

MMC combined cooler



The MMC combined cooler is a powerful high-performance cooler made of aluminium in a plate and bar version for harsh operating conditions. It has a compact design and was developed for cooling water, oil, charge air and fuel. Each cooler is selected pursuant to customised specifications. Depending on the application various media can be combined in one housing.

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1 Technical data

An MMC combined cooler is structured individually and consequently application-specific. Subject to the large number of possible variations, these operating and assembly instructions focus on a compact overall system with oil, water and charge air cooler as well as fan including hydraulic drive.



Illustration 1

The MMC combined cooler serves for thermal power transmission and is intended for fixed mounting in a plant. It may only be started up if the overall plant or machine that the MMC combined cooler is installed in complies with the relevant national provisions, safety regulations and standards.

For detailed information on the MMC combined cooler, e. g. fastening points and total weight, refer to the project documentation, dimensional drawing or type label. The permissible operating range is specified in the type label.



The application limits of the type label must absolutely be observed. If the specified figures are exceeded, the cooler may be damaged.



The specifications entered in the dimensional drawing, project documentation and type label have to be primarily observed.



There is the risk of cutting on threads, laminas and burrs. That is why you should always wear protective equipment with transport, assembly and maintenance.

2 Advice

2.1 General advice

Please read through these operating/assembly instructions carefully before you mount the MMC combined cooler.

Please pay special attention to the safety instructions!

The operating/assembly instructions are part of your product. Please store them carefully and close to the MMC combined cooler. The copyright for these operating/assembly instructions remains with KTR.

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2 Advi	Advice							
2.2 Safet	ty and advice	symbols						
STOP	Warning of p	ersonal injury	This symbol indicates notes preventing bodily injuries or may result in death.	which may o serious bodi	contribute to ly injuries that			
<u>_!</u>	Warning of product damages		This symbol indicates notes which may contribute to preventing material or machine damage.					
	General advi	ce	This symbol indicates notes preventing adverse results o	which may o or conditions	contribute to			
	Warning of h	ot surfaces	This symbol indicates notes preventing burns with hot su serious bodily injuries.	which may ourfaces result	contribute to ting in light to			

2.3 General hazard warnings



With assembly and disassembly of the MMC combined cooler it has to be made sure that the entire drive train is secured against accidental switch-on. You may be seriously hurt by rotating parts and hot surfaces. Please make absolutely sure to read through and observe the following safety indications.

- All operations on and with the MMC combined cooler have to be performed taking into account "safety first".
- Make sure to switch off the power pack and depressurize the system before you perform your work on the MMC combined cooler.
- Secure the power pack against accidental switch-on, e. g. by providing warning signs at the place of switch-on or removing the fuse for current supply.
- Do not reach into the operation area of the machine as long as it is in operation or stand by mode.
- Please secure the rotating drive components against accidental contact. Please provide for the necessary protection devices and covers.
- Make sure to wear safety clothing that protects you against mechanical, thermal and toxic features of the flow media.

2.4 Intended use

You may only assemble, disassemble, operate and maintain the MMC combined cooler if you

- have carefully read through the operating/assembly instructions and understood them
- are technically qualified and specifically trained (e. g. safety, environment, logistics)
- are authorized by your company

The MMC combined cooler may only be used in accordance with the technical data (see dimensional drawing, project documentation and type label). Unauthorized modifications on the combined cooler are not admissible. We will not assume liability for any damage that may arise. In the interest of further development we reserve the right for technical modifications.

The **MMC combined cooler** described in here corresponds to the technical status at the time of printing of these assembly instructions.

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2 Advice

2.5 Reference to EC Machinery Directive 2006/42/EC

The MMC combined cooler is defined as an incomplete machine within the terms of Machinery Directive 2006/42/EC. The MMC combined cooler is exclusively intended for installation in a machine so that it does not comply with all specifications of the Machinery Directive. It is forbidden to start up the MMC combined cooler until it is stated that the machine which the MMC combined cooler is installed in complies with all basic specifications of the Machinery Directive 2006/42/EC.

2.6 Directive for Pressure Equipment 2014/68/EU

The individually selected and designed MMC combined coolers are classified in accordance with the Directive for Pressure Equipment 2014/68/EU (PED) and subject to the relevant standards. Please refer to the type label for relevant details.

The EC declarations of incorporation (KTR-N 43501) are generated project-related and attached to the project documentation. The Directive for Pressure Equipment 2014/68/EU (PED) requires an assessment of each customer- and application-specific MMC combined cooler.



The application limits of the type label must absolutely be observed. If the specified figures are exceeded, the cooler may be damaged.

3 Storage, transport and packaging

3.1 Storage

The MMC combined coolers are supplied in preserved/painted condition and can be stored in a dry and roofed place in their transport packaging for 6 - 9 months. The connections must be kept closed to avoid dirt and corrosion inside. The connection seals must only be removed during mounting.



The storage rooms must not include any ozone-generating devices like e. g. fluorescent light sources, mercury-vapour lamps or electrical high-voltage appliances. Humid storage rooms are not suitable.

Please make sure that condensation is not generated. The best relative air humidity is less than 65 %.



With special paintings, e. g. CDP coating, the MMC combined cooler is to be protected from sunlight. The UV resistance of this coating is limited.



Make sure firm stand when storing the MMC combined cooler. Combined coolers standing upright must be protected from dropping subject to their high centre of gravity.

With an interim storage the MMC combined cooler needs to be protected from environmental impacts (moisture, solar radiation, etc.) as well as excessive dust exposure. Before storage provide for connection seals protecting from dirt and corrosion inside.

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3 Storage, transport and packaging

3.2 Transport and packaging



In order to avoid any injuries and any kind of damage please always make use of proper transport and lifting equipment.



The MMC combined cooler has a very high weight. Make sure to use adequately dimensioned lifting equipment.



Secure the transport area and do not step beneath suspended load.

The MMC combined coolers are packed differently each depending on size, number and kind of transport. Unless otherwise contractually agreed, packaging will follow the in-house packaging specifications of KTR.

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The MMC combined cooler has a customised design. The extent of the system complies with the provisions given in the customer specification. The large number of variations allows for delivery units ranging from unpainted individual cooling segments to multiple circuit combined coolers with fan, protective grid, sensor technology and drive.

The customised combined coolers are basically supplied ready for installation. If possible resp. requested, the individual components (see illustration 2) are supplied mounted, inspected and packed as a unit.

4.1 Components of MMC combined cooler

Components/subassemblies of MMC combined cooler (example: air-water-oil cooler with hydraulic motor)

Component	Quantity	Description
1	1	Hydraulic motor
2	1	Motor bracket
3	1	Fan grid
4	1	Fan
5	1	Fan cover
6	1	Side panel
7	1	Expansion tank
8	1	Charge air cooler
9	1	Water cooler
10	1	Oil cooler



Illustration 2: Components of MMC combined cooler (example: air-water-oil cooler with hydraulic motor)



Alternatively the fan can be provided with an electric motor resp. a direct drive of the I. C.engine can be used.

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4.1 Components of MMC combined cooler



Vibration-damped fastenings are not part of the scope of delivery as a standard.

Example: Structure of a vibration-damped fastening (optionally)



Illustration 3: Example of a vibration-damped fastening



Every vibration-damped fastening has a customised structure. For components and quantities of single parts refer to the dimension sheet.

4.2 Place of installation

Positioning of the combined cooler often follows the geometrical options within the machine so that the fastening points for designing (see dimension sheet) are defined project-related.



To make sure the calculated cooling power (see project documentation), unimpeded inflow, outflow and throughflow of the energy absorbing air must be ensured.



Preheating the aspirated cooling air through the selection parameters (see product documentation) reduces the thermal performance of the combined cooler, too.



Return flow of heated air (air short-circuit) as well as excessive preheating of aspired air must be avoided.

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The set-up/application height affects the performance of the combined cooler and is part of the selection of the application-specific MMC combined cooler.



A disadvantageous place of installation of the combined cooler may increase the noise level by reflection of sound.

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Place of installation 4.2

- Consider with positioning of the MMC combined cooler that the system may be vented after (B installation and an expansion tank, if not included in the scope of delivery, can be arranged over the combined cooler.
- For combined coolers with an integrated drive horizontal arrangement of the motor hub (P should be preferred to minimize the axial forces on the motor bearing.

Assembly of MMC combined cooler 4.3



With assembly make sure that all provided fastenings (see dimensional drawing) were mounted. Make use of proper tools.



To avoid damages on the MMC combined cooler, the system must be fastened adequately. For that purpose consider the total weight of the combined cooler in filled condition.



Protect the combined cooler from dropping.

The MMC combined cooler can be assembled in various positions. The assembly is based on the specific fastening points that are explicitly specified in the dimensional drawing.

- Align the MMC combined cooler properly. Observe sufficient distance to adjacent components.
- Screw the MMC combined cooler to all fastening points specified in the dimensional drawing.
- Only valid if vibration-damped fastening is used: Make sure correct arrangement of the single parts (see illustration 3 and dimensional drawing).



The cooler's fan cover includes holes serving to have drained condensation water that might be generated.

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4.4 Operating pressure and temperature

The MMC combined cooler was particularly selected and designed pursuant to the operating conditions and media specified by you. The selection parameters are listed in the project documentation.

The permissible operating range is recorded in the type label (illustration 4). Deviating from the permissible operating conditions and media results in voiding of warranty and operating licence.

KTR Systems GmbH WWW.ktr.com Directive 2014/68/EU							
Id-No.: KTR Id-No.: Manufdate:							
XX	x		XXX		XXX		
	TS °C	PS bar	PS bar PT bar \		Module	FlGrp.	
air	XX	xx	XX	xx	×	×	
l							

Illustration 4: Example - type label



With dynamic load pressure peaks and systemic pulsations must be avoided.



The maximum permissible temperature and pressures of the medium to be cooled are listed in the type label and must not be exceeded.

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The temperature of the ambiance and the medium to be cooled should not change rapidly.

4.5 Cooling medium



The flow media may have features and/or temperatures hazardous to health. This may result in risk of acid burns, frostbite or poisoning. Please wear special protective equipment.

An MMC combined cooler allows for combining several circuits within one housing. Cooling segments of water-glycol mixture, system oil, charge air and fuel coolers can be individually combined and selected pursuant to the customers' specifications.



High temperatures and toxic reactions may arise with emitting media. Inspecting the corrosion resistance of the MMC combined cooler with the media is part of the project phase. Changing the medium may affect the corrosion resistance.

LLC = Charge air cooler (with charged engines)

WK = Water cooler (content of glycol 40 % at the minimum)



High surface temperatures are to be expected on the MMC combined cooler and the pipes. Emitting steam must additionally be watched out for with the water cooler segment. Be specifically cautious when opening the pressure valve of the expension tank.

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4.6 Connection of media hoses



Illustration 5: Connection of a multiple circuit cooler to an I. C.-engine (example of application)

() J	Suitable hose clamps ensure safe and leakage-free connection to the combined cooler. Select those pursuant to the provisions of the hose connections.
(B)	Make sure that the connections and hoses are adapted to the cooler with regard to pressure, flow rate, temperature, liquid, vibration and pulsation. In addition you have to use flexible hoses for connecting the individual cooling segments with mobile machines and stationary machines exposed to vibrations.
	For details on the hose diameter and type of connection refer to the dimensional drawing.
	With screw connections and the use of hose clamps please observe the tightening torques specified. This refers to the connection of hydraulic motor and accessories, too.
	Before you remove the connection seal of the connection pipes make sure that no particles of dirt penetrate inside the open pipes and the single components with assembly.

- Remove the seal of the connection pipes.
- Connect all hoses with suitable hose clamps to the matching connection pipes of the MMC combined cooler (see dimensional drawing).

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Illustration 6: Connection of an expansion tank (example)



Make sure that the expansion tank must in every case be above the connected cooling segment in order to ensure proper venting operation of the MMC combined cooler.

• Unless part of the scope of delivery, connect the expansion tank to the matching connection on the combined cooler (see illustration 6 and dimensional drawing).

4.7 Electrical connection

In addition to a direct drive, separate hydraulic and electrical fan drives can be selected with the MMC combined coolers.

Before connecting the motor to the electricity supply network compare the specifications given in the type label of the motor to the voltage and frequency of the mains.

The direction of rotation of the fan must be inspected upon connection of the motor. A wrong direction of rotation reduces the air performance and consequently the required cooling capacity considerably.



The electric motors may only be connected to the electric supply by qualified personnel. Please observe the universal specifications and electrical safety regulations!



Incorrect connections, damaged cables etc. may energize the connected components or make the electric motor rotate in the wrong direction.



Please observe the operating instructions of the electric motor used by you.



We recommend to use an overload protection for the electric motor.

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5 Start-up

Before start-up make sure that the combined cooler is undamaged, properly connected and fastened.

Please observe the following procedure:

- The MMC combined cooler and the protective grid, if available, must be undamaged.
- Make sure the fan can rotate freely while not touching the fan grid or fan cover.
- All connections and fastenings must be properly mounted.
- The inside of the fan housing has to be free from any objects.
- The different cooling segments must be filled and vented as specified.



Free throughflow of laminas must be ensured. Dirty resp. blocked laminae channels must be cleaned (see chapter 7.1).



Components which are ejected may cause personal injuries or damage other components.



Make sure that protection against accidental contact is provided.

During operation of the MMC cooler, please pay attention to

- different operating noise
- vibrations occurring.

6 Breakdowns, causes and elimination

The below-mentioned failures can lead to a use of the MMC combined cooler other than intended. In addition to the specifications given in these operating/assembly instructions make sure to avoid such failures. The errors listed can only be clues to search for the failures. When searching for the failures the adjacent components must generally be considered.

General failures with use other than intended:

- Important data for the selection of the MMC combined cooler were not forwarded.
- Application limits of the combined cooler listed in the type label and project documentation were not observed.
- An MMC combined cooler with damage occurred during transport is assembled.
- Connections and hoses were not mounted properly.
- Tightening torques have been fallen below/exceeded.
- Components are mixed up by mistake/assembled incorrectly.
- No original KTR components (purchased parts) are used.
- Maintenance intervals are not observed.

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6 Breakdowns, causes and elimination

Breakdowns	Breakdowns Causes	
	Dirty cooler core laminas	 Set the combined cooler out of operation Clean the laminas
Diminished heat transfer, diminished cooling capacity	Impeded air volume flow by restricted air inflow, air throughflow résp. air outflow, for example caused by blocked fan grids	 Set the combined cooler out of operation Clean the combined cooler
	Impeded air volume flow by defective fan geometry	 Set the combined cooler out of operation Replace fan
	Mechanical destruction of cooling segment	 Set the combined cooler out of operation Drain medium Replace cooler core
Leakage	Connection of hoses on the connection pipes are not firmly screwed together	 Set the combined cooler out of operation Drain medium Inspect screw connections, replace gaskets, if necessary
	Overpressure in the system	 Set the combined cooler out of operation Inspect and adapt operation parameters, eliminate blockage in the system, if necessary
Vibration	Defective motor bearing/cooler fastening	 Set the combined cooler out of operation Inspect fastenings and bearings of the overall system and fasten as specified
	Geometry or position of fan not correct - imbalance	 Set the combined cooler out of operation Clean the combined cooler acc. to chapter 7.1 <i>Cleaning</i> Re-balance resp. replace the fan incl. hub
	Pulsation in the fluid system	 Set the combined cooler out of operation Inspect the system for unimpeded flow, venting, pump capacity; synchronise operating parameters (flow rate) with selection parameters and adapt, if necessary.
	Defective fan	 Set the combined cooler out of operation Clean the fan acc. to chapter 7.1 <i>Cleaning</i> Re-balance resp. replace the fan
Increased noise emission	Too high speed	 Set the combined cooler out of operation Synchronise operating parameters with operating limits and adapt, if necessary
	System is not operating freely, dragging of fan	 Set the combined cooler out of operation Make sure sufficient distance between fixed components and fan; provide for protective grid, if necessary; align cover

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7 Maintenance and service

Preventive maintenance operations have to be regularly performed by the user.

The following items of inspection are the main components of maintenance work:

• Unusual noise or vibrations must not be generated. If higher noise emissions or vibrations are generated, eliminate the cause acc. to chapter 6 Breakdown, causes and elimination.



Vibrations may cause severe damages on components and a failure of the MMC combined cooler.

- Make sure the fan can rotate freely while not touching the fan grid or fan cover.
- The fan must not have any imbalance.



Dirt on the MMC combined cooler or diminished inflow or outflow of cooling air reduce the air flow. Reduced air flow affects the heat dissipation and may cause thermal problems on the system to be cooled.

- Inspect the cooling laminas and the overall MMC combined cooler for dirt. If any components are dirty, the MMC combined cooler needs to be cleaned acc. to chapter *7.1 Cleaning*. The frequency of inspection and cleaning of the combined cooler depends on the operating conditions.
- Inflow and outflow of cooling air must be ensured.
- Inspect the MMC combined cooler regularly for damages.



Leakages have to be eliminated immediately. Media which have escaped have to be removed properly, since residues of media may ignite on hot components and endanger the environment. In addition, leakages may cause severe damage and a failure of the system.

• The MMC combined cooler must be regularly inspected for leakages.



Media which have escaped have to be collected and removed acc. to chapter 9 *Disposal* immediately.



Connection leakages of media on the inlet and outlet can often be found with the power pack operating only. With this inspection pay special attention to the safety regulations. Do not reach into the operation area of the machine.

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7 Maintenance and service

7.1 Cleaning



Before cleaning make sure that the combined cooler has cooled down. Touching the heated components causes burns.



With cleaning processes, e. g. with water, disconnect the combined cooler from the power supply. The protection class needs to be observed.

Side of air laminas

The air laminas can be cleaned with compressed air. If seriously soiled, cleaning should be done by means of a high-pressure cleaner and a proper detergent, if necessary. The jet should be kept carefully, keeping sufficient distance and in parallel with the air lamina.



To avoid damage on the cooler, make sure the detergent is compatible with the materials used, e. g. aluminium.

Medium side of cooling element

If soiled inside, e. g. caused by longer downtime with open combined cooler or soiling of media resulting in depositions in the filigree channel system, cleaning of the medium side of the cooling element by flushing is recommended. Always flush with the liquid/medium which is used later.

8 Spares inventory, customer service addresses

Since the MMC combined cooler is a customised unit, the components are manufactured order-related. A basic requirement to ensure the readiness for use of the combined cooler is a stock of the most important spare parts on site.

Contact addresses of the KTR partners for spare parts and orders can be obtained from the KTR homepage at www.ktr.com.



KTR does not assume any liability or warranty for the use of spare parts and accessories which are not provided by KTR and for the damages which may incur as a result.



The combined coolers are selected and designed application-specifically. All components are coordinated with each other with regard to performance. Replacing components by those with different parameter characteristics changes the selection of the overall system and may cause serious damage on the system to be cooled.

9 Disposal

In respect of environmental protection we would ask you to dispose of the products on termination of their service life in accordance with the legal regulations and standards that apply, respectively.

Metal

Any metal components have to be cleaned and disposed of by scrap metal.

Gaskets

Gaskets can be disposed of by residual waste.

Media

Media have to be collected in suitable tanks and disposed of by a waste disposal company.

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10 Enclosure A

10.1 Type code

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