



SEW
EURODRIVE

Addendum to the Operating Instructions



Gear Unit

R..7, F..7, K..7 S..7, SPIROPLAN® W Series

Oil-Air Cooler for Splash Lubrication /OAC



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1 Important information



INFORMATION

This addendum provides important additional information to the operating instructions for the "R..7, F..7, K..7, K..9, S..7, Spiroplan® W Gear Unit Series". Observe the additional information specified in this document.

This document does not replace the detailed operating instructions.

2 Oil-Air cooler for splash lubrication /OAC

2.1 Structure

If the thermal rating of the naturally cooled gear unit is not sufficient, an oil-air cooling system can be used.

INFORMATION

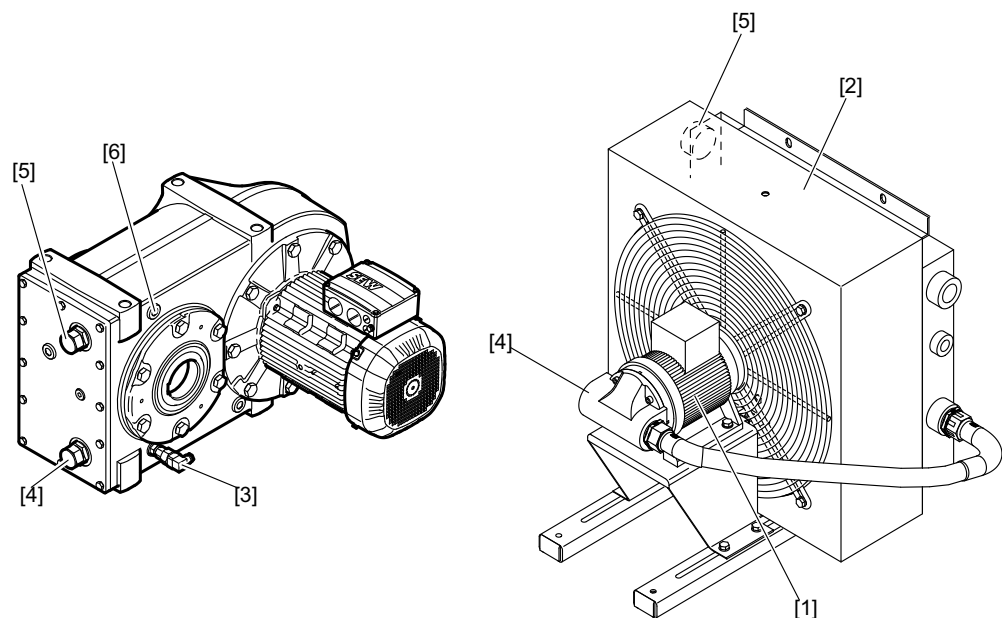


The following information applies for gear units with splash lubrication.

Also refer to the original operating instructions of the cooling system manufacturer.

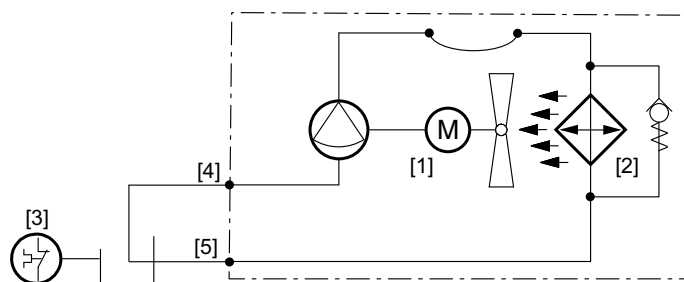
SEW-EURODRIVE uses oil-air cooling systems for standard gear units in sizes OAC 005, OAC 010 and OAC 020.

The following figure shows an example of a standard parallel-shaft helical gear unit next to an oil-air cooler.



- | | | | |
|-----|--|-----|---------------------------------------|
| [1] | Motor for pump and fan | [4] | Suction pipe connections |
| [2] | Oil-air heat exchanger | [5] | Pressure pipe connections |
| [3] | Temperature switch with 2 switching points | [6] | Option: Oil expansion tank connection |

The following figure shows the unit structure:



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- | | | | |
|-----|--|-----|---------------------------|
| [1] | Motor for pump and fan | [4] | Suction pipe connections |
| [2] | Oil-air heat exchanger | [5] | Pressure pipe connections |
| [3] | Temperature switch with 2 switching points | | |

2.2 General information

The cooling system is delivered without electrical wiring and piping as a complete unit on a base frame for separate installation.

The standard scope of delivery of the cooling system includes:

- Pump with directly mounted asynchronous motor
- Oil-air heat exchanger
- Temperature switch with 2 switching points

The customer has to carry out the following electrical wiring:

- Wiring between the temperature switch and the motor for the pump and fan
- Wiring the motor for the pump and fan

2.3 Information

2.3.1 Temperature switch

Temperature switches with different switching points are used, depending on the gear unit size.

Gear unit size R., F., K..	Temperature switch	First switching point (oil temperature)	Second switching point (oil temperature)
97 – 107	TSM-2-55NO	55 °C	90 °C
127 – 187	TSK-2-40NO	40 °C	

2.3.2 Pump

When the pump is operated, a pressure control valve in the cooler limits the plant pressure to 5 bar.



NOTICE

An incorrectly set valve can damage the gear unit.

Gear unit failure

- Do not change the factory setting of the pressure control valve.

2.4 Sizes, cooling capacity, selection

The performance data of the standardized cooling systems is summarized in the following tables depending on the line frequency.

The specified cooling power ratings are valid under the following conditions:

- Air temperature 40 °C
- Oil temperature 70 °C

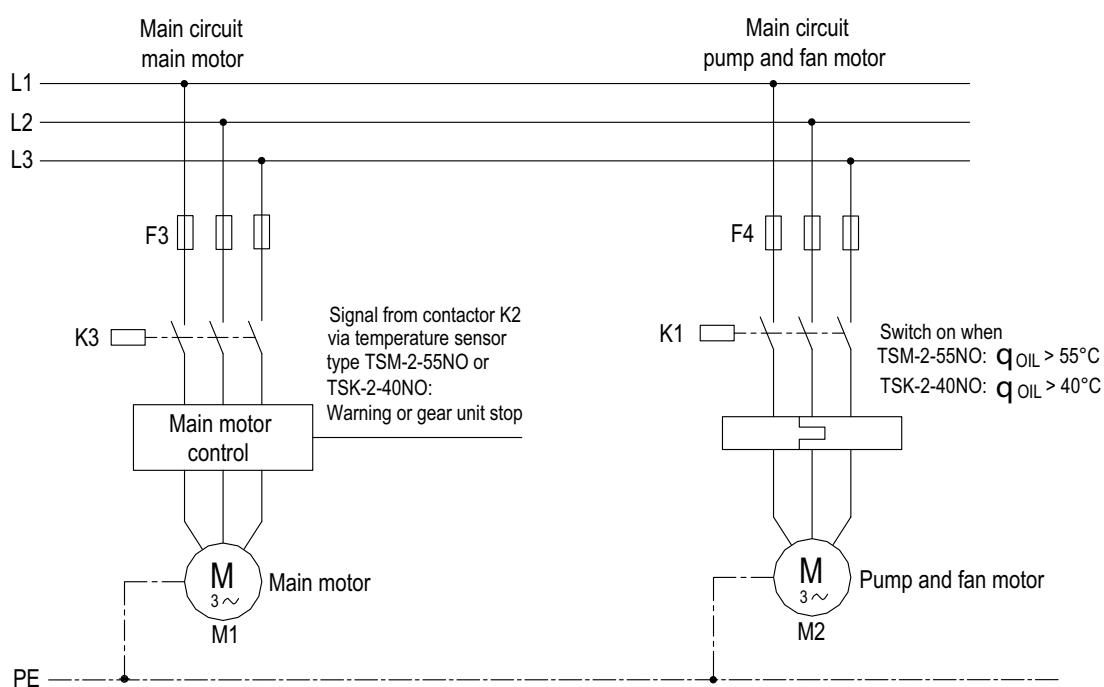
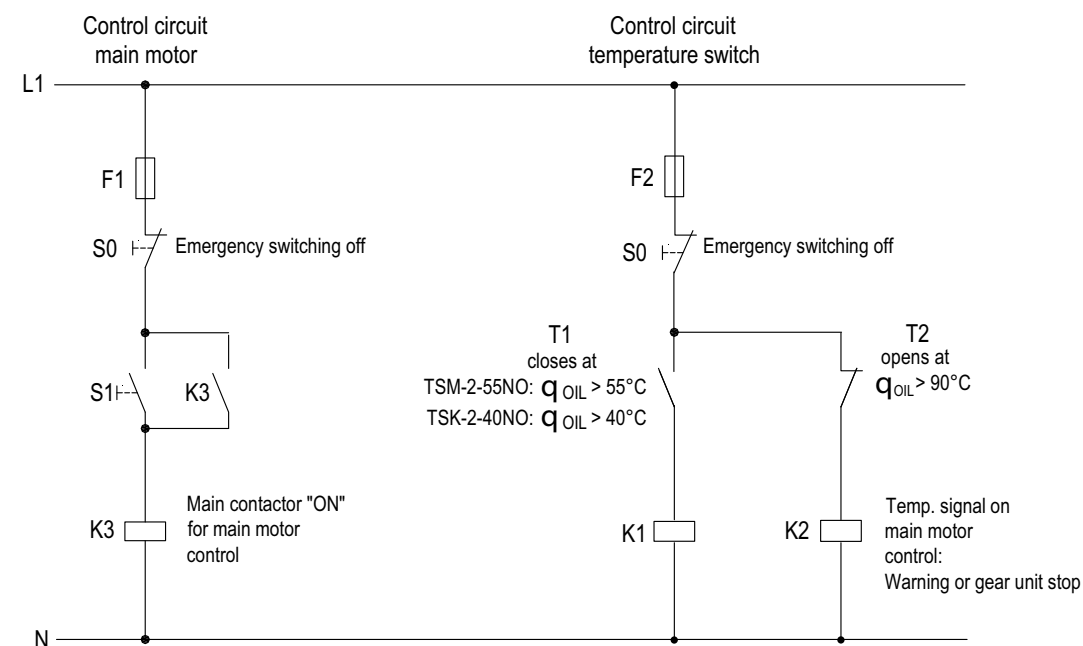
2.4.1 Performance data at 50 Hz line frequency

Size of the cooling system	OAC 005	OAC 010	OAC 020
Cooling capacity of the cooling system in kW	4.4	7.0	9.3
Oil flow rate of the cooling system in l min ⁻¹	15	28	28
Connected load of the motor for the pump and fan in kW	0.75	0.75	0.75
Motor voltage 50 Hz in V	230/400	230/400	230/400
Sound pressure level in dB	71	71	73
Oil fill quantity of oil-air cooler in l	1.8	1.8	2.3
Weight in kg	38	38	43

2.4.2 Performance data at 60 Hz line frequency

Size of the cooling system	OAC 005	OAC 010	OAC 020
Cooling capacity of the cooling system in kW	5.1	7.3	9.7
Oil flow rate of the cooling system in l/min	20	36	36
Connected load of the motor for the pump and fan in kW	0.9	0.9	0.9
Motor voltage 60 Hz in V	276/480	276/480	276/480
Sound pressure level in dB	71	71	73
Oil fill quantity of oil-air cooler in l	1.8	1.8	2.3
Weight in kg	38	38	43

2.4.3 Wiring diagram of sizes OAC 005 / 010 / 020



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2.5 Mechanical connection

Connect the heat exchanger to the cooling circuit according to the identifying markings observing local regulations.

In this respect, observe the following basic conditions:

- Do not reduce the specified cable cross sections.
- It is important that you choose the correct wall thickness and material when selecting pipes, hoses and screw fittings.

2.6 Electrical connection

Make the electrical connections for the temperature switch TSK-2-55NO or TSM-2-40NO and the motor of pump and fan according to local regulations.

Make sure that the pump rotates in the **correct direction**.

The following responses have to be tripped at the switching points of the temperature switch:

Setpoint 1

Switching point 1 exceeded	Action
TSK-2-55NO: Oil temperature > 40 °C → switch closes	COOLER ON Switch on the motor for pump and fan of the oil-air cooler
TSM-2-40NO: Oil temperature > 55 °C → switch closes	
Switching point 1 undercut	Action
TSK-2-55NO: Oil temperature < 40 °C → switch opens	COOLER OFF Switch off the motor for pump and fan of the oil-air cooler
TSM-2-40NO: Oil temperature < 55 °C → switch opens	

Setpoint 2

Switching point 2 exceeded	Action
TSK-2-55NO and TSM-2-40NO: Oil temperature > 90 °C → switch opens	Gear unit stop or Warning
Switching point 2 undercut	Action
TSK-2-55NO and TSM-2-40NO: Oil temperature < 90 °C → switch closes	Gear unit enable

2.7 Installation and connection information



NOTICE

Damage to the gear unit due to improper installation of the oil-air cooler.

Gear unit failure.

- Install the oil-air cooler in such a way that input and output air can flow unobstructedly.
- Ensure sufficient protection from dirt for the oil-air cooler.

Adhere to the following basic conditions when connecting the cooling system to the gear unit:

- Provide for a low-vibration installation site.
- The cooling system and the gear unit are set up separately as standard. The distance between the gear unit and the cooling system must not exceed 1 m.
- The cooling system must be installed at the same level as the gear unit or lower. If this is not possible, contact SEW-EURODRIVE.
- Do not reduce the specified cable cross sections.
- It is important that you choose the correct wall thickness and material when selecting pipes, hoses and screw fittings. Preferably use screw fittings with non-metallic gaskets.

SEW-EURODRIVE recommends the following cross sections for connecting the cooling system to the gear unit and the cooling circuit:

Size cooling system	Pump suction connection	Suction pipe ¹⁾	Cooler pressure connection	Pressure pipe ²⁾
OAC 005	G 1 1/4"	DN32	G 1"	DN25
OAC 010				
OAC 020				

1) Maximum length 1.5 m

2) Maximum length 2.5 m

INFORMATION



The dimensions of the oil-air cooler are specified in the original operating instructions of the respective cooling system manufacturer.

More detailed technical data of the several cooling systems are available from SEW-EURODRIVE on request.

2.8 Notes on checking the oil level



NOTICE

Incorrect oil fill damages the gear unit.

Gear unit failure.

- Note that the use of an oil-air cooler affects the oil level in the gear unit. The fill quantity on the nameplate of the gear unit must be increased by the oil fill quantities of the cooling system and the connection pipes.
- Fill the gear unit with the oil grade specified on the nameplate.

When the gear unit is connected to an oil cooling system, the oil fill quantity changes.

For the oil fill quantity of gear units with oil-air cooler applies:

Oil fill quantity of the system = oil fill quantity of the gear unit (see nameplate) + oil fill quantity of the cooling system (1.8 l) + volume of the pressure and suction pipes (depends on their length).

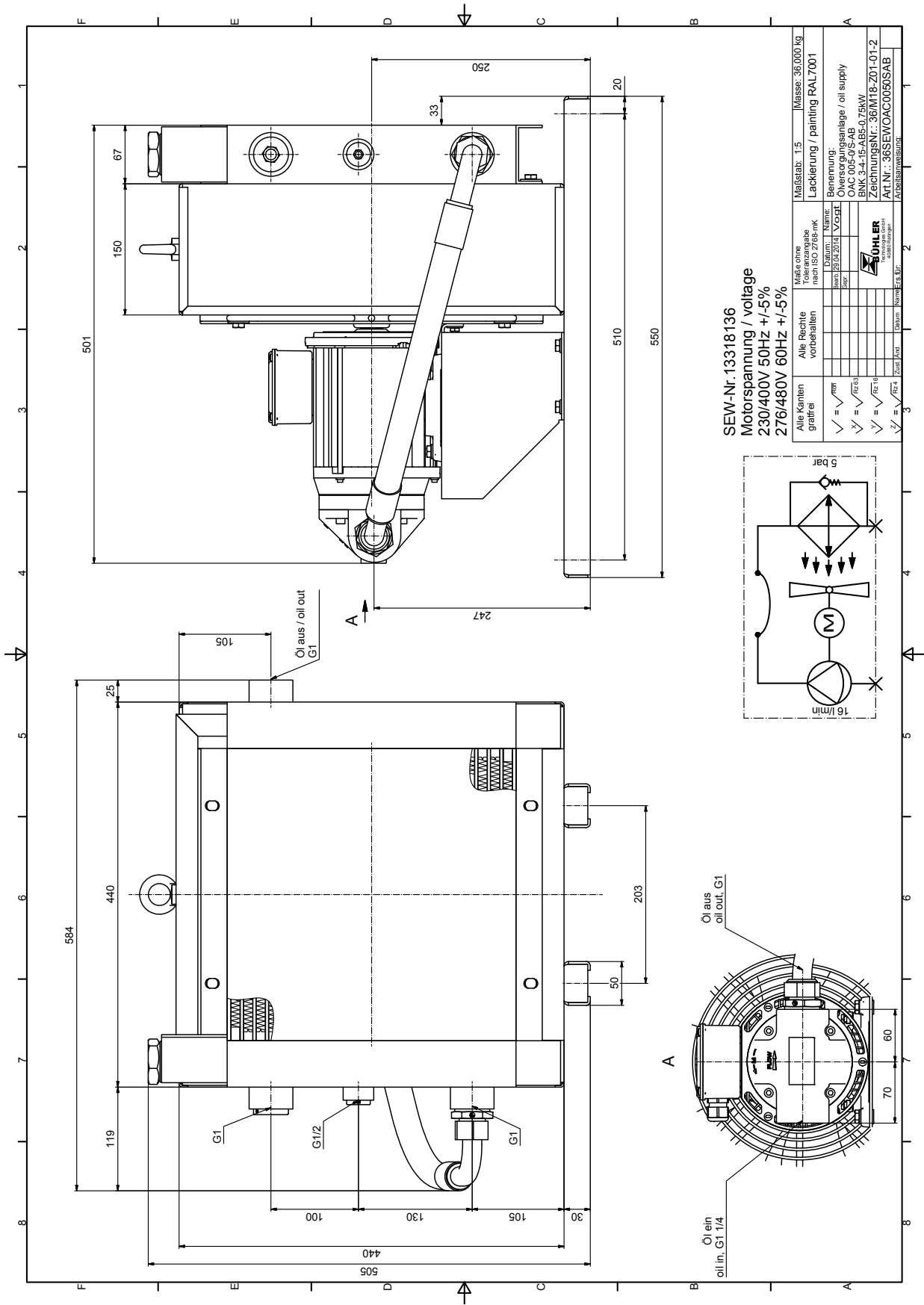
Check the oil level before startup. Observe the chapters "Checking the oil level" and "Checking the oil level and changing the oil in the " R..7, F..7, K..7, K..9, S..7, SPIROPLAN® W Gear Unit Series" operating instructions of the main drive.

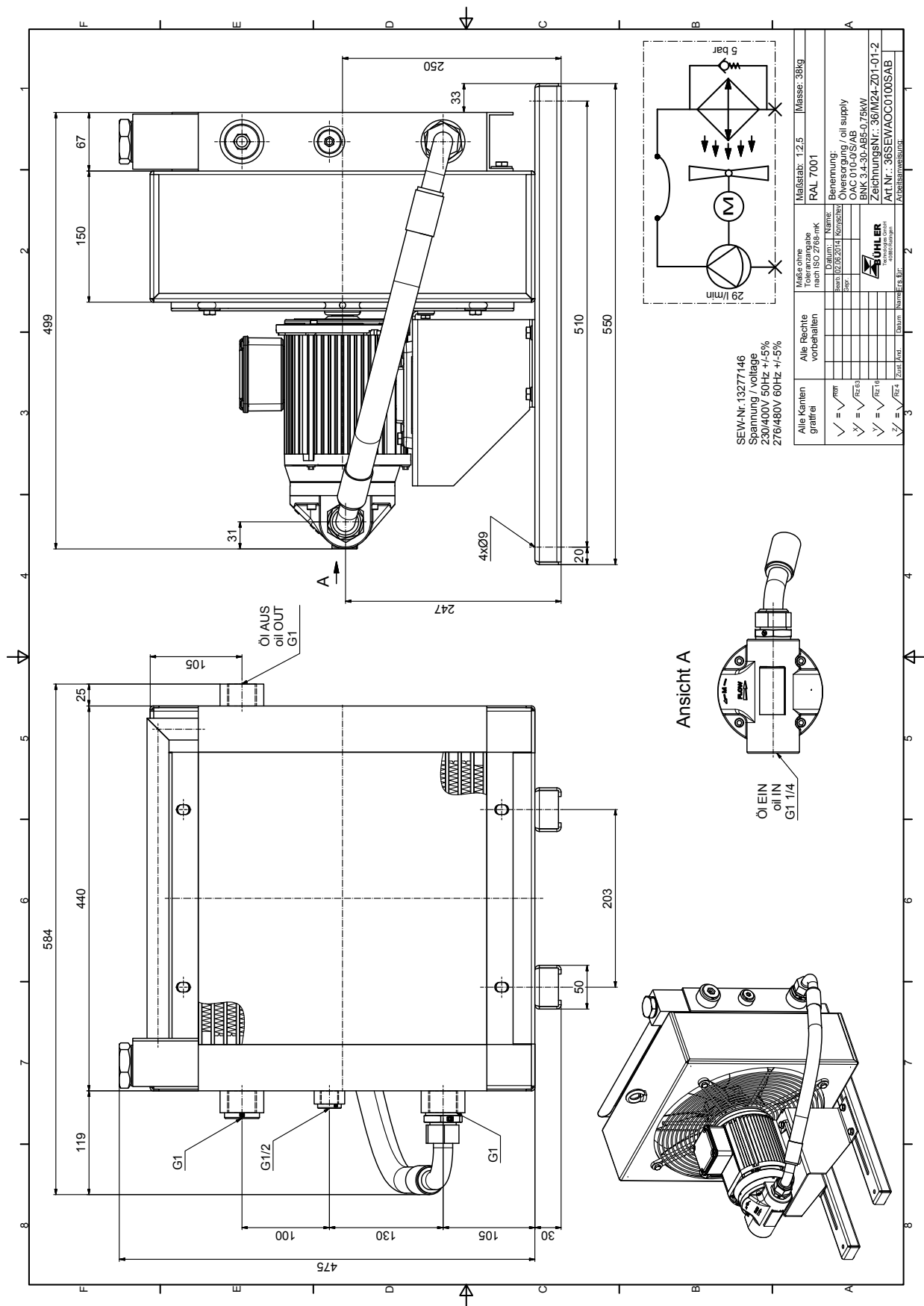
3 Supplier documentation

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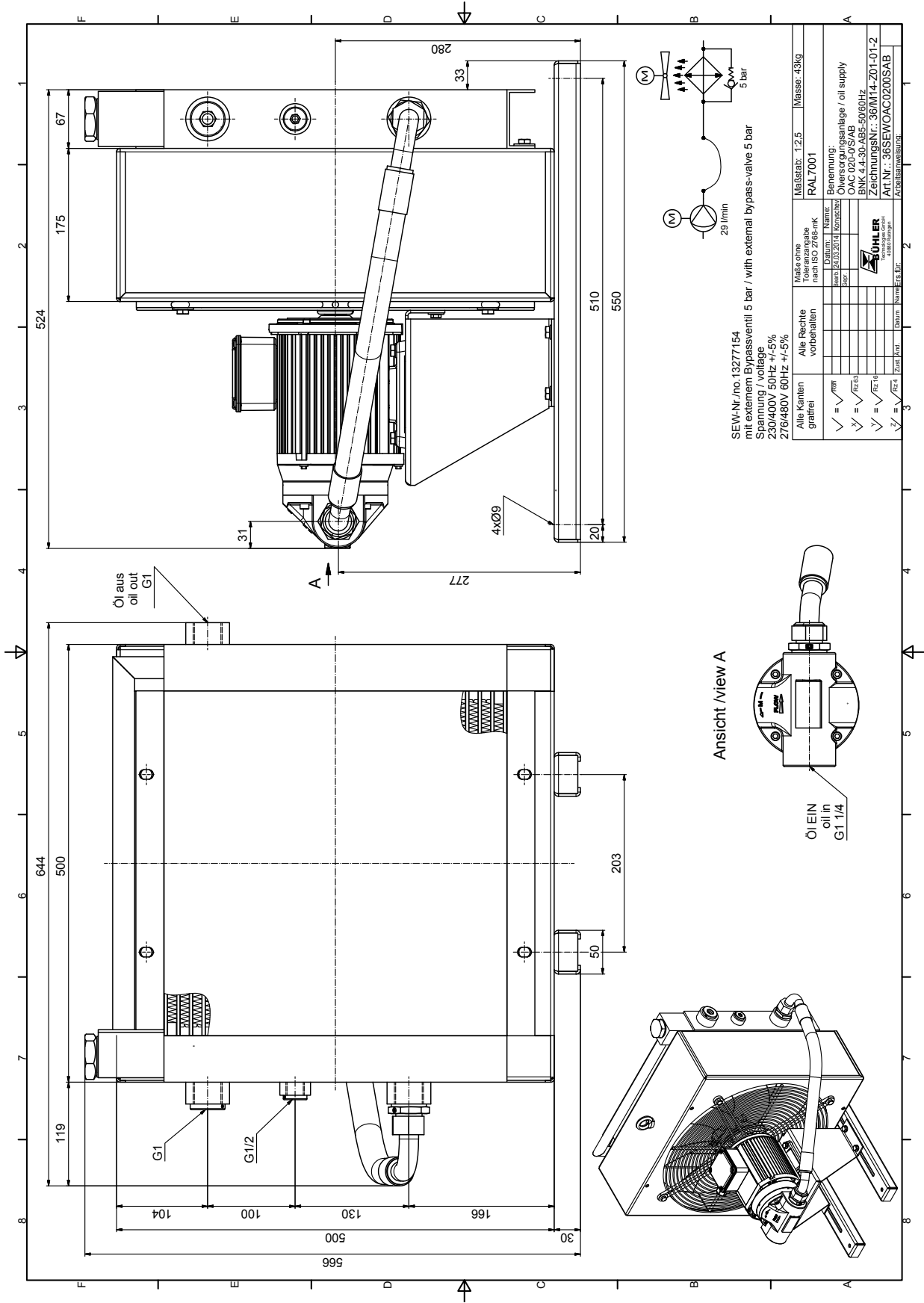
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Off-line coolers

BNK



Installation and Operation Instructions

Original instructions

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Read this instruction carefully prior to installation and/or use.
 Pay attention particularly to all advises and safety instructions
 to prevent injuries. Bühler Technologies can not be held re-
 sponsible for misusing the product or unreliable function due to
 unauthorised modifications.

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Installation and Operation Instructions
Off-line coolers BNK
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1 Introduction

1.1 Intended use

BNK off-line coolers are suited for the cooling of oils in hydraulic and lubrication systems. Their scope is given by their specifications. The use in other applications is not permitted without confirmation by Bühler Technologies GmbH.

1.2 Model key

BNK 4.4-30-0.75kW- IBx - T50

Motor power
Pump output per litre
Number of motor contacts
Frame size

To also have a bypass and/or thermal contact, the specification will be added to the type designation:

Bypass version	AB	external bypass
	IB	internal bypass
	ITB	internal temperature-dependent bypass 2 bar / 45 °C
	ATB	external temperature-dependent bypass 2 bar / 45 °C
	x	bypass value 2 bar, 5 bar, 8 bar
Temperature switch	T50, T60 T70, T80	Temperature in °C, specification see separate data sheet

1.3 Scope of delivery

- 1 x Off-line cooler
- Product documentation

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2 Safety instructions

2.1 Important advice

- Operation of the device is only valid if:
- the product is used under the conditions described in the installation- and operation instruction, the intended application according to the type plate and the intended use. In case of unauthorized modifications done by the user Bühler Technologies GmbH can not be held responsible for any damage,
 - when complying with the specifications and markings on the nameplates.
 - the performance limits given in the datasheets and in the installation- and operation instruction are obeyed,
 - monitoring devices and safety devices are installed properly,
 - service and repair is carried out by Bühler Technologies GmbH,
 - only original spare parts are used.
- This manual is part of the equipment. The manufacturer keeps the right to modify specifications without advanced notice. Keep this manual for later use.

Signal words for warnings

DANGER	Signal word for an imminent danger with high risk, resulting in severe injuries or death if not avoided.
WARNING	Signal word for a hazardous situation with medium risk, possibly resulting in severe injuries or death if not avoided.
CAUTION	Signal word for a hazardous situation with low risk, resulting in damaged to the device or the property or minor or medium injuries if not avoided.
NOTICE	Signal word for important information to the product.

Warning signs

In this manual, the following warning signs are used:

	Warning against hazardous situations		Warning against high pressure
	Warning against electrical voltage		General notice
	Warning against hot surface		Disconnect from mains
	Warning against environmental hazard		Wear protection gloves
	Warning against potentially explosive atmospheres		



2.2 General hazard warnings

Installation of the device shall be performed by trained staff only, familiar with the safety requirements and risks.
Check all relevant safety regulations and technical indications for the specific installation place.
Prevent failures and protect persons against injuries and the device against damage.

The operator of the system must secure that:

- safety and operation instructions are accessible and followed,
- local safety regulations and standards are obeyed,
- performance data and installation specifications are regarded,
- safety devices are installed and recommended maintenance is performed,
- national regulations for disposal of electrical equipment are obeyed.

Maintenance, repair:

- Repairs on the device must be carried out by Bühler authorized persons only.
- Only perform modifications, maintenance or mounting described in this manual.
- Only use original spare parts.

When carrying out maintenance works of any kind, the relevant health and safety regulations of the country of use must be observed.

DANGER 	Electrical voltage Electrocution hazard. a) Disconnect the device from power supply. b) Make sure that the equipment cannot be reconnected to mains unintentionally. c) The device must be opened by trained staff only. d) Regard correct mains voltage. 
CAUTION 	Hot surface Burning hazard Let the device cool down before maintaining.
CAUTION 	High pressure Hazard of injury due to flung off parts or oil, environmental hazard due to oil. a) Before starting any maintenance or repair to the oil circuit, make sure that the device is depressurized. This applies to the locking screws as well. b) Avoid environmental pollution (oil spills) during cleaning or maintenance of the oil circuit. c) Use drip pans.
DANGER 	Potentially explosive atmosphere Explosion hazard if used in hazardous areas. The device is not suitable for operation in hazardous areas with potentially explosive atmospheres.

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Transport and storage



3 Transport and storage

The products should be transported only in its original packaging or a suitable replacement. Secure device for transportation.

For transportation, units with air coolers have lifting screws M10 on top of the cooler housing. These points are not always above the center of gravity so that the cooler might swing when lifted. The threads M8 in the cooling elements are not allowed to be used for lifting the entire unit!

When not in use, protect the equipment against moisture and heat. Keep it in a covered, dry and dust-free room at ambient temperature.

	WARNING	Bruising hazard	
		Risk of bruising during transport and installation of the device. To prevent injuries when lifting the device, use appropriate lifting aids. Make sure that the used lifting equipment is not damaged and that it is approved for the weight of the oil/air cooler. Make sure that the device is fixed tightly.	

Installation and Operation Instructions
Off-line coolers BNK
Installation and connection



4 Installation and connection

4.1 Requirements to the installation site

Unit

The unit must be located in such a way that there is free airflow around and enough room for servicing and repair. If the device is installed outdoors, regard the protection class of the motor (IP55 is standard).

Air cooler

The cooler must be located in such a way that the air flowing through the matrix has free flow on entry and exit. The distance between air intake or air outlet to the nearest surrounding obstacle should be at minimum half the height of the matrix. Free air flow must be provided. If the cooler is to be sited near to working personnel, the effect of hot draught and noise emissions must be taken into account.

If the cooler is installed in closed space, ensure sufficient air circulation. Avoid back flow of warmed air. If necessary, the room must be vented.

Due to lower temperatures with respect to closed rooms, the cooling capacity outside raises, but on the other hand higher start up pressure may result due to higher oil viscosity. In this case, consider a bypass valve and / or a heating.

The rotating fan might lead to static charging. Therefore sensitive equipment like electronics should be kept away from the device.

4.2 Installing the unit

The unit is mounted with bolts to the mounting points on an adequate support structure. The connections to the system should be stress and vibration free. The use of flexible hoses is highly recommended. Please regard that the hose on the suction side is suitable for suction pressure for ex-ample a mesh wire reinforced type. Avoid leakage in the oil circuit. If necessary, place drip pans. Comply with local safety requirements and avoid any risk to the environment from oil spills etc.

4.2.1 Additional advices for units with pump

The distance from the unit to the reservoir should be as short as possible. Especially the suction pipe should be short and of sufficient inner diameter.

We suggest mounting the unit in the same height as the liquid level. Mounting below the liquid level is possible as well.

If the aggregate can only be installed above this level, the pump will have a constant suction pressure of 0.4 bar (atmosphere). Depending on the oil viscosity and temperature, this will result in a different suction lift. A difference in value of 2 m can be used as a guide.

Until the oil is heated to operating temperature, a suction pressure of 0.6 bar is permissible temporarily.

The diameter of the intake pipe should not be smaller than specified in the data sheet. We recommend a max. flow rate of 1.5 m/s.

When first starting up a hydraulic system with a long intake pipe can cause problems due to excess air in the intake pipe. In this case we suggest filling the suction pipe with oil and using a suction valve without spring.

Oil is sprayed into the pump housing during the assembly process at our factory. This is necessary to seal the gerator from the housing with an oil film. During extended periods of storage the pump housing may not have enough oil anymore to create this oil film when switching on the pump. The pump may then completely lose suction. Before connecting the suction pipe we recommend spraying some oil into the pump housing to prevent this.

The pump may be exposed to max. 0.5 bar of pressure on the suction side.

Installation and Operation Instructions
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Installation and connection



4.3 Hydraulic connection

Hydraulic connection is to be carried out as described in the appended data. All pipes are free of vibration and current. Generally speaking, connections should be made using tubes.

Contaminated fluids affect the service life of the fluid system. For this reason we advise using fluids of purity class 23/19/13 (as per ISO 4406).

Should your hydraulic system be equipped with switching valves or check valves, we recommend using a pressure relief valve to protect your system. A pressure relief valve has not been factory installed in the cooler.

4.4 Electrical connections

CAUTION

Electrical voltage

Wrong mains voltage may damage the device.

Installation of the device shall be performed by trained staff only. Regard the voltage given on the type plate. Make sure that the cables have sufficient strain relief.

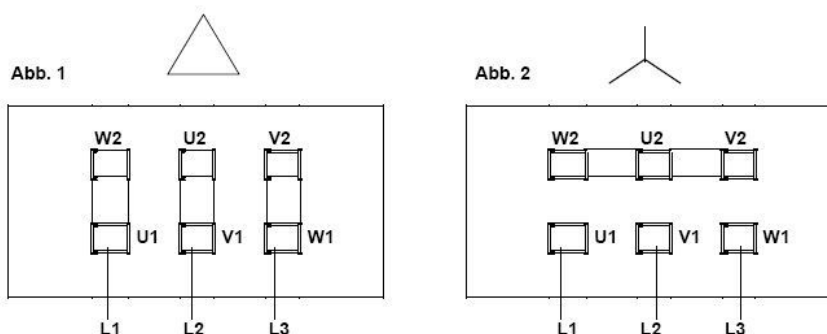
Fusing

Fusing has to be done due to local standards!

Polarity

Take care of the directional rotation of the motor. The fan rotates counter clockwise when regarded from the motor's side!

Watch the direction arrow on the type plate sticker.



The rotational direction is changed by exchanging the connection two phases.

For calculating the correct values of fuses and cross-section of connection wires, refer to local rules and standards. The motor and, if equipped, starting devices must be connected to protective earth.

Lead fuses protect the cables in case of a short cut, but are not sufficient to protect the motor coils from burning due to overload. Therefore, install an adequate motor circuit breaker with high precision range of adjustment for thermal protection to protect the motor against overload and operation with two phases.

Adjust the motor circuit breaker according to the nominal value given on the type plate of the motor. Operation out of the limits for mains voltage and frequency range is prohibited.

Lightning protection must be installed by the operator.

Installation and Operation Instructions
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Operation and control



5 Operation and control

WARNING 	Hazard due to rotating fan Injury of hands and fingers To avoid injuries, do not reach into the running fan!	
NOTICE 	The device must not be operated beyond its specifications.	
NOTICE 	Abrupt flow variation can lead to pressure peaks that may damage the cooler matrix. Make sure that the specifications are not exceeded in this case!	

5.1 Before starting

- Check that all parts are free of damage, especially the cooling element and fan guard. Do not put a damaged device into operation.
- Check if the two warning labels (rotating parts) on the cooler's housing are fitted.
- Check the correct connections of oil and power circuits according to chapter „Installation and connection“.
- Make sure that all valves or other parts in the cooling circuit, which have to be opened, are opened.

5.2 During starting

First, check that the fan rotates counter clockwise when looking from the motor's side.

CAUTION 	Hot surface Burning hazard Let the device cool down before maintaining.	
CAUTION  	High pressure Hazard of injury due to flung off parts or oil, environmental hazard due to oil. a) Before starting any maintenance or repair to the oil circuit, make sure that the device is depressurized. This applies to the locking screws as well. b) Avoid environmental pollution (oil spills) during cleaning or maintenance of the oil circuit. c) Use drip pans.	

Noise level

Our cooler is supplied with a low noise pump. If the noise level increases significantly check if the suction line has the right dimension and if the pump works in the appropriate temp/viscosity range. Ask Bühler Technologies GmbH for technical advice.



6 Maintenance

- Maintenance of the device shall be performed by trained staff only, familiar with the safety requirements and risks.
- Only perform maintenance work described in this manual.
- Regard all relevant safety regulations and internal operating instructions during maintenance.

DANGER 	Electrical voltage Electrocution hazard. a) Disconnect the device from power supply. b) Make sure that the equipment cannot be reconnected to mains unintentionally. c) The device must be opened by trained staff only. d) Regard correct mains voltage.	
CAUTION 	Hot surface Burning hazard Let the device cool down before maintaining.	
CAUTION  	High pressure Hazard of injury due to flung off parts or oil, environmental hazard due to oil. a) Before starting any maintenance or repair to the oil circuit, make sure that the device is depressurized. This applies to the locking screws as well. b) Avoid environmental pollution (oil spills) during cleaning or maintenance of the oil circuit. c) Use drip pans. The outer parts of the motor, especially the cooling fins and the cooling ducts must be kept as clean as possible to ensure sufficient heat dissipation. Keep in mind the protection class for dust and humidity. Cleaning the device with high pressure cleaners is only allowed if the motor has the respective protection class. The motor is equipped with on both sides with sealed ball bearings. The greasing is designed for the total lifetime. Maintenance (subsequent greasing) is not necessary. The bearings must be replaced by trained staff only.	



6.1 Cleaning and disassembly of the cooler matrix

Due to the design of the cooling fins, the cooler has low susceptibility to dust and dirt. Normally, it is sufficient to clean the front surface with a brush. If the ambient air is loaded with higher amounts of oil or dust, it may be necessary to clean the cooling matrix in regular intervals.

- First, let the cooling matrix cool down. Then disconnect the motor from the mains and secure it against reconnecting.
- Depressurize the system and disconnect the piping. Place an oil drip pan below the cooling matrix to collect leaking oil.
- Close all connections with plugs to avoid further oil leakage.
- Protect the cooling matrix from falling down.
- Dismantle the cooling matrix from the fan case by loosening the 4 fastening bolts. The cooler sizes 6 up to 8 provide threads for eyebolts in the cooler matrix for lifting with hoisting devices.
- Take it to the cleaning area. Be careful not to damage the fins during transport and cleaning.
- Clean the matrix by blowing pressurized air from the rear side through the fin rows in parallel.
- If dirt is wet and sticky use steam cleaner and /or some washing agent. In this case, rinse the cooler matrix with pure water.
- Remount the cooling matrix in reverse order.
- Regard correct mounting of the connecting sleeves.

6.2 Cleaning the cooler matrix inside

If the matrix gets clogged from the inside due to impurities it should be rinsed with a cleaning liquid.

- Dismantle the cooling matrix as described in chapter „Cleaning and disassembly of the cooler matrix“.
- Fill in a degreasing agent and plug the cooling matrix.
- After some reaction time, empty the cooling matrix and rinse it with clean duty oil. Dispose the degreasing agent and the cooling oil according to National regulations.
- Remount the cooling matrix in reverse order as described.

6.3 Cleaning the fan case

Due to the design, dust and dirt will not deposit in a large amount inside the fan case. Nevertheless, any deposits of dirt should be blown out each time the cooler is cleaned.

Installation and Operation Instructions
Off-line coolers BNK
Maintenance



6.4 Replacing fan parts

- Disconnect the motor from the mains and protect it from being re-connected unintentionally.
- Now remove the mains cable.
- There are two different fan models.
- Model with fixed fan hub, the fan can be replaced only together with the hub.
- Models with separated hub and fan, the fan can be replaced without replacing the hub.

Models with motor support and mounting brackets:

- Secure the fan unit against falling.
- Loosen the four fixing bolts at the case on top of the mounting brackets.
- Unscrew the four screws connecting the fan unit to the housing at the tips of the fan guard.
- The fan unit can now be pulled out carefully to the back.
- Remount the new fan in reverse order. If the fan is replaced, insert the screw adding with glue.

Models with motor support and elongated holes in the mounting rails:

- Secure the fan unit against falling.
- Loosen the screws fixing the support to the coolers feet about two revolutions.
- Unscrew the four screws connecting the fan unit to the housing at the tips of the fan guard.
- The fan unit can now be pulled out carefully to the back.
- Remount the new fan in reverse order. If the fan is replaced, insert the screw adding with glue.

Installation and Operation Instructions
Off-line coolers BNK
Service und repair



7 Service und repair

If the device shows irregularities see this chapter for troubleshooting.

Repairs on the device must be carried out by Bühler authorized persons only.

If you need help or more information

call: +49-(0)2102-498955 or your local agent

If the device doesn't work correctly after elimination of failures and turning power on, the device must be checked by the manufacturer. Please ship the device with suitable packing to

Bühler Technologies GmbH

- Reparatur/Service -

Harkortstraße 29

40880 Ratingen

Deutschland

In Addition, attach the filled in and signed Declaration of Decontamination status to the packing. Otherwise, your repair order cannot be processed!

The form can be requested by e-mail to service@buehler-technologies.com.

7.1 Troubleshooting

Problem / Failure	Possible cause	Solution
Cooling capacity not sufficient	– Ambient air temperature is higher than specified	– Select larger model
	– Motor's rotation direction wrong	– Correct connection, see Electrical connections
	– Motor doesn't start	– Correct connection, see Electrical connections
	– Air flow too low	– Correct connection, see Electrical connections
	– Air fins clogged	– Clean cooler matrix, see Maintenance
	– Near obstacles	– Regard minimum distance
	– Oil flow too low	– Increase oil flow
	– Oil channel clogged	– Cleaning, see chapter Cleaning the cooler matrix inside
	– Oil circuit blocked	– Open valves and cocks
	– Suction pressure too high, therefore reduced oil flow.	– Select suction hose with sufficient diameter
No oil flow	– Back pressure in the pressure line too big. Motor will be overloaded and motor speed braked down.	– Reduce suction height
		– Choose bigger nominal width
Not enough oil inside pump housing due to long standstill or storage, therefore no suction.	– Not enough oil inside pump housing due to long standstill or storage, therefore no suction.	– Refill some oil into the pump housing before connecting the suction hose
Pump too noisy	– Suction pressure too high	– Select suction hose with sufficient diameter
		– Reduce suction height

Tab. 2: Troubleshooting

Installation and Operation Instructions
Off-line coolers BNK
Disposal



8 Disposal

Dispose of the parts in such a way that does not present a danger to other people's health or to the environment. Observe the legal requirements in the country of use for the disposal of electrical components and oils and coolants.

Installation and Operation Instructions
Off-line coolers BNK
Calculations



9 Calculations

9.1 Calculating viscosity

Valid for VG-oil between 10 - 100 °C at an exactness from ± 5 %.

Definitions	Example: oil VG 46
V_{40} oil viscosity at 40 °C in cst	V_{40} 46 cst
T temperature in °C	T 25 °C
ν viscosity in cst	
$b = 159 \cdot \ln \frac{V_{40}}{0,23}$	$b = 159 \cdot \ln \frac{46}{0,23} = 842,4325$
$a = 0,23 \cdot e^{\frac{-b}{877}}$	$a = 0,23 \cdot e^{\frac{-842,4325}{877}} = 0,08801$
$\nu = a \cdot e^{\frac{b}{T+95,2}}$	$\nu = 0,08801 \cdot e^{\frac{842,4325}{25+95,2}} = 97,35 \text{ cst}$

9.2 Table of operational viscosity for VG oil

	10 °C	20 °C	30 °C	40 °C	50 °C	60 °C	70 °C	80 °C	90 °C
VG 46	264,45	131,96	73,58	46,00	29,13	20,04	14,43	10,78	8,32
VG 68	444,77	210,85	112,61	68,00	41,63	27,86	19,58	14,32	10,84
VG 220	2.120,17	861,60	404,31	220,00	121,71	74,99	49,00	33,61	24,01
VG 320	3.489,92	1.350,22	607,96	320,00	171,40	102,85	65,66	44,12	30,94

Viscosity given in cst (mm²/s)

9.3 Calculating the pressure loss

Valid for smooth straight piping per meter at laminar current.

Definitions	Example: oil VG 46
ν Viscosity in cst	ν 97,35 cst
ρ spec. gravity in kg/dm ³	ρ 0,8817 kg/dm ³
DN tube diameter in mm	DN 20 mm
V flow in m/s	V 3,18 m/s (60 l/min for tube DN 20)
PV pressure loss in bar	
$PV = \frac{0,32 \cdot \nu \cdot \rho \cdot V}{DN^2}$	$PV = \frac{0,32 \cdot 97,35 \cdot 0,8817 \cdot 3,18}{20^2} = 0,22 \text{ bar}$

NOTICE



Pressure loss increases significantly for bends and fittings. It might be necessary in some cases to determine the final shape of the suction line on site under specific conditions.

Please do not hesitate to contact us for help to calculate the pressure loss of the suction line for your specific application.

NOTICE



To avoid damage of the cooling system, make sure that the maximum pump pressure is not exceeded. High pressure may occur if the system is shut off or throttled at the pressure side.

Installation and Operation Instructions
Off-line coolers BNK
Pressure loss in straight pipes



10 Pressure loss in straight pipes

Pressure loss (bar) in straight pipes per meter at laminar flow with mineral flow:

BFP 8 8 l/min – DN 25								
	VG 46	VG 68	VG 120	VG 160	VG 220	VG 320	VG 460	VG 680
10 °C	0.03	0.05	0.11	0.17	0.25	0.42	0.68	1.14
20 °C	0.02	0.03	0.05	0.07	0.10	0.16	0.25	0.40
30 °C	0.01	0.01	0.02	0.03	0.05	0.07	0.11	0.17
40 °C	0.01	0.01	0.01	0.03	0.03	0.04	0.05	0.08
50 °C	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.04
60 °C – 100 °C < 0,03 bar								

BFP 15 16 l/min – DN 32								
	VG 46	VG 68	VG 120	VG 160	VG 220	VG 320	VG 460	VG 680
10 °C	0.02	0.04	0.08	0.12	0.19	0.31	0.50	0.85
20 °C	0.01	0.02	0.04	0.10	0.08	0.12	0.19	0.30
30 °C	0.01	0.01	0.02	0.05	0.04	0.05	0.08	0.12
40 °C	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06
50 °C	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.03
60 °C – 100 °C < 0,02 bar								

BFP 30 28 l/min – DN 32								
	VG 46	VG 68	VG 120	VG 160	VG 220	VG 320	VG 460	VG 680
10 °C	0.04	0.07	0.15	0.22	0.33	0.54	0.88	1.48
20 °C	0.02	0.03	0.06	0.09	0.13	0.21	0.33	0.52
30 °C	0.01	0.02	0.03	0.04	0.07	0.09	0.14	0.22
40 °C	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.10
50 °C	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06
60 °C – 100 °C < 0,03 bar								

BFP 60 57 l/min – DN 40								
	VG 46	VG 68	VG 120	VG 160	VG 220	VG 320	VG 460	VG 680
10 °C	0.03	0.06	0.12	0.18	0.28	0.45	0.74	1.24
20 °C	0.02	0.03	0.05	0.08	0.11	0.18	0.27	0.43
30 °C	0.01	0.01	0.03	0.04	0.05	0.08	0.12	0.18
40 °C	0.01	0.01	0.02	0.02	0.02	0.04	0.06	0.08
50 °C	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05
60 °C – 100 °C < 0,03 bar								

BFP 90 86 l/min – DN 40								
	VG 46	VG 68	VG 120	VG 160	VG 220	VG 320	VG 460	VG 680
10 °C	0.05	0.09	0.19	0.27	0.42	0.68	1.11	1.87
20 °C	0.03	0.04	0.08	0.12	0.17	0.26	0.41	0.65
30 °C	0.02	0.02	0.04	0.06	0.08	0.12	0.18	0.27
40 °C	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.13
50 °C	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.07
60 °C – 100 °C < 0,04 bar								

Installation and Operation Instructions
Off-line coolers BNK
Appendices



11 Appendices

11.1 Technical data

Materials / surface protection Cooling battery: ventilation box, safety guard and motor brackets: pump:	Aluminium, painted plastic-coated steel hard-anodised aluminium, sintered steel
Colour:	RAL 7001
Operating fluids:	Mineral oils per DIN 51524 Gear oil per DIN 51517-3
Operating pressure static: Suction pressure:	max. 10 bar max. - 0.4 bar
Operating oil temperature:	max. 80 °C (higher upon request)
max. Viscosity:	100 cSt medium viscosity (higher upon request)

Electric motors (others available upon request)	
Voltage / frequency:	230 / 400 V - 50 Hz ± 5 % 276 / 480 V - 60 Hz ± 5 %
Thermal stability:	Class of insulation F, utilisation per Class B
Protection class:	IP55
The motors comply with standards IEC 60034, IEC 60072, IEC 60085	

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Installation and Operation Instructions
Off-line coolers BNK
Appendices

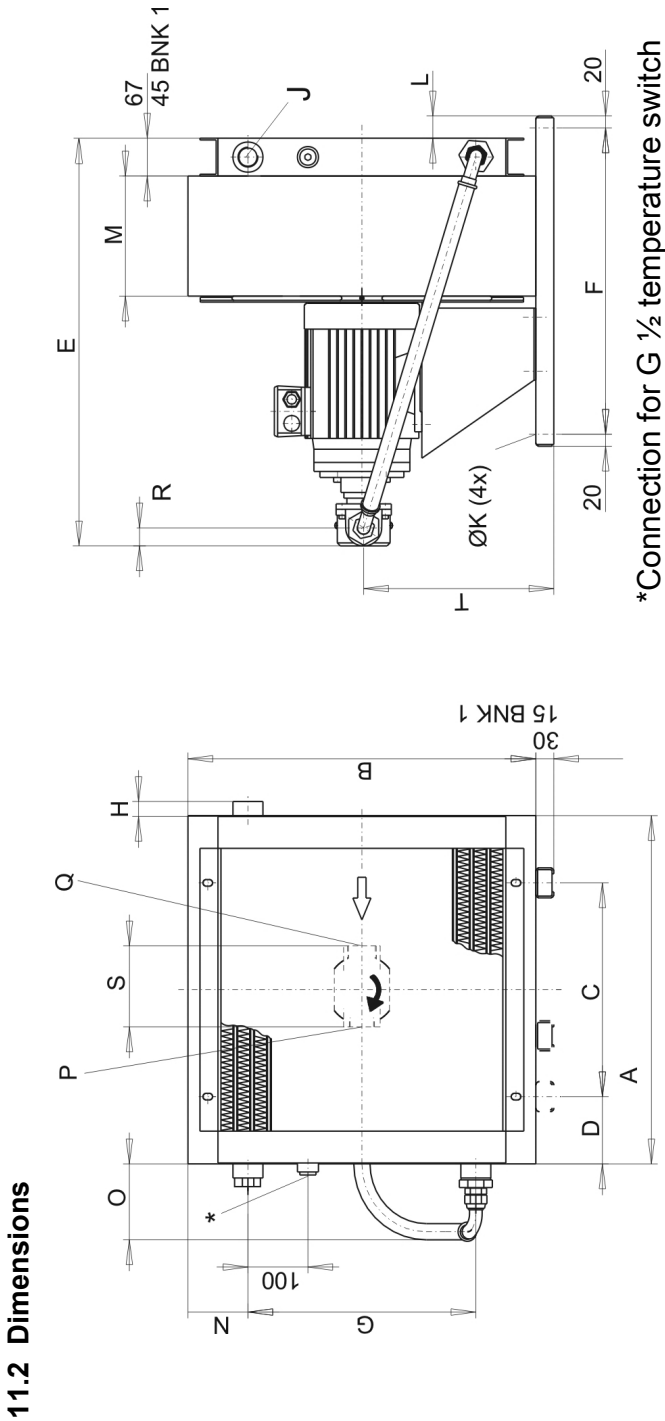


11.1.1 Basic data (at 50 Hz frequency)

Item no.	Cooler model	spec. cooling power kW/K	Cooling power at ETD = 40 K (kW)	max. circulation rate (l/min)	Motor power Number of poles Rated current at 400 V	Weight (kg)	Capacity (l)	Noise db(A)*
3601406IE2	BNK 1.4-7.5-0.75kW	0.04	1.6	7.5	0.75 kW / 4 / 1.94 A	25	0.7	64
3601401IE2	BNK 1.4-15-0.75kW	0.07	2.8	15	0.75 kW / 4 / 1.94 A	25	0.7	64
3602401IE2	BNK 2.4-15-0.75kW	0.09	3.6	15	0.75 kW / 4 / 1.94 A	30	1.3	66
3602402IE2	BNK 2.4-30-0.75kW	0.13	5.0	28	0.75 kW / 4 / 1.94A	33	1.3	66
3602407IE2	BNK 2.4-40-1.1kW	0.16	6.4	42	1.1 kW / 4 / 2.74 A	35	1.3	66
3603401IE2	BNK 3.4-15-0.75kW	0.15	6.0	15	0.75 kW / 4 / 1.94 A	35	1.8	71
3603402IE2	BNK 3.4-30-0.75kW	0.24	9.6	28	0.75 kW / 4 / 1.94 A	38	1.8	71
3603407IE2	BNK 3.4-40-1.1kW	0.28	11.2	42	1.1 kW / 4 / 2.74 A	40	1.8	71
3604402IE2	BNK 4.4-30-0.75kW	0.32	12.8	28	0.75 kW / 4 / 1.94 A	43	2.3	73
3604407IE2	BNK 4.4-40-1.1kW	0.34	13.6	42	1.1 kW / 4 / 2.74 A	45	2.3	73
3604403IE2	BNK 4.4-60-1.5kW	0.36	14.4	57	1.5 kW / 4 / 3.4 A	51	2.3	73
3604404IE2	BNK 4.4-90-2.2kW	0.38	15.2	86	2.2 kW / 4 / 4.59 A	61	2.3	73
3604605IE2	BNK 4.6-40-1.1kW	0.24	9.6	38	1.1 kW / 6 / 2.54 A	51	2.3	63
3604603IE2	BNK 4.6-60-1.1kW	0.26	10.4	57	1.1 kW / 6 / 2.54 A	61	2.3	63
3605403IE2	BNK 5.4-60-2.2kW	0.51	20.4	57	2.2 kW / 4 / 4.59 A	71	3.1	79
3605404IE2	BNK 5.4-90-2.2kW	0.56	22.4	86	2.2 kW / 4 / 4.59 A	73	3.1	79
3605605IE2	BNK 5.6-40-1.5kW	0.33	13.2	36	1.5 kW / 6 / 3.31 A	70	3.1	68
3605603IE2	BNK 5.6-60-1.5kW	0.38	15.2	55	1.5 kW / 6 / 3.31 A	72	3.1	68
3606413IE2	BNK 6.4-60-3.0kW	0.90	36.0	57	3.0 kW / 4 / 6.33 A	87	4.1	86
3606414IE2	BNK 6.4-90-3.0kW	1.01	40.4	86	3.0 kW / 4 / 6.33 A	88	4.1	86
3606613IE2	BNK 6.6-60-2.2kW	0.65	26.0	58	2.2 kW / 6 / 4.85 A	86	4.1	74
3607413IE2	BNK 7.4-60-3.0kW	0.93	37.2	58	3.0 kW / 4 / 6.33 A	99	5.4	89
3607414IE2	BNK 7.4-90-3.0kW	1.05	42.0	86	3.0 kW / 4 / 6.33 A	100	5.4	89
3607613IE2	BNK 7.6-60-2.2kW	0.71	28.4	58	2.2 kW / 6 / 4.85 A	98	5.4	75
3608613IE2	BNK 8.6-60-3.0kW	1.13	45.2	58	3.0 kW / 6 / 6.6 A	118	6.3	79

*DIN EN ISO 3744, Class 3

Installation and Operation Instructions
Off-line coolers BNK
Dimensions



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3 Supplier documentation

Installation and Operation Instructions
Off-line coolers BNK
Dimensions



Model	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T
BNK 1.4-7.5-0.75kW	315	243	190	62.5	417	340	-	-	2x G 1/2	9	40	52	-	-	G1	G 3/4	30	144	130
BNK 1.4-15-0.75kW	315	243	190	62.5	417	340	-	-	2x G 1/2	9	40	52	-	-	G1	G1 1/4	30	130	130
BNK 2.4-15-0.75kW	370	370	203	83.5	476	510	-	25	2x G1	9	33	125	106	119	G1	G1 1/4	30	130	212
BNK 2.4-30-0.75kW	370	370	203	83.5	474	510	-	25	2x G1	9	33	125	106	119	G1	G1 1/4	30	130	212
BNK 2.4-40-1.1kW	370	370	203	83.5	524	510	-	25	2x G1	9	33	125	106	119	G1	G1 1/4	30	130	212
BNK 3.4-15-0.75kW	440	440	203	118.5	501	510	230	25	3x G1	9	33	150	105	119	G1	G1 1/4	30	130	247
BNK 3.4-30-0.75kW	440	440	203	118.5	499	510	230	25	3x G1	9	33	150	105	119	G1	G1 1/4	30	130	247
BNK 3.4-40-1.1kW	440	440	203	118.5	548	510	230	25	3x G1	9	33	150	105	119	G1	G1 1/4	30	130	247
BNK 4.4-30-0.75kW	500	500	203	148.5	524	510	230	25	3x G1	9	33	175	104	119	G1	G1 1/4	30	130	277
BNK 4.4-40-1.1kW	500	500	203	148.5	574	510	230	25	3x G1	9	33	175	104	119	G1	G1 1/4	30	130	277
BNK 4.4-60-1.5kW	500	500	203	148.5	617	510	230	25	3x G1	9	33	175	104	135	G1 1/4	G1 1/2	30	135	277
BNK 4.4-90-2.2kW	500	500	203	148.5	688	510	230	25	3x G1	9	33	175	104	135	G1 1/4	G1 1/2	53	135	277
BNK 4.6-40-1.1kW	500	500	203	148.5	617	510	230	25	3x G1	9	33	175	104	135	G1 1/4	G1 1/2	30	135	277
BNK 4.6-60-1.1kW	500	500	203	148.5	652	510	230	25	3x G1	9	33	175	104	135	G1 1/4	G1 1/2	53	135	277
BNK 5.4-60-2.2kW	580	580	356	112	678	510	305	23.5	3x G1	9	33	200	100	134	G1 1/4	G1 1/2	30	135	317
BNK 5.4-90-2.2kW	580	580	356	112	713	510	305	23.5	3x G1	9	33	200	100	134	G1 1/4	G1 1/2	53	135	319
BNK 5.6-40-1.5kW	580	580	356	112	678	510	305	23.5	3x G1	9	33	200	100	134	G1 1/4	G1 1/2	30	135	317
BNK 5.6-60-1.5kW	580	580	356	112	713	510	305	23.5	3x G1	9	33	200	100	134	G1 1/4	G1 1/2	53	135	314
BNK 6.4-60-3.0kW	700	700	356	172	719	510	410	9.5	3x G1 1/4	9	33	225	110	132	G1 1/4	G1 1/2	30	135	377
BNK 6.4-90-3.0kW	700	700	356	172	754	510	410	9.5	3x G1 1/4	9	33	225	110	132	G1 1/4	G1 1/2	53	135	377
BNK 6.6-60-2.2kW	700	700	356	172	751	510	410	9.5	3x G1 1/4	9	33	225	110	132	G1 1/4	G1 1/2	53	135	377
BNK 7.4-60-3.0kW	700	840	356	172	744	510	590	9.5	3x G1 1/4	9	33	250	91	132	G1 1/4	G1 1/2	30	135	447
BNK 7.4-90-3.0kW	700	840	356	172	779	510	590	9.5	3x G1 1/4	9	33	250	91	132	G1 1/4	G1 1/2	53	135	447
BNK 7.6-60-2.2kW	700	840	356	172	776	510	590	9.5	3x G1 1/4	9	33	250	91	132	G1 1/4	G1 1/2	53	135	447
BNK 8.6-60-3.0kW	870	870	508	181	795	510	585	11	3x G1 1/4	9	33	275	101.5	134	G1 1/4	G1 1/2	53	135	462

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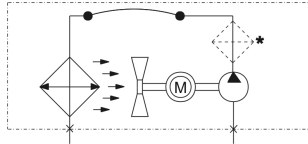
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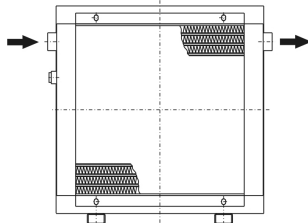
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11.3 Functional diagram

Standard version BNK 2

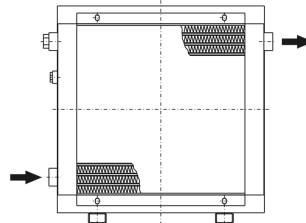
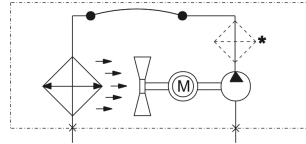


* recommended position of additional oil filter



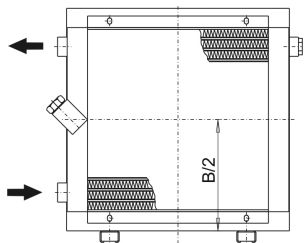
The oil inlet is on the left of the cooling battery. The oil outlet is always on the opposite side.

Standard version BNK 1, 3 to BNK 8



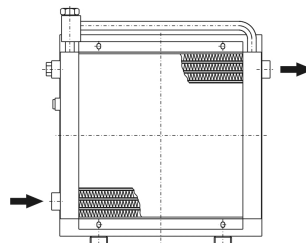
The oil inlet is on the bottom left of the cooling battery. The second connection at the top must be closed. The oil outlet is always on the opposite side.

Internal bypass IB/ ITB (BNK 3-8)



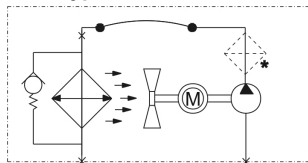
The oil inlet and outlet is always on the same side of the cooling battery. The connection on the opposite side must be closed.

External bypass AB/ATB (BNK 2-8)

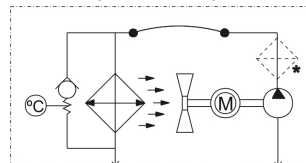


The oil inlet is always at the bottom left of the cooling battery. The second connection must be closed. The oil outlet is always on the opposite side.

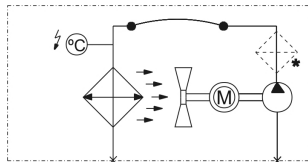
With bypass valve



With temperature-dependent bypass valve



With temperature switch attached



Installation and Operation Instructions
Off-line coolers BNK
Functional diagram



12 Attached documents

- Declaration of Conformity KX 350001
- Declaration of Contamination status

EG-Konformitätserklärung EC-declaration of conformity



Hiermit erklären wir, dass die nachfolgenden Produkte den wesentlichen Anforderungen der folgenden EG-Richtlinie in ihrer aktuellen Fassung entsprechen:

Herewith we declare that the following products correspond to the essential requirements of the following EC directive in its actual version:

2006/42/EG (Maschinenrichtlinie / *machinery*)

Folgende weitere Richtlinien wurden berücksichtigt / *the following directives were regarded*

2006/95/EG (Niederspannungsrichtlinie / *low voltage directive*)

2004/108/EG (EMV / *EMC*)

Produkte / *products:*

Öl-Luft Kühler, Öl-Nebenstromkühler

Oil/Air cooler, Offline Oil/Air cooler

Typ(en) / *type(s):*

BLK, BNK

Zur Beurteilung der Konformität wurden folgende harmonisierte Normen in aktueller Fassung herangezogen:

The following harmonized standards in actual revision have been used:

- EN 12100-1 **Sicherheit von Maschinen - Grundbegriffe, allgemeine Gestaltungsleitsätze - Teil 1: Grundsätzliche Terminologie, Methodologie**
- EN 12100-2 **Sicherheit von Maschinen - Grundbegriffe, allgemeine Gestaltungsleitsätze - Teil 2: Technische Leitsätze**
- EN 60204-1 **Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen - Teil 1: Allgemeine Anforderungen**
- EN 55011 **Industrielle, wissenschaftliche und medizinische Geräte - Funkstörungen - Grenzwerte und Messverfahren**
- EN 61000-6-2 **Elektromagnetische Verträglichkeit (EMV) - Teil 6-2: Fachgrundnormen - Störfestigkeit für Industriebereiche**

Dokumentationsverantwortlicher für diese Konformitätserklärung ist der Unterzeichnende mit Anschrift am Firmensitz.

The person authorised to compile the technical file is the one that has signed and is located at the company's address

Ratingen, den 14.07.2010

Stefan Eschweiler
Geschäftsführer – *general manager*

KX 35 0001

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Internet: www.buehler-technologies.com
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RMA - Dekontaminierungserklärung RMA - Decontamination Statement



DE/EN Gültig ab / valid since: 2014/11/01 Revision / Revision 1 ersetzt Rev. / replaces Rev. 0

Um eine schnelle und reibungslose Bearbeitung Ihres Anliegen zu erreichen, füllen Sie bitte diesen Rücksendeschein aus. Eine genaue Fehlerbeschreibung ist für die Ursachenanalyse nötig und hilft bei der schnellen Bearbeitung des Vorgangs. Die Aussage „Defekt“ hilft bei der Fehlersuche leider nicht.

Die RMA-Nummer bekommen Sie von Ihrem Ansprechpartner im Vertrieb oder Service.

Zu diesem Rücksendeschein gehört eine Dekontaminierungserklärung. Die gesetzlichen Vorschriften schreiben vor, dass Sie uns diese Dekontaminierungserklärung ausgefüllt und unterschrieben zurücksenden müssen. Bitte füllen Sie auch diese im Sinne der Gesundheit unserer Mitarbeiter **vollständig** aus.

Bringen Sie den Rücksendeschein mit der Dekontaminierungserklärung bitte zusammen mit den Versandpapieren in einer Klarsichthülle außen an der Verpackung an. Ansonsten ist eine Bearbeitung Ihres Reparaturauftrages nicht möglich!

Angaben zum Absender:

Please complete this return form to ensure your claim is processed quickly and efficiently. An accurate description of the problem is necessary for cause analysis and will help processing the claim quickly. Unfortunately, stating "defective" will not help us troubleshoot the issue.

You may obtain the RMA number from your sales or service representative.

*This return form includes a decontamination statement. The law requires you to submit this completed and signed decontamination statement to us. Please complete the **entire** form, also in the interest of our employees' health.*

Attach the return form including decontamination statement along with the shipping documentation to the outside of the package, inside a clear pouch. Otherwise we are unable to process your repair order!

Sender information:

Firma / Company		Ansprechpartner / Contact person	
Anschrift / Address		Abteilung / Department	
		E-Mail / E-Mail:	
		Tel. / Phone	
		Fax / Fax:	
Artikelnummer / Item number		RMA-Nr. / RMA no.	
Auftragsnummer / Order number			
Anzahl / Quantity			
Rücksendegrund / Return reason	Reparatur / Repair	Vorgangsnummer des Kunden / Customer transaction number::	
	Garantie / Warranty		
	Zur Prüfung / For inspection		
	Rückgabe / Return		
Fehlerbeschreibung / Description of the problem:			

Ort, Datum / Place, Date _____

Unterschrift / Stempel / Signature / Stamp: _____

RMA - Dekontaminierungserklärung RMA - Decontamination Statement



DE/EN Gültig ab / valid since: 2014/11/01 Revision / Revision 1 ersetzt Rev. / replaces Rev. 0

Bitte füllen Sie diese Dekontaminierungserklärung für jedes einzelne Gerät aus.

Please complete this decontamination statement for each individual item

Gerät / Device		RMA-Nr / RMA no:	
Serien-Nr. / Serial no.			

[] Ich bestätige hiermit, dass das oben spezifizierte Gerät ordnungsgemäß gereinigt und dekontaminiert wurde und keinerlei Gefahren im Umgang mit dem Produkt bestehen.

I herewith declare that the device as specified above has been properly cleaned and decontaminated and that there are no risks present when dealing with the device.

Ansonsten ist die mögliche Gefährdung genauer zu beschreiben:

In other cases, please describe the hazards in detail:

Aggregatzustand (bitte ankreuzen):

Aggregate state (please check):

☐ Flüssig / Liquid

☐ Fest / Solid

☐ Pulvrig / Powdery

☐ Gasförmig / Gaseous

Folgende Warnhinweise sind zu beachten (bitte ankreuzen):

Please note the following warnings (please check):

Explosiv Explosive	Giftig / Tödlich Toxic / lethal	Entzündliche Stoffe Flammable substances	Brandfördernd Oxidizing
Komprimierte Gase Compressed gasses	Gesundheitsgefährdend Hazardous to health	Gesundheitsschädlich Harmful to health	Umweltgefährdend Harmful to the environment

Bitte legen Sie ein aktuelles Datenblatt des Gefahrenstoffes bei!

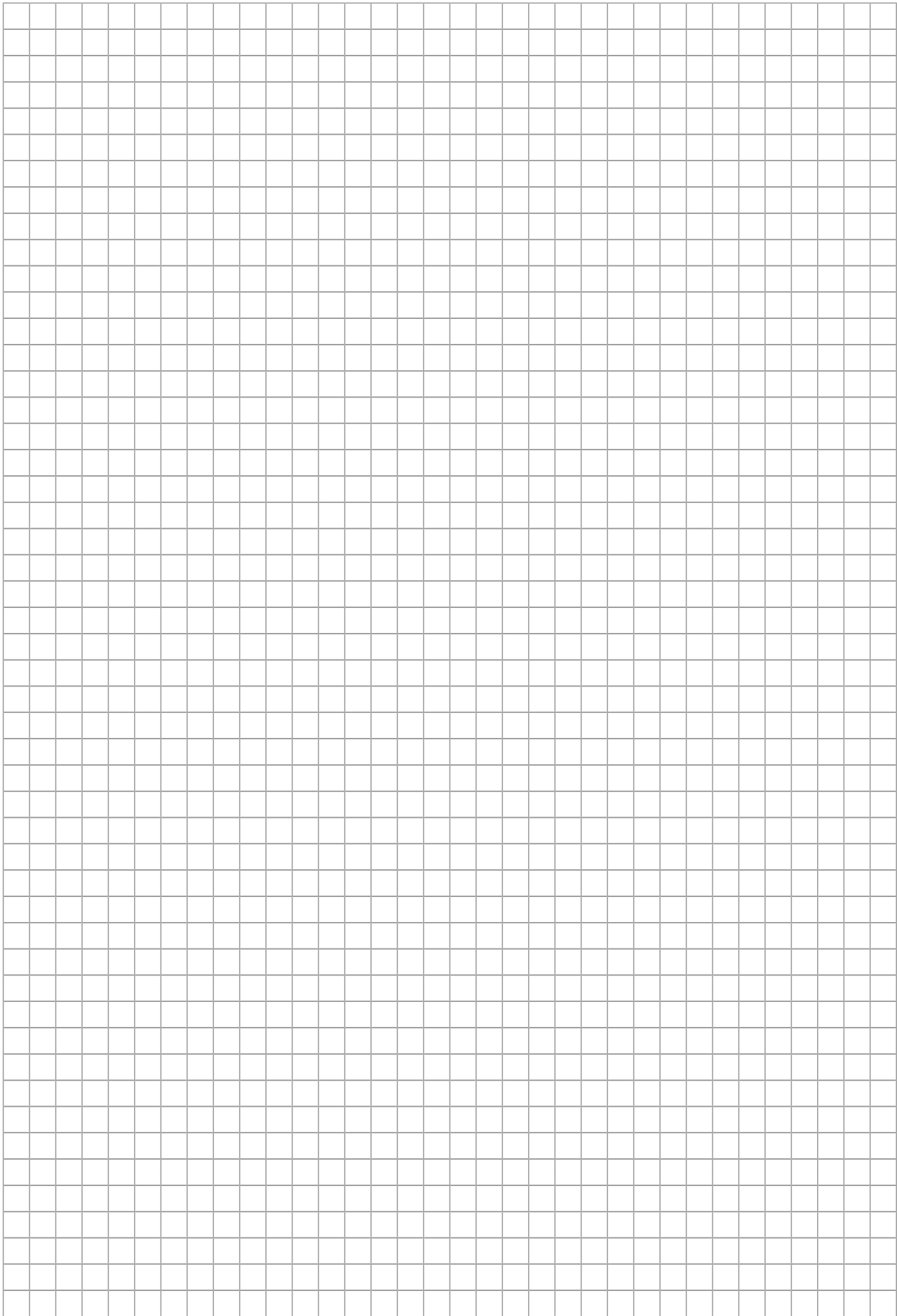
Please include an updated data sheet of the hazardous substance!

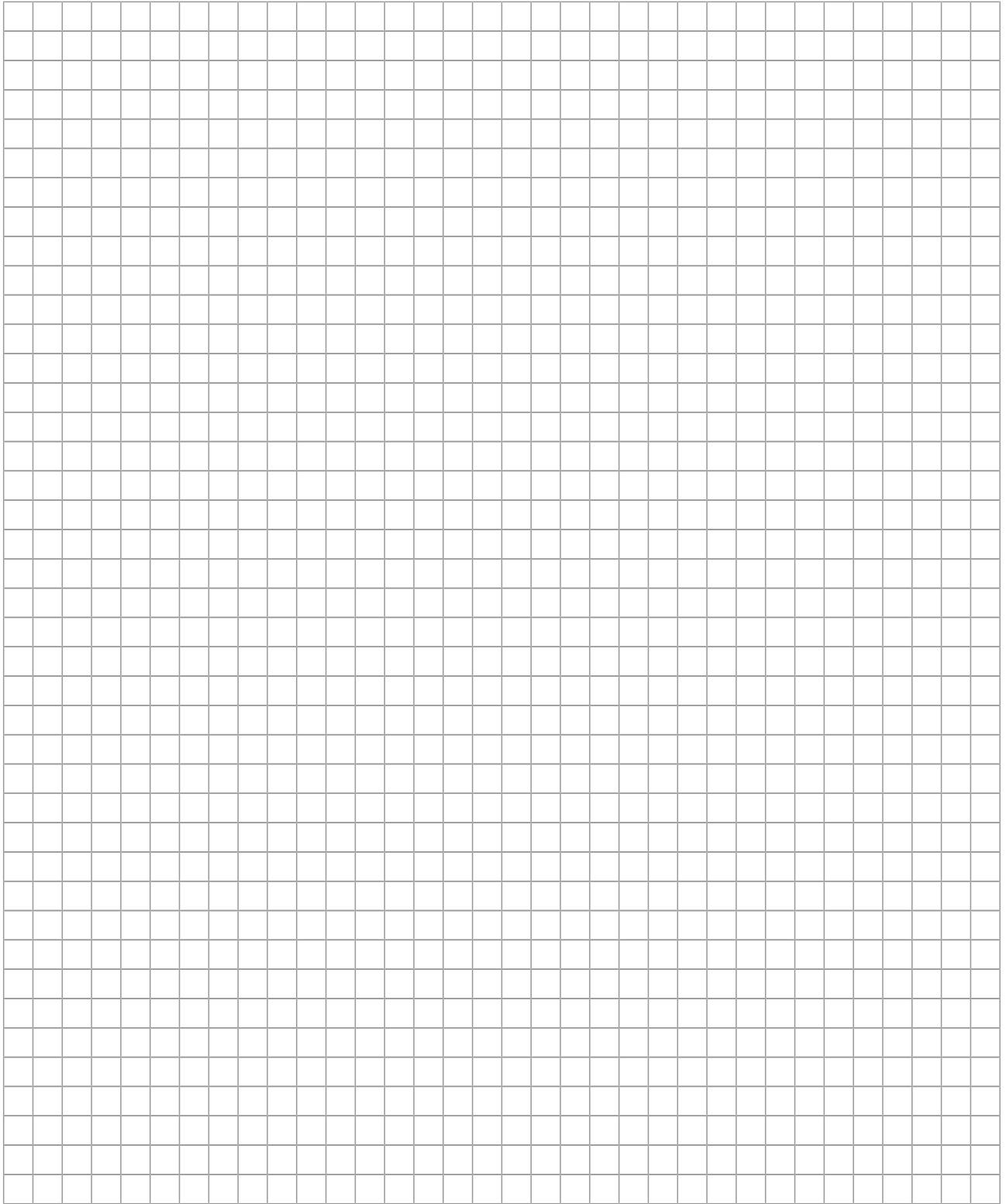
Ort, Datum /
Place, Date:

Unterschrift / Stempel
Signature / Stamp:

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SEW-EURODRIVE
Driving the world

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EURODRIVE

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