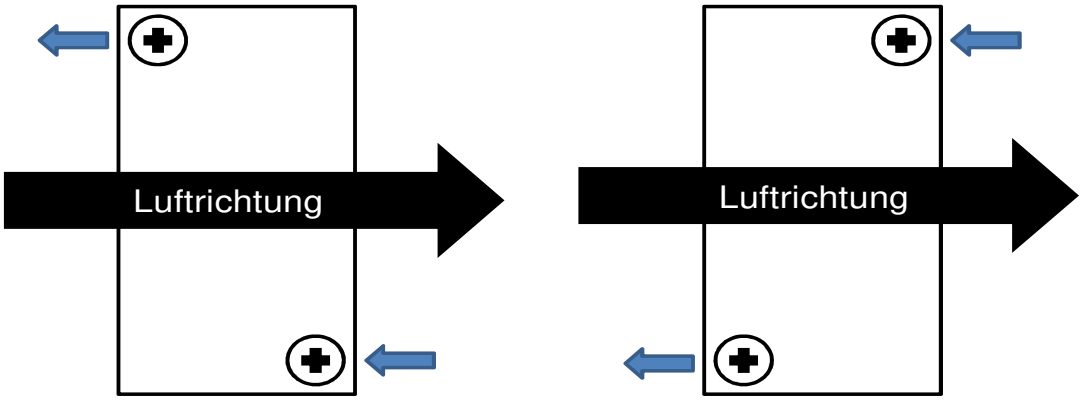



Illustration 4.8: Representation of the return flow, based on the direction of air flow

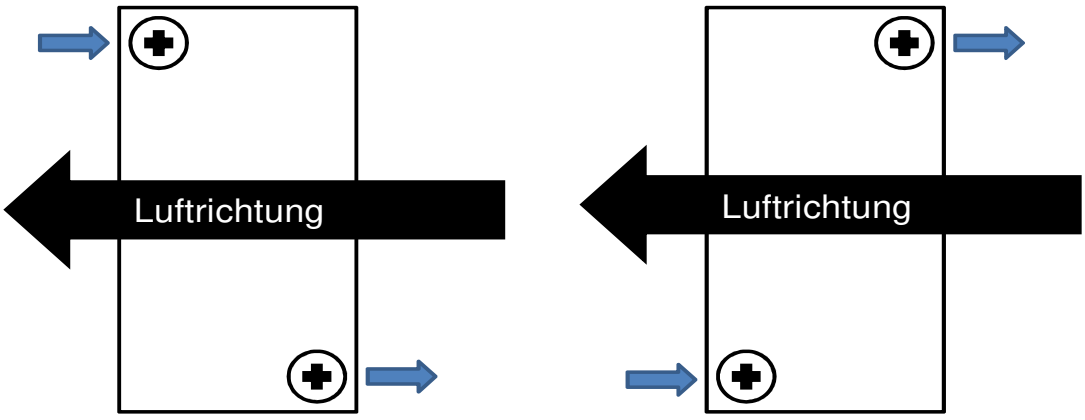



Illustration 4.9: Representation of the return flow, based on the direction of air flow

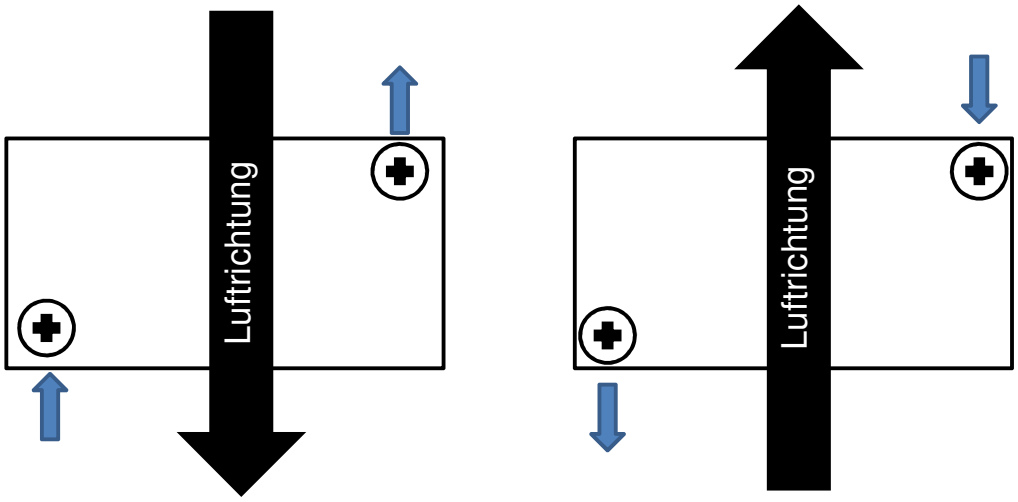



Figure 4.10: Representation of the return flow, based on the direction of air flow

**Removability of the heat exchanger**

In order to be able to pull the heat exchangers out of the air handling unit, detachable connections with screw couplings or flanges must be made. Supply lines may not hinder other built-in parts, such as filters and fans. The functional safety of the anti-freeze protection measures and system parts must be checked. The circulating hot or cold water must correspond to the requirements in accordance with VDI directive 2035 in regard to its quality.

Corrosion and limescale in the water system must be prevented through appropriate chemical measures.

### 4.4.2 Fin register heat exchanger

**Heat exchanger (copper pipe)**

The pipes are made of copper, mechanically expanded and with smooth or profiled and stamped and flanged onto the pipe penetration. The pipe penetration through the frame is designed with flanged punching (for the prevention of pipe damage from various material expansion) and drawn outward on both sides of the frame (for the prevention of bypass flows between end fins and frame).

The collector and deflecting curve areas are faced; the operating pressures are 15 bar (up to 120 ℃) and 12 bar (up to 14 ℃). The flow speed, the materials, the fin spacing and the water resistance are determined in accordance with quality specifications according to standards and directives.

**Heat exchangers (steel pipe)**

The heat exchangers are made of galvanised steel fin tubes, collecting chambers and connection ports made of steel, galvanised together in a bath. The collector and deflecting bend areas are faced: The flow speed, the fin spacing and the water resistance are determined in accordance with the

quality specifications according to standards and directives.

**Air heater section**

It must be ensured that the supply and return connections are not confused when connecting the pipes (normally counterflow principle with water intake and air outlet side). The pipelines must be flanged above or to the side of the air handling unit for the problem-free removal of the heat exchangers for maintenance purposes or the like.

**Assembly**

Supply and return lines must be connected in such a way that no vibration transfer and thermal tension can occur. The connections must be made with the name "Supply", "Return". Flanges, connections and shut-offs must be arranged in the supply and return of the air handling unit in such a way that the air heater can be replaced or cleaned without extensive disassembly work. The fault-free bleeding and emptying of the air heater and pipelines must be ensured on site. The thread connection ports of the copper-aluminium air heater must be protected against warping by holding while connecting the supply and return lines.

**Installation of the air heater**

1. Place air heaters on sliding rails and push in to the rear fastener
(Do not bend the fins on copper-aluminium air heaters!)
2. Align air heater and screw firmly in place
3. Screw on the cover
4. Slide rubber collar covers over the return supply and return connections
5. Attach the supply and return connections.

**Removal of the air heater**

1. Shut off heat carrier
2. Completely empty the air heater
3. Disconnect the supply and return connections.
4. Unscrew the cover
5. Remove top and bottom fastening screws for the air heater
6. Pull out the air heater to the side

### 4.4.3 Rotary heat exchanger

**Fan arrangement**

The installation of rotary heat exchangers must always take place in accordance with the applicable sketches. On the one hand, the fan arrangement must take the supply and discharge air into consideration (pressure ratios), and on the hand the position of the impeller. If impellers with rinsing chambers are installed, the prescribed differential pressure between the external air and exhaust air must be adhered to.

**Drive**

The side cover sheets are removable and the motor side is easily accessible through quick-release fasteners. The motor position can be changed at any time without a problem. Since the motor is mounted on a pivoting motor base, the drive belts do not have to be retightened. The electrical connection of the motor must take place in accordance with the provisions of the local power supply company and the respective manufacturer's specifications. After installation, all openings on the rotor casing which can contribute to the flow of leakage air between the supply and discharge must be closed airtight.

### 4.4.4 Plate heat exchanger

**Cross flow**

In **Figure 4.11** various air ducts and the resulting accumulation of condensate with the plate heat exchanger are shown. Position 1 shows the heat output, whereas Position 2 symbolises the heat absorption.

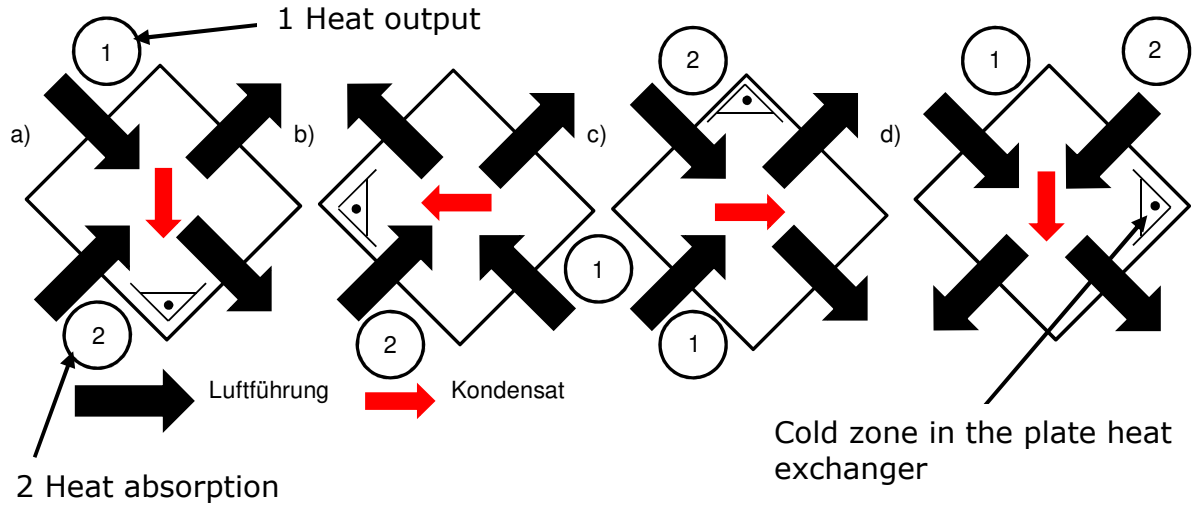



Figure 4.11: Condensate accumulation with the plate heat exchanger (cross flow)

There are four different cases:

a) The condensate is conveyed to the cold zone by gravity and flow. If a large amount of condensate accumulates, risk of freezing is smaller. If little condensate accumulates, risk of freezing is greater.

b) The condensate is conveyed to the cold zone by gravity and flow. If a large amount of condensate accumulates, risk of freezing is smaller. If little condensate accumulates, risk of freezing is increased.

c) The condensate is conveyed to the hot zone by gravity and flow. The risk of freezing is smaller.

d) The condensate is conveyed to the hot zone by gravity and flow. The risk of freezing is smaller.

**Plate heat exchanger with bypass and/or droplet separator**

If a plate heat exchanger with bypass is used, the electrical connection of the adjustment device must be made in accordance with the provisions of the local power supply company and the specifications of the motor manufacturer. The arrangement of the bypass flap is normally at the outside air intake side. The applicable drawing must be used for the individual case. A condensate discharge must be provided on the exhaust air side for plate heat exchangers with droplet separators.

**Cross counter-flow**

Cross counter-flow plate heat exchangers are normally used in HVAC systems in which circulating air is not permitted. In this case the discharge from the outside air flow is completely disconnected, because the two air ducts are routed past one another parallel to the "plates" according to the counter-flow principle. In doing so, a transfer of humidity or odours is eliminated.

### 4.4.5 Heat pipes

**Heat return unit as heat pipes**

The fin spacing is at least 2.00 mm on the supply side and 2.5 mm on the outlet side.

The heat recovery chamber must be equipped with a condensate pan made of stainless steel (at least 1.4301) with inclines on all sides. The heat recoverer must be arranged in such a way that it can be cleaned or removed from all sides in the installed state without necessitating the removal of other built-in parts.

### 4.4.6 Electric air heaters

**General instructions**

Electric air heaters are to be equipped with a flow monitor, a safety temperature monitor and a safety temperature limiter with manual resetting.

Instructions for the required flow monitor and an afterrun of the fan must be provided on the air handling unit. With the risk of damage from radiant heat and surface temperatures > 100 ℃, a safety clearance of 300 mm to the next component must be maintained (fire protection!).

### 4.4.7 Directly-fired air heater

**General notes**

Information and general instructions can be gathered from the unit-specific technical documentation from Rox-Klimatechnik GmbH.

## 4.5 Droplet separator

**Droplet separator**

The pulling along of droplets with the process must be prevented as a basic rule. The droplet separator must be equipped with a condensate pan made of stainless steel (at least 1.4301) with inclines on all sides. After switching off the system, no condensate may remain in the pan for hygienic reasons. The droplet separator is removable without having to remove other built-in parts and is equipped with removable fins for cleaning purposes.

**Siphon**

A suction-side and pressure-side siphon can be supplied, which are equipped with a non-return safeguard. In **Figure 4.12** the droplet separators from Rox-Klimatechnik GmbH are shown in the installed state.

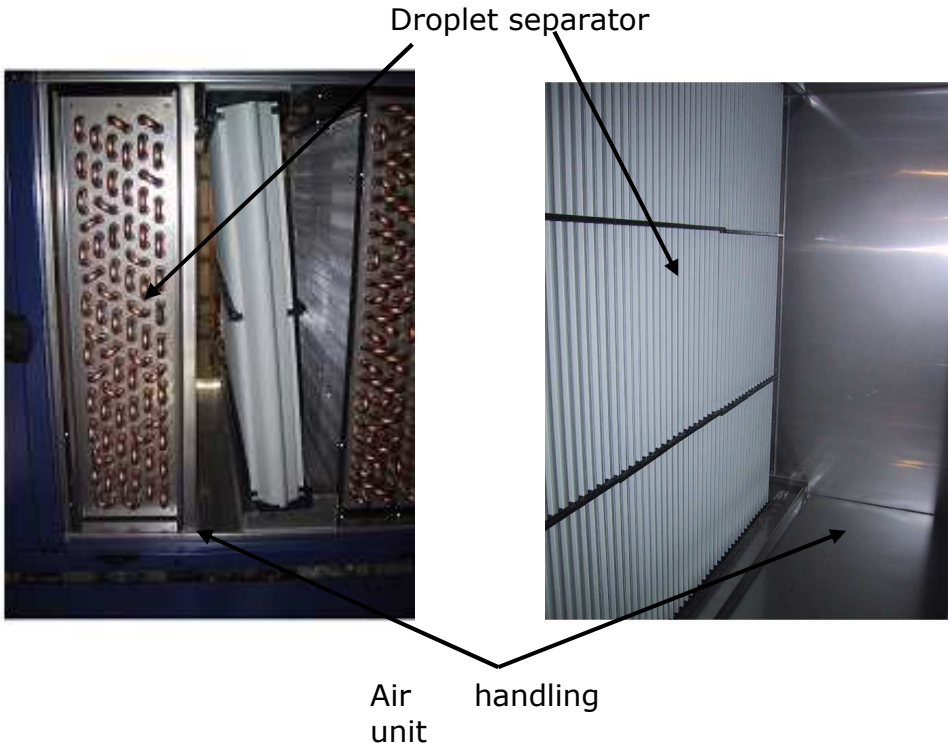



Figure 4.12: Droplet separator in installed state.

## 4.6 Sound attenuator

**Baffle silencers**

Absorption sound attenuators in air handling units from Rox-Klimatechik GmbH are equipped with removable baffle silencers.

The absorption material must be protected against mechanical damage. The baffles must be designed for cleaning so that they can be pulled out without having to remove other built-in parts. The support frames for the baffles have rounded entry and exit edges, upper and lower spacers and various baffle thicknesses. With pressure-side arrangement behind the fan, installation is possible without additional distribution equipment.

## 4.7 Fan

In the following section a general description of the various fan series used by Rox-Klimatechnik GmbH is given.

### 4.7.1 General notes

**Operator and work safety**

The operator of the air handling unit from Rox-Klimatechnik GmbH is obligated to only allow such persons to work on the fan who are familiar with the basic regulations over work safety and accident prevention and are instructed in working with a fan (see section 1 Expert personnel). The operating manual must always be kept at the place of installation of the air handling unit.

**Installation of the fan**

The fan is designed for conveying air. The transport supports on the fan base frame must be removed. The pressure and suction sides of the air handling unit must be connected to the duct system, the flaps must be opened and all inspection openings must be closed. The unit walls and inspection doors with their closures are part of the safety equipment.

**Fan direction of rotation**

The fan direction of rotation must be check on the basis of the arrow on the fan casing by briefly switching on the motor. If necessary, change the direction of rotation by reconnecting two phases.

**Electrical connections and safety equipment**

Electrical connections and safety equipment must conform to the valid regulations. The maintenance/service switch according to DIN 57111/VDE 0113 must be attached to the outside of the fan casing section and be lockable in the OFF position to prevent against unintended restarting with up to three locks. If the fan unit is supplied without a service switch, it must be installed on site so that the association of the fan is recognisable.

**Motors**

The connection and the commissioning of pole-switching motors or special motors, such as three-phase bypass, must be performed with extreme care by experienced experts in accordance with the manufacturer's specifications.

The drive motor must be inspected fro smooth, normal running and dirt depositing. In operating state, the current consumption must be measured with closed doors and compared with the type plate. If the direction of rotation is incorrect there is the risk of overloading the motor. The current consumption may not exceed

the specified nominal current. The maximum motor and fan speeds may not be exceeded. Inspection doors are only to be opened with the fan switched off and at a standstill. (Afterrun time approx. 1 to 3 minutes)

**Installation of the service switch**

With line cross sections of A=5x4 mm² = 20 mm² and greater, considerable force can be exerted on the cable guides of service switches, etc. For their wiring with a protection class greater than IP 44, Rox-Klimatechnik GmbH recommends the on-site installation of cable guard rails and accessories including pull relief in front of the cable guide into the casing (see **Figure 4.13**). Humidity damage caused through improper wiring, even on other components, is not covered by the warranty of Rox-Klimatechnik GmbH

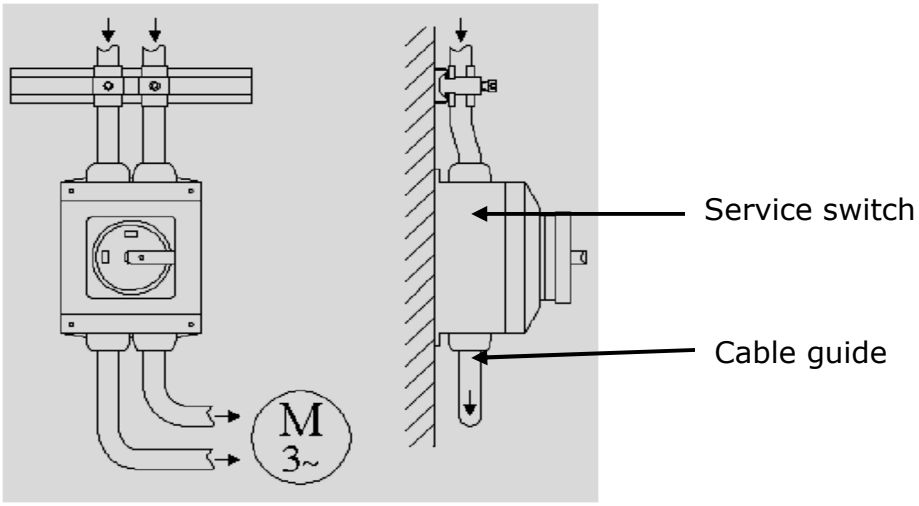



Figure 4.13: Representation of the proper installation of a service switch

### 4.7.2 Radial fans with freewheel

The fan, comprised of supply flow chamber with inlet blank, radial impeller with connection to the motor, electromotor, support construction and vibration attenuator, must be inspected on a regular basis in regard to impeller damage, imbalance, corrosion, contamination of the effectiveness of vibration attenuation. The motor bearings must be inspected, relubricated and/or replaced in accordance with the manufacturer's specifications. In **Figure 4.14** a radial fan with freewheel is shown in the installed state.

The fan must be cleaned as necessary, cleaned of rust in case of corrosion and re-coated. The geometric arrangement of the inlet blank to impeller must be check. During operation of the fan with a frequency converter, suitable measures must be taken to ensure that the maximum output specified on the type plate is not exceeded.

Normally, the drive motor is designed for continuous operation. In the case of repeated switching the motor can heat up above the permissible temperature through the high starting current. Under altered operating conditions the temperature in the motor can also increase. IN order to keep the starting current down, the specifications for the fan and the drive motor must be observed and the electrical

circuit and safety equipment must be appropriately dimensioned. This note applies in particular for the fan start-up with pole-switching motors.

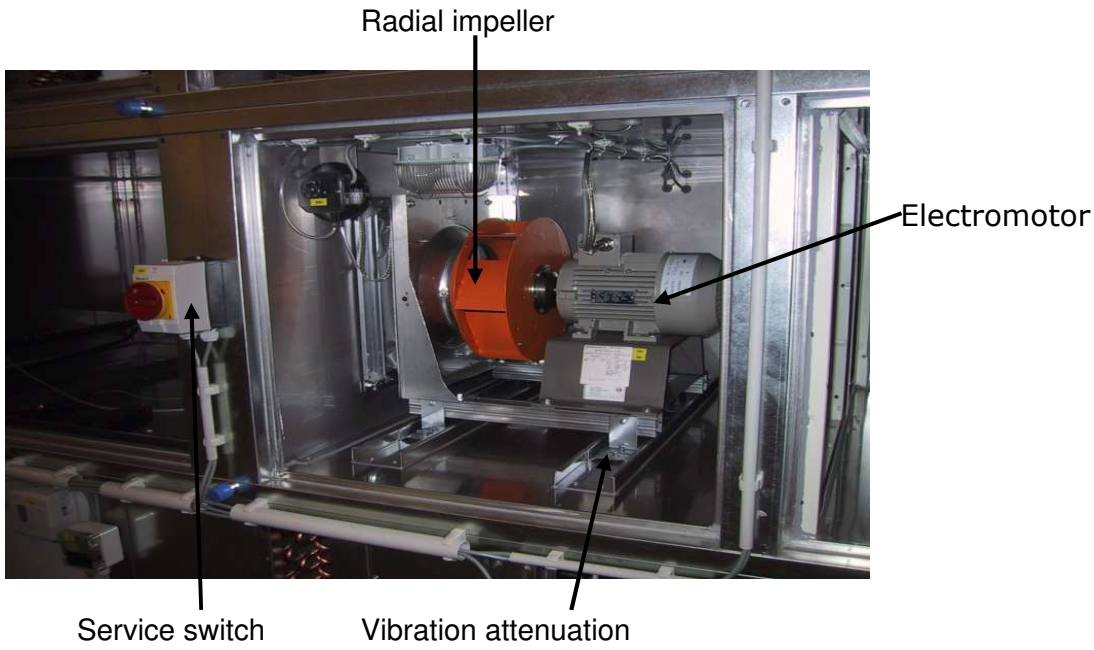



Figure 4.14: Representation of a radial fan with freewheel

### 4.7.3 Radial fans with V-belt drive

**Set equality**

The V-belts of a nominal measurement only deviate slightly from one another, so that the belts in PB quality can be cleaned unmeasured for sets.

**Tensioners**

If narrow V-belt-driven tensioners are used, the supported tensioners must be attached with the respective belt profile from inside, preferrably on the return strand. The tensioners should be installed as close as possible to the large pulley of the drive.

On the outside of a V-belt drive tensioners with flat running surfaces which tension on the reverse side of the belt can only be installed if the belt has a classic profile, however not with narrow V-belts. This should be arranged in the first third of the axle distance from the driving pulley out.

The tensioner should have at least the diameter of the small belt pulley. The play of a tensioner can only be determined by the scale chart. On the one hand, the belts must be routed over the outside diameter of a pulley and on the other hand a belt expansion of approx. 1 % over the entire service life must be taken into consideration.

With the routeing of a V-belt drive with tensioner, an appropriate safety factor must be taken into consideration.

**Storage**

V-belts should be stored in a dry room. They must be protected against thermal influences and direct sunlight. If possibly, they should be stored hanging freely and should never be tied up tightly.

**Belt guard**

When a belt guard is needed, a protective grating construction is preferential to a closed design because of the better ventilation.

**Alignment**

Perfect alignment is very important, because the belt edges will otherwise wear very quickly. The belts may not be forced into the grooves with a screwdriver or similar. Good alignment of the sides of the pulleys must be ensured. The regular inspection of the belt tension ensures a long service life of the belt.

The correct alignment of the pulleys must absolutely be ensured. This increases the service life of all related components. In addition, the energy consumption and vibrations are drastically reduced.

#### 4.7.3.1 Tensioning specification for V-belt drive

The V-belt drive is essentially maintenance free after the run-in period. However, Rox-Klimatechnik GmbH recommends checking the belt tension on a regular basis. The test load $F_p$is specified on the type plate and the layout data sheet. In **Figure 4.15** a V-belt drive is shown for this purpose.

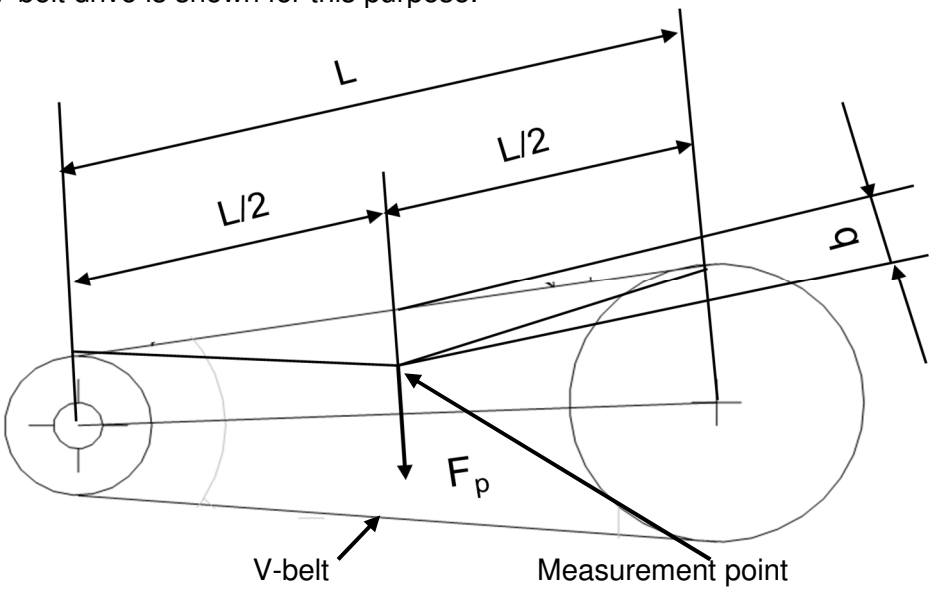



Figure 4.15: Representation of a V-belt drive

The correct belt tension is reached if a belt sag b = 16 mm per 1000 mm span length is possible with the individual test force $F_p$. The testing of the belt tension takes place above the static frequency of the drive belt. Here, the V-belt is natural displaced through slinging in natural vibration. This vibration is measured with an electronic measuring device (e.g. belt tension

meter). This vibration in Hz is to be adjusted to the specified value (documentation/type plate). The measurement point lies in the centre of the drive belt (see **Figure 4.16**).

### 4.7.4 Radial fan with flat belt drive

**Belt run and bearing temperature**

Pay attention to the faultless belt run. The bearing temperature must be monitored. The temperature of the bearing casing will usually rise to approx 50-60 °C (hand hot), rarely to 70 °C or higher.

If the temperature increases to higher values, the starting process must be repeated again after a phase and then a search for possible errors and remedy must take place. The belt tension may be too high. It must be checked that the bearing is well-greased, but not overgreased.

**Flat belt drive**

The flat belt drive is tensioned at the factory and does not need to be adjusted; it is maintenance-free. If a new flat belt is installed, the prescribed elongation must be adhered to. Excessive tension increases the bearing load, insufficient tension results in the belt slipping, squeaking and additional wear. Please observe the detailed instructions of the flat belt manufacturer.

#### 4.7.4.1 Tension specification for flat belt drives

Every flat belt drive must be dimensioned according to the drive specifications, whereby attention must be paid to the elongation achieved in the installation. A defined length is marked on the belt according to which the tensioning must be longer than the pre-tension (e.g. 1000 mm + 2% = 1020 mm in tensioned state). An exact alignment of the flat belt pulleys is required; too great of an alignment error becomes noticeable through the tendency of the belt to drift off. Before the test run, turn the pulleys in both directions by hand in order to check the run of the belt.

**Important general instructions**

- Never tension flat belts by feel!
- The required elongation must be precisely adhered to!
- Overtensioning of the flat belt can lead to bearing damage on the fan or the motor!
- Overtensioning of the flat belt can lead to damage to the
- flat belt.

**Tension specification for flat belt**

1. Install flat belt pulleys on the motor or fan shaft precisely aligned with one another and ensure cleanliness of the running surfaces of the flat belt pulleys. Make sure that the two shafts are parallel.

2. Install flat belts in a relaxed state on the two flat belt pulleys; pay attention to the running direction **(arrow marking on the flat belt)** of the flat belt!

3. Place two thin, waterproof markings (measurement markers) which cannot be wiped off at the greatest possible distance apart (e.g. 1000 mm or 800 mm) at a right angle to the relaxed, but not sagging flat belt. If the shaft spacing should be smaller, apply the measurement marks at a distance of 500 mm or 200 mm apart.

4. Tension flat belts by increasing the shaft spacing (motor tensioning carriage) until the distance between the measurement marks is increased by the value of the elongation ε (see **Figure 4.16**).

5. To check the flat belt run, the drive must be turned a few times by hand. The flat belt may not drift off even with a reversal of the direction of rotation.

**Calculation**

For clarification, a calculation for **Figure 4.17** for determining the exact measurement mark spacing on the tensioned flat belt is prescribed:

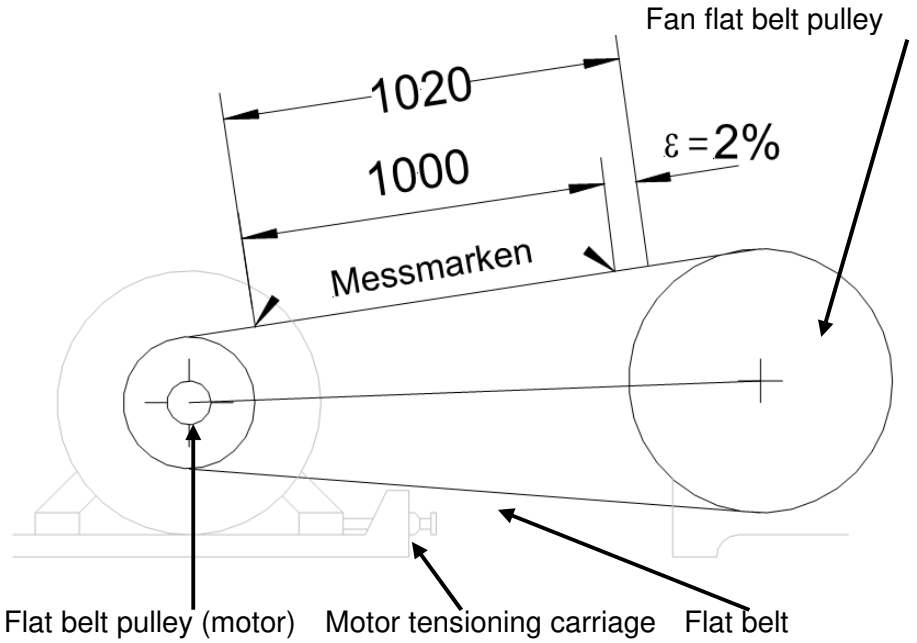



Figure 4.16: Measurement marks and elongation for determining the correct measurement mark spacing

**Example**

Given: Required elongation from the data card: **ε = 2%**
Measurement mark spacing on the relaxed flat belt: **$L_{Mu}$ = 1000 mm**

Wanted: Measurement mark spacing on the correctly tensioned flat belt: **$L_{Mg}$**
Solution:

$$L_{Mg} = \left[\left(1+\frac{\varepsilon}{100}\right)\cdot L_{Mu}\right] \pm 0{,}5\text{mm}$$

$$= \left[ \left( 1 + \frac{2}{100} \right) \cdot 1000\text{mm} \right] \pm 0{,}5\text{mm} = \ 1020\text{mm} \pm 0{,}5\text{mm}$$

**Flat belt initial installation**

In order to prevent the occurrence of high axle forces on the initial tensioning of the flat belt, especially when very large outputs must be transferred, the tensioning of the flat belt can also take place in stages. For this purpose, the new flat belt must first be tensioned to at least 1.5% of the elongation and then run in for approximately three hours. Afterwards, the flat belt can be re-tensioned to the elongation ε specified on the technical data sheet of the flat belt.

#### 4.7.4.2 Flat belt end and reassembly

**Procedure for the flat belt installation and reinstallation**

1. Before relaxing the flat belt, measure the exact spacing of the measurement markings. If the measurement markings are not longer visible, new markings must be made.
2. Relax the flat belt completely and remove it.
3. For the reinstallation, place the flat belt on and tension it until the original measurement marking spacing is re-established.
4. Then follow the instructions under section 4.7.4.1.

#### 4.7.4.3 Flat belt pulley with collar

**Flat belt pulley with collar**

Flat belt pulleys with collar (see **Figure 4.18**) are used increasingly more in the ventilation industry in order to prevent belts from driving off during the run-in phase.

In addition to the sectional representation of the flat belt pulley with collar in **Figure 4.17**, a taper V-belt pulley and a taper flat belt pulley are compared in **Figure 4.18** (see section 4.7.4.4).

**Correct alignment of flat belt pulleys**

Continuous contact of the flat belt with the collar results in the destruction of the flat belt. Therefore, the correct alignment of the pulleys must absolutely be ensured. This increases the service life of all related components. In addition, energy consumption and vibrations are drastically reduced.

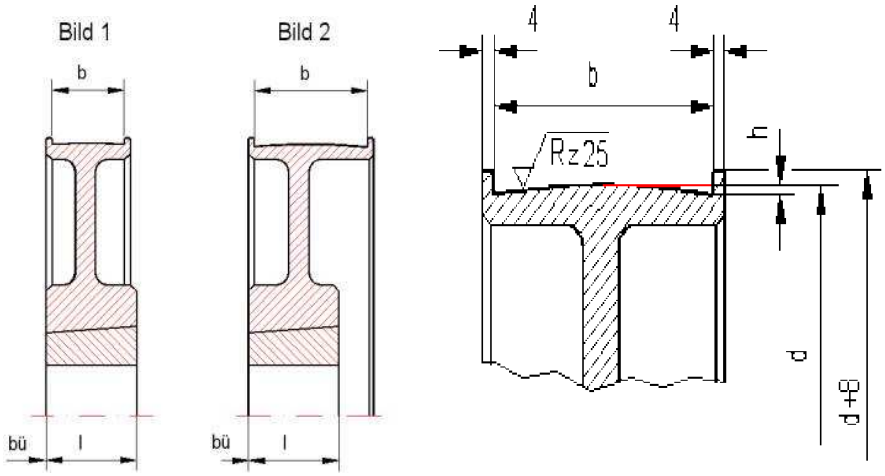



Figure 4.17: Sectional representation of flat belts with collar

a) Taper for V-belts

b) Taper for flat belts

Figure 4.18: Flat belt pulleys for V-belts and flat belts

#### 4.7.4.4 Taper-Lock drive

**Installing the flat belt pulley**

- Clean and degrease all unfinished surfaces.
- Fit the pulley and bushing together.
- Position holes on the cover and loosely screw in the screws.
- Slide the pulley with bushing onto the shaft and align.
- Tighten the screws evenly.

**Removal of flat belt pulleys**

- Remove screws.
- Screw in one of these screws as a lifting screw into the hole with
- a half thread into the bushing and tighten.
- By doing so, the Taper–Lock bushing is loosened.
- Remove the pulley unit, having become loose, without striking and without
- causing damage to the machine.

If high torques must be transferred and no fitted key is used, the Taper-Lock clamping bushing can be driven back into the conical hole using a suitable sleeve or a log. Afterward, the screws can be retightened somewhat. This process can be repeated.

The empty holes should be filled with grease in order to prevent the penetration of foreign objects.

## 4.8 Humidifying equipment

### Humidifier chamber

The humidifier chamber must be equipped with a pan made of stainless steel (at least 1.4301). The length of the humidifier section must correspond the specifications of the humidifier manufacturer in observance of the increase of humidity, air speed and temperature. For connection to external supply systems, observe the manufacturer's specifications!
In the case of air handling units for outdoor installation, make sure that the appropriate anti-freeze protection is provided!

### 4.8.1 Steam humidifier

Steam air generators for direction connection to the water mains (pressure 1-8 bar) for controlled operation 0-100%. The steam humidifier is equipped with one or two cylinders made of recyclable plastic material (polypropylene) which are easy to clean and/or replace. For the steam distribution, in the steam distribution system with several nozzle fittings is used in the air handling unit or in the duct, enabling the fast distribution and acceptance of the steam in the air flow. The construction of the nozzles ensures that the steam is only taken from the centre of the pipes, to that only dry steam and no condensate is distributed.

For the assurance of a maximum service life of the cylinder and for the minimisation of the current consumption, the steam humidifier automatically adapts to the given water qualities. This takes place through the changing of the fill and blowdown cycle frequencies depending on the discovered conductivity of the water. The commissioning program to be implemented through the display enables the maximum steam output to be limited to at least 50% of the nominal steam output, if necessary.

Water is brought to a boil in a cylindric container. The electrode systems which use the conductivity of the water for heating are also spread. The steam generated in this manner is transported in pipelines to the humidifier chamber and distributed in a steam lance in the air flow.

### 4.8.2 Contact humidifier/evaporative humidifier

The water is distributed over a porous surface where the air to be humidified flows. The evaporation takes place on the large and damp surface. The water which is not evaporated is conveyed back to the circuit and the contact surfaces. The humidifier must be equipped with a pan with inclines on all sides to that complete emptying is possible. Drop separators and rectifiers are to be made so that they can be disassembled for cleaning.

An inspection opening must be available. An inspection port (min. 150 mm diameter) incl. lighting and a method for darkening must be available. The dry run protection of the pump must be assured and a blow-down device must be available. The flow speed must be limited to a max. 3.2 m/s based on the connection cross-section. The surface quality of the unit must correspond at least to the quality of stainless steel (at least 1.4301), anti-corrosive aluminium (at least AlMg) or glass-fibre reinforced plastic.

### 4.8.3 Spray humidifier/adiabatic humidifying

Spraying of water in a humidifier chamber. Based on the relatively large droplets, only a small share of the water coming through the nozzles is evaporated. The water which is not evaporated collects in a pan and is returned to the nozzles.

## 4.9 Integrated heating system

**Oil burner**

Burner casing with sound attenuating intake casing . Transverse combustion air fan with oil pump and solenoid valve. Actuator for the control of the air flap for various load points. Fully-electronic control and diagnostics system in one or two-stage operation. Adjustable nozzle fitting for pressure-side control of the combustion air. Automatic de-airing of the nozzle with "no-air" use. Electronic igniter with shielded ignition lines. Microprocessor-controlled firing manager with e-BUS connection and fault output. Note of the last fault message via blink code. Wiring of the individual units with coded plugs. Oil catch pan with float switch. Conforms with EN267. Connection/commissioning on site.

**Gas burner**

Transverse combustion air fan. Sound attenuating intake casing. Electronic gas-air mixture control with separate multiphase motor drives. Fully electronic control and diagnostics system, smoothing two-stage or modulating mode. Special mixing device for low emission values through internal flue gas recirculation. Microprocessor-controlled firing manager with integrated seal control and LCD display as well as BUS connection and fault output.

**Directly fired air heaters**

Directly fired air heaters with calorific value technology for increased efficiency, with connection for flue gas removal. Combustion chamber appropriate for condensation operation, complete with heat-resistant stainless steel AISI430 with connection for condensation discharge. The accumulating condensate must be discharged in accordance with valid directives.

The system must be provided with a safety thermostat which switches off the burner when the highest permissible temperature is reached. The burner may only operate after the fan is switched on and a fan after-run controller has been provided. The combustion chamber connection flange must be suitable for all common manufacturers for oil burners and gas burners.

## 4.10 Instrumentation and control technology

The freely programmable pCO controller is the centrepiece of the **ROX DDC control system**. The program logic is stored and performed on it. All field instruments run here together. Multiple controllers can communicate with one another through an internal bus system, whereby expansions or an interconnection of several systems is enabled. ROX control systems always work according to the latest state of technology and are optimised to ensure the most **energy-efficient system operation** possible. There is the possibility of data logging, whereby an analysis and optimisation of the system is also possible after commissioning.

The integration of **electronic overheating controllers** for the control of expansion valves offers the advantage of integrating operating data of cooling systems into the information flow of the system. In addition, there is also the possibility of permanent monitoring of the cooling circuit and of reducing the cooling output in the case of threatening pressure faults. The **terminal** for operation is normally installed directly on the switch cabinet. An additional terminal can also be installed at another location in the building. All operating states and data for the system are displayed on the terminal; target values can be changed. The structuring takes place clearly laid out in menus which are subdivided into different access levels. All fault messages are displayed in clear text. Multilingual programming is problem-free. The connection to a superordinate **building control system** is made problem-free through various bus protocols as well as Modbus, BACnet, etc. The programming of the bus connection takes place in coordination with the customer.

### 4.10.1 Switch cabinets and operator panels, control units

The control system software is equipped by standard with a complete **manual automatic level**. This can be expanded to a hardware-side manual shift level on request. In addition, it is possible to display various status messages through LEDs. The operation terminal can optionally be installed locking in the switch cabinet.

## 4.11 Electrical components

### 4.11.1 Electromotors

All information for this is presented in section 4.7.1.

### 4.11.2 Service switches and terminal boxes

All information for this is presented in section 4.7.1.

### 4.11.3 Frequency converter

**Frequency converter**

Frequency converters are intermediate circuit voltage converters for the infinitely variable speed control of three-phase asynchronous motors, especially for the drive of compressors (pumps and fans with quadratic load torque). Frequency converter work without capacity reduction at nominal motor speed as compared to direct mains operation.

They are equipped with a control panel with clear text display for commissioning adjustments and representation of all relative operational data with keys for start, stop, manual and automatic mode.

**Standards and directives**

- EMC Directive 89/336/EEC
- Low-Voltage Directive 72/23/EEC
- EN 50081-1 Transient emissions
- EN 50082-2 Generic immunity
- EN 50178 PELV Safe galvanic disconnection of control inputs

**Standard functions**

- Automatic motor adjustment,
- automatic start-up and delayed start adjustment,
- min. and max. speed limiting,
- fixed speed selection,
- speed fading,
- direct current brake,
- synchronisation on already-running motor,
- motor thermistor evaluation,
- V-belt monitoring,
- Operating hour meter,
- fault message memory and
- PID controller (scalable in process sizes).

**Assembly**

The frequency converter is to be installed in the factory in a suitable location, operable from outside and in adherence to EMC Directive 89/336/EEC, in particular.

## 4.12 Integrated cooling system

**Integrated cooling system**

Integrated cooling systems are cooling machines with a refrigerant as a medium for thermal transfer within the air handling unit. Compressors and fittings are (usually)

installed separated from the air flow for maintenance and operation during unit operation. The cooling of the supply air by means of direct vaporiser, the re-cooling of refrigerant through a condenser installed in the outlet flow of the air handling unit.

**Auxiliary**

- Electrical casing heating,
- suction and pressure-side shut-off valves,
- tested refrigerant collector,
- liquid shut-off valves with cap,
- refrigerant sieve and filter dryer in the liquid line, sight glass with humidity indicator,
- thermostatic or electronic expansion valve,
- electronic intake throttle valve,
- hot gas bypass controller with post injection valve and
- service valves in sufficient quantities.

**Piping**

The internal piping of the cooling circuits must be made with high-quality, seamlessly drawn, de-oiled and deburred copper pipe. The intake mixture line is soldered under inert gas and provided with diffusion resistant thermal insulation. The cooling system can be pressure tested and in accordance with DIN and identified for accident prevention regulations, fully installed, evacuated, tested for tightness, with refrigerant and installed with proportionate oil filling, ready for operation.

**Recommendation**

Depending on local regulations a flow monitor may be prescribed instead of a temperature limiter. We recommend equipping the drive motor with motor protector.

## 4.13 Connection to external media and energy supply systems

**Humidifying equipment and adiabatic cooling (evaporation cooling)**

When connecting air humidifiers to on-site water mains, it must be ensured under all circumstances that a return of the water from the humidifier line to the mains is prevented. Stagnation within the humidifier line is only permitted under certain conditions. For this purpose, the adherence to the specifications for drinking water hygiene according to DIN 1988-4 as well as DIN EN 1717, VDE 6022 and VDI 6023 is mandatory.

# 5 Commissioning and maintenance

## 5.1 General notes for the commissioning and maintenance of air handling units

In order to ensure proper operation of air handling units, the commissioning and maintenance may only be assigned to trained expert personnel. The time intervals for the inspections, cleaning and maintenance depend on the duration of daily operation, the air contamination and the filter type, the water quality and the type of humidification, among other things. The intervals must be commonly defined by the system builder and the operator after completion of the test run under the guidance of existing standards and directives.

**Commissioning air handling units**

The instructions for the commissioning of air handling units and/or integrated components are presented in sections 5.1 to 5.12.

**Maintenance for air handling units installed indoors**

- There is danger from electrical current and rotating unit parts.
- Personal protection must be ensured.
- The air handling unit must be cleaned with greater frequency when the air contains oil or aggressive media.

Basically, the entire casing, parts and accessories, such as

- doors and inspection openings,
- seals,
- handles and closures,
- connections with foam rubber seals,
- sight windows and
- panels must be checked for damage and proper seating.

**Maintenance doors and inspection openings**

The seals must be checked and replaced as necessary. The door catch for pressure-side inspection doors must also be checked for function.

**Maintenance panels**

The panels must be inspected for damage and corrosion. If necessary, the anti-corrosion protection and/or paint must be renewed.

**Siphon maintenance**

The existing siphons must be cleaned and refilled.

**Hygienic controls**

All built-in parts must be inspected for soiling and cleaned, if necessary, as part of the hygienic control. Then a wiping disinfection must be performed, whereby the disinfectant may not attack the used materials. All seal materials must be inspected for germs and fungus and cleaned or replaced if necessary.

**Maintenance for air handling units installed outdoors**

In addition to observing the instructions for the "Maintenance for air handling units installed outdoors", roof units must be inspected for tightness, the panels and cover plates (e.g. baffles and drip guards) must be inspected and the weather protective grating for outside and exhaust air must be cleaned once per year.

**Condensate outlet maintenance**

The condensate outlets must be cleaned regularly and inspected for dirt.

## 5.2 Louvre valves

**Instructions for commissioning**

- There is danger from electrical current and rotating unit parts.
- Personal protection must be ensured.
- The proper mechanical installation must be ensured.
- The servo motor must be connected properly. In this case,
- the manufacturer's specifications must be observed.
- The lever and the gearwheel drive must be safeguarded against reaching in.
- If multiple flaps are coupled together, the connecting rod must be checked for proper seating and ease of movement.
- The rod must b adjusted so that the swing angle of 90° is guaranteed and the flaps reach their end position when closing. The correct tightening torque (see manufacturer's specifications) must be ensured.

**Maintenance**

The louvre valves must be checked periodically for function, soiling, damage and corrosion. If necessary, they must be cleaned and damage and corrosion must be repaired. The safety equipment must be checked periodically for effectiveness.

In the case of louvre valves with rod drive, the rods must be checked periodically for firm seating and movement. If brass bearings are present, they must be lubricated as necessary (plastic bearings do not require lubrication). The rods must also be lubricated as necessary.

**The louvre valves with gearwheel drive are not oiled or greased.**

## 5.3 Air filter

**Instructions for commissioning**

- The filter unit and the inserted filter must be checked for damage.
- The filter unit must be checked for proper seating in the support frame.
- Any accumulated dust must be cleaned off of the filter unit and the system parts in the air flow direction, insofar as necessary.
- Before the installation of filters of filter class F9 or higher, the air handling unit and the ventilation ducts must be cleaned once more.
- If the fan or fans are operated, the starting pressure differential on the measuring device must be marked and logged.

**Pocket filter maintenance**

These pocket filters must be placed in the air handling unit on sliding rails and easy to replace. The moltoprene seals and the foam seals at the vertical contact points must be inspected at the time of filter change for proper condition and replaced as necessary.

The differential pressure measuring devices as well as the contactors must be checked for function. If necessary, the measuring liquid (if present) must be refilled.

**Active carbon filter maintenance**

On repletion of the active coal, which means the expiration of the prescribed number of operating hours, the active carbon filter must be replaced. For the monitoring of the repletion, it is possible to check the weight increase by weighing the cartridge and marking down the measurement accordingly before re-weighing it after a certain amount of time. The filter support plates with active carbon filter cartridges must be checked for proper seating. In order to avoid reducing the service life of the expensive active carbon filter, an intact prefilter stage and fine filter stage must be ensured. In addition, the special maintenance instructions of the respective manufacturer must be observed.

**Grease catch filter maintenance**

The filter cells are made of aluminium wire mesh, whereby each air filter cell is equipped with an integrated grease collection pan. The filter cells must be washed out in a cleansing bath every 3 to 6 months and cleaned in a grease collection pan.

**Filter monitoring/filter replacement**

All filter elements of an HVAC system must be inspected at least once per month. The degree of contamination should be constantly monitored with a differential pressure manometer (e.g. inclined pipe or U-pipe manometer):

- The filter must be inspected for contamination, corrosion and damage.

- The filter support as well as the filter insert must be checked for tightness; the seals are to be replaced as needed.
- The differential pressure must be measured.
- The recommended final pressure differential for the pocket filter or the compact filter must be observed (see Table 5.1).
- The filter inserts must be replaced as necessary.
- The replacement pockets must be protected against damage.

The filters' final resistances according to DIN EN 13779 (see **Table 5.1**) are:

| Filter class | Recommend final resistance in Pa |
|---|---|
| G1-G4 | 200 |
| F5-F7 | 200 |
| F8-F9 | 300 |
| H0-H14 | 500 |

Table 5.1: Representation of the filters' final resistances according to DIN EN 13779

**Maintenance for removable filter pockets**

For the maintenance of removable filters, a sufficiently large working space of at least one unit depth must be present on the operation side (dust-laden-air-side filter maintenance).

**Replacement filter**

At least one set of reserve filters must be kept on hand and must be stored in a dry and dust-free environment. Damage to the filter surface must absolutely be avoided, otherwise the filter can tear during use. As a result, the filter class can no longer be guaranteed. After the expiration of the minimum service life, the filters may no longer be used. Only permitted filter media may be used for air handling units from Rox-Klimatechnik GmbH.

**Danger from flammable materials**

The filter material can be flammable and can easily ignite. The risk of fire can increase with the filters used depending on the filtered materials. The filters must be kept away from open flame.

**Filters/air handling unit**

The air handling unit should never be operated without filters. Rox-Klimatechnik assumes no liability nor guarantee for contamination of the unit resulting from missing filters.

**Environmentally-compatible disposal**

Heavily soiled filters endanger human health and can have a negative impact on production processes. The dirty filters must be disposed of with separate waste, depending on the filtered materials, and must be disposed of in accordance with applicable directives and laws in a correct and environmentally-compatible manner.

## 5.4 Heat exchanger

### 5.4.1 Fin register heat exchanger

**Instructions for commissioning**

When filling or bleeding heat exchangers, no hot media may be used, because there is the danger of scalding. In order to avoid skin burns, no hot surfaces may be touched. Physical contact must also be avoided when filling or bleeding with brine. In this case there is the risk of poisoning or irritation. The manufacturer's information must always be observed and specially requested as necessary.

The permissible pressure level may not be exceeded (see technical data sheet).

In order to prevent the freezing of the air heater, the anti-freeze medium must be added (see technical data sheet) or, depending on the system design, a condensate-side anti-freeze protection monitor must be installed.

A sufficient difference between the max. surface temperature of the heat exchanger (based on the media temperature) and possible minimum ignition temperature of the potentially present ignitable mixture in accordance with EN 1127 must be ensured.

In order to prevent damage to the system from overheating, steam heat exchangers may only be operated with the fan running. An air flow monitor or a temperature limiter must be provided. The proper connection of the supply and return (counter flow principle) must be ensured.

The system must be rinsed (removal of dirt) and filled with the heat transfer media in the appropriate concentration specified in the technical data sheet. For example, an excessive share of glycol can result in reduced capacity whereas too little glycol can promote frost damage.

The air heater must be carefully bled at the highest point of the system when the system is filled. For this purpose, the bleed screw at the upper connection port and/or the separate bleed screw must be opened. When air heaters are not properly bled, air cushions form which lead to a reduction in capacity.

After commissioning, the screw connections of the flanges must be checked for tightness and retightened if necessary.

**Maintenance of fin register heat exchangers**

Before beginning maintenance work it must be ensured that the heat exchangers have cooled down to environmental temperature. The heat exchangers must be cleaned in the installed state. If they are not accessible, they must be installed so that they are removable for cleaning. The removed dirt may not enter the nearby system parts. The dirt and the dirty water must be carefully removed in an environmentally-compatible manner.

The following instructions must be followed as a basic rule:

- The fin register heat exchangers must be checked periodically for a hygienic state, for potential air-side contamination, for damage, tightness and corrosion.
- The fin register heat exchangers must be bled (periodically).
- The fin register heat exchangers must be cleaned on the air side.
- Both the supply and return must be checked for function.
- The fins may not be bent.

During periods of extended shutdown, particularly when there is a risk of freezing, the fin register heat exchangers must be completely emptied. For this purpose, first remove the bleed screws and then the drain plugs. To complete emptying, each fin register heat exchanger should be blown out with air.

**Cleaning the air side**

A good air filtration prevents the soiling of heat exchangers. If coarse dusts and fibres accumulate at the air intake side, this dirt is to be removed with a vacuum cleaner, for example. Dirt between the fins must be removed with compressed air, steam or warm water with a suitable cleanser. When cleaning the fins there is the risk of cutting on the thin edges.

**Cleaning the water side**

The dirt trap in the system must be checked and cleaned at regular intervals. The rinsing of the water passages is generally not sufficient for removing dirt without have residue. If necessary, specialty companies must be contacted for this purpose.

**Removability**

In order to be able to pull the heat exchangers out of the air handling unit, detachable connections with screw couplings or flanges must be made. Supply lines may not hinder other built-in parts, such as filters and fans. The functional safety of the anti-freeze protection measures and system parts must be checked. The circulating hot or cold water must correspond to the requirements in accordance with VDI directive 2035 in regard to its quality. Corrosion and limescale in the water system must be prevented through appropriate chemical measures.

#### 5.4.1.1 Directly-fired heater unit

The information about the commissioning and maintenance can be found in the respective accompanying documentation.

### 5.4.2 Rotary heat exchanger

**Instructions for commissioning**

If the current supply is not disconnect at all poles, there is the risk of crushing and scraping of the limbs from sudden starting of the rotor through the automatic cleaning run or automatic restarting after a power failure.

Before commissioning, it must be ensured that no objects block the free movement of the rotor. Foreign objects and dirt must be removed.

The sealing strips must be checked for contact pressure. They must be pushed in as closely as possible to the storage material, whereby direct abrasion under operating pressure must also be avoided.

Basically, the bearing of the rotor as aligned at the factory. Depending on the installation conditions, however, a readjustment may be necessary. For this purpose, observe the manufacturer's instructions.

In addition, check before commissioning whether the belt (V-belt, Powerbelt, etc.) has sufficient tension. Since the belts are subject to natural elongation, the tension of the belt should be checked on a regular basis especially in the first 300 hours of operation.

The direction of rotation of the rotary heat exchanger must be checked. If necessary, disconnect the drive motor electrically. With a built-in rinsing zone, the heat accumulator must rotate from the discharge through the rinsing chamber to the supply. In order to prevent contamination of the supply air with the discharge air, the pressure potential of the fans must be selected in such a way that the system-based leakage flows from the supply side to the discharge side. For ATEX units, zone spreading must absolutely be avoided.

**Maintenance**

The rotary heat exchanger operation is essentially low-maintenance. The ball bearings and the gear motor (lifelong filling) do not require any maintenance under normal operating conditions.

The current supply must be disconnect at all poles for the maintenance, because there is the risk of crushing and scraping of the limbs from sudden starting of the rotor through the automatic cleaning run or automatic restarting after a power failure.

Otherwise, the following instructions must be observed:

- The rotary heat exchanger must be inspected periodically for hygienic state, for foreign objects, dirt, damage and corrosion.
- The sealing strips must be checked periodically for dirt, foreign objects and contact pressure.
- The sealing strips must be cleaned and replaced when worn out.
- The contact pressure of the sealing strips must be adjusted as necessary.

- The drive belts must be checked periodically for wear and tension and shortened
  if necessary or replaced.
- The rotary heat exchanger must be checked periodically for imbalance and lateral run out.
- The rotary heat exchanger must be balanced and aligned if necessary.
- The bearing must be checked periodically for impermissible heating, vibration or running noise.
- The water discharge and the siphon must be checked periodically for function and cleaned as necessary.

**Decommissioning**

With periods of extended standstill of the rotary heat exchanger, the rotor should be operated intermittently to maintain the self-cleaning.

### 5.4.3 Plate heat exchanger

**Instructions for commissioning**

In order to avoid damage to plate heat exchangers, the maximum permissible pressure gradient from supply to discharge may not be exceeded.

**Maintenance**

- The plate heat exchangers must be inspected periodically for hygienic state, for foreign objects, dirt, damage and corrosion.
- Foreign objects, dirt, damage and corrosion must be removed.
- The water discharges and the siphons must be checked periodically for function and cleaned as necessary.

**Cross flow heat exchangers**

The maintenance of the cross flow heat exchanger is limited to the visual inspection and checking the degree of soiling of the fins. If the heat exchanger is designed with a system to protect against frost formation, it must also be inspected. In addition, the ease of movement of any existing flaps must be checked.

### 5.4.4 Heat pipes

The information about the commissioning and maintenance can be found in the respective accompanying documentation.

### 5.4.5 Circulation unit system

The heat recoverers must be arranged in such a way that it can be cleaned or removed from all sides in the installed state without necessitating the removal of other built-in parts. The fin spacing is at least 2 mm on the supply side and 2.5 mm on the outlet side. The heat recovery chamber must be equipped with a stainless steel condensate pan (minimum material number 1.4301) and corresponding inclines.

**Maintenance of circulation unit systems**

The circulation unit systems are to be maintained analogously to the fin register heat exchanger.

**Pumps**

The installed pumps and the corresponding frequency converter must be checked periodically.

**Shut-off and regulating fittings**

An inspection must be performed at least twice per year for external soiling, damage, corrosion and movement. If necessary, they must be cleaned on the outside. In addition, a tightness check must be carried out.

**Dirt trap**

An inspection must be performed at least twice per year. If necessary, they must be cleaned.

**Pipelines and expansion tanks**

The following work must be performed at least semi-annually:

- Inspection for damage.
- Inspection for fastening.
- Visual inspection of the insulation for damage.
- Inspection of thermometers for damage.
- Inspection of manometers for damage.
- Inspection of liquid level and fill pressure.
- If necessary, refill liquid.
- Pipes with anti-freeze must also be line-bored.
- Functional check of safety equipment.
- Bleeding.

### 5.4.6 Electric air heaters

**Commissioning**

The electric air heaters may only be operated if a flow monitor is present. During operation of the system without sufficient cooling (e.g. shut-off of the system via main switch when the electric air heater is running or in case of an emergency shut-off through the safety mechanisms) overheating damage to the electric air heaters, casing, built-in parts, etc. can occur.

The air flow must be monitored by measuring the pressure differential at the fan part with an air pressure monitor. The function must be checked at the time of commissioning. The current consumption must be checked by measuring at all phases. The target data must be gathered from the type plate. If the target data is exceeded, contact Rox-Klimatechnik GmbH customer service.

**Maintenance**

Before beginning maintenance work, the heater rods must be allowed to cool down to environmental temperature. The hot heating rods may not be grasped. This could result in skin burns. The following instructions must be observed:

- The function of the air flow monitor must be checked periodically.
- The electric air heater must be checked periodically for function, hygienic status, dirt, damage, corrosion and fastening.
- The electric air heater must be cleaned.
- Damages and corrosion must be repaired.
- The function of the safety temperature limiter must be checked periodically.

## 5.5 Droplet separator

The droplet separator must be removable from the front of the casing for cleaning and maintenance purposes and can be taken apart for maintenance purposes. The fins are removable and can be cleaned individually. Dirty and calcified droplet separators lead the the emergence of droplets. For the decalcification and cleaning of the droplet separator fins, Rox-Klimatechnik GmbH recommends using the agent ROGA-LIN from ROGA–Chemie in Aachen.

**Maintenance**

- The droplet separator fins must be checked for dirt and damage.
- The droplet separator and the condensate pan must be cleaned with air, water, steam and standard degreasing cleansers.
- The water outlet and the siphon must be inspected periodically and checked for dirt, damage and corrosion.
- If necessary, the water outlet and the siphon must be cleaned.

## 5.6 Sound attenuator

The sound attenuators used by Rox-Klimatechnik GmbH are essentially maintenance-free. After a longer operating time we recommend vacuuming the sound attenuator with an industrial vacuum cleaner. The glass fibre cover can be cleaned and washed off.

**Commissioning**

The baffles must be checked for damage and dirt at the time of commissioning.
**Maintenance**

The sound attenuators must be subjected to a visual inspection in the scope of the maintenance work. The sound attenuator chambers and the sound attenuator baffles must be checked for hygienic state, dirt, damage and corrosion. The baffles must be cleaned and possibly repaired with a repair set. Accumulating corrosion must be removed.

## 5.7 Fan

**Encapsulated drive motor**

With encapsulated drive motors the intake grating must be inspected periodically and cleaned if necessary. If the intake grating should be clogged with dirt, there is the risk of motor damage or shutdown through the triggering of the thermal-contact protective function (posistor) in the motor.

**Standstill of the fans**

In order to prevent standstill storage damages (e.g. time period between assembly and commissioning), the drives must be actuated by hand in regular intervals in order to prevent bearing point loads.

**Fan**

The fan may only be switched on if the opening of the respective jointed flaps have been checked or displayed by means of a limit switch. Through the control system it must be ensured that when the shut-off flaps close the respective fans are immediately switched off. Rox-Klimatechnik GmbH assumes no liability for damages on the basis of improper operation.

In order to avoid damages from pressure surges with fire protection flaps in the air handling unit, overpressure flaps must be provided. In the case of flaps which are coupled with one another, the connecting rod must be inspected for non-positive connection and correct function, meaning the direction of rotation and limit position of the flaps. All screw couplings and connections must be checked for correct fastening. In the case of drives with servo motors, the rods must be installed so that the swing angle α = 90° is provided and the flaps reach their limit position when closing.

**Transport supports and fans**

The transport supports on fans and other built-in parts must be removed.

**Belt drive and belt tension**

V-belt tension and V-belt drive and/or flat belt drive must be inspected before and after test runs.

**Motors and fans - direction of rotation**

After installation of the safety equipment, the direction of rotation of motors and fans must be checked.

**Commissioning**

The fan is designed for conveying air. The transport supports on the fan base frame must be removed. The pressure and suction sides of the air handling unit must be connected to the duct system, the louvre valves must be opened and all inspection openings must be closed.

The casing walls and inspection doors with their closures (rotary bolts) are part of the safety equipment. The fan direction of rotation must be check on the basis of the arrow on the fan casing by briefly switching on the motor. If necessary, change the direction of rotation by reconnecting two phases.

The electrical connections and safety equipment must conform to the valid regulations. The maintenance/service switch according to DIN 57111/VDE 0113 must be attached to the outside of the fan casing section and be lockable in the OFF position to prevent against unintended restarting with up to three locks. If the fan unit is supplied without a service switch, it must be installed on site so that the association of the fan is recognisable.

The connection and the commissioning of pole-switching motors or special motors, such as three-phase bypass, must be performed with extreme care by experienced experts in accordance with the manufacturer's specifications.

The drive motor must be inspected fro smooth, normal running and dirt depositing. In operating state, the current consumption must be measured with closed doors and compared with the type plate.

The fan may not be operated with the louvre valves closed. The correct function (smooth running, vibration, imbalance, power consumption in all three phases, controllability) must be checked periodically.

The intake openings may never be blocked. The protective grating or the reach-in safeguard must be checked periodically for dirt and cleaned if necessary. Prior to checking the direction of rotation, foreign objects must be removed from the fan area. The fan impeller must be rotated a few times by hand and the ease of movement is to be checked. The direction of rotation must be checked by briefly switching on the fan. If the direction of rotation is incorrect the motor can be overloaded. A reach-in safeguard and/or a protective grating must be mounted on the fan motor. In the case of three-phase motors the direction of rotation can be reversed by swapping two phases. With single phase motors the direction of rotation can be changed by changing the current direction.

**Maintenance (periodic)**

- The fan must be checked for hygienic state, dirt, damage, corrosion and fastening.
- The impeller must be checked for imbalance and vibrations and re-balanced, if necessary.
- The bearing must be checked for noise, vibrations and heating.
- If necessary, the bearings must be replaced, however this must take place after the expiry of the theoretical service life.
- The bearings must be lubricated as necessary in accordance with the manufacturer's specifications.
- The flexible support must be checked for tightness.
- The vibration attenuators must be checked for function.
- The safety equipment must be checked for function.
- The vane control must be checked for function.
- The water drainage must be checked for function.
- The fan must be cleaned, damages and corrosion must be repaired and the fastenings must be retightened as necessary.
- Before commissioning the clearance must be measured, because the gap between the impeller and inlet nozzle can change during transport. There must be a gap around the entire circumference and the clearance must be the same. If necessary, the gap must be corrected. The gap overlap must be approx. 1% of the impeller diameter.

**Only approved components may be used for ATEX units.**

### 5.7.1 Cleaning and disinfection

The efficient cleaning and disinfection of the fan chambers, including all built-in parts takes place through removal of the flexible canvas connection at the air intake of the fan (see **Figure 5.1**)..


Illustration 5.1: Flexible canvas connection at the air intake of the fan

With removing the flexible canvas connection, efficient cleaning and disinfection of the canvas connection cannot take place with the folding.

Before removal can begun, all relevant safety precautions must be taken first (**see the sections Introduction and Commissioning and Maintenance**) before work on the air handling unit can commence. In the second step for the disassembly of the flexible canvas support, existing inspection walls must be removed using the rotary

bolt and removing any existing separating profiles by loosening the four Philips screws on the operator side of the air handling unit on the outside in order to access the work area of the fan chamber (see **Figure 5.2**). For this purpose, remove the earthing strap (potential equalisation). by loosening the nuts and screws (M8). Then the four screw connections (also M8) on the nozzle support plate and the two screw connections on the fan partitioning wall are loosened before the flexible canvas connection can be removed, cleaned and disinfected.

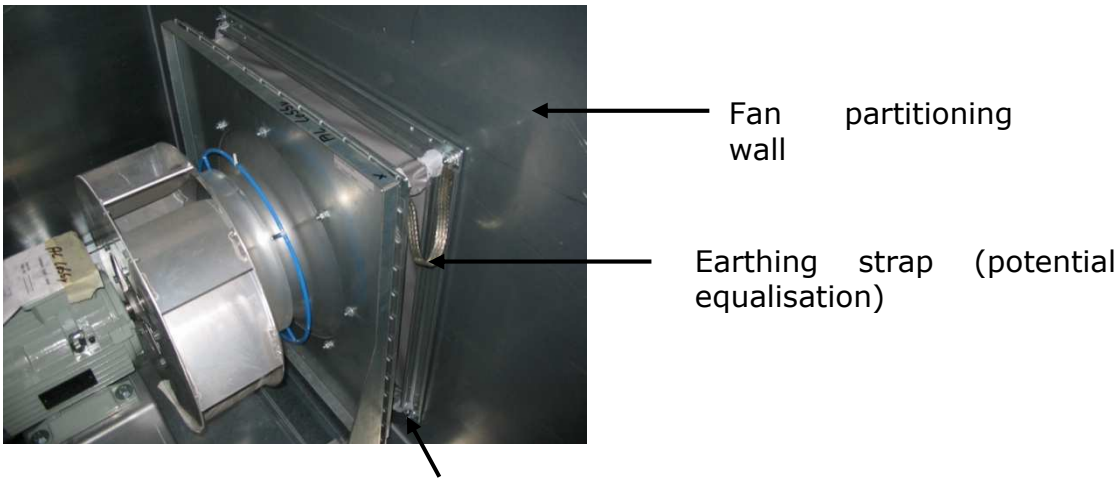



Illustration 5.2: Fan outflow side in the fan chamber

The flexible canvas connection must be pulled taut and completely treated with neutral cleansers and disinfectants, meaning both frames and the canvas (**see General maintenance, cleaning and disinfection instructions**).

After existing separating profiles and inspection walls and/or inspection openings on the control side of the air handling unit have been removed for the removal of the flexible canvas connection, a complete cleaning and disinfection of the fan chamber, the fan and the attached fan guide profiles can take place. For this purpose, the fan unit must be pulled out (see **Figure 5.3**), so that the intermediate and hollow spaces under the profile can be reached without a problem.

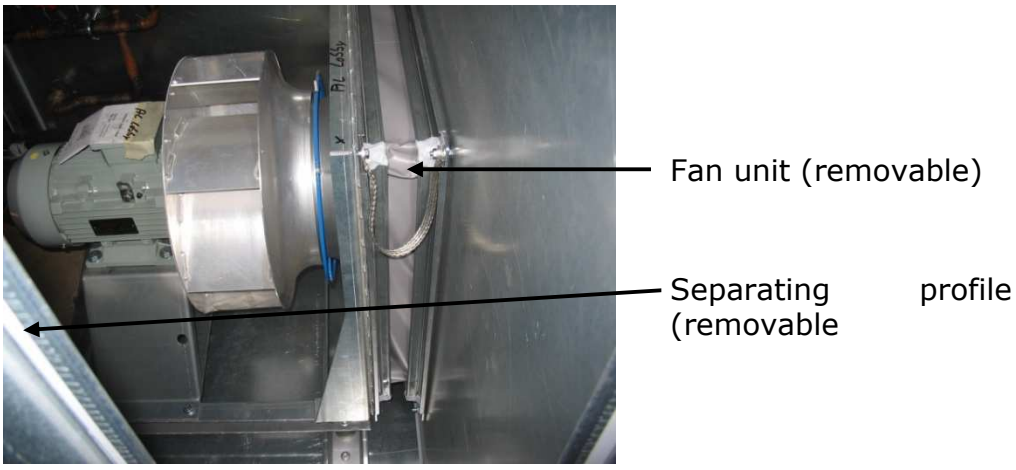



Illustration 5.3: Removability of fan units

For the cleaning and disinfection of fan chambers, the general maintenance, cleaning and disinfection instructions under section 1 must be observed.

### 5.7.2 Radial fan with freewheel

Additional points must be observed for the assembly and commissioning of fans with freewheels. The fastening construction of the fan motor unit must be inspected. The impeller must move without resistance. The overlap (U) between impeller and inlet nozzle must be 1% of the impeller diameter. An even clearance of the gap "s" must be ensured. Readjustments can be made easily.

The readjustment of the freewheel in the vertical direction can take place by sliding the nozzle. Horizontal adjustments can be made through the by sliding the motor fastening plate on the oblong holes. During commissioning it must be ensured that the maximum speed is not exceeded. With frequency converter operation a resonance range must be determined and blanked out. If these points are not observed, considerable damage to the freewheel and the air handling unit can occur. For this purpose the special documentation of the fan manufacturer must also be observed.

Rubber cushions are subject to material ageing, which can be exacerbated by unfavourable operating conditions. Therefore, the rubber cushions must be subject to at least an annual visual and functional inspection. In the process, attention must be paid to the formation of cracks, brittleness and cushioning behaviour. When necessary, however after five years at the latest, the rubber cushions must be replaced.

The fan component must be prepared for the initial commissioning. The following points must be observed in the process:

- The mechanical installation of the fan component must be correct.
- The electrical installation of the fan component must take place according to specifications.
- Foreign objects in the intake and outlet area and in the fan chamber must be removed.
- The transport supports on the fan base frame must be removed.
- The tension of the belts must be checked.
- The proper assembly of the fan accessories, such as the reach-in safeguard, protective grating, etc. must be checked.

**Maintenance**

- The electromotors must be checked for dirt, damage, corrosion and fastening.
- The motor bearings must be inspected, relubricated and/or replaced in accordance with the manufacturer's specifications.
- The impeller and the weld seams must be inspected for potential crack formation.
- The effectiveness of the vibration attenuator must be checked regularly.

The fan must be cleaned as necessary, cleaned of rust in case of corrosion and re-coated. The geometric arrangement of the inlet blank to impeller must be check. During operation of the fan with a frequency converter, suitable measures must be taken to ensure that the maximum output specified on the type plate is not exceeded. Normally, the drive motor is designed for continuous operation. In the case of repeated switching the motor can heat up above the permissible temperature through the high starting current. Under altered operating conditions the temperature in the motor can also increase. In order to keep the starting current down, the specifications for the fan and the drive motor must be observed and the electrical circuit and safety equipment must be appropriately dimensioned. This note applies in particular for the fan start-up with pole-switching motors.

### 5.7.3 Radial fan with V-belt drive

In **Table 5.2** the minimum possible settings for the axle spacing for V-belt drives are shown. The measurement $a_1$ in this case serves for the relaxed installation of V-belts, whereas the measurement $a_2$ is provided for the tensioning or re-tensioning of V-belts.

**Minimum possible settings for the axle spacing**

| Belt length $L_W$ (mm) | $a_1$ | | | | $a_2$ |
|---|---|---|---|---|---|
| | Z SPZ | A SPA | B SPB | C SPC | |
| 410 to 480 | 20 | 25 | 30 | 50 | 5 |
| 530 to 830 | | | | | 10 |
| 850 to 1160 | | | | | 15 |
| 1170 to 1500 | | | | | 20 |
| 1510 to 1830 | | | | | 25 |
| 1840 to 2170 | | | | | 30 |
| 2180 to 2830 | | | | | 40 |
| 2840 to 3500 | | | | | 50 |
| 3520 to 4160 | | | | | 60 |
| 4170 to 5140 | | | | | 70 |
| 5220 to 6150 | | | | | 85 |
| 6180 to 7420 | | | | | 105 |
| 7600 to 8390 | | | | | 125 |
| 8380 to 10170 | | | | | 145 |
| 10670 to 12500 | | | | | 175 |

Table 5.2: Minimum possible settings for the axle spacing for V-belt drives

The axle spacing must be reduced so that the V-belt can be installed in the grooves without force. Forceful installation using a metal strip, screwdriver or the like is not permitted. If V-belt pulleys with multiple grooves are present, all V-belts must be replaced. V-belts from various manufacturers may not be used as a belt set. The V-belts do not require any special care. The use of belt wax and belt spray is not permitted. The V-belts must be checked for tension and wear and retightened or replaced as necessary.

**Fans (radial fans with spiral casing)**

As a basic rule, radial fans with blades bent to the rear or axial fans must be used. Rotor drum fans must be avoided and may only be used with P ≤ 2.2 kW shaft output. The max. consumed electric current of the drive unit must be limited according to standards and directives and must be measured in case of doubt.

**Belt drive**

The following points must be carried out for maintenance and inspection.

- The fans must be checked for fastening.
- The fans must be checked for dirt, damage and corrosion.
- The vibration attenuators must be checked for function.
- The protective grating must be checked for function and cleaned as necessary.

V-belt checks (re-tensioning or replacement)

- Perform the initial check after approx. 50 operating hours
- Further checks depend on the service loading
- In normal operation (approx. 8 h per day) check on a quarterly basis
- Define shorter maintenance time periods for higher numbers of operating hours

## 5.8 Humidifying equipment

**Fittings**

Loosely supplied fittings of humidifying equipment or the like must be mounted.

### 5.8.1 Steam humidifier

Rox-Klimatechnik GmbH assumes no guarantee for steam humidifiers installed on site and/or casing feedthroughs made on site, as well as improper treatment of floor pans and improperly connected outlets. This note also refers to improper operation of the steam humidifier. The specifications and guidelines of the accompanying technical documentation from the respective manufacturer must be observed for the commissioning and maintenance.

### 5.8.2 Spray humidifier

Prior to commissioning, the inspection of the quality of freshwater and circulating water is required. The freshwater must fulfil the microbiological requirements of the drinking water regulation. The limit values for the quality of the circulation water (see standards and directives) must also be adhered to. The hygienic requirements according to directive VDI 6022 are mandatory.

## 5.9 Integrated heating system

The combustion chamber may not be operated in potentially explosive areas. It must be ensured through a pre-rinse that a potentially explosive atmosphere is not present before starting the burner.

According to DIN 4794 the initial commissioning of a combustion chamber and/or the system to which it belongs must be performed by the manufacturer and/or the Rox-Klimatechnik GmbH customer service.

Every system must be equipped with an Emergency STOP. During operation of the system without sufficient cooling (e.g. shut-off of the system via main switch when the combustion chamber is running via Emergency STOP button) or in case of an emergency shut-off through the safety mechanisms, overheating damage to the combustion chamber, casing, built-in parts, etc. can occur.

**Gas line burners**

The gas line burner may not be operated in potentially explosive areas. It must be ensured through a pre-rinse that a potentially explosive atmosphere is not present before starting the burner.

The $CO_2$ content of the room air may not exceed the locally prescribed limit values. With circulation air operation the use in of gas line burners is not permitted. The running system may not be entered, because there is a risk of burning.

Work on the gas line burner may only be performed by ROX customer services, if nothing different is agreed in exceptional cases.

## 5.10 Electrical components

### 5.10.1 Electromotors

**Personal safety**

All types of work may only be carried out by qualified expert personnel on the stationary low-voltage machine in the disconnected state, secured against restarting.

Connection must be carried out by an expert in accordance with the valid safety provisions.

The applicable setup and operating conditions as well as the standard national and international regulations must be taken into consideration. All work must be checked by responsible experts.

**Inspection before commissioning**

- Check whether the bearing protection has been removed.
- Observe the capacities on the type plate.
- Check whether the voltage and the frequency of the motor match the mains values.
- Check whether the direction of rotation is correct and the limit speed is not exceed during converter operation.
- Check whether the circuit of the motor matches the switch cabinet.
- Check whether the motor is protected in accordance with regulations.
- With star/delta starting, check and make sure that the switch from start to delta only takes place if the starting current of the star stage has faded out, because of the danger of impermissible operating loads.
- Check whether the electrical connections are firmly tightened and whether the monitoring equipment is connected and adjusted according to regulations.
- Check the refrigerant temperature.
- Check wither auxiliary equipment is functional.
- Check whether air intake openings and cooling surfaces are clean.
- Check whether safety measures have been performed; earthing.
- Check whether the motor is fastened properly.
- With belt drive, check the belt tension and alignment of the pulleys.
- Check whether the connection box cover has been closed and
- the line infeeds are properly sealed.
- The correct assignment of the phase sequence for the prescribed direction of rotation must be ensured before connecting the motor. The motor/fan can be damaged with incorrect connection.

For protection against impermissible heating as a result of overload, every motor must be protected in accordance with VDE 0165 by a current-independent protection switch in all phases or by other comparable equipment (see VDE 0165).

Before commissioning, the insulation resistance of the coil must be measured phase against phase and phase against mass by expert personnel.The storage of motors in damp air can lead to faults.

For the proper operation of the unit it is important that the unit is connected to the correct rotary field.

If necessary, check the rotary field with a rotary field measuring unit.

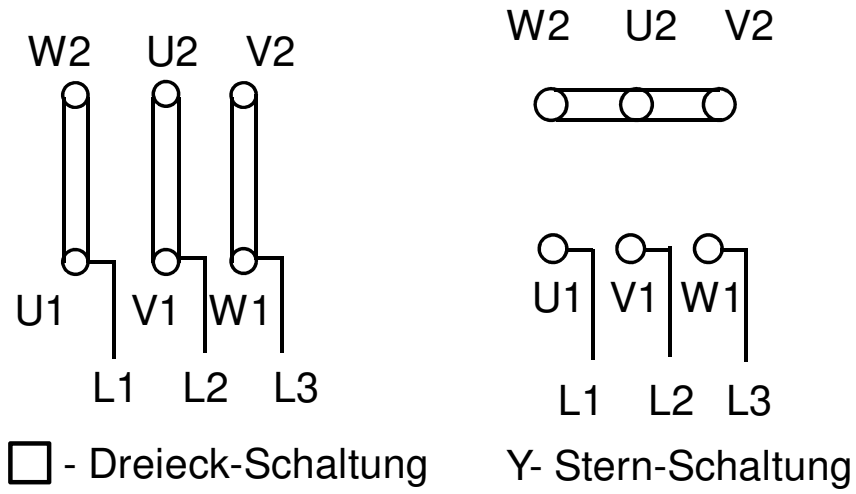
**Standards and directives**

| | |
|---|---|
| DIN EN 60204-1 | Safety of machinery: Electrical design of machinery, general requirements. |
| DIN VDE 0100 | Erection of power installations with rated voltages below |
| DIN VDE 0113 | Electrical equipment of machinery, general requirements. |
| DIN 57111/ VDE 0113 and/or DIN EN 60072/ | Insulation coordination, application guidelines. |

| | |
|---|---|
| UVV BGV A1 | Accident prevention regulations; General provisions. |
| UVV BGV A3 | Accident prevention regulations, electrical systems and equipment. |

**Delta circuit/star circuit**

The electomotors with a nominal rating of up to 3 kW are wired for direct starting. Electromotors for Rox-Klimatechnik GmbH with a nominal rating of 3 kW or higher are wired for star-delta starting (see **Figure 5.4**).




a) Delta circuit b) Star circuit

Illustration 5.4: Representation of various circuits on the motor terminal board.

#### 5.10.1.1 Circuits for speeds in the ratio 1:2

Coil with tapped winding: Design, e.g. for 1500/3000 rpm: 4/2 pole; 750/1500 rpm: 8/4 pole

#### 5.10.1.2 Circuits for two speeds

Two separate coils: Design, e.g. for 1000/1500 rpm: 6/4 pole; 750/1000 rpm: 8/6 pole

#### 5.10.1.3 Circuits for three speeds

Two separate coils, one of which has a tapped winding (for this purpose, nine supply terminals are required): Design, e.g. for 750/1000/1500 rpm: 8/6/4 pole

### 5.10.2 Service switches, terminal boxes

With mains supply installed from above and incorrectly sealed mains supply cable and any control lines, penetrating water can lead to damage and/or destruction of the service switch, terminal boxes and motor.

Connections which have been made from the top or the side must always be checked periodically for the tightness of the screw connections (see section 4.7.1).

(Possible water damage to the motor through capillary action through the cable).

### 5.10.3 Motor protection switch

Motors with thermostat relay or posistor must be safeguarded through a motor protection device with restart inhibit. All motors, whether they are with or without posistors, must be safeguarded with an overload switch. With regulated motors the posistor must be designed for the respective frequency converter.

### 5.10.4 Example for the wiring of a rotary heat exchanger

The drive of the rotary heat exchanger takes place through an electronic speed controller, which is comprised of the control system and the drive motor. The control signal from 0–10 V can be routed to the respective terminals (see **Figure 5.5**). The control system is prepared for various tasks, such as heat recovery for both heat and cold as well as checking the rotation and the motor protection. The control unit is supplied with single phase alternating current of 230 V 50 Hz.

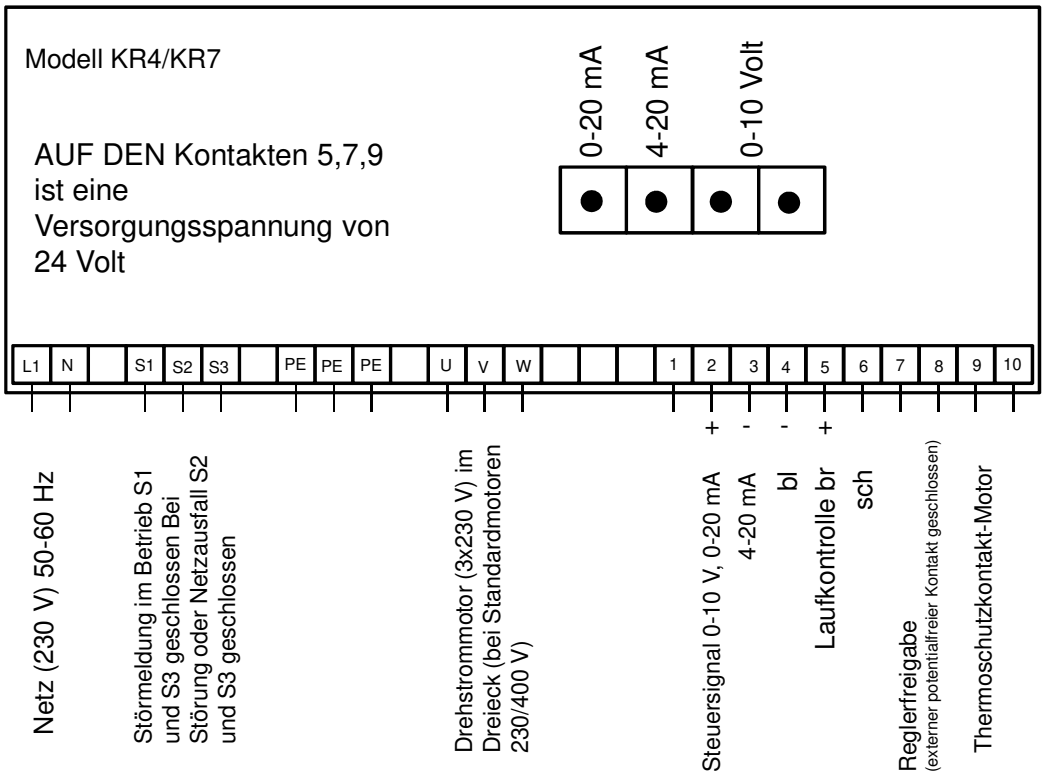



Illustration 5.5: Representation for the routeing of the control signal to the respective terminals for the wiring of a rotary heat exchanger.

## 5.11 Integrated cooling system

### Commissioning

- When connection, an inert gas filling must be provided.
- Check supply and return connections for the correct wiring.
- Check shut-offs and other fittings for proper installation, counter flow principle with medium intake on the air outlet side.
- Check pipe connections and fastening for firm seating.
- Filling of the cooling circuit with the medium which was intended with the layout.
- Check system for tightness.
- Check safety valves for function.
- Check max. temperature and max. pressure during operation.
- Create commissioning log.

### Maintenance

- Clean and inspect vaporiser / condenser.
- With direct evaporation, ensure the functionality of all cooling components (cooling machine, direct evaporator, distributor spider, refrigerant lines, etc.).

# 6 Decommissioning

## 6.1 Decommissioning of the air handling unit

When decommissioning an air handling unit for an extended period, the following work and/or activities must be performed on the air handling unit:

- Water and all operating materials, such as refrigerant, oils or brine must be removed,
- switch cabinet heating should remain switched on for air handling units with integrated switch cabinet,
- existing flaps must be moved to the closed position or closed by hand,
- the general cleaning of parts to be decommissioned is advised,
- dirty filters must be removed and disposed of in accordance with the applicable regulations,
- with large fans later bearing damage is likely to occur if intermitted movement does not take place over an extended downtime,
- observe the risk assessment.

### 6.1.1 Disassembly

**Disassembly**

**DANGER FROM ELECTRICAL CURRENT!**

**Decommissioning**

For all work for the decommissioning and disassembly of the air handling unit, you must switch all supply lines to zero potential and secure against restarting, establish a zero potential state, earth and short-circuit and cover or shield nearby live parts. Severe injuries or even death could be the consequence:

- Make sure that the hydraulic circuit is switched off!
- Close all hydraulic shut-off valves!
- Disconnect all connections – make sure that no operating materials escape in the process, such as oil, refrigerant and water-glycol mixtures.

Since the pipe system has relatively small diameters, it must always be taken into account that residual water remains in the air handling unit with normal draining. For safety reasons the system must also be blown out with compressed air in order to remove the residual water.

**Personal injury**

Safeguard the air handling unit against slipping!

- All instructions in section 2 "Transport" must be observed.
- Observe the risk assessment.

## 6.2 Disposal of the air handling unit

The proper and environmentally-compatible and/or environmentally-friendly disposal of operating and auxiliary materials, as well as components and filters must be ensured. Existing
regulations must be observed without fail.

Metal and plastic parts should be sorted and taken for recycling to save resources.

The disposal of the air handling unit or individual components must be performed by a specialty company with corresponding qualification. In order to prevent personal injury or property damage when dismantling the system, the precautionary measures described for the individual components, as well as the individual information of the component manufacturers must be observed. Before disposal, all emerging environmental risks must be checked. The disposal personnel must be be properly informed about this.

# 7 Customer service

ROX customer service (Tel. no. +49 (0) 2743/804-154) is available for any enquiries and detailed explanations as well as for maintenance work on ROX air handling units.

When ordering spare filters, seals, motors, bearings, V-belts, etc., the serial number of the air handling unit must be specified. This can be gathered from the type plate or the air handling unit master card.

**Please inform us of any requests or comments at Fax no.: +49 (0) 2743/807-153 or by E-mail: info@rox-online.de.**

Only professional technicians may perform repairs and fault remedy. They must, on the basis of their technical training and experience, have sufficient knowledge of the applicable accident prevention regulations and the other generally recognised rules of safety and occupational health.

The versatility and complexity of the built-in parts and special designs do not permit a simple plan for fault finding and remedy.

Therefore, we request that you contact your supplier for carrying out maintenance or repair work.

## 7.1 Spare parts procurement

For the ordering of spare parts, please use the spare parts list or provide us with the order confirmation number. Rox-Klimatechnik GmbH assumes no liability for damages from non-original parts.

The following data must be specified:

- ROX order number and/or serial number of the air handling unit,
- name of the spare part,
- quantity of spare parts,
- if applicable, the dimensions, capacity, etc.,
- Manufacturer and
- other specifications and information.

# 8 Certificates

## 8.1 Note regarding available certificates and association memberships

Rox-Klimatechnik GmbH is a member in the HVAC manufacturers' association RLT-Geräte e.V. and is certified according to EUROVENT (Real Unit Test and Modelbox), TÜV NORD AG (hygienic test) and TÜV Rheinland (ISO 9001:2008).

TÜV NORD

Prüfzertifikat

Kurzfassung des Gutachtens mit der Auftragsnummer 81 02 46 57 06

BAUMUSTERPRÜFUNG

Zentrallüftungsgeräteserien HYD in Hygieneausführung gemäß DIN 1946 Teil 4

Prüfstelle ..... TÜV NORD Systems GmbH & Co. KG

Auftraggeber ..... ROX Klimatechnik
Langenbacher Straße
57586 Weitefeld

Gutachter ..... Dipl.-Ing. Wilhelm Zickler, TÜV NORD Systems GmbH & Co. KG, Essen

Die Prüfungen an den Zentrallüftungsgeräten wurden nach DIN 1946 Teil 4, („Raumlufttechnik, Raumlufttechnische Anlagen in Krankenhäusern") durchgeführt. Dabei wurden auch die deutschen und europäischen Normen und Richtlinien, wie z.B. DIN EN 1886, DIN EN 1751, DIN EN 13779, VDI 3803, VDI 2167 und VDI 6022 berücksichtigt.

Das geprüften Mustergerät aus der mit HYD bezeichneten Serie erfüllt bei Beachtung der in der Bedienungs- und Montageanleitung enthaltenen Vorschriften und Hinweise die Anforderungen nach den oben genannten Regelwerken in allen Baugrößen, die in dem zugehörigen TÜV NORD Bericht aufgeführt sind. Die ROX Klimatechnik GmbH erhält die Erlaubnis, unter Beachtung der im Prüfzeichennutzungsvertrag geregelten Nutzungsbedingungen, das nebenstehende Prüfzeichen für werbetechnische Zwecke zu nutzen.

TÜV NORD Systems GmbH & Co. KG
Zentralabteilung Gebäudetechnik

Der Leiter: Dr. Becker

Der Gutachter: Dipl.-Ing. Wilhelm Zickler

Essen, 23.01.2007

EUROVENT CERTIFIED PERFORMANCE

AHU N° 02.03.036
Range HYD RAL

RLT
Raumlufttechnische Geräte
Herstellerverband e.V.

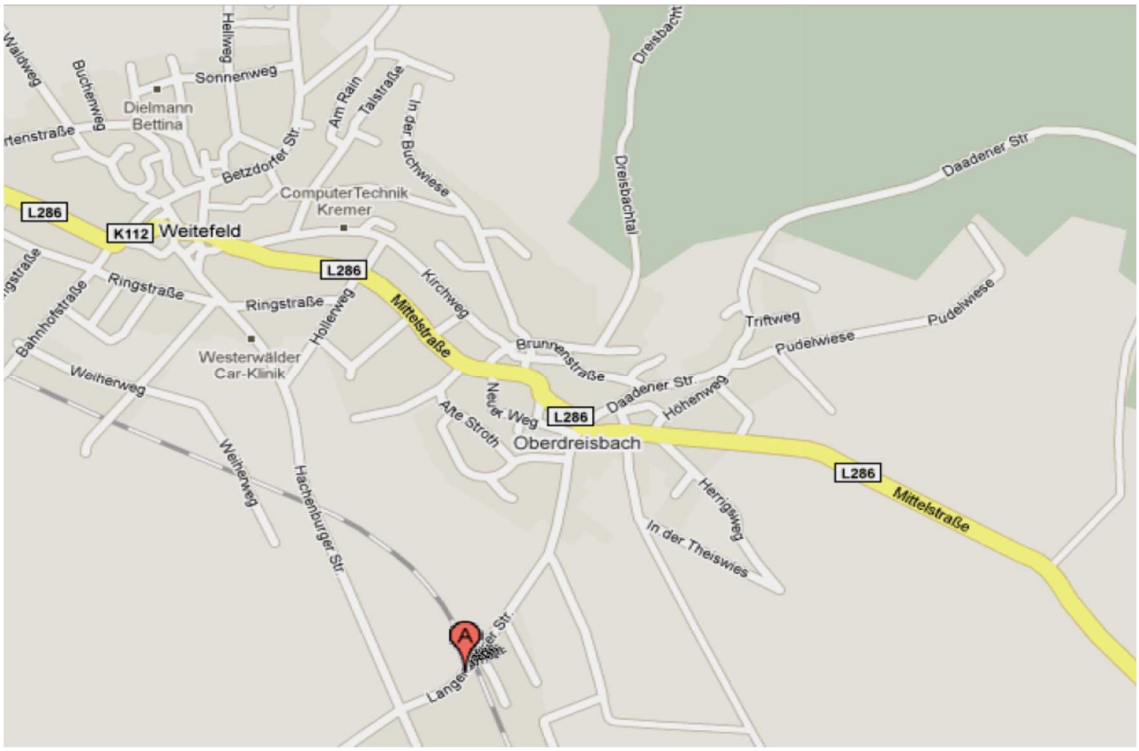
Illustration 8.1: Picture of the certificates of Rox-Klimatechnik GmbH

# 9 Address and directions

## Rox-Klimatechnik GmbH road directions

A 45 Wilnsdorf Exit:
Head towards Neunkirchen, Herdorf, Daaden, Weitefeld

A3 Dierdorf Exit:
Head towards Hachenburg, Kirburg, Langenbach, Weitefeld


Rox-Klimatechnik GmbH
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English version-Englische Version
06.2010

# 10 Definition of symbols

The following symbols identify specific dangers or provide information for safe operation:

| | |
|---|---|
|  | This symbol indicates in immediate danger for the health of persons. Non-observance of these instructions has the consequence of severe, detrimental effects on the health and possibly life-threatening injuries. |
|  | Warning of potentially-explosive atmosphere. |
|  | Air handling units with "Ex" symbols must be used in accordance with the unit identification on the type plate and within the potentially-explosive areas defined in the technical data sheet in accordance with ATEX Directive 94/9/EC. Limitations of use must be observed. |
|  | Danger from electrical current or high voltage! |
|  | Risk of crushing! |
|  | Life-threatening danger! Do not stand under suspended loads! |
|  | Caution! Hot surface! |
|  | This symbol provides important information for proper and efficient work with the air handling unit. Non-observance of these instructions can lead to minor injuries and/or health impairment as well as faults on the air handling unit or the surrounds. |
|  | This symbols is placed in locations to which special attention must be paid so that directives, regulations, instructions and the proper sequence of work are adhered to and damage is prevented. |
|  | Danger from sharp edges! With all work on air handling units there is the risk of sustaining cuts on thin sheets and fins. This applies, in particular, for maintenance and cleaning work on the fin surfaces of heating and cooling registers. |
|  | Air handling unit damage! If flaps are closed abruptly with the running system, the air handling units can be destroyed through excessive pressure or negative pressure. |
|  | Environmental damage! Special information as well as instructions and prohibitions for the prevention of damage to the environment, as well as references to existing national regulations for environmental protection. |
|  | Danger from rotating unit parts! Special information, instructions and prohibitions for the prevention of personal injury from rotating unit parts. |
|  | Personal injury! Special information, instructions and prohibitions for the prevention of personal injury. |
|  | A respiratory mask must be worn! |

| | |
|---|---|
|  | When cleaning and carrying out certain maintenance work on the air handling unit, gloves must be worn! |
|  | When cleaning and carrying out certain maintenance work on the air handling unit, a mask must be worn! |

# 11 Appendix

## 11.1 Intervals for hygienic inspection according to VDI 6022 page1

| | | Activity | Measure | 1 Month | 3 Months | 6 Months | 12 Months | 24 Months |
|---|---|---|---|---|---|---|---|---|
| **0** | **Hygienic inspection** | | | | | | | x |
| 1 | Outside air passages | | | | | | | |
| | 1.1 | Inspection for soiling, damage and corrosion, | Cleaning and service | | | | **x** | |
| **2** | **Decentral HVAC units/central HVAC units** | | | | | | | |
| | 2.1 | Randomly check units with outside air filters for dirt. | Replace air filter, clean unit | | | | **x** | |
| | 2.2 | Randomly check secondary air filters for dirt | Replace air filter, clean unit | | | | **x** | |
| | 2.3 | Randomly check heat exchangers for units without secondary air filters for dirt | Clean | | | **x** | | |
| | 2.4 | Replace air filter | | | | | **X** | **X** |
| | 2.5 | Randomly check heater, sensitive cooler, if applicable condensate pan for dirt, damage, corrosion and tightness | Cleaning and service | | | **X** | | |
| | 2.6 | Check air cooler with dehumidifying, condensate pan and drain during the dehumidification mode, if applicable randomly check the droplet separator for dirt, damage, corrosion and tightness | Cleaning and service | | **X** | | | |
| | 2.7 | Randomly check all other components through which secondary air flows | Cleaning and service | | | | **X** | |
| **3** | **Dehumidifier** | | | | | | | |
| | 3.1 | Check for dirt, damage, corrosion, Check corrosion and droplet accumulation | Cleaning, service | | **X (1)** | | | |
| | 3.2 | Check discharge and siphon for function | Service | | **X** | | | |
| | 3.3 | Clean wet cooler, droplet separator and condensate pan | | | | **X** | | |
| **4** | **Casing** | | | | | | | |
| | 4.1 | Check for air-side dirt, damage and corrosion | Cleaning and Service | | | | **X** | |
| | 4.2 | Check for water accumulation | Clean | | | **X** | | |
| | 4.3 | Check empty casing for dirt, damage and corrosion | Cleaning and Service | | | | **X** | |

| | | Activity | Measure | 1 Month | 3 Months | 6 Months | 12 Months | 24 Months |
|---|---|---|---|---|---|---|---|---|
| **5** | **Humidifier** | | | | | | | |
| | | **Humidifier with circulating water** | | | | | | |
| | 5.1.1 | Check for dirt, damage, microbial growth and corrosion | Cleaning and Service | **X (2)** | | | | |
| | 5.1.2 | Check the shut-off equipment for function | Readjust | | | | **X** | |
| | 5.1.3 | Determination of the total colony count of the circulating water | If KBE > 1000 KBE/ml: cleaning, rinsing out and drying of the pan, disinfection, quality check of the supplied water | **Every 2 weeks** | | | | |
| | 5.1.4 | Check atomiser nozzles for deposits | Clean or replace nozzles | **X** | | | | |
| | 5.1.5 | Check circulation pump for dirt and coating formation in the suction line; check dirt trap for status and function | Clean pump circuit | | **X** | | | |
| | 5.1.6 | Functional check of the conductivity measuring cell | Service | **X** | | | | |
| | 5.1.7 | Functional check of the sterilisation system | Service | | | **X** | | |
| | 5.1.8 | Complete emptying and drying of the humidifier system | | **at stand still (3)** | | | | |
| | 5.1.9 | Check droplet separator and flow rectifier for dirt, damage, coating formation and corrosion | With coating formation remove and clean, check the area behind the droplet separator | **X** | | | | |
| **5.2** | | **Humidifier without circulating water** | | | | | | |
| | 5.2.1 | Check for dirt, damage, microbial growth and corrosion | Cleaning and Service | | **X** | | | |
| | 5.2.2 | Check for condensate accumulation in the humidifier chamber | Steam humidifier Cleaning and Service | **X** | | | | |
| | 5.2.3 | Check steam distribution system for deposits | Clean | | | **X** | | |
| | 5.2.4 | Check atomiser nozzles for deposits | Clean or replace nozzles | **X** | | | | |
| | 5.2.5 | Check discharge | Cleaning and Service | | **X** | | | |
| | 5.2.6 | Determination of the total colony count of the humidifier water – exception: with steam humidifiers | If KBE > 1000 KBE/ml: cleaning, rinsing out and drying of the pan, disinfection, quality check of the supplied water | | | **X** | | |
| | 5.2.7 | Check regulating valve for function. | Service | | | **X** | | |
| | 5.2.8 | Inspection of the moisture limiter | Service | | | **X** | | |

| | | Activity | Measure | 1 Month | 3 Months | 6 Months | 12 Months | 24 Months |
|---|---|---|---|---|---|---|---|---|
| **6** | **Air passages** | | | | | | | |
| | 6.1 | Check air passages, built-in perforated sheet, wire mesh or sieves for dirt, damage and corrosion (random testing) | Clean or replace | | | | **X** | |
| | 6.2 | Randomly check filter fleece | Replace | | | | **X** | |
| | 6.3 | Check air passages with induction of the room air and discharge vents randomly for depositing of solid materials | Clean | | | | **X** | |
| | 6.4 | Cleaning of the components through which secondary air flows | | | | | **X** | |
| 7 | **Air filter** | | | | | | | |
| | 7.1 | Check for impermissible soiling and damage (leakage) and odours | Replacement of the relevant air filter | | **X** | | | |
| | 7.2 | Check differential pressure | Replace filter stage | | | **X** | | |
| | 7.3 | Latest filter change 1st stage | | | | | **X** | |
| | 7.4 | Latest filter change 2nd stage | | | | | | **X** |
| **8** | **Sound attenuator** | | | | | | | |
| | 8.1 | Check sound attenuators and the sound attenuator chamber for dirt, damage and corrosion | Service or replacement; adhesive film tests if applicable | | | | **X** | |
| **9** | **Fan** | | | | | | | |
| | 9.1 | Check for dirt, damage, corrosion | Cleaning and Service, check water discharge | | | **X** | | |
| **10** | **Heat exchanger/heat recovery unit** | | | | | | | |
| | 10.1 | Visual inspection of air-air plate heat exchanger for dirt, damage, corrosion | Cleaning, service | | | **X** | | |
| | 10.2 | Visual inspection of air-air rotary heat exchanger for dirt, damage, corrosion and tightness | Adjust seals, clean, service | | | **X** | | |
| | 10.3 | Visual inspection of directly fired heat exchangers for tightness | Replace seals, clean, service | | | | **X** | |
| | 10.4 | Heater: Check for dirt, damage, corrosion, and tightness | Cleaning and service, replace | | | **X** | | |
| | 10.5 | Cooler: check register, droplet separator and condensate pan for dirt, corrosion and tightness | Cleaning and service | | **X** | | | |
| | 10.6 | Check discharge and siphon for function | Cleaning and service | | **X** | | | |
| | | | | | | | | |

## 11.2 Training log Category C according to VDI 6022 page 1

**Training log VDI 6022 page 1 Category C**
**for an HVAC system and/or an HVAC unit**

Operator: _____

Location of the system: _____

Name of the instructed person:_____

Location and date: _____

**The instruction covered the following points:**

☐ Hygienic requirements during operation.

☐ Cleaning of the filter chamber and filter replacement.

☐ Cleaning of the heat exchanger.

☐ Cleaning of the fan.

☐ Recognition of defects which necessitate professional maintenance/service:

_____

_____

_____

_____

☐ The instructed person has received a full set of system documentation.

☐ The instructed person has received a copy of the training log.

**The training only applies for the HVAC system mentioned above.**

_____

Date Trainer Signature

_____

Date Instructed person Signature

## 11.3 Maintenance log

Rox-Klimatechnik GmbH

**MAINTENANCE LOG**

Object:_____

_____

Commissioned by:_____

_____

Order no.: _____

Project no.: _____

In use since: _____

Description of service:

_____

_____

_____

_____

Work-related note:_____

_____

_____

Comments:_____

_____

_____

_____

_____

ROX Klimatechnik GmbH Representative of the building owner

Name: _____Name:_____

Location,date:_____

Signature: _____ Signature:_____

# 12 Index directory