LU·VE

Air coolers

Product manual

Available languages

EN ORIGINAL INSTRUCTIONS

31800615EN-00

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1 Important information

1.1 Disclaimer

This Product Manual applies to all LUVE Air cooler products and is supplied in combination with a product line specific Instruction Manual. Both manuals must be carefully examined and instructions should be followed up at all times. LUVE does not accept liability for any damage resulting from from failure to comply with or incomplete compliance the instructions as given in the manuals and order-related documents. As the heat exchanger is supplied indirectly, the producer is not acquainted with its actual application.

1.2 Safety precautions

Do not modify the unit by removing any of the safety guards or by-passing any of the safety devices. This equipment shall not be used by children or people with limited physical, sensory or mental capabilities.

All work on the equipment must be carried out by trained personnel who are familiar with local codes and applicable regulations. They shall also have prior experience working with this type of equipment.

For handling, installing and maintenance operations it is essential to comply as follows:

- Employ authorized personnel only.
- Wear appropriate personal protection equipment (PPE) whenever necessary to avoid injuries.
- Overhead loads: never stand or walk below the loads.

All on-site electrical connections are the responsibility of the installer.

The heat exchanger shall be installed in conformance with the recognized national standards of electrical and refrigeration installation practice.

For electrical wiring operations it is essential to comply as follows:

- Employ authorized personnel only.
- Make sure the power line circuit is open.
- Installation of a main switch is mandatory and is the responsibility of the installer.
- The main switch on the general power panel is open and padlocked.
- The electrical supply is suitable for the equipment supplied.

For header/distributor connection operations it is essential to comply as follows:

- Employ authorized personnel only.
- Make sure the supply circuit is open (no pressure).
- When welding or brazing make sure the torch flame is directed away from any potentially flammable materials, sensitive equipment surfaces and components. Provide adequate shielding, wet rags or thermal paste when necessary. If required, provide a fire watch with an available means of fire suppressant and clearly post emergency exits in the event of evacuation.

Hydraulic circuit shall comply as follows:

- Refrigerants used in cooling and freezing equipment can be hazardous to people and environment. Only personnel who are trained and certified to handle refrigerants shall be allowed to do so. Follow all applicable local and national codes which may apply to transporting, charging, reclaiming and disposing of these chemicals.
- Refrigerant, temperature and pressure must agree with the data on the product label of the relevant heat exchanger.
- Always verify the maximum test pressure rating of any directly connected valves, system components or controls (ex. solenoids, expansion valves, pressure transducers, etc.) to avoid possible damage to these components during pressure testing. If required, install shut off / isolation valves between the unit cooler and any such accessories for purposes of system pressure testing.
- For leak tests after installation, always use only an inert fluid, such as nitrogen (N_2) or air. The use of oxygen is strictly prohibited, as it poses serious risks of fire and explosion.
- Do not damage the refrigerant circuit.

- The supplied heat exchanger is optimized for the refrigerants as stated in the data sheet or order documents. Please contact LUVE before using any other refrigerants. The allowed maximum pressure (design pressure PS) is noted on the type plate. During production the heat exchanger was subjected to a strength test exceeding the design pressure PS. However, during normal use the design pressure PS may not be exceeded.
- Heat exchangers supplied by LUVE are normally not equipped with a high-pressure cut out. The installer is responsible for fitting a high-pressure cut out on the system in which the heat exchanger is used.
- The heat exchanger shall not be blocked in. If the ambient temperature rises, the pressure could rise and exceed the design pressure.

Contact your local LUVE representative if any of the following occurs: hot or damaged power cable; unusual noise during operation; frequent operation of protective devices; unusual smell (such as a burning smell).

1.3 Intended use

Air coolers are partly completed machinery according to Machine Directive 2006/42/EC (EU market) - The Supply of Machinery (Safety) Regulations 2008 (UK market) and are intended for incorporation in cooling systems. Declarations of Incorporation are shipped with the units. The product is built according to the following standards and directives:

EU market	UK market
2014/68/EU Pressure Equipment Directive (PED)	Pressure Equipment (Safety) Regulations 2016 (PER)
EN 60204-1 Safety of Machinery - Electrical equipment of machines	The Electrical Equipment (Safety) Regulations 2016
2014/30/EU Electromagnetic Compatibility Directive	Electromagnetic Compatibility Regulations 2016
2014/35/EU Low Voltage Directive	The Electrical Equipment (Safety) Regulations 2016
Any applicable local or national legislation	
US market	
UL 60335-1 - UL Standard for Safety of Household and Similar Electrical Appliances, Part 1: General Requirements - Sixth Edition	
UL 60335-2-89 - UL Standard for Safety Household and Similar Electrical Appliances – Safety – Part 2-89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor - Second Edition	
ASME B31.5 - Refrigeration Piping and Heat Transfer Components	

However it is forbidden to operate our equipment before the machine incorporating the products or making part thereof has been declared to be in conformity with the Machine Directive 2006/42/EC (EU market) or The Supply of Machinery (Safety) Regulations 2008 (UK market). The heat exchanger shall be installed in conformance with the recognized national standards of electrical and refrigeration installation practice. It is not permitted to use the heat exchanger for any purpose other than the one it was designed for by LUVE.

1.4 Where to find product information

Detailed technical data for individual product models are available in order related documents, on the product label and in product data sheets. Comprehensive technical information for all LUVE air heat exchanger products is available on-line on luvegroup.com. This includes:

- Product manuals
- Instruction manuals
- Product leaflets & brochures
- Product data sheets (selection software)
- Dimensional drawings
- Electrical wiring diagrams
- Certificates

LUVE offers world-wide service and support.
In case of any questions or uncertainty please contact your local LUVE representative. Contact addresses are available at luvegroup.com.

luvegroup.com

1.5 Warning symbols

The following warning symbols are used in LUVE product & instruction manuals.

	General warning. Risk of malfunctioning and/or damage.		Hot surfaces. Danger of burns. Wear adequate protection.
	Moving parts. Danger of injuries. Do not operate without protection guard mounted.		Sharp surface. Danger of cutting injuries. Wear adequate protection.
	Overhead load. Never stand or walk below the load.		Mandatory prescription. Follow instructions as provided.
	Forklift trucks or other logistic vehicles. Stay clear of working space.		Risk of injuries. Wear head protection.
	Electrically powered component. Switch off power supply before any maintenance or installation activity.		Risk of injuries. Wear safety footwear.
	Cold parts. Danger of frostbite injuries. Wear adequate protection.		Risk of injuries. Wear protective gloves.
	Danger of crushing. Wear adequate protection.		Manuals must be carefully examined and instructions should be followed up at all times.
			Mandatory prescription. Install or check guard.

2 General

2.1 Operating principle

LUVE finned coil air heat exchangers have been designed to achieve an optimized exchange of thermal energy between air and another medium. The 'heart' of our air heat exchangers is the finned coil, built up from a circuit of interconnected tube serpentines and fins to increase the heat exchanging surface. Thanks to the combination of key design variables (coil materials, coil geometry, casing design, fan type), air heat exchangers are very versatile products with a great variety of applications in many industries.

Air coolers are key components in air cooling and refrigeration systems. On the refrigerant side the most common media are a brine or an evaporating refrigerant like HFO/HFC, ammonia or CO_2. When an evaporating refrigerant is used, the cooling coil is the evaporator in the vapor-compression refrigeration cycle.

Unit coolers constructed with copper tube coils are not suitable for use with R-717 (ammonia).

For those units working with R-744 (carbon dioxide) refrigerant:

- If the refrigeration system is de-energized, venting of the R-744 refrigerant through the system pressure regulating/relief valves can occur. In such cases, the system may need to be recharged with R-744, but in any case, pressure regulating /relief valves must not to be defeated or capped. The relief setting must not be altered in any way.
- A sufficient number of pressure relief and pressure regulating / relief valves may need to be provided based on the system capacity and located such that no stop valve is provided between the relief valves and any parts or sections of the system being protected
- The refrigeration system is under high pressure. Do not tamper with it. Contact qualified service personal before disposal.

2.2 Health and hygiene

If the equipment is used in the food industry, responsibility with regard to hygienic conditions lies with the end user.

2.3 Transport and storage






During transportation the heat exchanger must be handled with all required care. Any instruction or warning signs attached to the heat exchanger or the packaging must be followed. Avoid shocks or continuous vibrations during transport. These may cause damage to the product. If required, consult LUVE and disassemble during transport any parts that are likely to be set into vibration. Air heat exchangers must be adequately fixed on the transport vehicle. If temporary storage of the heat exchanger is required, the following points should be observed:

- Store the heat exchanger in its packing, in a dry place with sufficient protection against sun and other environmental influences.
- Always place air heat exchangers on an even surface.
- Do not stack air heat exchangers unless explicitly indicated this is allowed.
- Storage temperature between -40° C and +50 °C.
- Never open or remove the schrader valves. Overpressure in the coil must be maintained.

Shelf life of air coolers is one year. If longer storage periods occur, check:

- Proper functioning of the fan motor.
- Mounting brackets, lifting lugs and fan fixings for corrosion.

2.4 Checks at delivery

All finned coils are pressure tested with dry air, sealed and supplied with a slight overpressure. Prior to installation, the leak resistance must be checked with the schrader valve.

2.5 Damaged heat exchangers

At the moment of delivery, carefully check the units. Any present damage must be reported on the delivery note with a description of the damage. Damaged heat exchangers, including when the damage is not externally visible, are to be reported to the shipping agent and LUVE within 24 hours.

2.6 Return of unused heat exchangers

Air heat exchangers that have been delivered in accordance with orders are in principle not returnable. Heat exchangers can only be returned under certain conditions and following consultation with LUVE. This applies exclusively to unused units. The heat exchangers that are to be returned should be delivered carriage paid to LUVE in the original, undamaged and unwritten factory packaging. Not returnable are:

- Heat exchangers older than three months from the invoice date.
- Heat exchangers that have already been built in and/or are damaged.

2.7 Guarantee

For our guarantee conditions, we refer to the Terms of Delivery. In general, the warranty period between LUVE and the customer is 24 months from the date of delivery to the carrier. Heat exchangers must not be returned or disposed of, other than in accordance with instructions from LUVE. Contact your local LUVE representative before any remedial action is taken on the units, otherwise warranty may be void.

2.8 Disposal

After decommissioning the heat exchanger coil should be emptied from refrigerant fluids. Avoid any emissions in the environment. Any refrigerants and oil residuals must be properly disposed of according to applicable environmental regulations. The fully emptied heat exchanger unit, including all electrical components, should be handed in to the proper authorized companies for recycling.
LUVE products are made of:

- Plastic materials: polyethylene, ABS, rubber.
- Metallic materials: iron, stainless steel, copper, aluminium (possibly treated).

3 Installation and Operation

The instructions below are complementary to the information in the instruction manual that is supplied with every unit.

3.1 Location

Heat exchangers should be positioned such that the following criteria are met:

- Adequate space must be left on the air inlet side of the heat exchanger. The air discharge side should be free of restrictions. Recirculation of air is to be avoided.
- The heat exchangers should not be connected to ducting on either the air inlet side or discharge side, unless the heat exchanger has been specifically designed for such an application.
- Adequate distance from heat sources.
- Adequate distance from sources of radio or electromagnetic emissions.
- Noise within the limits permitted by applicable standards and regulations.
- Adequate space and illumination must be left for maintenance operations and personnel.
- Installation area free from oils, vapours and flammable gases.
- Installation surface shall support the weight of the unit and minimize vibration transmission. Weight information and dimensions are listed on the product label and/or in the relevant product documentation.
- Do not obstruct passageways or doors.
- Coolers must be hung such that the coolers can contract and expand somewhat. Cooler contraction occurs during refrigeration operation, and cooler expansion occurs during defrost. For air coolers with copper tubing this figure runs up to 1.65 mm per meter cooler length. All heat exchangers must be set up level.
- Hazards, position of controls and switch must be correctly signalled. Controls and switch must be positioned so that they are easily accessible and manageable.

It is important to remember that the total amount of heat to be dissipated depends on receiving the full design air volume at the design entry air temperature which allows this air to be freely discharged after passing through the heat exchanger. Any restrictions may impair the performance of the cooler. If in doubt, please check with LUVE.

3.2 Lifting

Air coolers may be lifted by a fork lift. In doing so, ensure that the cooler is not lifted directly onto the drain tray or the finned coil. The forks must be long enough to enable lifting the cooler past its center of gravity. In the case of long, slim coolers extra attention must be paid to prevent the cooler bending. Utilizing the proper wooden transport beams and/or pallets prevents the cooler bending at the extremes such that the cooling circuit or other components are damaged. In principle, air coolers are not designed to be hoisted from above. In hoisting air coolers, lifting lugs must be used. To hoist long, slim coolers, a hoisting beam may be required to prevent possible bending at the extremes. All lifting procedures must be carefully carried out by properly qualified personnel, ensuring absolute safety at all times. If in doubt about the proper hoisting or lifting method, please check with LUVE. Check the instruction manual for detailed lifting instructions about specific heat exchanger models.

3.3 Drainage

The coolers' drain lines must have adequate fall. In freezer areas, drains must be equipped with an internal or external heating element to prevent freezing.

- ➔ All pipework should be adequately attached to the walls/ceilings of the cold room and not only to the cooler itself.
- ➔ The heater tape, if external, must provide heating right up to the casing (drain tray) of the cooler.
- ➔ Check all drain lines and drain trays to ensure that no improper material such as, e.g., packaging material blocks the drain.

3.4 Pipework and connections

All pipework and connections must be made in accordance with good refrigeration design and installation practice. Ensure that no stresses are transmitted to the pipework. All pipework should be adequately attached to the walls/ceilings of the cold room and not only to the cooler itself. Pipework must be adequately supported to prevent vibration or external load on the cooler headers, etc.
Some traces of a transparent liquid may remain inside the coil circuit after the manufacturing process. This is evaporative oil which is completely compatible with all refrigerants and refrigeration oils in current use. This oil can sometimes collect in small quantities inside the coil header connections where it may be observed by installing personnel when removing the factory caps. It can be easily verified that this is oil and not water due to the fact that it evaporates very quickly when touched. If a drop of it is placed on a flat surface it widens out quickly like a stain and if exposed to flame it burns readily, giving off a white smoke.

3.5 Moisture in the refrigeration system

Moisture in a refrigeration system is undesirable. Moisture can cause malfunctioning in the refrigeration operation. A lesser known problem is that small amounts of moisture in the refrigeration system can after a time cause leakage through the formation of frost clumps. These frost clumps are the result of moisture seeping from the refrigeration system during defrost, as water seeps into the soldering seams and then freezes, resulting in a volume increase. This process repeats itself during each freeze/defrost cycle, as a result of which the cavities (potholes) thus formed become steadily larger and ultimately burst, causing leakage.

3.6 Using secondary refrigerants

In order to avoid crystallisation, and the consequent erosion of the circuit, the temperature of the secondary refrigerants may never fall below the protection temperature of the relevant secondary refrigerant. To avoid circuit erosion, the flow rate may not exceed the design value as indicated in the product specification without prior permission from LUVE. The secondary refrigerant used must have protective agents against oxidation, corrosion, erosion, furring, rust, etc. and may not contain any contaminants. Secondary refrigerants may only be used in a closed system.
The new cooling equipment and associate piping should be thoroughly rinsed with a mild cleaning solution or high-quality water and completely drained before brine is added. Pre-cleaning chemistry should be compatible with the construction material of the refrigeration equipment.
Note: The unit does not drain completely by gravity. Use pressurized air for complete draining.
When the system has been filled, it must be completely de-aerated. Deaeration of a secondary circuit is of major importance in all instances since oxygen contributes towards corrosion, in the worst scenarios leading to circuit leakage, and other problems and affects inhibitors. For correct design, de-aeration and operation always follow instructions given in the secondary refrigerant manufacturer manual. Particular attention is required when using potassium formiate based heat transfer fluids: the piping system and venting/draining valves of the heat transfer section must be adapted for the heat transfer fluid in question.

3.7 Distributor position DX or pumped system

In order for a refrigerant liquid distributor to function well, it is of the utmost importance that the positioning of the liquid distributor and the refrigerant supply line be vertical.
The positioning of the expansion valve and, if applicable, hot gas connections must be in accordance with good refrigeration design and installation practice. Any mounting instructions as given in the instruction manuals from additional components like the expansion valve must be carefully followed up.

3.8 Refrigerant distribution

The internal refrigerant circuiting, refrigerant connections and liquid distributor are arranged according to design parameters that must be specified when placing the order. Ensure that the user conditions of air coolers are in accordance with the design conditions.

3.9 Electrical connections

All electrical connections must be made in accordance with the locally valid regulations and in conformance with good installation practice. Route cables so that they cannot be touched by any rotating parts.
The site supply voltage, frequency, accepted power rating and number of phases must comply with the details on the technical documentation. All electrical supply lines must be connected to the terminal boxes through suitable waterproof glands using bottom entry or, in case of horizontal installation, the cable is routed to form a water trap.
Water ingress at the customer end of the cable can damage the device. Make sure the end of the cable is connected in a dry environment. Only connect the device to circuits that can be switched off with an all-pole disconnection switch.
Be sure to provide grounding; incorrect grounding can cause eletric shock.
If the heat exchangers are installed and there is to be an appreciable delay in putting the plant into operation, a temporary electrical supply should be connected to each motor, sufficient to run for at least 4 hours. This procedure should be carried out at least once every 4 weeks, until the heat exchanger is fully operational. It is up to the end user to verify the conditions for protection by automatic disconnection of supply, according to applicable standards. Heat exchangers are designed for TN power systems. Installation of line protection is not supplied by the manufacturer but raccomended according the fan motor type. For correct installation of line protection follow instruction given in the fan manual.
The insulation fault protection must be part of power supply of the heat exchanger and is not supplied by the manufacturer.

3.10 Power failure

In order to avoid damage to the compressor, the refrigerant supply must be closed in the event of power failure, e.g. by closing the magnetic valve. Safety measures elsewhere in the system will prevent the pressure in the heat exchanger from exceeding the design pressure PS.

3.11 Fan motors

The maximum load of the motors and the recommended settings for the overload relays are to be respected.
For AC fan motors, the thermal protection (TK) shall be connected to a contactor present in the system, in order to guarantee correct operation of the fan, which increases its power draw especially at low temperature and when heavily frosted. TK protection is recommended instead of circuit breakers as it allows the fans to increase their power draw, guaranteeing reliable operation over time.
After a power failure, the motor restarts automatically if the control voltage or a stored speed value is applied (EC motors), or if there is no customer control device preventing such restart (AC motors). Risk of injury: when working on the device, switch off the line voltage and ensure that it cannot be switched back on. Wait until the device comes to a stop. After working on the device, remove any tools or other objects from the device. The electrical control circuit should be arranged with a manual reset device in order to prevent continuous on/off switching (tripping) of the motors.
Suppliers and manufacturers of electrical motors provide no guarantee for motors that are combusted through overload. For correct installation and operation of fan speed control systems, follow instructions given in the controller and fan manuals.

3.12 Sound level

The sound level values indicated in the documentation are measured under free field conditions. Depending on construction and the materials used for the space in which the heat exchangers are placed, the measured sound pressure value may vary significantly from the documented value.

3.13 Fan ring heaters

Under certain conditions, it is possible that during defrost, water vapor originating from the heated coil condenses on the cooler casing, fan blade or fan ring. When the condensate freezes, the fan blade may freeze to the fan ring. In reactivating the installation it is possible that the fan does not function due to the problem mentioned above, which leads to operational

malfunction. This is easy to prevent by applying fan ring heating.
The heaters are suitable for 230/50/1 electrical supply, and these are suitable for either permanent connection or for linking to the cooler defrost system. These heaters are more than adequate to prevent icing during defrost if the heaters are linked to the cooler defrost system.

➔ Fan ring heaters must remain operational until the fans are reactivated.

3.14 Defrost general

Defrost of air coolers, regardless of the defrost system applied, must have an effect such that after the defrost period all frost has melted and the cooler surface is entirely cleared. When the refrigeration process is resumed after concluding the defrost cycle, remaining frost may form sites of solid ice. Such solid ice will increase with every following defrost cycle, and ultimately accumulate up into the drain tray. This inevitably leads to malfunctioning and damage to the cooler. Coolers without defrosting facilities may not be used in room temperatures below +2 °C.

Do not use any mechanical devices or any other means to speed up the defrosting process other than those recommended by the manufacturer.

3.15 Electrical defrost

Identical elements are used in the finned coil and in the drain tray. Always refer to the electrical scheme for both connections and nominal voltage of the electrical defrost option. Ground cable must always be wired and connected to the appropriate terminal in the connection box. Always refer to the electrical scheme order to identify the ground terminal. Installation of a switch for defrost line is mandatory and is the responsability of the installer. Warning about the neutral wire: it must be connected if indicated in the electrical scheme. It must not be connected if it is not shown in the electrical scheme.

3.16 Electric defrost termination

If the cooler is working on a time termination cycle, it is suggested that an initial defrost period be set at 35 to 45 minutes (in combination with the number of defrost periods). This setting is to be refined through trial and error, according to the actual defrost requirements depending on cooler model, size, and working conditions. If the defrosting cycle is terminated via a temperature sensor, close attention must be taken in positioning the thermostat sensor. The temperature sensor is usually set at a value between 10°C and 15°C. In general it should be positioned where the last traces of frost disappear, usually on the coil.
At room temperatures of around 0°C the last frost is usually in the top of the coil block. At room temperatures below -20°C, this is the consequence of the so-called 'chimney effect', usually in the lower half of the coil block at approx. ¼ of the fin height. Unfortunately a number of factors (cooler position relative to an access door or stored products, precise setting of the thermostatic expansion valve, etc.) may cause identical coolers to perform differently (see maintenance instructions). Thermostat sensors should NOT be placed in the direct vicinity of a heater element. The final position of the temperature sensors must be determined through trial and error.

➔ The next cooling cycle may only be started when the coil block has been completely defrosted.

3.17 Water defrost

The water inlet and drain sizes are calculated for the water defrost system. The entry and drain lines should be executed with the same line diameters. Success in water defrost lies in passing sufficient water over the coil, as specified by LUVE. In this, generous drain line slopes are essential. Some form of inlet flow adjustment is required.

➔ A reduced flow rate for a longer period simply does not work! The water distribution pattern may alter drastically, parts of the coil will defrost, and on other parts ice will build up, ultimately threatening the lifetime of the cooler. A clean supply of water is important and it is recommended that a suitable water filter be used in the supply line.

3.18 Hot gas defrost

When hot gas defrost is applied, a good hot gas supply must be secured during the entire defrost period. Generally this is two thirds of the defrost time required for electric defrost. The position of any temperature sensor to end the defrost cycle, is where the last traces of frost disappear, usually on the coil. The most important consideration during this process is the matter of condensate removal, since any tendency to log up liquid in the cooler can lead to severe problems. A good downward condensate drain directly from the cooler is essential, and where condensate drain lines rise locally, this must be correctly sized.

3.19 Drain tray insulation

It is recommended to apply drain tray insulation for coolers operating at room temperatures below
5 °C and/or with high humidity in the cold room.

3.20 Sight glass in the liquid tubing

On DX systems, LUVE recommends the utilization of a sight glass (to be installed immediately in front of the thermostatic expansion valve). LUVE recommends that this sight glass be inspected promptly for clarity, so that in the event of problems when the installation is activated or during operation it can be established whether any flash gas is in front of the expansion valve.

3.21 Commissioning

All connections must be thoroughly leak tested and the system evacuated in line with normal refrigeration practice. All bolts, fastenings, electrical connections etc., must be checked for security. In addition, the fans should be checked for correct rotation. If necessary, change the phase wiring to obtain correct rotation. Set all apparatus to operating temperatures and test run the heat exchanger to check for undue vibrations, and badly secured components, etc. LUVE strongly recommends to perform the filling of the circuit with an authorized company.

3.22 Switching off

During operation, switch off the device via the control input. Do not switch the motor (e.g. in cyclic operation) on and off via power supply. To activate the on current limitation, you must wait at least 90 seconds after switching off the line voltage before switching back on.
During maintenance operation disconnect the device from the power supply and be sure to disconnect the ground connection last.

4 Maintenance

4.1 General



It is essential after delivery that adequate protection and inspection are carried out on the equipment. This is especially important if there is any delay in installing or commissioning the equipment. After commissioning and setting up the defrost systems, the heat exchanger will require maintenance. Regular checks and good maintenance will ensure trouble free operation. The frequency of checks will depend on site location and the specific operating conditions.
Equipment installed in industrial or coastal areas, or in any kind of aggressive environment, generally requires more frequent inspections than the same equipment in rural, unpolluted areas. Damage can occur during site installation and during the period prior to commissioning. Inspections and remedial work should take place during this period. On sites where building work is in progress, it is strongly advised that finned block, headers and return bends are covered up to keep them clean and protected from damage until the time of commissioning.

➔ Header and cooler tubes can be extremely cold! Take precautions when maintenance is carried out near the header and cooler tubes.

Replace loose connections and defective cables immediately. Always check the protective ground.
After any service or routine maintenance is performed be sure to properly reinstall all access /cover panels, fan guards, drain pans, electrical covers and their fasteners. Never operate equipment with any of these components missing or damaged.

4.2 Cleaning and disinfecting

A coil block should be kept clean to guarantee it works well. The user of the heat exchanger should ensure that the cleaning and disinfecting agents that are used do not have a corrosive effect on the materials used by LUVE.

4.3 Casing

Casework checks should be carried out at least every 3 months. In doing so, inspect for any deterioration of coating and/or corrosion. If such flaws are noted, take immediately remedial action. Should any damage occur during installation, this should be repaired immediately to prevent further deterioration.

4.4 Coil and drain tray


The heat exchanger coil should be checked at least every 3 months, with close inspection being carried out for such things as leaks or chafing of tubes. In addition, any unusual vibration of the fans should be checked. The unit should be cleaned as instructed when necessary using low pressure compressed air, and/or low pressure water hose or a mild detergent wash. Care must be taken not to hose directly onto fan motors or electric control panels or the electrical connection boxes of the heaters. It should be noted that abnormal atmospheric conditions can greatly harm the lifetime of the finned coil. Please ensure the drain tray is empty before it is disassembled. The weight of any leftover water could injure the operator if the drain tray fell open accidentally.

4.5 Fans



Fans should be checked 3 months after commissioning and thereafter depending on operating conditions and as experience dictates, for any dirt build-up and/or unusual vibration, which could ultimately cause damage to the fan or to the heat exchanger itself. Ensure complete electrical isolation before removing fan guards. Fan blades should also be checked for any erosion or corrosion and remedial action taken as necessary. All dirt and other contamination should be removed to avoid imbalanced running of the fan and motor bearing overheating. The security of the fan fastenings and the integrity of the components should be checked integrally as part of the routine maintenance operation. Particular attention should be paid to

the fastening screws and balance of the fan blades. In the event of a broken mounting screw during operation, do not simply replace it. These issues are typically caused by a high level of vibrations and may persist even with new screws. If such problem occurs, the source of the vibration shall be identified (fan motor, ice, application, etc.). If the fan motor is identified as the source of vibration, the entire fan unit needs to be replaced. Otherwise, the other source of vibrations shall be eliminated.

➔ Heavy frost build up on the fan guards can hinder the cold air flow over the motors and lead to overheating and burning of the motors.

EC fan and motor assemblies are not designed for replacement or servicing of individual parts. Replace only as a complete assembly.
Where fan guards or portions of the casing have had to be removed for inspection, ensure that these items have been refitted and secured correctly before restarting the heat exchanger.
We recommend that a "Permit to Work" system be used to carry out all maintenance work, to ensure that only properly qualified staff carry out the work and that other staff on the site are made aware of the safety aspects related to the heat exchanger.

4.6 Shut down periods

During prolonged shut down periods, maintenance should be carried out as detailed above. If the shut down period is extended, all electric motors should be run once every four weeks for a minimum of 4 hours. EC fans must be kept powered during shut down periods to ensure that the motor heating prevents the rotor from freezing.

4.7 Electric defrost

Heavy frost or ice should remain on the finned coil after a regular defrost cycle, the following procedure should be carried out:

➔ Commence manual electric defrost and check each heater element using 'clip on' ammeter instrument. A phase amperage reading at the control panel is not sufficiently accurate. Any heater element found to be not working should be checked for electrical connection faults and if found to be defective it should be replaced (see additional notes on replacement of electrical heater elements).

- The ice should be removed from the finned block and from the drain tray. This process can be speeded up by covering fan apertures/guards and discharge outlet with polythene sheeting, etc. It may even be necessary to use warm water or hot air in the defrost process.
- The timing and frequency of the defrost should be set to allow time for the cooler to accumulate a generous frost load. This gives a better defrost result during the next defrost cycle and enhances the washing effect in the drain tray.

➔ A lightly frosted coil will defrost very quickly. As a result of the short defrost period, the drain tray may not heat sufficiently, which can cause a build up of solid ice in the drain tray.

4.8 Replacement of electric heater elements

It is crucial that before any work on the electric heating elements is performed, the electrical mains supply is turned off and the cooler is completely isolated. The following checks should be made prior to attempting withdrawal of heating elements:

- Check the phase fuse.
- The heater elements are wired so that they are evenly spread across the three phases. If there is a phase problem and the coil is icing, there will be a band of frost across the one third of the finned block that corresponds with the phase that has gone down.
- Check the resistance of the element before removing. No measurable resistance means that the element is defective. Then check the ground leak resistance of the heating element before removing it. This should be done by checking the resistance between the live and ground terminals. If the resistance is below 0,1 Meg Ohm, there is reasonable cause to change the element.
- Check the drain tray heater elements: these are also connected across the three phases. If one of these elements fails or shorts out it can knock out a whole phase.

To remove a heater element from the coil, first disconnect the electrical connection boxes and remove the fixing screw. Pull the heater element out using as little force as possible. If the element should feel stuck, give it a little twist and continue pulling.
The replacement is merely the reverse of removal, but it is most important to check the spade connectors to see whether they are straight before insertion into the coil block. If necessary, draw the cables through the defrost tubes using a string or cord. When inserting the elements keep them as straight as possible in order to facilitate assembly and avoid their becoming jammed.
To replace the drain tray elements, use the same procedure as above, but elements are held in by clamps. To release the elements, remove the drain tray. The elements should then be taken out quite easily from under the clamps.

➔ It is most important when replacing tray elements to ensure that the clamps do not hold the elements down too tightly. The elements must be able to move back and forth in order to expand when heated. When connecting the elements, allowance should be made for the fact that they lengthen during operation (approx. 1 cm per meter). The connecting wires must be able to cope with this displacement without becoming taut.

5 Residual risks

In the previous paragraphs many risks related to handling, installing and operating air cooler units have been pointed out.
Below is an overview of the most relevant residual risks that must be accounted for.

- **Sharp edges and corners**
  There is a substantial risk of injuries due to sharp edges and corners of coil and casing. Make sure to wear reliable protection during any handling of the unit and maintenance activities.
- **Drain tray**
  Ensure the drain tray is empty before lowering or disassembling. The weight of any leftover water or ice could injure the operator if the drain tray fell open accidentally.
- **Side plates**
  Removable side plates may only be opened by qualified staff. Ensure the side plates are properly secured after closing.
- **Fans**
  Rotating fans can cause injuries to fingers. Never operate fans without the mounted protection grid and take care of loose clothing.
  Switch power off before any maintenance and wait at least 5 minutes to ensure safety. Even after power-off, the risk of electric shock persists from energized or faulty parts.
- **Electrics**
  Power must be switched off before any work or maintenance on electrical parts of the unit. Secure the unit against unintentional switching on.
- **Burns or frostbite**
  (Distributor) tubes can be extremely cold, whereas defrost heater elements and drain tray can get very hot. Use reliable protection.
- **Working fluids**
  Working fluids might be toxic and/or flammable. These substances may only be handled by qualified staff while taking all necessary precautions and following any applicable regulations.
- **Fan vibrations**
  Continuous fan vibrations can cause material failure and hence a risk of injury or damage due to loose parts. Therefore vibrations must be reduced to a minimum at all times.

6 Troubleshooting

Fault	Possible cause	Required action
Fan motor not functioning	No power supply	Check/restore power supply.
	No control signal (EC motors)	Check/restore control signal.
	Fan blade blocked	Remove obstruction.
	Fan motor burnt	- Check for fan blade obstructions. - Check thermal protection device. - Replace fan motor.
Excess motor noise	Defective fan motor bearing	Replace fan motor.
Excess vibrations	Loose fan fasteners	Tighten fasteners.
	Unbalanced fan blades	Replace fan blades.
Insufficient capacity	Heat exchanger coil dirty/ blocked	Clean coil.
	Coil partly blocked by solid ice	- Check defrost cycle settings. - Check defrost heaters. - Perform 100% coil defrost to remove all ice.
	Fans not (properly) functioning	Check fans.
	Refrigerant supply/pressure insufficient	Restore refrigerant supply/ pressure to reference values.
Refrigerant leakage	Refrigerant containing parts damaged	- Stop fans. - Close refrigerant supply. - Repair leak.

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