

## 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 regard to P2.x ATEX-O2 sample gas pumps (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.

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



### 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.

- Inspect the leak tightness of your sampling system before putting the device into operation.
- Ensure that gases that are hazardous to health are discharged safely.
- 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.
- 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 ambience, 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<sub>2</sub>) 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**

For P2.x ATEX-O2 sample gas pumps (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](#) [> page 24]).

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 maintenance tasks be performed at suitable intervals (see [Maintenance schedule](#) [> page 21])

- 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                                                  | 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.<br><br>Replace if damaged or have them repaired by Bühler Technologies.             | Customer                                 |
| Complete pump               | Every 8,000 h or under high dust load                     | Clean the entire pump, see <a href="#">Cleaning the pump console</a> [> page 24].                                                                                             | Customer                                 |
| Valves                      | Every 8,000 h or if pressure drops                        | Check valves, replace valves if necessary, see <a href="#">Replacing the inlet and outlet valves</a> [> page 24].                                                             | Customer                                 |
| Bellow                      | Every 4,000 h or 6 months                                 | Check by shutting off the suction pipe. Repair if damaged, see <a href="#">Inspecting the bellow</a> [> page 22] + Replacing bellow and connecting rod-eccentric-combination. | Customer                                 |
| Complete pump               | After 43,800 h or 5 years                                 | Inspection by Bühler Technologies<br><br>Item number see <a href="#">Order number for the 43.800h inspection</a> [> page 26].                                                 | Service technician / Bühler Technologies |
| Coupling (P2.4-/P2.74-ATEX) | After 2,000 h or 3 months, then every 4,000 h or 6 months | Initial elastomer ring gear inspection, see <a href="#">Inspecting and replacing the flexible spider</a> .                                                                    | 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<sub>2</sub> applications

#### P2.x ATEX-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<sub>2</sub> unit. 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](#) [> page 21] for maintenance intervals.

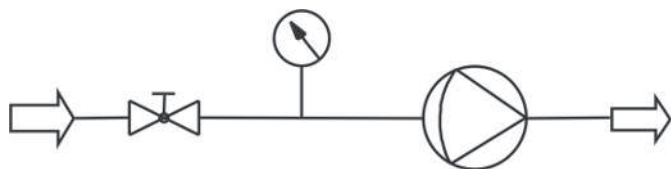


Fig. 2: Inspecting the bellow

## 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](#) [> page 24].
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 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 ATEX = 1.7 bar; P2.72/P2.74 ATEX = 1.8 bar  
Negative pressure: P2.2/P2.4 ATEX = -0.65 bar; P2.72/P2.74 ATEX = -0.6 bar  
Flow rate: P2.2/P2.4 ATEX = 400 l/h; P2.72/P2.74 ATEX = 700 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. For P2.x ATEX-O2 sample gas pumps (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 ATEX-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 ATEX = 1.7 bar; P2.72/P2.74 ATEX = 1.8 bar  
Negative pressure: P2.2/P2.4 ATEX = -0.65 bar; P2.72/P2.74 ATEX = -0.6 bar  
Flow rate: P2.2/P2.4 ATEX = 400 l/h; P2.72/P2.74 ATEX = 700 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

#### **ANGER**



#### **Electrostatic charge (Spark formation)**

Clean plastic parts and labels with damp cloth only.

#### **Inflammation of dust**

If the device is used in dust ambient, 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.

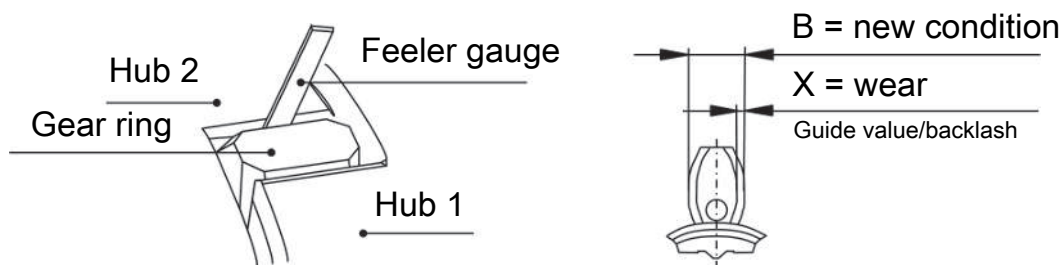


Fig. 3: Sample gas pump coupling

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

The coupling we use (on type P2.4 Atex / P2.74 Atex) 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.

For P2.x ATEX-O2 sample gas pumps (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 ATEX pump inspection item numbers

| 4261 | X | 0 | 0 | X | 00 |                   |
|------|---|---|---|---|----|-------------------|
|      | 7 |   |   |   |    | 230 V, 50/60 Hz   |
|      | 8 |   |   |   |    | 115 V, 50/60 Hz   |
|      | 9 |   |   |   |    | 380–420 V / 50 Hz |
|      | 0 |   |   |   |    | 500 V / 50 Hz     |
|      |   |   |   | 1 |    | 100 °C valves     |
|      |   |   |   | 2 |    | 140 °C valves     |

### P2.4 ATEX pump inspection item numbers

| 4262 | X | 0 | 0 | 0 | 00 |                   |
|------|---|---|---|---|----|-------------------|
|      | 7 |   |   |   |    | 230 V, 50/60 Hz   |
|      | 8 |   |   |   |    | 115 V, 50/60 Hz   |
|      | 9 |   |   |   |    | 380–420 V / 50 Hz |
|      | 0 |   |   |   |    | 500 V / 50 Hz     |

### P2.72 ATEX pump inspection item numbers

| 4265 | X | 0 | 0 | 2 | 00 |                   |
|------|---|---|---|---|----|-------------------|
|      | 7 |   |   |   |    | 230 V, 50/60 Hz   |
|      | 8 |   |   |   |    | 115 V, 50/60 Hz   |
|      | 9 |   |   |   |    | 380–420 V / 50 Hz |
|      | 0 |   |   |   |    | 500 V / 50 Hz     |

### P2.74 ATEX pump inspection item numbers

| 4266 | X | 0 | 0 | 0 | 00 |                   |
|------|---|---|---|---|----|-------------------|
|      | 7 |   |   |   |    | 230 V, 50/60 Hz   |
|      | 8 |   |   |   |    | 115 V, 50/60 Hz   |
|      | 9 |   |   |   |    | 380–420 V / 50 Hz |
|      | 0 |   |   |   |    | 500 V / 50 Hz     |

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

**Pump item number:** 4261711299000 (this number is located in the pump name plate, also see Item number structures and [Type plate](#) [> page 6]).

**Inspection item number:** 4261 1002 00