ATEX supplementary instructions manual

KRAL pumps/ pump units/pump stations

Series C, K, L, M, W, DKC DLC (ATEX design)

Equipment category: 2G/2D for use in zones 1/2 and 21/22.

Observe notes and regulations for use in potentially explosive areas.

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Table of contents

1 About this document

1.1 General information

These instructions are only valid in conjunction with the operating instructions for the pump/pump unit. They must be observed if the pump/pump unit is used in potentially explosive areas.

As with the operating instructions of the pump/pump station, these supplementary instructions form part of the product, must be read carefully and kept for future reference.

1.2 Associated documents

- ☐ Pump/pump unit operating instructions
- ☐ Pump/pump unit design data sheet
- ☐ Pump/pump unit material data sheet
- ☐ Operating instructions and technical data sheet of the drive technology and sensors supplied, if applicable

1.3 Scope

- ☐ C series screw pumps/pump units
- ☐ K series screw pumps/pump units
- ☐ L series screw pumps/pump units
- ☐ M series screw pumps/pump units
- ☐ W series screw pumps/pump units
- ☐ DKC series pump stations
- ☐ DLC series pump stations

1.4 Target groups

The instructions are intended for the following persons:

- ☐ Persons who work with the product
- ☐ Operator-owners who are responsible for the use of the product

Persons who work with the product must be qualified. The qualification ensures that possible dangers and material damage that are connected to the activity are detected and avoided. These persons are qualified personnel who carry out the work properly due to their training, knowledge and experience and on the basis of the relevant provisions.

Information on the required qualification of the personnel is provided separately at the beginning of the individual chapters in these instructions. The following table provides an overview.

Target group	Activity	Qualification
Transport personnel	Transporting, unloading, setting up	Qualified personnel for transport, mobile crane operators, crane operators, forklift operators
Fitter	Mounting, connection	Qualified personnel for mounting
Electrician	Electrical connection	Qualified personnel for electric installation
Trained personnel	Delegated task	Personnel trained by the operator-owner who know the task delegated to them and the possible dangers arising through improper behaviour.
Expert for work in potentially explosive areas	Operation, maintenance, servicing	Qualified personnel who because of their vocational training, training and experience, is qualified to recognize risks and possible hazards when working on the device or subcomponents in potentially explosive areas and is able counteract these by taking suitable measures. This qualified personnel has knowledge of different ignition protection types, installation procedures and zoning divisions. This qualified personnel is familiar with rules and regulations that are relevant for the activity and explosion protection, in particular with the ATEX Directives 2014/34/EU and 1999/92/EC.

Tab. 1: Target groups

1.5 Scope of the ATEX certification

The manufacturer is only responsible for material and equipment supplied, which have been selected on the basis of the data for the operating conditions provided by the customer or end user. These data are listed in the order confirmation. If in doubt, please contact the manufacturer.

Included in delivery	ATEX certification
Pump with free shaft end	☐ Explosion protection marking on the pump data plate applies solely to the pump. ☐ Any additional equipment attached must have separate certification to at least the same level of protection as the pump. The supplier(s) of this equipment is/are responsible for providing this equipment. ☐ The entire unit/pump unit must be certified separately by the creator of the overall configuration. The unit must be marked with its own data plate, which is provided by the creator of the overall configuration.
Pump unit	☐ Explosion protection marking on the pump data plate applies to the entire unit/ pump assembly.
Pump station	☐ Explosion protection marking on the pump station data plate applies to the entire unit/pump station.

Tab. 2: Scope of ATEX certification

1.6 Symbols

1.6.1 Danger levels

	Signal word	Danger level	Consequences of non-observance
	DANGER	Immediate threat of danger	Serious personal injury, death
	WARNING	Possible threat of danger	Serious personal injury, invalidity
	CAUTION	Potentially dangerous situation	Slight personal injury
	ATTENTION	Potentially dangerous situation	Material damage

1.6.2 Danger signs

	Meaning	Source and possible consequences of non-observance
	Potentially explosive atmosphere	Explosion or fire through potentially explosive atmosphere
	Electrical voltage	Electrical voltage causes serious physical injury or death.
	Raised load	Falling objects can result in serious physical injury or death.
	Heavy load	Heavy loads can result in serious back problems.
	Risk of slipping	Discharging pumped liquid and oils on the foundation or tread surfaces can cause falls with serious physical injury or death.
	Flammable substances	Discharging pumped liquid and oils can be easily inflammable and can result in serious burns.
	Hot surface	Hot surfaces can cause burns.

1.6.3 Symbols in this document

	Meaning
	Warning personal injury
	Safety instruction
	Prohibition sign cardiac pacemaker
	Request for action
1. 2. 3.	Multi-step instructions for actions
⇨	Action result
	Cross-reference

2 Safety

2.1 Potentially explosive atmosphere

A potentially explosive atmosphere is a mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture.

2.2 Intended use in potentially explosive atmospheres in compliance with Directive 2014/34/EU

The intended use of the three-spindle screw pumps and pump stations is the continuous, directional delivery of non-abrasive, exclusively liquid media.

ATEX screw pumps and pump stations are category 2G/2D outdoor equipment (outside the pump). This means that they can be used in potentially explosive gas atmospheres of Zone 1 or Zone 2 or in potentially explosive dust atmospheres of Zone 21 or Zone 22.

Atmosphere	Explosion subgroup		Category / EPL	
	Inside the pump	Outside the pump	Inside the pump	Outside the pump
Gas	–	IIC	–	2 / Gb
Dust	–	IIIC	–	2 / Db

Tab. 3: Possible areas of application

Zone	Interval (annual)	Interval (differentiated)	Dwell time
1 (gas) 21 (dust)	> 10 – 1000 times	> 1 time / month < 3 times/day	0.5 – 10 h
2 (gas) 22 (dust)	> 1 – 10 times	> 1 time/year < 1 time / month	< 0.5 h

Tab. 4: Occurrence of a mixture

In addition to the frequencies of occurrence according to the above table, it should be noted that an ignitable mixture may only be present for less than 50% of the operating time.

Special conditions

The following special conditions must be observed:

- ☐ For complete pump units, use in and on potentially explosive atmospheres may be restricted to exclusively gas explosive atmospheres, zone 1 and zone 2. Observe the Ex marking on the product.
- ☐ Before commissioning, the pump, pump unit or pump station must be included in the equipotential bonding of the entire system.
- ☐ For safety reasons the operator must avoid simultaneous delivery of medium and air, so that it can always be assumed that there is no zone inside the pump. Commissioning as well as start-up and shut-down procedures must be taken into account.
- ☐ The response of the ignition source monitoring must result in a safe shutdown of the drive motor.
- ☐ Equipment for supplying the temperature monitoring must be intrinsically safe.
- ☐ The temperature class of the pump/pump unit is determined by the pumped medium.
- ☐ Interactions between the pumped medium and the pump materials must be taken into account by the operator.
- ☐ The maximum medium temperature according to the operating instructions must not be exceeded.
- ☐ The operation of the pump can cause electrostatic charging of flowing liquids.
- ☐ For use in explosion subgroup IIC, only medium and high conductivity media (≤ 50 pS/m at 50 $*10^{-12}$ S/m) may be pumped.
- ☐ For use in explosion subgroups IIB and IIA, media with low conductivity (> 50 pS/m at 50 $*10^{-12}$ S/m) may also be conveyed. (TRGS 727)
- ☐ Dust accumulation on the outside > 5 mm must be excluded by the operator.
- ☐ The permissible ambient temperature range is explicitly marked on the data plate if it deviates from a range of -20°C to +40°C.
- ☐ The restrictions/limitations with regard to reversible operation must be observed.

2.3 Foreseeable misuse

The following misuse of the pump/pump unit/pump station is prohibited:

- ☐ Use of the pump/pump unit or pump station in an area with a higher ATEX category than that specified for the equipment concerned, e.g. use of a category 2 item of equipment in a category 1 system
- ☐ Operation under ambient conditions that deviate from the conditions specified in the section “Checking the operating conditions” of these supplementary instructions ↳ Installation, removal, Page 17
- ☐ Reversible operation of the pump without compliance with the restrictions/limitations for reversible operation
- ☐ Pumping air contaminated with ignitable or explosive dusts and operating the pump in such environments
- ☐ Pumping pyrophoric substances
- ☐ Operation with substances whose self-ignition temperatures are below the defined temperature rating

2.4 Materials and liquids

Interactions between the pumped liquid and the materials of the pump have to be considered by the operator-owner.

Ensure in particular that ...

- ☐ All accessories are conductive.
- ☐ The pump is not used for liquids which can form an explosive atmosphere under normal atmospheric conditions or process conditions.

2.5 Limits for surface temperatures

The standard ISO 80079-36 defines the permissible limits for surface temperatures. It differentiates between gases/vapours and dusts.

For gases and steams the devices are divided into temperature classes.

Temperature class	Max. surface temperature [°C]	Temperature range for mixtures [°C]	Typical gas (selection)
T1	450	> 450	I: Methane II A: Acetone, methane, methanol, propane II B: Town gas II C: Hydrogen
T2	300	> 300 – ≤ 450	II A: Ethyl alcohol, n-butane II B: Ethylene II C: Acetylene
T3	200	> 200 – ≤ 300	II A: Diesel, fuel oils II B: Hydrogen sulphide
T4	135	> 135 – ≤ 200	II A: Acetaldehyde, ethyl ether
T5	100	> 100 – ≤ 135	–
T6	85	> 85 – ≤ 100	II C: Sulphur hydrocarbon

Tab. 5: Limit temperatures for gases and vapours

For dusts the maximum permissible surface temperature of the device is specified instead of the temperature class, as in this case a safety gap between the surface temperature and the ignition temperature must also be observed.

The permissible surface limit temperature is based on the two values determined from processes A and B of IEC 50281-2-1:

Limit temperature = MIN (value A - 75 °C) and (value B x 2/3)

Dust (selection)	IEC 50281-2-1 Process A [°C]	IEC 50281-2-1 Process B [°C]	Max. permissible surface limit temperature [°C]
Wood flour	300	400	225
Cellulose	370	500	295
Lignite	225	380	150
Soot	385	620	310
Sulphur	280	280	186
Aluminium	280	530	205

Tab. 6: Limit temperatures for dusts from device group II

2.6 Evaluation of pump units and pump stations

Combinations of motors and pumps into pump units as well as pump stations are to be considered a "group of individual devices". In accordance with Section 3.7.5 of the ATEX Directive the manufacturer of a group of individual devices can assume that the latter fulfils the Directive if a corresponding Declaration of Conformity exists. This applies in particular for couplings and motors that are "equipment" in the sense of the Directive. In addition for further components that are used, for example, in the station construction (flow indicators/dry running protection, pressure switches, etc.). For further information on this topic please refer to the corresponding documentation of these devices.

The manufacturer of a group of individual devices solely verifies whether further dangers arise through the final combination of the components. This is not the case at the pump units and pump stations manufactured by KRAL. In accordance with the Directive there is therefore no need for a further evaluation of conformity or for an overall identification of this group of individual devices.

2.7 Additional obligations of the operator-owner when used in potentially explosive areas

When the product is used in potentially explosive areas the operator-owner has to observe the following additional obligations from the ATEX directive (minimum regulations for improving the health protection and the safety of the employees that can be endangered through potentially explosive atmospheres).

This results in the following additional obligations for the operator-owner:

Phase in life cycle	Obligations of the operator-owner
Project planning, selection and erection	Design electrical installations in hazardous areas according to EN 60079-14: ☐ Explosion protection principles ☐ Ignition protection types, device marking ☐ Tests according to EN 60079-17
All phases	☐ Evaluating and documenting explosion hazards for operating ranges of the plant in accordance with Directive 2014/34/EU Annex I. ☐ Compliance with Directive 1999/92/EC on health protection and safety of employees in potentially explosive atmospheres. ☐ Ensure that the specifications on the rating plate match the system data. ☐ Operate pump solely in accordance with ATEX marking. ☐ Ensure that motors, couplings and monitoring devices provided by the customer comply with the category and temperature class in the respective zone. ☐ Observe the data sheet supplied with the pump. ☐ Observe the instructions supplied with the supplier components, e.g. explosion-protected motor, coupling, ... ☐ Inform personnel about special hazards, e.g. explosion hazard when removing dust deposits.
Operation	The following aspects have to be ensured at all times: ☐ Pump earthed ☐ No contact between coupling and coupling protection ☐ The interior of the pump, seal chamber, auxiliary systems and suction line/pressure line must always be completely filled with pumped liquid; the pump chamber is a special case: according to the intended use described in Section 2.2 and the required category, an ignitable mixture may be present inside the pump for a limited period of time. ☐ Permissible surface temperature at the pump observed ☐ Fittings on suction side and pressure side set correctly ☐ Pump regularly maintained and monitored ☐ Dry running of the pump excluded, e.g. by level monitoring, flow measurement, flow monitor; this only applies for a period longer than described in Section 2.2 for the required category.
Maintenance and Servicing	☐ Ensure that work is only carried out by authorised qualified personnel who ... ▪ Are familiar with standards and regulations for devices for use in potentially explosive areas. ▪ Have the required knowledge when handling devices for use in potentially explosive areas. ☐ After performing maintenance and servicing, the pump unit for operation may only be approved by authorised personnel, by an officially recognised person or by the pump manufacturer.
Substantial modification	Ensure that after significant modifications to the pump unit, such as modifications to the sealing materials, seal designs, secondary seals, hydraulics... ☐ A new ignition hazard assessment is performed. ☐ The pump unit is checked in accordance with state of the art and the requirements of Directive 2014/34/EU. ☐ The changes are documented in the explosion protection document of the operator-owner in accordance with Directive 1999/92/EC or in the conformity assessment procedure in accordance with Directive 2014/34/EU through the issue of a Declaration of Conformity.

Tab. 7: Obligations of the operator-owner when used in potentially explosive areas

2.8 Safety instructions

2.8.1 Additional safety instructions for use in potentially explosive areas

⚠ DANGER

Loss of explosion protection can result in death.

The temperature in and around the pump may not exceed values that depend on the specific application and the pumped medium. The limit value is the maximum permissible surface temperature minus 25K, as further heating takes place briefly after switching off, see “Switch-off temperature” table.

- ► Ensure that the temperature in and around the pump is monitored continuously.
- ► Use flow indicators/dry running protection to allow for an immediate response to dry running, for example.
- ► If the temperature limit is exceeded, the pump unit must be switched off immediately in a safety-oriented manner.

Temperature limit	Unit	Switch-off temperature according to temperature class		
		T2	T3	T4
Max. permissible surface temperature	[°C]	300	200	135
Max. permissible temperature at the containment can	[°C]	275	175	110
Max. permissible heating medium temperature	[°C]	285	190	125
Max. permissible receiver media temperature	[°C]	285	190	125

Tab. 8: Switch off temperature

2.8.2 Dangers at magnetic coupling systems

Magnetic fields from magnetic coupling systems (MCS) can influence the function and operational safety of electrical and electronic devices. The following safety instructions must be observed.

The following safety instructions must be observed:

- ☐ Keep the MCS away from cardiac pacemakers. There is a danger to life!
  - ▪ Under no circumstances may persons with cardiac pacemakers perform installation, dismantling or maintenance work.
- ☐ Persons with cardiac pacemakers must comply with the following safe distances to the MCS:
  - ▪ 3 m distance to the openly accessible MCS
  - ▪ 1 m distance to pump units with installed MCS
- ☐ Do not bring the MCS in the immediate area of PCs, data carriers and other electronic components.
- ☐ Keep the MCS away from clocks, magnetized tools and measuring equipment as well as all magnetizable parts.
- ☐ Do not bring both the MCS parts together, as this can destroy the magnetic coupling system.

2.8.3 Expiration of the ATEX approval

The ATEX approval for the pump/pump unit or pump station will be invalidated through ...

- ☐ Improper use
- ☐ Unauthorised modifications
- ☐ Use of non-original spare parts
- ☐ Use of non-specified equipment
- ☐ Failure to observe these supplementary instructions and the applicable documents
- ☐ Failure to comply with the prescribed maintenance intervals/maintenance intervals

2.8.4 Ignition sources in normal operation

The table lists possible ignition sources in accordance with EN 1127-1.

Ignition sources in normal operation	Causes and protective measures
Hot seal housing surface	Possible causes: ☐ Operational heating due to relative movement on the sliding surfaces of the mechanical seal as well as leakage which can result in an ignitable mixture. ► Use pressure-relieved single-acting mechanical seals with downstream rotary shaft seals and a receiver. ► Ensure that the mechanical seal manufacturer has provided mathematical proof of the suitability of the mechanical seal for the specific order (required temperature class) and that it bears the relevant CE mark. ► Monitor the temperature in the return flow to the receiver tank. ► Monitor the minimum and maximum fill levels in the receiver tank.
Pump housing hot surface	Possible causes: ☐ Abrasive particles in the pumped medium cause surface damage. Surface damage leads to strong local heating due to increased friction values. ► Always use a suction filter with a maximum mesh size of 0.5 mm.
Electrostatics	Possible causes: ☐ Electrostatic effect of the insulating lacquer layer ☐ Signs for electrostatics ☐ Delivery of non-conductive liquids ► Ensure that the coating thickness of the paint does not exceed 2 mm. ► Use non-conductive signs with an area < 10000 mm^2. ► Always integrate the pump into the potential equalisation of the system. ► Refer to TRGS 727 when handling liquids of different conductivity in potentially explosive atmospheres.
Lightning	The installation of the pump/pump unit or pump station is permitted both indoors and outdoors. ► Equip the hazardous area with lightning protection on the operator side.
Electromagnetic waves in the frequency range 3×10^{11} – 3×10^{12} Hz	In particular, the focussing of sunlight, for example, can cause ignition in this spectral range through absorption on solid surfaces. ► In the case of direct sunlight (outdoor installation), suitable shading must be provided by the operator.

Tab. 9: Ignition sources in normal operation

The use of pumps with an EU Declaration of Conformity to Directive 2014/34/EU is permissible in Ex-Zone 2 and 22 (“safe in normal operation”) without further protective measures.

Note The maximum surface temperatures on the pump and its components to be expected during normal operation are determined by the temperature and viscosity of the pumped medium, motor speed and differential pressure of the pump. The maximum permissible media temperature is listed in the design data sheet.

2.8.5 Ignition sources at foreseeable malfunctions

The table lists possible ignition sources in accordance with EN 1127-1.

Ignition sources for foreseeable malfunctions	Causes and protective measures
Pump housing hot surface	Possible causes: ☐ Impermissibly high ambient temperature For ambient temperatures > 40 °C, heat dissipation is no longer possible to the extent calculated. ☐ Product temperature (pumped medium) too high ☐ Impermissibly high temperature of the heating medium (liquid or steam) ► In the event of impermissibly high or low ambient temperatures the operator must ensure that the pump unit is switched off immediately. ► Ignition source monitoring b1: Monitor the temperature on the pump housing. ► The operator must ensure that the permissible temperature of the heating medium is not exceeded.
Pump housing hot surface	Possible causes: ☐ Hot surface due to start-up of the inner components ☐ Pump has heated insufficiently or too quickly ► Observe the notes on maximum heating medium temperature depending on the temperature class. ► Maximum temperature difference of 50 – 70 K between product and heating medium must be observed. ► Observe heating time of at least 1 h (ambient temperature to operating temperature of the pump). ► Ignition source monitoring b1: Monitor maximum surface temperature in the pump housing.
Pump housing hot surface – additional frictional heat due to surface damage	Possible causes: ☐ Abrasive substances in the pumped medium ☐ Temporary dry running Surface damage causes friction on the rotating parts with strong build-up of heat. ► Ignition source monitoring b1: Monitor maximum permissible surface temperature in the pump housing. ► Always use a suction filter with a minimum mesh size of 0.5 mm.
Hot surface containment can (magnetic coupling)	Possible causes: ☐ Reduction or loss of the heat-dissipating leakage flow due to contamination, caking, crystallisation of the pumped medium. ► Ignition source monitoring b1: Monitor the maximum permissible temperature on the containment can. Temperature limits depending on the temperature class ↳ Safety, Page 6.
Pump housing hot surface	Possible causes: ☐ Provided that the pump, as part of the process system, is constantly filled with pumped medium, no explosive atmosphere can be produced in the interior of the pump that comes into contact with liquid. ► If the constant filling of the liquid cannot be ensured during operation, ignition source monitoring b1 is required: Monitor dry running by level monitoring.

Tab. 10: Ignition sources for foreseeable malfunctions

The use of pumps with an EU Declaration of Conformity to Directive 2014/34/EU is also permissible in Ex-Zone 1 and 21 (“high safety”) with the specified protective measures.

3 Monitoring devices/protective devices

3.1 Requirements

Monitoring devices, protective devices and protective measures ensure safe operation of the pump in potentially explosive areas. The following requirements must be observed:

- ☐ To ensure explosion protection the maximum surface temperature must always lie below the ignition temperature of the gas air mixture in which the pump is used.
- ☐ Temperature monitoring at the pump is required to ensure that the maximum permissible surface temperature according to the required temperature class is not exceeded.
- ☐ The limit is the maximum permissible surface temperature minus 25 K since heating up continues for a short period after switching off and the inertness of the sensors has to be considered ↳ Safety, Page 6, Table "Switch off temperature".
- ☐ Temperature monitoring has to take place in accordance with ignition hazard assessment according to ignition protection type b1 to EN ISO 80079-37. The safety requirement level of the safety equipment has to implemented according to IEC 61508 in SIL 1 or Performance Level/Category to ISO 13849-1 (PL c, Cat. 2).

3.2 Pump housing surface temperature monitoring

Parameter	Unit	Media temperature at the discharge connection	Storage temperature
Manufacturer / Type		Wika / TR40	
Sensor		1xPT100, 3-wire	
Ignition protection type		Ex i	
Identification		II 2G Ex ia IIC T3...T6 Gb II 2D Ex ia IIIC T125°C...T65°C Gb	
Accuracy class		B (EN 60571)	
Measuring resistor		Thin film	
Sensor version		Straight	
Temperature range	[°C]	-50 ... +200	
Cable length	[m]	2.45 (bare cable ends)	
Strand length	[mm]	50	
Protection class		IP65 (IEC 60529, min. 40 °C)	
Data sheet		Wika TE 60.40	
Operating instructions		Wika TRxx (14150915.06 ...)	
ATEX supplementary operating instructions		Wika TRxx (14150916.07 ...)	

Tab. 11: Temperature monitoring with contact temperature sensor EET 40

3.3 Surface temperature monitoring on the containment shroud (magnetic coupling)

Parameter	Unit	Media temperature at the discharge connection Storage temperature
Manufacturer / Type		JUMO / 9028219275
Sensor		1xPT100, 3-wire
Ignition protection type		Ex i
Identification		Ex II 2 G Ex ia IIC T6 Gb EX II 1/2 D Ex ia IIIC T80°C Da/Db
Accuracy class		B (EN 60571)
Sensor version		Straight
Temperature range	[°C]	-70...+260
Cable length	[m]	2.5 (wire-end ferrules)
Strand length	[mm]	60
Data sheet		JUMO 9028219275
Operating instructions		Installing and Using JUMO Thermometers (90000000T90Z...)
ATEX supplementary operating instructions		RTD temperature probes - Ex „i“ for use in areas with an explosion hazard (90282000T90Z...)

Tab. 12: Temperature monitoring with temperature sensor EET 43

3.4 Monitoring level of the pumped medium

For safety reasons and to detect and avoid dry running, the pump must always be filled with pumped medium. Monitoring of the filling level is ensured via a vibration limit switch.

Vibrating level switch operating mode

The tuning fork of the vibrating level switch vibrates in self-resonance. When it is covered with liquid, the vibration frequency decreases. This frequency change causes the vibration limit switch to switch over. Reliable operation is not affected by currents, turbulence, gas bubbles, vibration, etc.

Installation notes

The vibration limit switch is flanged or screwed directly into the pipeline. The manufacturer recommends installing the vibrating level switch in a vertical strand of the suction-side piping. It must be positioned at least at the level of the pump's discharge connection, and there must be no shut-off fittings between the vibration limit switch and the suction connection.

3.5 Protection of the mechanical seal

Simple mechanical seal with upstream rotary shaft seals

Explosion protection marking of the mechanical seal used:

☐ Ex h IIC T5...T1 Gb X
Ex h IIC T100°C...T450°C Gb X

For safe operation, a suitable API plan (e.g. API plan 51, 52, 55) or an additional seal supply system tailored to the relevant application must be used.

The API plan or seal supply system shall be capable of maintaining a secure seal and seal operating system in accordance with the required temperature rating. The medium used must be compatible with the process. This can be offered on request, but is not necessarily part of the scope of delivery.

On both sides, both seals can be connected to a supply system with the correct dimensions. Threaded connection holes are prepared by the manufacturer and marked on the order-specific scale drawing.

The sealing chamber (quench area) must be flooded at all times, i.e. the volume must be completely filled with receiver medium. The seal must not run dry under any circumstances. The ignition temperature of the receiver medium requires at least 50 K difference to the maximum permissible surface temperature of the specified temperature class.

The maximum pressure at the rotary shaft seals must not exceed 0.5 bar.

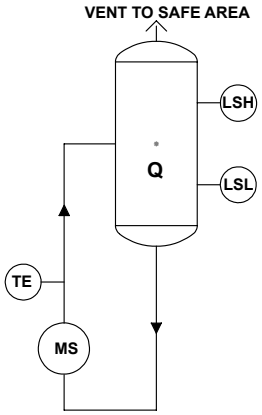
The medium temperature of the seal supply system must be monitored during operation to ensure that the permissible limit values are not exceeded ↳ Safety, Page 6, “Shut-off temperature” table. The seal supply system must be installed, commissioned and operated in accordance with the manufacturer's instructions.

Level monitoring of the receiver medium

The mechanical seal must be protected by a receiver medium. This protection must be ensured by the operator.

The level/fill level of the receiver medium used must be above the minimum level at all times.

Temperature monitoring and level monitoring must be carried out in accordance with ignition hazard assessment to ignition protection type b1 in accordance with EN ISO 80079-37. With regard to the safety requirement level of the safety device, this must be implemented in SIL 1 or performance level/ category according to ISO 13849-1 (PL c, Cat. 2) in accordance with IEC 61508.



MS	Mechanical seal
TE	Temperature transmitter
VENT TO SAFE AREA	Venting (to outside the Ex zone)
LSL	Fill level min. limit switch
LSH	Fill level max. limit switch
Q	Receiver tank (Quench)

Fig. 1: Protection of the mechanical seal by means of a receiver medium - schematic diagram

3.6 Coatings

Coatings of metallic surfaces must be conductive with a surface resistance **< 10^9 Ω**.

The dry film thickness of the paint systems offered in the factory is therefore limited to **max. 0.2 mm**.

3.7 Adhesive signs

Non-conductive adhesive signs are only permitted up to a total area of **max. 20 cm²**.

4 Identification

4.1 ATEX marking

Screw pumps that are intended for correct use in potentially explosive areas have the ATEX marking in addition to the data plate.

This information on explosion protection labelling is generally valid. The temperature class and type of protection are documented on the explosion protection label on the pump. The marking on the pump as non-electrical equipment according to Directive 2014/34/EU applies to the specified pump-motor combination. The motors supplied comply with the Directive and are tested and labelled. If the pump is supplied without a motor, the attached marking applies only to the pump. In this case, it is the responsibility of the operator to fit the pump with a motor in accordance with Directive 2014/34/EU.

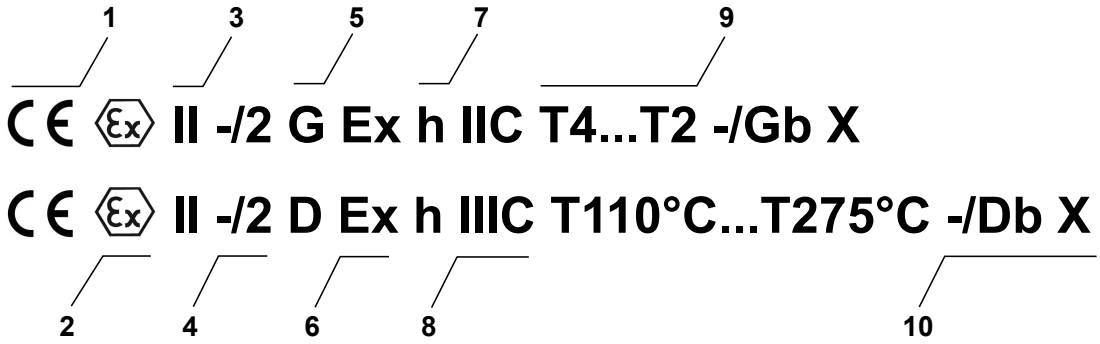


Fig. 2: ATEX marking

1	CE mark	**6**	Ex symbol
2	Symbol for explosion-protected equipment	**7**	Type of protection (here h)
3	Equipment group according to RL 2014/34/EU	**8**	Equipment group with subgroup
4	Equipment category according to RL 2014/34/EU	**9**	Temperature class range
5	Ex-atmosphere	**10**	Equipment Protection Level (EPL)

The conformity classification applies to the pump/pump unit or pump station under the "usual atmospheric conditions" as defined in EN ISO 80079-36:2016:

Parameter	Unit	Value
Ambient temperature range	[°C]	-20 ... 40
Ambient pressure range	[bar]	0.8 – 1.1
Oxygen content of the air	[%]	21

5 Installation, removal

5.1 Installing and connecting

The measures during installing and connecting of the pump/pump station depend on the category.

5.1.1 Unpacking the product

⚠ DANGER

Risk of explosion due to static charging of the packaging film.

► Remove packaging film only outside the potentially explosive atmosphere, i.e. before the product is transported into the potentially explosive atmosphere.

Requirement:

✓ Product outside the potentially explosive area

→ Remove the packaging material and dispose of in accordance with the locally applicable regulations.

5.1.2 Checking the explosion protection identification

→ Compare the explosion protection identification at the pump with the specifications in the ATEX Declaration of Conformity and ensure that both specifications correspond with the explosion protection requirements at the installation location.

5.1.3 Checking the conditions of use

1. → Checking ambient conditions:
   - Ambient temperature –20 °C...+40 °C
   - Seals and lubricants are resistant to all vapours, gases and dusts occurring at the point of use
2. → Check temperature of the pumped liquid:
   - For the permissible temperature range of application see the rating plate
3. → Check properties of the pumped liquid:
   – Does not contain solids
   – Does not form an explosive atmosphere under normal atmospheric conditions or under process conditions
   – Chemically stable (does not tend to disintegrate exothermically or under pressure under conditions of use and ambient conditions)
   – Not ignitable under exclusion of oxygen
4. → Check requirements at the installation location:
   –Free air supply to pump and motor
   – Earthing connection available

⇨ The pump/pump unit must not be used in case of deviating conditions of use.

5.1.4 Perform basic measures

1. → Check that the pump and motor are suitable for use in the selected area ↳ Identification, Page 16.
2. → For inverter operation:
   - Only use motors that are approved for this operating mode.
   - Ensure that the nominal speed of the pump is maintained, see data sheet.
   - Motor must be approved for ATEX operation with inverter.
   - Observe standards and regulations for installation and operation with an inverter.
3. → For a pump with motor provided by the operator:
   - The motor must meet the requirements (group, category) of the hazardous area.
   - If a frequency inverter is used, the motor must be suitable for this application.
4. → Observe the operating instructions for the motor, coupling and monitoring devices.
5. → For coupling with contact protection:
   - Only use contact protection with electrically conductive components.
6. → Prevent foreign bodies from being sucked in, for example with a separator or start-up sieve.
7. → Install leakage monitoring that complies with the requirements of Directive 2014/34/EU.
8. → Protect the pump from knocks and falling metal objects.

6 Operation

6.1 Commissioning

6.1.1 Perform basic measures

1. Ensure that the pump is completely filled and vented.
2. Observe the operating instructions for the motor, coupling and monitoring devices.
3. Coordinate every operation of the pump (including test run) with the operator.
4. After an emergency stop, only allow authorised personnel to carry out recommissioning.
5. Observe the maximum permissible temperature of the pumped medium.

7 Maintenance and Servicing

7.1 Safety during maintenance and servicing

⚠ DANGER

Explosion hazard through explosive vapours of the pumped medium.

- ► Let pumps cool before maintenance work and servicing work.
- ► Drain the pump before maintenance work and servicing work and flush if necessary.
- ► Collect any discharging pumped medium safely and dispose of it in accordance with the applicable regulations.

⚠ DANGER

Non-suitable spare parts can result in explosions.

- ► Always replace worn parts with original spare parts.

⚠ DANGER

Explosion hazard from sparks when the components of the magnetic coupling collide.

- ► Always use a positive guide when carrying out assembly work on pumps with magnetic coupling.
- ► Always carry out assembly work outside the potentially explosive area.
- ► Alternatively, eliminate the potentially explosive atmosphere for the duration of the assembly work, e.g. by extraction or ventilation.

⚠ DANGER

Magnetic field.

Risk of death for persons with cardiac pacemaker, metallic implant or neurostimulator.

- ► Under no circumstances may persons with cardiac pacemakers, metallic implant or neurostimulator perform work on the pump/pump unit.

7.2 Perform basic measures

1. Remove dust deposits according to operator specifications.
2. Remove metal chips and deposits on and under the coupling guard.
3. Observe the operating instructions for the motor, coupling and monitoring devices.
4. As a precaution, replace pump roller bearings with lifetime lubrication in category 2 applications every 8000 hours.
5. Change the motor roller bearings according to the manufacturer's instructions.

6. ▶ Check at appropriate intervals:
   - Engine and coupling according to the manufacturer's operating instructions
   - Deformation of the coupling guard and distance to rotating parts
   - Function of the monitoring devices
   - Tightness of the suction line

7.3 Additional required maintenance in case of use in potentially explosive areas

Note Test intervals have to be specified for the entire operating life in accordance with the applicable national laws on occupational safety laws. Tests and checks have to be carried out at least once a year.

1. ▶ Perform maintenance in accordance with the operating instructions of the pump/pump station.
2. ▶ Observe additional maintenance required.

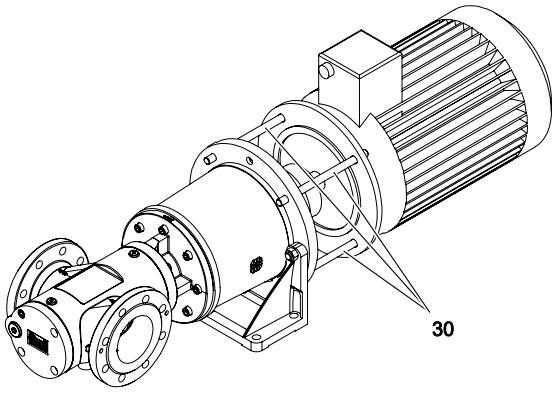
Component	Maintenance required	Cycle
Bearings	☐ **Essential**: Replace the bearings!	8000 h
Bearings	☐ Check for noise and vibration **Warning**: If any abnormalities are found, replace bearings immediately	4 weeks
Level monitoring/flow monitoring	☐ Functional test	4 weeks
Temperature sensors (surface of pump housing/containment can, receiver medium)	☐ Functional test	4 weeks
Mechanical seal with receiver	☐ Check the fill level of the receiver	2 weeks
	☐ Vent the sealing chamber	4 weeks

Tab. 13: Additional maintenance required

Note Maintenance intervals are shortened under difficult operating conditions or when being used in an aggressive environment.

7.4 Maintaining the pump

Personnel qualification:	☐ Fitter
Personal protective equipment:	☐ Work clothing ☐ Face protection ☐ Protective gloves ☐ Protective helmet
Aids:	☐ Positive guide



1. ▶ Use a positive guide **30** for all maintenance work on the pump with magnetic coupling.
2. ▶ Carry out maintenance in accordance with the pump operating instructions.

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