Installation instructions Insulated Coolers

Valid for the series:

TI...: thermofin® Insulated Cooler (axial / radial)

TP...: thermofin® Insulated Cooler Penthouse Type

Translation of the original installation instructions
Language: English (Englisch)
Edition 3.1

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Exclusion of liability

In case of problems in connection with the assembly and/or the operation of the unit which are not described in this manual, the operating/installing company is obligated to immediately get in contact with thermofin®. A further assembly and/or an operation of the unit is permitted until the subject is completely clarified.

For damages resulting from a non-observance, thermofin excludes any liability. Furthermore, thermofin® reserves the right to exclude any warranty claims attributable to this fact.

In case that an instruction of this manual should become invalid because of local ragulations related to the system, the regulations shall take their place. The remaining parts of the manual remain unaffected.

It must be observed that the instructions of this manual should be interpreted as minimum requirements. In case that the legal regulations are minor, the regulations of this manual are decisive.

Contents

1 General preliminary notes

The purpose of installation and operating manuals is to prevent dangers to persons and to the environment, which may be caused by a machine and by the work performed in connection with the machine, particularly during transport, assembly, commissioning and operation of the unit.

Therefore, all points of this manual must be carefully read and observed.

Warranty claims shall be excluded in case of errors and damages resulting from the fact that prescriptions of this operating manual have not been observed or in case of complaints resulting from the replacement of parts with non-original parts as well as from reconstructions or adjustments or modifications of the operating parameters or the functionality of the unit which have not been authorised explicitly by the manufacturer.

1.1 Fundamentals

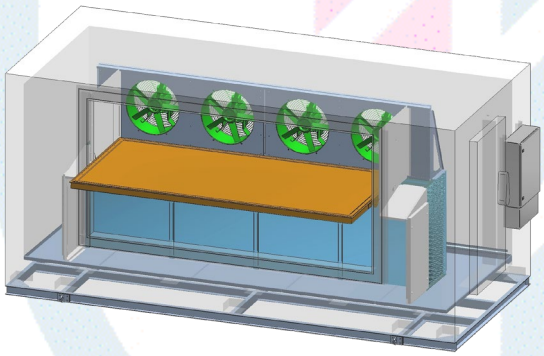
The present installation instructions refer to Insulated Coolers of the following type series:

- TI… - Insulated Cooler with axial fans (axial) or radial fans (radial)
- TP…- Insulated Cooler Penthouse Type (with axial fans)

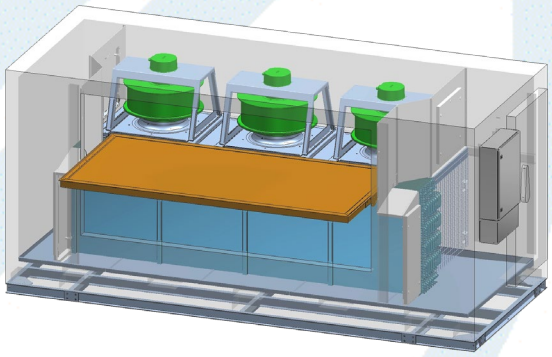
→ *TI..., TP...: The exact designation is written on the type plate or data sheet.*

The corresponding technical data can be seen from the current unit data sheet and the type plate. For the fan motors and controllers, the data given on their identification plates primarily apply.

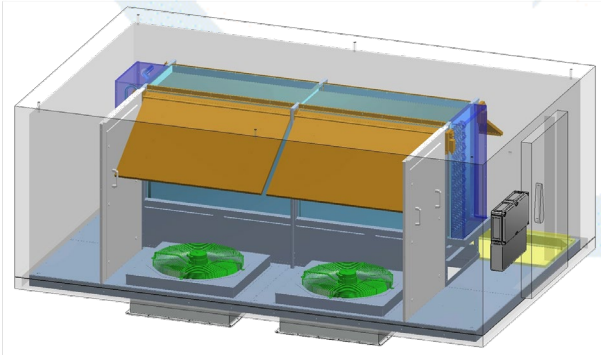
Depictions of common device configurations:



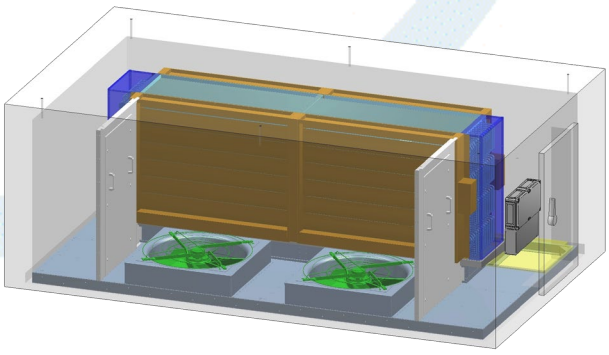
Insulated Cooler axial



Insulated Cooler radial



Penthouse Type with lightweight dampers



Penthouse Type with louvres

1.2 Scope of application

thermofin® Insulated Coolers are designed and manufactured according to customers' requirements and are intended for the installation to the outside wall or on the cold or freezing room. The design as well as the used materials are specified for the respective case of application.

The application limits regarding pressure, temperature and ambient conditions given on the data sheet, the specific drawing and the type plate must be observed.

The standard insulated coolers are not suitable for outdoor installation.
For the outdoor installation, a weather protection roof must be provided on site and the case of installation must be given with the order.

1.3 Standards and directives

The manufacturer certifies the compliance with the standards according to the order-related declaration of incorporation and/or declaration of conformity included in the documents of the units.

Furthermore, both the installation company and the operating company of the system should be familiar with the contents of the following standards, regulations and instructions:

- EU directive 2014 / 68 / EU for pressure equipment (Pressure Equipment Directive)
- EU directive 2006 / 42 / EC for machinery (Machinery Directive)
- EU directive 2004 / 108 / EC (EMC directive)
- EU directive 2006 / 95 / EC (low voltage directive)
- EN 378; parts 1 to 4; "Refrigeration systems and heat pumps, safety and environmental requirements"; state: June 2008
- German equipment and product safety act (GPSG); including regulations (GPSGV) for the Federal Republic of Germany
- BGR 500 "Operation of Work Equipment"; chapt. 2.35: "Operation of refrigeration systems, heat pumps and cooling equipment"; applicable in the Federal Republic of Germany
- VDMA (German Federation of Machinery and Plant Construction) norm 24243 (08/2005) “Refrigerating machines and plants, tightness of refrigeration systems and heat pumps, leak detection and leak test”
- The present operating manual “thermofin® insulated cooler”
- The labels attached to the machine, which contain instructions and information of the manufacturer
- Included order-related wiring diagram
- Wiring diagram for motor connection inside of the terminal boxes of the motors

The operator is obliged to observe – in addition to the regulations stated in this operating manual – all possible local particularities and / or applicable regulations.

2 Technical data

2.1 Operating mode

Insulated coolers (axial/radial or type penthouse) are heat exchangers assembled into an insulated casing. At the same time, the heat exchanger is a part of a cooling or refrigeration circuit in which a circulating medium absorbs heat from the ambient air (the cold room) by means of an air circulation generated by fans.

The refrigerants allowable for use are assigned to the safety group A1 according to DIN EN 378-1 or to the fluid group 2 according to EU directive 2014/68/EU (Pressure Equipment Directive).

2.2 Application and intended use

The unit as incomplete machine according to Machinery Directive 2006/42/EC is intended for the installation in cooling systems. Despite meeting the requirements of intended use and handling the machine properly, residual dangers cannot be completely avoided (see also 3 Safety instructions).

The unit may only be installed in surroundings complying with the design specifications.

The machine may only be used in places where the materials applied are not affected by the surrounding atmosphere or the medium flowing inside.

For all other cases, please contact the manufacturer.

The manufacturer does not assume liability for any damages resulting from the non-compliance with these provisions.

The unit may not be put into operation until the conformity of the complete plant has been declared!

2.3 Material specifications

2.3.1 Insulated casing

CFC-free foamed insulation panels, damper leaf and doors in the required thickness with metal sheet cover made of galvanised, painted sheet metal. Corresponding to the state of the art.

Further installations (floor, gutter, covers, etc.) made of stainless material.

2.3.2 Heat exchanger

Tubes: made of aluminium, copper, galvanised steel or stainless steel; hard soldered and/or welded

Fins: made of AlMg3, aluminium, aluminium epoxy coated, galvanised steel, stainless steel or copper

End sheets: made of AlMg3, galvanised steel, stainless steel

2.3.3 Base Frame

Galvanised steel or stainless steel. Profiles designed according to load with longitudinal and cross braces.

Fixations for crane lugs (not in case of the Penthouse Type). Forms a unit with the insulated casing.

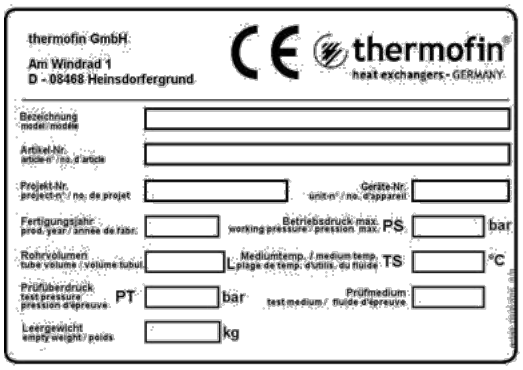
2.4 Sound information

The sound pressure stated was determined by calculation according to DIN EN 13487 and indicates the average value of the sound pressure on the entire enveloping surface at the defined distance.

2.5 Data on the type plate of the heat exchanger

The following data are given on the type plate:

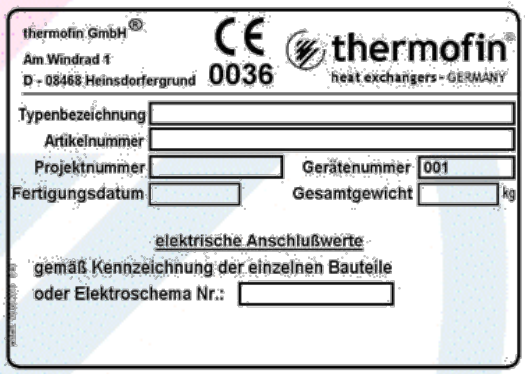
- designation of heat exchanger
- article number of the manufacturer
- project or serial number
- unit number
- month / year of manufacture
- tube volume of the heat exchanger
- test overpressure PT
- maximum working pressure PS
- allowed temperature range of the medium TS
- pressure test medium of the heat exchanger
- empty weight of the unit



2.6 Data on the type plate of the entire unit

The following data are given on the type plate:

- model description according to the unit key
- article number of the manufacturer
- project or serial number
- unit number
- month / year of manufacture
- empty weight of the machine
- number of the respective wiring diagram



3 Safety instructions

3.1 General safety instructions

The unit is state-of-the-art and reliable in operation. The machine may only be used in accordance with the specifications in the catalogue and the data given on the type plate.

The unit may only be installed, commissioned and maintained by competent personnel. For installing the system, the installation conditions according to standard DIN EN 378 are to be observed.

Furthermore, the applicable national rules and regulations, such as the water resources law, accident prevention regulations etc. are to be complied with. The company installing the system has to ensure the observance of all pressure and temperature limit values given on the type plate.

The compliance with the instructions of this operating manual does not release the plant operator from the obligation to install an appropriate warning system indicating each kind of malfunction immediately. In addition, emergency measures must be planned and prepared in order to prevent consequential damages in case of malfunctions.

Deactivate the power supply of all circuits for assembly, repair and maintenance works. Ensure the protection against unauthorised or unintended (automatic) activation. Ensure that the unit is free of voltage and protect it, if necessary, by earthing or short circuit. Cover adjacent parts which are under voltage.

Danger of suffocation in case of escaping refrigerants!
The insulated cell is a closed room and may not be entered in case of leaking refrigerants!

Danger of Cutting!
Prevent the contact with fin edges!

Danger of burning!
Hot gas or hot brine lines as well as electrical heating elements can be very hot! Prevent the contact with heating elements!

Unauthorised reconstructions or modifications influencing the function or the safety of the unit or the heat exchanger are forbidden!

It is forbidden to put objects through the fan grid or in the turning circle of the fan blades.

External forces on the units must always be prevented. Especially unit connections and collector tubes must not be charged (e.g. accessed).
Do not use any connection or tube for climbing. Do not step onto the fans!

Danger of falling!
The access to the roof of the casing is only permitted with suitable falling protection!

Caused by the design, the railing in the area of the defrost damper is very low. There is a risk of falling in case of an open damper. Only enter the area of the defrost damper if it is closed.

Before entering the insulated cooler, the fans must be deactivated and protected against restart!

Depressurise the unit before effecting welding or soldering works! During welding and soldering works, refrigerant residuals are subjected to high temperatures. In doing so, highly toxic decomposition products such as hydrogen chloride, hydrogen fluoride or phosgene are generated.

Ensure a personal protective equipment in case of escaping refrigerant. Prevent any contact with the refrigerant. Fluid refrigerant causes severe frostbites. Immediately consult a doctor in case of contact with the eyes!

Fans of insulated coolers have no protection grids on the connection side of the channel and must not be activated before all air ducts are properly connected.

Door frame heaters must always be activated in case of interior temperatures ≤ 0°C. Otherwise, the door leaf can freeze. The access to the unit is no more possible!

Danger to life! Trapped persons can freeze to death!

According to installation conditions and degree of freezing of the heat exchanger, the underpressure of the fans could be too high so that the access door can no more be opened.

Deactivate the fans before any maintenance and inspection works and protect it against restart. Never work alone on the units!

3.2 Safety requirements on the installation site

The erection and installation conditions according to DIN EN 378 are to be observed.
Pipes and fittings must be protected against misuse. Emergency facilities, such as lighting, venting, escape routes and the marking of which according to DIN EN 378 must be provided.

The machine must be lockable in case of leakage. Devices which are used for the discharge of released refrigerants must be operable from a safe location.

Refrigerant detectors and alarm systems which warn of hazardous concentrations have to comply with the assembly conditions of the DIN EN 378-3, chapt. 7 and 8.

No smoking at the installation site.

Open fire is prohibited.
The fire extinguishing equipment must meet the requirements of DIN EN 378-3.

There must be sufficient free space around the machine in order to prevent dangers to the machine and its connections and to ensure smooth execution of maintenance and repair work on the machine as well as on all fittings and components.

3.3 Safety instructions for the utilised fluids

The safety advices/instructions of the safety data sheet of the used refrigerant (heat carrier) must be observed! Further and detailed information on use, application and first aid as well as associated measures are indicated in the respective safety data sheet.

The following safety advices are only for information without claim to completeness. The system construction/installation company is responsible for the compliance with the legal safety instructions and the installation of suitable safety equipment.

In general, the following must be respected:

An escape of operating means must be prevented.
In case of leakages on the heat exchamger, it must be blocked ***if it is possible without any risk!*** *Activate the EMERGENCY STOP from a safe place!*

Liquid refrigerants can lead to frostbites and chemical burns on the skin. Prevent any skin contact!

Repair works (in particular brazing and welding) may only be effected on completely emptied system parts.
Ensure a good ventilation.

Do not bring refrigerants in contact with open fire or hot surfaces. Be careful in case of soldering and welding works!

3.3.1 Refrigerants of the group A1, fluid group 2

The used refrigerants R134a, R404A, R507, R407C … are so-called safety refrigerants of the group A1 according to the classification DIN EN 378, which are neither combustible nor toxic.

In general, refrigerants of the group A1 are heavier than air and can escape into lower rooms. In case of still air, the concentration can be increased near the ground.

A high concentration leads to a danger of suffocation because of the reduction of the oxygen content in the respiration air as well as the danger of cardiac arrhythmia or even of a sudden death.

The refrigerant contains dissolved compressor oil which must not get into the soil!
Dissolved compressor oil circulating and remaining in the tube system is combustible!

Prevent the contact with eyes, skin and clothing during fault clearance works. Wear personal protection equipment.

3.3.2 Ammonia

The used refrigerant ammonia (NH_3 / R717) corresponds to the fluid group 1 according to Pressure Equipment Directive 97 / 23 EC and/or B2 according to DIN EN 378-1: 2008 and requires special safety measures.

NH_3 is a toxic, pungent-smelling gas. However, a health risk starts high above odour threshold (warning effect of NH_3).

Ammonia is lighter than air.

Although NH_3 is both combustible and explosive, the risk of burning and explosion is, because of the high ignition temperature, the small flammability range and the high affinity to air humidity, the risk of burning and explosion is low.

NH_3 is strongly toxic for water organisms and must not enter drainage systems!
NH_3 gas must not enter combustible rooms, corridors or stairways.

NH_3 leads to unrest, dizziness, vomiting and cramps, in case of higher concentration also to suffocation as well as pulmonary oedema.

From a concentration of 0.2 Vol%, NH_3 has a life-threatening to deadly effect.

NH3 has a strongly caustic effect on eyes and mucous membranes. In case that NH_3 comes in contact with the eyes, they cannot be kept open → disorientation.
Inhaled NH_3 leads to a respiration stop → results in panic.

The handling of NH_3 requires the strict compliance with working protection regulations and standards, especially measures for the personal safety must be taken. It also comprises the personal body protection according to situation:
*protective gloves; protection glasses; respiratory protection which is **independent from the ambient air***

During fault clearance, be aware of remaining NH_3 subjected to bumping.

3.3.3 Carbon dioxide

The used refrigerant carbon dioxide (CO_2 / R744) corresponds to the fluid group 2 according to Pressure Equipment Directive 97 / 23 EC and/or A1 according to DIN EN 378-1 / 2008, but requires special safety measures.

CO_2 is a nontoxic, colour- and odourless gas. These properties may prevent the detection of leakages.

CO_2 is neither combustible nor explosive.

CO_2 – gas is heavier than air and must not escape into lower rooms, corridors or stairways or into the sewage system.

From a concentration of approx. 4% it leads to unconsciousness in case of longer inhalation. From a breathing air concentration of approx. 8 %, breathing difficulties, dizziness, rapid heartbeat and other symptoms are possible.

Near the ground, a concentration peak can be generated in case of steady ambient air. In case of high ceoncentration there is a risk of suffocation caused by a reduction of oxygen percentage in the breathing air.

A continuous monitoring of the system tightness and/or the room air concentration is required!

On escaping points of liquid CO_2, a strong electrostatic charge is possible!

The handling of CO_2 requires the strict compliance with working protection regulations and standards, especially measures for the personal safety must be taken. It also comprises the personal body protection according to situation:
*protective gloves; protection glasses; respiratory protection which is **independent from the ambient air***

During fault clearance, pay attention to a dangerous CO_2 concentration in the room air. Ensure a good ventilation of the rooms, use a respiratory protection which is independent from the ambient air or ensure that the room air concentration is harmless.

3.3.4 Ethylene glycol

Ethylene glycol is a colourless, slightly viscous, low volatile liquid which is mixable with water, hygroscopic and has a sweet odour and flavour.

Ethylene glycol vapours are heavier than air and can escape into lower rooms.

In case of still air, the concentration can be increased near the ground. A high concentration leads to a risk of suffocation because of the reduction of the oxygen content in the respiration air.

Ethylene glycol is combustible and, in case of higher temperatures in vaporous and gaseous condition, explosive!

Ethylene glycol leads to slight irritations in case of contact with the skin with the risk of skin absorption. The contact with eyes leads to mucosal membrane irritations. If swallowed, it leads to agitations with disorders of the central nervous system as well as fatigue, unconsciousness, coordination disorders and damaged kidneys.

Prevent the contact with eyes, skin and clothing during fault clearance works.
Wear personal protection equipment.
Take off polluted or soaked clothing immediately!

4 Transport and packaging

4.1 Transport and lifting

In case of transport with truck, the Insulated Cooler must be protected with a blanket.

In principle, the Insulated Cooler must be protected against weather, except that the insulated cooler is prepared in factory for external installation.

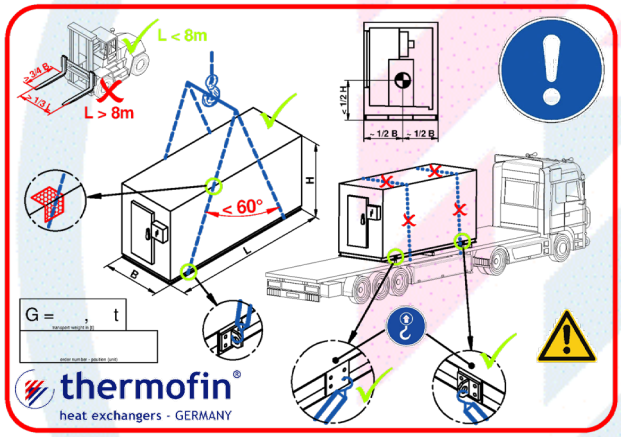
Depending on the unit design, an unloading either only by forklift or only by crane may be possible. The loading method shall be agreed in the planning phase.

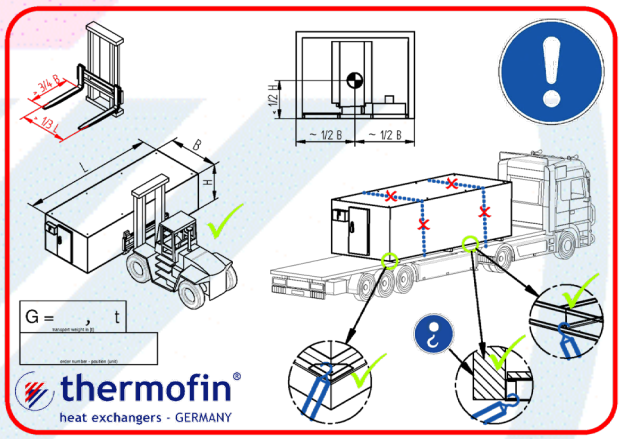
Before unloading and before assembly, the Insulated Cooler must be checked for damages (damages in transit).

Every transport of the Insulated Cooler must be effected very carefully.
Avoid a hard placing of the unit!

The lifting instructions attached to the unit must be observed. Use suitable slings. All used slings must not be drawn through the casing edges. They must be used in a manner that the casing is not pressed. In any case, a traverse must be used. Only fix slings to the provided lifting points.

On the following labels on the units, the empty (transport) weight as well as the order and position number are noted.





Before lifting, ensure that all transport lugs are fixed properly.
The lifting os only permitted on the marked points of the base frame.

In case of transport with forklift trucks, a sufficient fork length must be ensured. Pay attention to longitudinal bracings in the base frame and the position of centre of gravity!

Pay attention to safety sign on the units! (if any)

Transport with fork lifters is prohibited!

Lifting or lash down points

4.2 Packing

Decisive factors for packing are the route of transport, the size of the equipment and the regulations applicable in the country of importation.

If not otherwise expressly agreed, the delivery is effected ex works in standard transport packaging at the discretion of thermofin®. According to contractual agreement, design and packaging are sufficient for the transport to the contractual agreed place of transfer of risk.

The purchaser is responsible for a possible further transport and the respective packaging.

In case of a packaging by external companies ordered by the purchaser or the customer, thermofin® cannot give any warranty for the design of the packaging and possible resulting transport damages. A safe design of the packaging should be agreed with thermofin®.

The pallets, crates and export boxes used for thermofin® machines meet the requirements of the HPE and VDM standards (HPE – German Federal Association for Wooden Packages, Pallets and Export Packaging; VDM – Association of the German Furniture Industries). If required they can be tailored to the standards of ISPM 15.

thermofin® transport packages are made of environmental friendly materials and they are suitable for recycling.

According to the German regulation on packaging, we are prepared to take back our packages if they are returned to us, delivered free to our location in Heinsdorfergrund.

Loading on road vehicles is performed in accordance with the VDI guideline 2700 "Securing of loads on road vehicles".

In case of groupage traffic and reloading, responsibility lies with the forwarder.

All packing material on the insulated cooler must be removed during assembly; such as:

- Protective foil on the panels
- Corner and edge protection
- Container sliding strips (on bade frame)
- Wooden bracing
- Damper securing

If the packing material is not removed during assembly, a later removal might no more be possible!

5 Assembly and commissioning

5.1 General

The unit may only be installed, integrated in a refrigeration system, operated, maintained and repaired by qualified personnel of specialist companies according to the definitions of expertise from DIN EN 378.

During production and before delivery, each machine is subjected to comprehensive quality testing. The machine is provided in good order and condition.

Usually, thermofin® insulated coolers are provided completely assembled.

In the event that a machine is delivered disassembled – due to transportation or other reasons – it must be assembled on site according to the order-specific drawings enclosed.

5.2 Positioning and assembly

Steel / supporting structure

The manufacturer of the unit is not responsible for the suitability and the loading capacity of the scaffolds, consoles, frames, foundations etc. on site.

Additionally to the net weight on the type plate, the filling weight, a possible ice attachment and, in case of external installation, the wind and snow load must be considered for the load capacity of the construction on site.

The insulated cooler must be supported evenly and horizontally on all axis.

In case of a hanging design, especially an even tensile loading of the bars must be ensured.

Installation site

The doors must be easily accessible and reachable at any time.

The insulated cooler must not be damaged or affected in its function due to environmental risks (production or transport processes, other technical installations in close proximity).

Switches and isolating equipment must be protected against unauthorised use.

Insulated coolers are not suitable for a direct outdoor installation. A weather-protection roof must be installed on site over the entire unit in case of an outdoor installation.

Packaging / transport protection

After installation and before commissioning, all packing parts (also remaining protective foil on the outside panels) and transport protections must be disassembled.

In particular, the removal of the transport damper locking at the Insulated Cooler axial/radial must be ensured.

For security reasons, in case of longer transport ways, the servomotor is be unhinged and locked for transport. The locking must be removed and the control lever must be reconnected. In doing so, it must be ensured that the locking spring is fitted properly in the bolt.

Assembly remarks

Risk of falling!
The draw-in air grids (also running grids) of the penthouse design must not be loosened!
Since it is required to loosen them for reasons given on site, thermofin® is not liable for the safe and correct fixing.

To connect the insulatd cooler to the cold room or an air channel, the sketches according to appendix *B* to *appendix D* must be observed.

Without manufacturer's approval, it is forbidden to assemble parts to the insulation casing and to make apertures.
Excepted are sensors with their casings and connection tube passages (see advice 6) + 7) in chapter *5.3 Pipe connections*). In case of fixations to cell walls, the required holes must be sealed with silicone.

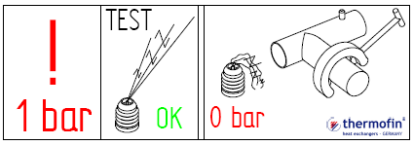
All wall openings must be carefully closed – otherwise, water can entre the panel wall and cause damages!
→ See also *appendix E Basic depiction of a panel penetration on Insulated Coolers.*

All additionally required cables may only be pulled through the existing cable gland plate and must be sealed with foam!

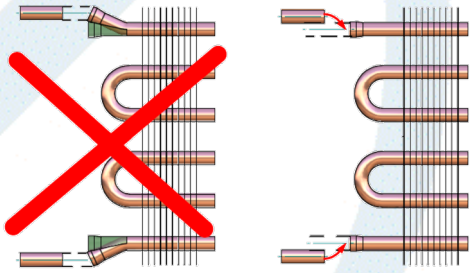
The roof of the casing is not suitable to support tubes, ducts and similar, except that it is factory-provided by constructive measures. By accessing the cell roof, a load partition by large, stable supports must be ensured.

5.3 Pipe connections

The units are delivered with an overpressure of approx. 1 bar (cleaned and dried air) (according to the regulation for the transportation of hazardous material ADR 1.1.3.2 c).



1) Before removing the closing caps or the counter flanges, it must be verified that the overpressure is present.
2) In case of a depressurized heat exchanger, the manufacturer must be informed immediately.
   A depressurized device indicates a leakage (Damage in transit!).
3) Release the transport pressure before removing the tube end caps (see indicating label).
4) Pipe connections are to be designed in such a way that any force, stress and vibration effects on the machine are prevented.
5) Refrigerant distributors must be arranged vertically. Distributor capillaries must not be shortened.
6) Tube passages through insulation panels must be effected professionally and according to the state of the art. Panel seams must not be cut through.



7) A humidity entry into the foam must be prevented by suitable internal and external measures!
8) Pay attention to the marking of connection tubes:

Inlet Outlet

All conducts of tubes, electrical cables etc. must be foamed and closed in a steam resistant manner before commissioning.
→ Entering water can damage sandwich panels!
It also applies to openings made by thermofin® in factory e.g. to lay connection lines for the heat exchangers.
→ See also E Basic depiction of a panel penetration on Insulated Coolers

5.4 Electrical connection

The electrical connection of the fans and/or the electrical accessories, if existent, must be performed in accordance with the applicable regulations according to DIN VDE 0100, DIN EN 60204 part 1, DIN EN 378-3, par. 6, as well as the provisions of the local energy supply company.

The electrical installation may only be carried out by qualified personnel.

The local regulations must be observed.

1) The data given on the respective identification labels are binding.
2) Wiring may only be performed in accordance with the circuit and wiring diagrams provided.
3) Strain-relief devices must always be used!
4) The direction of rotation of the fans must be observed!
5) The thermal motor protection is either already integrated in the electrical feed line of the fans or has to be integrated in the electrical control system by the company installing the machine (see wiring diagram of the fans).
6) A suitable all-pole circuit breaker must be integrated in the system.
7) Please note that in case of an installation in cold spaces humidity can condense out, which can lead to an accumulation of dripping water inside the socket as well!
8) For connecting the unit or subsequent installations assure compliance with the degree of protection. In particular the sealing of the cable glands and terminal covers must be checked for intactness and correct fitting.
9) If the unit is equipped ex-factory with a control cabinet, the wiring diagram is inside.
10) The control cabinet is applicable down to +5°C without additional heater (e.g. in case of external installation).
11) The thermofin® damper controller TFC is assembled into the control cabinet. There, you can also find the respective “manual TFC”. Please also observe: Functionality only down to -10°C without additional heater.

Caution!
The access to the dampers is prohibited during operation of the fans or the servomotors!

Remark
The fans may only be started with completely opened dampers.
Do not close the dampers as long as the fans are actuated!

5.5 Commissioning

***Caution**: In case that the unit is equipped with a TFC or a TCS, it opens the damper as standard setting.*
Before commissioning of the TFC / TCS the damper must be freely moveable. In doing so, the insulated cooler must be completely assembled and any damper securing must be removed.

Before commissioning, the system’s readiness for operation must be verified according to the following points:

1) Has the machine been properly installed and fixed according to the requirements of this instruction?
2) Have all fluid-carrying lines been connected and checked for tightness?
3) Are the shut-off devices open?
4) Is the flow direction correct?
5) Are all cables properly installed and completely connected? Has cabling been done according to the wiring diagrams provided?
6) Has the electrical protective installation been checked for proper functioning?
7) Are all protective grids correctly fixed and the inspection doors properly locked?
8) Have all bolted connections (e.g. fans, cable entries), fastenings, electrical connections etc. been checked for tight fit?
9) Are all terminal boxes and cable entries firmly closed and tight?
10) Do the fans rotate freely and in the right direction?
11) The defrost dampers (if existing), do they open and close properly and smoothly?
12) The access doors, do they close tightly (visual test from outside with internal light)?

13) Are all required sensor signals present?
14) The electrical heaters of dampers, door frames, drip tray, coil as well as the discharge trace heating, do they work correctly (resistance measuring)?

During commissioning the following measures have to be taken:

15) Adjust the electrical switching and control devices and check for correct functioning (see the specific operating instructions of the respective control device).
16) Check the switch point settings of the safety equipment.

5.6 Return to service after a longer period of standstill

If the machine is intended to be put into operation again after being shut down and standing still for a longer period of time, the following points must checked in addition to those mentioned under *5.5 Commissioning*:

1) Visual inspection of the heat exchanger coil; check for fouling and damages
2) Leak test of the heat exchanger coil
3) Correct fixation of all connections to tubing (also clamps), electrical system and casingas well as mounted parts
4) Check the electrical control and its components
   (Insbesondere Überprüfung der korrekten Funktion von Ventilatoren und Heizungen.)
5) Check the safety equipment

6 Operation and decommissioning

6.1 Normal operation

For running the machine, the entire plant including the electrical system must be operating. The machine is integrated in the cooling circuit by opening the corresponding shut-off valves.

It is turned on by activating the electrical system.

After reaching the machine-specific operating point the machine is ready for operation.

In case of operating conditions which differ from those stated in the offer, the manufacturer must be consulted.

6.2 Decommissioning

The machines are part of a cooling system. Machine decommissioning and return to service must meet the system-dependent requirements as well as the requirements of the operating manual of the equipment manufacturer and of the applicable standards and accident prevention regulations (see also chapter *1.3 Standards and directives*).

The decommissioning is effected by closing the fluid-bearing tubes and by switching off the electrical system.

The following applies for all devices: Exceeding the maximum pressure must be prevented!

7 Defrosting

7.1 Basics

In order to durably ensure the efficiency and the operational safety of the heat exchanger, it must be defrosted regularly and in due time. An excessive forming of ice may lead to an exceedance of the permitted operating weight (suspension points).

The defrost process must be started by customer via preset intervals or better on demand. The start and the end of the defrost process must be monitored and controlled with a suitable sensor technology.

7.2 Heating systems

Caution hot surface!
Caused by the design hot surfaces in the interior of the Insulated Cooler e.g. of heating rods and hot gas lines can be touched and cause burnings!

7.2.1 Electric heating

Electrical heaters can be integrated directly or upstream and/or downstream as separate heating register.

Drainage channels, drip trays, fan rings, damper frames and door frames are also electrical heated if required. (For the penthouse type, also other heating systems can be used.)

Heating rods can get very hot and must be absolutely monitored and controlled. An operation without temperature safety circuit is not permitted!
Take safety measures against overheating of the units in interior (temperature limiter) and against pressure exceedance (pump down switching) according to the prescriptions of DIN EN 378 as well as EN 60519-2 and VDE 0721.

The electrical heating rods (in heat exchanger, drainage channels, drip trays, fan rings and louver dampers) are not suitable for continuous operation. They can burn out and/or damage the unit and must be controlled by customer so that they do not exceed a temperatures of max. +80°C! (time- / temperature limit)

Door frame heaters and damper frame heaters (except louver dampers) are self-regulating abd suitable for continuous operation.

Recommended heat exchanger temperature for defrost process: +40°C

Recommended position of defrosting sensor:

→ In the upper area or on the position of the finned coil, the furthest from the next heating rod on the air inlet side.

For heat exchangers with lengths above 2 m, two sensors are recommended and to be requested in “and mode”.

7.2.2 Hot gas heating

The hot gas is directly guided into the heat eychanger tubes (and drip tray). In doing so, the heat exchanger must defrost from bottom to top. Otherwise the defrost process cannot be effected properly and can cause a too strong icing.

A sufficient quantity of hot gas must be available so that the defrost process can be effected quickly and completely.

Recommended hot gas temperature: 40°C (min. 20°C; max. approx. 60°C)

Depending on hot gas temperature, a limitation of the hot gas quantity (e.g. clocking) can already be required from 40°C so that the heat exchanger is not excessively heated.

Recommended position of defrosting sensor:

→ Temperature sensor approx. on half height of the air inlet side of the heat exchanger; possibly on outlet area of the hot gas.

For heat exchangers with lengths above 2 m, two sensors are recommended and to be requested in “and mode”.

7.2.3 Hot brine heating

Insulated coolers with exaporators are defrosted with a separate hot brine circuit. It is directly integrated into the heat exchanger or designe das separate heating register.

Insulated coolers with air coolers can directly use the cold brine circuit in the heat exchanger.

Caution!
Always ensure a sufficient frost protection in the brine. Otherwise the brine circuit can be damaged by freezing.

A gelling of the brine must be prevented! A brine micture must be accordingly designed.
In case that the brine gels in the evaporator, some strands of the brine circuit can not more be suvjected to hot brine during defrost process (mostly in lower area). Consequently, the heat exchanger cannot be properly defrosted.

Brine circuits tend to a separation of water and antifreeze agent in case of downtimes.
→ The brine circuit must be regularly circulated (also in cold condition).

Recommended position of defrosting sensor:

→ Temperature sensor approx. on half height on air inlet side of the heat exchanger; possibly in outlet area of the hot brine.

For heat exchangers with lengths above 2 m, two sensors are recommended and to be requested in “and mode”.

7.2.4 Warm air heating

It is also possible to use hot air for defrosting. The air temperature must be min. +5°C.

In case of cold rooms with sufficiently high temperature, the insulated cooler can be defrosted with circulating air. This variant is particularly energy effcient since also the „residual cold“ of the heat exchanger is fed into the cold room.

In case of sufficient air temperature in warmer months, ambient air can be used for defrosting.

Recommended position of defrosting sensor:

Outside/circulating air sensor (for recording of the air temperature and resulting defrost time):
→ Temperature sensor directly in front of draw-in opening of the ambient/circulating air; provide one sensor per damper/opening.

Two or more sensors shall be queried in „and mode“.

Defrost sensor:
→ Temperature sensor in the lower area of the heat exchanger on air outlet side.

For heat exchangers with lengths above 2 m, two sensors are recommended and to be requested in “and mode”.

7.3 Procedure of defrosting

Caused by different design and installation conditions, every insulated cooler has a different defrost behaviour. The principles described below must always be adapted to local conditions!
I fit is not observed, the following problems during defrost process are possible: e.g. evaporation due to an overheating or incomplete defrosting with icing.

Caution!
With the heating during defrost process, the pressure inside of the heat exchanger (especially evaporator) can be strongly increased. The exceedance of the permitted operating pressure must be escluded by suitable measures (e.g. pump out circuit).

All available **heaters** (e.g. damper, channel, drain, fan ring, motor heaters) must be activated during defrost process!

In general, the **heat exchanger** may only be heated up slowly. If it is heated up too quickly and/or too hot, the generated condensation water is evaporated. Condensate on cold surfaces in the interior of the Insulated Cooler (e.g. on walls, dampers, terminal boxes) will occur and form ice accumulations which are hard to defrost with a normal defrost process.
Furthermore, the heat exchanger can be damaged in case of irregular and too quick heating caused by contraction stresses.

Defrost dampers may only be moved if the fans are deactivated. Furthermore, the fans may only be activated after the dampers have reached their final positions.
In order to ensure this, damper position, movement and fan operation must be monitored by sensors/the controller. Between fan ON/OFF and damper movement, sufficient buffer times (e.g. 1 min) must be set.

After end of defrost time, a **drip phase** on min. 5 minutes is required in order to ensure that the entire water can escape from the insulated cooler. (heat exchanger must drip off completely and water escape into the tray/channel).

After a drip phase, a **precooling phase** of min. 5 minutes is required in order to freeze remaining humidity on the walls, to freeze air inside of the heat exchanger and to cool down the insulated cooler to room temperature. It prevents the inlet of humid air into the cold room. During precooling phase the defrost dampers remain closed and the fans deactivated.

The defrosting must be effected **completely**, this means after finalisation of the defrost process, frost and ice must be completely defrosted. Ice accumulations shall not remain in the corners.

Therefore, the selection of the defrost end temperature and the position of the defrost sensor is essential. (refer chapter *7.2 Heating systems*)

7.3.1 Insulated Cooler axial/radial with circulating air defrosting

Principle of function

For defrosting, the defrost damper on the insulated cooler is closed axially/radially and the heat exchangers is heated by an external heating source. The fans run with reeduced speed and ensure an air circulation.

In doing so, the entire interior is heated and defrosted.

Requirements / boundary conditions

During the entire defrost process, the defrost damper must be completely closed.

During starting time of the defrost process, the heat exchanger should not be heated over +20°C. Otherwise, this could lead to evaporations and an excessive droplet formation inside the insulated cooler (on ceiling and walls).

The internal temperature may only increase slowly and should not exceed +20°C. For this, the heat supply must be monitored and regulated (e.g. clocking) during defrost process.

Positioning of defrosting sensor see chapter *7.2 Heating systems.*

Procedure of circulating air defrosting

1) Stop refrigerant and empty coil (pump down)
2) Activate damper, channel, drain, fan ring, motor heaters if existing
3) Switch off fans
4) Close the defrosting damper (→ *The fans must stand still first!*)
5) **Defrosting**
   Switch on heating system
   Switch on the fans but with reduced speed. (The air is circulating in the Insulated Cooler.)
6) Switch off heating system and fans
7) Drip-off and drying time (at least 5 min.)
8) Freezing time: Start the refrigerant and wait until all water drops are frozen (if any) and the interior of the insulated cooler is cooled down sufficiently. (at least 5 min.)
9) Open the defrosting damper
10) Deactivate damper, channel, drain, fan ring, motor heaters if existing

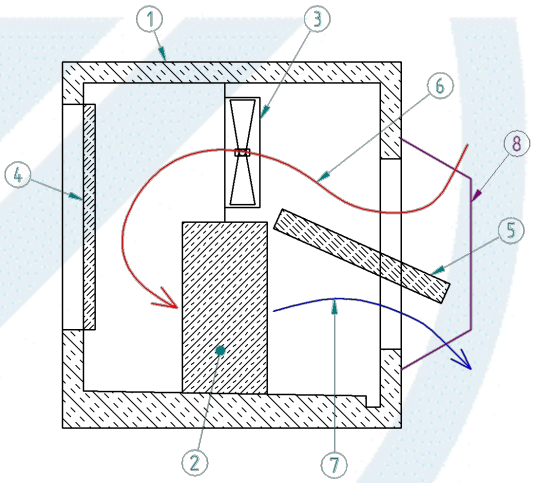
→ *The Insulated Cooler is ready for normal operation mode (cooling).*

7.3.2 Insulated Cooler axial/radial with outside air defrosting

Principle of function

By an additional damper warm outside air is directed through the insulated cooler. The flap also function as a separation of inlet and outlet air. The fans – running at reduced speed – pump the air through the unit.

In insulated coolers axial/radial the entire interior is heated and defrosted.



1) panele of insulated cooler
2) heat exchanger
3) fans
4) defrosting flap (closed)
5) outside air flap (open)
6) warm air inlet
7) cool air outlet
8) on-site weather protection / grid / filter

Requirements / boundary conditions

An outside air temperature of at least +5°C is needed all the year. However for short periods (max. 2...3 weeks a year) with temperatures below that margin the defrosting can be executed by the use of an optional auxiliary heating (e.g. electric heating). In that case its duration might increase vastly.

High demands on hygiene cannot be met, whereas a dirtying by the outside air is to be expected.

The following protections need to be installed on-site at the outside air opening: A weather protection with a grid / filter acc. to the needs to keep out dirt or animals. (at least a protection grid against birds or foliage)

The installation site shall provide enough space for the outside air to be sucked in and blown out again.
Additional it must be ensured that an easy access to the outside air flap for cleaning and maintaining is possible.

Danger of slipping!
Much condensate is to be expected in the area where the defrosting air is blown out.
Even icing can be possible in wintertime! Ensure that the condensate will be drained properly.

Positioning of defrosting sensor

see chapter *7.2.4 Warm air heating*

→ Additional use a room temperature sensor in the area of the access door. (Which detects the maximum cabin / interior temperature.) It shall be ensured that this section is sufficient warmed.

Ambient/circulating air sensors must be requested in „and mode“ whereby the ambient/circulating air sensor defines a minimum time for heating of the interior and the defrost sensor monitors the heat exchanger.

Procedure of outside air defrosting

1) Stop refrigerant and empty coil (pump down)
2) Switch off fans
3) Close the defrosting damper (→ *The fans must stand still first!*)
4) Open the outside air damper
5) **Defrosting**
   Switch on the fans but with reduced speed. (Outside air will be blown through the unit.)
   Adapt the defrosting time to ensure that the unit is defrosted completely at lowest outside air temperatures.
   → *The outside air temperature must be monitored by sensors installed at the outside air inlet to adjust the defrosting time by the control unit. That allows to reduce the defrosting and standstill time to a minimum especially in the hot summer time. However it must be ensured the defrosting is done completely at any temperature. (defrosting time must be long enough)*
6) Switch off fans
7) Close the outside air damper (→ *The fans must stand still first!*)
8) Drip-off and drying time (at least 5 min.)
9) Freezing time: Start the refrigerant and wait until all water drops are frozen (if any) and the interior of the insulated cooler is cooled down sufficiently. (at least 5 min.)
10) Open the defrosting damper

→ *The Insulated Cooler is ready for normal operation mode (cooling).*

Defrosting during cold weather conditions

In case of alternating temperatures around the margin (e.g. daytime highs +6°C / at night 0°C) ensure that the defrosting is done at highest possible temperatures by monitoring the outside temperature. At least the margin temperature should be reached.

During cold weather conditions (outside air temperatures below + 5°C) use the circulating air defrost procedure – refer chapter *7.3.1 Insulated Cooler axial/radial with circulating air defrosting*.
An auxiliary heating system must be installed. For the auxiliary heating systems have less capacity than normal ones the defrost procedure needs to be prolonged vastly.
The outside air dampers remain closed in this case.

Additional cleaning and maintenance works

There are additional maintenance works to be done by the use of outside air defrosting. Particularly dirtying and icing on the outside air damper should be watched carefully and removed if any.

→ A regular inspection of the interior is mandatory. (at least every second week)

Dirt and Ice can cause leakiness at the outside air damper. This allows outside air to be sucked in during normal (cooling) operation. This can cause severe icing in the insulated cooler and reduce its cooling capacity.

The function of the damper (opening / closing) and their tightness must be checked regularly. The damper shall push tightly against its end position bearings or gaskets.

7.3.3 Insulated Cooler Penthouse Type with circulating air defrosting

Principle of function

For defrosting, the refrigerant is stopped and the fans draw warm air from the cold room through the heat exchanger. There are no defrost dampers and no heating system.

Requirements / boundary conditions

The air temperature in the cold room must be minimum +5°C betragen.

Positioning of defrost sensor see chapter *7.2.4 Warm air heating*

Procedure of outside air defrosting

1) Stop refrigerant and empty coil (pump down)
2) **Defrosting**
   Switch on the fans but with reduced speed.
3) Switch off fans
4) Drip-off and drying time (at least 5 min.)
5) Freezing time: Start the refrigerant and wait until all water drops are frozen, if any. (at least 5 min.)

→ *The Insulated Cooler Penthouse Type is ready for normal operation mode (cooling).*

7.3.4 Insulated Cooler Penthouse Type with standard defrosting

Principle of function

For insulated coolers of penthouse in deep-freeze storage, only the heat exchanger is defrosted with closed defrost dampers.

Requirements / boundary conditions

The fans are deactivated and the defrost dampers must be completely closed.

A heating system according to *7.2 Heating systems* (except warm air) must be installed.

Positioning of defrost sensor see chapter *7.2 Heating systems*

Procedure of standard defrosting for Insulated Cooler Penthouse Type

1) Stop refrigerant and empty coil (pump down)
2) Activate damper, tray, drain, fan ring, motor heaters if existing
3) Switch off fans
4) Close the defrosting damper (→ *The fans must stand still first!*)
5) **Defrosting**
   Switch on heating system
6) Switch off heating system
7) Drip-off and drying time (at least 5 min.)
8) Freezing time: Start the refrigerant and wait until all water drops are frozen (if any) and the heat exchanger is cooled down sufficiently. (at least 5 min.)
9) Open the defrosting damper
10) Deactivate damper, tray, drain, fan ring, motor heaters if existing

→ *The Insulated Cooler Penthouse Type is ready for normal operation mode (cooling).*

7.4 Systems of defrosting dampers

7.4.1 General

Caution danger of crushing!
Caused by the automatic start, there is a risk of crushing on moving parts in the swivel range of the damper and servomotors.
The area of the defrost dampers must not be accessed during actuation of the servomotor!

7.4.2 Panel dampers (only Insulated Cooler axial / radial)

The defrost dampers and ambient air dampers of the insulated coolers axial/radial are made of sandwich panels (PU foam with metal sheet cover on both sides).

The seal of the defrost dampers to the soffit is executed with circumferential, adjustable and temperature-resistant silicon sealing lips fixed to the damper leaf.

In case of ambient air dampers, silicon hollow body seals are used which are executed doubly: One seal is fixed to the damper leaf and another inside of the frame. The seal of the frame is adjustable.

The soffit is circumferentially heated in order to prevent a freezing of the seals.

Caution danger of falling!
The defrost dampers are not safe to walk on and can break.
The dampers must not be walked on under any circumstances.

The damper leaf shall not be stressed mechanically anyway! This can cause damage to the damper leaf itself as well as to its driving mechanism or actuator.

Examples are particularly:

- *Entering the damper leaf*
- *Activation of the fans even the dampers are not in their final position*
- *Pulling/drawing on the damper leaf*
- *Placing of tools onto of positioning of ladders against the damper leaf*
- *Blocking of the damper leaf during movement*
- *Fixation of objectives on the damper leaf (e.g. air guide panels or furter seals)*

For protection of the damper and its drive mechanism, the drive shaft of the damper is realised with shear pin, which break by overload.
→ Overloads of the damper mechanism results in the expiry of warranty claims against thermofin®.

The opening mechanism is adjusted in factory and normally does not require any adaption. Small tolerances in the gaskets or mechanical damper stops are automatically adjusted by the actuator and the control. A separate stroke adjustment is not needed.

The dampers are actuated with an electrical servomotor. The damper moves completely from OPEN to CLOSE position or in reverse order. There are no intermediate positions.

The travel monitoring and limit switch are effected by the damper comtrol TFC. (see chapter *7.4.5 Actuator with thermofin® control (TFC / TCS)*)

In case of operating the insulated coolers below -30°C, all servomotors are equipped with a regulated electrical heating.

7.4.3 Lightweight dampers (only Penthouse Type)

Lightweight dampers consist of a thin sandwich panel and are only used in insulated coolers of type penthouse cooler. Thereby, two maintenance-free defrost dampers are installed – respectively one in front of and one behind the heat exchanger.

The dampers are actuated by electrical servo motors. Their opening angle can be tuned with an adjustable mechanical brake. These stops define the OPEN / CLOSED position. If the respective damper position is reached, the actuator moves against the stop and stops.

The actuators must not be disconnected from the mains. They shall remain connected to the power supply unto inversion of the direction. This allows the actuator to keep itself warm and to correct the damper position automatically.

The return signal of final position is effected via a plug potentiometer on servomotor. The respective control and and monitoring circuits are visible in the respective wiring diagram.

Tob e sure, the damper movement must be monitored using waiting time and time-out.

7.4.4 Louver dampers

Normally, louver dampers are used in insulated coolers of penthouse type for deep freezing and are used there for the same purpouse as the lightweight dampers. But louver dampers are completely made of metal (galvanised steel/aluminium/stainless steel).

The different damper systems are selected depending on the respective project regarding size of the unit and operating comditions.

They are actuated with the same servomotors as the leightweight dampers. (see chapter *7.4.3 Lightweight dampers (only Penthouse Type)*)

Caution! Danger of crushing!

The servomotor only stops in final position. Do not touch the fins or rods during the louver dampers OPEN/CLOSE!

7.4.5 Actuator with thermofin® control (TFC / TCS)

For actuators with thermofin® control (TFC / TCS), the complete control, limit switch, position monitoring and safety switch is effected by the TFC / TCS.

The interface for the system control on site is reached by the inlet signals requirement damper OPEN/CLOSED and the outlet signals OPEN, CLOSED, ERROR. The respective control circuit and siganal monitoring is visible in the respective wiring diagram.

Further details are noted in the “manual TFC / TCS” which can be find in the control cabinet or requested at thermofin®.

Remark on final position sensor

The final positions of the dampers are monitored by non-contact sensors. If it is supplied with operating tension and if a metal part approaches the sensor to less than 8 mm, it is activated. It is indicated by the illuminated LED on plug side of the sensor.

The optimum distance between switch flag of the caps and the sensor is 3-4mm.

7.5 Remarks for defrost water drain

Depending on the unit, the design and the position of the defrost water discharge can vary.

In rooms with temperatures below the freezing point, the defrost water discharges and tubes must be heated in order to prevent freezing of the water in the tube.

Heaters installed inside of the tubes as well as metal tubes shall be preferred used. These drain heaters shall be installed for the whole tube length, which leads through the deep-freeze room.

Ensure a sufficient slope (min. 3%) in freezing rooms, provide trace heating.

Siphons or similar must not be installed in deep-freeze rooms, because of the danger of freezing.

Screwed drain nozzles may only be connected by holding them using pliers (ennsure drainage of the unit)!
Otherwise, there is a risk of breakaway/cracking of the drain from/on the defrost channel/drip tray.

8 Maintenance and hygiene

The manufacturer recommends performing particular maintenance works at regular intervals. The form and frequency of the measures strongly depend on the respective installation site of the unit.

(see also chapter *9 Inspection- and maintenance plan (recommendation)*)

8.1 Cleaning

Depending on the installation site, mode of operation and the season, the heat exchanger fins are subject to fouling with varying degree.

The requirements on hygiene and the related cleaning works strongly depend from the application and needs to be defined by the operating company.

Especially the fins and the tube system of the heat exchanger are sensitive to contamination. As this directly affects the hygiene of the cold store and the performance of the machine, the cleanliness of the heat exchanger (especially the tubes and fins) must always be ensured.

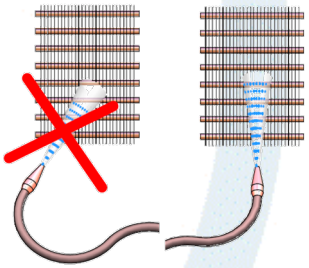
Before cleaning the following applies:
Switch off the machine (regarding refrigeration and electricity)!
In principle, the insulated cooler shall de cleaned in defrosted condition. (the best during dripping phase – see also 7.3 Procedure of defrosting)

Dry cleaning:

with a vacuum cleaner, a broom or a soft brush from the outside towards the fins or from the inside towards the outside by using compressed air – opposite to the direction of the air flow of the fans.

Wet cleaning:

with a water jet from the inside towards the outside and opposite to the direction of the air flow of the fans; and from top to bottom. The jet of the cleaning device must be vertical to the heat exchanger block (max. deviation ±5°), in order to prevent fin deformations.



Caution electric shock!
Electrical components may not be exposed to the water jet.
Do not spray directly on the distribution boxes.

When using cleaning agents, the compatibility of materials must be ensured. Never use aggressive or corrosive cleaning agents! In case of doubt, consult the manufacturer.

Mechanical cleaning (also icing) with hard objects, such as steel brushes, screwdrivers or peens may destroy the heat exchanger, therefore it is not permitted.

8.2 Maintenance works on fans

When effecting works on fans, and motors as well as during cleaning works between fans and the heat exchanger coil, it is necessary to disconnect the power supply and to protect it against restart!

According to DIN EN 60204-1, the units must be equipped with a disjunction system. This disjunction system must be protected in de-energised (switched-off) condition!

Do not leave items next to the fan after finalisation of repair and maintenance works. After restart, they can cause errors or damages to the fan, heat exchanger or damper mechanism.

After disassembling of the fans and their reinstallation, it is necessary to check the correct connection, the free running and the tight fitting of the screws.

All disassembled safety mechanisms (inspection covers, protective grids etc.) must be reassembled in its initial position and fixed properly.

8.3 Maintenance of direct driven radial fans

The impeller of the direct driven radial fans in the Insulated Cooler has a maintenance-free bearing. The impellers must be checked regularly for dirt and ice accumulation and must be cleaned, if required (hygiene, unbalance).

All fixations of the radial fan should be checked regularly for their tight fitting.

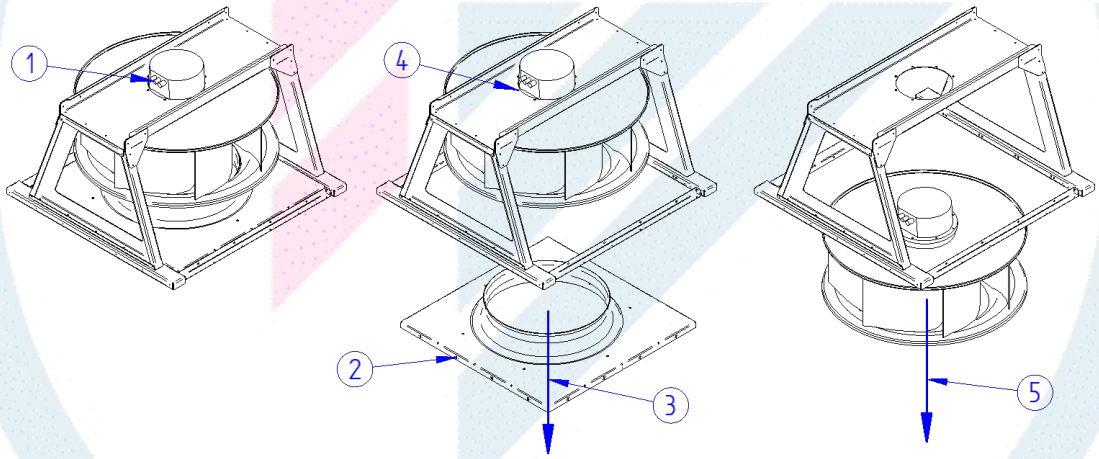
8.4 Mounting and disassembly of direct driven radial fans

For replacement, the direct driven radial fan can be removed downwards between heat exchanger and cell wall. See description below.

Replacement of the fan

For purposes of security, the cell must be completely defrosted without successive cooling before effecting any modification work. (The interior of the Insulated Cooler should be warm.)

While effecting work steps 1 to 10, the area of the damper and the draw-in area below the fan must be accessed.



1) Switch off and disconnect the fan motor from the mains and protect it against restart.
2) Close the defrosting damper, adjust the control to manual operation and disconnect its actuator and control from the power supply and protect it against restart.
3) Remove now the protective grids and the inspection doors.
4) Disconnect connection and control cable from the motor. (1)
5) Loosen the circumferential screw connection from the nozzle sheets. (2)
   Remark: The screw connection has slot holes to adjust the distance between nozzle ring and fan. Note the position of the screws for reassembly.
6) Remove the nozzle sheet (incl. nozzle ring) downwards. (3)

Caution! Fan unit can fall down!

Depending on its size, the fan unit can weight up to 120 kg. Secure the fan on the support frame before loosening its screws!

A hanging is only permitted on the supporting structure of the fans. Only use belts/ropes made of textile or synthetic fibres. Do not use chains or steel ropes. They can damage the fan!

7) Now, loosen the screw connection of the fan. (4)

8) Remove the fan downwards. (5)
9) The new fan is mounted in reverse order and meaning. (point 8 – 1)
   With installation of the nozzle plate according to no. 5, it must be ensured that the Nozzle is centrally installed to the fan so that it can rotate freely. (without contact)
10) The screws of the fan must be equipped with a screw lock (medium-tight) and must be tightened with 40 Nm.
11) After effecting the rest run, the protection devices must be reassembled.

8.5 Maintenance of axial fans

The used axial fans are maintenance free.

The impellers and protective grids must be checked regularly for dirt and ice accumulation and must be cleaned if necessary (hygiene, imbalance).

The fixations of the axial fan must be checked for tight fitting at regular intervals.

9 Inspection- and maintenance plan (recommendation)

9.1 General maintenance on the heat exchanger

Depending on type, installation and environmental conditions, the heat exchangers are subject to different signs of wear and contamination during operation. In order to ensure an excellent operation and a maximum operational reliability, periodical maintenance measures must be executed. Maintenance and repair measures as well as recurring inspections should comply with the valid standards and statutory provisions, e.g. EN 378, 842/2006/EC, VDMA 24243, 2006/42/EC, 2014/68/EU and/or local factory standards or regulations applicable at installation site. The following table can serve as recommendation.

The following table can serve as recommendation.

inspection point	main topic	interval	actions
general visual inspection	general condition corrosion pollution	monthly	initiate corresponding maintenance measures
heat exchanger coil	pollution tightness	quarterly	cleaning repair leakage if necessary
piping connections	tight fit tightness deformations	quarterly	ensure tight fitting, repair leakage if necessary determine the cause, contact manufacturer if necessary
connections and fixations	tight fit tightness deformations	quarterly	ensure tight fitting, repair leakage if necessary determine the cause, contact manufacturer if necessary
shut-off-devices, valves, security modules	function accessibility	quarterly	replace damaged parts ensure accessibility
fans, motors impellers	function free running noises soiled	quarterly	remove obstacles and soiling replace bearing if possible, replace damaged fans
	closed condensate holes	half-yearly	open and drain condensate
switching devices	function accessibility	quarterly	replace damaged parts ensure accessibility
junction boxes strain reliefs cable fittings	tight fit tightness function	quarterly	replace damaged parts retighten screws retighten loosened screw connections
safety equipment and devices emergency signals alarm systems	function	yearly	replace damaged parts
pressure relief equipment	tightness visual inspection	yearly	replace damaged parts
electric heating elements	visual inspection function	quarterly	secure loose heating elements replace faulty heating elements

9.2 Special maintenance works on insulated coolers

General notes:

The operating manual and all included safety instructions must be respected for the execution of all maintenance works!

This maintenance plan shall only serve as supplement to the operating manual. The given maintenance intervals only serve the general orientation and must be adapted according to case of allpication / local factors.

Directly after maintenance works / errors / (re)starts, the system must be tested 3x a day. It must be monitored and checked then for 2 months in shortened maintenance interval.
→ Only if all works properly, the next maintenance can be effected in normal interval.

All required spare parts can be ordered at thermofin®.

In case of problems / questions which are not mentioned, thermofin® must be contacted immediately.

Note:

The following tables contain maintenance notes to all possible – also optional – components and functions of insulated coolers and penthouse coolers. It must be checked which design is available. Skip non-applicable point.

	test item	criterion	repair measure	shortened interval	normal interval
1	**visual inspection of the entire unit (after defrost process)**				
1.1	inspect unit on icing	the unit must be free from ice, ice accumulations in the corners must be prevented	completely remove ice accumulations by hand; adapt defrost times	weekly	quarterly
1.2	check unit for pollution	the unit must be clean, theheat exchanger free from pollutions	cleaning; adapt cleaning interval	weekly	quarterly
1.3	check sealing on dampers and doors	seals must be tightly fitted	readjust dampers/doors so that the seals are tightly fitted	weekly	quarterly
		seals must not be damaged	replace seals	weekly	quarterly
1.4	entire unit	there shall be no mechanical damages	ask thermofin® fragen	weekly	quarterly
		formation of condensation water on the outside	find and remove the thermal bridge; contact thermofin® if necessary	weekly	quarterly

	test item	criterion	repair measure	shortened interval	normal interval
2A	**defrost dampers – insulated cooler**				
2A 1	damper position in automatic operation	depending on program, the dampers must be completely opened/closed; the damper must press against the final positions	check damper function with manual operation; replace defective motors	weekly	quarterly
2A 2	functional test of final position sensor	the respective signal must be applied to the right position (in TFC / TCS)	signal error → check + cable; readjust switch point on the sensor position; replace defective sensors	weekly	quarterly
2A 3	damper frame heaters	the frames of the defrost dampers must be free from ice	check the function of the heaters, extend the running time of heaters	weekly	quarterly
		the heaters must be in operation, the damper frames slightly heated	measure current consumption of the heaters; 1) replace defective heaters (connect redundant heater)	weekly	quarterly

1) **Remark**: Damper frame heaters are self-regulating. The current consumption at +20°C is around 0. → Measure in cold condition!

2B	**defrost dampers – jalousie dampers penthouse coolers (insulated coolers optional)**				
2B 1	damper position in automatic operation	depending on program, the dampers must be completely opened/closed	check damper function with manual operation; readjust final position on servo motor; replace defective motors	weekly	quarterly
2B 2	functional test of auxiliary switch	the respective signal must be applied to the right position auxiliary switches must not be activated to early	signal error → check + cable; readjust switch point on the sensor position; replace defective sensors	weekly	quarterly
2B 3	damper heaters	the frames of the jalousie dampers must be free from ice	check the function of the heaters, extend the running time of heaters	weekly	quarterly
		the heaters must be in operation, the damper frames slightly heated	measure current consumption of the heaters; replace defective heaters	weekly	quarterly

	test item	criterion	repair measure	shortened interval	normal interval
3	**fans**				
3.1	connection elements on the fans	screws must be tightly fitted, metal sheets must not be loose	retighten the screws	weekly	quarterly
3.2	effect a functional test through the entire speed range	there must be no unusual noises (rubbing, clicking, knocking,…)	noises on nozzle plate? → correct the position noises on motor → ask thermofin®	weekly	quarterly
		the fans must run silently, there must be no strong vibrations there must be no resonances	resonance: → program the speed with a range of ± 10%.	weekly	quarterly

4	**cleaning**				
4.1	drip tray and drainage of heat exchanger	components must not be soiled free drainage of the condensate must be ensured	clean and disinfect if required the components according to chapter *8 Maintenance and hygiene*	1)	1)
4.2	remaining internal room	check cleanliness as required		1)	1)
4.3	unit outside	no rough soiling shall remain on the unit fine dust cannot influence the operation		1)	1)

1) **Remark**: The cleaning interval must be defined and adapted according to the local conditions and requirements. Depending on application and installation, the soiling degree can variate strongly – also between units of the same system!

5	**additional cleaning and maintenance works in case of outside air defrosting**				
5.1	outside air damper	sealing of the damper and inside the frame	cleaning	weekly	quarterly
5.2	damper support (outside air damper)	contact pressure to the bearings → damper must be clearly compressed to the bearings	readjust the damper support	weekly	quarterly
5.3	air grid/filter on site	check for soiling	cleaning / replacement	weekly	quarterly

10 Help for troubleshooting

incident	possible cause	action
drop of cooling capacity, air outlet temperature too high, air power too low	iced coil	defrost coil
		check automatic defrost
		check defrost heaters
	fan out of work	check power supply
		measure power consumption
		check appropriate terminal box
		check thermostat relay
	partition doors not assembled	fit and lock all partition doors
vibrations	fan out of balance	iced fan wings
		check impellers for damages, replace fan if necessary
	casing panel and/or partition door loose	fix the panel, firmly fit partition door and/or readjust lock bar
noises	impellers and motors do not rotate freely	remove possible obstacles (ice)
	bearing damage on motor	replace fan
	casing panel and/or partition door loose	fix the panel, firmly fit partition door and/or readjust lock bar
leakage	core tube damaged of leaky	localise and repair core tube, shut down if necessary
	leaking bend or connector	repair or replace the part
malfunctions on servo motor of lightweight / jalousie dampers	cover hoods above the servo motor not assembled	assemble cover hoods
	servo motors deenergised	do not deactivate the tension until next change of direction
icings in the area		
of interior	defrost periods to short	adapt defrost periods
formation of snow (e.g. in the corners)	start of the cooling operation without / with to short freezing/cooling time	comply with freezing/cooling time, extend if neccessary
of access doors	access doors not tight	check door sealing readjust door hinges
	door frame heater out of operation	activate/replace door frame heater
of defrost damper	defrost damper not tight → „damper does not close properly“	check function of defrost damper – readjust final position if necessary
	seals of defrost damper misaligned or cracked	readjust or replace seals
between heat exchanger and drain channel	defrosting without circulating air operation	activate circulating air during defrosting
Inside the drain channel	heating deactivated / defective	activate/replace heating
formation of droplets on ceiling	temperature inside the heat exchanger during defrosting to high	considerably reduce the temperature inside the heat exchanger particularly at start of defrosting

incident	possible cause	action
defrost damper does not open/close properly	track blocked (e.g. by tools or ice)	clear the track
	motor force not sufficient	Select higher setting on TFC or TCS
permanent errors on TFC / TCS	sensors misaligned	correct adjustment of sensors
	sensors defective	replace sensors
occasional errors on TFC / TCS without obvious error	control cabinet temperature below +5°C	Check control cabinet heater, install one if necessary

→ *Refer to the manual of the control for further information on TFC/ TCS error codes and their removal.*

11 Spare parts

After-sales services are to be performed by the responsible specialist company.

Spare parts are stated in the spare parts list enclosed in the appendix or in the specified drawing. They can also be requested from the manufacturer by indicating the device name and the project number on the type plate.

Only use original spare parts for the replacement of equipment components.

During warranty time, thermofin® must be informed in case of all problems regarding the unit.

12 Disposal

Discharge the system properly, dispose of the working fluid according to the rules. No emissions to the environement!

Oil residuals must not enter the soil and must be treated as special waste.

Send the drained unit for recycling.

13 Appendices

Notice:

The principles and explanations shown in the appendices can be understood only as an example illustration. They are only intended as a guide to facilitate the understanding of operating the equipment.

They must be adapted in any case to the local conditions!

If this is not taken into account, it may cause malfunctions.

A Recommendations for a defrost cycle

Defrosting demand is notified

1) Block the refrigerant supply, discharge the evaporator (pump down).
2) Deactivate the fans
3) Activate standstill and/or ring heaters of the fans as well as damper, tray and tray heaters (if existing with internal temperatures below -0°C).
4) Before any movement of the dampers, ensure that they are not frozen (suitable feed of the damper heaters) and that the fans do not move.
5) Close the dampers
6) If all dampers reached safely their limit position (monitoring necessary!)
7) Activate the defrost system.
8) Insulated Cooler (axial/radial): run the fans with considerably reduced speed

Remark:
The fan speed must be limited with closed damper to max. 20%!
Higher speeds can damage the damper leaf and are not permitted!

9) Insulated Cooler Penthouse Type: the fans remain deactivated.

→ *If evaporator (and interior of the Insulated Cooler (axial/radial)) are completely defrosted*

10) Deactivate defrost system (and fans).
11) Give enough time for dripping-off (min. 5 minutes).
12) Deactivate all heaters (excepting door frame heater, it runs continuously!).
13) Activate the refrigerant supply and cool minimum 5 minutes without fans so that remaining water drops and steam can freeze and do not enter the channel system / the cold room.
14) Open dampers.
15) If all dampers reached safely their limit position (monitoring necessary!)
    Activate the fans.
16) Continuation of the normal cooling operation.

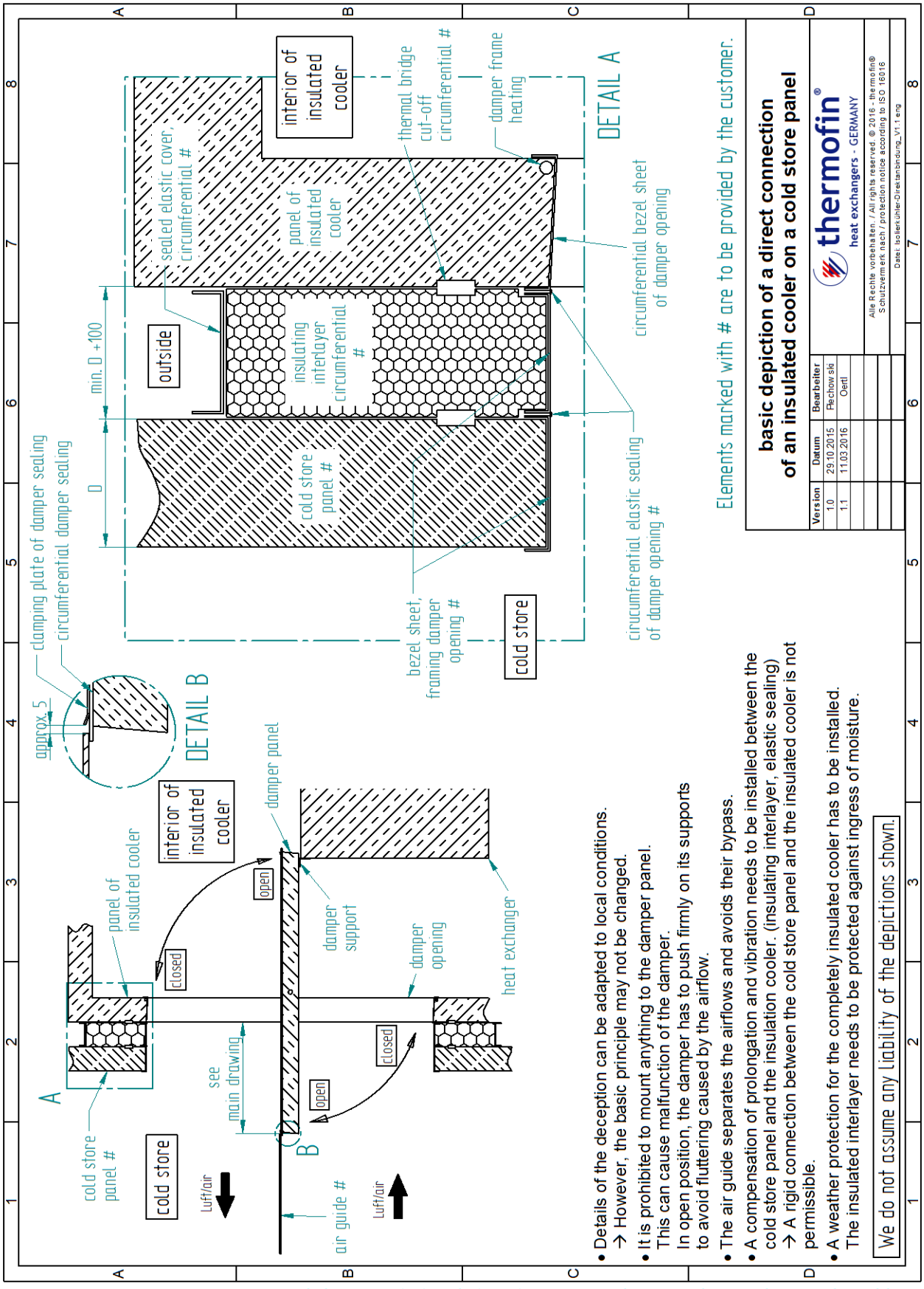
Caution!

The access to the dampers during operation of the fans or the servomotors is prohibited!

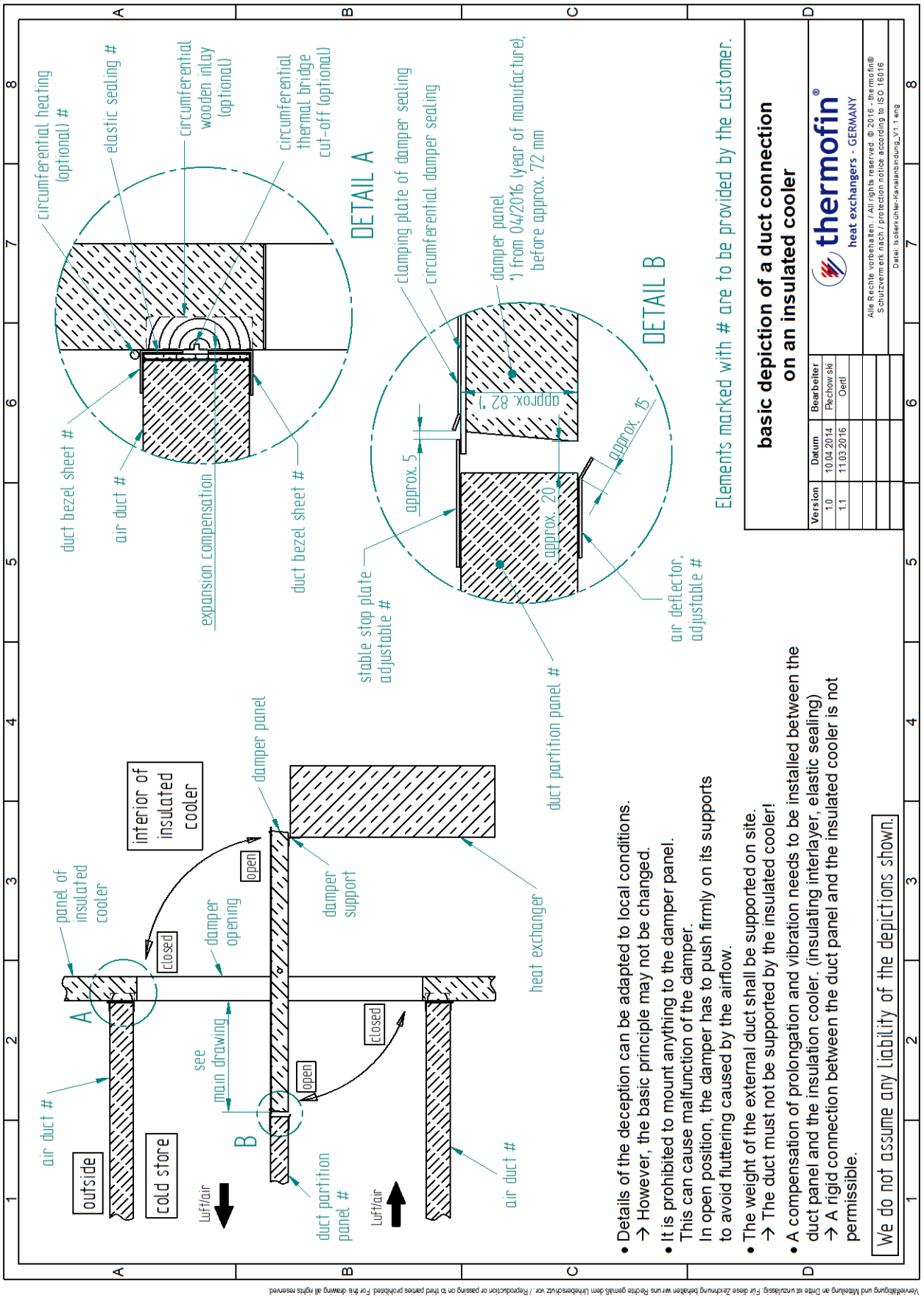
The fans shall only be operated with completely opened dampers!
Do not close the dampers as long as the fans rotate!

The “recommendations for a defrost cycle” are a list of procedure out of experience. From case to case, deviations are possible especially in time which require adaptions.

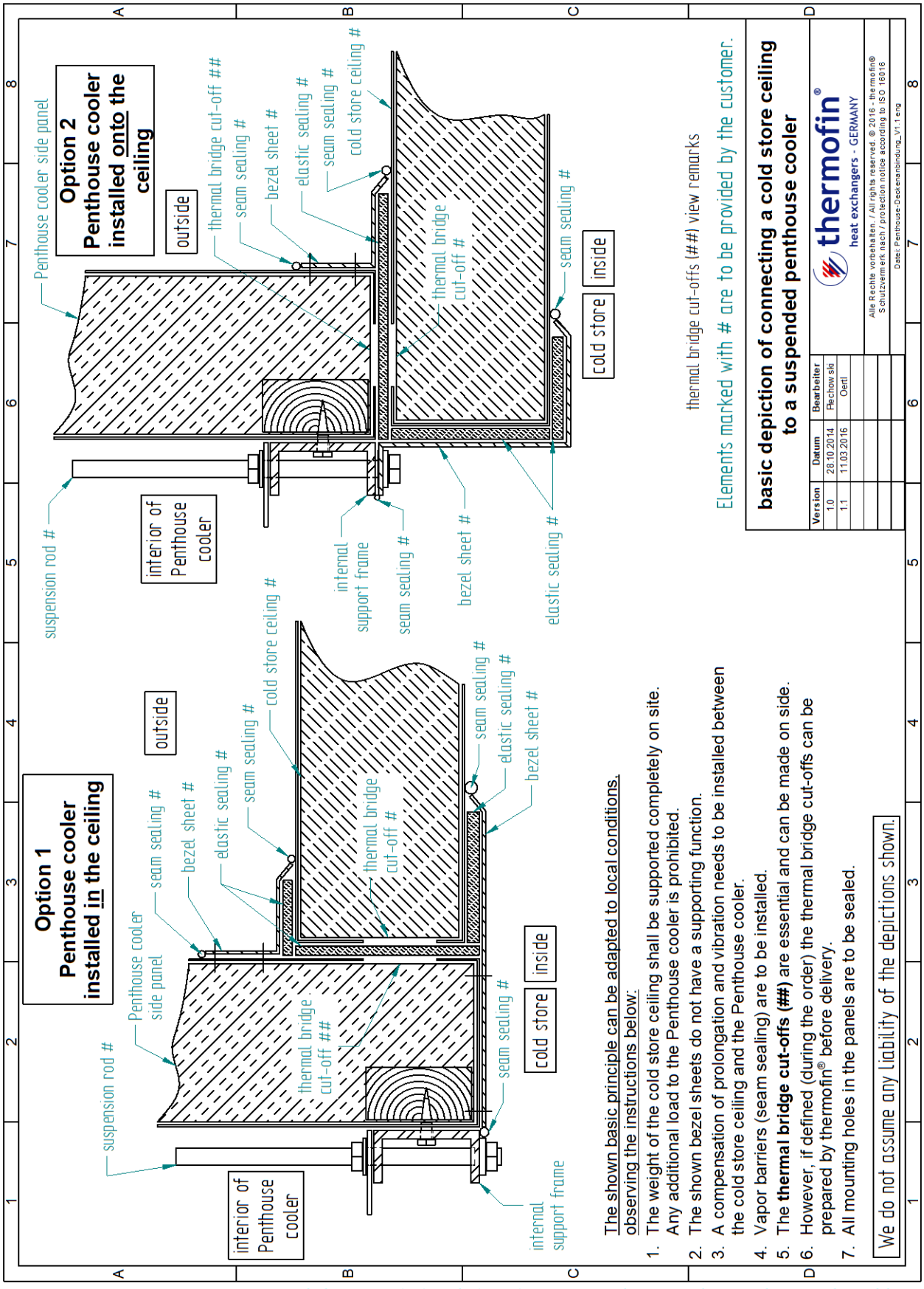
B Basic depiction of a direct connection of an Insulated Cooler (a/r) on a cold store panel



C Basic depiction of a duct connection on an Insulated Cooler (a/r)



D Basic depiction of connecting a cold store ceiling to a suspended Penthouse Type



E Basic depiction of a panel penetration on Insulated Coolers