Transformer oil cooler BETA

(GB) Installation, Operation and Maintenance Manual

COILTECH

Description – Safety Precautions and Warnings

General

The cooler cools transformer oil with ambient air. The transformer oil circulates by use of a pump, which can be ordered separatly. If the cooler has more than one fan, the fans are separated by partition walls. This enables stepwise power regulation, by adding or deleting one fan at a time according to the cooling needs.

Labelling

The name plate is located on the connection side of the cooler and provides information about:

- Manufacturer
- Maximum working pressure
- Test pressure
- Motor data
- Order No.
- Year of manufacture
- Dry weight
- Inner oil volume

Quality system

Coiltech is certified according to quality system standard ISO 9001 and environmental management standard ISO 14001.

Handling and care

Read the whole manual before handling the cooler.
The cooler must be installed in a place which is not open to public. All work on the cooler has to be carried out by trained personnel familiar with the product and the safety regulations.
The cooler surface is not designed to carry a mans' weight.

Lifting

The dry weight of the cooler is stated on the name plate, which is located on the connection side of the cooler.

The cooler may be lifted by a fork-lift with long forks. See Figure 1a. Alternatively, the cooler may be lifted using the lifting eyes provided. See Figure 1b.

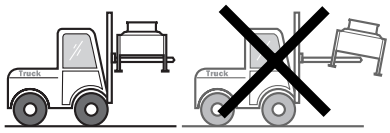


Figure 1a. Lifting by means of a truck.

Before lifting the cooler:
- Make sure the lifting eyes are secured and intact.
- Make sure that appropriate lifting equipment is used, and that the size of the hooks is adapted to the lifting eyes.

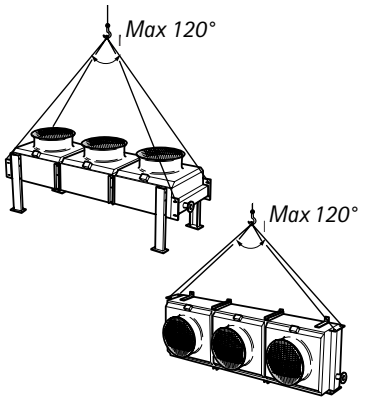


Figure 1b. Lifting by means of a crane. Maximum crowfoot angle 120°.

Mounting

The cooler must be secured to a fundament or to special brackets mounted for this purpose. The fundament and the brackets must be stable enough to bear the dry weight of the cooler plus the weight of the transformer oil.

Operating pressure

The cooler may only be used in a system which has been approved for the maximum working pressure (MWP, MPa) and the maximum working temperature (MWT, °C) indicated on the name plate.

Connections

The pipe couplings of the cooler may not be forced to carry the dead weight of the piping system, nor to take up the expansion forces of the piping system. We recommend installing compensators between the couplings and the piping.
Note: Mechanical loads and impacts can damage the cooler.

Cleaning

Only use environmentally acceptable cleaning agents which will not damage the cooler.

High temperatures

When the heat exchanger is in operation, the connection header, the casing and the cooling air leaving the cooler can be quite hot.

Environments with risk of explosions

The cooler is not designed to be used in environments where there is a risk of explosion.

Installation

Transport

Check for any damage caused during transport or unloading. Parts with high damage risk are the plate surfaces of the heat exchanger, the lifting eyes and the connection header. The cooler is designed to withstand normal loads during transport.
Any transport damage has to be reported immediately to the forwarder and to Coiltech. Information about the damage should also be written on the consignment note.

Mounting

Coolers for vertical airflows are supplied with separate legs or wall mounting brackets. These legs/brackets must be attached to the cooler before installation. The free space underneath the cooler must be at least 600 mm according to Figure 2a and 2b below.
The cooler should be placed in such a way that the necessary airflow is not impeded. The distance between the coolers should be at least 600 mm according to Figure 2c below.
However it can be less if there is more free space behind the cooler.
The free space between the cooler and the wall must be at least 1000 mm.
Other relevant dimensions are indicated on the dimensional drawing for each cooler size.

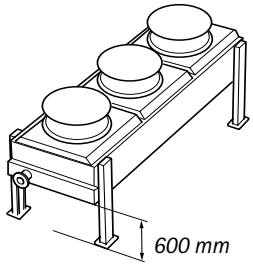


Figure 2a. Horizontal mounting, distance from floor.

Mechanical requirements

The cooler must be secured to a fundament. The cooler is provided with securing holes. See the relevant dimensional drawing.

Venting/drainage

The connection header is provided with nipples for venting and drainage. The system should be thoroughly vented before commissioning.

Electrical requirements

Each fan motor is connected to a lockable safety switch with a closing auxiliary switch. The safety switch may not be used to start and stop the unit. Starting/stopping must be accomplished by means of other external equipment. The system must be equipped with an emergency stop switch, which has to override all other equipment. The motor must be protected by a contactor, which should highest be adjusted to trip when the motor current exceeds the maximum permissible motor current according to IEC-34-1 (see tables 1a and 1b).
This protection is necessary, because the nominal current of the motor can be exceeded before the airflow reaches the designated temperature. The risk of motor damage is minimal, since the motor is cooled by the cool ambient air. The phase leads L1, L2 and L3 and the protective earth lead are connected as indicated in Figure 7, 8 and 9.
When the fan motor is electrically connected, make sure the fan rotates in the direction of the arrow. The arrow is located on the outside of the fan ring.

Cable runs

When mounting cable runs, it is important to be cautious in order to avoid damaging the heat exchanger.

Dismounting

Before removing the cooler from the system, you have to make sure that the oil has been drained. See the comment above about venting/draining.
Note: Any products potentially harmful to the environment must be collected in suitable containers, which can be sent for disposal or recycling.
The cooler may not be lifted before all oil has been drained.

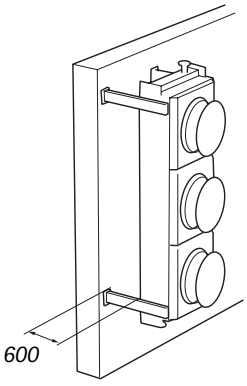


Figure 2b. Vertical mounting, distance from wall.

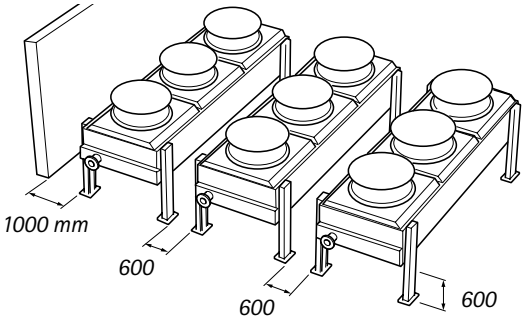


Figure 2c. Multiple coolers, distance between units.

Maintenance and service

General

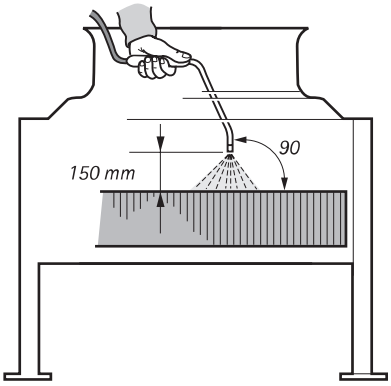
The cooler should be inspected regularly to prevent operating problems.

The following checks should be done:

1. Noise or vibration may be due to a damaged motor bearing or a damaged impeller.
2. Mounting - make sure no load-carrying screws or threads are damaged.
3. Electrical - check for visible damage and test the safety switch.
4. Fin body - check that the fins are clean and intact.

Cleaning the heat exchanger

The heat exchanger is preferably cleaned by means of high-pressure washing. To enable cleaning against the airflow direction, the safety screen at the fan exit should be removed. See Figure 3.



Figur 3. Cleaning the heat exchanger.

First spray the entire heat exchanger with an environmentally acceptable solvent under low pressure. High-pressure clean with water after 10 - 12 minutes. The nozzle should be aimed perpendicularly to the fin surface, at a distance of at least 150 mm. There may not remain any traces of solvent after cleaning, for that would cause new dust particles to stick to the surface. Fins deformed during cleaning may be straightened by means of a fin comb (QLAZ-20), which can be ordered from Coiltech.

Fan motor

The fan motors are permanently lubricated. At changing of bearings, consideration must be taken to the motor ambient temperature, for the right choice of grease.
The motors and fan impellers can be accessed by first removing the protective screen (guard).
If the refrigeration unit is switched off for a longer period there is a danger of motor damage owing to condensation and static load on bearings causing the film of lubrication to be penetrated.
If the refrigeration unit is to be periodically switched off (more then one month), the motors must be fitted with heating inside the motor windings in order to prevent condensation. The motors must be rotated manually or given a warm-up run at least once a month in order to prevent the film of lubrication covering the bearings from being penetrated.
An alternative to electrical heating is to connect two series DC phases from a source providing a total output as per table 1. This method is for motors of less that 10 kW only.
To calculate DC, use the Ohms law formula:

$$U_{(v)} = \sqrt{P_{(w)} \, x \, R_{(\Omega)}}$$

where R is the resistance in the series windings. Resistance should be measured using a precision ohmmeter.

Table 1 Heating windings

Motor size	Output
90 – 132	25 W

Another alternative is to use single-phase AC (between 10 and 15% of rated voltage) between the two seriesconnected phases.
The windings heating shall be is connected when the motors are running

Draining:

The motors are equipped with drain holes in the lowest part of the motor. This openings shall be open. At maintenance of the motors, the drain holes shall be checked and cleaned from clogging.

Repair work

Parts and materials suggested by Coiltech must be used; otherwise the warranty will become void.

Long-term storage

If the cooler has to be stored for longer periods of time (in a Scandinavian climate, this means more than 1 month), the following rules apply:
1. The cooler should be stored indoors, oriented in accordance with its working position. This ensures the draining holes for the motor to remain functional.
2. If the cooler is stored in a damp place, the external coating must be examined to make sure there are no damaged spots. Damaged spots should be repainted.
3. The fan exit should be covered with reinforced plastic sheets or some other mechanical protection against water and contaminants, which may harm the finned coil body and/or the motors. The free fin surface must be protected mechanically by a panel or the like.
4. The connection couplings of the cooler should be closed by steel plate covers, which seal the connection header by means of rubber gaskets.
5. During storage, the motor shafts should be turned by hand at least once every 3 months.

Maintenance and service

Spare parts

For units with a very high up-time requirement, the operator is advised to keep a spare motor and impeller. Motors and impellers are normally available from Coiltech spare parts depots.
When keeping spare electric motors it is important to check them regularly and replace certain parts. Follow the instructions from the motor manufacturer.
Motors must always be stored indoors in dry and dust-free rooms.

Replacing fan and motor

1. Disconnect the main power supply. Put the lockable safety switch in the OFF position, and lock it.

2. Remove the screws holding the safety screen and remove the screen.

3. Release the screw on the cover. The two socket head cap screws that are now visible in the fan hub are released and placed in the holes provided alongside. Then tighten the screws a little on a time until the impeller wheelis released from the shrink-fit taper, figure 4.

4. With vertical airflow: Fit a lifting eye bolt with an M10 (6-pole M12) thread at the end of the motor shaft .

5. Disconnect the electrical cable from the terminal block.

6. With vertical airflow: Secure the motor using the lifting eye bolt at the end of the motor shaft, or secure it to a lifting device. When using a lifting bar to lift the motor, be careful not to damage the fan ring.

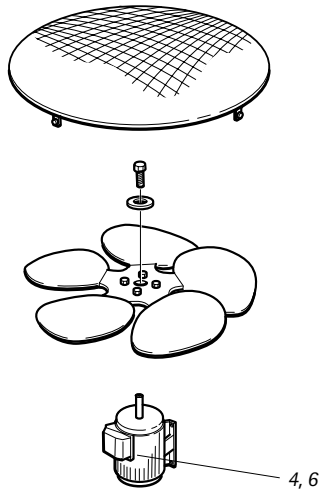
7. Remove the screws which secure the motor to the motor shelf. Lift out the motor.

8. For installation of fan and / or motor. Perform these points in reverse order. Use a torque wrench when tightening load-bearing screwed connections.

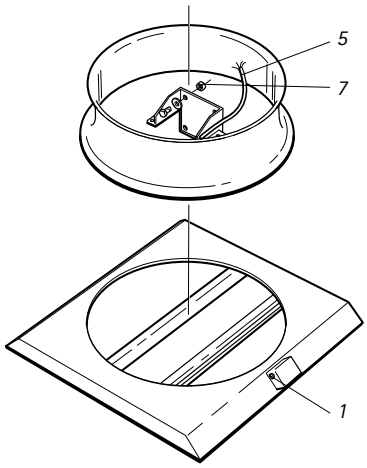
9. When installing the impeller wheel on the motor shaft apply some kind of corrosion protection to the shaft and the screw.

10. Before starting the motor, check if the impeller rotates inside the fan ring, and make a trial start to check that the impeller rotates in the direction indicated by the arrow.

Motor weight:	20 kg
Impeller weight:	53 kg
Tightening torque:	50 Nm



Figur 4. Motor and impeller

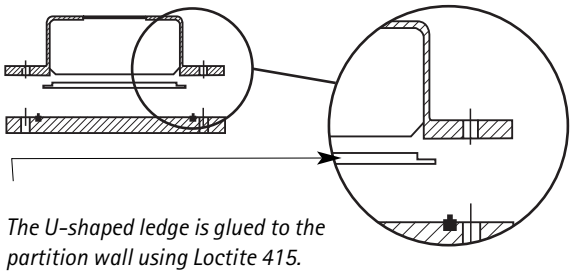


Figur 5. Motor mounting

Maintenance and service

Replacing the connection header gasket

If the connection header must be removed (which is not part of normal maintenance), we recommend replacing the O-ring gasket. A new gasket may be ordered from your local retailer or from Coiltech.



The U-shaped ledge is glued to the partition wall using Loctite 415. The gasket may not pass over the O-ring.

Figure 6a. Header profile, with partition wall and packing as well as tube plate with O-ring.

Air vent and drain nipple

The connection chamber of the heat exchanger is provided with an air vent and a drain nipple, connection thread M16. The nipples have a copper gasket made of solid full annealing copper (DIN 7603 A), this gasket should be replaced every time the nipple is released.

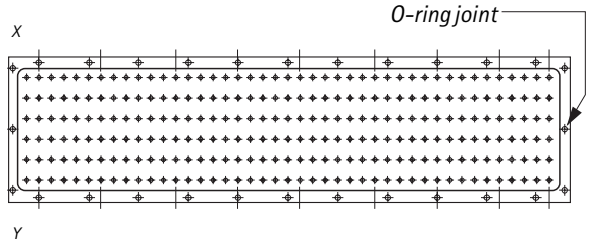


Figure 6b. Tube plate with a groove for an O-ring

1 The O-ring gasket is jointed on the middle of the short side of the tube plate, and is cut 8 - 10 mm longer than the circumference of the O-ring groove, after placing the gasket in the O-ring groove on the tube plate. The joint should be straight and be cut at the same time.
The ends are pressed against each other. This extra length will ensure that the gasket will fit in the groove when the chamber cover is tightened.

2 Cut an U-ledge for the partition wall.
The ends are cut flat and the ledge length is made equal to the distance inside the O-ring in the tube plate.
The U-shaped ledge is glued to the partition wall.

3 Check if the header is clean on the inside, and does not have any visible damage.

4 Mount the header.
Tighten the screws alternately on the X and the Y side towards the O-ring gasket joint, according to Figure 6b.
Tightening torque: 70 Nm.

Technical specifications/ Connection diagram

Operating data

Max. operating pressure:	0,2 MPa
Max. operating temperature:	100 °C
Test pressure:	0,3 MPa

Heat exchanger

The heat exchanger in the cooler is made of tubes that have been expanded mechanically against fins. The fins are in one piece, without slits or joints, to prevent dust particles and fibres from sticking to the fin body. The connection chamber of the heat exchanger, in which the oil is distributed, is provided with a venting and draining nipple, with a M16 thread. The pipe couplings comply with DIN 2633, ANSI 16.5 150Lb, or square stud bolt flange coupling DN 100.

Motor/Fan

The fan motor is a fully encapsulated foot-mounted squirrel-cage motor, made of die-cast aluminium or cast iron. The axial fan is directly mounted on the motor shaft and made of aluminium plates fitted to an epoxi-coated steel hub. The impellers are statically balanced according to ISO 1940, class G6.3.
The fan exits are protected by safety screens, which may be removed for an inspection of fan and motor, or for cleaning the heat exchanger body.

Protection classes

The fan motor is protected to the IP55 class, with open draining holes at the lowest point of the motor. The safety switches are protected to the IP54 class. During a transitional period, the cable colours for the phase leaders L1, L2 and L3 may be black, brown and blue.

Connection diagram

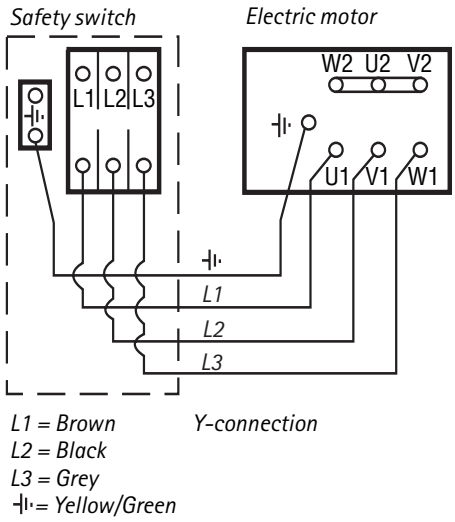


Figure 7. Circuit diagram of a Y-connected single speed motor.

Weight and volume

The dry weight and the inner volume of the cooler are indicated on the name plate.

Motor data

The motor data are also stated on the name plate.

Table 2a. Motor data for a supply voltage of 400 V, 50 Hz

r/min	Fan speed Code eee	Rated power, kW	Rated current, A	Imax 1) A	Weight kg
440	512	0,15	0,8	1,1	14
705	508	0,75	2,54	3,0	22
940	506	1,5	3,88	4,3	26

Table 2b. Motor data for a supply voltage of 480 V, 60 Hz

r/min	Fan speed Code eee	Rated power, kW	Rated current, A	Imax 1) A	Weight kg
520	612	0,25	1,1	1,5	13
810	608	1,0	2,8	3,3	18
1150	606	2,13	4,8	5,3	20

1) According to IEC-34-1

Product specification

Cooler **BETA-aa-b-c-d-eee-f-gg-h**

Number of fans **(a_1)**
1, 2, 3 or 4
Number of rows **(a_2)**
3, 4, 5 or 6

Number of oil passes **(b)**
1 or 3

Turbulator or inserts **(c)**
0 = without inserts
4 = with inserts

Connection size **(d)**
d = 1 ⇒ DN80
d = 2 ⇒ DN100
d = 3 ⇒ DN125
d = 4 ⇒ DN150
d = 5 ⇒ ANSI 3"
d = 6 ⇒ ANSI 4"
d = 7 ⇒ ANSI 5"
d = 8 ⇒ ANSI 6"
d = 9 ⇒ DN100 Flat square flange with M16 bolts

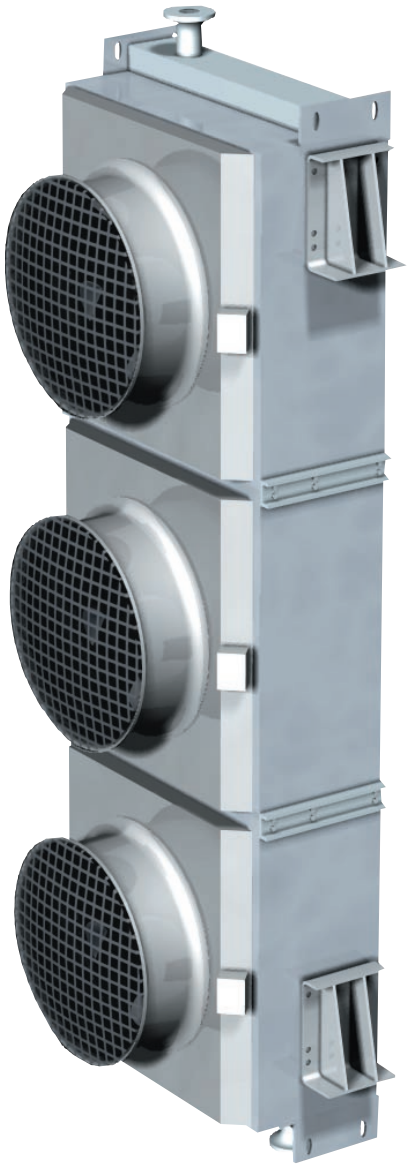
Motor power supply **(e_1)**
5 = 400 V, 50Hz
6 = 480 V, 60Hz

Number of poles**(e_2e_3)**
06 = 6-poles
08 = 8-poles
12 = 12-poles

Materials in tubes, tube plates and fins **(f)**
1 = Aluminium – Aluminium - Aluminium
2 = Copper – Brass - Aluminium
3 = Copper – Brass - Copper

Mounting alternatives **(gg)**
See catalogue.

Type of design **(h)**



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