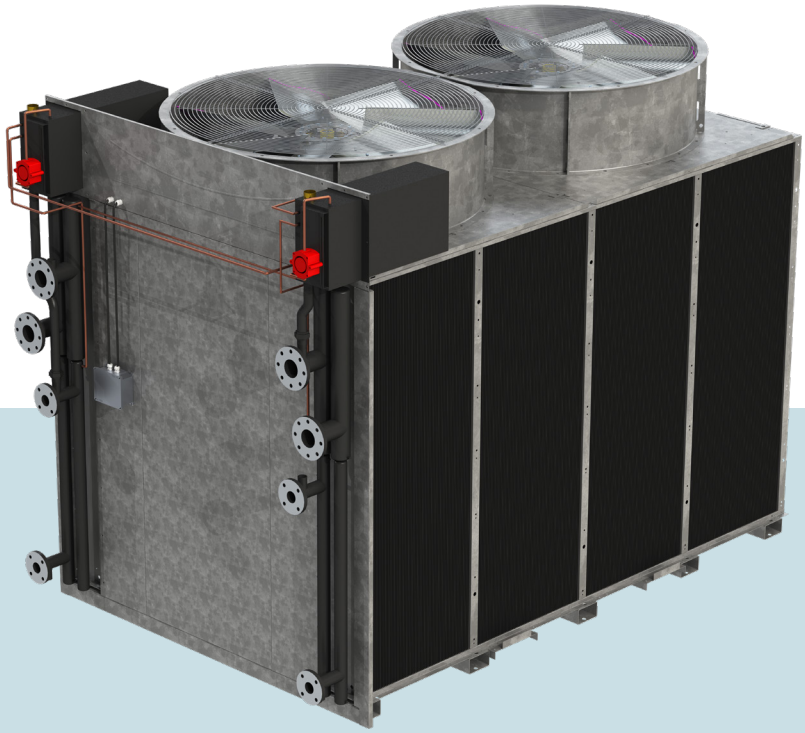
ALFA LU-VE

GenSet



DCH

Gen-set radiator units

Instruction manual

Product description
Product labels
Unpacking and lifting
Installation
Maintenance
Spare parts

ORIGINAL INSTRUCTIONS

LU-VE GROUP leadership with passion

31583232EN-02

Index

1 Important information

1.1 Disclaimer

This Instruction Manual applies to all DCH radiators and is supplied in combination with the Air Cooled Liquid Coolers Product Manual AHE00050. Both manuals must be carefully examined and instructions should be followed up at all times. Alfa LU-VE does not accept liability for any damage resulting from non-compliance to the instructions as given in the manuals and order-related documents.

1.2 Intended use

DCH radiators 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 available on alfa.luvegroup.com. 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	

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 EC Machine Directive.
It is not permitted to use the heat exchanger for any purpose other than the one it was designed for by Alfa LU-VE.

1.3 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 Alfa LU-VE air heat exchanger products is available on-line on alfa.luvegroup.com. This includes:

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

alfa.luvegroup.com/dch

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

2 Product description

2.1 General information and application

Industrial DCH radiator units are designed for cooling of water or other process fluids for Diesel and Gas Power Generation. This heat exchanger configuration offers a compact solution with dimensions and capacity range as typically required for Gen-set containers in the Power Generation industry. A typical Gen-set container includes the engine, electric generator, radiator, control panel, silencer, etc. DCH radiator units are designed to be installed inside the container. DCH radiator units can also be used for other cooling applications in process and general industries.

2.2 Standard configuration

- Heat exchanger coil:
  The innovative heat exchanger coil gives excellent heat transfer thanks to new corrugated aluminium fins combined with copper tubing. Tubes and fins are available in different diameters and thicknesses. DCH radiators are designed with two vertically positioned, independent heat exchanger coils. Thanks to the two separated coils or the use of split coil circuits it is possible to cool different fluids. This configuration allows to cool two different circuits (i.e. LT and HT engine circuit) in a unique, compact radiator unit. Copper manifolds are provided with aluminium flanged connections, draining and venting nozzles. DCH can have one or two modules, depending on the required performance. Each heat exchanger undergoes a pressure and leak test with dry air at 15 bar (design pressure 10 bar).
- Fan motors:
  3-Phase 400 V-50 Hz squirrel cage induction motors (IEC) are used, on demand 460 V-60 Hz or other power supply. Protection Class IP55, temperature class F or H, depending on the working conditions. On demand greasers can be included. Each electric fan motor is wired to a terminal box or a safety switch close to the fan cowl.
- Fan blades:
  DCH can be supplied with different fan diameters (1250 up to 1440 mm) fitted with fan blades in aluminium (wind profile), fiber glass or galvanized steel. Fans can have either fixed or adjustable blades. Fans are protected by a epoxy coated or hot deep galvanized metal protection grid.
- Frame and casing:
  Casing is made of pre-galvanized sheet steel. New frame design provides high rigidity, also for heavy applications. Maintenance can be easily done from outside or by entering inside the unit using special inspection doors.
- Support feet:
  Heavy duty, hot-dip galvanized steel profiles permit easy transportation of the unit and can be used at the same time to fix the DCH inside the container.

2.3 Options

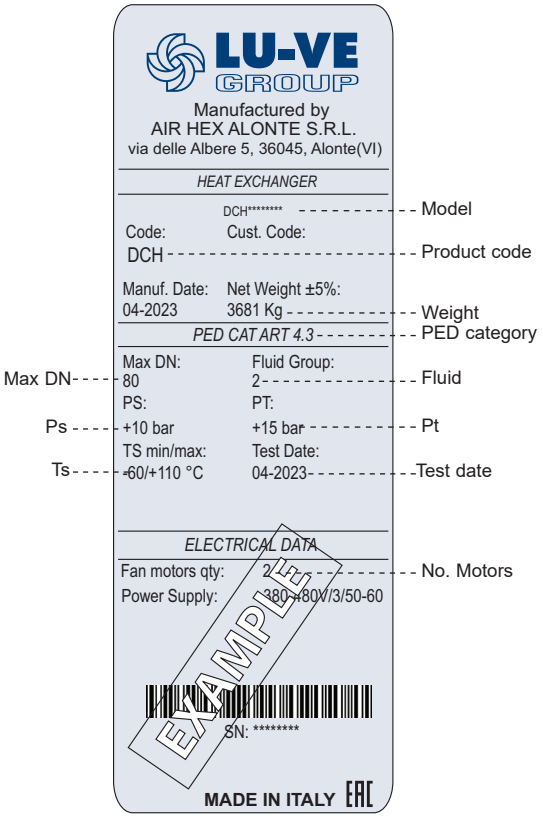
- Combined version and double circuit (LT/HT)
- Several fin spacings
- Coil treatment for aggressive environments
- Stainless steel tubes
- Counter-flanges
- Vent and drain ball valves
- Extra static pressure drop up to 150 Pa
- Expansion tank delivered installed and completely connected to the manifold:
  - Basic or with level indicator
  - Over-pressure valve (0.5 bar)
  - High temperature piping
- High Temperature Electric Motors
- Electric motor Space Heaters (optional)
- Electrical parts:
  - Isolating switch (one switch for each fan motor)
  - Terminal box (all fans wired for easy electrical connection switchboard)

2.4 Code description

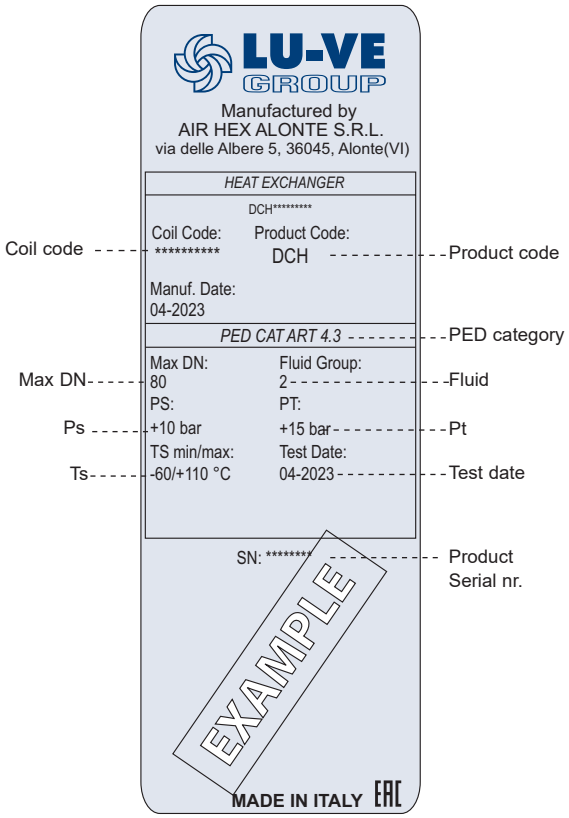
DCH	-	2	E	38	E	50	-	K	8	A	-	3	-	200	H	-	95	DN65	5	-	125	DN100	S
1		2	3	4	5	6		7	8	9		10		11	12		13	14	15		16	17	18

1 DCH Gen-set radiator unit (DCH=standard Cu tube, DCH6= 5/8” Cu tube)
2 Number of fans (1, 2)
3 Coil size LT circuit
4 Tube rows LT circuit
5 Coil size HT circuit
6 Tube rows HT circuit
7 Fan diameter (X=1.2 m, K=1.4 m)
8 No. of motor poles (6, 8, 10)
9 Power supply (A=3/380-420 V/50 Hz, B=3/440-480 V/60 Hz, C=3/380 V/30 Hz, D=other)
10 Coil length (1.5, 1.65, 3, 3.3 m)
11 Motor size (160, 180, 200, 225)
12 Motor insulation class (F, H)
13 No. of LT circuits
14 LT connection size
15 LT connections (S=same end, O=opposite end)
16 No. of HT circuits
17 HT connection size
18 HT connections (S=same end, O=opposite end)

3 Product labels



Product label	
Model	Refer to paragraph "2.4 Code description"
Product code	Communicate this when ordering spare parts as they identify the unit
Unit Net Weight	Check before any lifting operation to ensure that proper lifting tools are used
PED Category	According to PED
Max DN	Maximum diameter of the distributor tube
Fluid	Refrigerant
Ps	Design pressure
Pt	Test pressure
Coil Ts	Range of operating temperatures for the coil
Test date	Date on which the coil has been pressure tested in the factory
No Motors	Number of fans



Product label - coil

Product code Product serial nr.	Communicate these when ordering spare parts as they identify the unit
PED Category	According to PED
Max DN	Maximum diameter of the distributor tube
Fluid	Refrigerant
Ps	Design pressure
Pt	Test pressure
Coil Ts	Range of operating temperatures for the coil
Test date	Date on which the coil has been pressure tested in the factory

General warning
Risk of malfunctioning and/or damage.

Electrical warning
Electrically powered component. Switch off power supply before any maintenance or installation activity.

Moving parts
Danger of injuries. Do not operate without protection guard mounted.

Overhead load
Never stand or walk below the load.

Do not walk
Don't walk on the headers or on the fan cowls

4 Unpacking and lifting

Always follow guidelines and instructions as given in the air cooled liquid coolers product manual AHE00050.
DCH can be delivered either on standard trucks or in 40' High Cube containers with the following packaging:

- on wooden pallets or wooden supports
- on metal skid
- wrapped with a nylon cover

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 Alfa LU-VE within 24 hours.

Check by a dynamometric spanner that the bolts on the air cooler, the support structure (where present) and the fan motor groups are tighter.

4.1 Storage

If the equipment has to be stored one or more months before its installation, it is convenient to take the following precautions:

- Store the DCH indoors, in a room with adequate conditions, temperature (15 to 45 ºC) and humidity (50 to 70 %).
- In an environment without corrosive liquids or vapours.
- If the equipment is stored outdoors, it is advisable to operate the fan(s), at least once per week, during 4 to 6 hours each time, in order to prevent damage to the electrical motors.

4.2 Lifting

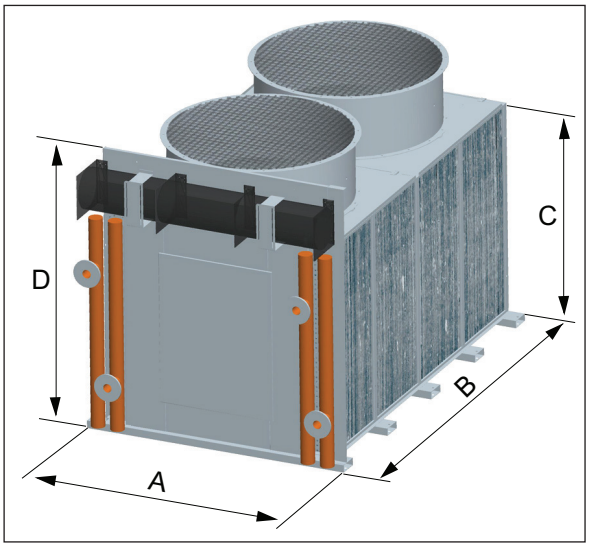
Tools and accessories for lifting are not included in the scope f supply.

- Open end or combination wrenches kit, (sizes from 10 to 20 mm).
- Steel slings or chain with load capacity according to the DCH weight and safety factor (refer to project data sheet)
- Lifting crane with load capacity according to the DCH weight and safety factor (refer to project data sheet)
- N.6 Safety sling hooks with load capacity according to the DCH weight and safety factor (refer to project data sheet)
- Fork lift with load capacity according to the DCH weight and safety factor (refer to project data sheet) with this suggested specification:
  - Fork dimension: 2000 x 200 mm
  - Max distance between the forks: 2000 mm
  - Capacity: according to the DCH weight and safety factor (refer to project data sheet)
- Lifting bar with load capacity according to the DCH weight and safety factor (refer to project data sheet).
  Refer to project data sheet for the unit weight.

5 Installation

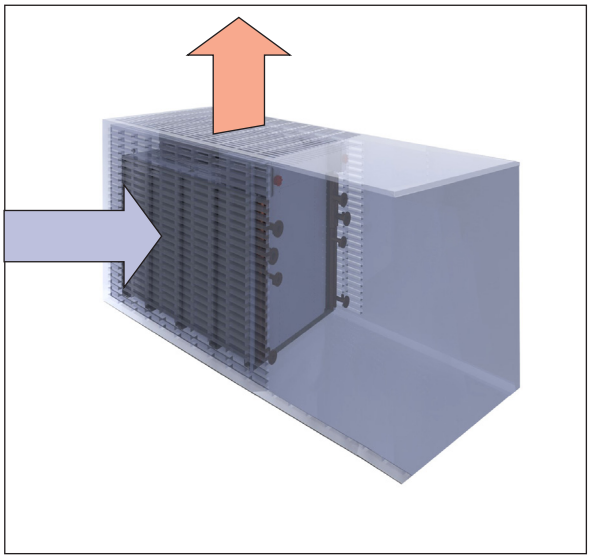
Always follow guidelines and instructions as given in the liquid cooler product manual AHE00050.

5.1 Mounting dimensions



Main dimensions (m)	
A	Max 2.1
B	1.5, 1.65, 3, 3,3 (without manifolds; in case of two fans)*
C	2.0
D	2.5

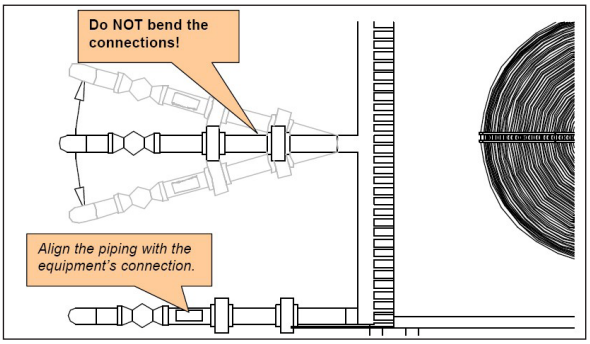
*other dimensions on request



The particular design of the DCH permits the installation inside a 40' HC container.
In case of running inside the container, this must be provided of 2 lateral windows in correspondence of the coils for the air inlet and 1 top window, over the fans for the air outlet.

5.2 Piping connections

The equipment is delivered with PN 10 or PN 16 DIN Flanged connections.

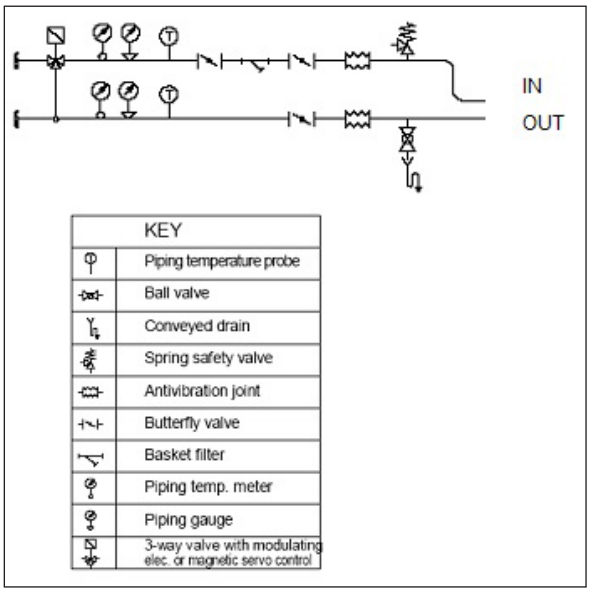


- Design and prepare the piping.
- Check the alignment of the piping with the inlet and outlet connections.
- Support the piping to avoid loads/torques on the radiator flange connection.
- If there is a risk of loads/vibrations, rubber pipes or flexible connections are strongly recommended.
- Clean the piping with water/detergent after installation and before connecting to the equipment to avoid dirt and welding residues.

It is strongly recommended:

- The pipe's sizes should be in accordance with the inlet and outlet connection's diameter of the coil.
- Avoid the water hammer effect. It is a pick of pressure of short duration that can appear during the starting or the shutdown of a system, making the liquids to move through a pipe like a wave at the speed of the sound. This effect can produce considerable damages to the equipment.
- To verify the operation, thermometers at the input and output of the equipment should also be installed.
- All the threads should be covered with teflon to assure the air tightness.
- Avoid any type of loads, forces or vibrations on the flanges connections.

Suggested installation layout



5.3 Electrical connections

Provide the following electrical connections:

- direct to the electrical motor, in relation to the installed motor characteristics (see the motor electrical scheme inside the terminal box)
- to the service switches or to the connection box, if present

For details, please refer to electrical motor instruction manual.

Power supply

Three phase : 3 x 400 V at 50 Hz
3 x 460 V at 60 Hz (on request/depending on the design)
or according to the electrical diagram (in case of non standard delivery)

If the unit is designed to work with a frequency converter, see the project datasheet

Starting

The starting equipment should be provided electric overload or power failure protection, with the proper capacity for starting and full load currents.
Ground connection is required by law.
The ground connection should be made from the equipment structure to the grounded electrode.

General security rules

In case of general power failure, the power supply to the electrical box has to be switched off from the general switch, before attempting any inspection. If the service to be provided involves only one part of the unit (e.g. one fan motor) it is recommended to mechanically block the switch in the O position, to avoid an accidental starting by unauthorized persons.

Starting checks

- Rotation direction:
  Check the rotation direction according with the nameplate indication by shortly powering the fan motor. To change the rotating direction, interchange any 2 phases out of the 3 phases of the power supply. The maximum rotation speed has to be double checked in the project data sheet.
- Power consumption:
  The current should be measured after a reasonable period of time to ensure that it does not exceed the nameplate current. Avoid frequent stop-and-start of the motor as this will lead to overheating. Direct on-line starts should be limited to 4/hour. Slight differences between actual and rated current and tension values are normal, depending on the type of installation, the temperature and the altitude above sea level. Maximum Voltage/Ampere/Frequency have to be checked in the project data sheet.

Grounding

The ground connection is required by law. Ground resistance should be lower than 3 Ω.

For the electrical cable tray installation, avoid drilling the metal sheet, in case of painted casing. As long as possible, use the existing holes.

5.4 Electrical motors

The fan motors have the following specifications:
Type: Induction squirrel cage
Protection type: IP55 (standard delivery)
Insulation type: F or H Class
Ball bearings characteristics as per maximum design temperature
Connection: 3 Phase 400 V ± 5 % / 50 Hz ± 2 % (standard delivery) or 460 V ± 5 % / 60 Hz ± 2 % (special design)

Please refer to electrical motors specifications in the motor manual.
Motors with IP > 54 require regular condensate water presence check, by opening the bottom plug.
In case of motor with grease nipples follow the instruction provided by the motor manufacturer about oil type, quantity and greasing frequency.

During prolonged shut down periods (e.g. in winter), all electric motors should be run once every four weeks for a minimum of 4 hours. In winter, when the fan motors are not in use, the space heaters, if any, shall be activated.

During winter periods, fan motors should be switched on only when the system is warm; this allows the fan motors to receive a positive temperature from the hot finned exchangers.
If the temperature is too low, the fan will work with high air density and the absorbed power will be higher than normal. For this reason, the motor protection devices (fuses, etc.) must be selected and slightly oversized in case the installation site reaches negative temperatures.

6 Operation

The use of the equipment in conditions different from those specified in this manual may generate serious damages.

6.1 Start-up procedure

The following procedure is to be respected at every system start-up:

- Check that all the equipment-fastening screws are perfectly tighter.
- Check that the equipment inlet valve is closed and the outlet valve is fully open.
- Open the vent valve and then start the liquid feeding pump.
- Open the equipment inlet valve slowly, until reaching the designed flow.
- When the whole air in the equipment was purged, close the vent valve. Make sure that the whole circuit, including the external piping, is free of air.
- Check the direction of rotation with the casing nameplate.
- Verify that there are no leaks in the equipment or in the circuit.

In case of abnormal noise or too high vibrations at the first start-up, contact immediately Alfa LU-VE.

6.2 Operating the equipment

- Check the liquid inlet and outlet temperatures.
- Check the fluid flow rate.
- Check if the air circulating is correct, from air recycling point of view and correct if any.
- Check the fan rotation direction.
- Check if the coil is clean.
- Check that the current load indicated on a current clamp tester is equal or slightly lower than the rated, when the fan(s) are running at rated rpm.
- The fan speed is indicated in the data-sheet. Check the correspondence to fan data-sheet and the order.

Never use the fans at higher speeds than the nominal fan speed.
The fans are suitable for continuous use in clean air.

Number of starts

The fans are suitable for continuous operation. The number of starts should be limited to:

- 4 direct on-line start per hour
- 2 starts in quick succession followed by 30 minutes cooling, which may be achieved by running or switching off.

Reversal

A reversal running will generate (in most of the installations) an air flow equal to the 50% of the nominal fan air flow.

Before the reversal is carried out, the fan must be completely stopped. The proper run down time can be measured by simple observation. It is usually between 15 and 90 seconds.

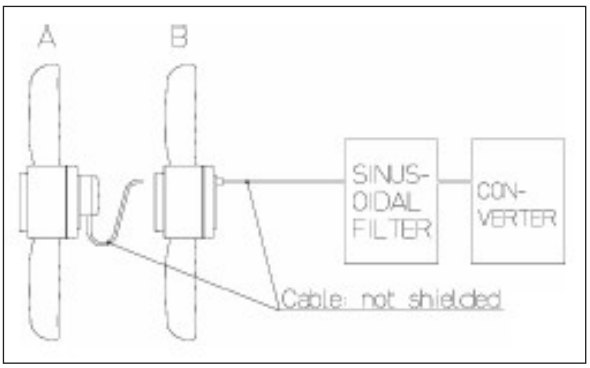
6.3 Operating under frequency converter

The frequency converter must be properly sized according to the motor power. Refer to the frequency converter and motor manual for elctrical connections, wiring and safety requirements.

Do not run the motor with a frequency higher than the motor name-plate frequency or the frequency indicated in the project data-sheet.

A proper starting ramp should be chosen in order to avoid motor over heating and vibrations. If the fan must be run at speeds different from the nominal motor speed, its important to verify that the selected speeds do not generate vibrations or resonance in the fan or in other parts of the equipment/installation.

For drives with frequency converters as with all other drives, the operator must ensure that he complies with current regulations. These vary, depending on the drive and the environment. Frequency converters place a much greater stress on the motor and the environment than when the motor is connected directly to the mains.
Alfa LU-VE suggests sinusoidal filters effective on all poles for the electric motor operation using frequency converters.
These sinusoidal filters supply sinusoidal output voltages phase against phase and phase against protective conductor, which approximate to the details of DIN V ENV 61000, part 2-2.



Sinusoidal filters are installed between the converter and the motor directly on the output terminals of the converter.

Benefits with the sinusoidal filters:
- Practically no increased stress on motor compared with mains operation. Therefore hardly any effect on the environment.
- Generally no need for shielded motor leads. It is essential to follow the guidelines of the manufacturer of the converter and sinusoidal filter in this respect.
- Metallic motor terminal boxes are not necessary.
- A second earth lead connection is not required on the motor as no significant leakage currents flow to the motor.
- No special conditions apply to the air and leakage paths in the motor terminal boxes.
- The life of the insulation system and bearing are the same as with mains operation.

Depending on the guidelines of the filter manufacturer the leads must be protected according to the effectiveness of the filter.

If it's not necessary from a performance point of view, do not run the motor at the nominal maximum frequency. A lower frequency means longer bearing life and lower electrical consumption.

6.4 Variations of the operating conditions

The operating conditions (rpm, ambient temperature, quote above sea level) are given on the data sheet at the design conditions. If the equipment runs under different conditions, the following rules apply.

Temperature

The ambient temperature modifies the thermal performance of the liquid cooler. If the ambient temperature increases, the thermal performance decreases.
Contact Alfa LU-VE to check the cooler thermal performance at ambient temperature different from the design condition.
Temperature also changes the density of the air and therefore the power absorbed by the fan motor.
Here following some air density values at different temperatures are shown:

T	-20	0	15	50	100	°C
ρ	1.39	1.29	1.09	0.9	0.94	Kg/m³

Blade Pitch Angle
If adjustable pitch blades impellers are installed and the blade pitch angle is changed, the fan performances and absorbed power change accordingly.
Contact Alfa LU-VE for more details.

A change in blade pitch angle may generate an absorbed power higher than the motor nominal power. This is a dangerous situation. Check carefully the operating condition before changing the blade pitch angle and measure the current after the change.

The change of the blade pitch angle must be made according to the fan manual.

6.5 Shutdown

If the unit requires emptying for maintenance, system shutdown or dismounting, proceed as follows:

- Close the inlet valve to the equipment
- Close the outlet valve of the equipment
- Switch off the liquid circulating pump
- Switch off the fan(s)

If the procedure of shutdown has to be done in winter, add some antifreeze into the piping and the radiators. Before close the inlet and outlet valves, put the pump in rotation to distribute and mix the antifreeze fluid in all the pipes.

It is important to follow the starting procedure at every equipment's starting.

6.6 Draining the coil

When the coil unit needs to be emptied for maintenance or when the system is not in use in winter-time, proceed as described below:

- Turn off the system and open the vent valve on the highest point of the circuit and the ½” Gas vent-plug located on the top of the manifold
- Open the circuit drainage plug/valve and wait for the system to empty.
- Remove the drain-plug located at the bottom of the header and make sure the coil-block is to-tally drained (use pressurized air), or open the drain valve if installed.
- When the circuit is empty and to avoid the ice formation, fill the coil with antifreeze mixture. To restart the operation, repeat the procedure, but in opposite order.

7 Maintenance

Ensure complete electrical isolation before performing any maintenance activity and always follow guidelines and instructions as given in the air cooled liquid coolers product manual AHE00050.
The power supply should be turned off from the sectional board. For further security, the operator can also turn the switch on/off to the off position to avoid accidents.

The air coolers require regular maintenance in order to assure efficiency and prevent damage to objects and persons. The frequency of ordinary maintenance depends on the actual operating conditions. In optimal working conditions and continuous operation, it is recommended to carry out servicing after approximately 100 hours of work and later at periodical intervals of 1500 hours.
Only some applications require the use of completely clean water. Generally the water comes from closed systems (mains) or in some cases from open systems such as wells, beds or rivers. In time this water can lead to precipitation or the deposit of organic and inorganic substances on the internal surfaces of the pipes (fouling).
These fouling deposits act on both the thermal resistances to reduce the thermal exchange and on the hydraulic resistances, increasing the load losses.
During installation it is always recommended to fit a filter upstream from the exchanger; it is the responsibility of the user to establish the quality of the water used and to ensure that it is compatible with the materials used in the exchanger.
Some parameters that must be checked are:

- The hardness of the water, to assess the need for softening.
- pH analysis (a value between 7.5 – 9 is recommended).
- A sediment analysis to determine the need for filters in order to avoid the formation and ac-cumulation of residues and pipe erosion.

The indicated servicing frequency is considered a recommended minimum; it may be increased at the discretion of the maintenance technician depending on the installation characteristics.
The DCH maintenance can be made from outside or entering inside the equipment thanks to the inspection doors. An additional locked safety door is required in front of the radiator door. Only authorised service personnel should be allowed access.
If the equipment should remain without operation for long periods (three or more months), it is advisable to operate the fan(s), at least once per week, during 4 to 6 hours each time.

7.1 Coil cleaning

The normal and continuous operation of the unit will increase the risk to get the coil dirty.
Depending on the environmental working conditions (atmospheric pollution, presence of pollen, dust, working residues, external temperature, distance from the sea, etc.), the buildup of dirt can become serious and lead to the drastic reduction in the performance of the unit.
When the dirt is serious, it's possible a drastic performance reduction, the heat exchange coefficient decreases and air pressure drop increases (consequently the fan consumption too).
Depending on the amount of dirt, the coil needs an appropriate cleaning plan.
Finned coils should be cleaned using compressed air or using a water jet, directed perpendicularly to the coil in order to avoid bending or damaging the fin profiles.

The DCH model permits to clean the coil on both sides, external and internal (you can enter inside the unit with the door on the manifold side).
If the finned pack is a little "bended", it can be adjusted by using a special tool (the comb).

Incorrect use of high pressure water can damage the coil.

Tools required:
- Pressurised water for fins cleaning (Pmax < 1 bar) or pressurised air (Pmax < 5 bar)
- Water-soluble degreasing solution
- Combs for the finned pack

Recommended interval (depending on the site conditions): 1 year

7.2 Checking the air in the coil

When the system is first filled, a certain amount of air inevitably remains trapped inside, collecting in the highest parts of the system. More air may form during normal use. It is therefore a good idea to include automatic vent valves on the tops of columns, elbows and other high parts of the system. The air cooler is often located in a “higher” position than the rest of the system, and therefore the coil air removal operation must be carried out not only during start-up but also at regular intervals. The manifold is fitted with a threaded coupling with a brass cap: this can be used for the installation of an automatic or manual vent valve, or the cap can be unscrewed manually to let out the air, closing it when the water starts to come out.

Be careful to the temperature of the water coming out once all the air has escaped.

It is recommended to clean the metal filters in the hydraulic pipes (at least every 6 months).

Estimated time per unit: 5 minutes
Recommended interval: 1 year

7.3 Draining the coil

When the coil needs to be emptied for maintenance or machine stop, proceed as described below:
- Turn off the system and open the vent valve on the highest point of the circuit.
- Open the drainage valve (if installed by the customer) and wait for the system to empty (use pressurized air to make it faster).
- It is recommended to fill the coil with antifreeze mixture, in accordance with the proportions shown in the table below, once it is empty, to avoid the formation of ice.

Air Temp [°C]	Glycol % [Kg/Kg]
0	10
-5	20
-10	30
-15	35
-20	40
<-20	50

Estimated time per unit: 2 minutes/module
Recommended interval: when required

7.4 Checking and tightening nuts and bolts

Checking that the bolts on the air cooler, the support structure (where present) and the fan motor groups are tighter.

Tools required: dynamometric spanners
Estimated time per unit:
- 15 minutes (casing bolts/nuts)
- 60 minutes (fans and electric motor supports)

Recommended interval: 1 year





7.5 Bearings

DCH coolers can be supplied with two different types of motors (sealed for life or with greasers). With sealed for life bearing there is no need of lubrication. Operating life varies depending on the actual operating and environment conditions. Considering an average operating time of 8,500 hours/year, bearings should be replaced ~ every 3 years (depending on the working conditions). Spare parts used must comply with the original.

Before carrying out any operation make sure that the fan is not moving and cannot be occasionally or accidentally switched on (electrical power off). The replacement is extraordinary maintenance activity and must be carried out by qualified staff using the appropriate equipment.

If electrical motor with greasers are installed, a periodical lubrication is mandatory. Intervals depend on fan speed (rpm), ambient conditions, etc.
Proper grease quantity must be used at any time. Continue filling until the new clean grease comes out from the discharging holes. Failure in complying this requirement results in severe damage for the motor.

Please refer to the electrical motors manual or contact the motor supplier for dismounting/mounting, bearings replacement and periodical lubrication details.

7.6 Visual control of the vibrations

The vibration levels could give noise or ball bearing damages. There are several vibration reasons:

- drive shaft bearings damaged
- one or more unbalanced blades
- non-complanarity of the blades
- drive shaft not aligned
- fixing nuts loose

Periodical check is recommended to ensure the correct operation of the fans:

- Visual inspection with the fan at a standstill to check the structural integrity and the cleanliness of the blades (dirty blades can unbalance the impeller).
- Visual inspection with the fan running to check that there are no abnormal vibrations (if present, they are easily noted on the fan nozzle).

Estimated time per unit: 10 minutes
Recommended interval: 3 months

7.7 Checking the ground connections

Checking the condition of the ground connection and the absence of PD between the unit casing and the earth circuit.

Tools required: normal electrician’s tool kit
Estimated time per unit: 5 minutes
Recommended interval: 6 months

7.8 Checking the condition of the electrical wires and tightening the terminals

Checking the tightness of the electrical terminals both inside the control panel (where present) or switches or terminal box, and in the electric motor box.

Tools required: normal electrician’s tool kit
Estimated time per unit: 30 minutes
Recommended interval: 6 months






7.9 Electric motor replacement

Extraordinary maintenance activity due to mechanical or electrical damage to the motor.
Spare parts electric motors can be used for replacement.

- Remove the protective grid.
- Unscrew the fan impeller main bolt on the hub. Remove the complete impeller. Handle with care.
- Enter inside the unit by the door.
- Anchor the motor eyebolts with lifting straps to support the weight of the motor before loos-ening the nuts.
- Open the electrical connection box and disconnect the terminals.
- Unscrew the fixing nuts of the motor support rods.
- Remove the motor-fan unit.
- Mount the new motor following the above steps in the reverse order.
- Make the electrical connections in the connection box.
- Switch on briefly to check the rotation direction.

Before carrying out any operations make sure that the fan is not moving and cannot be casually or accidentally switched on (electrical power off). The removal and relative assembly are extraordinary maintenance activity, and must be carried out by qualified staff using the appropriate equipment.






7.10 Fan maintenance

Fans require regular maintenance to ensure their efficiency and prevent damage to people and property.
The frequency of operational maintenance will depend on the operating conditions.
In the case of ideal operating conditions and continuous operation, it is recommended to inspect the machine:

- after the first 100 hours of use
- after the first 200 hours of use
- at 2500 hour intervals

Before carrying out any maintenance, make sure that the fan is not running and the impeller is not moving. Ensure that the fan cannot be started accidentally. Only qualified personnel shall carry out all maintenance operations.

- Components found to be damaged or worn after inspection must be replaced.
- Any maintenance operation that alters the original characteristics of the product is prohibited
- Repairs carried out without the express written authorisation of the manufacturer will render the product warranty and certification null and void.

It is recommended to use compressed air to clean the fan: it is better not to use water, water jets and wet clothes to avoid electric shock or motor damage.

7.11 Fan cleaning

Cleaning is particularly important for fans and must be carried out regularly to remove dust and debris from the ends of the blades to prevent friction.
Clean the blades and hub thoroughly, removing all dirt deposits.
Ensure that the blades are free from any signs of bending or scratching.
Check the tightness of the bolts fixing the blades to the hub and the bolts fixing the impeller to the shaft accordance with the tables in the impeller manual supplied.
Check that the gap, i.e. the distance between the tip of the blade and the inner wall of the casing, is the same for all the blades.

7.12 Fan replacement

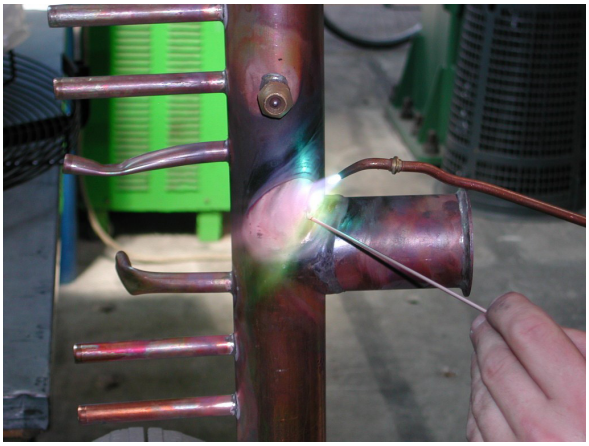
Extraordinary maintenance activity.

- Remove the protective grid.
- Unscrew the electrical motor shaft bolt (the one that fixes the fan impeller).
- Lift and remove the fan.
- Mount the new fan following the above steps in the reverse order.

Before carrying out any operations make sure that the fan is not moving and cannot be casually or accidentally switched on (electrical power off). The removal and relative assembly are extraordinary maintenance acitivity, and must be carried out by qualified staff using the appropriate equipment.

7.13 Coil repairing

Extraordinary maintenance activity due to broken coil.



Following any damage causing the coil to break, having emptied the circuit the repair shall be carried out using braze-welding (for copper pipes), or TIG welding (for stainless steel pipes). Welding repairs must be carried out using the special alloys. For further information please contact your local Alfa LU-VE representative.

Seal test on site: fill the circuit with nitrogen using a bottle with reducer until a pressure of 10 bars is reached. Any losses must be identified using a bubble leak finder. Any bubbles or foam indicate a localised leak.

If any leaks are found during the test, drain the circuit before welding using the appropriate alloys.

8 Troubleshooting

Fault	Possible cause	Required action
Fans off	Line voltage below the tolerance limits	Check the voltage values be-tween the phases using a tester
	One phase missing	Measure the voltage between the phases on the fan terminal block. Check the entire power supply line.
	Overloaded motor	Check with an ammeter
	Motor fault	Replacement
Outlet temperature higher than the design value	Air flow-rate too low – coil is dirty	Check the finned surface and clean if necessary.
	Exchanger fluid inlet temperature higher than the design values	Check the causes. Decrease the flow-rate of the fluid within the allowed design limits.
	Fluid flow-rate different from the design value	Check the causes.
	Deposits of dirt inside the pipes	Chemically wash the exchanger
	Glycol concentration higher than the design value	Dilute the fluid with water
	Parallel layout of the fluid flow and air flow	Reverse the direction of flow of the fluid
Problem regarding the electrical motor	Refer to the electrical motor installation manual	Refer to the electrical motor installation manual
Problem regarding the fan	Refer to the fan installation manual	Refer to the fan installation manual

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