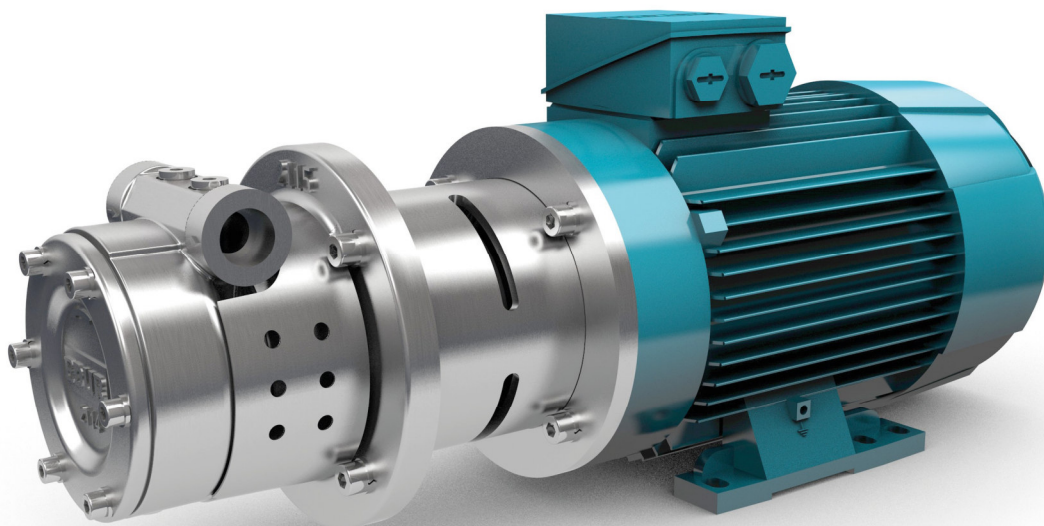


Peripheral pumps PBM ATEX



Operating instructions



**Translation of the original operating instructions
Please read and retain**



Service?
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1 Introduction

1.1 Addresses

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Delivery address for returns

EDUR-Pumpenfabrik
Eduard Redlien GmbH & Co. KG
Marie-Curie-Straße 15
24145 Kiel
Germany

1.2 Applicable documents

The overall documentation encompasses the following other applicable documents:

- Data sheet
- Hydraulic water characteristic curve
- Dimension sheet/installation plan
- Supplier documentation for assemblies from external suppliers
- Test certificates, if included in the scope of delivery of external suppliers and contractually agreed
- Acceptance test certificates, if contractually agreed
- Further documents, if contractually agreed.

1.3 About these operating instructions

In these operating instructions, safety information is contained in the 'Safety' chapters and in the warnings that can occur in all chapters.

The warnings are subdivided into hazard levels and are identified as follows:

WARNING

This warning indicates a possibly hazardous situation. Failure to observe this warning can result in death or severe physical injuries.

CAUTION

This warning indicates a possibly hazardous situation. Failure to observe this warning can result in moderate or slight physical injuries.

NOTICE

This warning constitutes a warning concerning property damage.

A pump assembly always consists of the pump and a motor. For simplification, the term **pump** is used in the operating instructions.

The pump is intended for installation in machines or systems. For simplification, the word **system** is used in the operating instructions.

1.4 Signs on the pump

The signs are part of the pump. They must not be removed, painted over or rendered illegible. Damaged, illegible or missing signs must be replaced.

Signs on the pump

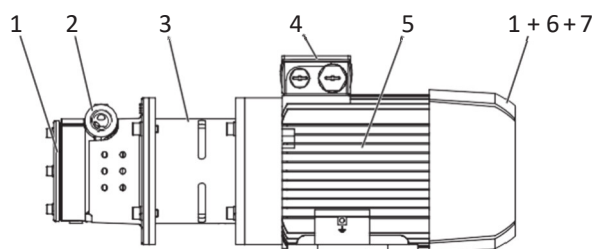


Fig. 1-1 Signs on the pump

Item	Sign	Explanation
1		Rotation direction The arrow indicates the specified direction of rotation of the pump.
2		Direction of flow The arrow indicates the specified direction of flow.
3		Warning of magnetic field Warns the personnel of a magnetic field.
4		Read instructions Requests the personnel to read the instructions before working on the pump.
5		Motor type plate , see Type plate on the motor, page 8.
6		Pump type plate , see Type plate on the pump casing, page 7.
7		Additional ATEX sign , see ATEX type plate on the pump casing, page 8.

Tab. 1-1 Explanations concerning the signs

Type plate on the pump casing

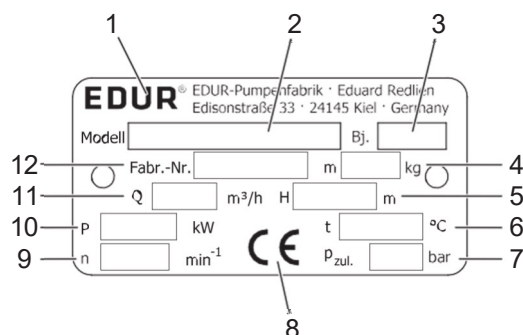


Fig. 1-2 Type plate on the pump casing

- 1 Manufacturer
- 2 Model designation
- 3 Year of construction
- 4 Overall weight
- 5 Head
- 6 Maximum temperature of the pumped fluid
- 7 Maximum permissible pressure
- 8 CE symbol
- 9 Rated speed
- 10 Power consumption
- 11 Volumetric flow/delivery rate
- 12 Factory number/serial number

ATEX type plate on the pump casing

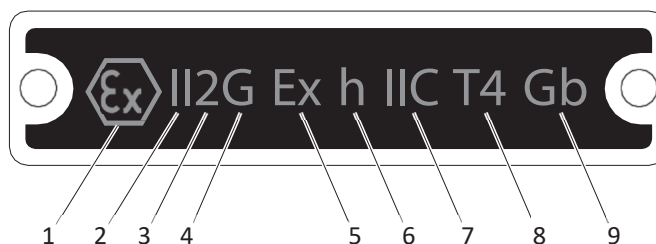


Fig. 1-3 ATEX type plate on the pump casing

- 1 Marking for explosion-protected operating equipment
- 2 Device group
- 3 Device category
- 4 Areas with an explosive gas, vapour, mist-air mixture
- 5 The device complies with valid EN standards
- 6 Ignition protection type
- 7 Explosion group
- 8 Temperature classification, maximum surface temperature
- 9 Equipment protection level (EPL)

Type plate on the motor

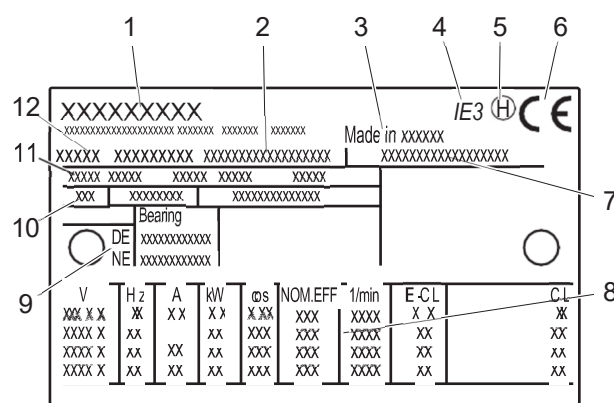


Fig. 1-3 Type plate on the motor

- 1 Manufacturer
- 2 Motor designation
- 3 Country of origin
- 4 Efficiency class
- 5 Balancing
- 6 CE symbol
- 7 Serial number with year of manufacture
- 8 Rated motor data
- 9 Storage
- 10 Weight | Insulation class | Temperature range
- 11 Standards | Size | Type | Protection class
- 12 Number of phases

The item numbers in the figure may deviate depending on the motor make.

2 Safety

2.1 Reading the operating instructions

The personnel that carries out work on the pump must have read and understood the operating instructions. The operating instructions must be available at the operating location and be retained throughout the entire service life of the pump.

The local, generally valid, statutory and other binding accident prevention and environmental protection regulations must be observed in addition to the operating instructions.

2.2 Proper use

The pump is intended for installation in machines and systems that pump pure pumped fluids or fluid/gas mixtures or that enrich fluids with gases.

Possible applications include water and wastewater technology as well as industrial technology.

Each pump is built for a specific customer. The materials and seals are selected for the respective pumped fluid and the operating area. The pump may only be operated with the approved pumped fluid and within the specified limits of the operating area, see Chapter 1.2 Applicable documents, page 5.

The pump assembly is suitable for use in explosive areas. The precise explosion protection marking is shown on the type plate. The information on the type plate is explained in Chapter ATEX type plate on the pump casing, page 8.

The technical data and the explosion protection marking pursuant to Directive 2014/34/EU (ATEX) of the pump assembly and the system must match. This also includes the motor.

2.3 Improper use

The pump may only be operated in installed condition within a pipe network. Switching it on even temporarily outside of the pipe network is considered improper.

The pump must not be operated in an explosive environment.

2.4 Basic safety instructions

Installation and removal work, operation and maintenance may only be carried out by qualified specialist personnel. Qualified specialist personnel includes persons who are able to independently recognise and avoid possible hazards based on their training and experience. The owner must ensure these qualifications.

Observe all local, statutory and system-specific regulations and requirements.

Do not carry out any independent modifications or conversions. Modifications and conversions must be approved by the manufacturer.

Always operate the pump in the specified direction of rotation and with pumped fluid.

When pumping pumped fluids that pose a risk to health and the environment, observe the statutory and operational safety regulations. Avoid any risk of inhalation, swallowing or contact with eyes, skin and mucous membranes.

2.5 Specific safety instructions

2.5.1 Danger due to explosion

Special requirements apply to the operation of explosion-protected pumps. The explosion protection information must be observed.

- Work on the electrical system may only be carried out by electrically skilled persons. The electrically skilled persons must have special knowledge:
 - Ignition protection types
 - Rules and regulations for operating equipment in explosive areas
- Only pumps with a corresponding marking may be operated in explosive areas.
- Explosion protection is only guaranteed in the case of intended use. Impermissible operating modes must always be avoided.
- The conditions stated in EU Directive 2014/34/EU (ATEX) - or in comparable requirements - for operating explosion-protected pumps must be observed.

The pump fulfils the ignition protection type constructive safety 'c' (ignition protection type 'h' on the type plate).

2.5.2 Danger from magnetic field

The magnetic field of the magnetic coupling can lead to serious personal injury and property damage. Observe the following safety instructions.

- Persons with cardiac pacemakers or implanted defibrillators must not be in the vicinity of the pump or work on the pump. These persons must maintain a safety distance of at least 1 metre. There is a danger to life.
- Ensure that no magnet-sensitive devices, such as ID cards with magnetic strips, electrical, electronic and precision mechanical devices, are located in the vicinity of the pump.
- Ensure that no magnetisable metal parts can be attracted to the magnetic coupling.
- Ensure that parts of the magnetic coupling cannot be attracted by magnetisable metals.

2.5.3 Danger due to overheating of the magnetic coupling

The magnetic coupling can overheat and therefore represent a potential ignition source that causes explosions. Observe the following safety instructions.

- Magnetic couplings with metal coupling enclosures may only be operated in explosive areas with temperature monitoring.

NOTE! All magnetically coupled pumps with a metal coupling enclosure are supplied with a resistance thermometer.

- Temperature monitoring is optional, not mandatory, for magnetic couplings with ceramic or CF-PEEK coupling enclosures.

The owner is obliged to check the necessity of temperature monitoring.

- Temperature measurement is carried out with a resistance thermometer directly on the jacket of the coupling enclosure or in a blind hole in the flange of the coupling enclosure. The resistance thermometer is set to the limit value of the respective temperature class.

$\Delta T = 15 \text{ K}$ should lie below the maximum surface temperature permissible for the ex-area, see Chapter 3.4 Temperature limits, page 16

NOTE! Monitoring the coupling enclosure temperature is not sufficient to monitor pump dry running.

If the pumped fluid or the surface of the coupling enclosure of a magnetically coupled pump reaches a critical value, the pump assembly must be automatically switched off and switched to a safe operating status. The pump may only be started up again once the fault has been rectified.

2.6 Protective devices

Pumps with a coupling can be equipped with a coupling guard depending on type.

The owner must install the following protective devices on all pumps:

- Facility for disconnecting the power supply in an emergency
- Motor protection/overload protection

The owner must install further protective devices depending on the type, the technical data and the installation location:

- Contact protection in the case of very hot or cold pumped fluids

2.7 Safety measures when operating explosion-protected pumps

The following safety measures must be implemented in order to operate explosion-protected pumps safely.

- Explosive pumped fluids can escape as a result of leaks. Escaping pumped fluid must be collected and conducted away so that no hazards for persons, systems or the environment arise.
- Observe permissible temperature classes in order to prevent excessively high surface temperatures on the pump.
- If no temperature monitoring for the magnetic coupling is available on delivery, the owner must check the necessity of temperature monitoring. Magnetic couplings with metal coupling enclosures must be equipped with temperature monitoring.
- The pump assembly may only be operated within the specified limit values and in filled condition.

If the owner of the system is unable to ensure adherence to these requirements, suitable monitoring facilities must be installed. The owner is obliged to check the necessity of additional monitoring facilities. The monitoring facilities that are used must be approved for use in the respective ex-area and may not themselves represent an ignition source.

The following monitoring facilities are possible:

- Level monitor
- Fill level monitor
- Flow monitor
- Pressure switch
- All external devices that are used in combination with a pump pursuant to Directive 2014/34/EU (ATEX) must be approved in accordance with Directive 2014/34/EU (ATEX) and be of the same or a higher standard as or than the pump.
- Prevent sparks caused by friction. Choose the material for the coupling guard so that no sparks fly in the event of mechanical contact.

Make sure that potential equalisation is mounted on the pump to prevent electrostatic charging.

2.8 Personal protective equipment

The personal protective equipment is dependent on the operating location and the pumped fluid. The scope of the personal protective equipment must be defined by the owner.

The manufacturer recommends the following as the minimum requirement:

- Safety shoes
- Protective gloves
- Safety glasses (optional)
- Ear protectors (optional)
- Soundproofing if the statutory specifications concerning noise emissions are exceeded
- Protection against weather and environmental influences

When pumping pumped fluids that pose a risk to health and the environment, the owner must implement corresponding safety measures, e.g. installing a collection facility.

The pump must only be operated with installed and functioning protective devices.

3 Technical data

The type plate and the applicable documents contain the technical data. The technical data specified here are generally valid and can deviate in individual cases.

3.1 Pump

Peripheral pumps PBM	
Permissible pressure	Max. 16 bar
Delivery volume	0.5 to 12.5 m ³ h ⁻¹
Shaft seal	Magnetic coupling

Tab. 3-1 Pump technical data

3.2 Motor

IEC three-phase motor (self-cooled)	
Protection class	IP55
Insulation class	F (155°C)
Operating mode	S1 continuous operation
Ambient temperature (permissible coolant temperature)	–20°C to 40°C
Installation height above MSL	Max. 1000 m
Rotational speed	1,450 (1,750) rpm 2,900 (3,500) rpm
Frequency	50 (60) Hz

Tab. 3-2 Motor technical data

3.3 Noise emissions

Rated power requirement [kW]	Emission sound pressure level LpA [dB] at rotational speed	
	1,450 rpm	2,900 rpm
0.55	55	65
0.75	56	66
1.1	57	66
1.5	58	67
2.2	60	67
3.0	62	68
4.0	63	68
5.5	65	71
7.5	66	72
11.0	68	74
15.0	69	75

Tab. 3-3 Emission sound pressure level LpA

The emission sound pressure level actually determined on site may deviate significantly from the specified values due to the operating and installation conditions. The values have a measurement tolerance of ± 3 dB and cannot be guaranteed.

Increased noise emissions can occur due to cavitation, defective or worn bearings and due to vibrations. Observe installation and maintenance instructions, see Chapter 7 Installation, page 17 and Chapter 10 Maintenance, page 26.

3.4 Temperature limits

In normal operating status, the highest temperatures are to be expected on the surface of the pump casing and at the magnetic coupling. The maximum surface temperature that occurs at the pump casing corresponds to the temperature of the pumped fluid. The following table contains the temperature classes and the resulting theoretical limit values of the pumped fluid temperature. The temperature class indicates the maximum temperature that the surface of the pump may reach during operation.

The maximum permissible temperature of the actual pump and the motor is indicated on the pump type plate and the motor type plate. Refer to the following table for the maximum permissible temperature for the pump assembly.

Temperature classes	Maximum permissible surface temperature [°C]	Shut-off temperature [°C] ¹
T1	450	350 ²
T2	300	285
T3	200	185
T4	135	120
T5	100	85
T6	85	70

¹ Measurement with resistance thermometer

² Operating temperature of the magnetic coupling max. 350°C

Tab. 3-4 Temperature limits depending on temperature classes

3.5 Resistance thermometer

(If included in the scope of delivery.)

ATEX Pt-100 resistance thermometer with adapter sleeve	
The thermometer is suitable for use in intrinsically safe electrical circuits pursuant to:  II 1 G Ex ia IIC Ga	
Connection type	3-wire technology
Jacket tube length	150 mm (stainless steel)
Jacket diameter	4.5 mm
Tolerance class	B deviation: $\pm 0.30^{\circ}\text{C}$ at 0°C / $\pm 0.80^{\circ}\text{C}$ at 100°C
Nominal resistance	100 ohms at 0°C
Connection cable	2 m PVC insulation (-30°C to $+105^{\circ}\text{C}$)
Clamp connection	G1/8" (stainless steel)

Tab. 3-5 Technical data of resistance thermometer

4 Design and function

4.1 Pump

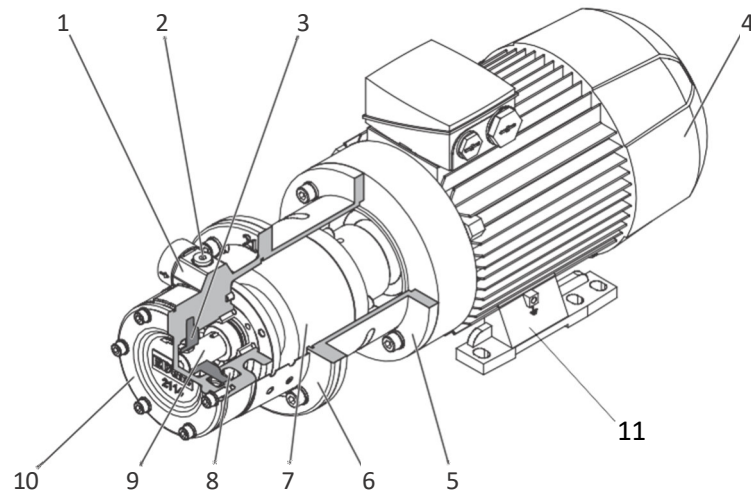


Fig. 4-1 Pump design

- 1 Side channel with suction and pressure nozzles
- 2 Venting screw
- 3 Impeller
- 4 Motor
- 5 Lantern
- 6 Casing
- 7 Magnetic coupling
- 8 Impeller port
- 9 Shaft
- 10 Cover
- 11 Foot

Peripheral pumps are a special form of centrifugal pumps. They are suitable for pumping pure pumped fluids. Peripheral pumps can also pump high contents of gas without interrupting the fluid flow. They are characterised by an impeller port in the casing that encompasses the vane channels on the face and outer sides.

By means of an energy gradient, the pumped fluid flows via the suction nozzle into the pump, where it encounters the rotating impeller. The impeller consists of straight vanes arranged in a star shape on both sides on the outer edge of a hub. The impeller is driven by the motor via a shaft and a magnetic coupling.

The vanes of the impeller apply force onto the pumped fluid and increase its angular momentum. Energy is transferred to the pumped fluid and the pressure and absolute velocity increase. The pumped fluid circulates back from the side channel into the impeller channel several times before flowing out of the pump through the pressure nozzle. This increases the energy transfer and enables the achievement of high heads even with compact designs. To maintain the flow, an energy gradient must also be present at the pressure nozzle.

Losses in the system caused by friction or leakages increase the pump's power consumption.

The magnetic coupling prevents the pumped fluid from escaping at the rotating shaft. The venting screws are used to release trapped air. A lantern is inserted between the motor and casing.

The spare part drawing shows the detailed design of the pump. The spare part drawing can be downloaded in the service area of the EDUR homepage, www.edur.com.

4.2 Magnetic coupling

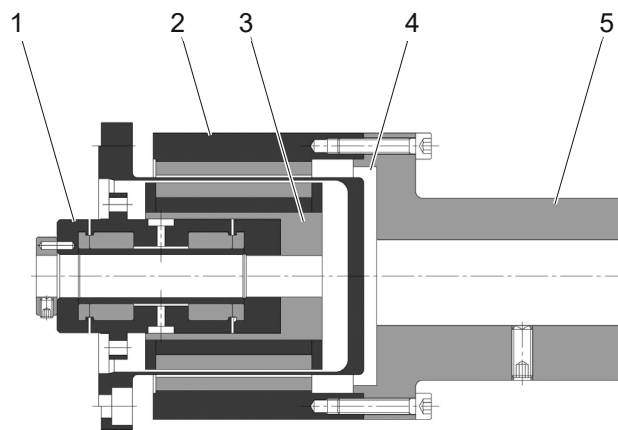


Fig. 4-2 Design of the magnetic coupling

- 1 Bearing support housing
- 2 Outer rotor
- 3 Inner rotor
- 4 Coupling enclosure
- 5 Motor-side half of the coupling

The magnetic coupling transfers the force of the motor to the shaft. The transmission of force is carried out without contact. The magnetic coupling is hermetically sealed. No maintenance is required for trouble-free operation.

5 Transport

The pump can be transported with an industrial truck or a crane.

5.1 Safety during transport with a crane

Improper transport can lead to personal injury and property damage. Observe the following safety instructions.

- Transport must only be carried out by qualified and trained personnel.
- Transport the pump in the horizontal position only.
- Use suitable lifting and lashing equipment. Observe the weight data on the type plate and the packaging.
- Do not use the ring bolts on the motor. The ring bolts on the motor are only designed for the weight of the motor.
- Do not remain beneath suspended loads.
- Make sure that nobody remains in the danger zone.
- Wear safety shoes.

5.2 Transporting the pump with a crane

Pumps with a power of 2.2 kW or more can be lifted, as shown below. All pumps with a power of less than 2.2 kW are too small to securely attach lashing equipment. These pumps weigh less than 25 kg and can be lifted by hand.

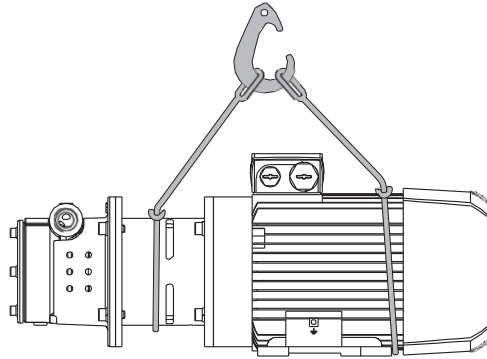


Fig. 5-1 Transporting the pump with a crane

1. Fasten lashing equipment to the pump, see figure.
2. Raise the pump carefully and transport it to the destination location.
3. Put the pump down carefully.
4. Remove the lashing equipment.

5.3 Transporting the pump with an industrial truck

The pump is secured on a pallet for shipping. After delivery, the pump can be transported on the pallet and with the packaging using a suitable industrial truck.

In the event of subsequent transport, the pump can again be placed onto a pallet and secured on it.

6 Storage

6.1 Safety during storage

Improper storage can lead to damage to the pump and to environmental pollution. Observe the following safety instructions.

- Corrosion protection agents can be dangerous to health and the environment. Collect corrosion protection and cleaning agents and dispose of them properly. Observe the safety instructions on the corrosion protection agent packaging.
- Wear protective gloves.

Store the pump under the conditions specified here.

- The storage location must be covered, dry, well ventilated, frost-free and as vibration-free as possible.
- The humidity should be constant.
- Store the pump horizontally.
- Preserve the pump if it is stored for a long time. Tightly seal the suction and pressure nozzles. Check the corrosion protection every 3 months.
- Rotate the shaft by hand once a month, e.g. rotate the fan on the motor.
- If stored for more than two years, check the motor shaft bearings before installation and exchange them if necessary. If stored for more than four years, check the motor shaft bearings before installation and generally exchange them.

6.2 Removing preserving agents

Stainless steel pumps are not preserved.

6.3 Storing the pump

The pump must be prepared accordingly after removal and prior to renewed storage.

Stainless steel pumps can be stored without preservation.

WARNING

Risk of contamination when pumping pumped fluids that can be dangerous to health and the environment

Pumped fluids that can be dangerous to health and the environment can chemically burn, poison or otherwise injure persons and damage the environment.

- Completely decontaminate the pump prior to storage.
-

NOTICE**Damage to the sealing elements**

Oils and greases can damage sealing elements with elastomers made of EP rubber.

- Avoid contact with oils and greases.

Prerequisite

- The pump has been removed, cleaned and decontaminated if necessary.
- The pump is in a horizontal position.

Procedure

1. Firmly screw in the venting screw(s) and drain screw(s).
2. Tightly seal the suction and pressure nozzles.

7 Installation

7.1 Safety during installation

Improper installation can lead to personal injury and property damage. Observe the following safety instructions.

- Installation must only be carried out by qualified and trained personnel.
- Observe the requirements for the installation location, see Chapter 7.2 Requirements for the installation location, page 18.
- Carry out installation in voltage-free condition.
- Observe the direction of flow.
- Secure the pipes and pump to prevent stumbling, and provide a safety area if necessary.
- Pay attention to noise emissions and fit soundproofing if necessary.

Observe the approved installation position, see figure. Any other installation position requires the approval of the manufacturer. Improper installation results in the risk of leaks at the feed lines and the risk of tearing off the pipe.

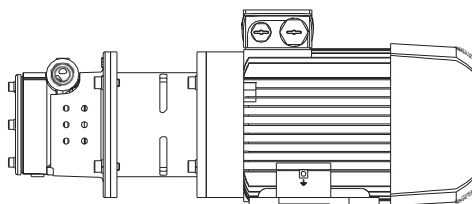


Fig. 7-1 Approved installation position

7.2 Requirements for the installation location

The installation location must meet the following requirements:

- The atmosphere must not be explosive.
- The installation location should be dust-free and not corrosive.
- The foundation must be horizontal, flat, adequately dimensioned for the weight of the pump and sufficiently strong.
- The pump must be freely accessible for monitoring, servicing, maintenance, installation and removal.
- A sufficient air supply must be ensured for cooling the motor. The motor fan must not be blocked. Impermissible heating can cause damage to the motor.
- The pump must be protected against environment influences such as wind, rain, frost or sand.

7.3 Requirements for the pipe system

The criteria listed in the following must be observed when designing the pipe system to ensure trouble-free and efficient pump operation:

- Route pressure and suction lines as per the respectively valid regulations and the relevant accident prevention regulations.
- Do not place strain on the pump due to the weight of the pipes.
- Never use the pump as a point for fixing the pipes.
- The pipe system must not cause any forces or torques (torsion, thermal expansion) to act on the pump.
- Provide suitable compensators to reduce the stresses that occur due to temperature fluctuations and vibrations, see chapter 7.5 Sound insulation and compensators, page 20.
- Provide slide gate valves close to the pump in the pressure and suction lines for maintenance work.
- Provide a non-return valve to avoid reverse flows.
- Providing a foot valve in the suction line for self-priming pumps during suction mode is recommended to prevent the pump and suction line from running empty during standstill.
- Use a suction strainer or filter to keep impurities in the pumped fluid away from the pump. No air from the fluid level or swirled-up dirt from the 'sump' may enter the suction line via the suction strainer in this case. Regularly clean the suction strainer and filter.
- Dimension the rated pipe widths comparatively large. Using rated widths that correspond at least to those of the pump connections is recommended.

- Design fittings so that they constrict the full pipe cross-section as little as possible.
- Always design the suction line as short and straight as possible in order to minimise pressure losses and achieve a high $NPSH_A$.
- Route the suction line without raised points in order to avoid gas accumulations.
- Position unavoidable pipe bends on one level only in order to avoid extensive pipe flow turbulence.
- Wherever possible, design cross-section extensions with an extension angle of $< 8^\circ$ to minimise pressure losses and prevent flow separation.
- Provide a straight pipe section with a length that is five times the inner diameter of the suction flange as a settling section between the suction flange and upstream fittings, cross-section changes or pipe deflections in order to avoid additional pressure losses and cavitation in the event of flow onto the pump impeller. Shorter settling sections are possible but can affect the hydraulic performance of the pump and/or lead to cavitation.
- Route the suction line to the pump with a descent of at least 10° for admission mode, and an ascent of at least 10° for suction mode, to avoid air pocket formation.
- Guarantee that the fluid level in the suction vessel is located a vertical distance of at least four times the inner diameter of the suction line above the inlet into the suction line in order to avoid air-sucking surface vortices.
- Round the transition from the suction vessel to the suction line or provide it with a chamfer to avoid cavitation in the pump inlet. This particularly applies in the case of pumped fluids that are close to or in boiling state.
- In the case of a pumped fluid that is close to or in boiling state, first route the suction line downstream of the suction vessel downwards over the longest possible section in order to prevent pumped fluid degassing.

7.4 Requirements for the electrical connection

The following requirements must be observed when connecting the motor:

- To protect the pump and the motor, always install overload protection, e.g. a motor circuit breaker. Operation without overload protection is impermissible.
- Observe the connection values and circuit type on the motor type plate. The specified voltage must not be exceeded.
- Earth the pipes and pump.

i Information

The power must be reduced as specified by the motor supplier if the pump is operated at ambient temperatures over 40°C or at installation heights over 1000 m (above MSL).

Tightening torques for terminal board connections on the motor

Thread	Tightening torque [Nm]
M4	0.8 to 1.2
M5	1.8 to 2.5
M6	2.7 to 4.0
M8	5.5 to 8.0
M10	9.0 to 13.0
M12	14.0 to 20.0
M16	27.0 to 40.0

Tab. 7-1 Tightening torques depending on the thread

7.5 Sound insulation and compensators

Pumps can cause increased noise emissions. Insulating the foundation and/or installing compensators, for example, is recommended to minimise noise but also to prevent vibrations and to compensate for thermal expansion.

NOTICE

Damaged compensators

Damaged compensators can crack and lead to damage to the system.

- Check compensators for embrittlement and cracks at regular intervals, and arrange for their exchange if necessary.

Recommended measures for noise minimisation:

- Insulation of the floor foundation by means of a suitable insulating plate **(3)**. The foundation must not be firmly connected to the floor or the walls.
- Installation of suitable compensators **(1)** between the pipe and pump.
- Use of vibration dampers **(2)**. In this case, a frame beneath the pump foot is required.

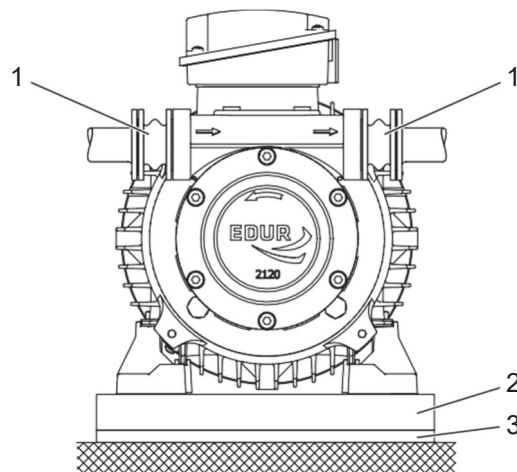


Fig. 7-2 Noise minimisation

7.6 Installing the pump

⚠ WARNING

Weight of the pump

There is a risk of crushing and abrasions during installation.

- Note the weight of the pump.
- Transport the pump using suitable lifting equipment.
- Wear protective gloves and safety shoes.

NOTICE

Checking the direction of rotation without pumped fluid

Operation without a pumped fluid is impermissible. Dry running for even a short time to check the direction of rotation can damage the magnet coupling.

- Fill and ventilate the pump before checking the direction of rotation.

Prerequisite

- Corrosion protection agent has been removed if necessary.
- Flange covers have been removed.
- The system is voltage-free and secured to prevent reactivation.
- There are no foreign objects in the pump.

Procedure

1. Position the pump at the installation location.
2. Align the pump.
3. Bolt the foot to the foundation.
4. Connect pipes.
5. Connect the motor according to the wiring diagram.

6. Protect cable glands to prevent dust and moisture from entering.
7. For this purpose, mount the potential equalization to the intended earth connection.
8. Fill and ventilate the pump.
9. Check the direction of rotation.

Briefly switch on the motor and immediately switch it off again. Monitor the direction of rotation of the fan impeller. The direction of rotation must correspond to the direction of rotation arrow. If the direction of rotation is incorrect, check the electrical connection on the motor, and also check the switchgear if necessary.

8 Removal

8.1 Safety during removal

Improper removal can lead to personal injury and property damage. Observe the following safety instructions.

- Removal must only be carried out by qualified and trained personnel.
- Carry out removal in voltage-free and unpressurised condition.
- Observe the statutory regulations when pumping pumped fluids that can be dangerous to health and the environment.
- Carry out removal carefully. Do not use force.

8.2 Removing the pump

WARNING

Weight of the pump

There is a risk of crushing and abrasions during removal.

- Note the weight of the pump.
 - Transport the pump using suitable lifting equipment.
 - Wear protective gloves and safety shoes.
 - Secure the pump to prevent it from tipping during removal.
-

⚠ WARNING

Risk of contamination when pumping pumped fluids that can be dangerous to health and the environment

Pumped fluids that can be dangerous to health and the environment can chemically burn, poison or otherwise injure persons and damage the environment.

- Avoid direct contact with the pumped fluid.
 - Wear personal protective equipment. If necessary, wear a protective mask.
 - Collect escaping pumped fluid and dispose of it properly.
 - Decontaminate and flush the pipe system and pump.
-

Prerequisite

- The system/pump is switched off and depressurised.
- The pipe system and pump have been flushed and decontaminated if necessary.
- The pump is at ambient temperature.

Procedure

1. Close the slide gate valves in the pressure and suction lines.
2. Switch off the pump's voltage and secure it to prevent reactivation.
3. Disconnect the electrical connections and secure the cable ends.
4. Remove the earthing from the pump.
5. Place a collection container for collecting the pumped fluid or the flushing fluid beneath the pump.
6. Unscrew the drain screw.
7. Unscrew the venting screw.
8. Drain the pumped fluid or flushing fluid into the collection container.
9. Screw in the drain and venting screws.
10. Release the pipe fitting on the pressure nozzle.
11. Release the pipe fitting on the suction nozzle.
12. Release the fasteners on the foundation.
13. Lift the pump with the motor out from the pipe system.
14. Place the pump down on a horizontal, firm surface and secure it to prevent tipping.

9 Operation

9.1 Safety during operation

- Only operate the pump in flawless condition. Immediately shut off the system and secure it to prevent reactivation in the event of damage, leaks, overheating, unusual vibrations and noises.
- Only operate the pump within the pipe system.
- Only operate the pump when all safety devices are installed and functional.
- The pump can become extensively heated due to pumping hot pumped fluids. Do not touch the pump during operation. Wear protective gloves when working in the vicinity of the pump.
- The pump's noise emissions can exceed the statutory limit values. Wear ear protectors when remaining in the vicinity of the running pump.
- Exceeding the permissible pressure and temperature range can lead to leaks and cause the pump to burst. Adhere to the pump's pressure and temperature range, see type plate and chapter 1.2 Applicable documents, page 5.
- In the event of a fire, a hot pump can burst due to the use of cold extinguishing agent. Do not unnecessarily cool the pump excessively when extinguishing.
- Damage to the magnetic coupling if the pump is operated without pumped fluid. Fill and ventilate the pump before commissioning it.

9.2 Safety when operating explosion-protected pumps

The following safety information must be observed when operating explosion-protected pumps. Non-observance can lead to the escape of pumped fluids that are harmful to health and the environment and to explosions.

- Impermissible operating modes can lead to potential ignition sources. The operating limits with respect to the delivery volume, rotational speed, density, head, working temperature and motor output may not be exceeded. The pump may only be operated with the approved pumped fluid.
- Dry running can lead to the exceedance of the permissible temperature limits.
Always operate the pump filled and completely ventilated.

NOTE! Dry running can also occur with an excessively high gas content in the pumped fluid. Operation outside of the specified operating parameters can also lead to dry running as a result of evaporation or cavitation.

- Ensure a sufficiently high supply pressure.

- Operation against closed slide gate valves can lead to the exceedance of the permissible pressure and temperature limits.

Do not operate the pump against closed slide gate valves.

- An excessively high motor switching frequency can lead to increased surface temperatures on the motor.

Observe information on the switching frequency in the manufacturer's documentation.

- Defective bearings and bearing seals can lead to overheating.

Regularly check running noises. Immediately shut down the system and secure it to prevent reactivation in the event of overheating, unusual vibrations and noises.

When draining tanks and/or containers, implement suitable measures (e.g. fill level monitoring) to protect the pump from dry running.

9.3 Initial commissioning

Prerequisite

- The pipe system and pump have been flushed.

Procedure

1. Fill the suction line and pump with pumped fluid. Ventilate the suction line and pump.
2. Completely open the slide gate valve on the suction line.
3. Completely close the slide gate valve in the pressure line.
4. Switch on the motor.

The pump now pumps against the closed slide gate valve in the pressure line.

5. Immediately after reaching the operating speed, slowly open the slide gate valve in the pressure line and regulate the operating point.

9.4 Operation

The pump is usually controlled by the overall system's central control system. The following points must be taken into consideration during operation:

- Regulating the pump output via the suction-side slide gate valve can cause damage to the pump. Regulate the pump output exclusively using the pressure-side slide gate valve.
- If the slide gate valve in the pressure line is closed abruptly or for a long time during operation, this can lead to pressure surges in the pump and therefore to damage to the pump and/or the system. Do not close the slide gate valve in the pressure line abruptly during operation.
- Do not operate the pump against the closed slide gate valve.
- Pumps that are not required (redundancy) must be switched on 1x a week, as the impeller can otherwise seize.
- Check shut-down pumps for damage before recommissioning.

9.5 Ending operation

Procedure

1. Close the slide gate valve in the pressure line.

If a non-return valve is installed and there is sufficient back-pressure in the pressure line, the slide gate valve can remain open.

2. Switch off the pump motor.
3. Close the slide gate valve in the suction line to prevent running empty.

Drain the pump completely at temperatures below freezing or in the event of long down times.

10 Maintenance

10.1 Safety during maintenance

Improper maintenance can lead to personal injury and property damage. Observe the following safety instructions.

- Perform all maintenance work at the specified intervals.
- Maintenance work must only be carried out by qualified and trained personnel.
- When replacing components, use only original spare parts or spare parts approved by the manufacturer.
- Carry out maintenance work only when the pump has been depressurised and drained.
- Perform maintenance work in voltage-free condition. Secure the system to prevent reactivation.
- When pumping hot or very cold pumped fluids, wait until the pump has reached the ambient temperature.
- Close the slide gate valves at the suction nozzle and the pressure nozzle.
- Completely drain the pump casing before opening the pump. Collect the pumped fluid in suitable containers. Exercise particular care with pumped fluids that pose a risk to health and the environment. Wear personal protective equipment. If necessary, wear a protective mask.
- Decontaminate the pump prior to maintenance work in the case of pumped fluids that pose a risk to health and the environment. Document decontamination.
- Note the weight of the pump. There is a risk of crushing and abrasions. Use suitable lifting equipment. Wear protective gloves and safety shoes.
- Observe tightening torques, see Chapter 10.3.1 Tightening torques, page 27.

10.2 Explosion protection information

Explosion protection information

Special requirements apply to the maintenance of explosion-protected pump assemblies. Non-observance leads to a risk of explosion. Observe the following explosion protection information.

- Perform the maintenance work under the exclusion of an explosive atmosphere.
- Avoid the occurrence of sparks.
- Avoid electrostatic discharge.
- Observe the local safety regulations.

10.3 Maintenance schedule

Assembly	Maintenance activity	Interval
Pump	Check delivery data (pressure, delivery volume).	Daily
	Check pump operation (smooth, vibration-free).	Daily
	Check pump for leaks (casing and shaft seal).	Daily
	Check that screws are firmly seated, tighten if necessary, see Chapter 10.4.1 Tightening torques, page 35. WARNING! Check only when the pump has been switched off.	Every 6 months
Motor	Check power consumption.	Daily
	Check shaft bearings (temperature, vibrations).	Daily
	Exchange shaft bearings.	After 20,000 hours of operation, but after 3 years at the latest
Pump and motor	Remove dust, dirt and deposits. WARNING! Clean only when the pump has been switched off.	Depending on the degree of soiling
	Check earthing and potential equalisation.	Daily

Tab. 10-1 Maintenance activities and intervals

10.4 Maintenance work

10.4.1 Tightening torques

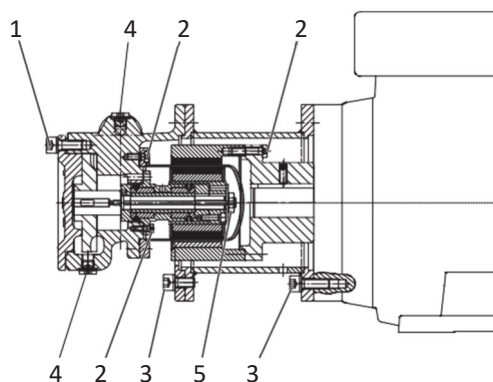


Fig. 10-1 Tightening torques PBM

Item	Thread	Tightening torque [Nm]
1	M10	30
	M12	50
	M14	75
2	M8	25
	M10	50

	M12	75
	M16	75
3	M10	30
4	G1/4	20
5	M10	10

Tab. 10-2 Tightening torques depending on the thread

10.4.2 Exchanging shaft bearings

Defective and worn shaft bearings lead to consequential damage. Vibrations, increased noise emissions and increased power consumption with otherwise constant operating conditions indicate wear.

The temperature of the shaft bearing must not exceed 90°C (measured at the motor casing, outer side).

The shaft bearings have lifetime lubrication, are maintenance-free and cannot be re-lubricated. Under normal operating conditions, the shaft bearings should be exchanged after 20,000 hours of operation, but after 3 years at the latest. In the case of high ambient temperatures, corrosive or very dusty environments, the shaft bearings must be checked more frequently and exchanged earlier if necessary.

To exchange the shaft bearings, contact the motor manufacturer or commission a specialist workshop.

11 Faults

11.1 Safety during fault rectification

Improper fault rectification can lead to personal injury and property damage. Observe the following safety instructions.

- Fault rectification must only be carried out by qualified and trained personnel.
- When replacing components, use only original spare parts or spare parts approved by the manufacturer.
- Carry out fault rectification only when the pump has been depressurised and drained.
- Carry out fault rectification in voltage-free condition. Secure the system to prevent reactivation.
- When pumping hot or very cold pumped fluids, wait until the pump has reached the ambient temperature.
- Before opening the pump, close the slide gate valve at the suction nozzle and the pressure nozzle.
- Completely drain the pump casing before opening the pump. Collect the pumped fluid in suitable containers. Exercise particular care with pumped fluids that pose a risk to health and the environment. Wear personal protective equipment. If necessary, wear a protective mask.
- Decontaminate the pump prior to fault rectification in the case of pumped fluids that pose a risk to health and the environment. Document decontamination.

11.2 Fault table

Contact the manufacturer in the event of faults that are not listed here.

Fault	Cause	Fault rectification
Pump blocked	Bearing damage on the motor shaft	– Exchange shaft bearings.
	Impeller blocked	– Remove deposits and foreign objects from the interior of the pump.
Head/delivery rate too low	Pump and/or suction line not completely ventilated or filled	– Ventilate and fill pump and/or suction line.
	Suction head too high/system NPSH value too low	– Completely open the slide gate valve in the suction line. – Check the foot valve/suction strainer. – Increase the fluid level if necessary.
	Gas content in the pumped fluid too high	– Re-seal the suction line. – Check the suction strainer. – Increase the fluid level if necessary.
	Air pocket formation in the suction line	– Change the suction line. – Install a vent valve.
	Incorrect direction of rotation	– Check the electrical connection, change if necessary.
	Pump component wear	– Exchange components.
	Rotational speed too low	– Contact the manufacturer.
	Density/viscosity of the pumped fluid higher than specified in the order confirmation	– Contact the manufacturer.
Pump not running smoothly	Suction head too high/system NPSH value too low	– Completely open the slide gate valve in the suction line. – Check the foot valve/suction strainer. – Increase the fluid level if necessary.
	Air pocket formation in the suction line	– Change the suction line. – Install a vent valve.
	Pump running outside of the characteristic curve	– Re-regulate the operating point.
	Forces from the pipe system are acting on the pump	– Check pipe connections, the pump fastening and the pipe clamp mounting spacing, and correct if necessary.
Leaks on casing parts	Connecting screws loosened	– Tighten the connecting screws.
	Casing seal(s) worn or defective	– Renew casing seal(s).
Drive overloaded	Pump running outside of the characteristic curve	– Re-regulate the operating point.
	Rotational speed too high	– Contact the manufacturer.

Fault	Cause	Fault rectification
	Density/viscosity of the pumped fluid higher than specified in the order confirmation	– Contact the manufacturer.
No pumping despite the motor running	Maximum torque of the magnetic coupling exceeded, the magnetic coupling is "torn off"	– Switch off the pump and wait until standstill. Then switch the pump on again.
Motor protection tripping	Pump running outside of the characteristic curve	– Re-regulate the operating point.
	Rotational speed too high	– Contact the manufacturer.
	Density/viscosity of the pumped fluid higher than specified in the order confirmation	– Contact the manufacturer.
	Motor protection device not set correctly or defective	– Check the motor protection device, exchange if necessary.
Pump becomes hot	Suction head too high/system NPSH value too low	– Completely open the slide gate valve in the suction line. – Check the foot valve/suction strainer. – Increase the fluid level if necessary.
	Gas content in the pumped fluid too high	– Re-seal the suction line. – Check the suction strainer. – Increase the fluid level if necessary.
	Air pocket formation in the suction line	– Change the suction line. – Install a vent valve.
	Delivery rate too low	– Re-regulate the operating point.

Tab. 11-1 Causes and rectification of faults

12 Disposal

12.1 Safety during disposal

Improper disposal can lead to personal injury and property damage. Observe the following safety instructions.

- Disposal must only be carried out by qualified and trained personnel.
- Decontaminate the pump prior to disposal in the case of pumped fluids that pose a risk to health and the environment. Document decontamination.
- Note the weight of the pump and the individual components. There is a risk of crushing and abrasions. Use suitable lifting equipment. Wear protective gloves and safety shoes.
- Observe the statutory regulations concerning the disposal of industrial waste.

12.2 Disposing of the pump

Prerequisite

- The pump has been cleaned thoroughly and decontaminated if necessary.

Procedure

1. Properly disassemble the pump.
2. Separate components according to materials, e.g.:
 - Metal
 - Plastic
 - Electrical scrap
 - Greases and lubricants
3. Dispose of components according to local specifications or send for controlled disposal. Send reusable materials for recycling.

12.3 Returning

If necessary, the pump can be sent to the manufacturer for maintenance. The address can be found on the cover of these operating instructions.

Prerequisite

- The pump has been cleaned thoroughly and decontaminated if necessary.

Procedure

1. Fill in the certificate of unobjectionability completely.
2. Properly seal the pump openings.
3. Package the pump on a pallet for safe transport.
4. Send the pump and the certificate of unobjectionability to the manufacturer.

Information

Pumps without a certificate of unobjectionability will not be opened by the manufacturer.

13 Annex

13.1 Content of the declaration of conformity

EU Declaration of Conformity

according to EC Machinery Directive 2006/42/EC, Annex II, 1 A

We,

EDUR-Pumpenfabrik
Eduard Redlien GmbH & Co. KG
Edisonstraße 33
24145 Kiel
Germany

hereby declare that the machine designated in the following complies with the fundamental health and safety requirements of the EC Directive.

Designation of the machine:

PBM 201

The precise type designation is located on the pump type plate.

Model designation and factory number, see cover sheet.

Applied harmonised standards:

DIN EN ISO 12100:2011
DIN EN 809:2012

Representative for compiling the relevant technical documents:

Tjark Kaeding (Head of Technical Department)
EDUR-Pumpenfabrik, Edisonstraße 33, 24145 Kiel, Germany

**EU Declaration of Conformity
within the meaning of the EU ATEX Directive 2014/34/EU, Annex VIII**

We,

EDUR-Pumpenfabrik
Eduard Redlien GmbH & Co. KG
Edisonstraße 33
24145 Kiel
Germany

hereby declare that the supplied version of the machine designated in the following complies with the regulations of the following European Directives:

2014/34/EU, Annex VII

Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

Designation of the machine:

PBM 201

The precise type designation is located on the pump type plate. Model designation and factory number, see cover sheet.

ATEX marking:

Ⓔ II2G Ex h IIC T3 Gb, Ⓔ II2G Ex h IIC T4 Gb

Compliance with the regulations of this Directive is demonstrated through adherence to the following standards:

DIN EN 1127-1:2019, DIN EN ISO 13237:2012, DIN EN ISO 80079-36:2016
DIN EN ISO 80079-37:2016

This declaration becomes invalid in the event of a change to the machine that is not coordinated with us.

The documentation required pursuant to 2014/34/EU Annex VIII is deposited with the following notified body:

Physikalisch-Technische Bundesanstalt
P.O. Box 3345
38023 Braunschweig
Germany

Representative for compiling the relevant technical documents:

Tjark Kaeding (Head of Technical Department)
EDUR-Pumpenfabrik, Edisonstraße 33, 24145 Kiel, Germany

13.2 Certificate of unobjectionability

The certificate of unobjectionability can also be downloaded in the service area of the EDUR homepage, www.edur.com.

CERTIFICATE OF UNOBJECTIONABILITY

Please complete this form in detail and attach it to the pump to be repaired.

This certificate of unobjectionability being sent by us, the signer, with the pump and its component parts for inspection-/repair order,

Model:

Serial number:

Date of delivery:

Reason for inspection-/repair order:

Range of application:

Pumped medium:

☐ was **not** used for / in liquids hazardous to health or environment. Before dispatch / delivery the pump was drained carefully and cleaned inside and outside. During further handling particular safety measures will not be necessary.

☐ was used for / in liquids hazardous to health or environment.

☐ Before dispatch / delivery the pump was drained carefully and cleaned inside and outside. During further handling particular safety measures will **not** be necessary.

☐ Before dispatch / delivery the pump was drained carefully and cleaned inside and outside. Following safety measures will be necessary with regard to the pumped liquid and rinsing liquids:

Please attach the safety data sheet.

We confirm that the before mentioned information is correct and complete and that the dispatch / delivery is made according to the legal requirements.

Company name and address:

Phone:

Telefax:

E-Mail:

Name:

Position:

Date:

Company stamp/Signature:

Please use this delivery address for shipping units to us:

EDUR-Pumpenfabrik Eduard Redlien GmbH & Co. KG • Marie-Curie-Straße 15 • 24145 Kiel, Germany

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Delivery address for returns

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