BÜHLER TECHNOLOGIES

Gas Analysis

Sample gas pumps

P2.x AMEX

Installation and Operation Instructions

Original instructions

BE420003
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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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Contents

1 Introduction

1.1 Intended use

P2.x AMEX sample gas pumps are intended for installation in gas analysis systems for industrial applications to transport gaseous media only. They are not suitable for liquids. The sample gas pumps are not designed to be used outdoors without protection from weather effects.

The AMEX versions are suitable for use in Class I, Div. 2, Groups B, C, D, temperature classes T3/T3C; they are not suitable for use in dusty areas.

The complete designation of the P2.x AMEX sample gas pump is:

NI / I / 2 / BCD / T3, T3C

CL.I Div.2 Gr BCD T3, T3C

DANGER! Explosion hazard when used in explosive areas

The sample gas pumps must not be used in dusty areas or in areas other than the designated explosive area.

If the specifications in these operating instructions are observed, in particular the temperature parameters in the technical data, the P2.x AMEX sample gas pumps can convey non-flammable and also flammable gaseous media, which can occasionally be explosive in normal operation.

The delivery of highly particle-laden, explosive gas mixtures can lead to a dangerous electrostatic charge in the bellows/pump body. Install particle filtration with the appropriate fineness upstream from the pump gas input. For the P2.x AMEX-O2 versions in particular, we recommend a filter fineness of <10 µm.

The maximum surface temperature varies according to the medium and ambient temperatures. Please refer to the technical data in the Appendices [> page 31] to see the correlation between media temperature, ambient temperature and the pump's temperature class.

The pump head and the drive motor on the P2.4 AMEX/P2.84 AMEX sample gas pump are isolated for use in hot applications. The sample gas pump has a split adapter which can be mounted with one half inside a heated cabinet while the other half mounted on the outside supports the drive motor. In doing so, wall thicknesses of up to 30 mm can be bridged without additional modifications.

Applications where sample gas is still moist can result in condensation in the lines and the pump body. In these cases, the pump head must be suspended (see item Alteration of hanging pump bodies).

Sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2) are optimised especially for use with increased oxygen concentrations with regard to the parts in contact with the medium. Only BAM (Federal Institute for Materials Research) tested materials are used. Special cleaning of the components to minimise organic and inorganic contamination is mandatory. Manufacturing the products under controlled cleanliness conditions ensures compliance with the limit values in accordance with EIGA Doc 33/18.

Sample gas pumps P2.x AMEX-H2 (item no.: 42.....-H2) are specially refined using advanced manufacturing measures, in particular to prevent hydrogen-induced component damage. In addition, the parts in contact with the media are subjected to an additional visual inspection to remove any residual metallic contamination, such as chips and particles. Finally, a leak test is carried out as standard.

Please note the information in the Appendices [> page 31] to this manual on the specific intended use, existing material combinations, as well as pressure and temperature limits of the various models. In addition, please also note the specifications and markings on the nameplates.

1.2 Specific conditions of use

It is the responsibility of the installer to ensure that the combination of ambient temperature and process heating does not exceed the maximum specified ambient temperature rating of 40 °C at the motor.

1.3 Item number structures

This unit is available in various versions. Please refer to the type plate for the specific version.

In addition to the order number or ID number, the type plate also contains the item number with a code, where each character (x) represents specific equipment:

P2.x AMEX

42	xx	x	x	x	x	x	9	0	0	0	Product characteristics	
											Base model	
	71										P2.2 AMEX 400 l/h (direct operation without intermediate flange)	
	72										P2.4 AMEX 400 l/h (with intermediate flange)	
	73										P2.82 AMEX 800 l/h (direct operation without intermediate flange)	
	74										P2.84 AMEX 800 l/h (with intermediate flange)	
											Motor voltage	
		7									230 V 50/60 Hz 0.8/0.7 A	
		8									115 V 50/60 Hz 1.6/1.5 A	
											Pump head position	
			1								Normal position vertical	
			2								turned by 180° [1]	
											Pump head material	
				1							PTFE	
				2							Stainless steel 1.4571	
				3							PTFE with bypass valve [1]	
				4							Stainless steel 1.4571 with bypass valve [1]	
											Valve material	
					1						up to 100 °C; PTFE/PVDF [2]	
					2						up to 140 °C; PTFE/PEEK	
											Screw-in connections (depending on pump body)	
											PTFE pump body	**Stainless steel pump body**
						9					1/4"–1/6" (standard)	1/4" (standard)
						1					DN 6/8	8 mm
						2					3/8"–1/4"	3/8"
						3					1/4"–1/8"	
						5					DN 4/6	6 mm
											Mounting accessories	
							9				incl. mounting bracket and bumpers [1]	

[1] not possible with P2.4 AMEX or P2.84 AMEX.

[2] not possible with P2.4 AMEX, P2.82 AMEX, or P2.84 AMEX.

P2.x AMEX-H2/-O2

42	xx	x	x	x	x	x	9	0	0	0	x	Product characteristics	
												Base model	
	71											P2.2 AMEX 400 l/h (direct operation without intermediate flange)	
	72											P2.4 AMEX 400 l/h (with intermediate flange)	
												Motor voltage	
		7										230 V 50/60 Hz 0.8/0.7 A	
		8										115 V 50/60 Hz 1.6/1.5 A	
												Pump head position	
			1									Normal position vertical	
			2									turned by 180° [1]	
												Pump head material	
				2								Stainless steel 1.4571	
				4								Stainless steel 1.4571 with bypass valve [1] [2]	
												Valve material	
					2							PTFE/PEEK [2]	
												Screw-in connections (varies by application)	
												For -H_2 (stainless steel)	**For -O_2 (stainless steel)** [3]
						0						N/A	no screw-in connection
						9						1/4"	1/4"
						1						8 mm	8 mm
						5						6 mm	6 mm
												Mounting accessories	
							9					incl. mounting bracket and bumpers [1]	
												Area of application	
											-H2	optimised for high-purity hydrogen	
											-O2	optimised for high-purity oxygen	

[1] not possible with P2.4 AMEX.

[2] For O_2-BAM-tested materials version.

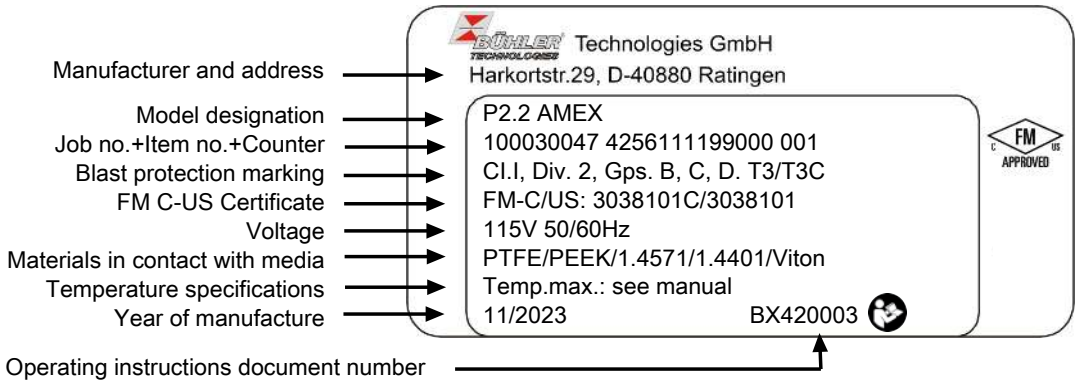
[3] For O_2version, cleaned fittings are enclosed in a separate bag. BAM-tested PTFE sealing tape required [see accessories].

Any special features applicable to a pump model are described separately in the operating manual.

When connecting, please note the specific values of the pump, and the correct version when ordering spare parts (e.g.: valve).

1.4 Type plate

Example:



1.5 Scope of delivery

P2.2 / P2.82 AMEX	P2.4 / P2.84 AMEX
1 x Sample gas pump with motor	1 x Pump body with intermediate flange
4 x Rubber-metal bumpers	1 x Motor
1 x Mounting bracket	1 x Coupling flange
Product documentation	1 x Coupling
	1 x Mounting ring
	Product Documentation

2 Safety instructions

2.1 Important advice

This unit may only be used if:

- the product is being used under the conditions described in the operating- and system instructions, used according to the nameplate and for applications for which it is intended. Any unauthorized modifications of the device will void the warranty provided by Bühler Technologies GmbH,
- complying with the specifications and markings in the type plate,
- complying with the threshold values specified in the data sheet and the instructions,
- monitoring equipment / protection devices are connected correctly,
- service and repair work not described in these instructions are performed by Bühler Technologies GmbH,
- genuine spare parts are used.

These operating instructions are a part of the equipment. The manufacturer reserves the right to change performance-, specification- or technical data without prior notice. Please keep these instructions for future reference.

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

These instructions include the following warnings:

	General warning sign		Warning against hand injuries
	Voltage warning		General mandatory sign
	Warning not to inhale toxic gases		Unplug from mains
	Warning of corrosive substances		Wear respiratory equipment
	Warning of explosion hazard		Wear a safety mask
	Warning of hot surfaces		Wear gloves

2.2 General hazard warnings

This product has no dangerous ignition sources when observing regulations and operating parameters in these operating instructions. Installation into a complete system can pose new hazards the manufacturer of this sample gas pump has no control over. If necessary, perform a risk assessment of the complete system this product will be installed into.

Observe the relevant national safety regulations for the installation site and the generally applicable state of the art when configuring and building the complete system. These can be determined through applicable harmonised standards, e.g. **EN 60079-14** among others. Additional national regulations pertaining to initial operation, operation, maintenance, repairs, and disposal must be observed.

Avoid any exothermic reactions in your system, do not use materials with a catalytic effect in the conveyor lines. Dangerous rises in temperature may otherwise occur. Sample gas pump materials in contact with mediums are specified in this operating manual to facilitate the safety assessment.

Adiabatic compression is part of the physical operating principle of bellows pumps. Dangerous rises in temperature cannot be ruled out when exceeding the operating parameters.

Avoid these dangerous conditions. If necessary, protect the entire system against flashback. Follow these notes and the applicable national regulations and prevent malfunctions to avoid personal injury and property damage.

The operator of the system must ensure:

- The equipment is installed by a professional familiar with the safety requirements and risks,
- Safety notes and operating instructions are available and observed,
- The permissible data and operating conditions are observed,
- Protective devices are used and the required maintenance is performed,
- The unit is disposed according to the law.

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.

DANGER

Danger of explosions, danger of poisoning from poisonous corrosive gases

During maintenance work, depending on the medium used, explosive and/or poisonous corrosive gases could escape, and this could lead to a danger of explosion or could be hazardous to health.

a) Inspect the leak tightness of your sampling system before putting the device into operation.

b) Ensure that gases that are hazardous to health are discharged safely.

c) Turn off the gas supply before beginning any maintenance or repair work and flush the gas lines with inert gas or air. Secure the gas supply so that it cannot be turned on unintentionally.

d) Protect yourself during maintenance from poisonous / corrosive gases. Wear appropriate protective equipment.

DANGER

Explosion hazard

Life and explosion risk may result from gas leakage due to improper use.

a) Use the devices only as described in this manual.

b) Regard the process conditions.

c) Check tubes and hoses for leakage.

DANGER

Adiabatic compression (explosion hazard)!

In case of adiabatic compression, high gas temperatures may occur. The operator is responsible to consider this situation.
Make sure to obey the allowed technical specifications and ambient conditions (see data sheet), take special attention to the media temperature with respect to temperature class T3 or T3C. These vary in addition to gas composition and ambient conditions. Where necessary, the operator must install temperature sensors for monitoring and must automatically shut down the sample gas pump should the temperature exceed the limits.

DANGER

DANGER - Explosion danger in case of high temperatures

Temperature of the device depends on the medium temperature. Correlation between medium temperature and **temperature classes** is given in the data sheets.
Observe maximum temperature classes T3 or T3C for the pumps and the allowed ambient temperatures and medium temperatures.

DANGER

Diffusing pumped media
Explosion hazard! Formation of explosive atmosphere due to escaping flammable gases.
When operating the sample gas pumps with media that tend to diffuse strongly, such as hydrogen (H_2) in high concentrations, it is essential to note that these are not permanently technically leak-proof due to their design. To ensure safe operation, the official regulations for installation and operation must be observed. In addition to regular leakage checks, suitable technical measures such as gas monitoring devices, technical ventilation, etc. must be provided depending on the installation situation.

CAUTION

Hot surface

Burning hazard
According to the product type and operation conditions, the temperature of the housing may exceed 50 °C during operation.
Depending on the conditions at the installation site it may be necessary to provide these areas with appropriate warning signs.

CAUTION

Tipping hazard

Equipment damage.
Secure the device against tipping, sliding and falling.

3 Transport and storage

Only transport the product inside the original packaging or a suitable alternative.

The equipment must be protected from moisture and heat when not in use. It must be stored in a covered, dry and dust-free room at a temperature between -20 °C and +40 °C (-4 °F to 104 °F). To avoid bearing damage, ensure a vibration-free environment (v eff<0.2 mm/s).

Outdoor storage is **not** permitted. In principle, the operator must meet all applicable standards with respect to preventing damage due to lightning, which could result in damage to the sample gas pump.

Especially with sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2), any contamination of components in contact with the media must be ruled out.

Storage areas must not contain any equipment generating ozone, e.g. fluorescent lighting, mercury vapour lamps, high-voltage electrical equipment.

After prolonged storage or downtimes, test the insulation resistance of the winding, phase against phase and phase against mass, prior to initial operation. Moist windings can cause current leaks, flashovers and breakdown. The insulation resistance of the stator winding must be at least 1.5 MΩ measured at a winding temperature of 20 °C (68 °F). Values below this require the winding to be dried.

The motor shaft should be turned occasionally to ensure the entire bearing remains lubricated. To do so, remove the three cross-tip screws (9) from the console cover (8). This exposes the crank gear (10). You can now turn the motor shaft on it.

For the item numbers, please refer to the assembly drawing 42/025-Z02-01-2 in the appendix.

CAUTION	**Contusion hazard**
	Contusion of the fingers Don’t have your fingers caught between eccenter and slide.

4 Installation and connection

Check the equipment for damage before installation. Among other things, this could be a damaged housing, supply cables, etc.. Never use equipment with obvious damage.

DANGER

Diffusing pumped media
Explosion hazard! Formation of explosive atmosphere due to escaping flammable gases.
When operating the sample gas pumps with media that tend to diffuse strongly, such as hydrogen (H_2) in high concentrations, it is essential to note that these are not permanently technically leak-proof due to their design. To ensure safe operation, the official regulations for installation and operation must be observed. In addition to regular leakage checks, suitable technical measures such as gas monitoring devices, technical ventilation, etc. must be provided depending on the installation situation.

CAUTION

Use appropriate tools

According to DIN EN 1127-1, the operator is responsible to select and use appropriate tools.

CAUTION

Contamination of cleaned components

With sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2), contamination with oil, grease, dust, particles, lint, hair, etc. must be ruled out for fire protection reasons when working on components that come into contact with media. If necessary, adapt your operational and organisational measures with regard to the work clothing to be used, hygiene regulations, etc. If necessary, move such work to a suitable, cleaner work area.

CAUTION

Unit leakage rate

With sample gas pumps P2.x AMEX-H2 (item no.: 42.....-H2), the leakage rate is tested at the factory to verify compliance with defined limit values. This may deviate after loosening or retightening cap screws and/or pipe fittings. Carry out a new test if necessary.

4.1 Requirements to the installation site

CAUTION

Equipment damage

Protect the equipment, particularly gas connections and gas lines, from dust, falling objects, as well as external blows.
Lightning
On principle, the operator must meet all applicable standards with respect to preventing damage to the equipment due to lightning, which could result in equipment damage.

CAUTION

Avoid vibrations and resonances

The operator is responsible to mount the pump in a way that vibrations and resonance do not cause premature failure resulting in creating an effective ignition source.

The sample gas pump must be assembled and connected as well as disassembled in a non-Ex zone with the unit cooled down.

Never block the vent. The exhaust air, including from adjacent units, must not be immediately suctioned in.

When installing without a Bühler mounting bracket, ensure adequate distance between the motor and the back panel (at least 40 mm).

The sample gas pumps are rated for altitudes <= 1000 m. They're available in various styles, and the specific technical data may vary. Therefore, always note all device-specific data on the pump and motor type plate, along with their specific limits – see Technical Data.

4.1.1 Outdoor installation

The sample gas pumps were not specifically designed for outdoor setup. The operating and environmental conditions are crucial for the required types of protection and any additional measures required, such as:

– adequate protection from the weather
– Adjusting the maintenance intervals (e.g. cleaning and replacing wear parts)

Use suitable measures and regular inspections to prevent damage to the equipment from e.g.:

– Corrosion
– Sunlight (temperature peaks and damage from UV rays)
– Moisture from condensation (e.g. due to rapid temperature changes or downtimes)
– Icing
– Insects and microbes
– other animals, e.g. martens, etc.

Please remember that all technical operating parameters of the equipment must also be met with outdoor installation. Specifically:

– Maximum or minimum operating temperatures
– Degree of protection

4.2 Installation

CAUTION	**Damage to the device**
	Protect the device, especially the gas inlets and tubes, against dust, falling parts and external impact.

P2.2 AMEX/P2.82 AMEX

When installing the P2.2 AMEX/P2.82 AMEX on mounting plates, use the mounting bracket included and only use the rubber/metal bumpers included. Operation without rubber/metal bumpers is prohibited. These must also be used when installing the pump on an existing substructure. For the hole pattern in the mounting bracket and the motor foot, please refer to the Technical Data at the end of the operating and installation instructions.

P2.4 AMEX/P2.84 AMEX

Please refer to assembly drawing **42/025-Z02-02-2** when installing the P2.4 AMEX/P2.84 AMEX sample gas pump. Before beginning the installation, ensure that the sample gas pump is complete. You will also require 6 x M6 bolts of suitable length and nuts for installation.

The pump head on all pump types can only be aligned turned by 0° or 180°.

4.3 Special condition moist sample gas

Applications where the sample gas is still moist may result in condensate forming in line and the pump body. In these events the pump head must be suspended (pump body facing down).

If the pump was not ordered this way, it can easily be converted on site.

Install the line between the gas output and condensate drain with a grade so the condensate can drain and does not collect inside the pump or the lines.

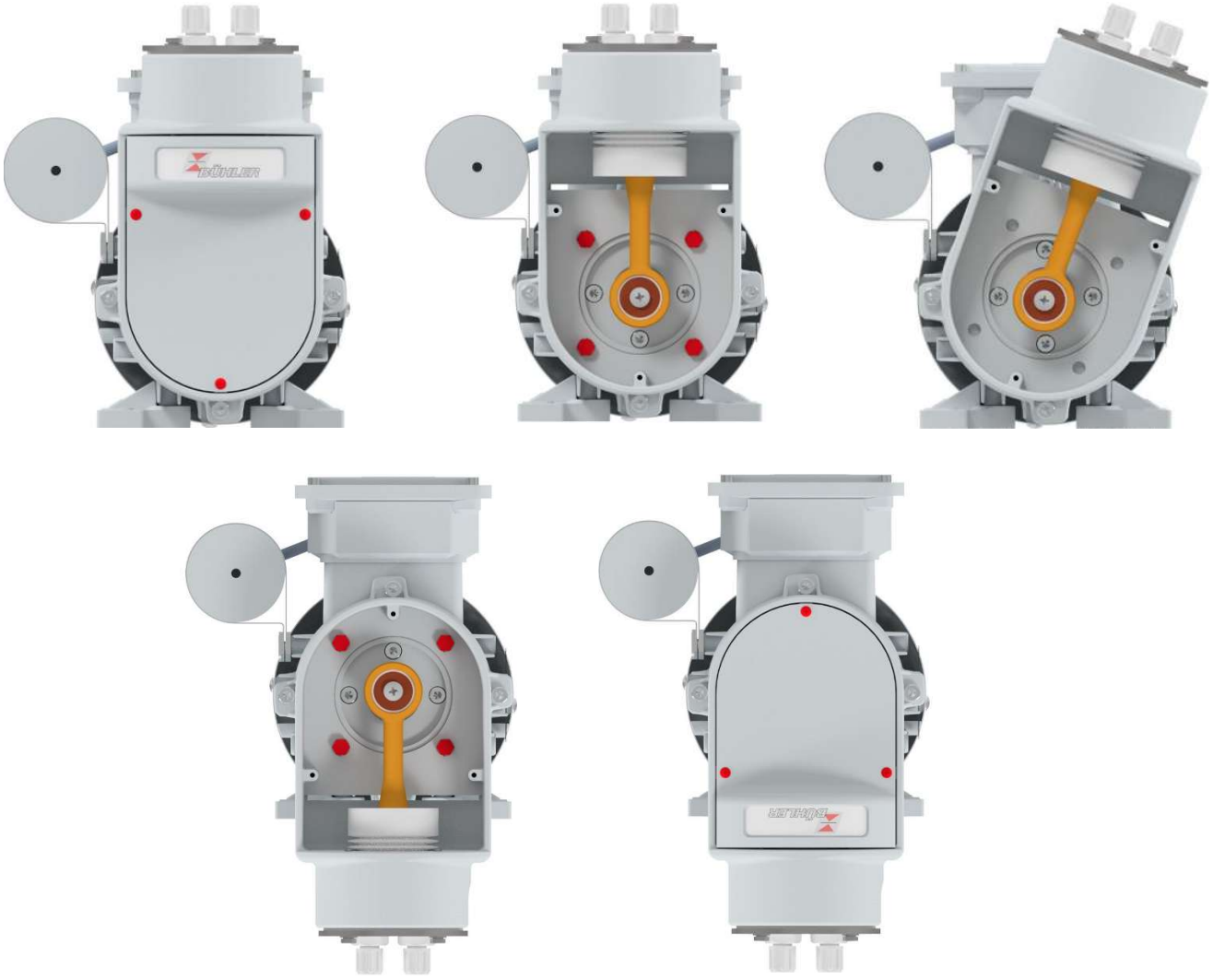
4.3.1 Alteration of hanging pump bodies

CAUTION	**Damage to the device**
	Especially with pump head pointing down, make sure that no dust or small parts can intrude the pump through the ventilations slot. Nevertheless, the slot must not be covered directly. If this is not possible, the pump must not be mounted with pump head pointing downward.

Please refer to assembly drawing 42/025-Z02-01-2 in the appendix for the conversion.

- Remove the three cross-tip screws (9) and remove the console cover (8) from the pump console (5). This exposes the crank gear (10) and the Motor flange or, depending on pump model, the intermediate flange.
- The Pump console attaches to the flange with four hexagon screws (7) and lock washers (6). Completely unscrew these, holding the pump console, and rotate it 180° on the centring of the flange.
- Reinstall all parts in the reverse order. Please note the torque of the hexagon screws (7) is 3 Nm.

Installing the pump head offset by 90° is prohibited!



4.4 Connecting the gas tubes

The pumps are fitted with the connections you have selected (not pre-assembled for sample gas pumps P2.x AMEX-O2). Compare the item number on the type plate with the item number structure in the Introduction [> page 2].

Avoid mixed-material installation, i.e. piping on plastic bodies. If this cannot be avoided in isolated applications, screw the metal connections into the PTFE pump body with care, taking care to avoid use of force.

Lay the lines so that the line at the inlet and outlet remains flexible for an adequate distance (pump vibrates).

The pumps are marked **“In”** for inlet and **“Out”** for outlet. Ensure that the gas line connections are tight.

With sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2), only RT fittings (tapered thread) are supplied by the factory as separately packaged accessories. These must be fitted with $_2$PTFE sealing tape approved for O applications (see Spare parts and accessories [> page 29]).

4.4.1 Monitoring the sample gas pump

NOTICE

When following preventive maintenance according to the maintenance plan, a crack in the bellows is a rare malfunction, but cannot be completely eliminated.

NOTICE

If the bellow cracked, turn the pump off immediately!

NOTICE

If flammable gases (even above upper explosion limit (UEL)) or toxic gases are supplied, continuous monitoring of the pump is mandatory.

DANGER

Explosion hazard, danger of poisoning!

A crack in the bellows when conveying flammable or poisonous gasses may allow explosive or poisonous gas mixtures to leak or develop.
Monitor the pump with a flow- and/or vacuum monitoring system (see flow diagram).
If a pump defect occurs, shut it off immediately.

4.4.1.1 General monitoring measures

Since a crack **in the bellow allows** the ambient atmosphere to be sucked in and the sample gas pump continues to generate pressure, **the bellows of the sample gas pumps must be inspected regularly.**

In addition, the flow rate of the pump (to the sample gas outlet) must be monitored with a suitable flow meter.

For more information or Inspecting the bellow the maintenance schedule, please refer to the chapter Maintenance at the end of the operating and installation instructions.

4.4.1.2 Monitoring measures when conveying flammable and/or toxic gasses

Conveying flammable and/or toxic gasses **further requires** continuous monitoring **of the sample gas** pump during operation. This can be done as follows (1) or (2).

1. Flow rate monitor before the pump's gas inlet and after the gas outlet. A sudden reduction of the suction volume / flow volume ahead of the pump and consistent or suddenly increased flow volume after the pump indicates a defective bellow (the pump can convey ambient air suctioned in due to the tear).
2. Vacuum monitoring before the pump's gas inlet and flow monitoring after the gas outlet (see illustration). A sudden drop in the vacuum before the gas inlet indicates a defective bellow.

When conveying flammable gasses above the upper explosive limit (UEL) we further recommend monitoring the lower explosive limit (LEL) in the installation location.

When conveying toxic gasses we recommend MAC monitoring (MAC: Maximum Workplace Concentration) at the installation site.

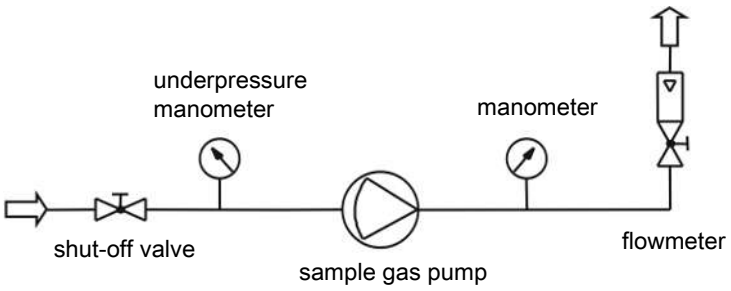


Fig. 1: Sample flow diagram of suitable monitoring

4.5 Electrical connections

WARNING	**Hazardous electrical voltage** The device must be installed by trained staff only.

WARNING	Inverter operation is forbidden!

WARNING	Regard National directives concerning installation and operation of electrical devices in hazardous areas when installing and commissioning the motor (e. g. EN 60079-14).

CAUTION	**Wrong mains voltage** Wrong mains voltage may damage the device. Regard the correct mains voltage as given on the type plate.

Only operate the unit with the factory-installed motor. The user must not exchange the unit or replace it with a different motor.

The sample gas pump must be protected against prohibited heating with suitable overload protection (protective motor switch following approval).

Please note the rated current for the protective switch settings (see motor type plate).

Verify that the pump motor has the correct voltage and frequency: Voltage tolerance ±5 %, frequency tolerance ±2 % – from rated value.

Properly connect the sample gas pump as shown in the corresponding wiring diagram (see below). If the wiring diagram inside the cover of the terminal box is different, consult that instead.

The terminal box has a Ø22 mm bore for installing a 1/2" NPT cable fitting as per NEC Standard requirements. Ensure the connecting cable has adequate strain relief.

The supply line and earth cross-sections must be adjusted to the rated current. Use a minimum line cross-section of 1.5 $mm.^2$.

Be sure to connect the following protective earth terminals to your on-site earth conductor in line with local regulations:

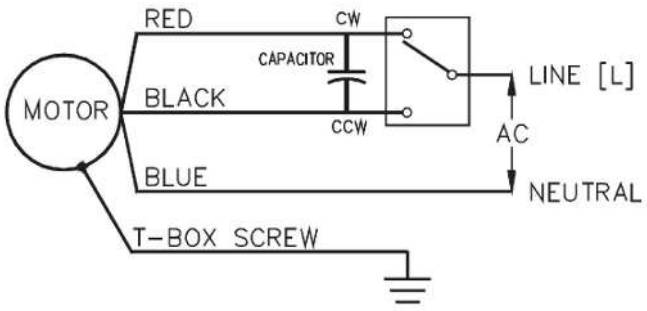
– Protective earth terminal inside the motor terminal box.
– Protective earth terminal on the mounting bracket.

Stray electrical currents must not be allowed to flow through this connection.

There must be no foreign objects, contaminants, or moisture inside the junction box.

To maintain the IP rating specified by the manufacturer, ensure that the original seal is correctly seated and tighten the bolts at 1.6–2 Nm when sealing the terminal box with the cover.

Be sure to observe any deviating information on the rating plate. The conditions at the site must correspond with all rating plate information.



5 Operation and control

NOTICE

The device must not be operated beyond its specifications.

DANGER

Danger of explosions, danger of poisoning from poisonous corrosive gases

During maintenance work, depending on the medium used, explosive and/or poisonous corrosive gases could escape, and this could lead to a danger of explosion or could be hazardous to health.

a) Inspect the leak tightness of your sampling system before putting the device into operation.

b) Ensure that gases that are hazardous to health are discharged safely.

c) Turn off the gas supply before beginning any maintenance or repair work and flush the gas lines with inert gas or air. Secure the gas supply so that it cannot be turned on unintentionally.

d) Protect yourself during maintenance from poisonous / corrosive gases. Wear appropriate protective equipment.

DANGER

Adiabatic compression (explosion hazard)!

In case of adiabatic compression, high gas temperatures may occur. The operator is responsible to consider this situation.
Make sure to obey the allowed technical specifications and ambient conditions (see data sheet), take special attention to the media temperature with respect to temperature class T3 or T3C. These vary in addition to gas composition and ambient conditions. Where necessary, the operator must install temperature sensors for monitoring and must automatically shut down the sample gas pump should the temperature exceed the limits.

DANGER

Dangerous electrostatic charge (explosion hazard)

Transporting materials such as very dry, particle-loaded gases can cause incendive electrostatic charges in the bellow / pump body.
Install particle filtration with the appropriate fineness upstream from the pump gas input. For the P2.x AMEX-O2 versions in particular, we recommend a filter fineness of <10 µm.

DANGER

Diffusing pumped media
Explosion hazard! Formation of explosive atmosphere due to escaping flammable gases.
When operating the sample gas pumps with media that tend to diffuse strongly, such as hydrogen (H_2) in high concentrations, it is essential to note that these are not permanently technically leak-proof due to their design. To ensure safe operation, the official regulations for installation and operation must be observed. In addition to regular leakage checks, suitable technical measures such as gas monitoring devices, technical ventilation, etc. must be provided depending on the installation situation.

CAUTION

Hot surface

Burning hazard
According to the product type and operation conditions, the temperature of the housing may exceed 50 °C during operation.
Depending on the conditions at the installation site it may be necessary to provide these areas with appropriate warning signs.

5.1 Switching on the sample gas pump

Before switching on the unit, check that:

- the hose and electrical connections are correctly installed and not damaged.
- no parts of the sample gas pump have been removed (e.g. the cover).
- the gas inlet and outlet of the sample gas pump are not closed.
- the pre-pressure is below 0.5 bar (g).
- a bypass is installed for continuous operation for throttling below 150 l/h (P2.x AMEX) or 400 l/h (P2.8x AMEX).
- ambient parameters are complied with.
- rating plate information is observed.
- the voltage and frequency of the motor match the mains values.
- electrical connections are securely connected and monitoring devices are connected and set correctly!
- air inlets and cooling surfaces are clean.
- precautions have been taken; earthing!
- the motor is properly secured!
- the junction box cover is closed and the cable glands sealed properly.
- the elastomer ring gear on the coupling (only P2.4 AMEX/P2.84 AMEX) is mounted correctly and undamaged.
- the necessary safety and monitoring devices, depending on the application, are installed and functional (e.g. protective motor switch, pressure gauge, flame arrester, temperature monitor, depending on pump type).
- the sample gas pump is sufficiently tight, as specified in your operator specifications. If necessary, tighten the 4 cap screws to 3 Nm.

When switching on the unit, check that:

- there is no unusual noise or vibration.
- the flow rate is not elevated or low. This can indicate a bellow defect.

5.2 Operating the sample gas pump

The sample gas pump is intended exclusively for the pumping of gaseous media. It is not suitable for liquids.

The sample gas pump should be operated without pre-compression. A preliminary pressure of more than 0.5 bar is not permitted. The gas outlet must not be shut. The flow rate must be at least 50 l/h for the P2.x AMEX and at least 200 l/h for the P2.8x Amex pumps. In the event of throttling under 150 l/h for the P2.x AMEX and under 400 l/h for the P2.8x Amex pumps in continuous operation, the flow rate must be regulated via a bypass. In this case you should choose a version with bypass valve.

NOTICE

Extreme throttling reduces the life time of the bellow.

For pumps with an integrated bypass valve, the output power can be adjusted. Do not expend a great amount of power when turning the valve as otherwise the valve could be damaged! The turning range of the valve is around seven rotations.

NOTE: Read and observe the maintenance plan!

6 Maintenance

When performing maintenance work on the unit, the unit must be cooled down and in a non-Ex zone. In particular, cleaning work with compressed air may only be carried out in a non-Ex zone.

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.

With sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2), there are special requirements for avoiding contamination when carrying out maintenance work:

- Only use cleaned and undamaged tools. We recommend cleaning with a lint-free cloth, ideally pre-soaked with a mixture of isopropanol and demineralised water for residue-free degreasing.
- Only use cleaned, original spare parts (see sections Spare Parts [> page 29] and Spare parts and accessories [> page 29]).
- Do not use any parts whose original packaging is damaged.
- The use of compressed air is only permitted if it corresponds to at least class 2 in accordance with ISO 8573-1:2010.

NOTICE

Please refer to the assembly drawings in the appendix when carrying out 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.

DANGER

Danger of explosions, danger of poisoning from poisonous corrosive gases

During maintenance work, depending on the medium used, explosive and/or poisonous corrosive gases could escape, and this could lead to a danger of explosion or could be hazardous to health.

a) Inspect the leak tightness of your sampling system before putting the device into operation.

b) Ensure that gases that are hazardous to health are discharged safely.

c) Turn off the gas supply before beginning any maintenance or repair work and flush the gas lines with inert gas or air. Secure the gas supply so that it cannot be turned on unintentionally.

d) Protect yourself during maintenance from poisonous / corrosive gases. Wear appropriate protective equipment.

DANGER

Use appropriate tools

According to DIN EN 1127-1, the operator is responsible to select and use appropriate tools.

Application in explosive atmosphere

Combustible gases and dust may inflame or explode. Avoid the following hazardous situations:

Electrostatic charge (spark formation)

Clean plastic parts and labels with damp cloth only.

Spark formation

Protect the equipment against external impact.

Install a flame arrester in case of a flashback hazard.

Inflame of dust

If the device is used in dust ambiance, remove the layer from the components regularly. Also remove the dust layer in areas difficult to access (see chapter "Cleaning").

Conserve the protective effect of the coating

To avoid potential ignition hazard, the protective effect of the coating must not be derogated by abrasion or corrosive media and must be conserved in any case.

Refinishing or repainting is not allowed!

Do not use sharp or pointed tools.

DANGER

Explosion hazard due to incorrect replacement of components

The replacement of the components requires carefulness. Inexpert operation could lead to explosion.

If you feel uncertain about any details of the operation, please bear in mind that the replacement should be done by the manufacturer only.

DANGER

Diffusing pumped media

Explosion hazard! Formation of explosive atmosphere due to escaping flammable gases.

When operating the sample gas pumps with media that tend to diffuse strongly, such as hydrogen (H_2) in high concentrations, it is essential to note that these are not permanently technically leak-proof due to their design. To ensure safe operation, the official regulations for installation and operation must be observed. In addition to regular leakage checks, suitable technical measures such as gas monitoring devices, technical ventilation, etc. must be provided depending on the installation situation.

CAUTION

Hot surface

Burning hazard

According to the product type and operation conditions, the temperature of the housing may exceed 50 °C during operation.

Depending on the conditions at the installation site it may be necessary to provide these areas with appropriate warning signs.

CAUTION

Tipping hazard

Equipment damage.

Secure the device against tipping, sliding and falling.

CAUTION

Gas leakage

The sample gas pump should not be dismantled under pressure.

CAUTION

Contamination of cleaned components

With sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2), contamination with oil, grease, dust, particles, lint, hair, etc. must be ruled out for fire protection reasons when working on components that come into contact with media. If necessary, adapt your operational and organisational measures with regard to the work clothing to be used, hygiene regulations, etc. If necessary, move such work to a suitable, cleaner work area.

Depending on the quality of the sample gas being transported, you may need to occasionally replace the inlet and outlet valves (see Replacing the inlet and outlet valves).

If the valves are very dirty, particularly after just a short period of operation, you should install a particle filter upstream from the pump. This will significantly extend service life.

Depending on the operating conditions, the following must be checked at suitable intervals (see Maintenance schedule).

– check the cleanliness of terminal compartments and terminals, and clean if necessary.
– ensure the electrical connections are tight.
– clean the cooling air ducts of the motor.
– perform a circumferential backlash test and a visual inspection of the ring gear.

The motor's suction intakes and cooling surfaces must be protected from clogging and dirt.

6.1 Maintenance schedule

Component	Interval in operating hours	Work to be performed	To be performed by
Pump body screws	After 500 h	Tighten screws to 3 Nm	Customer
Complete pump	Every 500 h	Check hose connections, protective and control devices, proper function, dirt, tightness. Replace if damaged or have them repaired by Bühler Technologies.	Customer
Complete pump	Every 8000 h or under high dust load	Clean the entire pump, see Cleaning the pump console [> page 24].	Customer
Valves	Every 8,000 h or if pressure drops	Check valves, replace valves if necessary, see Replacing the inlet and outlet valves	Customer
Bellow	Every 4,000 h or 6 months	Check by shutting off the suction pipe. Repair if damaged, see Inspecting the bellow + Replacing bellow and connecting rod-eccentric-combination	Customer
Complete pump	After 43,800 h or 5 years	Inspection by Bühler Technologies GmbH Item number see Order number for the 43.800h inspection	Service technician/ Bühler Technologies GmbH
Coupling P2.4/P2.84 AMEX	After 2000 h or 3 months, then every 4000 h or 6 months	Initial elastomer ring gear inspection, see Inspecting and replacing the flexible spider	Customer

Also observe the motor manufacturer's maintenance instructions. The manufacturer information can be found in the enclosed documents.

Important information about sample gas pumps for O_2applications

P2.x AMEX-O2 (item no.: 42.....-O2):

Despite all precautions (gloves, cleaned tools, etc.) and the greatest possible care, it cannot be guaranteed when maintenance work is carried out by a Bühler service technician in the field that the product will be made equivalent to a newly manufactured O_2unit. In addition to the individual environmental conditions that we cannot assess, we cannot assess the actual condition of the products to be serviced. For a full warranty, all parts in contact with the media must be replaced under defined production conditions at the Bühler-Technologies GmbH plant.

6.2 Inspecting the bellow

NOTICE

When following preventive maintenance according to the maintenance plan, a crack in the bellows is a rare malfunction, but cannot be completely eliminated.

NOTICE

If the bellow cracked, turn the pump off immediately!

NOTICE

If flammable gases (even above upper explosion limit (UEL)) or toxic gases are supplied, continuous monitoring of the pump is mandatory.

DANGER

Explosion hazard, danger of poisoning!

A crack in the bellows when conveying flammable or poisonous gasses may allow explosive or poisonous gas mixtures to leak or develop.
Monitor the pump with a flow- and/or vacuum monitoring system (see flow diagram).
If a pump defect occurs, shut it off immediately.

Since a crack **in the bellow allows** the ambient atmosphere to be sucked in and the sample gas pump continues to generate pressure, **the bellow on the sample gas pump must be inspected regularly**.

This is done by connecting a suitable shut-off unit and a suitable vacuum pressure gauge ahead of the sample gas input (see illustration). If during operation, after closing the suction line, no negative pressure is produced, the bellows is defective and must be replaced.

Please refer to the Maintenance schedule for maintenance intervals.

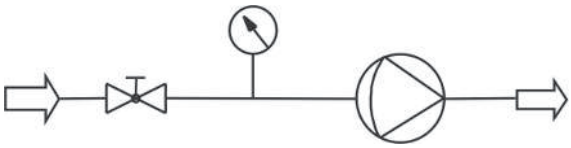


Fig. 2: Inspecting the bellow

6.3 Replacing bellow and connecting rod-eccentric-combination

NOTICE

Restrictions for connecting rod-eccentric replacement

The individual replacement of the eccentric, connecting rod or bearings is not allowed. Only the factory pre-assembled connecting rod-eccentric combination is suitable for replacement by the operator.

Please refer to assembly drawing 42/025-Z02-01-2 in the appendix for this help with this maintenance.

1. Remove the three cross-tip screws (9) and remove the console cover (8) from the pump console (5)
2. Clean any dust and other dirt off the sample gas pump. Wipe off stubborn dirt with a damp, clean cloth (do not use solvent-containing cleaning products).
   Be sure to observe all of the information in the Cleaning section. Cleaning.
3. Remove the 4 hexagon screws (16) and the spring washers (15) at the top of the pump body (13). PTFE pump bodies also have a mounting ring (14) installed for improved seating stress.
4. Carefully pull the pump body up and out of the pump console. Be careful not to overstretch the bellow (12). If the pump body is stuck to the bellow, try carefully turning it to release it.
5. Hold the bellow just above the follower (10) and unscrew it anti-clockwise. When only changing the bellow, skip to step 14.
6. Remove the 4 hexagon screws (7) and lock washers (6) and remove the pump console from the flange.
7. Loosen and remove the set screw (11) from the eccentric of the crank gear (10). This may either be hexagon socket (SW 2) or star drive (TX 8). Use the appropriate tool.
8. Now carefully remove the crank gear from the shaft. This is best done with 2 large slot screwdrivers.
9. Clean the shaft and, if necessary, remove any residue such as frictional corrosion, etc.
   Check the fit size of 11k6.
10. Dampen the shaft with resin-free oil prior to assembly.
11. Attach the new crank gear to the shaft and align the locking bore for the set screw with the corresponding bore in the shaft. Avoid using striking tools, as these may damage the ball bearings.
12. Insert the set screw with medium-strength threadlock (min. continuous operating temperature: 150 °C) and tighten to 1.5 Nm. Ensure that the flat point of the set screw is properly seated in the bore on the shaft.
13. Now place the pump console over the crank gear again and either align it upward or rotated by 180°, then secure with the hexagon screws (7) and lock washers (6) – tightening torque 3 Nm.
14. Check the sealing surface and the pleats of the bellow for damage and dirt.
15. Insert the bellow through the pump console from above and twist it clockwise onto the plunger of the crank gear until hand-tight.
16. Clean the pump body and check the sealing face for damage.
17. Attach the pump body to the bellow and turn into the desired position in relation to the gas inlet and outlet. In principle, the alignment of the pump body is irrelevant.
    However, it's important to ensure that the marking on the mounting ring or pump body fits the installed valve and its function. There is no difference between inlet valve and outlet valve. Their installation position determines the function. The valves are always labelled "EIN" or "IN" for inlet and "AUS" or "OUT" for outlet.
18. Reattach the pump body with the 4 hexagon screws (16) and spring washers (15) – and with the mounting ring for PTFE bodies – and tighten the bolts crosswise, first at 1 Nm, then 3 Nm.
19. Finally, reattach the console cover with the 3 cross-tip screws.
20. Check the sample gas pump for leaks.
21. Perform a test run. It must reach the following values at minimum:
    Excess pressure: P2.2/P2.4 AMEX = 1.7 bar; P2.82/P2.84 AMEX = 3.5 bar
    Negative pressure: P2.2/P2.4 AMEX = -0.65 bar; P2.82/P2.84 AMEX = -0.75 bar
    Flow rate: P2.2/P2.4 AMEX = 400 l/h; P2.82/P2.84 AMEX = 800 l/h

Record the maintenance, including test values, in the Operating Log (template) of the sample gas pump.

6.4 Replacement of the O-ring of the bypass valve (optional)

Please refer to assembly drawing 42/025-Z02-01-2 in the appendix for help with this maintenance.

- Loosen the two bolts (24) and carefully pull the entire unit consisting of valve plate (23), spindle (22) and O-ring (21) on the knob (26), out of the pump body (13). On VA pump bodies, unscrew the spindle holder (25) with a SW13 open-end spanner, turning clockwise, and remove the entire unit.
- Remove the old O-ring from the spindle.
- Moisten a new O-ring with suitable O-ring grease (min. continuous operating temperature: 215 °C, e.g. Fluoronox S90/2) and carefully attach it to the spindle. With sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2), only lubricants that are suitable for oxygen applications (e.g. Krytox NRT 8908) may be used.
- Carefully reinsert the entire unit into the pump body in a turning motion and tighten the bolts or spindle holder.
- Check the sample gas pump for leaks.

6.5 Replacing the inlet and outlet valves

Please refer to assembly drawing 42/025-Z02-01-2 in the appendix for this help with this maintenance

- Remove the screw-in connections (18) from the pump body (13).
- Unscrew the valves (17) with a wide slot screwdriver. Stainless steel pump bodies have displacers (20) under the valves. These reduce the dead volume and must remain installed on these pump bodies.
- Screw the new valves into the pump body and tighten to max. 1 Nm. Ensure that the valve is installed the correct direction. Valves for a permitted gas inlet temperature of max. 100 °C are black/red, and grey/orange for max. 160 °C. The valves of the P2.x AMEX-O2 sample gas pumps are not coloured.
- Here, the red or orange end corresponds to the gas inlet and the black or grey end corresponds to the gas outlet. The valves at the gas inlet are marked "EIN" and "IN" and "AUS" and "OUT" at the gas outlet. The marking that you see looking into the pump body from above determines the valve function.
- Lastly, reinstall the screw-in connections in the pump body. In the case of stainless steel screw-in connections, replace any damaged seals (19).
- Check the sample gas pump for leaks.
- Perform a test run. It must reach the following values at minimum:
  Excess pressure: P2.2/P2.4 AMEX = 1.7 bar; P2.82/P2.84 AMEX = 3.5 bar
  Negative pressure: P2.2/P2.4 AMEX = -0.65 bar; P2.82/P2.84 AMEX = -0.75 bar
  Flow rate: P2.2/P2.4 AMEX = 400 l/h; P2.82/P2.84 AMEX = 800 l/h

Record the maintenance, including test values, in the Operating Log (template) of the sample gas pump.

6.6 Cleaning

6.6.1 Cleaning the pump console

DANGER

Electrostatic charge (Spark formation)
Clean plastic parts and labels with damp cloth only.
Inflame of dust
If the device is used in dust ambiance, remove the layer from the components regularly. Also remove the dust layer in areas difficult to access.
Conserve the protective effect of the coating
To avoid potential ignition hazard, the protective effect of the coating must not be derogated by abrasion or corrosive media and must be conserved in any case.
Refinishing or repainting is **not** allowed!
Do not use sharp or pointed tools.

- To clean the inside of the pump console, unscrew the three cross-tip screws (9) of the console cover (8) and remove the cover.
- You can now clean dust and other dirt inside the pump console. Wipe off stubborn dirt with a damp, clean cloth. Do not use cleaning products containing solvents.
- Now reattach the console cover and tighten the three bolts.

For the item numbers, please refer to the assembly drawing 42/025-Z02-01-2 in the appendix.

6.6.2 Cleaning the motor

Depending on the operating conditions of the pump, the following routine work is required:

- Check the terminal compartments and terminals are clean.
- Verify the electrical connections are tight.
- Clean ventilation paths.
- Verify the motor runs freely and vibration-free and check for noise. If you notice anything unusual, please contact our Service Department.

The cooling surface and suction intakes must be protected from clogging and dirt.

6.7 Inspecting and replacing the flexible spider

NOTICE

Restrictions for maintaining the coupling

Only replacement of the flexible spider is allowed.
Loosening, re-tightening and replacing the coupling hub is allowed only by Bühler Technologies GmbH. The hexagon socket screws are marked with locking varnish which must not be damaged.

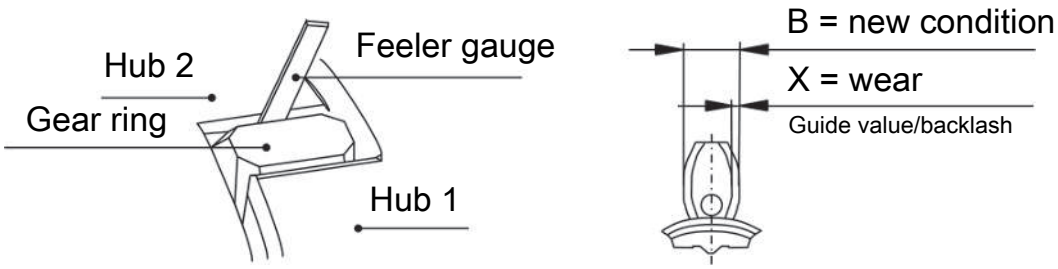


Fig. 3: Sample gas pump coupling

Please refer to assembly drawing 42/025-Z02-02-2 in the appendix for this maintenance.

The coupling we use (on P2.4 AMEX / P2.84 AMEX) is a zero-play coupling!

Check the play between the coupling cam (28a/28b) and the ring gear (28c). As soon as there is play, the ring gear must be replaced immediately regardless of the inspection intervals.

To do so, disconnect the pump head and intermediate flange (X/28) assembly by removing the hexagon screws (32) and washers (31) from the rest. Remove the worn ring gear and clean any dust and other dirt off the coupling- and intermediate flange. Wipe off stubborn dirt with a damp, clean cloth (do not use solvent-containing cleaning products).

Install a new ring gear on the hub side facing the motor. The required installation force can be reduced by slightly greasing or lubricating the elastomer. Only use mineral oil based oils and greases without additives for this purpose.

Now reinsert the pump head and intermediate flange assembly in the coupling flange and reattach with the hexagon screws and washers. A sight hole in the coupling flange allows you to verify proper installation.

Perform a test run and record the maintenance in the „operating log (template)“ of the pump.

6.8 Order number for the 43.800h inspection

Please indicate the relevant item number in the inspection order.

The inspection item numbers are structured similarly to the pump item numbers. Select the item number according to the pump features.

Replace the x with the respective version. The other features are omitted and are represented by a 0 in item number.

With sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2), it is not possible to order an inspection using the following item numbers. Please contact us for an individual offer.

P2.2 AMEX pump inspection item numbers

4271	X	0	0	X	00	
	7					230 V, 50/60 Hz
	8					115 V, 50/60 Hz
				1		100 °C valves
				2		140 °C valves

P2.4 AMEX pump inspection item numbers

4272	X	0	0	0	00	
	7					230 V, 50/60 Hz
	8					115 V, 50/60 Hz

P2.82 AMEX pump inspection item numbers

4273	X	0	0	0	00	
	7					230 V, 50/60 Hz
	8					115 V, 50/60 Hz

P2.84 AMEX pump inspection item numbers

4274	X	0	0	0	00	
	7					230 V, 50/60 Hz
	8					115 V, 50/60 Hz

Example: P2.2 Amex pump, 230 V 50/60 Hz, connections up, PTFE pump body and 140 °C valves.

Pump item number: 4271 7112 99 000 (this number is located in the pump name plate, also see Item number structures [> page 3] and Type plate [> page 4]).

Inspection item number: 4271 7002 00

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

CAUTION

Risk due to defective device

Personal injury or damage to property

a) Switch off the device and disconnect it from the mains.

b) Repair the fault immediately. The device should not be turned on again before elimination of the failure.

CAUTION

Hot surface

Burning hazard
According to the product type and operation conditions, the temperature of the housing may exceed 50 °C during operation.
Depending on the conditions at the installation site it may be necessary to provide these areas with appropriate warning signs.

Malfunction	Cause	Action
Pump doesn't start up	– Broken or incorrectly connected lead	– Check connection or fuse and switch
	– Defective	– have repaired by Bühler service technician
Pump doesn't convey	– Defective or dirty valves	– Carefully blow out or replace valves or see chapter Replacing the inlet and outlet valves.
	– Bypass valve open	– Close bypass valve
	– Defective bypass valve O-ring	– have repaired by Bühler service technician or see Replacement of the O-ring of the bypass valve (optional).
	– Torn bellow	– have repaired by Bühler service technician or see Replacing bellow and connecting rod-eccentric-combination.
	– Coupling hub broken	– have repaired by Bühler service technician
	– Broken/worn ring gear	– have repaired by Bühler service technician or see Inspecting and replacing the flexible spider.
Noisy pump operation	– Crankshaft out of alignment	– have repaired by Bühler service technician or see Replacing bellow and connecting rod-eccentric-combination.
	– Work ring gear	– have repaired by Bühler service technician or see Inspecting and replacing the flexible spider.
	– Loose coupling hub	– have repaired by Bühler service technician
	– Engine bracket damaged	– have repaired by Bühler service technician
Premature ring gear wear	– e.g. contact with ozone influences or similar, causing a physical change to the ring gear	– Eliminate any physical changes to the ring gear
Protective device is triggering	– Coil- and terminal short circuit	– Measure insulation resistance
	– Start-up time exceeded	– Check start-up requirements (see chapter Switching on the sample gas pump).
Poor performance	– Leakage	– Tighten head screws, note torque (see chapter Maintenance).
	– Torn bellow	– have repaired by Bühler service technician or see Replacing bellow and connecting rod-eccentric-combination.
	– Defective or dirty valves	– Carefully blow out or replace valves or see chapter Replacing the inlet and outlet valves.

Tab. 1: Troubleshooting

For information about replacing spare parts, please refer to chapter Maintenance.

7.2 Spare Parts

Please also specify the model and serial number when ordering parts.

Upgrade and expansion parts can be found in our catalog.

Available spare parts:

Sample gas pump	Spare part	Item no.	Position in assembly drawings 42/025-Z02-01-2 & 42/025-Z02-02-2
P2.2/P2.4 AMEX	Bellow	4200015	12a
	Plunger / eccentric combination	4200075	10a, 11
	Coupling ring gear	4220011	28c
	Set of 100 °C valves	4201002	2x 17a
	Set of 160 °C valves	4202002	2x 17b
	Bypass valve O-ring (Viton)	9009115	21a
P2.82/P2.84 AMEX	Bellow	4200071	12b
	Plunger / eccentric combination	4200097	10b, 11
	Coupling ring gear	4220011	28c
	Set of 160 °C valves	4202002	2x 17b
	Bypass valve O-ring (Viton)	9009115	21a

Spare parts, especially for sample gas pumps P2.x AMEX-O2 (item no.: 42.....-O2):

Sample gas pump	Spare part	Item no.	Position in assembly drawings 42/025-Z02-01-2 & 42/025-Z02-02-2
P2.2/P2.4 AMEX-O2	Bellow	4200015-O2	12a
	Plunger / eccentric combination	4200075	10a, 11
	Coupling ring gear	4220011	28c
	PTFE/PEEK valve (1 piece)	4202014-O2	2x 17b
	Bypass valve O-ring (Viton)	9009458-O2	21a

7.2.1 Spare parts and accessories

Item no.	Description
9022325	BAM-approved PTFE sealing tape (Roll of 4,5 m)

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 P2.x AMEX

Nominal voltage:	see ordering information
Marking:	NI / I / 2 / BCD / T3, T3C CL.I Div.2 Gr BCD T3, T3C
IP rating:	electrical IP44 mechanical IP 20
Dead volume:	8.5 ml
Weight:	approx. 7.5 kg (P 2.2 / P 2.82 AMEX) approx. 8.5 kg (P 2.4 / P 2.84 AMEX)
Materials in contact with media varies by configuration:	PTFE, PVDF (standard pump with 100 °C valves) + PEEK (standard pump with 140 °C valves) + FKM (standard pump with 100 °C valves and bypass valve) + PCTFE, FKM (standard pump with 140 °C valves and bypass valve) + 1.4571 (VA pump body) + 1.4401, FKM (VA pipe fittings) + FKM (VA pump body with bypass valve)

The following tables describe the temperature characteristics and the resulting limits for the permissible operation of the sample gas pumps. The temperature classes apply both to the gas in the installation area (zone) and to the explosive pumped medium in the gas path:

		P2.2			P2.4	
Temperature class	Motor ambient temperature	Pump head ambient temperature	Medium temperature [1]		Pump head ambient temperature [1]	Medium temperature [1]
			without bypass valve	with bypass valve		
T3	-20 °C...40 °C	max. 40 °C	max. 140 °C	max. 135 °C [2]	max. 100 °C	max. 140 °C
T3C			max. 90 °C	max. 85 °C	max. 90 °C	max. 90 °C

[1] Particularly in applications with increased ambient or medium temperatures, the corresponding thermal endurance properties of these components must be taken into account when using plastic screw-in fittings. The compression processes inside the pump cause additional temperature increases. The plastic screw-in fittings (PVDF) installed at the factory have a maximum continuous operating temperature of 140 °C.

[2] At a medium temperature of > 85 °C, operation with a bypass valve is only permitted in the stainless steel version.

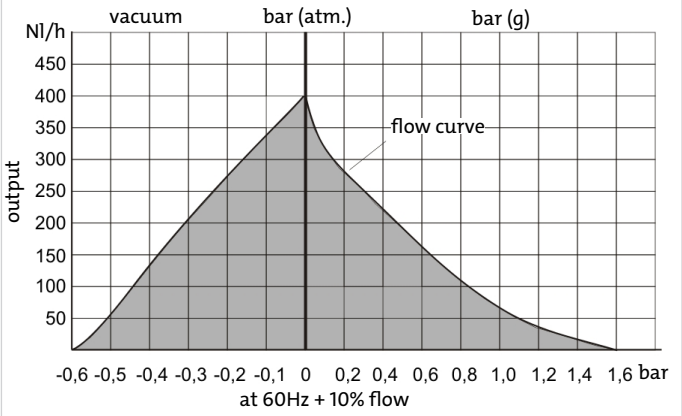
		P2.82			P2.84	
Temperature class	Motor ambient temperature	Pump head ambient temperature	Medium temperature [1]		Pump head ambient temperature [1]	Medium temperature [1]
			without bypass valve	with bypass valve		
T3	-20 °C...40 °C	max. 40 °C	max. 90 °C	max. 70 °C [2]	max. 90 °C	max. 90 °C

[1] Particularly in applications with increased ambient or medium temperatures, the corresponding thermal endurance properties of these components must be taken into account when using plastic screw-in fittings. The compression processes inside the pump cause additional temperature increases. The plastic screw-in fittings (PVDF) installed at the factory have a maximum continuous operating temperature of 140 °C.

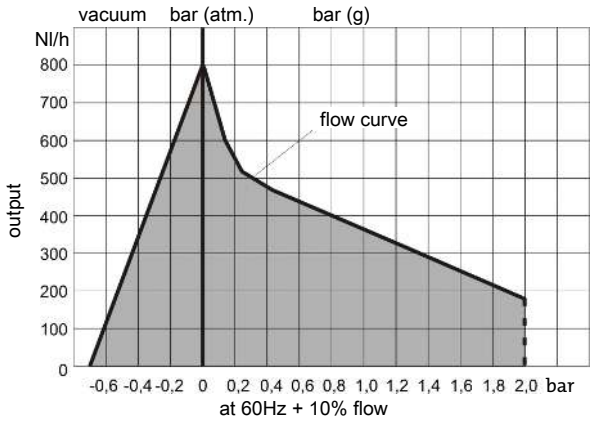
[2] At a media temperature of > 20 °C, operation with a bypass valve is only permitted in the stainless steel version.

Feed curves

400 l/h



800 l/h



9.2 Technical Data P2.x AMEX-H2/-O2

Nominal voltage:	see ordering information
Marking:	NI / I / 2 / BCD / T3, T3C CL.I Div.2 Gr BCD T3, T3C
IP rating:	electric IP44 mechanical IP 20
Dead volume:	8,5 ml
Weight:	approx. 7,5 kg (P 2.2 AMEX) approx. 8,5 kg (P 2.4 AMEX)
Materials in contact with media vary by configuration:	PTFE, PEEK, 1.4571 (contained in all models) + FKM (bypass valve) + 1.4401, FKM (VA pipe fittings for H_2 variant) + 1.4401 (VA RT pipe fittings for O_2 variant, BAM-tested PTFE sealing tape required [see accessories])

The following tables describe the temperature characteristics and the resulting limits for the permissible operation of the sample gas pumps. The temperature classes apply to the gas in the installation area (zone) as well as to the explosive medium in the gas path:

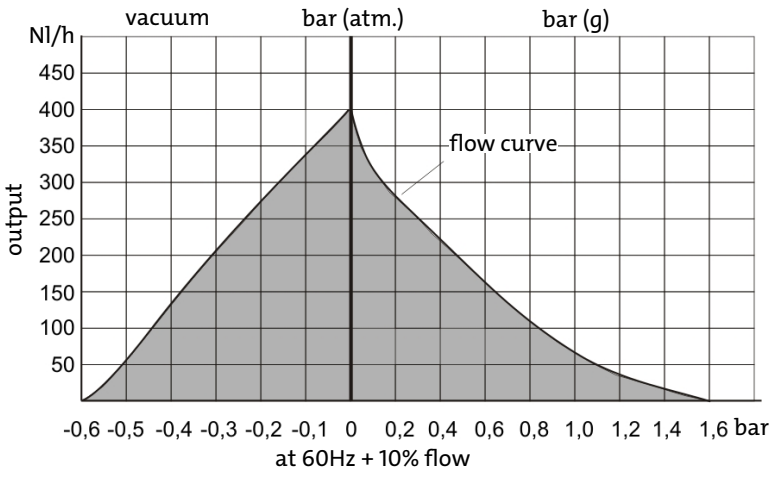
Temperature characteristics P2.x AMEX-H2 variants

		P2.2			P2.4	
Temperature class	Ambient temperature motor	Ambient temperature pump head	Media temperature		Ambient temperature pump head	Media temperature
			without bypass valve	with bypass valve		
T3	-20 °C...40 °C	max. 40 °C	max. 140 °C	max. 135 °C	max. 100 °C	max. 140 °C
T3C			max. 90 °C	max. 85 °C	max. 90 °C	max. 90 °C

Temperature characteristics P2.x AMEX-O2 variants

		P2.2		P2.4	
Temperature class	Ambient temperature motor	Ambient temperature pump head	Media temperature	Ambient temperature pump head	Media temperature
T3	-20 °C...40 °C	max. 40 °C	max. 75 °C	max. 75 °C	max. 75 °C
T3C					

Flow curve 400 l/h



9.3 Important motor notices

Motors used in EX areas require a protection device!

Installing the motor protection switch outside the EX area

Motor voltage		Item no.
7 = 230 V 50/60 Hz	0,7 - 1 A	9132020041
8 = 115 V 50/60 Hz	1,4 - 2 A	9132020057

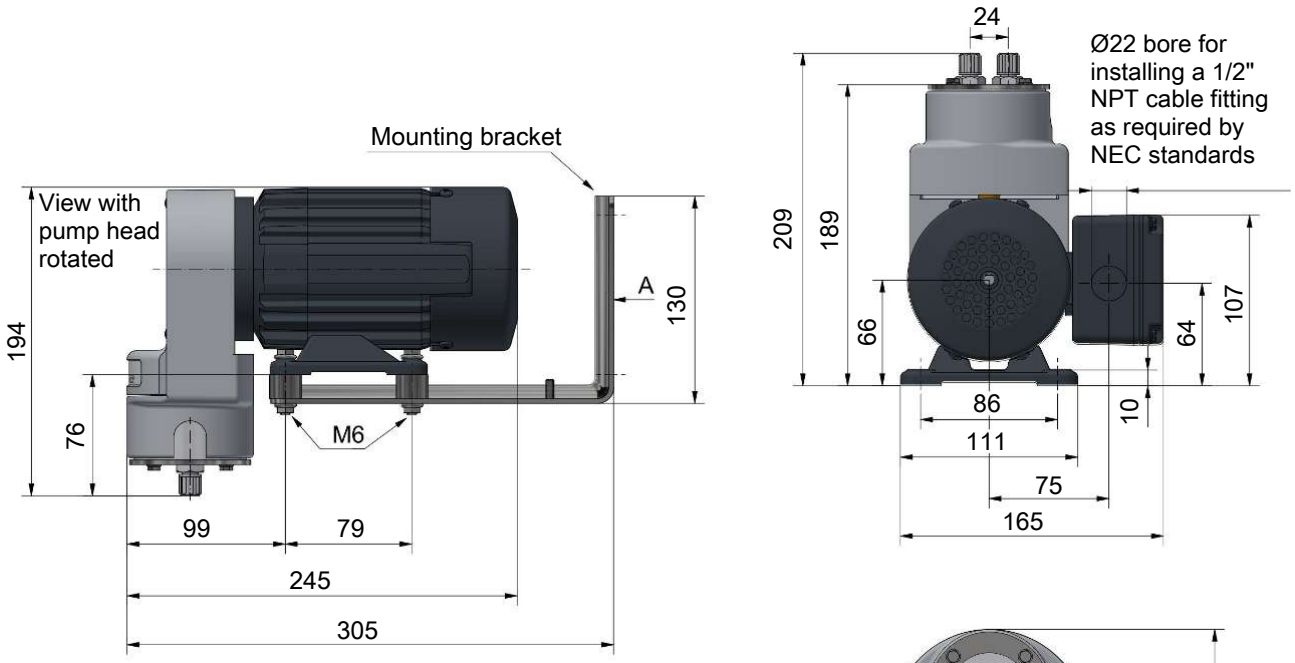
Installing the motor protection switch inside the EX area Zone 1 or 2 (ATEX only)

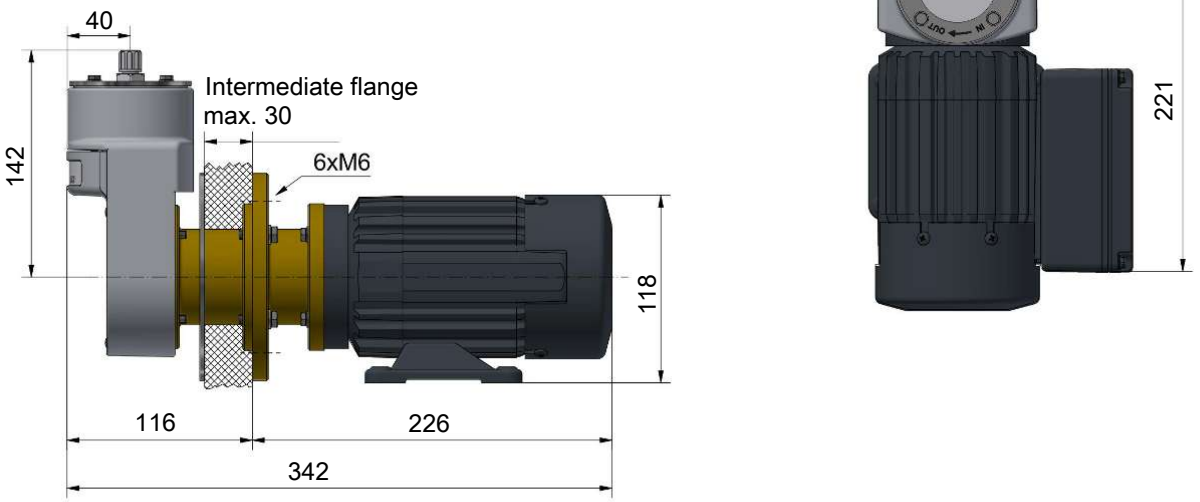
Motor voltage		Item no.
7 = 230 V 50/60 Hz	0,63 - 1 A	9132020036
8 = 115 V 50/60 Hz	1 – 1,6 A	9132020032

9.4 Dimensions

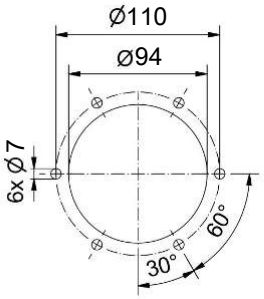
P2.2 AMEX, P2.82 AMEX – standard versions

P2.4 AMEX, P2.84 AMEX – versions with intermediate flange

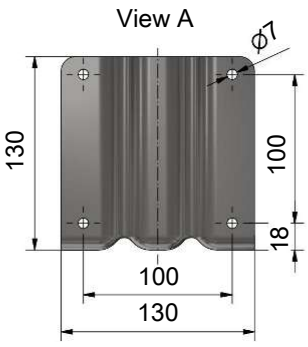




Cabinet cut-out for pumps with intermediate flange



Adjustable bypass valve (optional)



Installation notices:
1) This pump should be installed horizontally
2) If necessary, rotate the pump head during installation. When conveying gasses with condensate content it must be installed valves down.

9.5 List of chemical resistance

The materials of your device that come into contact with media are printed on the type plate.

Formula	Medium	Concentration	Teflon® PTFE	PCTFE	PEEK	PVDF	FFKM	Viton® FPM	V4A
CH_3COCH_3	Acetone		1/1	1/3	1/1	3/4	1/1	4/4	1/1
C_6H_6	Benzol		1/1	1/3	1/1	1/3	1/1	3/3	1/1
Cl_2	Chlorine	10% wet	1/1	0/0	4/4	2/2	1/1	3/0	4/4
Cl_2	Chlorine	97%	1/0	1/3	4/4	1/1	1/0	1/1	1/1
C_2H_6	Ethane		1/0	0/0	1/0	2/0	1/0	1/0	2/0
C_2H_5OH	Ethanol	50%	1/1	1/3	1/1	1/1	1/1	2/2	1/0
C_2H_4	Ethylene		1/0	0/0	0/0	1/0	1/0	1/0	1/0
C_2H_2	Ethyne		1/0	0/0	0/0	1/0	1/0	2/0	1/0
$C_6H_5C_2H_5$	Ethylbenzene		1/0	0/0	0/0	1/1	1/0	2/0	1/0
HF	Hydrofluoric acid		1/0	0/0	0/0	2/2	2/0	4/0	3/4
CO_2	Carbon dioxide		1/1	0/0	1/0	1/1	1/0	1/1	1/1
CO	Carbon monoxide		1/0	0/0	1/1	1/1	1/0	1/0	1/1
CH_4	Methane	technically pure	1/1	0/0	1/1	1/0	1/0	1/1	1/1
CH_3OH	Methanol		1/1	1/1	1/1	1/1	1/1	3/4	1/1
CH_3Cl_2	Methylene chloride		1/0	2/0	1/0	1/0	1/0	3/0	1/1
H_3PO_4	Phosphoric acid	1–5%	1/1	1/1	1/1	1/1	1/1	1/1	1/1
H_3PO_4	Phosphoric acid	30%	1/1	1/1	1/1	1/1	1/1	1/1	1/1
C_3H_8	Propane	gaseous	1/1	0/0	1/0	1/1	1/0	1/0	1/0
C_3H_6O	Propylene oxide		1/0	0/0	0/0	2/4	2/0	4/0	1/0
HNO_3	Nitric acid	1–10%	1/1	1/0	1/1	1/1	1/0	1/1	1/1
HNO_3	Nitric acid	50%	1/1	1/0	3/3	1/1	1/0	1/0	1/2
HCl	Hydrochloric acid	1–5%	1/1	1/1	1/0	1/1	1/1	1/1	2/4
HCl	Hydrochloric acid	35%	1/1	1/1	1/0	1/1	1/1	1/2	2/4
O_2	Oxygen		1/1	0/0	1/0	1/1	1/1	1/2	1/1
SF_6	Sulphur hexafluoride		1/0	0/0	1/0	0/0	1/0	2/0	0/0
H_2SO_4	Sulfuric acid	1–6%	1/1	1/1	2/2	1/1	1/1	1/1	1/2
H_2S	Hydrogen sulphide		1/1	1/1	0/0	1/1	1/1	4/4	1/1
N_2	Nitrogen		1/1	0/0	1/0	1/1	1/0	1/1	1/0
$C_6H_5C_2H_3$	Styrene		1/1	0/0	1/0	1/0	1/0	3/0	1/0
$C_6H_5CH_3$	Toluol (methylbenzene)		1/1	0/0	1/0	1/1	1/1	3/3	1/1
H_2O	Water		1/1	0/0	1/1	1/1	1/1	1/1	1/1
H_2	Hydrogen		1/0	1/0	1/0	1/0	1/0	1/0	1/0

Tab. 2: Durability list

0 – no information available

1 – durability/suitability very good

2 – durability/suitability good

3 – limited suitability

4 – not suitable

Two values are specified per medium. Left number = value at 20 °C, right number = value at 50 °C.

Important information

The tables were listed based on specifications from various raw material manufacturers. The values solely refer to laboratory tests using raw materials. Components made from these are often subject to impacts which cannot be determined in laboratory testing (temperature, pressure, material strain, impacts of chemical agents, design features, etc.). The values specified can therefore only serve as a guide. When in doubt, we recommend performing a test. These specifications do not infer a legal claim, we exclude any warranty and liability. The chemical and mechanical durability alone do not suffice to determine the serviceability of a product. In particular the regulations for liquid fuels (Ex-protection) must be observed, among others.

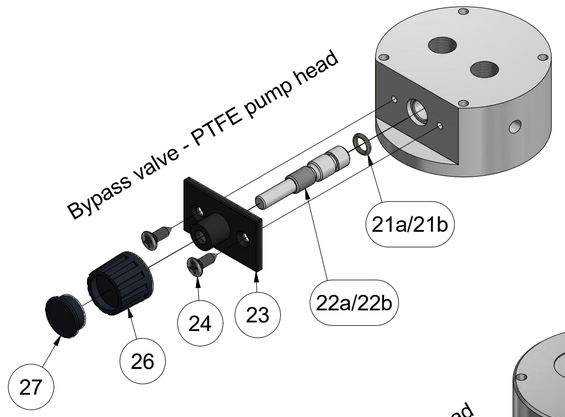
Durability to other mediums available upon request.

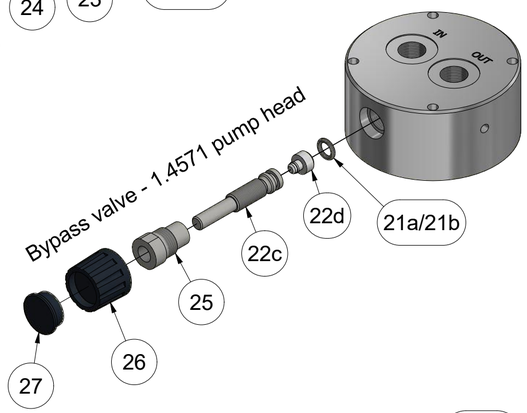
9.6 User book (Please make copies)

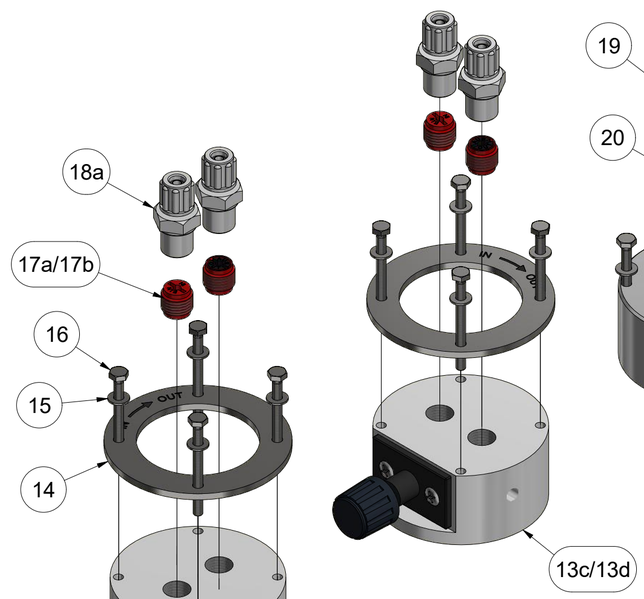
Maintained on	Unit no.	Operating hours	Remarks	Signature

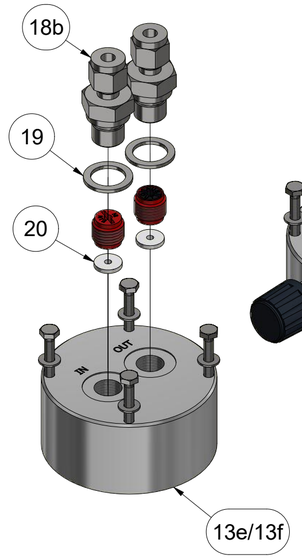
10 Attached documents

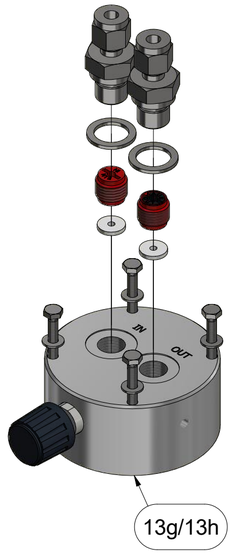
- Drawings: 42/025-Z02-01-2, 42/025-Z02-02-2; 42/025-Z02-03-2
- O_2declaration B#420025
- Certificates: FM21US0082X, FM21CA0055X
- Operation instructions: Electric motor
- RMA – Decontamination Statement

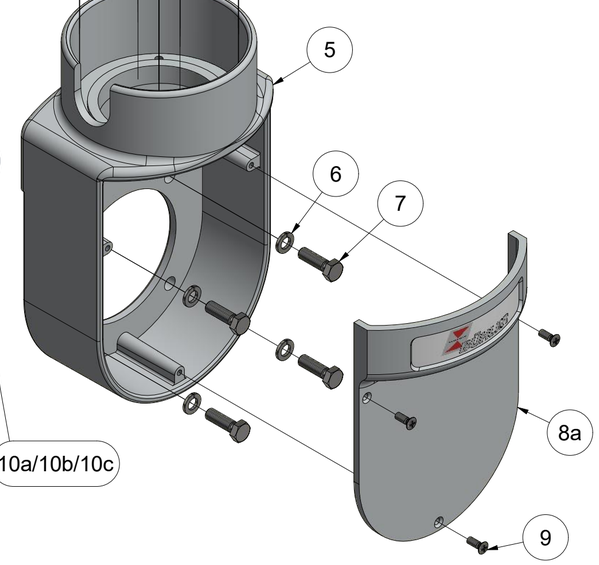


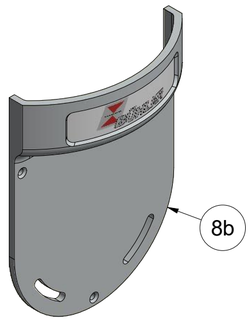












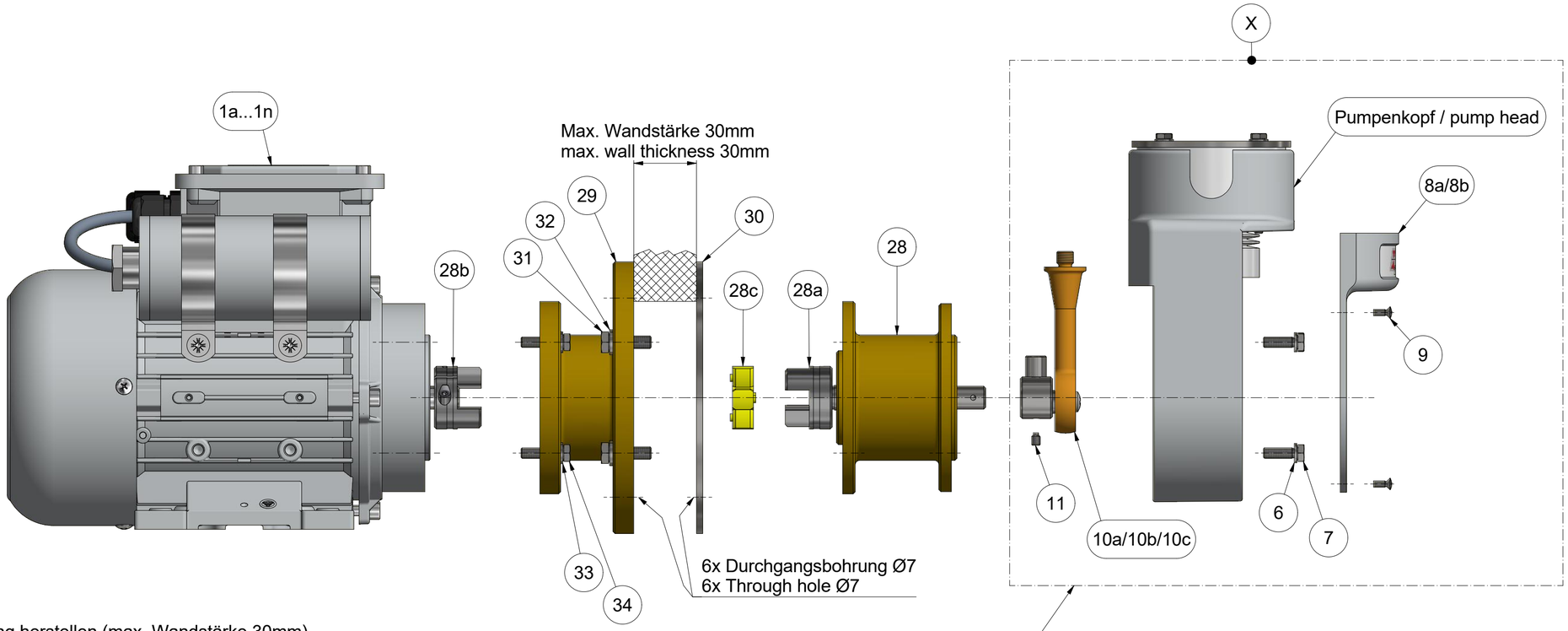
Die Pumpentypen P2.4, P2.84, P2.4C, P2.4 Atex/Amex, P2.74 Atex und P2.84 Amex sind mit einem Zwischenflansch zwischen Motor und Pumpe ausgestattet. Beachten Sie hierzu zusätzlich die spezifische Explosions- und Montagezeichnung 42/025-Z02-02-2.

The pump types P2.4, P2.84, P2.4C, P2.4 Atex/Amex, P2.74 Atex and P2.84 Amex are equipped with an intermediate flange between the motor and the pump. Please also note the specific exploded view and assembly drawing 42/025-Z02-02-2.

Die Legende zu den Positionsnummerierungen dieser Zeichnung, sowie deren spezifische Zuordnung zu den unterschiedlichen Pumpentypen befindet sich auf der Zeichnung 42/025-Z02-03-2.

The legend for the item numbers in this drawing and their specific assignment to the different pump types can be found on drawing 42/025-Z02-03-2.

Alle Kanten gratfrei		Alle Rechte vorbehalten				Maße ohne Toleranzangabe nach ISO 2768-mK			Maßstab: 1:1,75		Masse:
									Werkstoff:		
							Datum:	Name:	Benennung:		(b)
= Roh						Bearb.	03.02.2021	Sundergeld	Montagezeichnung - Assembly drawing - P2.3, P2.83, P2.4, P2.84, P4.3, P4.83, P2.3C, P2.4C, P2.2 Atex / Amex, P2.4 Atex / Amex, P2.72 Atex, P2.74 Atex, P2.82 Amex, P2.84 Amex		
X = Rz 63						Gepr.					
Y = Rz 16						BÜHLER Technologies GmbH 40880 Ratingen			ZeichnungsNr.: 42/025-Z02-01-2B		
Z = Rz 4		b	Bezeichn.	16.09.21	Sun				Art.Nr.: ---		
		a	Motor Nr.	15.06.21	Sun						
		Zust.	Änd.	Datum	Name	Ers.für:			Arbeitsanweisung:		



Alle Details zu den pumpenspezifischen Bauteilen können der Explosions- und Montagezeichnung 42/025-Z02-01-2 entnommen werden

All details about the pump-specific components can be found in the Exploded and assembly drawing 42/025-Z02-01-2

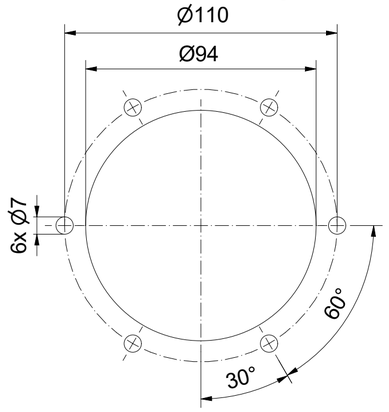
Montagehinweise:
- Wandausschnitt nach Zeichnung herstellen (max. Wandstärke 30mm)
- Verbindungsschrauben (31/32) lösen und die Einheit "Pumpenkopf-Zwischenflansch" (28/28a/28c/X) vom Kupplungsflansch (29) trennen/abziehen
- Montage der Einheit "Motor-Kupplungsflansch" (1a-g/28b/29) von Außen (z.B. an einen Schaltschrank) und Montagering (30) von Innen (z.B. innerhalb eines Schaltschranks) mit passenden Schrauben und Muttern (M6)
- Die Einheit "Pumpenkopf-Zwischenflansch" auf das Gegenstück (28b) schieben und wieder mit den Verbindungsschrauben (31/32) montieren - an dieser Stelle kann der Pumpenkopf auch um 180° gedreht montiert werden - der Pumpenkopf zeigt dann nach unten
- Die zusätzliche Befestigung des Motors mit z.B. der Bühler Montagekonsole ist bei Pumpen mit Zwischenflansch weder notwendig noch zulässig. Dies könnte sich aufgrund einer Systemüberbestimmung negativ auf die Kugellager auswirken.

Wichtiger Hinweis zur Kupplung bei Atex/Amex Pumpentypen:
Die Kupplungsnaben 28a und 28b werden mit einer Klemmschraube auf den jeweiligen Wellen montiert. Diese Klemmschraube wird mit einem Schraubensicherungskleber und einem speziellen Drehmoment montiert und dürfen nur durch einen Bühler Servicetechniker gelöst werden. Bei dem Ersatzteil "Zwischenflanschbaugruppe (28/28a)" ist die Kupplungsnabe bereits vormontiert und kann demnach auch betreiber-seitig ausgetauscht werden.

Assembly instructions:
- Create a wall cut-out according to the drawing (max. wall thickness 30mm)
- Loosen the connecting screws (31/32) and remove the unit "pump head-intermediate flange" (28/28a/28c/X) from the coupling flange (29)
- Assemble the unit "Motor-coupling flange" (1a-g/28b/29) from the outside (e.g. to a cabinet) and the mounting ring (30) from the inside (e.g. inside a cabinet) with suitable screws and nuts (M6)
- The unit "pump head-intermediate flange" slide onto the counterpart (28b) and re-assembled with the connecting screws (31/32) - at this point the pump head can also be rotated by 180° installed - the pump head then points downwards
- The additional fastening of the motor with e.g. the Bühler mounting bracket at pumps with Intermediate flange is neither necessary nor allowed. This could be due to system over-determination and have a negative effect on the ball bearings.

Important note for the coupling at Atex/Amex pump types:
The coupling hubs 28a and 28b are mounted onto the shafts using clamping screws. This clamping screws are mounted with a screw lock adhesive and a special torque and shall only be released by a Bühler service technician. In case of the "intermediate flange assembly" (28/28a) as a replacement part, the coupling hub is already pre-assembled and can therefore also be exchanged by the operator.

Wandausschnitt / mounting cut-out



Die Legende zu den Positionsnummerierungen dieser Zeichnung, sowie deren spezifische Zuordnung zu den unterschiedlichen Pumpentypen befindet sich auf der Zeichnung 42/025-Z02-03-2.

The legend for the item numbers in this drawing and their specific assignment to the different pump types can be found on drawing 42/025-Z02-03-2.

Alle Kanten gratfrei				Alle Rechte vorbehalten				Maße ohne Toleranzangabe nach ISO 2768-mK			Maßstab: 1:1,75	Masse:
									Datum:	Name:	Werkstoff:	
√ = √ Roh								Bearb.	04.02.2021	Sundergeld	Benennung: Montagezeichnung - Assembly drawing - P2.4, P2.84, P2.4C, P2.4 Atex/Amex, P2.74 Atex, P2.84 Amex	
X √ = √ Rz 63								Gepr.				
Y √ = √ Rz 16								BÜHLER Technologies GmbH 40880 Ratingen			ZeichnungsNr.: 42/025-Z02-02-2A	
Z √ = √ Rz 4	a	Motor Nr.	15.06.21	Sun							Art.Nr.: ---	
	Zust.	Änd.	Datum	Name				Ers.für:			Arbeitsanweisung:	

Zeichnungsnummer/Drawing no. 42/025-Z02-03-2 | Rev.B | Date: 16.09.2021 | Autor: Sundergeld
Änderung: B = P4 Motoren hinzugefügt | Geprüft am: | Prüfer:

Legende und spezifische Zuordnung der Positionsnummern aus den Montagezeichnungen
Legend and specific assignment for the item numbers of the assembly drawings

42/025-Z02-01-2 & 42/025-Z02-02-2

Pos. No.	Description	Beschreibung	P2.3	P2.83	P2.4	P2.84	P4.3	P4.83	P2.3C	P2.4C	P2.2 Atex	P2.2 Amex	P2.4 Atex	P2.4 Amex	P2.72 Atex	P2.74 Atex	P2.82 Amex	P2.84 Amex
1a	Motor 230V 50/60Hz	Motor 230V 50/60Hz	X	X	X	X	---	---	X	X	---	---	---	---	---	---	---	---
1b	Motor 115V 50/60Hz	Motor 115V 50/60Hz	X	X	X	X	---	---	X	X	---	---	---	---	---	---	---	---
1c	Motor 230/400V 50/60Hz	Motor 230/400V 50/60Hz	X	X	X		---	---	X	X	---	---	---	---	---	---	---	---
1d	Motor 230V 50/60Hz with two shaft ends	Motor 230V 50/60Hz mit 2 Wellenenden	---	---	---	---	X	X	---	---	---	---	---	---	---	---	---	---
1e	Motor 115V 50/60Hz with two shaft ends	Motor 115V 50/60Hz mit 2 Wellenenden	---	---	---	---	X	X	---	---	---	---	---	---	---	---	---	---
1f	Motor 230V 50/60Hz Atex, IECEx	Motor 230V 50/60Hz Atex, IECEx	---	---	---	---	---	---	---	---	X	---	X	---	X	X	---	---
1g	Motor 115V 50/60Hz Atex, IECEx	Motor 115V 50/60Hz Atex, IECEx	---	---	---	---	---	---	---	---	X	---	X	---	X	X	---	---
1h	Motor 380-420V 50Hz Atex, IECEx	Motor 380-420V 50Hz Atex, IECEx	---	---	---	---	---	---	---	---	X	---	X	---	X	X	---	---
1i	Motor 500V 50Hz Atex, IECEx	Motor 500V 50Hz Atex, IECEx	---	---	---	---	---	---	---	---	X	---	X	---	X	X	---	---
1j	Motor 230V 50/60Hz Cl.I, Div.2	Motor 230V 50/60Hz Cl.I, Div.2	---	---	---	---	---	---	---	---	---	X	---	X	---	---	X	X
1k	Motor 115V 50/60Hz Cl.I, Div.2	Motor 115V 50/60Hz Cl.I, Div.2	---	---	---	---	---	---	---	---	---	X	---	X	---	---	X	X
2	Montagekonsole	Mounting bracket	X	X	---	---	X	X	X	---	X	X	---	---	X	---	X	---
3	Gummi-Metall-Puffer	Shock absorber	X	X	---	---	X	X	X	---	X	X	---	---	X	---	X	---
4	Mutter DIN 6923 - M6	Nut DIN 6923 - M6	X	X	---	---	X	X	X	---	X	X	---	---	X	---	X	---
5	Pumpenkonsole	Pump housing	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	Federring DIN 127 B5,1	Spring washer DIN 127 B5,1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	Schraube DIN 933 M5x16	Screw DIN 933 M5x16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8a	Konsolendeckel - standard	Cover - standard	X	X	X	X	X	X	---	---	X	X	X	X	X	X	X	X
8b	Konsolendeckel mit Schlitzen	Cover with slots	---	---	---	---	---	---	X	X	---	---	---	---	---	---	---	---
9	Schraube DIN 966 M3x8	Screw DIN 966 M3x8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10a	Kurbeltrieb für 400l/h Pumpen (Stößel gold)	Crank drive for 400l/h pumps (plunger gold)	X	---	X	---	X	---	X	X	X	X	X	X	---	---	---	---
10b	Kurbeltrieb für 700l/h Pumpen (Stößel grün)	Crank drive for 700l/h pumps (plunger green)	---	---	---	---	---	---	---	---	---	---	---	---	X	X	---	---
10c	Kurbeltrieb für 800l/h Pumpen (Stößel schwarz)	Crank drive for 800l/h pumps (plunger black)	---	X	---	X	---	X	---	---	---	---	---	---	---	---	X	X
11	Schraube DIN 915 M4x6 oder ISO 4028 M4X6 TX 8	Screw DIN 915 M4x6 or ISO 4028 M4X6 TX 8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12a	Faltenbalg für 400l/h Pumpen (4 Falten)	Below for 400l/h pumps (4 folds)	X	---	X	---	X	---	X	X	X	X	X	X	---	---	---	---
12b	Faltenbalg für 700l/h und 800l/h Pumpen (8 Falten)	Below for 700l/h and 800l/h pumps (8 folds)	---	X	---	X	---	X	---	---	---	---	---	---	X	X	X	X
13a	Pumpenkörper - PTFE für 400l/h Pumpen	Pump head - PTFE for 400l/h pumps	X	---	X	---	X	---	X	X	X	X	X	X	---	---	---	---
13b	Pumpenkörper - PTFE für 800l/h Pumpen	Pump head - PTFE for 800l/h pumps	---	X	---	X	---	X	---	---	---	---	---	---	---	---	X	X
13c	Pumpenkörper - PTFE mit Bypassventil für 400l/h Pumpen	Pump head - PTFE with bypass valve for 400l/h pumps	X	---	X	---	X	---	X	X	X	X	X	X	---	---	---	---
13d	Pumpenkörper - PTFE mit Bypassventil 800l/h Pumpen	Pump head - PTFE with bypass valve for 800l/h pumps	---	X	---	X	---	X	---	---	---	---	---	---	---	---	X	X
13e	Pumpenkörper - 1.4571 für 400l/h und 700l/h Pumpen	Pump head - 1.4571 for 400l/h and 700l/h pumps	X	---	X	---	X	---	X	X	X	X	X	X	X	X	---	---
13f	Pumpenkörper - 1.4571 für 800l/h Pumpen	Pump head - 1.4571 for 800l/h pumps	---	X	---	X	---	X	---	---	---	---	---	---	---	---	X	X
13g	Pumpenkörper - 1.4571 mit Bypassventil für 400l/h und 700l/h Pumpen	Pump head - 1.4571 with bypass valve for 400l/h and 700l/h pumps	X	---	X	---	X	---	X	X	X	X	X	X	X	X	---	---
13h	Pumpenkörper - 1.4571 mit Bypassventil für 800l/h Pumpen	Pump head - 1.4571 with bypass valve for 800l/h pumps	---	X	---	X	---	X	---	---	---	---	---	---	---	---	X	X
14	Montagering - nur für PTFE Pumpenkörper	Mounting ring - only for pump heads made of PTFE	X	X	X	X	X	X	X	X	X	X	X	X	---	---	X	X
15	Spannscheibe DIN 6796 d=4	Clamping washer DIN 6796 d=4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
16	Schraube DIN 933 M4x45	Screw DIN 933 M4x45	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
17a	Ventil - geeignet bis zu 100°C Gaseingangstemperatur	Valve - suitable up to 100°C gas inlet temperature	X	---	---	---	X	---	X	---	X	X	---	---	---	---	---	---
17b	Ventil - geeignet bis zu 160°C Gaseingangstemperatur	Valve - suitable up to 160°C gas inlet temperature	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
18a	Kunststoff Einschraubverschraubung - diverse Typen - siehe Pumpendatenblätter	Plastic fitting - various types - see pump data sheets	X	X	X	X	X	X	X	X	X	X	X	X	---	---	X	X
18b	Edelstahl Rohrverschraubung - diverse Typen - siehe Pumpendatenblätter	Stainless steel fitting - various types - see pump data sheets	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
19	Dichtring - nur für Edelstahl Pumpenkörper	Sealing ring - only for pump heads made of 1.4571	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
20	Verdränger - nur für Edelstahl Pumpenkörper	Displacer - only for pump heads made of 1.4571	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21a	O-Ring - FKM	O-Ring made of FKM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21b	O-Ring - FFKM	O-Ring made of FFKM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
22a	Spindel für Bypassventil - geeignet bis zu 100°C Gaseingangstemperatur	Spindle for PTFE bypass valve - suitable up to 100°C gas inlet temperature	X	---	---	---	X	---	X	---	X	X	---	---	---	---	---	---
22b	Spindel für Bypassventil - geeignet bis zu 160°C Gaseingangstemperatur	Spindle for PTFE bypass valve - suitable up to 160°C gas inlet temperature	---	X	X	X	---	X	---	X	---	---	X	X	X	X	X	X
22c	Spindel für Edelstahl Bypassventil	Spindle for 1.4571 bypass valve	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
22d	Spindelspitze	Spindle tip	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
23	Montageplatte Bypassventil	Mounting plate bypass valve	X	X	X	X	X	X	X	X	X	X	X	X	---	---	X	X
24	Schraube DIN 7982 4,2x13	Screw DIN 7982 4,2x13	X	X	X	X	X	X	X	X	X	X	X	X	---	---	X	X
25	Spindelaufnahme	Spindle holder	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
26	Drehknopf	Knob	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
27	Deckel	Cover	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
28	Zwischenflansch	Intermediate flange	---	---	X	X	---	---	---	X	---	---	X	X	---	X	---	X
28a/28b	Kupplungsnabe	Coupling hub	---	---	X	X	---	---	---	X	---	---	X	X	---	X	---	X
28c	Kupplungsstern	Spider	---	---	X	X	---	---	---	X	---	---	X	X	---	X	---	X
29	Kupplungsflansch	Coupling flange	---	---	X	X	---	---	---	X	---	---	X	X	---	X	---	X
30	Montagering	Mounting ring	---	---	X	X	---	---	---	X	---	---	X	X	---	X	---	X
31	Schraube DIN 933 M6x20	Screw DIN 933 M6x20	---	---	X	X	---	---	---	X	---	---	X	X	---	X	---	X
32	Unterlegscheibe DIN 125 A6,4	Washer DIN 125 A6,4	---	---	X	X	---	---	---	X	---	---	X	X	---	X	---	X
33	Unterlegscheibe DIN 125 A5,3	Washer DIN 125 A5,3	---	---	X	X	---	---	---	X	---	---	X	X	---	X	---	X
34	Schraube DIN 933 M5x20	Screw DIN 933 M5x20	---	---	X	X			---	X	---	---	X	X	---	X	---	X
X	Kompletter Pumpenkopf - diverse Kombinationsmöglichkeiten	Complete pump head - various combinations	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

O2-Erklärung
O2 Declaration

Messgaspumpen für den Einsatz mit hochreinem Sauerstoff optimiert

Sample Gas Pumps optimised for use with high-purity oxygen

Applikationen mit Sauerstoff: Partikel-, Öl- und Fettfreiheit
Mit dieser Erklärung bestätigen wir, dass alle medienberührenden Flächen der nachfolgenden Produkte in Anlehnung an die Vorgaben der EIGA Doc 33/18 und des VDA-Band 19 gereinigt und gefertigt sind.

Applications with oxygen: free of particles, oil and grease
With this declaration, we confirm that all surfaces of the following products that come into contact with media have been cleaned and manufactured in accordance with the specifications of EIGA Doc 33/18 and VDA Volume 19.

Produkt / ***Products***	**Messgaspumpen** / ***Sample Gas Pumps***
Typen / Types:	P2.x ATEX-O2 P2.x AMEX-O2 P1.3-O2
Art-Nr. / Item no.:	42 .....-O2

Ratingen, den 25.04.2024

Bühler Technologies GmbH

Sample gas pumps optimized for use with high-purity oxygen

Applications with oxygen: Free from particles, oil and grease

For use with high-purity oxygen, the product requires special cleaning to ensure that it is free from oil and grease, as oxygen is a strong oxidising agent. Under unfavourable conditions, oxygen can cause spontaneous combustion of organic substances such as particles, oils and fats, and generally promotes the combustion of substances. Oils and fats can even react explosively on contact with oxygen. We use special cleaning and production processes to ensure the safe use of our products with high-purity oxygen and avoid the above-mentioned undesirable reactions.

With this declaration, we confirm that all surfaces of the following products that come into contact with media have been cleaned and manufactured in accordance with the requirements of EIGA Doc 33/18 and VDA Volume 19.

Product:	**Sample gas pumps**
Models:	P2.x ATEX-O2 P2.x AMEX-O2 P1.3-O2
Item no.:	42 .....-O2

For the "O2" measuring gas pumps, only materials that have been tested by the Federal Institute for Materials Research and Testing (BAM) for oxygen applications, taking into account the relevant application parameters, are used for the components in contact with the medium.

All components in contact with the medium undergo a special cleaning process to reliably remove impurities (such as oil, grease and particles). This process is documented by a comprehensive delivery specification to the service provider and compliance with the limit values is verified with regular analyses by an independent, accredited laboratory.

The contamination limits of the surfaces in contact with media are defined as follows (as in EIGA Doc 33/18 Cleaning of Equipment for oxygen service):

	Contamination limits
Non-volatile organic or inorganic impurities:	≤ 220 mg/m² for non-volatile impurities
Particles:	≤ 22 particles/m² between 500 µm and 1000 µm

The "O2" measuring gas pumps are manufactured in a structurally separated clean room in accordance with VDA Volume 19.

Compliance with the production and assembly specifications is documented by the trained specialist by means of a test report. After cleaning, the sample gas pumps are packed in airtight and dustproof packaging and clearly labeled “Cleaned for oxygen service. Do not open until ready for use”.

All described cleaning properties are lost if the product comes into contact with oily or greasy media or is otherwise contaminated from the outside.

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CERTIFICATE OF COMPLIANCE

HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

P2.2 AMEX (P/N 4271XXXX99), P2.4 AMEX (P/N 4272XXXX99), P2.5 AMEX (P/N 4278XXXX99), P2.82 AMEX (P/N 4273XXXX99) and P2.84 AMEX (P/N4274XXXX99) Rated 115V/230V AC, 50/60Hz, 1.7A/0.89A. Sample Gas Pumps.
NI / I / 2 / BCD / T3, T4 Ta = -20 °C to +50 °C
x = denote power supply, position of pump head, material of pump head and material of valves.

For ordinary locations:

P2.3 (P/N 4256XXXX99), P2.4 (P/N 4257XXXX99), P2.5 (P/N 4258XXXX99), P2.83 (P/N4263XXXX99), P2.84 (P/N 4264XXXX99) Rated 115VAC, 50/60Hz, 1.7A and P4.3 (P/N 4280XXXXX99), P4.83 (P/N 4281XXXX99) Rated 115VAC, 50/60Hz, 1.7A . Sample Gas Pumps.
x = denote power supply, position of pump head, material of pump head, material of valves and accessories (only P4.XX)

Equipment Ratings:

Nonincendive electric apparatus for use in Class I, II, Division 2, Groups A, B, C & D indoor hazardous (Classified) locations and for use in ordinary Locations

FM Approved for:

Bühler Technologies GmbH
Ratingen D-40880 Germany

FM Approvals

Member of the FM Global Group

This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

Class 3600	1998
Class 3611	2004
Class 3810	2005

Original Project ID: 3038101 Approval Granted: May 24, 2010

Subsequent Revision Reports / Date Approval Amended

Report Number	Date	Report Number	Date

FM Approvals LLC

J. E. Marquedant
Group Manager, Electrical

24 May 2010
Date

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CERTIFICATE OF COMPLIANCE

HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

P2.2 AMEX (P/N 4271XXXX99), P2.4 AMEX (P/N 4272XXXX99), P2.5 AMEX (P/N 4278XXXX99), P2.82 AMEX (P/N 4273XXXX99) and P2.84 AMEX (P/N4274XXXX99) Rated 115V/230V AC, 50/60Hz, 1.7A/0.89A. Sample Gas Pumps.
NI / I / 2 / BCD / T3, T4 Ta = -20 °C to +50 °C
x = denote power supply, position of pump head, material of pump head and material of valves.

Equipment Ratings:

Nonincendive electric apparatus for use in Class I, II, Division 2, Groups B, C & D indoor hazardous (Classified) locations and for use in ordinary Locations

FM Approved for:

Bühler Technologies GmbH
Ratingen D-40880 Germany

FM Approvals®

Member of the FM Global Group

This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

Class 3600	2011
Class 3611	2004
Class 3810	2005

Original Project ID: 3038101

Approval Granted: 24 May 2010

Subsequent Revision Reports / Date Approval Amended

Report Number	Date	Report Number	Date
120709	July 29, 2012		

FM Approvals LLC

J.E. Marquedant

J. E. Marquedant
Group Manager, Electrical

24 July 2012
Date

CERTIFICATE OF CONFORMITY

1. **HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT PER US REQUIREMENTS**
2. **Certificate No:** **FM21US0082X**
3. **Equipment:** **Model P2.2 AMEX, P2.4 AMEX, P2.5 AMEX, P2.82 AMEX and P2.84 AMEX Sample Gas Pumps**
   (Type Reference and Name)
4. **Name of Listing Company:** **Bühler Technologies GmbH**
5. **Address of Listing Company:** **Harkortstrasse 29**
   Ratingen
   D-40880
   Germany
6. The examination and test results are recorded in confidential report number:

   3038101 dated 24th May 2010
7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

   FM Class 3600:2018, FM Class 3611:2021, FM Class 3810:2005
8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.

Certificate issued by:

J.E. Marquedant
VP, Manager - Electrical Systems

24 September 2021
Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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SCHEDULE

US Certificate of Conformity No: FM21US0082X

9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.

10. Equipment Ratings:

    Nonincendive for Class I, Division 2, Groups B, C, D T3/T3C, Ta = -20°C to +40°C, hazardous (classified) locations. Refer to manual BX420003 for relationship between temperature class, ambient temperature and process temperature.

11. The marking of the equipment shall include:

    Cl. I, Div. 2, Gps. B, C, D. T3/T3C

    Temp. max.: see manual BX420003

12. **Description of Equipment:**

    General – The sample pumps move sample gases from stacks to an analyzer. A sample pump consists of a motor and a pump head, which can be split by an intermediate flange with variable versions.

    Construction – The sample pumps are of painted metal construction. The motors for the pumps provide a terminal box with an opening suitable for a ½" NPT conduit hub.

    Ratings – The pumps operate at 115 Vac, 1.5 to 1.6 A, or 230 Vac, 0.7 to 0.8 A, depending upon model type. The pumps are rated for an ambient temperature range of -20°C to +40°C.

    Model types – Approved model number variants are as defined below. Refer to Installation and Operation Instructions document BE420003 for further details concerning model types.

    42aabcdef9000. Sample Gas Pumps, where:
    aa = Base model: 71, 72, 73, 74, where:
        71 = P2.2 AMEX
        72 = P2.4 AMEX
        73 = P2.82 AMEX
        74 = P2.84 AMEX
    b = Motor voltage: 7, 8
    c = Pump head position: 1, 2
    d = Pump head material: 1, 2, 3, 4
    e = Valve material: 1, 2
    f = Screw-in connections: 9, 1, 2, 3, 5

13. **Specific Conditions of Use:**

    It is the responsibility of the installer to ensure that the combination of ambient temperature and process heating does not exceed the maximum specified ambient temperature rating of 40 °C at the motor.

SCHEDULE

US Certificate of Conformity No: FM21US0082X

14. **Test and Assessment Procedure and Conditions:**

This Certificate has been issued in accordance with FM Approvals US Certification Requirements.

15. **Schedule Drawings**

A copy of the technical documentation has been kept by FM Approvals.

16. **Certificate History**

Details of the supplements to this certificate are described below:

Date	Description
24th May 2010	Original Issue.
24th July 2012	Supplement 1: Report Reference: 120709 dated 24th July 2012. Description of the Change: Update FM Class 3600 to 2011 edition. Correct error in gas Group designation in Certificate. Relocate ordinary location certificate information to separate ordinary location certificate.
24th September 2021	Supplement 2: Report Reference: RR228650 dated 24th September 2021. Description of the Change: New motor supplier. Revise ambient temperature range. Update standards FM Class 3611 from 2004 to 2021 and FM Class 3600 from 2011 to 2018. Apply specific condition of use relating to process and ambient temperatures. Re-create certificate in new format. Apply corrections to and reformat Certificate and Approval Guide listing.

CERTIFICATE OF CONFORMITY

FM Approvals
Member of the FM Global Group

1. **HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT PER US REQUIREMENTS**
2. **Certificate No:** **FM21US0082X**
3. **Equipment:**
   (Type Reference and Name) **Model P2.2 AMEX, P2.4 AMEX, P2.5 AMEX, P2.82 AMEX and P2.84 AMEX Sample Gas Pumps**
4. **Name of Listing Company:** **Bühler Technologies GmbH**
5. **Address of Listing Company:** **Harkortstraße 29, Ratingen D-40880, Germany**
6. The examination and test results are recorded in confidential report number:

   3038101 dated 24th May 2010

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

   FM 3600:2022, FM 3611:2021, FM 3810:2005

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.
10. Equipment Ratings:

    See Annex

11. The marking of the equipment shall include:

    See Annex

12. **Description of Equipment:**

    See Annex

13. **Specific Conditions of Use:**

Certificate issued by:

J.E. Marquedant
VP, Manager - Electrical Systems

19 April 2024
Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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See Annex

14. **Test and Assessment Procedure and Conditions:**

This Certificate has been issued in accordance with FM Approvals US Certification Requirements.

15. **Schedule Drawings**

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19 April 2024	Supplement 3: Report Reference:RR240898 dated 19 April 2024. Description of the Change(s): Introduction of two new options H2 and O2 and update of user manual to include this option. Update of FM3600 to revision 2022.

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ANNEX

42aabcdef9000

Equipment Ratings:

Nonincendive for Class I, Division 2, Groups B, C, D T3/T3C, Ta = -20°C to +40°C, hazardous (classified) locations. Refer to manual BX420003 for relationship between temperature class, ambient temperature and process temperature.

Markings:

Cl. I, Div. 2, Gps. B, C, D. T3/T3C
Temp. max.: see manual BX420003

Description of Equipment:

General – The sample pumps move sample gases from stacks to an analyzer. A sample pump consists of a motor and a pump head, which can be split by an intermediate flange with variable versions.
Construction – The sample pumps are of painted metal construction. The motors for the pumps provide a terminal box with an opening suitable for a ½" NPT conduit hub.
Ratings – The pumps operate at 115 Vac, 1.5 to 1.6 A, or 230 Vac, 0.7 to 0.8 A, depending upon model type. The pumps are rated for an ambient temperature range of -20°C to +40°C.
Refer to Installation and Operation Instructions document BE420003 for further details concerning model types.

42aabcdef9000. Sample Gas Pumps, where:
aa = Base model: 71, 72, 73, 74, where:
71 = P2.2 AMEX
72 = P2.4 AMEX
73 = P2.82 AMEX
74 = P2.84 AMEX
b = Motor voltage: 7, 8
c = Pump head position: 1, 2
d = Pump head material: 1, 2, 3, 4
e = Valve material: 1, 2
f = Screw-in connections: 9, 1, 2, 3, 5.

Specific Conditions of Use:

It is the responsibility of the installer to ensure that the combination of ambient temperature and process heating does not exceed the maximum specified ambient temperature rating of 40 °C at the motor.

42aabcdef9000gg

Equipment Ratings:

Nonincendive for Class I, Division 2, Groups B, C, D T3/T3C, Ta = -20°C to +40°C, hazardous (classified) locations.
Refer to manual BX420003 for relationship between temperature class, ambient temperature and process temperature.

Markings:

Cl. I, Div. 2, Gps. B, C, D. T3/T3C
Temp. max.: see manual BX420003

Description of Equipment:

General – The sample pumps move sample gases from stacks to an analyzer. A sample pump consists of a motor and a pump head, which can be split by an intermediate flange with variable versions.
Construction – The sample pumps are of painted metal construction. The motors for the pumps provide a terminal box with an opening suitable for a ½" NPT conduit hub.
Ratings – The pumps operate at 115 Vac, 1.5 to 1.6 A, or 230 Vac, 0.7 to 0.8 A, depending upon model type. The pumps are rated for an ambient temperature range of -20°C to +40°C.
Refer to Installation and Operation Instructions document BE420003 for further details concerning model types.

42aabcdef9000gg. Sample Gas Pumps, where:
aa = Base model: 71, 72, where:
71 = P2.2 AMEX
72 = P2.4 AMEX
b = Motor voltage: 7, 8
c = Pump head position: 1, 2
d = Pump head material: 1, 2, 3, 4
e = Valve material: 1, 2
f = Screw-in connections: 9, 1, 2, 3, 5
g = Options H2, O2.

Specific Conditions of Use:

It is the responsibility of the installer to ensure that the combination of ambient temperature and process heating does not exceed the maximum specified ambient temperature rating of 40 °C at the motor.

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CERTIFICATE OF COMPLIANCE

HAZARDOUS LOCATION ELECTRICAL EQUIPMENT PER CANADIAN REQUIREMENTS

This certificate is issued for the following equipment:

P2.2 AMEX (P/N 4271XXXX99), P2.4 AMEX (P/N 4272XXXX99), P2.5 AMEX (P/N 4278XXXX99), P2.82 AMEX (P/N 4273XXXX99) and P2.84 AMEX (P/N4274XXXX99) Rated 115V/230V AC, 50/60Hz, 1.7A/0.89A. Sample Gas Pumps.
NI / I / 2 / BCD / T3, T4 Ta = -20 °C to +50 °C
x = denote power supply, position of pump head, material of pump head and material of valves.

Equipment Ratings:

Nonincendive electric apparatus for use in Class I, II, Division 2, Groups B, C & D indoor hazardous (Classified) locations and for use in ordinary Locations

FM Approved for:

Bühler Technologies GmbH
Ratingen D-40880 Germany

FM Approvals®

Member of the FM Global Group

This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

CSA	C22.2 No. 213, May 1987	Re-affirmed 2008
CSA	C22.2 No. 61010-1, 2004	Re-affirmed 2009

Original Project ID: 3038101

Canadian Project ID: 3038101C

Approval Granted: July 24, 2012

Subsequent Revision Reports / Date Approval Amended

Report Number	Date	Report Number	Date

FM Approvals LLC

J.E. Marquedant

J.E. Marquedant
Group Manager, Electrical

21 July 2012
Date

CERTIFICATE OF CONFORMITY

1. **HAZARDOUS LOCATION ELECTRICAL EQUIPMENT PER CANADIAN REQUIREMENTS**
2. **Certificate No:** **FM21CA0055X**
3. **Equipment:** **Model P2.2 AMEX, P2.4 AMEX, P2.5 AMEX, P2.82 AMEX and P2.84 AMEX Sample Gas Pumps**
   (Type Reference and Name)
4. **Name of Listing Company:** **Bühler Technologies GmbH**
5. **Address of Listing Company:** **Harkortstrasse 29**
   Ratingen D-40880
   Germany
6. The examination and test results are recorded in confidential report number:

   3038101C_Rev120709 dated 24th July 2012
7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

   CAN/CSA-C22.2 No. 213:2016, CAN/CSA-C22.2 No. 61010-1:R2009
8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.

Certificate issued by:

J. E. Marquedant
VP, Manager - Electrical Systems

24 September 2021
Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

FM Approvals LLC. 1151 Boston-Providence Turnpike, Norwood, MA 02062 USA
T: +1 (1) 781 762 4300 F: +1 (1) 781 762 9375 E-mail: information@fmapprovals.com www.fmapprovals.com

SCHEDULE

Canadian Certificate of Conformity No: FM21CA0055X

9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.

10. Equipment Ratings:

    Nonincendive for Class I, Division 2, Groups B, C, D T3/T3C, Ta = -20°C to +40°C, hazardous locations. Refer to manual BX420003 for relationship between temperature class, ambient temperature and process temperature.

11. The marking of the equipment shall include:

    Cl. I, Div. 2, Gps. B, C, D. T3/T3C

    Temp. max.: see manual BX420003

12. **Description of Equipment:**

    General – The sample pumps move sample gases from stacks to an analyzer. A sample pump consists of a motor and a pump head, which can be split by an intermediate flange with variable versions.

    Construction – The sample pumps are of painted metal construction. The motors for the pumps provide a terminal box with an opening suitable for a ½" NPT conduit hub.

    Ratings – The pumps operate at 115 Vac, 1.5 to 1.6 A, or 230 Vac, 0.7 to 0.8 A, depending upon model type. The pumps are rated for an ambient temperature range of -20°C to +40°C.

    Model types – Approved model number variants are as defined below. Refer to Installation and Operation Instructions document BE420003 for further details concerning model types.

    42aabcdef9000. Sample Gas Pumps, where:
    aa = Base model: 71, 72, 73, 74, where:
    71 = P2.2 AMEX
    72 = P2.4 AMEX
    73 = P2.82 AMEX
    74 = P2.84 AMEX
    b = Motor voltage: 7, 8
    c = Pump head position: 1, 2
    d = Pump head material: 1, 2, 3, 4
    e = Valve material: 1, 2
    f = Screw-in connections: 9, 1, 2, 3, 5

13. **Specific Conditions of Use:**

    It is the responsibility of the installer to ensure that the combination of ambient temperature and process heating does not exceed the maximum specified ambient temperature rating of 40 °C at the motor.

14. **Test and Assessment Procedure and Conditions:**

    This Certificate has been issued in accordance with FM Approvals Canadian Certification Scheme.

SCHEDULE

Canadian Certificate of Conformity No: FM21CA0055X

15. **Schedule Drawings**

A copy of the technical documentation has been kept by FM Approvals.

16. **Certificate History**

Details of the supplements to this certificate are described below:

Date	Description
24th July 2012	Original Issue.
24th September 2021	Supplement 1: Report Reference: RR228650 dated 24th September 2021. Description of the Change: New motor supplier. Revise ambient temperature range. Update standard CSA C22.2 No. 213 from May 1987, re-affirmed 2009 to 2016. Apply specific condition of use relating to process and ambient temperatures. Re-create certificate in new format. Apply corrections to and reformat Certificate and Approval Guide listing.

CERTIFICATE OF CONFORMITY

1. **HAZARDOUS LOCATION ELECTRICAL EQUIPMENT PER CANADIAN REQUIREMENTS**
2. **Certificate No:** **FM21CA0055X**
3. **Equipment:** **Model P2.2 AMEX, P2.4 AMEX, P2.5 AMEX, P2.82 AMEX and P2.84 AMEX Sample Gas Pumps**
   (Type Reference and Name)
4. **Name of Listing Company:** **Bühler Technologies GmbH**
5. **Address of Listing Company:** **Harkortstraße 29, Ratingen D-40880, Germany**
6. The examination and test results are recorded in confidential report number:

   3038101C_Rev120709 dated 24th July 2012

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

   CSA C22.2 No. 213:2016, CSA C22.2 No. 61010-1:2004

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.
10. Equipment Ratings:

    See Annex

11. The marking of the equipment shall include:

    See Annex

12. **Description of Equipment:**

    See Annex

13. **Specific Conditions of Use:**

Certificate issued by:

J.E. Marquedant
VP, Manager - Electrical Systems

19 April 2024
Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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See Annex

14. **Test and Assessment Procedure and Conditions:**

This Certificate has been issued in accordance with FM Approvals Canadian Certification Scheme.

15. **Schedule Drawings**

A copy of the technical documentation has been kept by FM Approvals.

16. **Certificate History**

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19 April 2024	Supplement 2: Report Reference: RR240898 dated 19 April 2024. Description of the Change(s): Addition of H2 and O2 Options, Update manual for option update and misc.items.

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ANNEX

42aabcdef9000

Equipment Ratings:

Nonincendive for Class I, Division 2, Groups B, C, D T3/T3C, Ta = -20°C to +40°C, hazardous locations. Refer to manual BX420003 for relationship between temperature class, ambient temperature and process temperature.

Markings:

Cl. I, Div. 2, Gps. B, C, D. T3/T3C
Temp. max.: see manual BX420003

Description of Equipment:

General – The sample pumps move sample gases from stacks to an analyzer. A sample pump consists of a motor and a pump head, which can be split by an intermediate flange with variable versions.
Construction – The sample pumps are of painted metal construction. The motors for the pumps provide a terminal box with an opening suitable for a ½" NPT conduit hub.
Ratings – The pumps operate at 115 Vac, 1.5 to 1.6 A, or 230 Vac, 0.7 to 0.8 A, depending upon model type. The pumps are rated for an ambient temperature range of -20°C to +40°C.
Model types – Approved model number variants are as defined below. Refer to Installation and Operation Instructions document BE420003 for further details concerning model types.

42aabcdef9000. Sample Gas Pumps, where:
aa = Base model: 71, 72, 73, 74, where:
71 = P2.2 AMEX
72 = P2.4 AMEX
73 = P2.82 AMEX
74 = P2.84 AMEX
b = Motor voltage: 7, 8
c = Pump head position: 1, 2
d = Pump head material: 1, 2, 3, 4
e = Valve material: 1, 2
f = Screw-in connections: 9, 1, 2, 3, 5

Specific Conditions of Use:

It is the responsibility of the installer to ensure that the combination of ambient temperature and process heating does not exceed the maximum specified ambient temperature rating of 40 °C at the motor.

42aabcdef9000gg

Equipment Ratings:

Nonincendive for Class I, Division 2, Groups B, C, D T3/T3C, Ta = -20°C to +40°C, hazardous locations. Refer to manual BX420003 for relationship between temperature class, ambient temperature and process temperature.

Markings:

Cl. I, Div. 2, Gps. B, C, D. T3/T3C
Temp. max.: see manual BX420003

Description of Equipment:

General – The sample pumps move sample gases from stacks to an analyzer. A sample pump consists of a motor and a pump head, which can be split by an intermediate flange with variable versions.
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Model types – Approved model number variants are as defined below. Refer to Installation and Operation Instructions document BE420003 for further details concerning model types.

42aabcdef9000gg. Sample Gas Pumps, where:
aa = Base model: 71, 72, where:
71 = P2.2 AMEX
72 = P2.4 AMEX

b = Motor voltage: 7, 8
c = Pump head position: 1, 2
d = Pump head material: 1, 2, 3, 4
e = Valve material: 1, 2
f = Screw-in connections: 9, 1, 2, 3, 5
g = Option H2, O2.

Specific Conditions of Use:

It is the responsibility of the installer to ensure that the combination of ambient temperature and process heating does not exceed the maximum specified ambient temperature rating of 40 °C at the motor.

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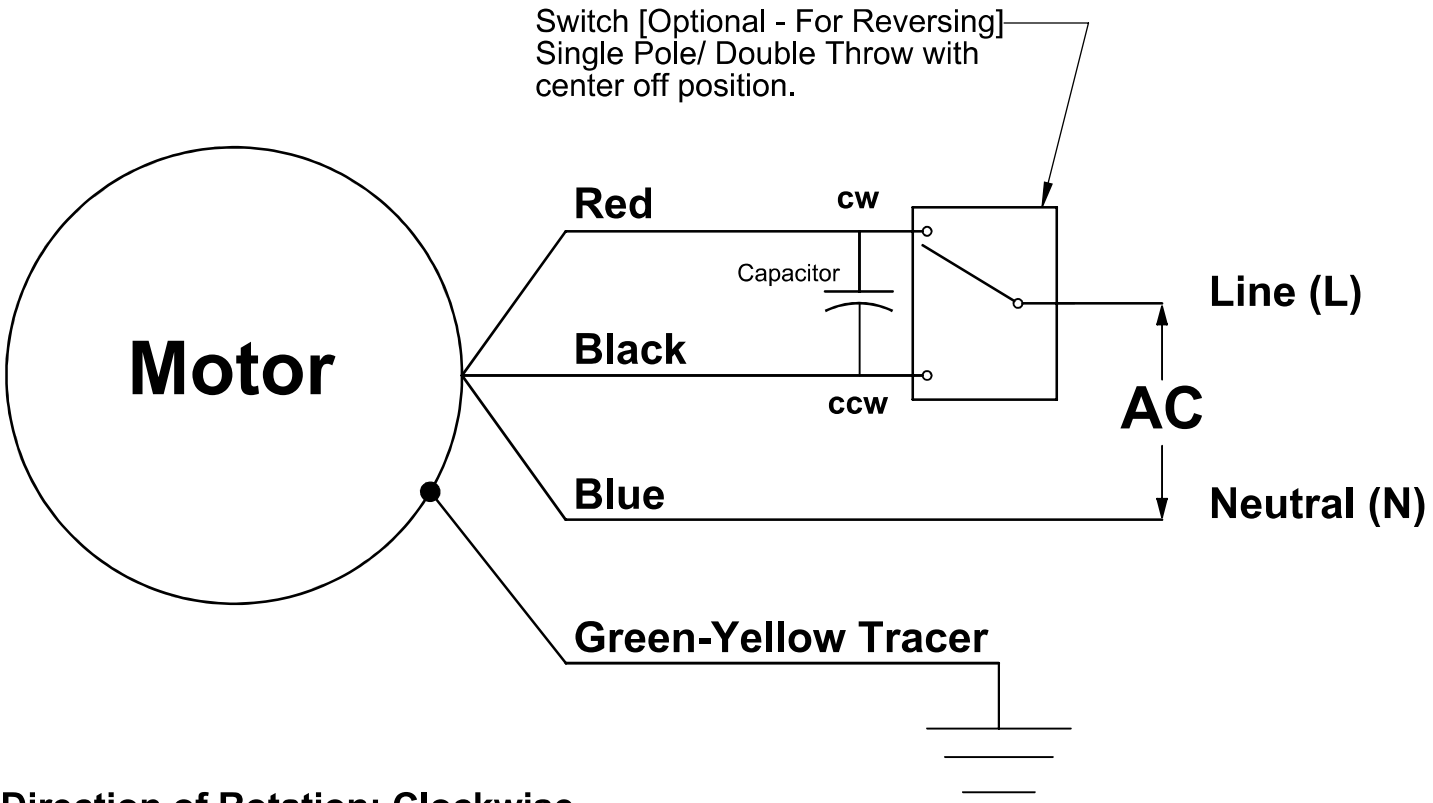
BODINE ELECTRIC COMPANY

Contact Us:
Tel: 1-800-7BODINE (U.S. only)
Tel: 773-478-3515
Fax: 773-478-3232
E-mail: service@bodine-electric.com
Corporate Web: www.bodine-electric.com

QUALITY IN MOTION

CONNECTION DIAGRAM 07410951

1-Phase 3-Wire Reversible Hazardous Location



Direction of Rotation: Clockwise

BODINE LIMITED WARRANTY

The Bodine Electric Company warrants all products manufactured by it to be free of defects in workmanship and materials when used under Normal Operating Conditions and when applied in accordance with nameplate specifications. This warranty shall be in effect for a period of twelve months from date of purchase or eighteen months from date of manufacture, whichever comes first.
The Bodine Electric Company will, at its option, repair, replace, or refund the purchase price of any of its products, which has been found to be defective and is within the warranty period, provided that the product is shipped freight prepaid, with previous authorization, to Bodine Electric, or to the nearest Bodine Authorized Service Center. At its option, all return shipments are F.O.B. Bodine's plant or Authorized Service Center. Bodine is not responsible for removal, installation, or any other incidental expenses incurred in shipping the product to or from Bodine.
This warranty is in lieu of any other expressed or implied warranty—including (but not limited to) any implied warranties of merchantability and/or fitness for a particular use or purpose.
Bodine's liability under this warranty shall be solely limited to repair or replacement of the Bodine product within the warranty period and Bodine shall not be liable, under any circumstances, for any consequential, incidental or indirect damages or expenses associated with the warranted products.
Commutators and/or brush wear and its associated effects are a normal occurrence and are not covered by this warranty unless otherwise agreed to by Bodine in writing.
Any Bodine product, which is damaged due to misuse, abuse, negligence or has been modified or dismantled without the knowledge or written consent of Bodine, is not covered by this warranty.

Motor/Gearmotor Serial No. _____ Purchase Date _____ Installed By _____

See Other Side for Safety, Installation, Use and Maintenance Information

Printing Instructions per SMKDI-770-01 Model: 07410951 eDOC: 20200262 Part No.: 07410951 A

Gearmotor/Motor Safety,Installation,Use, and Maintenance Information - Hazardous Location

Thank you for selecting a gearmotor/motor from Bodine Electric Company. With your new drive unit you will find yourself enjoying the same high performance and trouble free operation that has been characteristic of Bodine products since 1905.

Bodine Electric Company prides itself on the quality of design and manufacture of its products. Great care is taken in an attempt to provide products free of defects in workmanship, or materials.

Safety

"The use of electric machines, like that of all other utilization of concentrated power, is potentially hazardous. The degree of hazard can be greatly reduced by proper design, selection, installation, and use, but hazards cannot be completely eliminated. The reduction of hazard is the joint responsibility of the user, the manufacturer of the driven or driving equipment, and the manufacturer of the machine".

Bodine products are designed and manufactured to comply to applicable safety standards and, in particular, to those issued by ANSI (American National Standards Institute), NEMA (National Electrical Manufacturers Association), and U.L. (Underwriters Laboratories, Inc.).

Bodine products suitable for Hazardous Locations Class I, Division 2, Groups A,B,C,D or unclassified locations are U.L. Listed, file number E474208. Bodine products suitable for Hazardous Locations Class I, Division 1, Groups C and D are U.L. Listed, file number E318315.

If you need specific information regarding the "third party approval" of Bodine products, contact your Bodine Representative, or the Corporate Headquarters.

However, since even well built apparatus can be installed or operated in a hazardous manner, it is important that the users observe safety considerations. With respect to the load and environment, the user must properly *select, install,* and *use* the apparatus—for guidance on all three aspects see safety standards publication No. ANSI/NEMA MG-2.*

* Standards Publication No. ANSI/NEMA MG-2. "Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators."
Available from: National Electrical Manufacturers Assoc.
www.nema.org

Selection

Before proceeding with the installation, the user should review the application to confirm that the proper drive has been selected. This should be done after reading this notice and all applicable safety standards. If in doubt, contact your Bodine Representative or the Corporate Headquarters if there is no Representative in your area. Any selection or application suggestions made by Bodine or their Representatives are only to assist the customer—and in all cases, determination of fitness for purpose or use is solely the customer's responsibility.

All nameplate ratings are based on the following *normal operating conditions*:

1. Duty: 8 hours per day; 5 days per week if nameplated continuous duty (CONT), without frequent reversals or starts and stops.
2. Ambient temperature 0°C to 40°C, unless otherwise noted on the product nameplate.
3. Load: Uniform and free from shock or high inertia.
4. Voltage: Within 10% of nameplate rating.
5. Frequency: Within 5% of nameplate rating.
6. Combined variation of voltage and frequency—Within a total of 10% providing frequency variation does not exceed 5%.

Variations from the above conditions may be hazardous.

Installation

It is the responsibility of the equipment manufacturer or individual installing the apparatus to take diligent care in installing it. The National Electrical Code (NEC), sound local electrical and safety codes, and when applicable, the Occupational Safety and Health Act (OSHA) should be followed when installing the apparatus to reduce hazards to persons and property.

Inspection

Examine the apparatus for damage from shipment before connecting. Any claim(s) for shipping damage should be made to the freight carrier. Do not attempt to turn the output shaft of a gearmotor with an externally applied torque arm. Paint thickness of .006 maximum does not apply to published dimensional values.

Mounting

Any screws or similar devices, that penetrate the motor frame either for mounting the Bodine product or mounting something to the product, should be limited in length so as not to come in contact with, or in close proximity to, intended features that conduct electricity.

Bodine stock products are designed for universal horizontal mounting. Vertical mounting, with gearhead above motor is not normally recommended. Consult the factory for custom mounting requirements.

Connection

Follow nameplate for voltage, frequency, and phase of power supply. See accompanying wiring diagram as to connections for rotation (and capacitor, resistor, relay, protector, if required). *When connecting, make sure that your motor/gearmotor is securely and adequately grounded—failure to ground properly may cause serious injury to personnel.* Wiring diagrams are available at: www.bodine-electric.com

Wiring

For wire sizes and electrical connections refer to the National Electrical Code (NEC), Article 430, "Motors, Motor Circuits, and Controllers" and/or applicable local area codes. Extension cords should not be used.

Use

Additional Safety Considerations

The chance of electric shock, fires, or explosions can be reduced by giving proper consideration to the use of grounding, thermal and over current protection, type of enclosure, and good maintenance procedures.

The following information *supplements* the foregoing safety considerations: This information is not purported to be all-inclusive and the aforementioned references should be consulted.

1. Bodine standard totally enclosed products for Hazardous Location are certified for Class I, flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors. Division 1 certification is for an environment where ignitable concentrations of flammable gases or flammable liquid-produced vapors can exist under normal operating conditions. Division 2 certification is for an environment where ignitable concentrations of flammable gases or flammable liquid-produced vapors are not likely to exist under normal operating conditions.

2. Enclosed motors/gearmotors for Hazardous Location CID2 are suitable for dirty, damp locations with an environmental rating of IP44 with 1/2" NPT conduit installed per NEC specifications. Motors/gearmotors for Hazardous Location CID1 have been tested by a third party to demonstrate compliance with IP66.

3. Moisture will increase the electrical shock hazard of electrical insulation. Therefore, consideration should be given to the avoidance of (or protection from) liquids in the area of motors. Use of totally enclosed motors/gearmotors will reduce the hazard if all openings are sealed.
4. Motors/gearmotors that employ capacitors can develop more than nameplate voltage across the capacitor and/or capacitor winding (depending on design). Suitable precautions should be taken when applying such motors.
5. Do not rely upon self-locking gears or permanent magnet, or energized motors to hold a load in place if movement could result in personal injury. Mechanical locking devices should be used in such applications.
6. For motors driven by electronic controls, do not use a function of the control for safety interlock purposes. An independent switch or relay should be used.

Before Starting

1. Before attempting to start, check all connections and fuses.
2. Proper consideration should be given to rotating members: Before starting, be sure keys, pulleys, etc. are securely fastened. *Proper guards should be provided to prevent hazards to personnel while rotating.*
3. Other mechanical considerations include proper mounting and alignment of products and safe loads on shafting and gearing.

Starting

1. The motor/gearmotor should be test-started in an unloaded state (because of possible reaction torque, the drive should be securely mounted when starting—even when unloaded).
2. If the drive unit does not start promptly and run smoothly, disconnect immediately.
3. If unable to correct the problem, contact your purchase source, or a Bodine Authorized Service Center, describing the trouble in detail. Include the serial number, type, and other nameplate data. Do not dismantle the product—tampering or disassembly voids the warranty.

Maintenance

IMPORTANT—*Before* servicing or working on equipment, disconnect power source (this applies especially to equipment using automatic restart devices instead of manual restart devices and when examining or replacing brushes on brush-type motors/gearmotors).

Clean regularly to prevent dirt and dust from interfering with ventilation or clogging moving parts.

Products Employing Capacitors—Before servicing motors/gearmotors employing capacitors, always discharge the capacitor by placing a conductor across its terminals before touching the terminals with any part of your body.

Lubrication

All Bodine products are lubricated for life, and do not require re-lubrication.
(All information and data are subject to change without notice.)

Part No.: 07410951 A

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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