



Oil/air cooler

ELK

## 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 responsible for misusing the product or unreliable function due to unauthorised modifications.

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Document information

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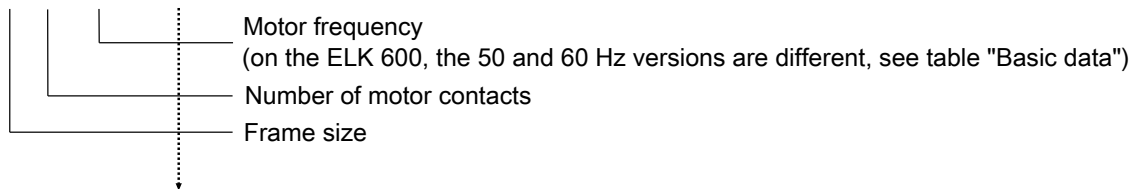
# 1 Introduction

## 1.1 Intended use

ELK oil/air coolers are used to cool oils in hydraulic and lubrication circuits. Their scope is indicated in the specifications. Any other applications require the prior approval of Bühler Technologies GmbH.

## 1.2 Model key

ELK 300-4-50/60Hz-xxx



ELK 300-4-50/60Hz-T50 *To also have a thermal contact, the specification will be added to the type designation:*

Temperature switch

T50, T60  
T70, T80

Temperature in °C, specification see  
separate data sheet

## 1.3 Scope of delivery

- 1 x oil/air cooler
- Product documentation

## 2 Safety instructions

### 2.1 Important advice

Operation of the device is only permitted 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

<b>DANGER</b>	Signal word for an imminent danger with high risk, resulting in severe injuries or death if not avoided.
<b>WARNING</b>	Signal word for a hazardous situation with medium risk, possibly resulting in severe injuries or death if not avoided.
<b>CAUTION</b>	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.
<b>NOTICE</b>	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		Warning against potentially explosive atmospheres
	Warning against hot surface		General notice
	Warning against environmental hazard		Disconnect from mains
	Warning against rotating parts		Wear protection gloves

## 2.2 General hazard warnings

The equipment must be installed by a professional familiar with the safety requirements and risks.

Be sure to observe the safety regulations and generally applicable rules of technology relevant for the installation site. Prevent malfunctions and avoid personal injuries and property damage.

### The operator of the system must ensure:

- Safety notices and operating instructions are available and observed,
- The respective national accident prevention regulations are observed,
- The permissible data and operational conditions are maintained,
- Safety guards are used and mandatory maintenance is performed,
- Legal regulations are observed during disposal,
- compliance with national installation regulations.
- Nearby equipment is EMC protected, e.g. through shielding.
- The current and voltage supply for the aggregate has a (mains) separator with adequate switching capacity. National requirements must be observed.

### Maintenance, Repair

Please note during maintenance and repairs:

- Repairs to the unit must be performed by Bühler authorised personnel.
- Only perform conversion-, maintenance or installation work described in these operating and installation instructions.
- Always use genuine spare parts.
- Do not install damaged or defective spare part. If necessary, visually inspect prior to installation to determine any obvious damage to the spare parts.

Always observe the applicable safety and operating regulations in the respective country of use when performing any type of 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 threaded plugs 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.

## 3 Transport and storage

Only transport the product inside the original packaging or a suitable alternative. Ensure secure fastening and mooring.

Air coolers have M8 or M10 eye bolts at the top of the cooler housing for transport. Please note, due to the variety of versions the mounting bracket is not located at the centre of gravity and the cooler may swing when hoisted.

Only use the motor transport eyes to hoist the motor without add-ons.

Do not use the eye bolts according to DIN 580 in ambient temperatures below -20 °C. The eye bolts could fracture in these temperatures, injuring personnel and/or damage the system.

Do not strain the eye bolts more than 45° in the thread direction.

When not in use, the equipment must be protected from moisture and heat. It must be stored in a covered, dry, dust-free room at room temperature.

### WARNING



### Crushing hazard

Crushing hazard during equipment transport and set-up.  
Use the correct hoisting gear to prevent injuries during hoisting.  
Be sure the hoisting gear is free from defects and approved for the weight of the device.  
Ensure secure fastening and mooring when transporting.

## 4 Installation and connection

### 4.1 Requirements to the installation site

#### Aggregate

The aggregate must be set up to allow for unobstructed air flow and adequate room for maintenance/repairs. When installed outdoors, be sure to consider the motor protection rating (standard: IP 55) and ensure adequate protection from the weather.

#### 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 units are screwed in place at the attachment points using screws. Be sure the support structure is sized adequately. To protect the system from damage, the connections must be stress free. We recommend using flexible hoses. Be sure the hose is stable against negative pressure, e.g. steel wire reinforced. Avoid possible leaks in the circuit to prevent environmental damages. If necessary, use an oil pan. Protect the aggregate from mechanical impact.

#### 4.2.1 Installing swivel nuts in the fitting body

Proceed as follows:

- Carefully slide the preinstalled pipe end into the 24° cone on the fitting body.
- Tighten the swivel nut until a considerable increase in force can be felt (fixed point).
- Use a suitable spanner to tighten the swivel nut a 1/12 turn more (30°) beyond the fixed point. A marker line on the swivel nut and the fitting body facilitates observing the correct tightening angle.

Tube A.D.	Thread	Torque (Nm) for straight screwed plug	Torque (Nm) sealing plug
6	G 1/8"	18	13
8	G 1/4"	35	30
10	G 1/4"	35	30
12	G 3/8"	70	60
15	G 1/2"	90	80
18	G 1/2"	90	80
22	G 3/4"	180	140
28	G 1"	310	200
35	G 1 1/4"	450	400
42	G 1 1/2"	540	450



## 4.3 Hydraulic connection

Carry out the hydraulic connection as described in the attached data. Connect the lines stress and vibration free, so typically using hoses.

Be sure to use suitable lines (with regard to pressure, fluid resistance, environmental influences, fire) when connecting to the hydraulic-, lubrication circuit. Tighten the hose lines with a suitable torque (see appendix).

Contaminated fluids impact the life of the cooling system, we therefore recommend a purity class of minimum 3/19/13 per ISO 4406.

If your hydraulic system is equipped with control or shut-off valves, we recommend protecting the cooling system with a pressure relief valve. No pressure relief valves are factory installed in the cooler.

When installing an air cooler in return lines, sudden changes to the flow rate can potentially cause significant pressure peaks which even safety relief valves cannot dampen. The limits for the static pressure must not exceed max. 21 bar, or 15 bar for dynamic pressure peaks. Otherwise an off-line cooler must be used.

## 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 sticker.



Abb. 1

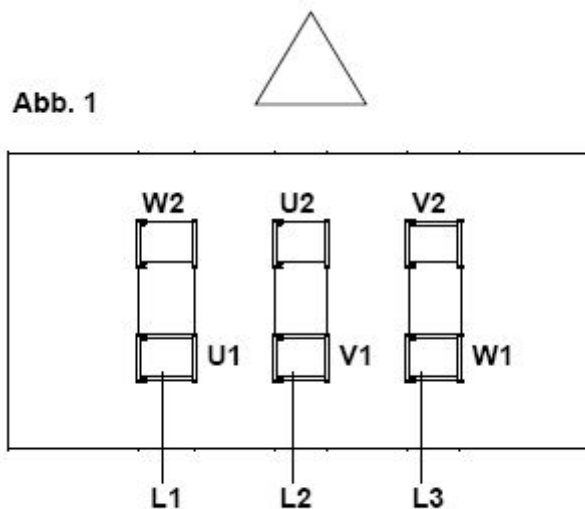
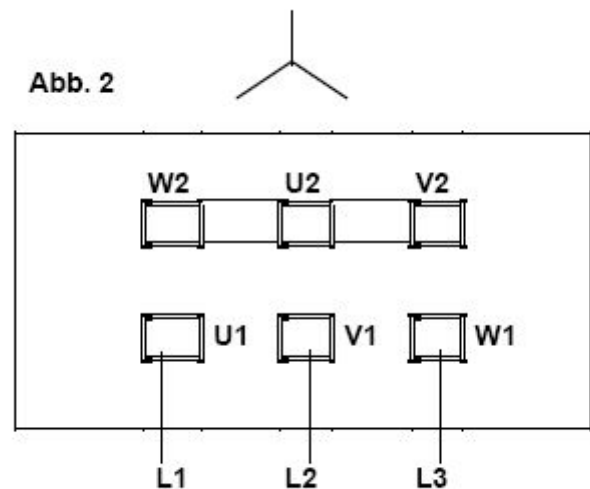


Abb. 2



The direction of rotation can be changed by reversing any two phases.

Use the applicable local regulations to determine the safety values and the cross-sections of connection leads. The motor and, if equipped, starting devices must be connected to protective earth.

Lead fuses protect the cables in case of a short circuit, 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 specified on the type plate of the motor. Operation outside the specified mains voltage and frequency range limits is prohibited.

Take appropriate measures to protect energised parts from being touched by persons and/or interference from foreign objects.

**The operator of the equipment is responsible for ensuring lightning protection.**

Connect the protective earth of the motor to the protective earth on site. Protective earth per DIN VDE 0100 must be connected to the marked earth lead terminal.

#### 4.4.1 Electrical connection temperature switch TSA (accessory)

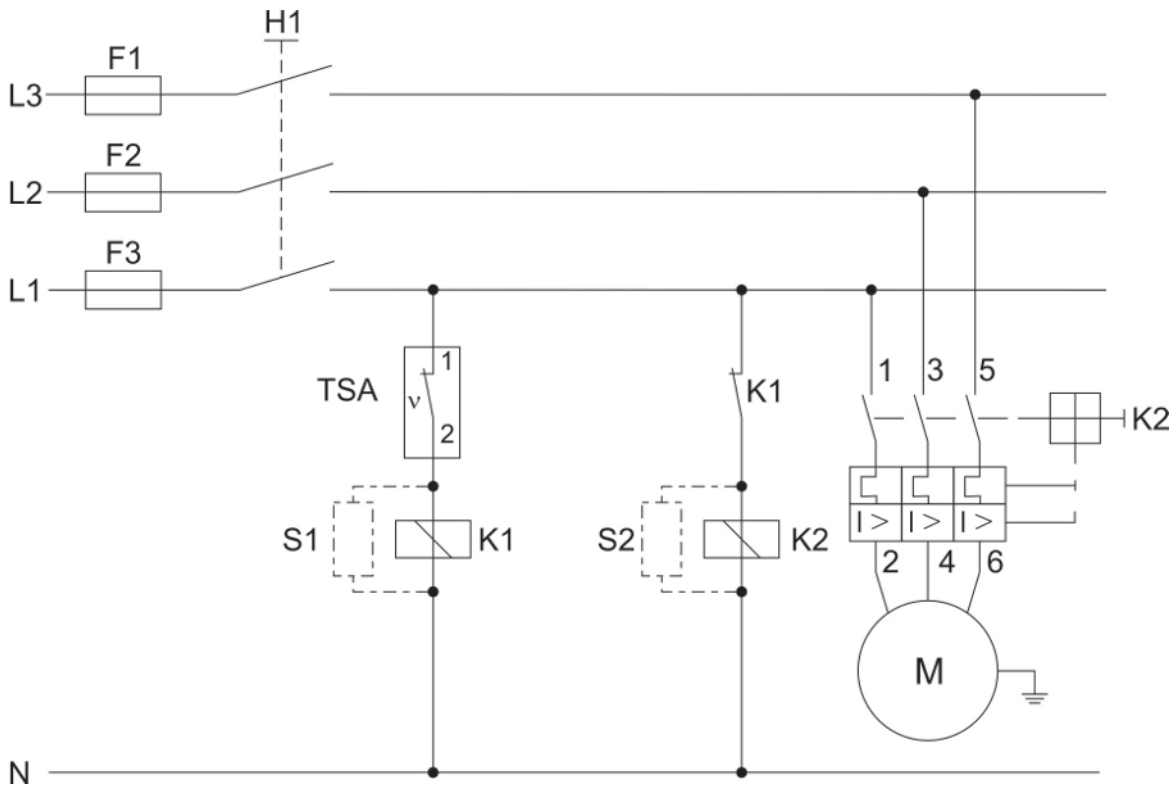
The temperature switch TSA is installed in a cooling circuit with an oil/air cooler ELK as a typical application. Through reaching the switching temperature the fan-motor is switched-on and the oil will be cooled. After falling under the hysteresis the motor shuts off.

If the cooling matrix has an optional temperature contact type TSA, the maximum values (see below) must not be exceeded. If connecting it to a relay, a free wheel circuit has to be added. Carry out the connection according to the following specifications (numbering inside the connector):

Terminal 1–2	Contacts
Terminal 3	Not used
Terminal PE	Protective earth

<b>Temperature switch TSA</b>	T50	switching temperature	50 °C
	T60		60 °C
	T70		70 °C
		max. voltage	230 V AC/D
		max. switching current	2 A, contact load max. 100 VA
		switching function	NC
		Hysteresis	approx. 10 °C
		protection class	IP 65

#### Example wiring with temperature switch



F1 Fuse	K1 Relay
F2 Fuse	K2 Circuit breaker
F3 Fuse	S1 Protecting device
H1 Mains switch	S2 Protecting device

Relay, circuit breaker and protecting devices are not part of the delivery.

## 5 Operation and control

### WARNING



#### Danger due to rotating fan

Injuries to the hand may occur. Do not reach into the safety guard!

### 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 motor is proper electrically connected and 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.

- Before starting any maintenance or repair to the oil circuit, make sure that the device is depressurized. This applies to the threaded plugs as well.
- Avoid environmental pollution (oil spills) during cleaning or maintenance of the oil circuit.
- Use drip pans.

### Noise level

The coolers, which are supplied with an additional circulation pump, have a low noise. If the noise level increases significantly over the listed value, this could be caused through improper installation of the cooler, specially of the suction line. The technical consultants from Bühler Technologies GmbH will be happy to assist you.

## 6 Maintenance

During maintenance, remember:

- The equipment must be maintained by a professional familiar with the safety requirements and risks.
- Only perform maintenance work described in these operating and installation instructions.
- Observe the respective safety regulations and operating specifications when performing any type of maintenance.
- Always use genuine spare parts.

### DANGER



#### Electrical voltage

Electrocution hazard.

- Disconnect the device from power supply.
- Make sure that the equipment cannot be reconnected to mains unintentionally.
- The device must be opened by trained staff only.
- 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.

- Before starting any maintenance or repair to the oil circuit, make sure that the device is depressurized. This applies to the threaded plugs as well.
- Avoid environmental pollution (oil spills) during cleaning or maintenance of the oil circuit.
- Use drip pans.

Under normal operating conditions the aggregates are maintenance free. Preventive maintenance must therefore be routinely carried out by the operating company.

When doing so, please pay attention to:

- Tight screw fittings,
- Tightness,
- Damage to the aggregate (replace damaged parts),
- Abnormal (unusual) noise and vibration,
- Cooler matrix cleanliness. Dirt on the cooler matrix reduces the cooling capacity,
- Check warning labels for legibility and damage.

Electrical connections must be checked annually by a licensed electrician.

The external parts the motors, particularly the cooling ribs and cooling ducts as clean as possible to prevent compromising heat release.

Please note the specified protection against dust and moisture. Pressure cleaning is only permitted if the motor has the respective protection rating.

The motors feature ball bearings sealed on both sides. The grease filling is designed to last for the life of the unit. Greasing is not necessary.

The motor mounts may only be replaced by Bühler Technologies GmbH or a qualified specialist company.

## 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. However, particularly if the air has a high dust and/or oil mist content, the cooling matrices may require regular cleaning.

- First allow the cooling matrix to cool down. Disconnect the motor from the mains and secure it against accidental restarting.
- Depressurize the system and disconnect the piping to the cooling matrix. Place an oil drip pan below the cooling matrix to collect leaking oil.
- Close all connections with plugs to avoid more oil leaking from the matrix.
- Protect the cooling matrix from falling down.
- First remove the fan guard with motor and fan wheel by unscrewing the 4 fastening screws. After removing the four connecting bolts to the box, the cooling element can be loosened and removed.
- Move the cooling matrix to the cleaning area. Be sure not to crush the fins during transport and cleaning.
- The fins can easily be cleaned with compressed air. Carefully direct the stream parallel to the fins.
- Residue can be carefully removed with a pressure washer and degreaser. Rinse with clear water after cleaning.
- After cleaning, remount the cooling matrix in reverse order.
- Ensure the splices are seated correctly.

## 6.2 Cleaning the cooler matrix inside

In the event of deposits in the cooling matrix due to inadequate filtration, you may try to remove these as follows after cleaning the outside:

- Remove the cooler matrix as described in “Cooler matrix cleaning and disassembly”.
- Add degreaser and close all connections of the cooler matrix with plugs.
- After allowing the degreaser to sit for a while, drain and flush the cooler matrix with clean fluid. Dispose of the degreaser and flushing oil as required by law.
- After cleaning, remount the cooler matrix in reverse order.

## 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.

## 6.4 Replacing fan parts

- Disconnect the motor from power and secure against restarting.
- Now disconnect the connecting cable.
- Protect the fan from falling.
- Now loosen the four connecting screws to the box at the tips of the grate.
- You can now carefully remove the fan out the back.
- Insert the new fan in the reverse order. When replacing the fan wheel, the retaining screw of the fan must be installed in the motor shaft using glue to secure the screws.

## 7 Service and repair

This chapter contains information on troubleshooting and correction should an error occur during operation.

Repairs to the unit must be performed by Bühler authorised personnel.

Please contact our Service Department with any questions:

**Tel.: +49-(0)2102-498955** or your agent

For further information about our services and customised maintenance visit <http://www.buehler-technologies.com/service>.

If the equipment is not functioning properly after correcting any malfunctions and switching on the power, it must be inspected by the manufacturer. Please send the equipment inside suitable packaging to:

**Bühler Technologies GmbH**

**- Reparatur/Service -**

**Harkortstraße 29**

**40880 Ratingen**

**Germany**

Please also attach the completed and signed RMA decontamination statement to the packaging. We will otherwise be unable to process your repair order.

You will find the form in the appendix of these instructions, or simply request it by e-mail:

**[service@buehler-technologies.com](mailto:service@buehler-technologies.com)**.

### 7.1 Troubleshooting

Problem/malfunction	Possible cause	Action
Insufficient cooling capacity	– Air temperature higher than specified	– Select a larger cooler model
	– Motor direction of rotation incorrect	– Correct connection, see <a href="#">Electrical connections</a> [> page 7]
	– Motor doesn't start	– Correct connection, see <a href="#">Electrical connections</a> [> page 7]
	– Air flow too low	– Correct connection, see <a href="#">Electrical connections</a> [> page 7]
	– Fins clogged	– Clean per chapter <a href="#">Maintenance</a> [> page 10]
	– Obstructions nearby	– Maintain the minimum clearance
	– Oil flow too low	– Increase oil flow
	– Oil channel clogged	– Clean per chapter <a href="#">Cleaning the cooler matrix inside</a> [> page 11]
	– Oil circuit blocked	– Open valves and cocks

Tab. 1: Troubleshooting

## 8 Disposal

The applicable national laws must be observed when disposing of the products. Disposal must not result in a danger to health and environment.

The crossed out wheelie bin symbol on Bühler Technologies GmbH electrical and electronic products indicates special disposal notices within the European Union (EU).



The crossed out wheelie bin symbol indicates the electric and electronic products bearing the symbol must be disposed of separate from household waste. They must be properly disposed of as waste electrical and electronic equipment.

Bühler Technologies GmbH will gladly dispose of your device bearing this mark. Please send your device to the address below for this purpose.

We are obligated by law to protect our employees from hazards posed by contaminated devices. Therefore please understand that we can only dispose of your waste equipment if the device is free from any aggressive, corrosive or other operating fluids dangerous to health or environment. **Please complete the "RMA Form and Decontamination Statement", available on our website, for every waste electrical and electronic equipment. The form must be applied to the packaging so it is visible from the outside.**

Please return waste electrical and electronic equipment to the following address:

Bühler Technologies GmbH  
WEEE  
Harkortstr. 29  
40880 Ratingen  
Germany

Please also observe data protection regulations and remember you are personally responsible for the returned waste equipment not bearing any personal data. Therefore please be sure to delete your personal data before returning your waste equipment.

## 9 Appendices

### 9.1 Technical data

#### Technical Data

##### Materials/surface protection

Cooling matrix:	Aluminium, powder-coated
Fan hub:	Aluminium, bare
Fan blades:	Glass-reinforced polypropylene (PPG), bare
Ventilation box, guard and motor brackets:	Steel, galvanised, powder-coated
Screw connections:	V2A stainless steel
Hydraulic screw fittings:	Steel, zinc-nickel coated

<b>Colour:</b>	Steel parts: RAL 9005, jet black Motor: RAL9005 jet black or RAL7031 blue grey (special colours on request)
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<b>Surface protection:</b>	Steel parts: ISO 12944, C3 medium Motor: ISO 12944, C2 medium (higher on request)
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<b>Operating fluids:</b>	Mineral oils according to DIN 51524 Gear lubricant according to DIN 51517-3 Oil/water emulsions HFA and HFB according to CETOP RP 77 H Water glycol HFC according to CETOP RF 77 H Phosphoric ester HFD-R according to CETOP RP 77 H
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##### permissible operating pressure

static	max. 21 bar
dynamic	15 bar (at 2 M load cycle, 3 Hz)

<b>Operating oil temperature:</b>	max. 80 °C (higher upon request)
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<b>Ambient temperature:</b>	-20 °C to +40 °C (different ambient temperatures on request)
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<b>max. set-up altitude:</b>	1000 m (higher on request)
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#### Electric motors (others available upon request)

<b>Voltage/frequency:</b>	230/400 V 50 Hz 265/460V 60Hz (special voltages/motor approvals on request)
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<b>Thermal stability:</b>	Class of insulation F, utilisation per class B (higher on request)
---------------------------	--

<b>IP rating:</b>	IP55 (higher on request)
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The motors comply with standards  
IEC 60034, IEC 60072, IEC 60085, EU 2019/1781

### 9.1.1 Basic data

Item no.	Cooler model	Power output		Weight (kg)	Volume (L)	Sound pressure level db(A)*	
		Number of contacts	Rated current			50 Hz	60 Hz
		400 V 50 Hz	460 V 60 Hz	50/60 Hz	50/60 Hz	50 Hz	60 Hz
35ELK10040	ELK100 -50/60Hz	0.09 kW/4-poles/0.31 A	0.1 kW/4-poles/0.3 A	17	1.7	66	70
35ELK20040	ELK200 -50/60Hz	0.12 kW/4-poles/0.37 A	0.14 kW/4-poles/0.37 A	21	1.7	67	71
35ELK30040	ELK300 -50/60Hz	0.25 kW/4-poles/0.66 A	0.29 kW/4-poles/0.67 A	28	2.2	70	74
35ELK40040	ELK400 -50/60Hz	0.37 kW/4-poles/0.92 A	0.43 kW/4-poles/0.91 A	32	3.2	73	77
35ELK50040	ELK500 -50/60Hz	0.75 kW/4-poles/1.75 A	0.86 kW/4-poles/1.68 A	44	3.7	77	81
35ELK60041	ELK600 -50Hz	1.1 kW/4-poles/2.5 A	-	54	4.3	80	-
35ELK60042	ELK600 -60Hz	-	1.3 kW/4-poles/2.5 A			-	83



## 9.1.2 Power and pressure loss graphs

### Performance curves

Tolerance:  $\pm 5\%$

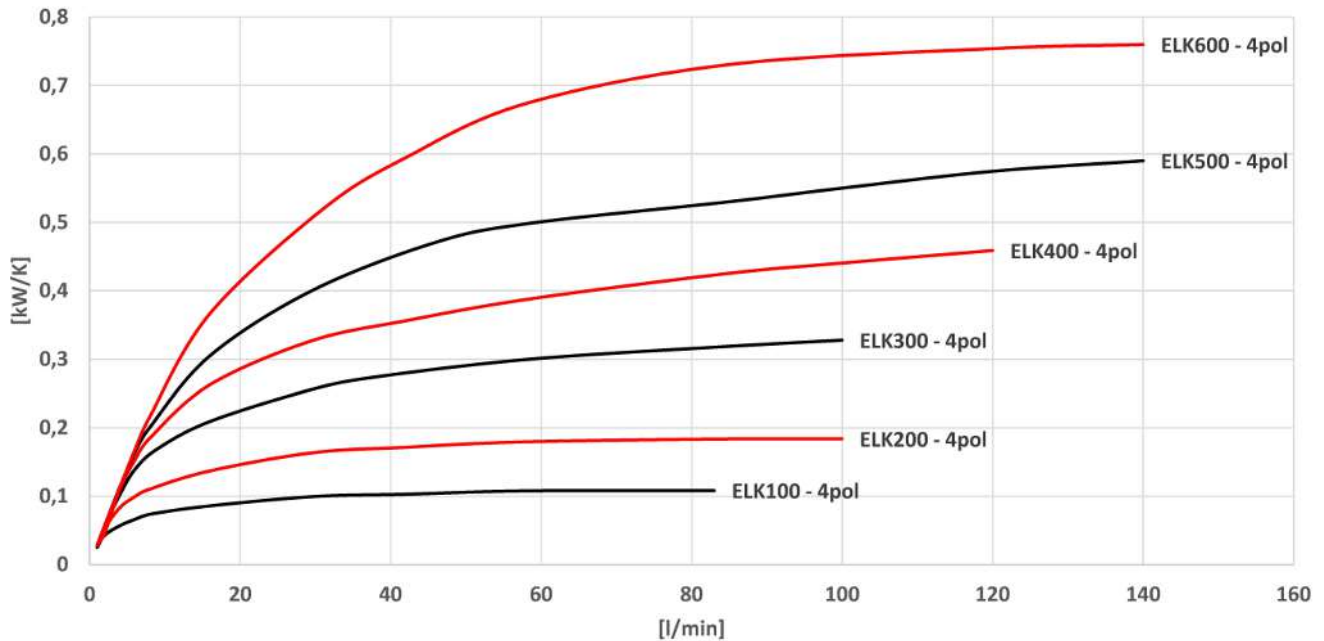


Fig. 1: Specific cooling capacity

### Pressure loss curves at medium viscosity of 30 cSt

Tolerance:  $\pm 5\%$

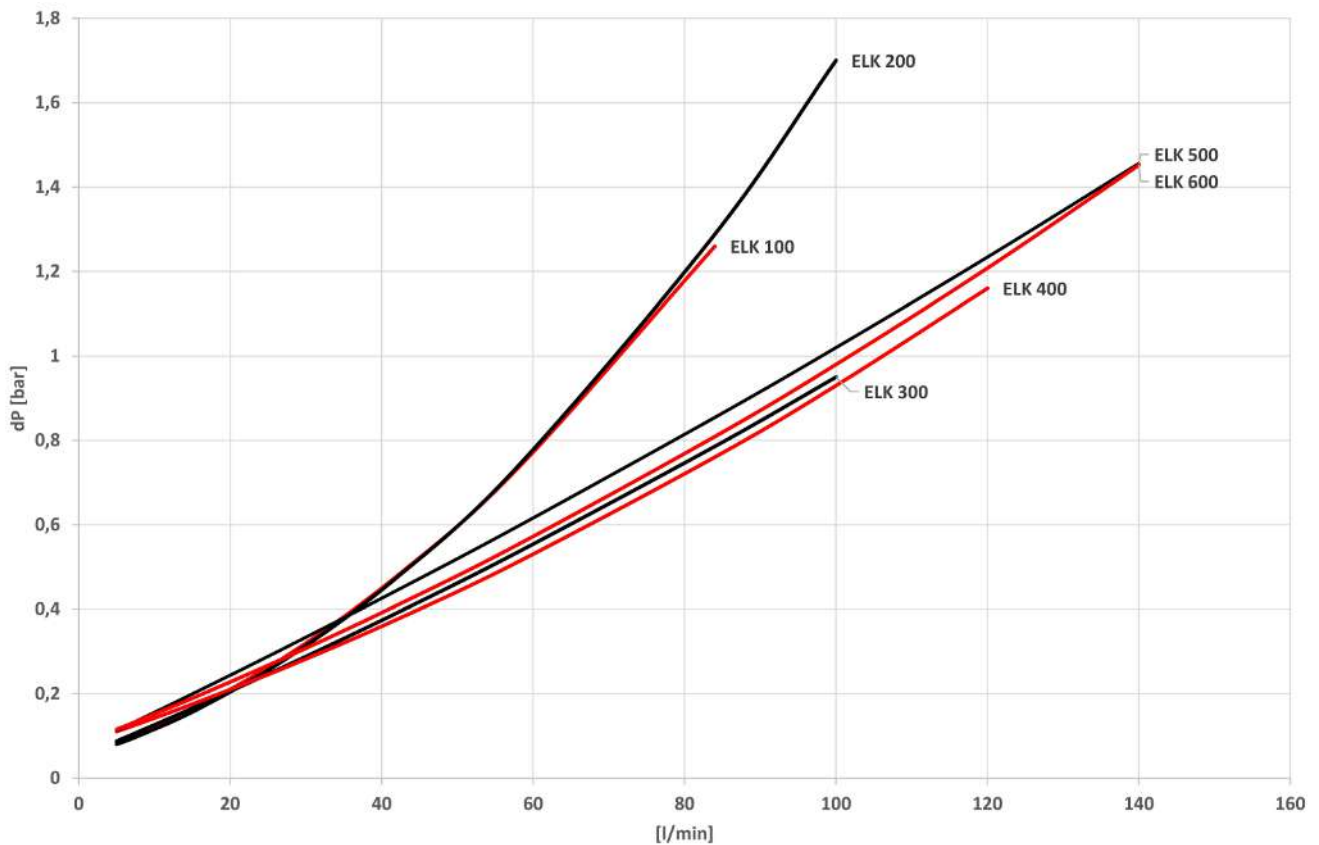
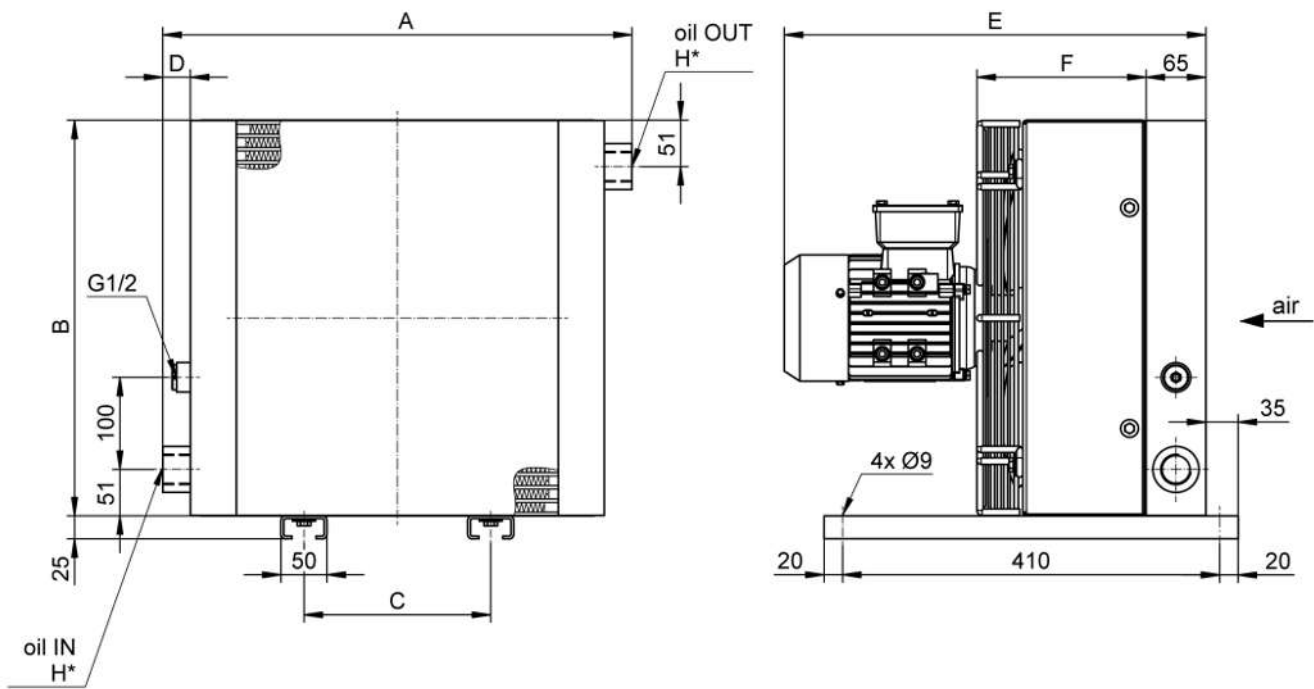


Fig. 2: Pressure loss

Note: When installed outdoors or using higher viscosities, an additional bypass valve may be required. These are not available for the ELK series. In this case, use our BLK series or an external bypass valve.

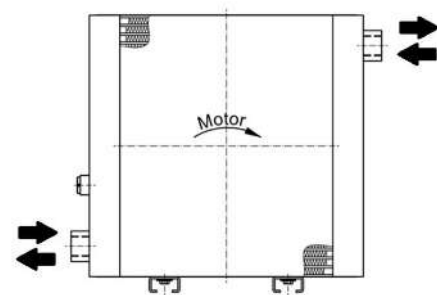
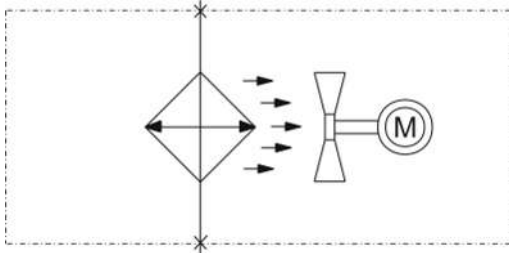
## 9.2 Dimensions



Type	A	B	C	D	E	F	G	H
ELK100	360	290	203	25	390	151	170	2x G3/4"
ELK200	425	355	203	25	402	144	202	2x G3/4"
ELK300	510	430	203	30	458	184	240	2x G1"
ELK400	570	491	203	30	476	202	270	2x G1"
ELK500	630	551	356	30	526	213	300	2x G1"
ELK600	690	611	356	30	606	245	330	2x G1"

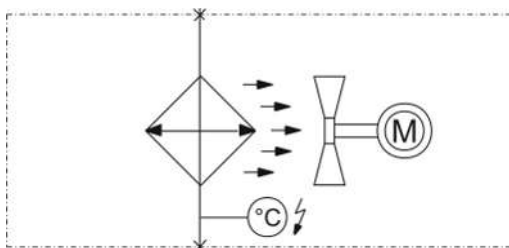
## 9.3 Functional diagram

Standard ELK version



Direction of flow left to right or vice versa.

With temperature switch attached



## 9.4 Installation torques and clamping range for cable fitting

Size	Strain relief clamping range (mm)	Installation torque (Nm)
M12x1,5	3-6	1,5
M16x1,5	5-9,5	2,5
M20x1,5	8-13	3,5
M25x1,5	11-17	5
M32x1,5	15-21	5
M40x1,5	19-28	7,5
M50x1,5	27-35	7,5
M63x1,5	32-42	13

## 9.5 Screw torques

Thread	Torque (Nm)
M5	4
M6	8
M8	15
M10	30
M12	51

## 9.6 Hose torques

Connections/mounts	Torque (Nm)
Hose connections DN20	180
Hose connections DN25	250
Hose connections DN32	350

## 9.7 Calculations

### 9.7.1 Calculating viscosity

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

	Definitions
$V_{40}$	oil viscosity at 40 °C in cst
$T$	temperature in °C
$\nu$	viscosity in cst

	Example: oil VG 46
$V_{40}$	46 cst
$T$	25 °C

$$b = 159 \cdot \ln \frac{V_{40}}{0,23}$$

$$a = 0,23 \cdot e^{\frac{-b}{877}}$$

$$\nu = a \cdot e^{\frac{b}{T+95,2}}$$

$$b = 159 \cdot \ln \frac{46}{0,23} = 842,4325$$

$$a = 0,23 \cdot e^{\frac{-842,4325}{877}} = 0,08801$$

$$\nu = 0,08801 \cdot e^{\frac{842,4325}{25+95,2}} = 97,35 \text{ cst}$$

## 9.7.2 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 (mm<sup>2</sup>/s)

## 9.7.3 Calculating the pressure loss

Valid for smooth straight piping per meter at laminar current.

### Definitions

$\nu$	Viscosity in cst
$\rho$	spec. gravity in kg/dm <sup>3</sup>
DN	tube diameter in mm
$V$	flow in m/s
$PV$	pressure loss in bar

$$PV = \frac{0,32 \cdot \nu \cdot \rho \cdot V}{DN^2}$$

### Example: oil VG 46

$\nu$	97,35 cst
$\rho$	0,8817 kg/dm <sup>3</sup>
DN	20 mm
$V$	3,18 m/s (60 l/min for tube DN 20)

$$PV = \frac{0,32 \cdot 97,35 \cdot 0,8817 \cdot 3,18}{20^2} = 0,22 \text{ bar}$$

### 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 you 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.

## 9.8 Pressure loss in straight pipes

### Pressure loss (bar) per metre in straight tubing with laminar flow of mineral oil:

#### BFP 8 8 l/min – DN 25

	VG 46	VG 68	VG 120	VG 160	VG 220	VG 320	VG 460	VG 680
<b>10 °C</b>	0.03	0.05	0.11	0.17	0.25	0.42	0.68	1.14
<b>20 °C</b>	0.02	0.03	0.05	0.07	0.10	0.16	0.25	0.40
<b>30 °C</b>	0.01	0.01	0.02	0.03	0.05	0.07	0.11	0.17
<b>40 °C</b>	0.01	0.01	0.01	0.03	0.03	0.04	0.05	0.08
<b>50 °C</b>	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.04
<b>60 °C – 100 °C</b>	< 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
<b>10 °C</b>	0.02	0.04	0.08	0.12	0.19	0.31	0.50	0.85
<b>20 °C</b>	0.01	0.02	0.04	0.10	0.08	0.12	0.19	0.30
<b>30 °C</b>	0.01	0.01	0.02	0.05	0.04	0.05	0.08	0.12
<b>40 °C</b>	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06
<b>50 °C</b>	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.03
<b>60 °C – 100 °C</b>	< 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
<b>10 °C</b>	0.04	0.07	0.15	0.22	0.33	0.54	0.88	1.48
<b>20 °C</b>	0.02	0.03	0.06	0.09	0.13	0.21	0.33	0.52
<b>30 °C</b>	0.01	0.02	0.03	0.04	0.07	0.09	0.14	0.22
<b>40 °C</b>	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.10
<b>50 °C</b>	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06
<b>60 °C – 100 °C</b>	< 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
<b>10 °C</b>	0.03	0.06	0.12	0.18	0.28	0.45	0.74	1.24
<b>20 °C</b>	0.02	0.03	0.05	0.08	0.11	0.18	0.27	0.43
<b>30 °C</b>	0.01	0.01	0.03	0.04	0.05	0.08	0.12	0.18
<b>40 °C</b>	0.01	0.01	0.02	0.02	0.02	0.04	0.06	0.08
<b>50 °C</b>	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05
<b>60 °C – 100 °C</b>	< 0.03 bar							

#### BFP 90 86 l/min – DN 40

	LVG 46	VG 68	VG 120	VG 160	VG 220	VG 320	VG 460	VG 680
<b>10 °C</b>	0.05	0.09	0.19	0.27	0.42	0.68	1.11	1.87
<b>20 °C</b>	0.03	0.04	0.08	0.12	0.17	0.26	0.41	0.65
<b>30 °C</b>	0.02	0.02	0.04	0.06	0.08	0.12	0.18	0.27
<b>40 °C</b>	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.13
<b>50 °C</b>	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.07
<b>60 °C – 100 °C</b>	< 0.04 bar							

**Note:** Values in blue exceed the suction operation limit of -0.4 bar.

## 10 Attached documents

- Declaration of Conformity KX350006
- RMA - Decontamination Statement

**EG-/EU Konformitätserklärung**  
**EC/EU Declaration of Conformity**



Hiermit erklärt Bühler Technologies GmbH,  
dass die nachfolgenden Produkte den  
wesentlichen Anforderungen der Richtlinie  
**2006/42/EG**

**(MRL)**

in ihrer aktuellen Fassung entsprechen.

Die Produkte sind Maschinen nach Artikel 2 a).

Folgende Richtlinien wurden berücksichtigt:

*Herewith declares Bühler Technologies GmbH  
that the following products correspond to the  
essential requirements of Directive*

**2006/42/EC**  
**(MD)**

*in its actual version.*

*The products are machines according to article 2 (a).*

*The following directives were regarded:*

**2014/30/EU (EMV/EMC)**  
**2014/35/EU (NSR/LVD)**

**Produkt / products:** Öl-Luft Kühler / *Oil/Air cooler*  
Öl-Nebenstromkühler / *Offline Oil/Air cooler*  
**Typ / type:** ELK  
ENK

Die Betriebsmittel dienen zur Kühlung beziehungsweise Förderung und Luftkühlung von Ölen in  
Hydraulik- und Schmierkreisläufen.  
*The equipment is suited for cooling respectively transportation and air cooling of oils in hydraulic and  
lubrication systems.*

Das oben beschriebene Produkt der Erklärung erfüllt die einschlägigen  
Harmonisierungsrechtsvorschriften der Union:  
*The object of the declaration described above is in conformity with the relevant Union harmonisation  
legislation:*

**EN ISO 12100:2010**  
**EN 55011:2016/A1:2017**

**EN 60204-1:2018**  
**EN ISO 4413:2010**

**EN 61000-6-2:2005/AC:2005**

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller.  
*This declaration of conformity is issued under the sole responsibility of the manufacturer.*

Dokumentationsverantwortlicher für diese Konformitätserklärung ist Herr Stefan Eschweiler mit  
Anschrift am Firmensitz.  
*The person authorised to compile the technical file is Mr. Stefan Eschweiler located at the company's  
address.*

Ratingen, den 01.11.2022

  
Stefan Eschweiler  
Geschäftsführer – *Managing Director*

  
Frank Pospiech  
Geschäftsführer – *Managing Director*

# UK Declaration of Conformity



The manufacturer Bühler Technologies GmbH declares, under the sole responsibility, that the product complies with the requirements of the following UK legislation:

## **Machinery Safety Regulations 2008**

The following legislation were regarded:

## **Electromagnetic Compatibility Regulations 2016**

## **Electrical Equipment Safety Regulations 2016**

**Products:** Oil/Air cooler  
Offline Oil/Air cooler  
**Types:** ELK  
ENK

The equipment is suited for cooling respectively transportation and air cooling of oils in hydraulic and lubrication systems.

The object of the declaration described above is in conformity with the relevant designated standards:

**EN ISO 12100:2010**  
**EN 61000-6-2:2005/AC:2005**  
**EN ISO 4413:2010**

**EN 60204-1:2018**  
**EN 55011:2016/A1:2017**

Ratingen in Germany, 01.11.2022

A handwritten signature in blue ink, appearing to be 'Stefan Eschweiler', written over a horizontal line.

Stefan Eschweiler  
Managing Director

A handwritten signature in blue ink, appearing to be 'Frank Pospiech', written over a horizontal line.

Frank Pospiech  
Managing Director



# RMA-Formular und Erklärung über Dekontaminierung

## RMA-Form and explanation for decontamination



RMA-Nr./ RMA-No.

Die RMA-Nr. bekommen Sie von Ihrem Ansprechpartner im Vertrieb oder Service. Bei Rücksendung eines Altgeräts zur Entsorgung tragen Sie bitte in das Feld der RMA-Nr. "WEEE" ein./ You may obtain the RMA number from your sales or service representative. When returning an old appliance for disposal, please enter "WEEE" in the RMA number box.

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./ 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 employee health.

### Firma/ Company

Firma/ Company

Straße/ Street

PLZ, Ort/ Zip, City

Land/ Country

Gerät/ Device

Anzahl/ Quantity

Auftragsnr./ Order No.

### Ansprechpartner/ Person in charge

Name/ Name

Abt./ Dept.

Tel./ Phone

E-Mail

Serien-Nr./ Serial No.

Artikel-Nr./ Item No.

### Grund der Rücksendung/ Reason for return

- Kalibrierung/ Calibration       Modifikation/ Modification  
 Reklamation/ Claim             Reparatur/ Repair  
 Elektroaltgerät/ Waste Electrical & Electronic Equipment (WEEE)  
 andere/ other

bitte spezifizieren/ please specify

### Ist das Gerät möglicherweise kontaminiert?/ Could the equipment be contaminated?

- Nein, da das Gerät nicht mit gesundheitsgefährdenden Stoffen betrieben wurde./ No, because the device was not operated with hazardous substances.  
 Nein, da das Gerät ordnungsgemäß gereinigt und dekontaminiert wurde./ No, because the device has been properly cleaned and decontaminated.  
 Ja, kontaminiert mit:/ Yes, contaminated with:



explosiv/  
explosive



entzündlich/  
flammable



brandfördernd/  
oxidizing



komprimierte  
Gase/  
compressed  
gases



ätzend/  
caustic



giftig,  
Lebensgefahr/  
poisonous, risk  
of death



gesundheitsge-  
fährdend/  
harmful to  
health



gesund-  
heitsschädlich/  
health hazard



umweltge-  
fährdend/  
environmental  
hazard

### Bitte Sicherheitsdatenblatt beilegen!/ Please enclose safety data sheet!

Das Gerät wurde gespült mit:/ The equipment was purged with:

*Diese Erklärung wurde korrekt und vollständig ausgefüllt und von einer dazu befugten Person unterschrieben. Der Versand der (dekontaminierten) Geräte und Komponenten erfolgt gemäß den gesetzlichen Bestimmungen.*

*This declaration has been filled out correctly and completely, and signed by an authorized person. The dispatch of the (decontaminated) devices and components takes place according to the legal regulations.*

Falls die Ware nicht gereinigt, also kontaminiert bei uns eintrifft, muss die Firma Bühler sich vorbehalten, diese durch einen externen Dienstleister reinigen zu lassen und Ihnen dies in Rechnung zu stellen.

Should the goods not arrive clean, but contaminated, Bühler reserves the right, to commission an external service provider to clean the goods and invoice it to your account.

Firmenstempel/ Company Sign

Datum/ Date

rechtsverbindliche Unterschrift/ Legally binding signature



### Vermeiden von Veränderung und Beschädigung der einzusendenden Baugruppe

Die Analyse defekter Baugruppen ist ein wesentlicher Bestandteil der Qualitätssicherung der Firma Bühler Technologies GmbH. Um eine aussagekräftige Analyse zu gewährleisten muss die Ware möglichst unverändert untersucht werden. Es dürfen keine Veränderungen oder weitere Beschädigungen auftreten, die Ursachen verdecken oder eine Analyse unmöglich machen.

### Umgang mit elektrostatisch sensiblen Baugruppen

Bei elektronischen Baugruppen kann es sich um elektrostatisch sensible Baugruppen handeln. Es ist darauf zu achten, diese Baugruppen ESD-gerecht zu behandeln. Nach Möglichkeit sollten die Baugruppen an einem ESD-gerechten Arbeitsplatz getauscht werden. Ist dies nicht möglich sollten ESD-gerechte Maßnahmen beim Austausch getroffen werden. Der Transport darf nur in ESD-gerechten Behältnissen durchgeführt werden. Die Verpackung der Baugruppen muss ESD-konform sein. Verwenden Sie nach Möglichkeit die Verpackung des Ersatzteils oder wählen Sie selber eine ESD-gerechte Verpackung.

### Einbau von Ersatzteilen

Beachten Sie beim Einbau des Ersatzteils die gleichen Vorgaben wie oben beschrieben. Achten Sie auf die ordnungsgemäße Montage des Bauteils und aller Komponenten. Versetzen Sie vor der Inbetriebnahme die Verkabelung wieder in den ursprünglichen Zustand. Fragen Sie im Zweifel beim Hersteller nach weiteren Informationen.

### Einsenden von Elektroaltgeräten zur Entsorgung

Wollen Sie ein von Bühler Technologies GmbH stammendes Elektroprodukt zur fachgerechten Entsorgung einsenden, dann tragen Sie bitte in das Feld der RMA-Nr. „WEEE“ ein. Legen Sie dem Altgerät die vollständig ausgefüllte Dekontaminierungserklärung für den Transport von außen sichtbar bei. Weitere Informationen zur Entsorgung von Elektroaltgeräten finden Sie auf der Webseite unseres Unternehmens.

### Avoiding alterations and damage to the components to be returned

Analysing defective assemblies is an essential part of quality assurance at Bühler Technologies GmbH. To ensure conclusive analysis the goods must be inspected unaltered, if possible. Modifications or other damages which may hide the cause or render it impossible to analyse are prohibited.

### Handling electrostatically conductive components

Electronic assemblies may be sensitive to static electricity. Be sure to handle these assemblies in an ESD-safe manner. Where possible, the assemblies should be replaced in an ESD-safe location. If unable to do so, take ESD-safe precautions when replacing these. Must be transported in ESD-safe containers. The packaging of the assemblies must be ESD-safe. If possible, use the packaging of the spare part or use ESD-safe packaging.

### Fitting of spare parts

Observe the above specifications when installing the spare part. Ensure the part and all components are properly installed. Return the cables to the original state before putting into service. When in doubt, contact the manufacturer for additional information.

### Returning old electrical appliances for disposal

If you wish to return an electrical product from Bühler Technologies GmbH for proper disposal, please enter "WEEE" in the RMA number box. Please attach the fully completed decontamination declaration form for transport to the old appliance so that it is visible from the outside. You can find more information on the disposal of old electrical appliances on our company's website.

