Translation of Original Operating Instructions

Transportation | Assembly | Operation | Maintenance

Product line: Evaporator
Series variant description: NH\textsubscript{3} High efficiency unit cooler (stainless steel / aluminium)
Series: AGHN

www.guentner.de

| 2010-09 |
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1 General safety instructions

1.1 General instructions

Purpose

possible dangers associated with the device during

• transport
• setup
• commissioning and operation
• maintenance (cleaning, maintenance and servicing)
and to reduce such dangers to a minimum for persons, materials and the environment.

Binding regulations

• EU Directive 97 / 23 / EG on pressure equipment (pressure equipment directive)
• EU Directive 98 / 37 / EG on machines (machine directive)
• EN 378; Parts 1 to 4; "Refrigeration systems and heat pumps, technical safety and environmental requirements" (a standard that supports the basic demands of the aforementioned EU Directives in accordance with CEN)
• Law on Equipment and Product Safety (GPSG); including ordinances (GPSGV) valid for the Federal Republic of Germany
• BGR 500 "Operation of Work Equipment"; Chapter: "Operation of refrigeration systems, heat pumps and cooling equipment"; valid for the Federal Republic of Germany
• VDMA standard sheet 24243; Parts 1 to 5; "Impermeability of refrigeration systems and heat pumps; leak test and leak detection"; valid for the Federal Republic of Germany
• "Operating Instruction Manual in accordance with EN 378-2; Güntner NH₃ evaporators" (see www.guentner.de)
• Adhesive labels on the machine with regulations and indications by the manufacturer:

1. GN 10.3.01 Unit nameplate (for smaller devices on the arch panel)
2. GN 10.04.01 Güntner logo (logo type D, AC: 4819) to fan Ø 500 from Ø 650 Logo type C (AC: 4818)
3. SP36 Warning sign transportation filling at the Schrader valve (item code: 940)
4. SP79 Warning sign "Do not use tongs" beside the drip tray (item code: 4413)
5. SP87 Service door (item code: 938), only with hinged fans
6. SP97 Warning sign: Only use with protection guards that can be dismantled separately (item code: 3083)
7. SP32 ON, OFF connections (item code: 942)
8. SP41 Corrosion resistance (item code: 947)
9. SP99 Notice for streamer (item code: 4a99), only attach if Güntner streamer is used
10. SP37 Forklift application (item code: 946) - visible on packaging

Apart from applying these Operating Instructions, the operator is also obliged to observe the information and requirements outlined in the "Operating Instruction Manual in accordance with EN 378-2; Güntner" in order to maintain his warranty claims.

These Operating Instructions apply for serial equipment. These Operating Instructions are only conditionally valid for custom-made equipment. In this case, the manufacturer must be consulted.

⚠️ WARNING

Should defects be detected in the unit, the manufacturer must be informed immediately so that he can contribute to eliminating such defects.

⚠️ CAUTION

To avoid ensuing damage caused by disruptions of operations, the customer must possess a warning system which immediately indicates any kind of malfunction. Emergency measures must be planned and prepared which in case of malfunctions help to avoid ensuing damage.
1.2 Safety instructions

Device

⚠️ WARNING

Danger of frostbite (freezing of unprotected parts of the body) when touching heat exchanger parts and piping at refrigerant temperatures below ± 0 °C when refrigerating and danger of burns when touching heat exchanger parts, electric heating elements (if available) and piping at temperatures above + 60 °C during defrosting!

⚠️ WARNING

⚠️ WARNING

Sharp edges and corners on the units (especially on the fins) can cut fingers and hands; wear protective gloves.

⚠️ CAUTION

Work on pressurised parts (pipelines, heat exchanger components): depressurise this section of the system and/or siphon off the NH₃ refrigerant from this section.

⚠️ CAUTION

Maintenance work: equipment components must always be replaced with original spare parts.

⚠️ CAUTION

The maximum operating pressure specified on the nameplate may not be exceeded.

⚠️ CAUTION

If the unit is installed close to possible heat sources with danger of occurrence of high temperatures: take effective measures to protect the unit from excessive heat.

Electrical system

⚠️ CAUTION

Electrical installation of the units: only be electricians in compliance with the relevant VDE rules (or the national and international regulations) and the technical work regulations of the public utilities.
NOTICE

All work on fans or motors: it is imperative that the power supply is disconnected. During installation and maintenance work, the power supply to the unit must be disconnected. The system must be secured against unintentional reactivation.

WARNING

The fan motors of the units must be provided with a deactivation facility in compliance with the DIN EN 60204-1 standard to prevent unexpected starting (e.g. repair switch or via fuses in the adjacent switch cabinet). These deactivation devices must be secured to prevent them from being unexpectedly or unintentionally reactivated when the power is dead (e.g. can be locked by a padlock).

Fans

CAUTION

Removal of the fan protection guards and working on the fans: only permissible with the power supply switched off (power dead) and if appropriate protection is provided against unintentional reactivation (remove fuses, put up warning signs).

Achtung • Caution • Attention

Ventilator-Betrieb nur mit Schutzgitter
GEFAHR!
Fan operation only with guard grille!
DANGER!
Mode operatoire de ventilateur qu’avec grille protective!
DANGER!

NOTICE

Working on the fan air inlet and outlet guides: ensure that the power has been disconnected. When work is concluded, do not leave any components near the fan as they will cause faults or damage to the fans and/or heat exchangers upon reactivation.

Operating agents

CAUTION

ATTENTION! The unit is operated with ammonia (NH₃). The following special safety information applies for ammonia (NH₃): Ammonia is a Group L2/B2 refrigerant in compliance with classification according to flammability (L) and toxicity (B) in line with the EU Directive 97 / 23 / EG on pressure equipment (Pressure Equipment Directive):

- refrigerants which, when mixed with air, have a lower explosion limit of at least 3.5% V/V.
• refrigerants with a time-weighted, average concentration that have no adverse effects on
  the majority of staff who are exposed to this concentration every day during a normal 8-
  hour working day and a 40-hour working week, which is greater than or equal to 400 ml/m³
  (400ppm(V/V)).

⚠️ WARNING

NH₃ is a flammable, explosive gas although the risk of fires and explosions is low owing to its high ignition temperature, small ignition range, low explosive power and high affinity with humidity.

⚠️ CAUTION

NH₃ is a toxic, pungent-smelling gas although it is not harmful to health until well beyond the odour actually perceived (warning effect of NH₃).

⚠️ WARNING

NH₃ is hazardous to health owing to its irritable effect when combined with moisture, especially the eyes, mucous membranes and other unprotected areas of skin.

⚠️ CAUTION

NH₃ is a tear gas and generates unrest, dizziness, vomiting and cramps; stronger concentrations cause symptoms of suffocation and life-threatening lung oedemas.

⚠️ CAUTION

NH₃ from a concentration of 0.2% volume and/or upon longer exposure is life-threatening to fatal.
CAUTION

If NH₃ comes into contact with eyes, it causes such strong stinging that eyes can not stay open resulting in a lack of orientation. If NH₃ penetrates the breathing apparatus, it causes respiratory breakdown resulting in panic.

WARNING

If liquid NH₃ comes into contact with skin, it causes burns and frostbite (-33 °C).

CAUTION

In the event of the evaporator displaying leaks (emanating NH₃), the EMERGENCY OFF switch must be pressed and the endangered evaporator must be shut off to ensure non-hazardous handling.

CAUTION

During troubleshooting after NH₃ breakaway releases, please be aware of remaining NH₃ under defervescence as splashes can lead to burns and frostbite on skin and eyes while evaporation can lead to intoxication.

CAUTION

Wear protective clothing.

CAUTION

Protect your face and respiratory organs.

CAUTION

Spills of refrigerant and oil must be impeded.
CAUTION

Refrigerant vapour or gas must be impeded from penetrating neighbouring rooms, staircases, yards, passages or drainage systems in close vicinity of the installation room and must be discharged without risk.

CAUTION

Suitable fire-fighting equipment must be provided on site when working with flames, e.g. grinding, welding etc.

- Particular attention must be paid to the danger of ignition by spread oil residue and NH₃ refrigerant.
- The fire extinguishers to be provided must be available and ready for use in sufficient numbers, and their extinguishing agents must not react dangerously with the NH₃ refrigerant.

CAUTION

Contact by NH₃ refrigerant with naked flames must be avoided. For this reason, welding work may only be performed after full removal of NH₃ refrigerant from the relevant section of the system. Good ventilation must be ensured. When performing emergency work in high concentrations of NH₃, it is imperative that self-contained breathing apparatus independent of the ambient air is worn.

CAUTION

Smoking is prohibited during work. To avoid inhalation of high vapour concentrations, working areas must be well ventilated.

WARNING

Constant compliance with the limit values must be ensured by monitoring the refrigerant concentration in the ambient air. With good air ventilation and offtake, levels easily fall below the permissible limit values.

CAUTION

Handling NH₃ refrigerant demands particular adherence to technical guidelines and standards governing industrial safety and hygiene. This includes wearing protective equipment depending on the respective situation:
Protective gloves
Eye protection
Respiratory protection
Protective clothing
2 Technical data

2.1 General information on the unit

<table>
<thead>
<tr>
<th>Manufacturer:</th>
<th>Güntner AG &amp; Co. KG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hans-Güntner-Strasse 2-6</td>
</tr>
<tr>
<td></td>
<td>D-82256 Fürstenfeldbruck</td>
</tr>
<tr>
<td>Unit name:</td>
<td>See order-specific offer documents</td>
</tr>
<tr>
<td>Volume V:</td>
<td>See order-specific offer documents</td>
</tr>
<tr>
<td>Fan type/number</td>
<td>See order-specific offer documents</td>
</tr>
<tr>
<td>Fluid:</td>
<td>Ammonia (NH₃)</td>
</tr>
<tr>
<td>Max. perm. pressure PS:</td>
<td>32 bar</td>
</tr>
<tr>
<td>Perm. max./min. temperature TS:</td>
<td>- 60...+ 140 °C</td>
</tr>
<tr>
<td>Test pressure applied PT:</td>
<td>35.2 bar</td>
</tr>
<tr>
<td>Test medium:</td>
<td>Dried air</td>
</tr>
</tbody>
</table>

2.2 Technical data

See order-specific offer documents and unit nameplate

2.3 Sound specifications

In accordance with the standard procedure for calculating the sound pressure level as per EN 13487, Annex C.
3 Operation

3.1 Application

Refrigeration technology; large refrigeration systems, e.g. butcher shops, abattoirs, fish processing, breweries, walk-in freezers, large cold stores or similar for cooling and circulating ambient air.

3.2 Definitions

This is an incomplete assembly.

A fan-ventilated evaporator is a component of a refrigeration system which conducts heat from the air to a refrigerant. The evaporator therefore serves as a heat exchanger in which refrigerant fluid is evaporated by absorbing heat from the ambient air (the medium to be cooled). The air is conducted mechanically over the heat exchange surface by installed fans, i.e. the entire external surface of the evaporator.

The refrigerant is the fluid used for exchanging heat in a refrigeration system and which absorbs heat at low temperature and low pressure while dissipating heat at higher temperatures and higher pressure, whereby the fluid then changes status.

Güntner AG & Co. KG NH₃ evaporators work on the evaporation principle of "flooded evaporation" as standard: the refrigerant fluid directed to the evaporator contains several times the volume required for full evaporation (approx. 2-5 times as much). The refrigerant fluid can be supplied via cold transfer medium pumps (pump circulation) or gravity (gravity circulation).

Both operating modes require a liquid separator which separates the refrigerant liquid-vapour mixture enabling pure cold transfer medium vapour only to reach the compressor and ensuring safe supply of boiling refrigerant liquid to the evaporator (via pump or gravity).

Ammonia (NH₃) refrigerant is a Group L2/B2 refrigerant (see also section 1.2. "Safety instructions").

3.3 Fan motor

**NOTICE**

During longer storage or downtime periods, the fans must be operated for 2 to 4 hours each month.

**NOTICE**

In the case of fans with protection type IP55 or higher, any sealed condensate drain holes must be opened at least every six months.

Motors with PTC resistors require an additional trigger device for the installed thermistors. Locking is recommended to prevent reactivation. Max. 2.5 V test voltage or current-limited meters on thermistors.

When using step switching, the corresponding time delays must be taken into consideration for motors with 2 speeds.

For motors with direct start and a connection value > 4.0 kW, a startup current limitation (softstart using thyristor) may be necessary.
AC technology

| NOTICE |

When using other brands for frequency converter mode on external rotor motors (Ziehl-Abegg), please observe the following: effective all-pole sinus filters should be fitted between the converter and the motor (sinus-shaped output voltage, phase against phase, phase against protection conductor). Güntner frequency converter speed regulators feature this function as standard. Güntner three-phase standard motors are suitable for operation on frequency converters.

The fan motors can be operated by means of star-delta connection with two speeds and/or with speed control. The direction of rotation must be checked. If the direction is wrong, it can be changed by interchanging two phases.
4 Transportation and storage

4.1 Packaging

<table>
<thead>
<tr>
<th>Material</th>
<th>Quality assessment and guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper board containers</td>
<td>Quality assessment for corrugated board packaging by the Federation of Corrugated Board Manufacturers VDM standard and DIN 55468</td>
</tr>
<tr>
<td>Pallets, crates, cases</td>
<td>HPE Packaging Directive by the Federal Association for Wooden Packaging Materials, Pallets and Export Packaging e.V. (incorporated society) and the VDM</td>
</tr>
<tr>
<td>Transportation packaging</td>
<td>Güntner transportation packaging is made from environmentally-friendly materials and is suitable for recycling</td>
</tr>
</tbody>
</table>

Please observe the symbols on the packaging, e.g.:

![Symbols](image)

4.2 Transportation and unloading

The units designated for transport must be adequately protected against transport damage and damaging atmospheric influences.

The units are delivered with approx. 1 bar overpressure (purified and dried air) (in accordance with regulation ADR 1.1.3.2 c governing the transportation of hazardous materials).

Before removing the sealing caps, check whether overpressure prevails.

An unpressurised unit indicates a leak (transport damage! leak test!).

If a unit arrives without pressure, the manufacturer must be consulted immediately.

Before installation, release the transportation pressure and remove the sealing caps.
NOTICE

The units must be protected against hard blows and hard setting down as well as against slipping and mechanical damage.

NOTICE

Ongoing mechanical stress caused by uneven road surfaces and potholes as well as vibrations during transport by sea can cause transport damage. Prior to transport by sea or in countries with critical transport routes, add-on parts which can cause vibrations – especially fans and stands – must be dismantled for transport.

An unloading device that is appropriate for the weight of the equipment must always be used and operators must be qualified for unloading the equipment properly.

The equipment may only be lifted with a forklift with adequate fork length.
12 Squared timber screwed to suspenders B1 via fan and connecting pieces + 50 mm
13 Front panel screwed to pallet H1 via unit height without drip tray
14 Forklift truck element L1 via drip tray + 100 mm air
CAUTION
When transporting the units by crane or forklift, even weight distribution must be strictly observed.

CAUTION
When lifting: observe the position of centre of gravity (see symbols for transportation).

CAUTION
When transporting by crane: Only secure hooks and shackles for load takeup devices at locations specified by the manufacturer.
Connecting pieces and header tubes: Never use as attachment points for transportation.

NOTICE

Special note: The sheet metal construction of the housing must not be crushed by belts – use crane yokes if necessary (see transportation labels in the section on “General safety instructions”).

The units are transported as complete system components. If units are delivered in parts, they must be mounted in accordance with the enclosed order-specific drawings.

The scope of delivery must be checked for completeness upon receipt. Any transport damage and/or missing parts must be recorded on the bill of delivery. These facts must be reported immediately in writing to the manufacturer.

4.3 Storage

NOTICE

Storage of the units: Only with protection against dust, contamination, moisture, damage and other damaging influences.

The ammonia (NH₃) refrigerant used is extremely hygroscopic.

Letting the units stand around unnecessarily and permeation by humidity and dirt into the open unit is not permissible on account of the danger of corrosion and contamination.

The same applies to unpacking the units, cleaning and installation before start-up.
5 Assembly and installation

5.1 Installation information

The units must be fixed at the fastening points appropriate for their weight and must be bolted down with fastening bolts. The operator or installer of the equipment is responsible for ensuring that the bolted connections are of the appropriate strength.

When fastening the units, the following instructions must be observed:

• The diameters of the mounting holes have been statically determined by the manufacturer; the fastening bolts must be adapted accordingly.
• The fastening bolts must be secured against loosening by means of an appropriate locking device.
• The fastening bolts must not be overtightened or stripped.
• All fastening bolts must be tightened equally to achieve a load distribution that is as balanced as possible.
• When calculating the transferring bearing strength or suspension load, it is imperative that the overall weight of the unit is taken into account. The bearing strength or suspension load is calculated as follows:

\[
F_{\text{max}} = \frac{\text{total weight} \times X}{\text{number of suspenders}}
\]

Total unit weight = Net unit weight
+ weight of tube contents
+ additional weight (moisture, dirt or similar )
X : safety coefficient (X ≥ 1)

• In the course of maintenance intervals, the fastening bolts must be tested for functional safety (see "Maintenance").

The evaporator must be installed in such a way that it can not be damaged through environmental sources of danger (production, transportation or other processes in the area of installation) or functionally disturbed by unauthorised persons.

NOTICE

The units must be installed with sufficient slope towards the drain for condensation water.

NOTICE

All anchoring points must maintain the distance to the mounting plate constantly and under load so that no mechanical stresses arise in the unit. The units must be anchored in their installation position to prevent the equipment from moving.

NOTICE

Installing the units: There must be enough free space available so as to enable unhindered replacement of electric heating elements.
NOTICE

Installing the units: In such a way that they can be inspected, checked and maintained from all sides at any time, i.e. there must be unobstructed access to the fluid-carrying and electrical components, connections and lines, and the pipeline labels must be identifiable as well as offering adequate space for testing.

WARNING

Fluid-carrying pipelines: Protect against mechanical damage. Customer connections: Keep the unit free of load when mounting; force may not be exerted on the distribution and header pipes.

When installing the NH₃ evaporator, it is imperative that the following is observed:

- Damage must not be incurred by environmental sources of danger (production, transportation or other processes).
- No functional disturbances caused by intervention on the part of unauthorised persons.
- Maintenance of distance from objects which could be endangered by an explosion or the toxic effect of NH₃.
- Measures must be taken to protect such objects from an NH₃ concentration of more than 200 ppm.
- Do not store any flammable materials underneath the unit.

CAUTION

Installing the units: Damage must not be incurred as a result of in-plant traffic or transportation processes.

In areas used for inner-plant traffic, the pipelines to and from the units may only be installed without detachable connections and fittings.

CAUTION

When installing the units, it is imperative that the requirements formulated in the binding regulations (see section on "General safety instructions") regarding refrigerants, filling weight and heat exchange systems are met.

The following document(s) serve(s) as installation plans for fastening the units:

See order-specific offer documents (see section 2. "Technical data").
5.2 Installation guidelines

When mounting the units (on the ceiling, on the wall or leg mounting), the following regulations must be observed:

1. Direction of air

2. 200 size 041
   400 size 046, 051
   600 size 066, 071, 081

3. 25 size 041, 046, 051
   35 size 066, 071, 081

4. Suspension point

5. Suspension points
   Type 041./3

6. Suspension points
   Type 046./3
   Type 051./3
   Type 066./3
   Type 071./3
5.3 Assembly

All assembly work must be performed by qualified personnel. Damage caused by incorrect installation invalidates the manufacturer’s warranty obligations.

A Unloading  
B Assembly

The unit may only be fastened at the anchoring points provided.
1 Fastening in accordance with the section on "Installation information".

Information on installation

The drip tray is connected to the discharge line in accordance with the following regulation:
The drains must be absolutely free of mechanical stress.
When connecting the drip tray to the discharge line, the connection nut must be tightened by hand.
Do not use tongs.
THE UNIT IS FILLED WITH DRIED AIR (SEE SECTION ON "TRANSPORTATION AND UNLOADING"). BEFORE DISCHARGING THE DRIED AIR: ALL PIPELINE INSTALLATION WORK PERFORMED BY THE CUSTOMER MUST BE COMPLETED.

**WARNING**

Fluid-carrying connections: They must be absolutely free of mechanical stress. The customer pipeline system must be provided with support before connecting to the unit.

**CAUTION**

Welding work is only permitted on depressurised units.

**WARNING**

The pipeline installation must be kept as short as possible. As few bends must be used as possible and only those with large radii.

**WARNING**

The unit must be expertly evacuated in accordance with the guidelines of the VDMA.
CAUTION

The general requirements associated with installing evaporators must be taken into consideration in accordance with the applicable regulations (see section on "General safety instructions").

NOTICE

The free space around the unit (e.g. the distance between the bottom edge of the tray and possible tubular track installations) must be sufficiently large so that the unit is not in danger of being damaged, and regular maintenance of the components as well as inspection of the components, pipelines and fittings as well as repair work is possible.

CAUTION

It must be possible to lock the unit in the event of a leak. It must be possible to operate all installations intended for the discharge of emanating NH₃ refrigerant from a safe position.

CAUTION

Smoking is prohibited at the installation site; the use of naked flames is prohibited. Fire extinguishers and extinguishing agents used to protect the unit and operating staff must comply with the requirements outlined in EN 378-3.

WARNING

Mounting of electrical installations, e.g. for driving fans, for ventilation, illumination and the alarm system in the installation room: Condensing air humidity and dripping water must be taken into account as per EN 378-3; section 6.

CAUTION

NH₃ refrigerant detectors and alarms must be set up in the installation room in accordance with section 7 of EN 378-3 for control reasons and to provide warning in the event of explosion or fire risks and concentrations harmful to health.

NH₃ evaporator pipelines:
- Installation of pipes, valves and their components for lines to and from the unit in accordance with EN 378-2 and the section on "Operating Refrigeration Plants, Heat Pumps and Cooling Equipment" in BGR 500
- Weld all connections as per stainless steel variant.
- Install gas and liquid lines separately and insulate on both sides.
- Avoid leaks; weld carefully and thoroughly.
- Avoid overheating during welding (danger of excessive heat waste).
- Use inert gas when welding (to avoid heat waste).
- After completion of the pipe installation and before connecting the units, perform expert internal cleaning, a pressure test and evacuation in line with the guidelines of the VDMA.
6 Start-up and operation

6.1 Operation

6.1.1 Normal operation

To operate the unit, the entire system and electrical installations must be in operation. The unit is switched on by opening the relevant valves on the inlet and outlet side of the system and by connecting it to the electrical system. The unit is ready for operation once it has reached the specified operating point (see order-specific offer documents).

The operating point setting
- Cold medium return temperature or circulating cold medium volume
- Evaporation temperature
- Air flow
- Air intake temperature
- Relative humidity

is to be fixed as described in section 2.2 "Technical data".

If operating conditions deviate from the specifications (according to order-specific offer documents), it is imperative that the manufacturer is consulted.

6.1.2 Taking out of service and final shutdown

The unit is taken out of service by disconnecting it from the system as a whole. In this case, the fluid-carrying pipes must be shut off from the refrigeration system and the fans and electrical defrost heating elements (where installed) must be disconnected from the electrical system.

⚠️ CAUTION

When shutting down, observe the maximum operating pressure. If necessary, take precautions to ensure that this level can not be exceeded.

The units are system components of a refrigeration system. Taking out of service and recommissioning must be carried out in accordance with system-specific configuration as per the applicable standards and accident prevention guidelines (see "General safety instructions").

The pressure test after recommissioning may only be carried out using the appropriate media and at suitable test pressure.

6.1.3 Modifications to the unit and non-permissible operating conditions and working methods

Modifications to the unit include:
- changing the function as specified in the section on "Function"
- changing the operating point in accordance with the section on "Technical data"
- changing over to another fluid.
Non-permissible operating conditions and working methods as far as the warranty is concerned include:

- changing the function as specified in the section on "Function"
- changing the fan output (air volumes)
- incorrect unit installation (see section on "Installation and assembly")
- changing the operating point (heat transfer rate)
- changing the fluid (evaporator suitability and performance, thermostatic expansion valve suitability, function and performance)

These changes, operating conditions and working methods may only be performed following agreement with and approval by the manufacturer if the warranty cover is to be maintained.
7 Maintenance

7.1 General information

The unit does not require special servicing. However, regular checking and maintenance will ensure smooth operation. The maintenance intervals depend on the installation site and operating conditions. During maintenance checks, special attention should be given to looking for soiling, white frost and/or icing, leaks, corrosion and vibrations.

7.2 Cleaning

The planned and guaranteed heat transfer rate of the unit can only be provided if the heat exchanger coil is clean. Contamination and white frost and/or icing must be removed from the fins as well as from the area surrounding the unit.

Dry dust or dirt can be removed using a brush, a hand brush, compressed air (against the direction of air movement) or a powerful industrial vacuum cleaner.

**NOTICE**

If possible, always brush in the longitudinal direction of the fins. Use soft brushes.

**NOTICE**

Never brush sideways across the fins.

Heavier wet or greasy soiling must be removed using a high-pressure water jet (max. pressure of 50 bar), steam pressure jet (max. pressure of 50 bar) at a minimum distance of 200 mm with a flat jet nozzle, using a neutral cleaning agent where possible, and always against the direction of air movement.

Where possible, cleaning should be carried out from the inside to the outside and top down. The jet of the cleaner should be held vertically to the heat exchanger coil where possible (max. deviation of ± 5°) to prevent the fins from bending.

Keep cleaning until all of the dirt has been removed.
When cleaning: the unit must be disconnected from the refrigeration system as well as the power supply. Water and steam jets must be kept well away from electric connections and electric motors.

**NOTICE**

Only use cleaning agents which are compatible with the unit materials; they may be neither aggressive nor corrosive.

### General tips on cleaning

Soiling and white frost and/or icing on the fans and fan protection guards must be removed on a regular basis as they cause unbalances and even disintegration or engine output loss. The actual fan motors are maintenance-free.

**CAUTION**

Fans and protection guards that have been removed or opened for maintenance must be returned to their original positions before recommissioning.

**NOTICE**

Mechanical cleaning with hard objects (e.g. wire brushes, screwdrivers or similar) will damage the heat exchanger and is not allowed.

### 7.3 Defrosting (recommendations for defrosting)

Timely defrosting of the heat exchanger coil ensures continuous operating safety and the prevention of deficiencies which can lead to standstill and faults. The following operating instructions must be observed for effective defrosting of the unit:

- **Check for white frost and/or icing at regular intervals:**
  The unit must be defrosted when a frost thickness of max. 1 mm per fin is detected in order to ensure smooth and safe operation.

- **Timely commencement of the defrosting process**

- **Defrosting must be complete:**
  When the defrosting process is over, ensure that defrosting is actually complete. A key prerequisite for this is selection of the correct defrosting end temperature:

- **Idle time**
  Between completion of the defrosting process and switching of the unit, a period (of approx. 5 minutes) has proven necessary as the unit's heat exchanger coil can drip off fully during this period and the condensation water is able to flow off through the drip tray drain.
• Delayed fan start-up
  If the fans are not switched for another short period (approx. 5 minutes) until after refrigeration
  mode has started, the defrosting heat is absorbed by the heat exchanger coil instead of being
  blown into the room as humid air or droplets of water.

7.3.1 Defrosting

The defrosting process is triggered at preset intervals and/or as required.

Ending the defrosting process must be dually secured (time/temperature and/or temperature/temperature).

During defrosting (hot gas, ambient air, electrical connections), ensure correct installation of the de-
frosting sensor at the customer's. Please refer to the defrosting process described below.

Recommendation for performing the defrosting process in line with the following order:

<table>
<thead>
<tr>
<th>Hot gas defrosting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Refrigeration mode</strong></td>
</tr>
<tr>
<td>Siphon-off mode</td>
</tr>
<tr>
<td>Defrosting mode</td>
</tr>
<tr>
<td>Drip phase</td>
</tr>
<tr>
<td>Freeze phase</td>
</tr>
<tr>
<td>Refrigeration mode</td>
</tr>
<tr>
<td>Fans</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electric defrosting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Refrigeration mode</strong></td>
</tr>
<tr>
<td>Siphon-off mode</td>
</tr>
<tr>
<td>Defrosting mode</td>
</tr>
<tr>
<td>Drip phase</td>
</tr>
<tr>
<td>Freeze phase</td>
</tr>
<tr>
<td>Refrigeration mode</td>
</tr>
</tbody>
</table>
7.3.2 Hot gas defrosting

When defrosting with hot gas, it must be ensured that at the time of defrosting a sufficient number of other consumers are in refrigeration mode so that a sufficiently large volume of hot gas is available (approx. 2-3 times the defrosting output can be calculated when compared to refrigeration output). It must however be noted that alternate defrosting within a room necessitates the use of defrosting seal equipment (defrosting valves, textile seal equipment) (see section 7.3.5. "Additional information").

Recommended defrosting sensor positioning

7.3.3 Ambient air defrosting

When operating the units at room temperatures above zero (air intake temperature ≥ +5 °C; cold stores above zero), ambient air defrosting is sufficient in most cases:

in the case of shut-off fluid pipes, the requisite defrosting heat is generated by the fan heat and air temperatures above zero.

Recommended defrosting sensor positioning

7.3.4 Electric defrosting

It must also be noted that alternate defrosting within a room (group defrosting) necessitates the use of defrosting seal equipment (defrosting valves, textile seal equipment). To exclude the danger of overheating the units, the customer must effect surveillance with a safety device (temperature controller; must be provided for when the system is built) in accordance with regulation EN 60519-2; VDE 0721; T. 411. Operating the units without temperature control is not permitted.

It is imperative that the maximum permissible fuse protection of the electric heating element groups of 25 A is adhered to. The value for minimum fuse protection can be found in the order-specific wiring diagrams.

To avoid exceeding the permissible pressure in the evaporator by means of electric defrosting, either a refrigerant shifting or, on a par with that, a siphoning-off operation must be provided for in accordance with EN 378-2 for electric defrosting.
7.3.5  Additional information

The drip tray drains must be heated (except in cold stores above zero) to prevent the formation of ice. The defrosting seal equipment provided (defrosting valves, textile seal equipment) must be used to prevent the formation of water vapour outside the unit coil and therefore the formation of white frost and ice. When using fan ring heating, textile seal equipment must not be installed. Please refer to the "Defrosting valve operating and assembly instructions".

Please note: The use of textile defrosting seal equipment (e.g. shut-up) in refrigeration mode leads to additional pressure losses on the air side. This fact must be taken into consideration during design.

7.4  Maintenance and repair

Before commencing maintenance and repair work, the NH₃ refrigerant must be siphoned off and the electrical connections disconnected from the power supply to enable work to be carried out safely.

Maintenance and repair work must be carried out in such a way that danger to people and goods is avoided as much as possible.

Maintenance and repair work must be carried out in accordance with EN 378-4.

The repaired unit must be tested in accordance with EN 378-2.

The following plans serve as recommendations concerning care, maintenance and checkups:

<table>
<thead>
<tr>
<th>Measure</th>
<th>Medium</th>
<th>Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of white frost and component cleaning</td>
<td>Mechanically</td>
<td>As required (visual inspection)</td>
</tr>
<tr>
<td>Defrosting the heat exchanger</td>
<td>See section on &quot;Defrosting (recommendations for defrosting)&quot;</td>
<td>Depending on local conditions (stress caused by penetrating moisture, e.g. air or goods)</td>
</tr>
<tr>
<td>Overall cleaning</td>
<td>Water or cleaning agent which is environmentally compatible with the material</td>
<td>As required (visual inspection)</td>
</tr>
<tr>
<td>Leak test</td>
<td>External visual inspection (EN 378-2; Annexes A, B)</td>
<td>Depending on the leak rate (see EN 378-2; Annex C)</td>
</tr>
<tr>
<td>Corrosion protection check</td>
<td>See EN 378-2; Annex D</td>
<td>Depending on the leak rate (see EN 378-2; Annex C)</td>
</tr>
<tr>
<td>Component / Control point</td>
<td>Intervals</td>
<td>Measure</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Heat exchanger coil / Fluid connections</td>
<td>See VDMA standard sheet 24243</td>
<td>See VDMA standard sheet 24243</td>
</tr>
<tr>
<td>Fans</td>
<td>Monthly (control lamp in switch cabinet display)</td>
<td>Replace fan or run-wheel</td>
</tr>
<tr>
<td>Housing / Fastenings</td>
<td>Every 3 months</td>
<td>Tighten</td>
</tr>
<tr>
<td>Electrical connections/components</td>
<td>Monthly (control lamp in switch cabinet display)</td>
<td>Repair or replace</td>
</tr>
</tbody>
</table>
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