Fluidcontrol

Off-line filter units

BNF

Installation and Operation Instructions

Original instructions

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08/2022

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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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1 Introduction

1.1 Intended use

BNF Off-line filters are used to filter oil in hydraulic and lubrication circuits. Their scope is given by their specifications. The use in other applications is not permitted without confirmation by Bühler Technologies GmbH.

1.2 Ordering instructions

Off-line filters

Item no.	Type	Description
3802010	BNF 18	without contamination indicator NBR
3802110	BNF 18	mechanical contamination indicator (optional)
3802210	BNF 18	electric contamination indicator NBR
3803020IE3	BNF 30	without contamination indicator NBR
3803120IE3	BNF 30	mechanical contamination indicator (optional)
3803220IE3	BNF 30	electric contamination indicator NBR
3806030IE3	BNF 60	without contamination indicator NBR
3806130IE3	BNF 60	mechanical contamination indicator (optional)
3806230IE3	BNF 60	electric contamination indicator NBR
3809030IE3	BNF 90	without contamination indicator NBR
3809130IE3	BNF 90	mechanical contamination indicator (optional)
3809230IE3	BNF 90	electric contamination indicator NBR

Filter elements

For type	Item no.	Description
BNF 18 / BNF 30	3825003	N 0250 DN 3
	3825006	N 0250 DN 6
	3825010	N 0250 DN 10
BNF 60 / BNF 90	3840003	N 0400 DN 3
	3840006	N 0400 DN 6
	3840010	N 0400 DN 10

1.3 Scope of delivery

- 1 x Off-Line Filter
- 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

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

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.

WARNING

Voltage flashovers

Electrocution hazard
Do not earth the heat exchanger when carrying out welding work!

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

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

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, protect the equipment against moisture and heat. Keep it in a covered, dry and dust-free room at ambient temperature.

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.

When using a filter with visual service indicator, the aggregate must be set up so as not to block the service indicator.

4.2 Aggregate installation

The aggregate mounts to the reservoir cover or a suitable mount with four screws. When installing the aggregate, be sure to maintain the required removal height for removing the filter element. The contamination indicator must be clearly visible.

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.

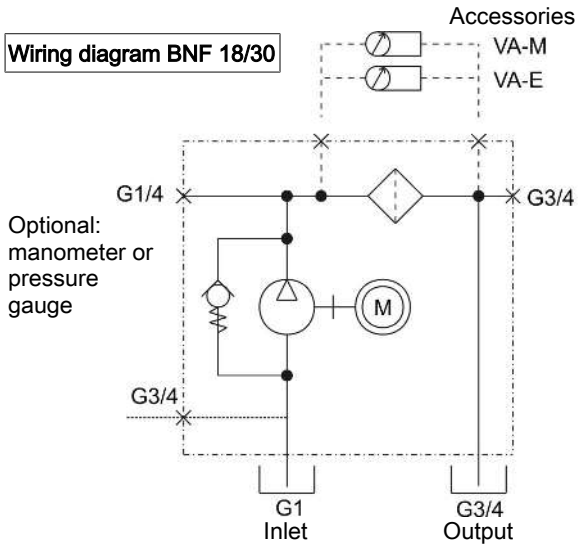
4.2.1 Installing swivel nuts in the fitting body

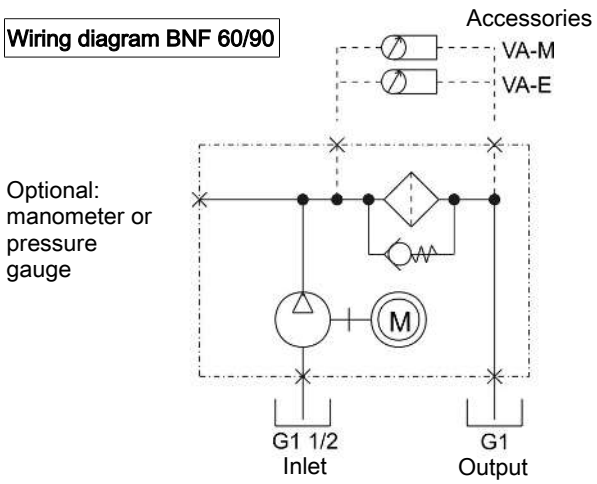
Proceed as follows:

– 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 shown in the wiring diagram. 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 23/19/13 per ISO 4406.

When installing the aggregate onto the reservoir cover, the suction and return pipes immediately go down, vertically, as a straight pipe. Ensure the thread is sealed well, particularly on the suction end, and use the included seals for the aggregate.

When installing the aggregate next to the reservoir or a different location in the system, the suction- and return bores on the underside of the aggregate must first be sealed tightly.

With this installation, the suction pipe must not be small than defined by the present threaded connections. If longer suction pipes are required, the cross-section of the lines may need to be larger so as not to continuously exceed the approved negative suction pressure of max. 0.4 bar.

For proper evacuation of the suction parts it's advisable to fill the pump or the suction pipe with oil prior to initial start-up and for long suction pipes. Add some oil to the empty filter housing will usually suffice. Then briefly run the e-motor with the filter cover open. If the oil level in the filter housing rises, the pump is suctioning properly. Now insert the filter element and close the filter cover. To vent the filter housing, the vent plug in the cover is opened by half a turn. The air should audibly escape and the plug should be screwed back in tightly when oil escapes. Venting is recommended, especially with highly viscous oils, because otherwise cavitation noises can occur in the pump. The unit is now ready for use.

4.4 Electrical connections

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 **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 rotation direction is indicated on the motor housing “M” and an arrow or by an arrow sticker on the motor.

Abb. 1

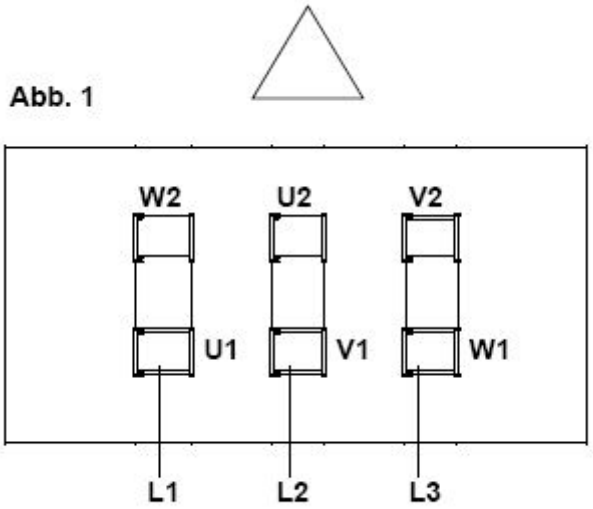
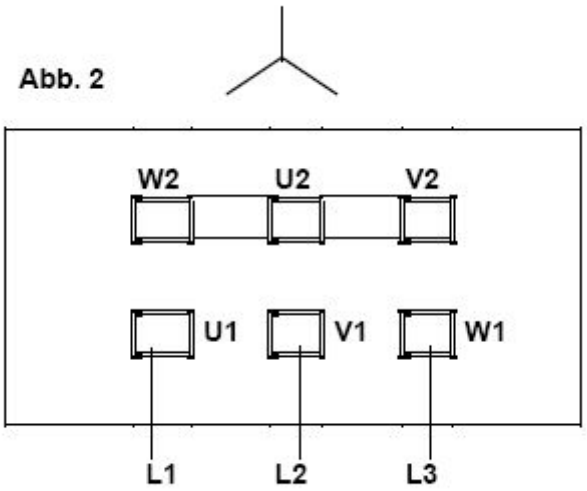


Abb. 2



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 Connecting the electric contamination indicator (optional)

The electric contamination indicator connects via 2-pin connector plug per DIN 43650, with the poles marked 1 and 2.

The top can be attached as an opener or closer by turning by 180°.

4.5 Bypass, contamination indicator

The BNF/BKF 18/30 features a bypass valve which returns the oil flow to the suction line. The BNF/BKF 60/90 has a bypass valve in the filter housing, which opens at a pressure above 3.5 bar.

We recommend retrofitting the bypass unit with a mechanical/electric display to switch the pump off when the filter element reaches its contamination capacity and simultaneously output a visual or electric signal.

5 Operation and control

NOTICE

The device must not be operated beyond its specifications.

5.1 Before start-up

- Check all parts for damage. Do not put a damaged device into operation.
- Verify the connection is correct as described in chapter “Installation and connection”.
- Verify a filter is inside the attached filter housing (the aggregate is delivered without element).
- Check if all valves or other parts which must be open during start-up were opened.

NOTICE

Before starting up a hydraulic system, any contamination from assembly (including in the oil) must be flushed out.

5.1.1 Flushing the reservoir

On smaller oil reservoirs the oil can also be cleaned via off-line filter during start-up.

This is done with the system off, only the off-line filter is on.

During this process the oil should preferably at a minimum be at room temperature. It will heat up further during the cleaning cycle. So long as the oil temperature does not exceed 60 °C, the process may be continued until the oil has reached the desired purity level. Unless otherwise recommended by the system manufacturer, we recommend a minimum purity class of 15/11 per ISO 4406.

Flushing is also required if the oil was added via the off-line filter, since based on the mechanics of the filter only a so-called single pass is performed.

Flushing is also recommended after changing the oil unless the new oil used meets the specified purity class.

Be sure the filter element does not exceed the filtration capacity, which can occur very quickly (within minutes) during flushing. Replace the filter element as described in chapter Replacing the filter element [> page 13] and continue flushing.

After flushing we recommend documenting the purity class achieved through oil analysis.

After flushing the filter element must always be replaced (see chapter Replacing the filter element [> page 13]).

5.2 During starting

First, check that the pump rotates counter clockwise. The direction is marked on the pump housing with M and directional arrow.

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.

Noise level

Our pump is supplied with a low noise. 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.

5.3 Monitoring the filter element

5.3.1 With visual / electric indicator

If the aggregate is equipped with a visual / electric indicator (option), after cold starting you will be able to tell if contamination capacity remains or if the element needs to be replaced. Due to the higher oil viscosity and therefore a higher pressure drop during warm-up depending on how contaminated the filter element is, the red button on the visual indicator will pop out and an electric signal triggered.

Push the red button in again once the operating temperature has been reached. If it is immediately tripped again or the electric signal does not go out after reaching the operating temperature, the filter element will need to be replaced at the end of the shift.

If the contamination indicator indicates a contaminated element during normal operation, it must be replaced no later than at the end of the shift (approx. 8 h).

5.3.2 No contamination indicator

The filter element must be replaced after every system test run or flushing cycle. Then follow the instructions of the system manufacturer.

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.

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.

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,
- 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.

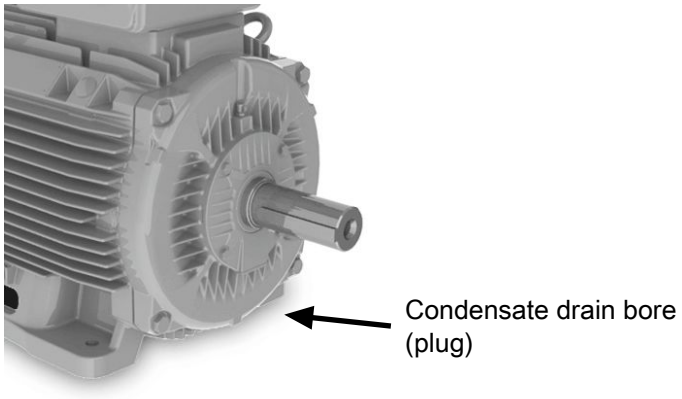
Please note the specified protection against dust and moisture. Pressure cleaning is only permitted if the motor has the respective protection rating.

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.

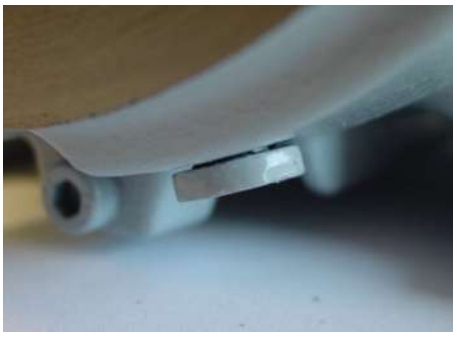
The motor mounts may only be replaced by Bühler Technologies GmbH or a qualified specialist company.

Condensate drain holes at motors from manufacturer WEG

If the motor is used in surrounding with high humidity this could lead, depending on the ambient temperature, to formation of condensate inside the motor housing. Specially at longer nonoperation period. The motors of WEG have a condensate drain plug which can be used for draining off. Pull out the plug according to the pictures and push it then back. If the plug is not pushed back or completely removed, the motor losses the IP degree of protection.



closed position



open position

plug

6.1 Replacing the filter element

- Shut off aggregate and relief the filter on the pressure end.
- Unscrew the filter cover counter-clockwise.
- Remove the filter element to the top by slightly moving it back and forth.
- Check the O-ring inside the filter cover for damage. Replace if necessary. Be sure the spring washer (possibly still attached to the filter element) inside the filter bowl is located above the filter seat at the bottom of the filter bowl.
- Verify the replacement element matches the old element.
- Slide the element over the holder inside the filter bowl.
- Now screw the cover hand tight onto the filter bowl and then turn the cover back a 1/8 turn. The cover is radially sealed and therefore no tightening against the stop is necessary. To vent the filter housing, the vent plug in the cover is opened by half a turn. The air should audibly escape and the plug should be screwed back in tightly when oil escapes.
- Switch the aggregate on again.

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.

7.1 Troubleshooting

Problem / malfunction	Possible cause	Action
Insufficient pump capacity	– Motor direction of rotation incorrect	– Correct connection, see chapter Electrical connections
	– Motor doesn't start	– Correct connection, chapter Electrical connections
	– Oil flow too low	– Increase oil flow
	– Oil circuit blocked	– Open valves and cocks
Loud pump	– Cavitation noises	– Vent the filter housing
	– Negative intake pressure too high	– Select a large enough suction hose
		– Reduce suction lift

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		
Pump housing:	Anodised and impregnated cast aluminium	
Gerotor:	Sintered steel	
Hydraulic screw joint:	Galvanised steel	
Operating fluids:	Mineral oils per DIN 51524	
Operating oil temperature:	max. 80 °C (higher temperatures on request)	
Seal:	Perbunan (NBR) or Viton (FPM) on request	
Ambient temperature:	-20 °C to +40 °C	

Electric motors		
Voltage/frequency	**BNF 18/30:**	220/380 V - 230/400 V - 240/415 V 50 Hz 460 V 60 Hz Electr. motor per NEMA; UL, CSA, EAC approval
	BNF 60/90:	220/380 - 245/420 V 50 Hz 220/380 - 280/480 V 60 Hz no approval
Thermal stability:	Class of insulation F, utilisation per Class B	
Design:	three-phase asynchronous squirrel-cage induction motor totally enclosed, fan cooled	
Degree of protection:	IP55	
on request:	other voltages higher motor power for higher viscosities UL- or CSA-approved motors higher protection class	
The motors comply with standards IEC 60034, IEC 60072, IEC 60085		

Please also observe the operating manual for the motor! All motors are supplied with cable gland inside the terminal box. The total aggregate height may vary by motor make.

Installation information:

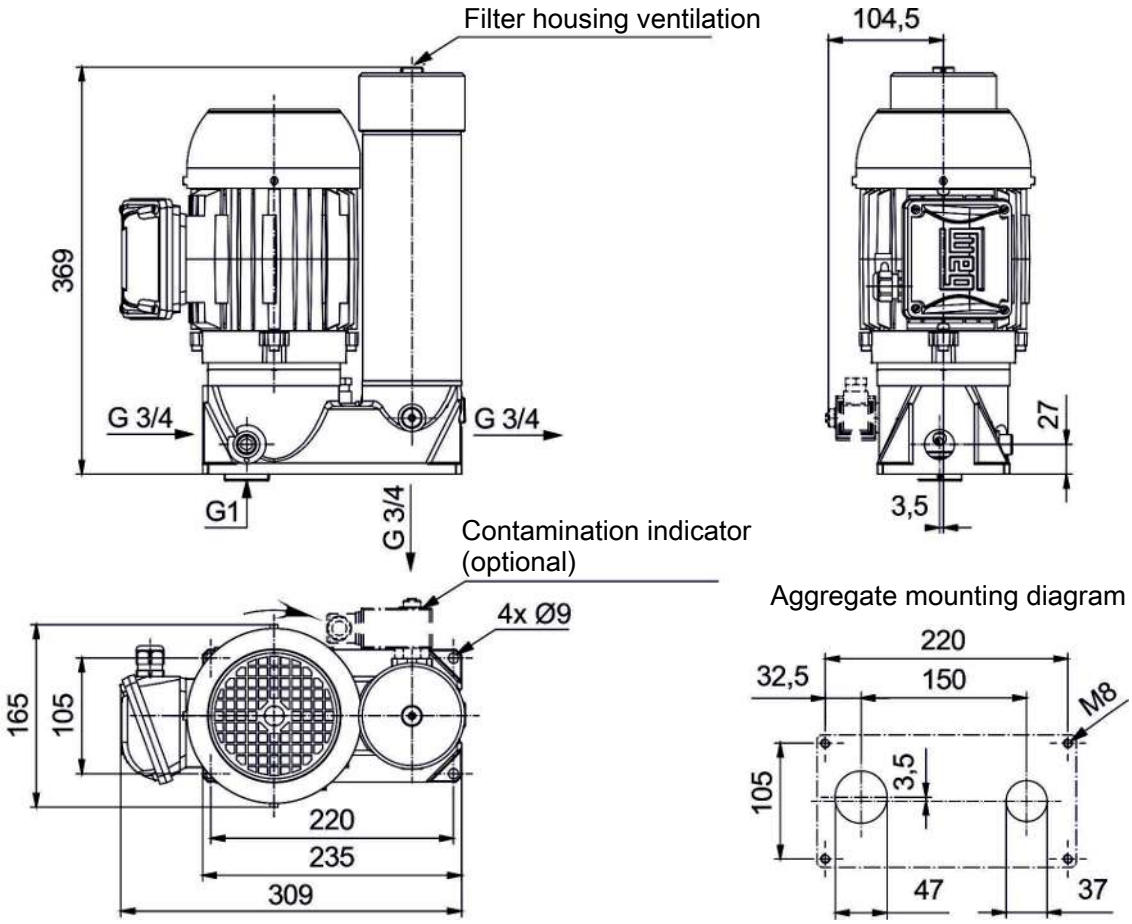
The connection threads are manufactured to ISO 228. The screw-in surfaces are finished and suitable for the use of soft seals. We recommend using screwed plugs per ISO 1179-2.

Please note:

Especially note the dimension of the suction pipe. The cross-sections should not be smaller than specified. In most cases, loud noise indicates the cross-section was reduced too much.

Please refer to the notices in the operating instructions.

9.1.1 BNF 18 / BNF 30



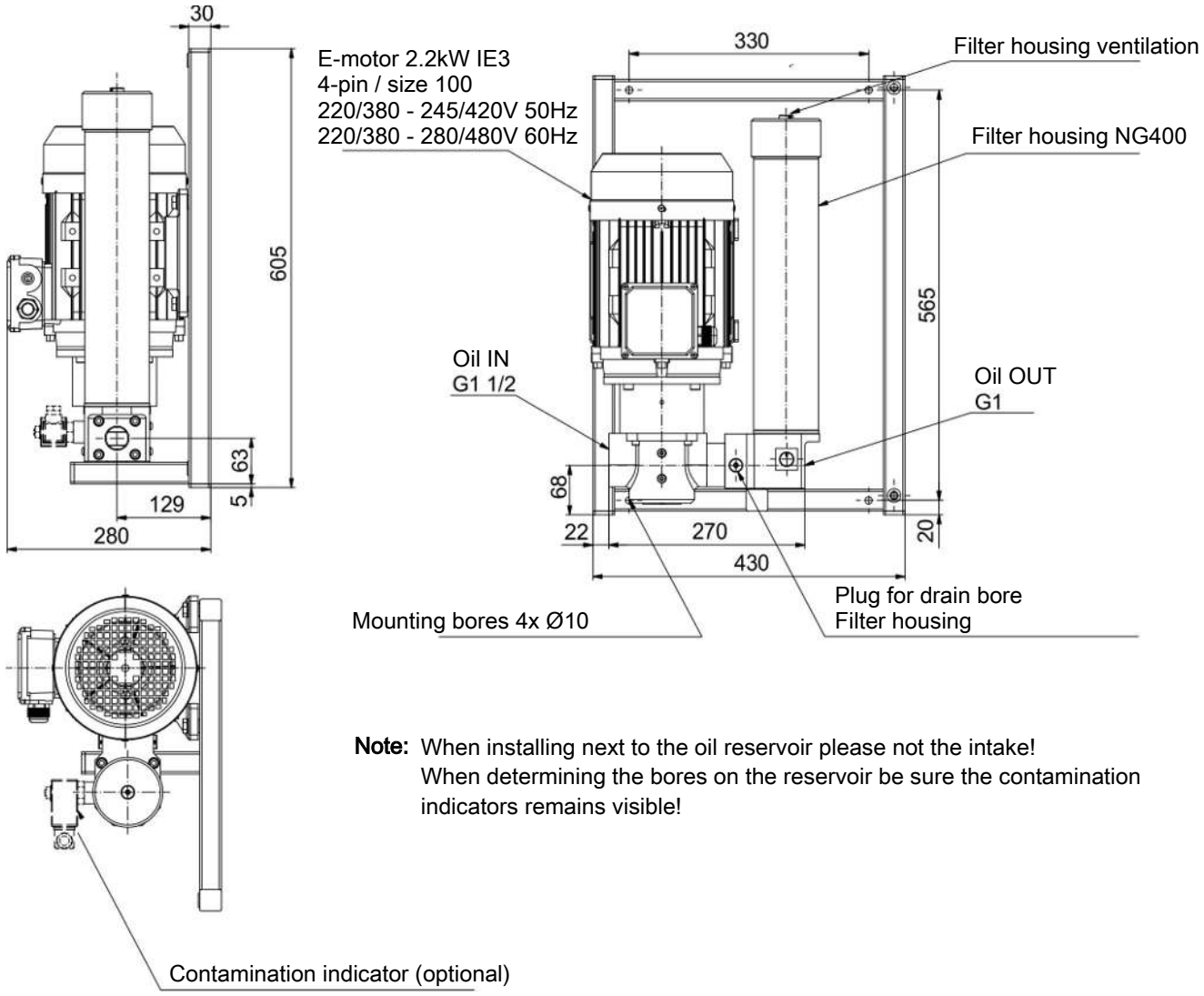
Note: When installing next to the oil reservoir please not the intake!
When determining the bores on the reservoir be sure the contamination indicators remains visible!

Type:	BNF 18-6-0.55*	BNF 30-4-0.75-IE3*
Motor power:	0.55 kW	0.75 kW
Number of poles:	6	4
Power input (400 V 50 Hz):	~ 1.5 A	~ 1.6 A
Suction lift:	2 m	2 m
Display pressure contamination indicator:	2.2 bar	2.2 bar
Suction end connection:	G3/4 / G1	G3/4 / G1
Suction end hose:	DN 20 / DN 25	DN 20 / DN 25
Pressure end connection:	G3/4	G3/4
Pressure end hose:	DN 20	DN 20
Suction pressure:	-0.4 bar	-0.4 bar
For all aggregates briefly:	-0.6 bar	
Flow rate:	18 L/min	28 L/min
max. oil viscosity:	600 cSt	300 cSt
at maximum feed pressure (pressures above open the internal bypass valve):	6 bar	6 bar
Acoustic power as per ISO 3744** (46 cSt at 2 bar feed pressure):	55 dB(A)	59 dB(A)
Weight:	approx. 18 kg	approx. 20 kg

* Electr. motor per NEMA, UL, CSA, EAC approval

** On 60 Hz versions the acoustic power is approx. 3 dB(A) higher.

9.1.2 BNF 60 / BNF 90



Note: When installing next to the oil reservoir please not the intake!
When determining the bores on the reservoir be sure the contamination indicators remains visible!

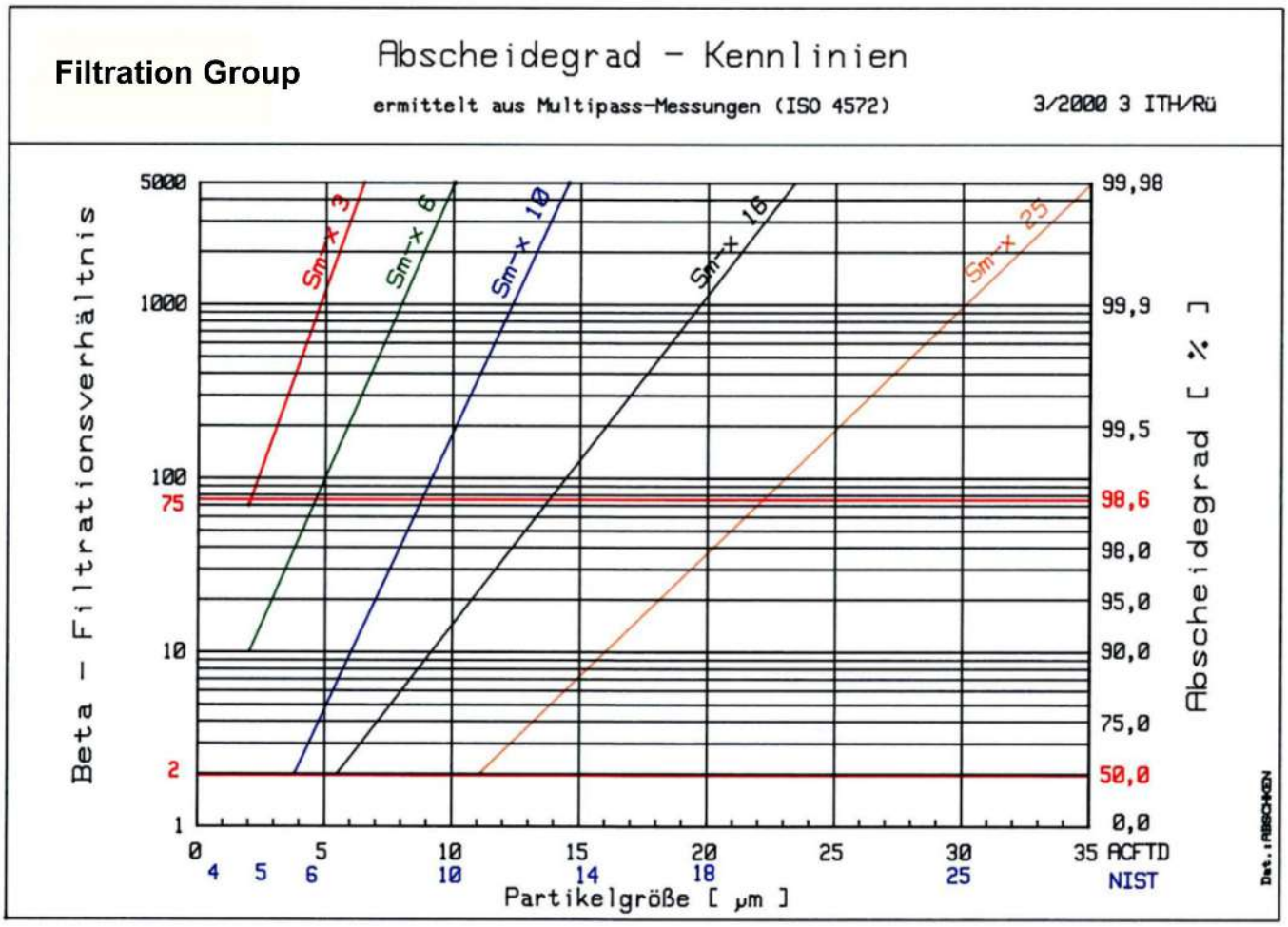
Type:	BNF 60-4-2.2-IE3*	BNF 90-4-2.2-IE3*
Motor power:	2.2 kW	2.2 kW
Number of poles:	4	4
Power input (400 V 50 Hz):	~ 4.6 A	~ 4.6 A
Suction lift:	2 m	2 m
Filter element pressure limit:	3.5 bar	3.5 bar
Display pressure contamination indicator:	2.2 bar	2.2 bar
Suction end connection:	G1 1/2	G1 1/2
Suction end hose:	DN 40	DN 40
Pressure end connection:	G1 1/4	G1 1/4
Pressure end hose:	DN 32	DN 32
Suction pressure:	-0.4 bar	-0.4 bar
For all aggregates briefly:	-0.6 bar	
Flow rate:	57 L/min	86 L/min
max. oil viscosity:	800 cSt	200 cSt
at maximum feed pressure:	8 bar	8 bar
Acoustic power as per ISO 3744** (46 cSt at 2 bar feed pressure):	64 dB(A)	66 dB(A)
Weight:	approx. 34 kg	approx. 35 kg

* On request: Electr. motor per NEMA, UL, CSA, EAC approval.

** On 60 Hz versions the acoustic power is approx. 3 dB(A) higher.

9.2 Selecting the filter fineness

Determining the contamination class per ISO 4406			System type	Recommend filter retention rate	Recommended element
>4 µm	>6 µm	>14 µm			
13	11	8	Highly reliable control systems susceptible to sludge accumulations; laboratory or aerospace	1-2	Sm-N2
14	12	9	High performance servo systems and high pressure systems with a long life; e.g. aviation, machine tool, etc.	3-5	Sm-x3
16	13	10			Sm-x6
17	15	11	High-quality, reliable systems: general machinery construction	10-12	Sm-x10
20	17	12	General machinery construction and vehicles; moderate pressure, moderate capacity	12-15	Sm-x16
23	19	13	General machinery construction and vehicles; low-pressure systems in heavy machinery construction	15-25	Sm-x25 / Mic 10



9.3 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

9.4 Screw torques

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

9.5 Hose torques

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

9.6 Calculations

9.6.1 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
υ	viscosity in cst

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

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

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

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

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

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

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

9.6.2 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^2/s)

9.6.3 Calculating the pressure loss

Valid for smooth straight piping per meter at laminar current.

	Definitions
υ	Viscosity in cst
ρ	spec. gravity in kg/dm^3
DN	tube diameter in mm
V	flow in m/s
PV	pressure loss in bar

	Example: oil VG 46
υ	97,35 cst
ρ	0,8817 kg/dm^3
DN	20 mm
V	3,18 m/s (60 l/min for tube DN 20)

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

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

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.

9.7 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
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

	LVG 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							

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

10 Attached documents

– Declaration of conformity KX380001
– 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.

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

2006/42/EC
(MD)

in its actual version.

Die Produkte sind Maschinen nach Artikel 2 a).

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

Folgende Richtlinien wurden berücksichtigt:

The following directives were regarded:

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

Produkt / products: Kühl-/Filteraggregat / Nebensstromfilteraggregate
cooling filter / Off-line filter

Typ / type: BNF, BKF

Die Betriebsmittel dienen zur Kühlung und Filterung von Ölen in Hydraulik-und Schmierkreisläufen.
The equipment is suited for cooling and filtering 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 60204-1:2018
EN ISO 4413:2010
EN 61000-6-2:2005/AC:2005
EN 61000-6-3:2007/A1:2011

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*

KX 38 0001

Bühler Technologies GmbH, Harkortstr. 29, D-40880 Ratingen,
Tel. +49 (0) 21 02 / 49 89-0, Fax. +49 (0) 21 02 / 49 89-20
Internet: www.buehler-technologies.com

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:	Cooling filter
	Off-line filter
Types:	BNF
	BKF

The equipment is suited for cooling and filtering of oils in hydraulic and lubrication systems.

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

EN 60204-1:2018
EN 61000-6-3:2007/A1:2011
EN 61000-6-2:2005/AC:2005
EN ISO 4413:2010

Ratingen in Germany, 01.11.2022

Stefan Eschweiler
Managing Director

Frank Pospiech
Managing Director

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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	

Ansprechpartner/ Person in charge

Name/ Name	
Abt./ Dept.	
Tel./ Phone	
E-Mail	

Gerät/ Device	
Anzahl/ Quantity	
Auftragsnr./ Order No.	

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	☐ gesundheitsgefährdend/ harmful to health	☐ gesundheitsschädlich/ health hazard	☐ umweltgefährdend/ 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 comission an external service provider to clean the goods and invoice it to your account.

Firmenstempel/ Company Sign

Datum/ Date

rechtsverbindliche Unterschrift/ Legally binding signature

Bühler Technologies GmbH, Harkortstr. 29, D-40880 Ratingen
Tel. +49 (0) 21 02 / 49 89-0, Fax: +49 (0) 21 02 / 49 89-20
E-Mail: service@buehler-technologies.com
Internet: www.buehler-technologies.com

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 assembles 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.

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