



Photo: Wilson Transformer Company

# BETA & CETA

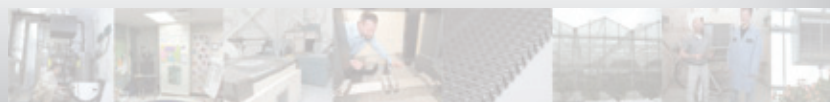
Transformer oil coolers



Coiltech<sup>®</sup> industrial heat transfer



A07





# MODINE - MEETING YOUR FUTURE ENERGY AND NOISE REQUIREMENTS TODAY

## **Know-how and experience**

Modine has designed and manufactured high-quality coils and coolers for industrial applications for over 70 years. With our many years of experience, heat transfer expertise and global span, we're designing and manufacturing products that bring improved performance, efficiency and dependability to every installation.

## **ErP Directive**

Modine transformer oil coolers are compatible with most transformer projects world wide. The latest series of BETA and CETA transformer oil coolers meet or exceed the new Energy related Products (ErP) Directive 2015 and are made with reference to EN 50216.

## **Customer focus**

Modine's strategy is to understand our customers challenges and to work together in partnership to bring improvement to their applications and processes. Our commitment and collaborative spirit make Modine a partner on which our customers depend.



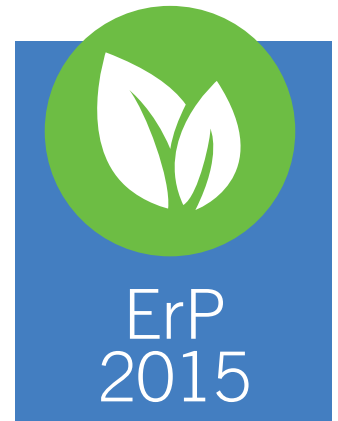


Modine's management system is certified acc. to ISO 9001:2008, ISO 14001:2004 & ISO 3834-2:2005.



# MODINE TRANSFORMER OIL COOLERS WORLD WIDE

Our transformer oil coolers are compatible with most transformer projects world wide. We offer a wide range of capacity variants for different installation requirements, including project based corrosion protection. Modine - Power in good hands.



Modine designs and manufactures transformer oil coolers, type BETA and CETA, specifically for mineral oil insulated power transformers and reactors. The cooler operates with built-in fans and an oil circulation pump to maintain correct flow rates and cooling capacity.

## NEW FEATURES

- More efficient fans (which fulfills the ErP directive).
- Increased corrosion protection systems, including E-coating for marine conditions (C5-M) and Industrial environment (C5-I).
- A new size of heat exchanger tube have been introduced in addition to standard 15 mm tubes. This makes it possible to further optimize performance.
- Stainless steel tubes (increased corrosion protection).
- Now available with up to 5 fans per cooler, which in some cases makes it possible to decrease total number of units.

## ENVIRONMENTAL THINKING

We work consciously and in a structured way to safeguard the environment throughout the product's service life, including development, manufacture, application, phase-out and recycling. By streamlining the use of material and energy, we can contribute to long-term management of natural resources.



Modine transformer oil coolers are compatible with most transformer projects world wide.





## BENEFITS

The Modine transformer oil cooler concept, type Oil Forced Air Forced (OFAF), offers many benefits including:

- Pre-designed with simple ordering product code
- Two types – BETA & CETA
- Different sizes within each cooler type
- Wide capacity range
- High cooling capacity & compact design
- Low sound level – different fan speeds
- Low energy consumption
- Two different connections within one motor: Delta & Star
- Horizontal/vertical installation design
- Thoroughly cleaned inside by oil flushing
- Different materials available for correct corrosion protection.
- Selection software COILS for sizing, see page 7.

## TRANSFORMER OIL CIRCULATION PUMP

**type VMOA** can be supplied by Modine Söderköping AB (on request). The pump has an integrated motor and is highly efficient, cooled and lubricated by the transformer oil, robust, reliable and maintenance free. The sound level is also low. The pump can be supplied in two different sizes and with varying flow rates. Modine can help you selecting the right oil circulating pump for your cooler.



Oil pump type VMOA.

## SPECIAL DESIGN

We have a wide range of standard products, but if your application needs a cooler that need special requirements, such as corrosion protection, special materials, different dimensions or installation in limited spaces, a special design may be the best solution. Contact us for more information.



# TRANSFORMER OIL COOLER, DESCRIPTION

## TYPE BETA & CETA

The transformer oil coolers, type BETA and CETA are delivered as fully factory-assembled units. The difference between the two coolers is their size - CETA is larger than BETA (see *dimensions, page 11*). Each cooler consists of a casing with a finned tube heat exchanger, with one up to five fan units.

If the cooler has more than one fan, the fans are separated by partition walls. This enables better power regulation, by switching on or off one fan at a time depending on the unique cooling needs. The cooler is designed to withstand vibrations, shocks, seismic forces and thermal movements.

## FINNED HEAT EXCHANGER

The finned heat exchanger includes bolted headers made of anti-corrosion coated steel. The headers are bolted to the tube plates. When the number of liquid passes is three, each header is fitted with partition walls to make the required cross-flow circuit, relative to the air flow.

The rubber o-rings arranged between the headers and the tube plates provide an effective seal. The tubes are mechanically expanded into the fins as to give absolute contact between the tubes and fins for best heat transfer. Plugged vent and drain connections are provided on each header.

## FAN AND MOTOR

The state of the art fan motors offers a low sound level and power consumption but with a high air flow. The coolers could be ordered with external- or internal rotor motor technology giving a wide range of possibilities in order to optimize the cooling solution.

## CASING

The casing of the heat exchanger is made of hot-dip galvanized steel. The fan deck and the fan cone is made of painted pre-galvanized steel. If required it can be painted for aesthetic reasons or increased corrosion protection.

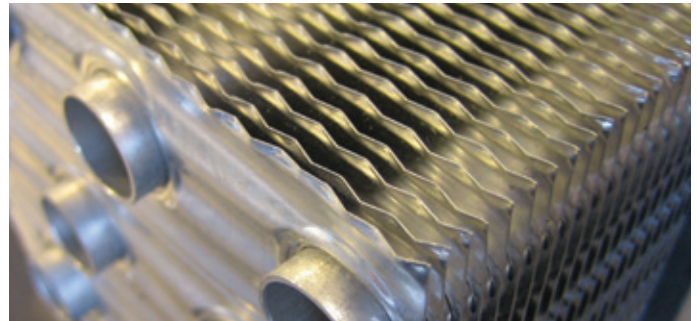
The casing is equipped with lifting lugs and brackets, in order to fit the cooler to the transformer.



Headers made of anti-corrosion coated steel.



Tubeplate with smoothly rolled-in tubes.



Tubes mechanically expanded into the fins.



The coolers could be ordered with external- or internal rotor motor technology.

# COILS SELECTION SOFTWARE

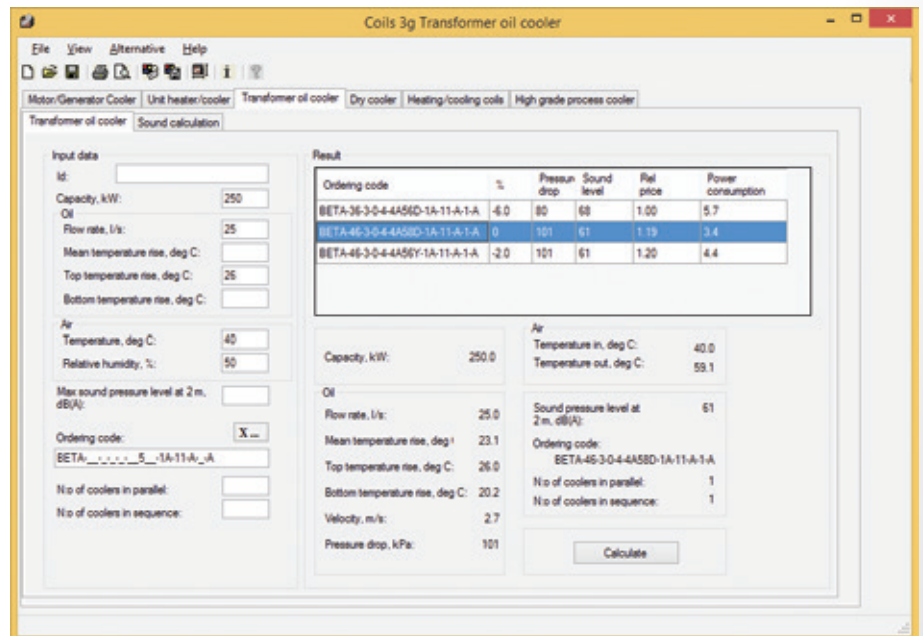
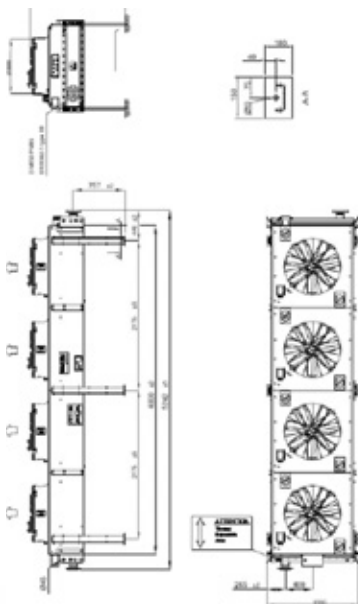
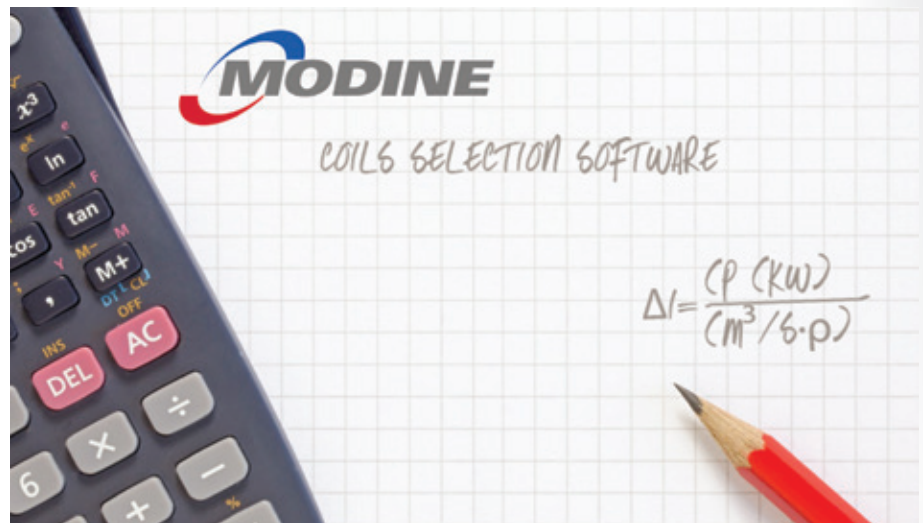
Modine's selection software COILS makes it possible to select and size the correct transformer oil cooler for any installation. The program is reliable and flexible and generates a print-out of technical data and a dimensional drawing of the selected cooler.

**Download COILS at [www.modine.com/coiltech](http://www.modine.com/coiltech)**

Modine's transformer oil cooler is available in a wide range of configurations. In order to dimension coolers for various conditions and requirements a wide variety of options are available. Specific data for a certain case is given by performing sizing in Coils or by contacting Modine sales.

Some variables to be considered while sizing and selecting include:

- Cooling capacity
- Oil flow rate & temperatures
- Ambient temperature
- Sound level (fan speed)
- Cooler size
- Mounting alternative
- Fan motor power supply
- Environmental conditions



Coils user interface.

Dimensional drawing of the selected cooler.

# TRANSFORMER OIL COOLER BY MODINE

“New tube dimension to further optimize performance”



“Increased corrosion protection systems, including E-coating with C5-M, C5-I”



## TECHNICAL DATA, STANDARD BETA & CETA

**Cooler size:** From 1 up to 5 fans, *see page 11*

**Max working pressure:** 0.35 MPa

**Test pressure:** 0.50 MPa

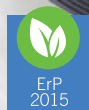
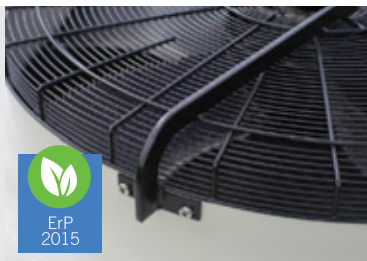
**Max working temperature:** 100°C

**Min working temperature:** -40°C (lower on request)





“More efficient fans  
which fulfills the  
ErP directive”



## CODE KEY

**BETA-aa-b-c-d-eeee-ff-gg-h-i-A-(Z)**

**CETA-aa-b-c-d-eeee-ff-gg-h-i-A-(Z)**

**a** = Number of fans: BETA 1–5, CETA 1–4

**-a** = Number of tube rows: 3–6

**b** = Number of oil passes: 1–8

**c** = Type of tube

0 = 15 mm tube without turbulator

2 = 1/2 inch tube without turbulator

4 = 15 mm tube with turbulator

**d** = Oil connection flange size

1 = DN 80 EN 1092-1 type 11 PN16

2 = DN 100 EN 1092-1 type 11 PN16

3 = DN 125 EN 1092-1 type 11 PN16

4 = DN 150 EN 1092-1 type 11 PN16

5 = 3" ANSI B16.5 150 Lb

6 = 4" ANSI B16.5 150 Lb

7 = 5" ANSI B16.5 150 Lb

8 = 6" ANSI B16.5 150 Lb

9 = DN 100 square flange with pin bolts

**e----** = Type of fan

2 = 800 inner rotor motor

3 = 1000 inner rotor motor

4 = Al blade 800 external rotor motor

5 = Al blade 910 external rotor motor

6 = Al blade 1000 external rotor motor

**-e---** = Motor type

A = AC external rotor

I = AC Internal rotor - foot motor solution

**--e-** = Motor frequency

5 = 50Hz

6 = 60Hz

**---e-** = Number of poles

6 = 6-poled motor

8 = 8-poled motor

2 = 12-poled motor

**---e-** = Motor connection

D = Connection delta

Y = Connection star

**f-** = Material combination, Tube – Tube plate – Fins

1 = Aluminium - Aluminium - Aluminium

2 = Copper - Brass - Aluminium

3 = Copper - Brass - Copper

4 = Aluminium - Aluminium - AlMg

5 = Stainless steel - Stainless steel - AlMg

6 = Aluminium - Aluminium - Aluminium with E-coating

**-f** = Casing corrosion protection

A = C3

B = C3 aesthetic paint

C = C4

D = C5-M/C5-I medium

E = C5-M/C5-I high

**gg** = Mounting arrangement

g1= 1= standard connection, 2= mirrored connections

g2= see alternatives, page 12

**h** = Internal design code

**i** = Connection box, pump and oil flow meter cable:

0 = without connection box

1 = with connection box in composite material, without pump and oil flow cable

2 = with connection box in composite material and pump cable

3 = with connection box in composite material, pump cable and oil flow cable

4 = with connection box in stainless steel, without pump and oil flow cable

5 = with connection box in stainless steel and pump cable

6 = with connection box in stainless steel, pump cable and oil flow cable

**A** = Revision letter

**Z** = Mounted accessory, page 13

# MATERIALS & CORROSION PROTECTION

Modine offers a wide variety of material choices depending on the required performance and application. With our heat transfer knowledge, we can select the specific material best suited for the corresponding environment and application. Modine also provide specialised coatings to give our products the longest possible life and keep them working efficiently.

## MATERIALS

The heat exchanger of the cooler is as standard made of aluminium tubes mounted in a bundle of aluminium plate fins. The fins on the tubes give an increased heat surface as to compensate for the low heat transfer coefficient on the air side.

The continuous arrangement of the fins and the wide fin pitch provide good resistance against clogging.

Considering high requirement corrosivity, Modine could suggest also other materials for tubing (such as stainless steel) and for the fin package (such as AlMg).

Class	Corrosivity	Outdoor environment	Suggested cooler material combination & coating* Heat exchanger	Casing and fan/motor
C3	Moderate	Atmospheres with some salt or moderate air pollution. Urban areas and light industrial areas. Areas with some influence from the coast.	Al tubes with Al fins	Standard, hot dip galvanized steel panels and fasteners with painted galvanized steel fan deck.
C4	High	Atmospheres with a moderate amount of salt or tangible amount air pollution. Industrial- and coastal areas.	Al tubes with AlMg fins	Painted hot dip galvanized and galvanized steel, stainless steel fasteners and added coating on fans/motors.
C5-I	Very high (Industrial)	Industrial areas with high humidity and aggressive atmosphere.	Al tubes with Al fins, completely e-coated	Painted hot dip galvanized and galvanized steel, stainless steel fasteners and added coating on fans/motors.
C5-M	Very high (Marine)	Coastal and offshore areas with large amounts of salt.		

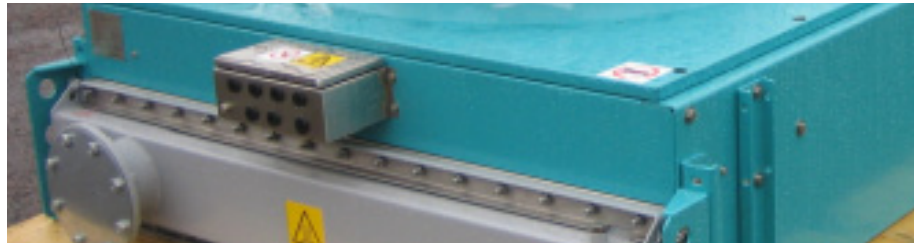
Corrosivity class acc to ISO 12944-2. \*) Stainless steel tubes is optional when applicable. See our complete material and coating specification for each category (on request).

## CORROSIVITY CLASS

The standard cooler design (including aluminium tubes and fins) fulfills the corrosivity category C3 requirements (ISO 12944/ISO 12944:5), but can as option be extended up to category C4 or C5.

## PAINTING

Heat exchanger casing can be corrosion protected with painting systems for C4 and C5 (ISO 12944:5). Standard top coat color code: RAL 7042 (grey). Other colors on request.



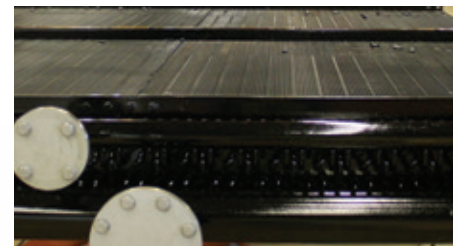
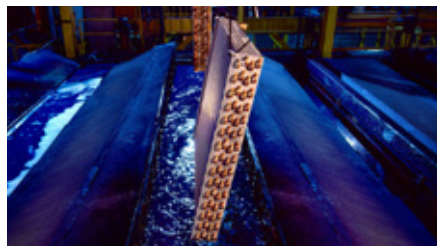
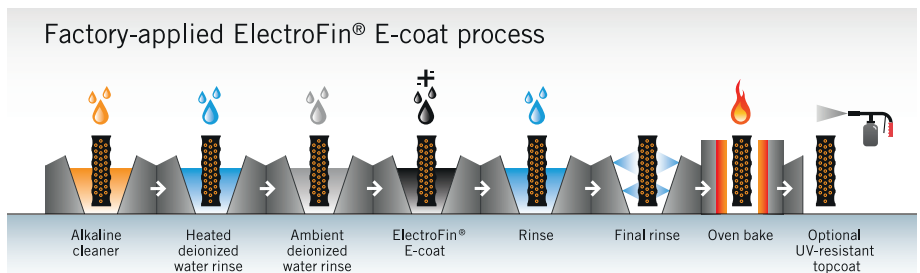
Top coating in special color on request.

## E-COATING WITH C5 CLASSIFICATION

ElectroFin E-coat by Modine is a factory-applied electro-deposition coating process that guarantees complete heat exchanger coverage. The heat exchanger is fully immersed in a bath, where it acts as a magnet, attracting the coating to every surface.

The result is a thin, flexible, durable, corrosion-resistant coating, giving the very best in corrosion protection. Electrofin® E-coating with UV topcoat meets the requirements

of ISO 12944-6 for C5-M high durability and C5-I high durability.



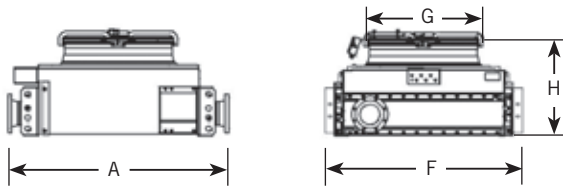
ElectroFin® E-coat process with C5-M and C5-I.



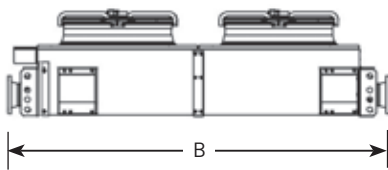
# OUTLINE DIMENSIONS, ELECTRICAL WIRING

**Outline dimensions.** Type BETA: 1-5 fans. Type CETA: 1-4 fans.

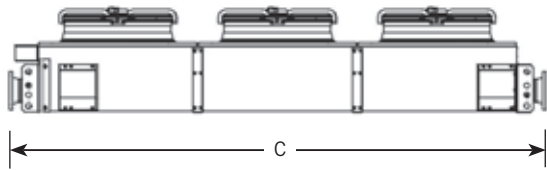
One fan



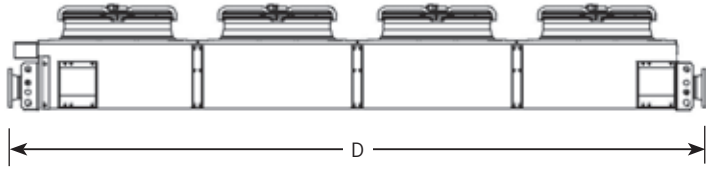
Two fans



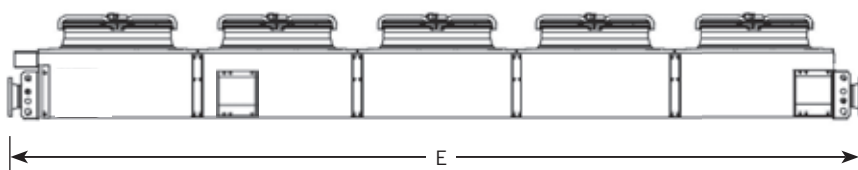
Three fans



Four fans



Five fans



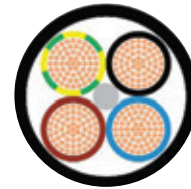
Cooler type	A 1 fan	B 2 fans	C 3 fans	D 4 fans	E 5 fans	F 1-5 fans	G 1-5 fans	H 1-5 fans
BETA	1642	2842	4042	5242	6442	1472	800/910	~790
CETA	1842	3242	4642	6042	-	1872	910/1000	~850

All dimensions in mm. Subject to change without prior notice.

## ELECTRICAL WIRING

For easier electric power supply connection, the fan motors are wired from each safety switch to one common connection box. The connection box is made of stainless steel or composite material equipped with terminal blocks (supplied by Phoenix) and has a venting membrane.

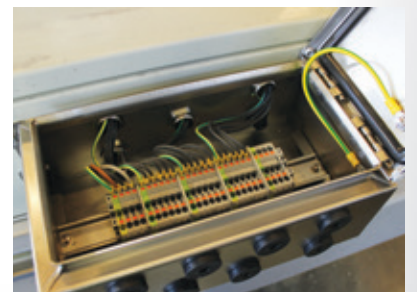
Each motor is equipped with a thermal contact that is wired to the connection box. Extra cable with terminal blocks for connection of an oil circulation pump motor can be provided.



Temperature resistant cable type, BETAflam® 145flex, is used as standard, both for power supply of fan motors and oil circulation pump.



Safety switch      Connection box



Lockable connection box.

# INSTALLATION MOUNTING ARRANGEMENTS, ETC

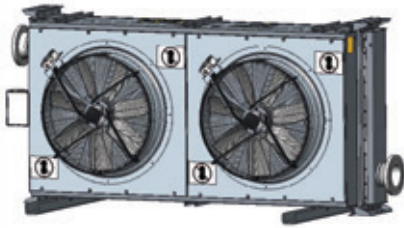
## Installation mounting arrangements



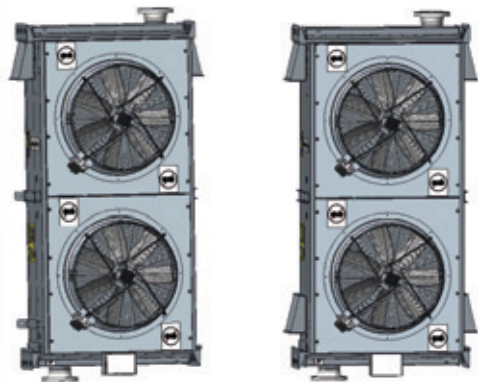
Arrangement 11



Arrangement 12

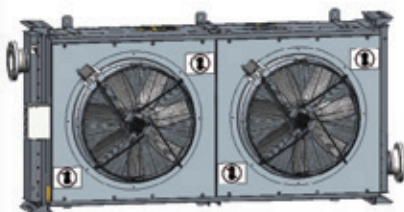


Arrangement 13



Arrangement 14

Arrangement 16



Arrangement 15

## Cleanliness

Before delivery each cooler is carefully cleaned inside by flushing with transformer oil, with an on-line particle counter to ensure it meets the requirements for cleanliness for power transformer applications in accordance with ISO 4406, 10/7 (correlated to NAS 1638 class 1).

## Packing

The transformer oil coolers are as standard delivered bolted to a wooden pallet, but separate wooden boxes or alternative packing options are also available upon request, *see page 13*. A protective plastic wrapping covers the fan unit. The oil connections of the heat exchanger are covered. The cooler is equipped with lifting lugs and brackets, in order to fit the cooler to the transformer.



Standard packing, bolted on a wooden pallet.

## Modine Sales of Service

We are proud to present the Modine sales of service. Whether it is a complete replacement project or a smaller inspection, Modine Söderköping's team of technicians has extensive experience and can customize a maintenance package that best serves your specific needs.

**Email: [servicesolutions-sodese@modine.com](mailto:servicesolutions-sodese@modine.com)**





# OPTIONS & ACCESSORIES

Modine offer several options and accessories that makes our product fit your needs:

## Options & Accessories

BETZ-07-b 3m cable mounted on pump safety switch.  
 CETZ-07-b b=1, cable type FXTQ-T 4G 2.5  
 b=2, cable type Betaflam 145 flex 4G 2.5

BETZ-09-b Cable ladder, *see picture*.  
 CETZ-09-b b=0, vertical cooler  
 (gg=14, 16, 24, 26)  
 b=1, horizontal cooler  
 (gg=11, 12, 21, 22)

BETZ-13-b-c Fin surface protection grid, *see picture*.  
 CETZ-13-b-c b=number of fans 1-4  
 c=1, Hot dip galvanized  
 c=2, Painted acc. BETZ-14/CETZ-14  
 c=3, Stainless steel

BETZ-14-bbbb Painting and increased corrosion protection.  
 CETZ-14-bbbb bbbb=RAL color code

*Category "Aesthetic" includes outside painting of casing parts (color match). Cat. C4 includes outside and inside painting of casing parts, additional painting of fan motor unit and stainless steel bolts. Epoxy polyurethane paint, acc. to Modine standard specification (c=1). Note! Also the cooler heat exchanger should be considered. Select AIMg (f=4 in the code) for C4 (on request). Corrosion protection acc. to cat C5 is calculated and quoted on request.*

BETZ-15-b-c Openable fan unit, *see picture*  
 CETZ-15-b-c b=number of fans 1-4  
 c=1, openable to left c=2, openable to right

BETZ-16-b Angled fan unit, *see picture*  
 CETZ-16-b b=number of fans 1-4

## Others:

- Fan motors for other power supply voltage.
- With or without turbulator inserts into the heat exchanger tubes for increased efficiency.
- Transformer oil circulation pump type VMOA, *see page 5*.
- Design for Mobile transformer, *see picture*.
- Different packing depending on mode of shipment, *see picture*.
- Low temperature options, to -60°C.
- Net screen filter on air intake side.



Transformer oil cooler with **angled fan unit**. Designed for efficient and directed evacuation of hot exhaust air.



Transformer oil cooler with **openable fan unit** for easy access and cleaning.



Cable ladder.



Fin surface protection grid, mounted on cooler air intake side.



Aesthetic painting, color match.



Mobile transformer.



Special packing for example sea shipment.



Stacked coolers on wooden pallet.

# ADDITIONAL INFORMATION



## ENVIRONMENTAL THINKING

We have a conscious and structured approach to protecting the environment throughout the lifecycle of our products, from development, manufacture and application to phase-out and recycling. We streamline and monitor our use of materials and energy, as part of our commitment to the long-term management of natural resources.

## HISTORY

In 1941, Modine in Sweden began manufacturing heat exchangers and coolers. Since then, we have developed our product range for a wide variety of applications.



## SPECIAL SOLUTIONS

We have a wide range of standard products, but if you need a cooling solution with corrosion protection, specific materials, special dimensions or installation in limited spaces, we can create a bespoke solution just for you.

## MODINE IS A TRULY GLOBAL PARTNER

Talent: 10,500 employees across five continents

Global Footprint: Operations in North America, South America, Europe, Asia and Africa







Coiltech  
Specialty Transformer  
Solutions





Photo: Wilson Transformer Company



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Modine specializes in providing innovative thermal management solutions, and is a leading provider of engineered heat transfer systems and high-quality heat transfer components.

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