GOULDS PUMPS

Installation, Operation and Maintenance Instruction

ICB

ITT

Table of Contents

1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance

CAUTION:
Failure to observe the instructions contained in this manual could result in personal injury and/or property damage, and may void the warranty. Read this manual carefully before installing and using the product.

NOTICE:
Save this manual for future reference and keep it readily available.

1.1.1 Requesting other information

Special versions can be supplied with supplementary instruction leaflets. See the sales contract for any modifications or special version characteristics. For instructions, situations, or events that are not considered in this manual or in the sales documents, please contact the nearest ITT representative.

Always specify the exact product type and serial number when requesting technical information or spare parts.

Specifications such as weights, dimensions or centers of gravity of the pump, pump unit or subassemblies are described in the supplier's applicable documentation.

1.1.2 Standard manufacturer

ITT Bornemann GmbH

Industriestr. 2

D-31683 Obernkirchen

GERMANY

The actual manufacturer is indicated on the name plate and the data sheet supplied.

1.2 Safety

WARNING:

- Risk of serious personal injury. Applying heat to impellers, propellers, or their retaining devices can cause trapped liquid to rapidly expand and result in a violent explosion. This manual clearly identifies accepted methods for disassembling units. These methods must be adhered to. Never apply heat to aid in their removal unless explicitly stated in this manual.

- The operator must be aware of the pumpage and take appropriate safety precautions to prevent physical injury.
- Risk of serious injury or death. If any pressure-containing device is over-pressurized, it can explode, rupture, or discharge its contents. It is critical to take all necessary measures to avoid over-pressurization.
- Risk of death, serious personal injury, and property damage. Installing, operating, or maintaining the unit using any method not prescribed in this manual is prohibited. Prohibited methods include any modification to the equipment or use of parts not provided by ITT. If there is any uncertainty regarding the appropriate use of the equipment, please contact an ITT representative before proceeding.
- If the pump or motor is damaged or leaking, electric shock, fire, explosion, liberation of toxic fumes, physical harm, or environmental damage may result. Do not operate the unit until the problem has been corrected or repaired.
- Risk of serious personal injury or property damage. Dry running may cause rotating parts within the pump to seize to non-moving parts. Do not run dry.
- Risk of death, serious personal injury, and property damage. Heat and pressure buildup can cause explosion, rupture, and discharge of pumpage. Never operate the pump with suction and/or discharge valves closed.
- Running a pump without safety devices exposes operators to risk of serious personal injury or death. Never operate a unit unless appropriate safety devices (guards, etc.) are properly installed. See specific information about safety devices in other sections of this manual.
- In the case of hot pumped media, ensure that personnel cannot touch hot surfaces on the pump and pipelines.

CAUTION:

- Risk of injury and/or property damage. Operating a pump in an inappropriate application can cause over pressurization, overheating, and/or unstable operation. Do not change the service application without the approval of an authorized ITT representative.

1.2.1 Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Hazard levels

Hazard level	Indication
 **DANGER:**	A hazardous situation which, if not avoided, will result in death or serious injury
 **WARNING:**	A hazardous situation which, if not avoided, could result in death or serious injury

Hazard level	Indication
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:

ELECTRICAL HAZARD:

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

1.2.1.1 The Ex symbol

The Ex symbol indicates safety regulations for Ex-approved products when used in atmospheres that are potentially explosive or flammable.

1.2.2 Environmental safety

The work area

Always keep the station clean to avoid and/or discover emissions.

WARNING:
Move equipment to a safe/non Ex environment for repairs/adjustments or use spark resistant tools and work methods.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

WARNING:
If the product has been contaminated in any way, such as from toxic chemicals or nuclear radiation, do NOT send the product to ITT until it has been properly decontaminated and advise ITT of these conditions before returning.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

1.2.2.1 Recycling guidelines

Always follow local laws and regulations regarding recycling.

1.2.3 User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Hardhat
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

Provide LOTO procedures to prevent unexpected start-up.

Install an Emergency Stop that meets the requirements of EN ISO 13850. If it can be shown that a normal cut-off device functions as an Emergency Stop with the same efficiency this is admissible and it shall be marked as such.

Noise

WARNING:
Sound pressure levels may exceed 80 dbA in operating process plants. Clear visual warnings or other indicators should be available to those entering an area with unsafe noise levels.

Personnel should wear appropriate hearing protection when working on or around any equipment, including pumps. Consider limiting personnel's exposure time to noise or, where possible, enclosing equipment to reduce noise. Local law may provide specific guidance regarding exposure of personnel to noise and when noise exposure reduction is required.

Temperature

WARNING:
Equipment and piping surfaces may exceed 130ºF (54ºC) in operating process plants. Clear visual warnings or other indicators should alert personnel to surfaces that may reach a potentially unsafe temperature. Do not touch hot surfaces. Allow pumps operating at a high temperature to cool sufficiently before performing maintenance. If touching a hot surface cannot be avoided, personnel should wear appropriate gloves, clothing, and other protective gear as necessary. Local law may provide specific guidance regarding exposure of personnel to unsafe temperatures.

1.2.3.1 Precautions before work

Observe these safety precautions before you work with the product or are in connection with the product:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that all safety guards are in place and secure.
- Make sure that you have a clear path of retreat.
- Make sure that the product cannot roll or fall over and injure people or damage property.
- Make sure that the lifting equipment is in good condition.
- Use a lifting harness, a safety line, and a breathing device as required.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product has been thoroughly cleaned.
- Disconnect and lock out power before you service the pump.
- Check the explosion risk before you weld or use electric hand tools.

1.2.3.2 Precautions during work

Observe these safety precautions when you work with the product or are in connection with the product:

CAUTION:
Failure to observe the instructions contained in this manual could result in personal injury and/or property damage, and may void the warranty. Read this manual carefully before installing and using the product.

- Never work alone.
- Always wear protective clothing and hand protection.
- Stay clear of suspended loads.
- Always lift the product by its lifting device.
- Beware of the risk of a sudden start if the product is used with an automatic level control.
- Beware of the starting jerk, which can be powerful.
- Rinse the components in water after you disassemble the pump.
- Do not exceed the maximum working pressure of the pump.

- Do not open any vent or drain valve or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.

1.2.4 Hazardous liquids

The product is designed for use in liquids that can be hazardous to your health. Observe these rules when you work with the product:

- Make sure that all personnel who work with biologically hazardous liquids are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.
- A small amount of liquid will be present in certain areas like the seal chamber.

1.2.5 Wash the skin and eyes

1. Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Chemicals or hazardous fluids on skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

1.3 Product warranty

Coverage

ITT undertakes to remedy faults in products from ITT under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to an ITT representative within the warranty period.
- The product is used only under the conditions described in this manual.
- The monitoring equipment incorporated in the product is correctly connected and in use.
- All service and repair work is done by ITT-authorized personnel.
- Genuine ITT parts are used.
- Only Ex-approved spare parts and accessories authorized by ITT are used in Ex-approved products.

Limitations

The warranty does not cover faults caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation made without consulting ProCast
- Incorrectly executed repair work
- Normal wear and tear

ITT assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

ITT products are high-quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, then contact your ProCast representative.

1.4 Ex Considerations and Intended Use

Special care must be taken in potentially explosive environments to ensure that the equipment is properly maintained. This includes but is not limited to:

Follow these special handling instructions if you have an Ex-approved unit.

Personnel requirements

These are the personnel requirements for Ex-approved products in potentially explosive atmospheres:

- All work on the product must be carried out by certified electricians and ITT-authorized mechanics. Special rules apply to installations in explosive atmospheres.
- All users must know about the risks of electric current and the chemical and physical characteristics of the gas, the vapor, or both present in hazardous areas.
- Any maintenance for Ex-approved products must conform to international and national standards (for example, EN 60079-17).
- All work that causes sparking has to be carried out outside the potentially explosive atmosphere (e.g. welding, hammering, grinding).

ITT disclaims all responsibility for work done by untrained and unauthorized personnel.

Product and product handling requirements

These are the product and product handling requirements for Ex-approved products in potentially explosive atmospheres:

- Only use the product in accordance with the approved operating range and permitted limits of use (see applicable documents, especially pump data sheet). Install safety and monitoring devices to ensure the operation in normal range.
- Only use the product in accordance with the approved motor data.
- The Ex-approved product must never run dry during normal operation. Dry running during service and inspection is only permitted outside the classified area.
- Install safety and monitoring devices to ensure the correct liquid level at any time.
- A buildup of gases within the pump, sealing system and or process piping system may result in an explosive environment within the pump or process piping system. Ensure process piping system, pump and sealing system are properly vented prior to operation.
- Do not apply additional paint or coatings to the pump when in an ATEX enviroment. Static electric discharge can be initiated when contacting or rubbing surfaces with excessive coating thickness.

- Potential electrostatic charging hazard. Do not rub, clean, or blast equipment with dry cloth or dry media.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.
- Make sure that thermal contacts are connected to a protection circuit according to the approval classification of the product, and that they are in use.
- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an authorized ITT representative.
- Only use parts that are provided by an authorized ITT representative.
- Do not operate the pump in processes that can cause shock waves or adiabatic compression (e.g. high pressure gases or oxidizing gases).
- Operate the pump with mounted suction strainers with mesh size according to pump size.
- Inspect the pump housing for corrosion and gaps in sealing for wear regularly. If the gaps exceed the defined tolerance limits replace the worn parts.
- Operate the pump within the maximum permitted design pressure according to the name plate.
- Keep housing surfaces dust-free. Clean surfaces carefully so that no potentially explosive atmosphere can occur.
- If using a casing heating, ensure that the maximum temperature of the heating medium is at least 15 K lower than the permitted temperature class of the pump.
- Make sure that supplied electric and non-electric equipment correspond to the specific pump application in the potentially explosive atmosphere (e.g. zone, category, temperature class). Check declaration of conformity of the supplier.
- If using a motor speed control (hydrovar), install device outside of the potentially explosive atmosphere. Transmitters used in the potentially explosive atmosphere must be designed in the appropriate ignition protection type. Check declaration of conformity of the supplier.

Description of Ex-Directives

The Ex-directives are a specification enforced in Europe and the United Kingdom for electrical and non-electrical equipment installed in those locations. Ex-directives deal with the control of potentially explosive atmospheres and the standards of equipment and protective systems used within these atmospheres. The relevance of the Ex-requirements is not limited to Europe or the UK. You can apply these guidelines to equipment installed in any potentially explosive atmosphere.

The ATEX directives are a specification enforced in only Europe. The UK Ex directives are a specification enforced in only the United Kingdom.

Explosive directives in other regions and countries depend on local regulations.

The preventive maintenance section must be adhered to in order to keep the applicable Ex classification of the equipment. Failure to follow these procedures will void the Ex classification for the equipment. Bearing replacement intervals are given in the specific pump model IOM.

Guidelines for compliance

Compliance is fulfilled only when you operate the unit within its intended use. Do not change the conditions of the service without the approval of an ITT representative. When you install or maintain explosion proof products, always comply with the directive and applicable standards (for example, IEC/EN 60079-14).

1. Monitoring the pump frame liquid end temperature.

2. Maintaining proper bearing lubrication.
3. Ensuring that the pump is operated in the intended hydraulic range.

The Ex conformance is only applicable when the pump unit is operated within its intended use. Operating, installing or maintaining the pump unit in any way that is not covered in the Instruction, Operation, and Maintenance manual (IOM) can cause serious personal injury or damage to the equipment. This includes any modification to the equipment or use of parts not provided by ITT Goulds Pumps. If there is any question regarding the intended use of the equipment, please contact an ITT Goulds representative before proceeding.

Current IOMs are available at https://www.gouldspumps.com/en-US/Tools-and-Resources/Literature/IOMs/ or from your local ITT Goulds Pumps Sales representative.

All pumping unit (pump, seal, coupling, motor and pump accessories) certified for use in an Ex classified environment, are identified by an Ex tag secured to the pump or the baseplate on which it is mounted. A typical tag would look like this:

If applicable, your pump may have either a CE Ex (ATEX) tag or UKCA Ex tag affixed to the pump. See the Safety section for a description of the symbols and codes. Typical nameplate only shown below, the actual area classification may be different.

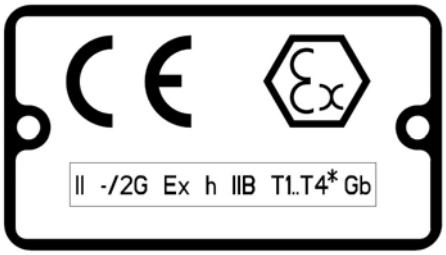


Figure 1: Typical ATEX nameplate

Figure 2: Typical UKCA ATEX nameplate

II - Group – Non Mining Equipment

2G – Category – Category 2 – Gas

Ex – required by ISO 80079 – 36:2016

h – h indicates mechanical equipment

IIB – Gas Group

T1 – T4 – Permitted Maximum Surface Temperature

Gb – Atmosphere + Equipment Protection Level

Table 1: Temperature class definitions

Code	Maximum permissible surface temperature in °C | °F	Maximum permissible liquid temperature in °C | °F
T1	440 | 824	372 | 700
T2	290 | 554	267 | 513
T3	195 | 383	172 | 342
T4	130 | 266	107 | 225
T5	Option not available	Option not available
T6	Option not available	Option not available

* Maximum liquid temperature may be limited by the pump model and order specific options. Table 1: Temperature class definitions on page 12 is for the purpose of determining T'x' code for Ex applications with liquid temperatures exceeding 107ºC | 225ºF.

The code classification marked on the equipment must be in accordance with the specified area where the equipment will be installed. If it is not, do not operate the equipment and contact your ITT Goulds Pumps sales representative before proceeding.

ISO 80079-37:2016 Section 5.7

Recommended bearing replacement interval (based on L10 life) = 17,500 hours of operation.

Equipment for monitoring

For process monitoring, condition-monitoring devices may be utilized. Condition-monitoring devices include but are not limited to these devices:

- Pressure gauges
- Flow meters
- Level indicators
- Motor load readings
- Temperature detectors
- Bearing monitors
- Leak detectors
- PumpSmart control system

WARNING:

- When pumping unit is installed in a potentially explosive atmosphere, the instructions after the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact a Goulds representative before proceeding.
- If equipment is to be installed in a potentially explosive atmosphere and these procedures are not followed, personal injury or equipment damage from an explosion may result.
- Particular care must be taken when the electrical power source to the equipment is energized.
- Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.
- Lock out driver power to prevent electric shock, accidental start-up and physical injury.
- NEVER start pump without proper prime (all models).
- All equipment being installed must be properly grounded to prevent unexpected static electric discharge. If not, a static electric discharge may occur when the pump is drained and disassembled for maintenance purposes.
- Alignment procedures must be followed to prevent unintended contact of rotating parts. Follow coupling manufacturer's installation and operation procedures.
- When installing in a potentially explosive environment, ensure that the motor and accessories are properly certified.
- The impeller clearance setting procedure must be followed. Improperly setting the clearance or not following any of the proper procedures can result in sparks, unexpected heat generation and equipment damage.
- The impeller and wear ring clearance setting procedures must be followed. Improperly setting the clearance or not following any of the proper procedures can result in sparks, unexpected heat generation and equipment damage.
- Service temperature in an Ex classified environment is limited to the area classification specified on the Ex tag affixed to the pump (Refer to Table 1: Temperature class definitions on page 12 for Ex classifications).

- Pumps must be fully primed at all times during operation.
- The preventive maintenance section must be adhered to in order to keep the applicable Ex classification of the equipment. Failure to follow these procedures will void the Ex classification for the equipment. Bearing replacement intervals are given in the specific pump model IOM.
- Inspection intervals should be shortened appropriately if the pumpage is abrasive and/or corrosive, or if the environment is classified as potentially explosive.
- Throughout this section on bearing lubrication, different pumpage temperatures are listed. If the equipment is Ex certified and the listed temperature exceeds the applicable value shown in Table 1: Temperature class definitions on page 12, then that temperature is not valid. Should this situation occur, please consult with your ITT/Goulds representative.
- Cooling systems, such as those for bearing lubrication, mechanical seal systems, etc., where provided, must be operating properly to prevent excess heat generation, sparks and premature failure.
- Rotate shaft by hand to ensure it rotates smoothly and there is no rubbing which could lead to excess heat generation, sparks and premature failure.
- Flange loads from the piping system, including those from thermal expansion of the piping, must not exceed the limits of the pump. Casing deformation can result in contact with rotating parts which can result in excess heat generation, sparks and premature failure.
- Ensure that pump and systems are free of foreign objects before operating and that objects cannot enter the pump during operation. Foreign objects in the pumpage or piping system can cause blockage of flow which can result in excess heat generation, sparks and premature failure.
- Do not insulate or allow the bearing housings to accumulate a dust layer as this can result in excess heat generation, sparks and premature failure.
- Check for magnetism on the pump shaft and demagnetize the shaft if there is any detectable magnetism. Magnetism will attract ferritic objects to the impeller, seals and bearings which can result in excess heat generation, sparks and premature failure.
- Leakage of process liquid may result in creation of an explosive atmosphere. Ensure the materials of the pump casing, impeller, shaft, sleeves, gaskets and seals are compatible with the process liquid. Follow all pump and seal assembly procedures.
- A buildup of gases within the pump, sealing system and or process piping system may result in an explosive environment within the pump or process piping system. Ensure process piping system, pump and sealing system are properly vented prior to operation.
- Sealing systems that are not self purging or self venting, such as plan 23, require manual venting prior to operation. Failure to do so will result in excess heat generation and seal failure.
- Do not apply additional paint or coatings to the pump when in an Ex environment. Static electric discharge can be initiated when contacting or rubbing surfaces with excessive coating thickness.
- Potential electrostatic charging hazard. Do not rub, clean, or blast equipment with dry cloth or dry media.
- Stray electrical currents may ignite explosive atmospheres. Ensure drives are certified for variable frequency drive operation by the manufacturer.
- User shall observe necessity of using a safety device, such as a flame arrestor, to prevent flame entering or leaving the pump sump, tank, or barrel when applicable.
- For variable speed motor applications, the electric motor must be specified with shaft grounding and used with a conductive type coupling suitable for the area classification.

- In plants or pumps with cathodic corrosion protection, a small current constantly flows through the construction. This is not permissible on the complete pump or partially-assembled machinery without further precautions being taken. ITT should be consulted in this context.
- Move equipment to a safe/non Ex environment for repairs/adjustments or use spark resistant tools and work methods.

2 Transportation and Storage

2.1 Inspect the delivery

2.1.1 Inspect the package

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.
   If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.2 Inspect the unit

1. Remove packing materials from the product.
   Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
   For your personal safety, be careful when you handle nails and straps.
4. Contact your sales representative if anything is out of order.

2.2 Transportation guidelines

2.2.1 Pump handling and lifting

Precautions for moving the pump

Use care when moving pumps. Consult with a lifting and rigging specialist before lifting or moving the pump to avoid possible damage to the pump or injury to personnel.

WARNING:

- Dropping, rolling or tipping units, or applying other shock loads, can cause property damage and/or personal injury. Ensure that the unit is properly supported and secure during lifting and handling.
- The pump or the unit must be transported properly. It must be ensured that during transport the pump/unit remains in the horizontal position and does not slip out of the transport suspension points.

CAUTION:
Risk of injury or equipment damage from use of inadequate lifting devices. Ensure lifting devices (such as chains, straps, forklifts, cranes, etc.) are rated to sufficient capacity.

Keep the pump unit in the same position in which it was shipped from the factory.

Close the suction and discharge ends of the pump with plugs for transport and storage.

Precautions for lifting the pump

WARNING:

- Dropping, rolling or tipping units, or applying other shock loads, can cause property damage and/or personal injury. Ensure that the unit is properly supported and secure during lifting and handling.
- Risk of serious personal injury or equipment damage. Proper lifting practices are critical to safe transport of heavy equipment. Ensure that practices used are in compliance with all applicable regulations and standards.
- Lifting and handling heavy equipment poses a crush hazard. Use caution during lifting and handling and wear appropriate Personal Protective Equipment (PPE, such as steel-toed shoes, gloves, etc.) at all times. Seek assistance if necessary.
- Safe lifting points are specifically identified in this manual. It is critical to lift the equipment only at these points. Integral lifting eyes or eye bolts on pump and motor components are intended for use in lifting the individual components only.

NOTICE:

- Make sure that the lifting equipment supports the entire assembly and is only used by authorized personnel.
- Do not attach sling ropes to shaft ends.

Lifting the pump

Hoist the pump using a suitable sling under solid points such as the casing, flanges, or frame.

Figure 3: Pump lifting

2.3 Storage guidelines

2.3.1 Short-term storage

Storage requirements short-term (less than six month).

Store in a covered and dry location.

2.3.2 Long-term storage

If the unit is stored for more than 6 months, these requirements apply:

- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.
- Rotate the shaft by hand several times at least every three months.

Treat bearing and machined surfaces so that they are well preserved. Refer to the drive unit and coupling manufacturers for their long-term storage procedures.

For questions about possible long-term storage treatment services, please contact your local ITT sales representative.

3 Product Description

3.1 General description

ICB pumps are single-stage volute casing pumps in block design. Hydraulic design and dimensions comply with ISO 2858/ EN 22858, the technical design complies with ISO 5199/EN 25199.

The motors comply with DIN 42677-IM B5. Motor and pump shaft are coupled rigidly.

The permitted application conditions and design details of the delivered pump are shown in the attached data sheet and / or the order confirmation.

Installation position: ICB pumps are intended for use with horizontal shaft, discharge up. Installation positions deviating therefrom must be approved by the manufacturer.

Casing

- Top centerline discharge
- Integral cast feet
- Back pullout design
- Standard 3/8 in. NPT casing drain

Impeller

The impeller is fully enclosed and key driven by the shaft. Standard back vanes or balance holes reduce axial thrust and seal chamber pressures.

Mechanical seals

Pumps of design ICB are exclusively sealed with single mechanical seals with installation dimensions acc. to EN 12756 (DIN 24960), design "K", form "U".

NOTICE:
The mechanical seal used in the standard design is not resistant to mineral oils.

NOTICE:
For further details about mechanical seals, as well as the dangers of accidents, connected to them refer to Monitoring and Mechanical seals.

Shaft sealing

Two shaft sealing variants are available. On the data sheet and / or the order confirmation the kind of shaft sealing is given. An instruction for the mounting and operation of mechanical seals is contained in the particular "Mounting Instruction of Shaft Sealing".

Bearing

The shaft is guided by the ball bearings of the motor. The bearings are grease lubricated for life and, therefore maintenance-free.

3.2 Nameplate information

Pump nameplate

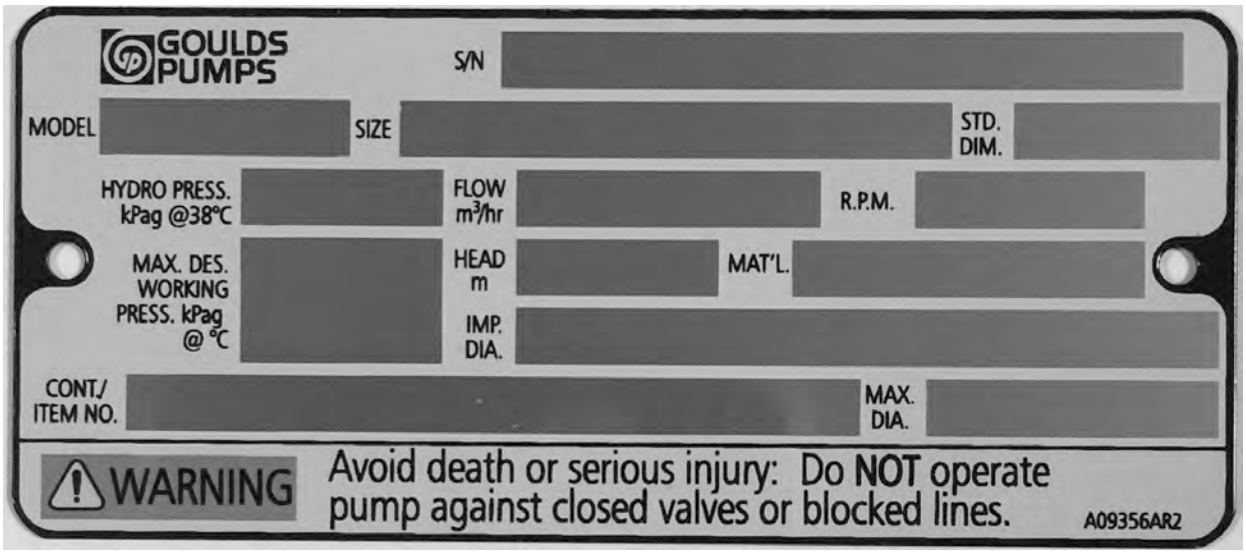


Figure 4: Pump nameplate

Nameplate Field	Explanation
S/N	Serial number of the pump
MODEL	Pump Model
SIZE	Size of Pump
STD DIM	ANSI Std designation – Not applicable ISO Pumps
HYDRO PRESS	Pump Test Pressure in kPag
FLOW	Rated pump flow in cubic metres per hour
RPM	Rated pump speed in revolutions per minute
MAX DESIGN WORKING PRESS	Maximum Design pressure in kPag at rated temperature in degrees Centigrade
HEAD	Rated pump head in metres
MATL	Material of which the pump is constructed
IMP DIA	Impeller diameter fitted
CONT/ITEM NO	Contract or tag number
MAX DIA	Maximum impeller diameter

4 Installation

4.1 Pre-installation

Precautions

WARNING:

- When installing in a potentially explosive environment, ensure that the motor is properly certified.
- All equipment being installed must be properly grounded to prevent unexpected discharge. Discharge can cause equipment damage, electric shock, and result in serious injury. Test the ground lead to verify it is connected correctly.

NOTICE:

- Electrical connections must be made by certified electricians in compliance with all international, national, state and local regulations.
- Supervision by an authorized ITT representative is recommended to ensure proper installation. Improper installation may result in equipment damage or decreased performance.
- Install and operate electrical equipment for a pump unit according to the suppliers' instructions.

4.1.1 Pump location guidelines

WARNING:
Lifting and handling heavy equipment poses a crush hazard. Use caution during lifting and handling and wear appropriate Personal Protective Equipment (PPE, such as steel-toed shoes, gloves, etc.) at all times. Seek assistance if necessary.

WARNING:
Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as swivel hoist rings, shackles, slings and spreaders must be rated, selected, and used for the entire load being lifted.

Guideline	Explanation/comment
Keep the pump as close to the liquid source as practically possible.	This minimizes the friction loss and keeps the suction piping as short as possible.
Make sure that the space around the pump is sufficient.	This facilitates ventilation, inspection, maintenance, and service.
If you require lifting equipment such as a hoist or tackle, make sure that there is enough space above the pump.	This makes it easier to properly use the lifting equipment and safely remove and relocate the components to a safe location.
Protect the unit from weather and water damage due to rain, flooding, and freezing temperatures.	This is applicable if nothing else is specified.

Guideline	Explanation/comment
Do not install and operate the equipment in closed systems unless the system is constructed with properly-sized safety devices and control devices.	Acceptable devices: • Pressure relief valves • Compression tanks • Pressure controls • Temperature controls • Flow controls If the system does not include these devices, consult the engineer or architect in charge before you operate the pump.
Take into consideration the occurrence of unwanted noise and vibration.	The best pump location for noise and vibration absorption is on a concrete floor with subsoil underneath.
If the pump location is overhead, undertake special precautions to reduce possible noise transmission.	Consider a consultation with a noise specialist.

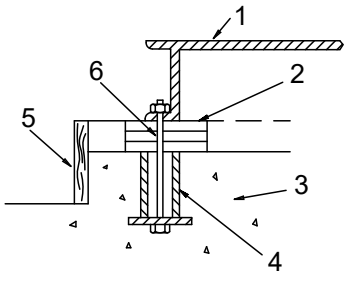
4.1.2 Foundation requirements

Requirements

- The location and size of the foundation bolt holes must match those shown on the assembly drawing provided with the pump data package.
- The foundation must weigh between two and three times the weight of the pump.
- Provide a flat, substantial concrete foundation in order to prevent strain and distortion when you tighten the foundation bolts.
- The concrete foundation must have sufficient firmness according to DIN 1045 or equal standard.

Sleeve-type bolts

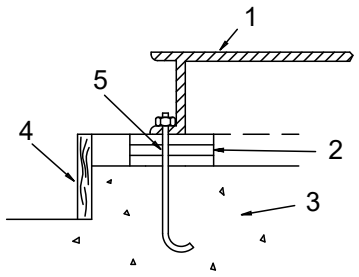
NOTICE:
Sleeve-type and J-type foundation bolts are most commonly used. Both designs allow movement for the final bolt adjustment.



Item	Description
1.	Baseplate
2.	Shims
3.	Foundation
4.	Sleeve
5.	Dam
6.	Bolt

Figure 5: Sleeve type bolts

J-type bolts



Item	Description
1.	Baseplate
2.	Shims or wedges
3.	Foundation
4.	Dam
5.	Bolt

Figure 6: J-type bolts

4.2 Baseplate-mounting procedures

4.2.1 Prepare the baseplate for mounting

1. Remove all the attached equipment from the baseplate.
2. Clean the underside of the baseplate completely.
3. If applicable, coat the underside of the baseplate with an epoxy primer.
   Use an epoxy primer only if using an epoxy-based grout.
4. Remove the rust-proofing coat from the machined mounting pads using an appropriate solvent.
5. Remove water and debris from the foundation-bolt holes.

4.2.2 Prepare the foundation for mounting

1. Chip the top of the foundation to a minimum of 25.0 mm | 1.0 in. in order to remove porous or low-strength concrete.
   If you use a pneumatic hammer, make sure that it does not contaminate the surface with oil or other moisture.

   NOTICE:

   Do not chip the foundation using heavy tools such as jackhammers. This can damage the structural integrity of the foundation.

2. Remove water or debris from the foundation bolt holes or sleeves.
3. If the baseplate uses sleeve-type bolts, then fill the sleeves with a non-binding, moldable material. Seal the sleeves in order to prevent the grout from entering.
4. Coat the exposed portion of the anchor bolts with a non-bonding compound such as paste wax in order to prevent the grout from adhering to the anchor bolts.
   Do not use oils or liquid wax.
5. If recommended by the grout manufacturer, coat the foundation surface with a compatible primer.

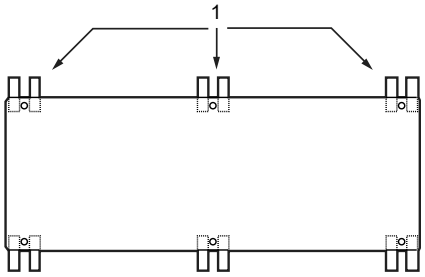
4.2.3 Install the baseplate using shims or wedges

Required tools:

- Two sets of shims or wedges for each foundation bolt
- Two machinist's levels
- Baseplate-leveling worksheet

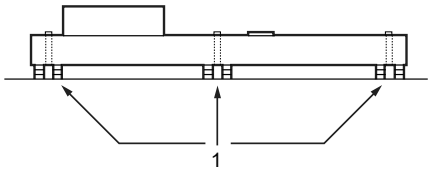
This procedure is applicable to cast iron and fabricated steel baseplates.

1. If you use sleeve-type bolts, fill the bolt sleeves with packing material or rags to prevent grout from entering the bolt holes.
2. Put the sets of wedges or shims on each side of each foundation bolt.
   The sets of wedges should have a height of between 19 mm | 0.75 in. and 38 mm | 1.50 in.



1. Shims or wedges

Figure 7: Top view



1. Shims or wedges

Figure 8: Side view

3. Lower the baseplate carefully onto the foundation bolts.
4. Put the machinist's levels across the mounting pads of the driver and the mounting pads of the pump.

NOTICE:

Remove all dirt from the mounting pads in order to ensure that the correct leveling is achieved. Failure to do so can result in equipment damage or decreased performance.

5. Level the baseplate both lengthwise and across by adding or removing shims or moving the wedges.

   You can use the 4.2.7 Baseplate-leveling worksheet on page 30 when you take the readings.
6. Hand-tighten the nuts for the foundation.

4.2.4 Install the baseplate using jackscrews

Tools required:

- Anti-seize compound
- Jackscrews
- Bar stock

- Two machinist's levels
- Baseplate-leveling worksheet

This procedure is applicable to the feature-fabricated steel baseplate and the advantage base baseplate.

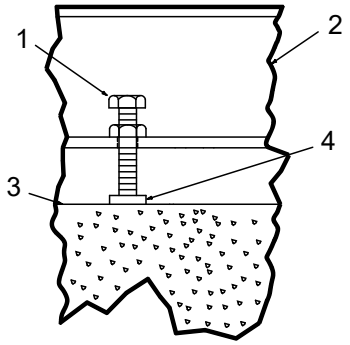
1. Apply an anti-seize compound on the jackscrews.
   The compound makes it easier to remove the screws after you grout.
2. Lower the baseplate carefully onto the foundation bolts and perform these steps:

   a) Cut the plates from the bar stock and chamfer the edges of the plates in order to reduce stress concentrations.

   b) Put the plates between the jackscrews and the foundation surface.

   c) Use the four jackscrews in the corners in order to raise the baseplate above the foundation.
   Make sure that the distance between the baseplate and the foundation surface is between 19 mm | 0.75 in. and 38 mm | 1.50 in.

   d) Make sure that the center jackscrews do not touch the foundation surface yet.



Item	Description
1.	Jackscrew
2.	Baseplate
3.	Foundation
4.	Plate

Figure 9: Jackscrews

3. Level the driver mounting pads:

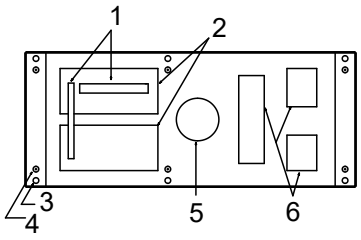
NOTICE:

Remove all dirt from the mounting pads in order to ensure that the correct leveling is achieved. Failure to do so can result in equipment damage or decreased performance.

   a) Put one machinist's level lengthwise on one of the two pads.

   b) Put the other machinist's level across the ends of the two pads.

   c) Level the pads by adjusting the four jackscrews in the corners.
   Make sure that the machinist's level readings are as close to zero as possible, both lengthwise and across.



Item	Description
1.	Machinist's levels
2.	Driver's mounting pads
3.	Foundation bolts
4.	Jackscrews
5.	Grout hole
6.	Pump's mounting pads

Figure 10: Level driver mounting pads

4. Turn the center jackscrews down so that they rest on their plates on the foundation surface.
5. Level the pump mounting pads:

NOTICE:

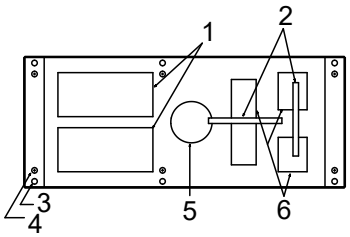
Remove all dirt from the mounting pads in order to ensure that the correct leveling is achieved. Failure to do so can result in equipment damage or decreased performance.

a) Put one machinist's level lengthwise on one of the two pads.

b) Put the other level across the center of the two pads.

c) Level the pads by adjusting the four jackscrews in the corners.

Make sure that the machinist's level readings are as close to zero as possible, both lengthwise and across.



Item	Description
1.	Driver's mounting pads
2.	Machinist's levels
3.	Foundation bolts
4.	Jackscrews
5.	Grout hole
6.	Pump's mounting pads

Figure 11: Level pump mounting pads

6. Hand-tighten the nuts for the foundation bolts.

7. Check that the driver's mounting pads are level and adjust the jackscrews and the foundation bolts if necessary.

   The correct level measurement is a maximum of 0.167 mm/m | 0.002 in./ft .

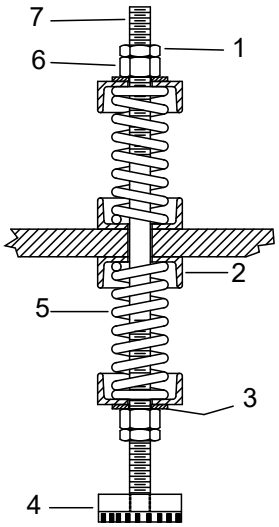
4.2.5 Install the baseplate using spring mounting

NOTICE:
The spring-mounted baseplate is designed only to support piping loads from thermal expansion. Ensure that the suction and discharge piping are supported individually. Failure to do so may result in equipment damage.

The foundation pads are not provided with the baseplate. Make sure that the foundation pads are 316 stainless-steel plates, which have a 16-20 micro-inch surface finish.

Before you start this procedure, make sure that the foundation pads are correctly installed on the foundation/floor (see the manufacturer's instructions).

1. Put the baseplate on a support above the foundation/floor.
   Make sure that there is enough space between the baseplate and the foundation/floor in order to install the spring assemblies.
2. Install the lower part of the spring assembly:
   a) Screw the lower jam nut onto the spring stud.
   b) Screw the lower adjusting nut onto the spring-stud, on top of the jam nut.
   c) Set the lower adjusting nut to the correct height.
   The correct height depends on the required distance between the foundation/floor and the baseplate.
   d) Put a washer, a follower, a spring, and one more follower onto the lower adjusting nut.
3. Install the spring assembly on the baseplate:
   a) Insert the spring assembly into the baseplate's anchorage hole from below.
   b) Put a follower, a spring, another follower, and a washer onto the spring stud.
   c) Fasten the spring assembly with the upper adjusting nut by hand.
4. Thread the upper jam nut onto the spring stud by hand.
5. Repeat steps 2 through 4 for all the spring assemblies.
6. Lower the baseplate so that the spring assemblies fit into the foundation pads.
7. Level the baseplate and make the final height adjustments:
   a) Loosen the upper jam nuts and adjusting nuts.
   b) Adjust the height and level the baseplate by moving the lower adjusting nuts.
   c) When the baseplate is level, tighten the top adjusting nuts so that the top springs are not loose in their followers.
8. Fasten the lower and upper jam nuts on each spring assembly.



1. Upper jam nut
2. Follower
3. Washer
4. Foundation pads
5. Spring
6. Upper adjusting nut
7. Spring stud

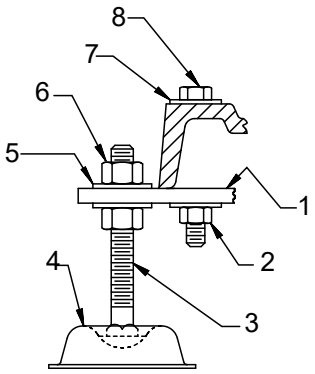
Figure 12: Example of an installed spring assembly

4.2.6 Install the baseplate using stilt mounting

NOTICE:
The stilt-mounted baseplate is not designed to support static piping loads. Ensure that the suction and discharge piping are supported individually. Failure to do so may result in equipment damage.

1. Put the baseplate on a support above the foundation/floor.
   Make sure that there is enough space between the baseplate and the foundation/floor to install the stilts.
2. Install the lower part of the stilt assembly:
   a) Screw the lower jam nut and adjusting nut onto the stilt.
   b) Set the lower adjusting nut to the correct height.
   The correct height depends on the required distance between the foundation/floor and the baseplate.
   c) Put a washer onto the lower adjusting- nut.
3. Install the stilt assembly on the baseplate:
   a) Insert the stilt assembly into the baseplate's anchorage hole from below.
   b) Put a washer onto the stilt.
   c) Fasten the stilt assembly with the upper adjusting nut by hand.
4. Screw the upper jam nut onto the stilt by hand.
5. Repeat steps 2 through 4 for all the stilt assemblies.

6. Lower the baseplate so that the stilts fit into the foundation cups.
7. Level the baseplate and make the final height adjustments:
   a) Loosen the upper jam nuts and adjusting nuts.
   b) Adjust the height and level the baseplate by moving the lower adjusting nuts.
   c) When the baseplate is level, tighten the top adjusting nuts.
8. Fasten the lower and upper jam nuts on each stilt.

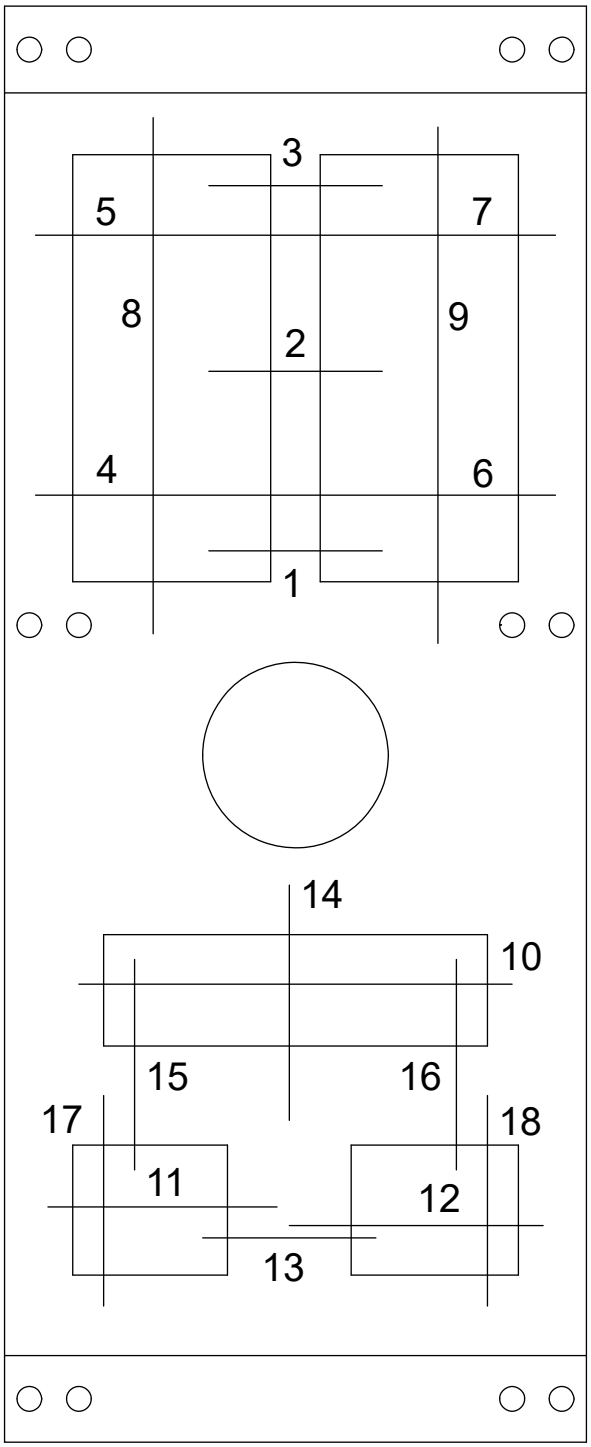


1. Mounting plate
2. Mounting nut
3. Stilt bolt
4. Foundation cups
5. Washer
6. Upper adjustment nut
7. Mounting washer
8. Mounting bolt

Figure 13: Example of an installed stilt assembly

4.2.7 Baseplate-leveling worksheet

Level measurements



1)_____

2)_____

3)_____

4)_____

5)_____

6)_____

7)_____

8)_____

9)_____

10)_____

11)_____

12)_____

13)_____

14)_____

15)_____

16)_____

17)_____

18)_____

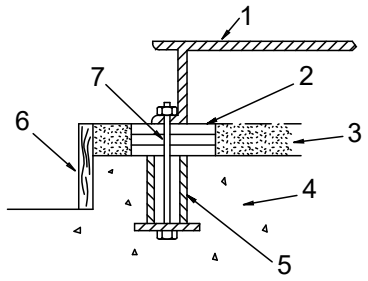
4.3 Grout the baseplate

Required equipment:

- Cleaners: Do not use an oil-based cleaner because the grout will not bond to it. See the instructions provided by the grout manufacturer.
- Grout: Non-shrink grout is recommended.

NOTICE:
It is assumed that the installer who grouts the baseplate has knowledge of acceptable methods. More detailed procedures are described in various publications, including API Standard 610, latest edition, Appendix L; API RP 686, Chapter 5; and other industry standards.

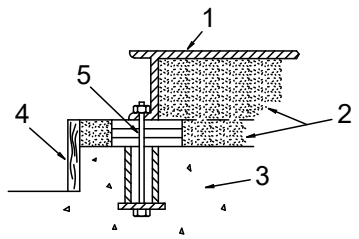
1. Clean all the areas of the baseplate that will come into contact with the grout.
2. Build a dam around the foundation.
3. Thoroughly wet the foundation that will come into contact with the grout.
4. Pour grout through the grout hole into the baseplate up to the level of the dam.
   When you pour the grout, remove air bubbles from it by using one of these methods:
   - Puddle with a vibrator.
   - Pump the grout into place.
5. Allow the grout to set.



Item	Description
1.	Baseplate
2.	Shims or wedges
3.	Grout
4.	Foundation
5.	Sleeve
6.	Dam
7.	Bolt

Figure 14: Pour grout into baseplate

6. Fill the remainder of the baseplate with grout, and allow the grout to set for at least 48 hours.



Item	Description
1.	Baseplate
2.	Grout
3.	Foundation
4.	Dam
5.	Bolt

Figure 15: Fill remainder of baseplate with grout

7. Remove the leveling jackscrews after the grout hardens in order to remove any stress points.
8. Tighten the foundation bolts.
9. Make sure that treatment of the concrete is in accordance with DIN 1045.

4.4 Piping checklists

4.4.1 General piping checklist

Precautions

WARNING:

- Risk of premature failure. Casing deformation can result in misalignment and contact with rotating parts, causing excess heat generation and sparks. Flange loads from the piping system, including those from the thermal expansion of the piping, must not exceed the limits of the pump.
- Risk of serious personal injury or property damage. Fasteners such as bolts and nuts are critical to the safe and reliable operation of the product. Ensure appropriate use of fasteners during installation or reassembly of the unit.
    - Use fasteners of the proper size and material only.
    - Replace all corroded fasteners.
    - Ensure that all fasteners are properly tightened and that there are no missing fasteners.

CAUTION:

Flange loads from the piping system, including those from the thermal expansion of the piping, must not exceed the limits of the pump. Casing deformation can result in contact with rotating parts, which can result in excess heat generation, sparks, and premature failure.

NOTICE:
Vary the capacity with the regulating valve in the discharge line. Never throttle the flow from the suction side. This action can result in decreased performance, unexpected heat generation, and equipment damage.

Piping guidelines

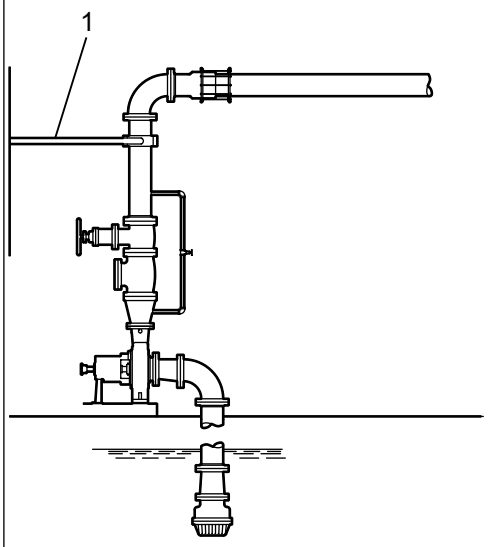
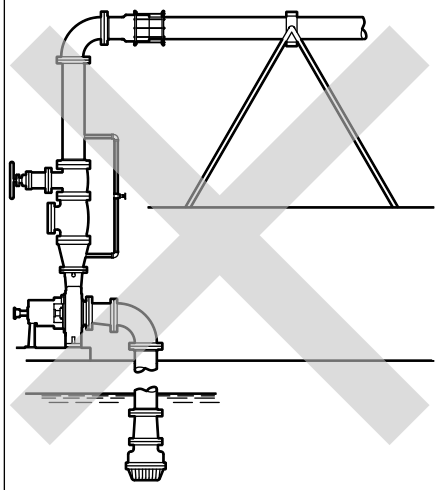
Guidelines for piping are given in the Hydraulic Institute Standards available from the Hydraulic Institute at 9 Sylvan Way, Parsippany, NJ 07054-3802. You must review this document before you install the pump.

Checklist

Check	Explanation/comment	Checked
Check that all piping is supported independently of, and lined up naturally with, the pump flange.	• Strain on the pump • Misalignment between the pump and the drive unit	
Keep the piping as short as possible.	This helps to minimize friction losses.	
Keep the piping as straight as possible. Avoid unnecessary bends. Use 45° or long radius 90° fittings where necessary.	This helps to minimize friction losses.	
Check that only necessary fittings are used.	This helps to minimize friction losses.	
Make sure that the inside diameters match properly when you use flange joints.	—	
Do not connect the piping to the pump until: • The grout for the baseplate or sub-base becomes hard. • The grout for the pit cover becomes hard. • The hold-down bolts for the pump and the driver are tightened.	—	
Make sure that all the piping joints and fittings are airtight.	This prevents air from entering the piping system or leaks that occur during operation.	
If the pump handles corrosive fluids, make sure that the piping allows you to flush out the liquid before you remove the pump.		
If the pump handles liquids at elevated temperatures, make sure that the expansion loops and joints are properly installed.	This helps to prevent misalignment due to linear expansion of the piping.	
Make sure that all piping components, valves and fittings, and pump branches are clean prior to assembly.	—	
Make sure that the isolation and check valves are installed in the discharge line.	Locate the check valve between the isolation valve and the pump. This will permit inspection of the check valve. The isolation valve is required for regulation of flow, and for inspection and maintenance of the pump. The check valve prevents pump or seal damage due to reverse flow through the pump when the driver is turned off.	

Check	Explanation/comment	Checked
Use cushioning devices.	This protects the pump from surges and water hammer if quick-closing valves are installed in the system.	
In no case should loads on the pump flanges exceed the limits stated in API Standard 610, 11th Edition (ISO 13709).	Bottom of casing should be supported by a solid foundation or casing feet should be used.	

Example: Installation for expansion

Correct	Incorrect
This illustration shows a correct installation for expansion:  1. Expansion loop/joint	This illustration shows an incorrect installation for expansion: 

4.4.2 Permitted nozzle loads and torques at the pump nozzles

Designing suction and discharge piping

The suction and discharge piping must be designed so that a minimum of forces affect the pump. Do not exceed the force and torque values as shown in the following table. The values are valid for when the pump is operating or when it is idle.

ICB/ICMB

... following the Europump-Recommendation for pump acc. to ISO 5199.

The data for forces and torques are only valid for

- static piping loads.
- All values for forces and torques refer to standard materials EN-GJS400-18LT and 1.4408.

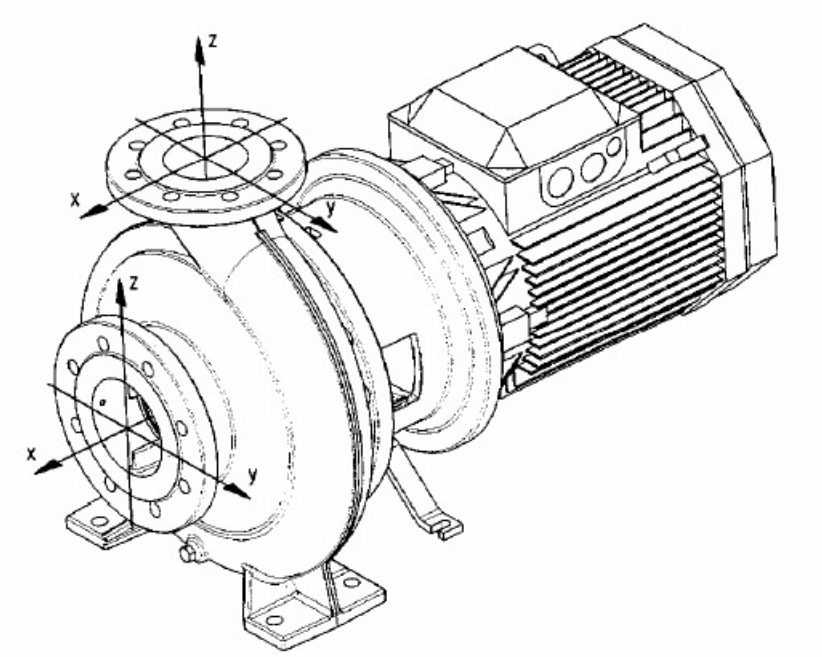


Figure 16: Permitted Nozzle loads and torques at pump Nozzle

∅DN	Forces in N				Torques in Nm				∅DN	Forces in N				Torques in Nm			
	Fx	Fy	Fz	∑F	Mx	My	Mz	∑M		Fx	Fy	Fz	∑F	Mx	My	Mz	∑M
Suction nozzle									Discharge nozzle								
40	700	620	560	1100	730	500	590	1070	25	420	400	480	730	500	340	400	730
50	920	840	760	1450	780	560	650	1150	32	500	480	590	930	620	420	480	900
65	1180	1040	950	1850	840	620	670	1230	40	620	560	700	1100	730	500	590	1060
80	1400	1260	1150	2200	900	650	730	1320	50	840	760	920	1450	780	560	650	1150
100	1880	1680	1520	2950	980	700	810	1450	65	1040	950	1180	1850	840	620	670	1230
125	2210	2000	1800	3480	1180	840	1070	1710	80	1260	1150	1400	2200	900	650	730	1320
150	2800	2520	2270	4400	1400	980	1150	2050	125	2000	1800	2210	3480	1180	840	1070	1710
200	3750	3360	3030	5850	1820	1290	1490	2700	150	2520	2270	2800	4400	1400	980	1150	2050

4.4.3 Suction-piping checklist

Performance curve reference

CAUTION:
Vary the capacity with the regulating valve in the discharge line. Never throttle the flow from the suction side. This action can result in decreased performance, unexpected heat generation, and equipment damage.

Net positive suction head available ($NPSH_A$) must always exceed NPSH required ($NPSH_R$) as shown on the published performance curve of the pump.

Suction-piping checks

Check	Explanation/comment	Checked
Check that the distance between the inlet flange of the pump and the closest elbow is at least five pipe diameters.	This minimizes the risk of cavitation in the suction inlet of the pump due to turbulence. See the Example sections for illustrations.	
Check that elbows in general do not have sharp bends.	See the Example sections for illustrations. —	
Check that the suction piping is one or two sizes larger than the suction inlet of the pump. Install an eccentric reducer between the pump inlet and the suction piping.	The suction piping must never have a smaller diameter than the suction inlet of the pump.	
Check that the eccentric reducer at the suction flange of the pump has the following properties: • Sloping side down • Horizontal side at the top	See the example illustrations.	
Suggested suction strainers are used. Check that they are at least three times the area of the suction piping. Monitor the pressure drop across the suction strainer. An increased pressure drop across the strainer of 34.5 kPa | 5 psi indicates that the strainer should be removed and cleaned. After a period of time (24 hours minimum) system flushing should be complete and the suction strainer can be removed.	Suction strainers help to prevent debris from entering the pump. Mesh holes with a minimum diameter of 1.6 mm | 1/16 in. are recommended. Liquids with specific gravity less than 0.60 a pressure drop across the suction strainer may be due to ice buildup. Ice buildup can cause turbulence, low pressure areas and pumpage vaporization.	
If more than one pump operates from the same liquid source, check that separate suction-piping lines are used for each pump.	This recommendation helps you to achieve a higher pump performance and prevent vapor locking especially with specific gravity of liquid less than 0.60.	
If necessary, make sure that the suction piping includes a drain valve and that it is correctly installed.	—	
Assure adequate insulation is applied for liquids with specific gravity less than 0.60.	To assure sufficient NPSHa.	

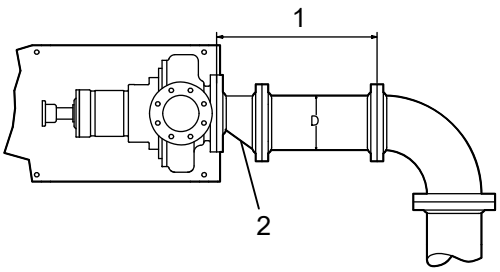
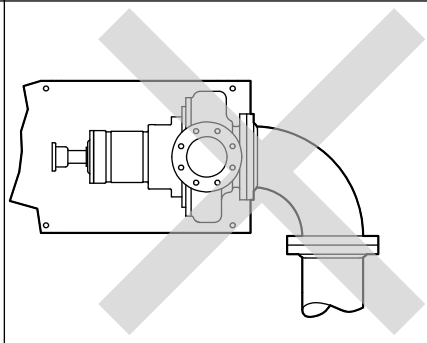
Liquid source below the pump

Check	Explanation/comment	Checked
Make sure that the suction piping is free from air pockets.	This helps to prevent the occurrence of air and cavitation in the pump inlet.	
Check that the suction piping slopes upwards from the liquid source to the pump inlet.	—	
If the pump is not self-priming, check that a device for priming the pump is installed.	Use a foot valve with a diameter that is at least equivalent to the diameter of the suction piping.	

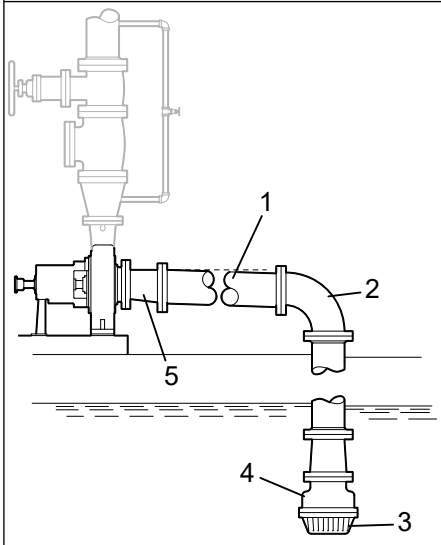
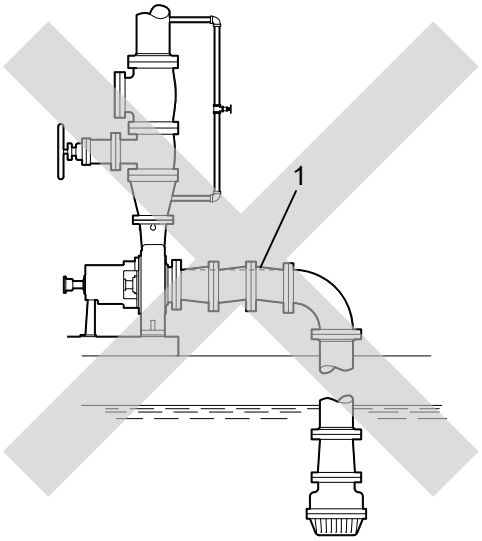
Liquid source above the pump

Check	Explanation/comment	Checked
Check that an isolation valve is installed in the suction piping at a distance of at least two times the pipe diameter from the suction inlet.	This permits you to close the line during pump inspection and maintenance. Do not use the isolation valve to throttle the pump. Throttling can cause these problems: • Loss of priming • Excessive temperatures • Damage to the pump • Voiding the warranty	
Make sure that the suction piping is free from air pockets.	This helps to prevent the occurrence of air and cavitation in the pump inlet.	
Check that the piping is level or slopes downward from the liquid source.	—	
Make sure that no part of the suction piping extends below the suction flange of the pump.	—	
Make sure that the suction piping is adequately submerged below the surface of the liquid source.	This prevents air from entering the pump through a suction vortex.	

Example: Elbow close to the pump suction inlet

Correct	Incorrect
 1. Enough distance to prevent cavitation 2. Eccentric reducer with a level top	 **NOTICE:** This illustration shows an incorrectly installed elbow.

Example: Suction piping equipment

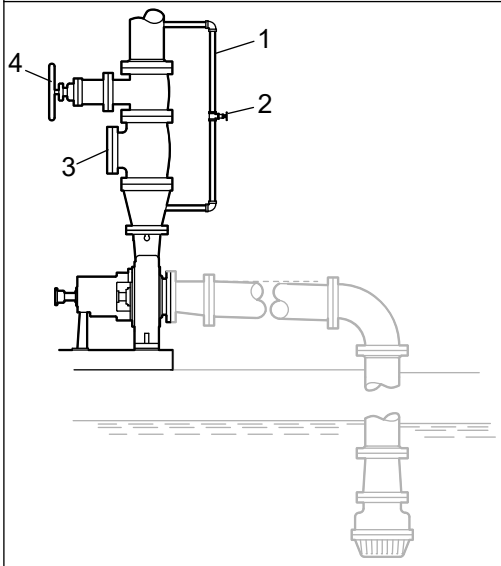
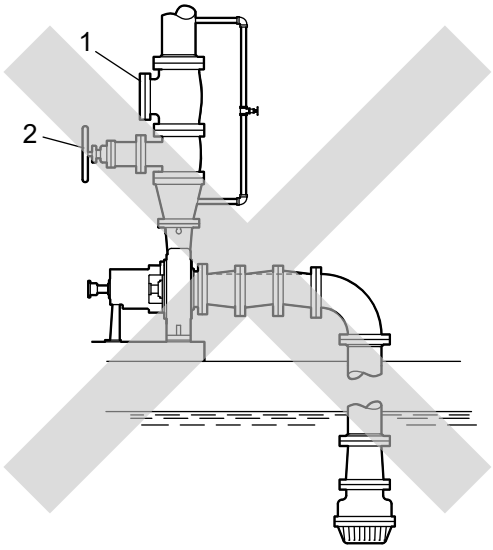
Correct	Incorrect
	
1. Suction pipe sloping upwards from liquid source 2. Long-radius elbow 3. Strainer 4. Foot valve 5. Eccentric reducer with a level top	1. Air pocket, because the eccentric reducer is not used and because the suction piping does not slope gradually upward from the liquid source

4.4.4 Discharge piping checklist

Checklist

Check	Explanation/comment	Checked
Check that an isolation valve is installed in the discharge line.	The isolation valve is required for: See Example: Discharge piping equipment for illustrations.	
If increasers are used, check that they are installed between the pump and the check valve.	See Example: Discharge piping equipment for illustrations.	

Example: Discharge piping equipment

Correct	Incorrect
	
1. Bypass line 2. Shut-off valve 3. Check valve 4. Discharge isolation valve	1. Check valve (incorrect position) 2. The isolation valve should not be positioned between the check valve and the pump.

4.4.5 Bypass-piping considerations

When to use a bypass line

Provide a bypass line for systems that require operation at reduced flows for prolonged periods. Connect a bypass line from the discharge side (before any valves) to the source of suction.

When to install a minimum-flow orifice

You can size and install a minimum-flow orifice in a bypass line in order to prevent bypassing excessive flows. Consult your ITT representative for assistance in sizing a minimum-flow orifice.

When a minimum-flow orifice is unavailable

Consider an automatic recirculation control valve or solenoid-operated valve if a constant bypass (minimum-flow orifice) is not possible.

4.4.6 Auxiliary-piping checklist

Precautions

CAUTION:

- Risk of heat generation, seal failure, and possible physical injury. Sealing systems that are not self-purging or self-venting, such as plan 23, require manual venting prior to operation.
- Running a mechanical seal dry, even for a few seconds, can cause seal failure and physical injury. Never operate the pump without liquid supplied to the mechanical seal.

NOTICE:

- Auxiliary cooling and flush systems must be operating properly to prevent excess heat generation, sparks, and/or premature failure. Ensure auxiliary piping is installed as specified on the pump data sheet prior to startup.
- Make sure that the ignition temperature of the cooling liquid is at least 50 K higher than the surface temperature of the bearing frame, if the pump is used in potentially explosive environment.

Checklist

Check	Explanation/comment	Checked
	–	
Check that the cooling water pressure does not exceed 7.0 kg/cm^2 | 100 psig .	–	

4.4.7 Final piping checklist

Check	Explanation/comment	Checked
Check that the shaft rotates smoothly.	Rotate the shaft by hand. Make sure there is no rubbing that can lead to excess heat generation or sparks.	
Re-check the alignment to make sure that pipe strain has not caused any misalignment.	If pipe strain exists, then correct the piping.	

5 Commissioning, Startup, Operation, and Shutdown

5.1 Preparation for startup

WARNING:

- Risk of serious physical injury or death. Exceeding any of the pump operating limits (e.g. - pressure, temperature, power, etc.) could result in equipment failure, such as explosion, seizure, or breach of containment. Assure that the system operating conditions are within the capabilities of the pump.
- Risk of death or serious injury. Leaking fluid can cause fire and/or burns. Ensure all openings are sealed prior to filling the pump.
- Breach of containment can cause fire, burns, and other serious injury. Failure to follow these precautions before starting the unit may lead to dangerous operating conditions, equipment failure, and breach of containment.
- Risk of explosion and serious physical injury. Do not operate pump with blocked system piping or with suction or discharge valves closed. This can result in rapid heating and vaporization of pumpage.
- Risk of breach of containment and equipment damage. Ensure the pump operates only between minimum and maximum rated flows. Operation outside of these limits can cause high vibration, mechanical seal and/or shaft failure, and/or loss of prime.
- Risk of death, serious personal injury, and property damage. Heat and pressure buildup can cause explosion, rupture, and discharge of pumpage. Never operate the pump with suction and/or discharge valves closed.
- Running a pump without safety devices exposes operators to risk of serious personal injury or death. Never operate a unit unless appropriate safety devices (guards, etc.) are properly installed.
- Failure to disconnect and lock out driver power may result in serious physical injury or death. Always disconnect and lock out power to the driver before performing any installation or maintenance tasks.
    - Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.
    - Refer to driver/coupling/gear manufacturer's installation and operation manuals (IOM) for specific instructions and recommendations.

NOTICE:

- Verify the driver settings before you start any pump. Refer to the applicable drive equipment IOMs and operating procedures.
- Excessive warm-up rates can cause equipment damage. Ensure the warm-up rate does not exceed 1.4°C | 2.5°F per minute.

NOTICE:

You must follow these precautions before you start the pump:

- Flush and clean the system thoroughly to remove dirt or debris in the pipe system in order to prevent premature failure at initial startup.
- Bring variable-speed drivers to the rated speed as quickly as possible.
- If temperatures of the pumped fluid will exceed 93°C | 200°F, then warm up the pump prior to operation. Circulate a small amount of fluid through the pump until the casing temperature is within 38°C | 100°F of the fluid temperature. Accomplish this by flowing fluid from pump inlet to discharge drain (optionally, the casing vent can be included in warm-up circuit but not required). Soak for (2) hours at process fluid temperature.

Precautions

WARNING:
The mechanical seal used in an Ex-classified environment must be properly certified.

CAUTION:
When a cartridge mechanical seal is used, ensure that the set screws in the seal locking ring are tightened and that the centering clips have been removed prior to startup. This prevents seal or shaft sleeve damage by ensuring that the seal is properly installed and centered on the sleeve.

5.2 Check the rotation

WARNING:

- Starting the pump in reverse rotation can result in the contact of metal parts, heat generation, and breach of containment. Ensure correct driver settings prior to starting any pump.
- Failure to disconnect and lock out driver power may result in serious physical injury or death. Always disconnect and lock out power to the driver before performing any installation or maintenance tasks.
    - Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.
    - Refer to driver/coupling/gear manufacturer's installation and operation manuals (IOM) for specific instructions and recommendations.

1. Unlock power to the driver.
2. Make sure that everyone is clear. Jog the driver momentarily, about a half a second. You should be able to check motor rotation by observing the motor fan direction. The direction should be the same as the arrow on the close coupled frame.
3. Lock out power to the driver.

5.3 Shaft-sealing options

In most cases, the manufacturer seals the shaft before shipping the pump. If your pump does not have a sealed shaft, see the Shaft-seal maintenance section in the Maintenance chapter.

This model uses these types of shaft seals:

- Cartridge mechanical seal
- Conventional inside-component mechanical seal

- Conventional outside-component mechanical seal

5.3.1 Mechanical seal options

Pumps are usually shipped with mechanical seals installed. If they are not, then refer to the mechanical seal manufacturer's installation instructions.

These are the mechanical seal options for this pump:

- Cartridge mechanical seal
- Conventional inside component mechanical seal
- Conventional outside component mechanical seal

5.3.2 Connection of sealing liquid for mechanical seals

Seal lubrication is required

Seal faces must have liquid film between them for proper lubrication. Locate the taps using the illustrations shipped with the seal.

Seal flushing methods

Table 2: You can use these methods in order to flush or cool the seal:

Method	Description
Product flush	Run the piping so that the pump pushes the pumped fluid from the casing and injects it into the seal gland. If necessary, an external heat exchanger cools the pumped fluid before it enters the seal gland.
External flush	Run the piping so that the pump injects a clean, cool, compatible liquid directly into the seal gland. The pressure of the flushing liquid must be 0.35 to 1.01 kg/cm^2 | 5 to 15 psi greater than the seal chamber pressure. The injection rate must be 2 to 8 lpm | 0.5 to 2 gpm.
Other	You can use other methods that employ multiple gland or seal chamber connections. Refer to the mechanical seal reference drawing and piping diagrams.

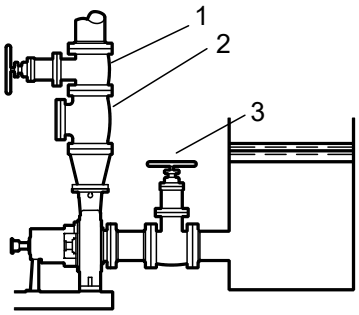
5.4 Pump priming

WARNING:
These pumps are not self priming and must be fully primed at all times during operation. Loss of prime can lead to excessive heat and severe damage to the pump and seal.

WARNING:
A build-up of gases within the pump, sealing system, or process piping system may result in an explosive environment. Make sure the process piping system, pump and sealing system are properly vented prior to operation.

5.4.1 Prime the pump with the suction supply above the pump

1. Slowly open the suction isolation valve.
2. Open the air vents on the suction and discharge piping until the pumped fluid flows out.
3. Close the air vents.



Item	Description
1.	Discharge isolation valve
2.	Check valve
3.	Suction isolation valve

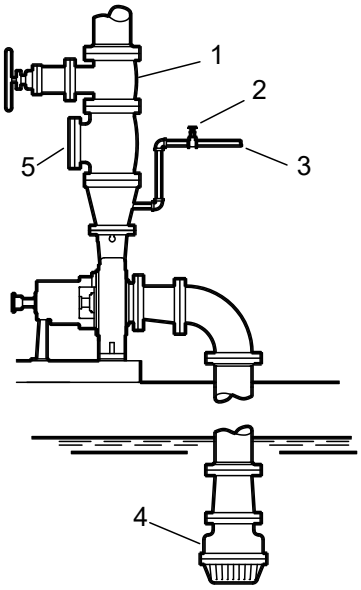
Figure 17: Suction supply above pump

5.4.2 Prime the pump with the suction supply below the pump

Use a foot valve and an outside source of liquid in order to prime the pump. The liquid can come from one of these sources:

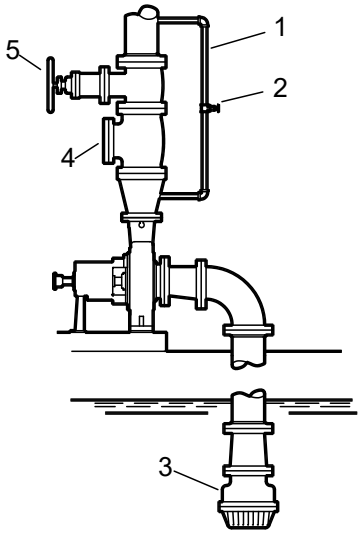
- A priming pump
- A pressurized discharge line
- Another outside supply

1. Close the discharge isolation valve.
2. Open the air vent valves in the casing.
3. Open the valve in the outside supply line until only liquid escapes from the vent valves.
4. Close the vent valves.
5. Close the outside supply line.



Item	Description
1.	Discharge isolation valve
2.	Shutoff valve
3.	From outside supply
4.	Foot valve
5.	Check valve

Figure 18: Pump priming with suction supply below pump with foot valve and an outside supply



Item	Description
1.	By-pass line
2.	Shutoff valve
3.	Foot valve
4.	Check valve
5.	Discharge isolation valve

Figure 19: Pump priming with suction supply below pump with foot valve using bypass around check valve

5.4.3 Other methods of priming the pump

You can also use these methods in order to prime the pump:

- Prime by ejector
- Prime by automatic priming pump

5.5 Start the pump

WARNING:

- Risk of equipment damage, seal failure and breach of containment. Ensure all flush and cooling systems are operating correctly prior to starting pump.
- Make sure that the ignition temperature of the cooling liquid is at least 50 K higher than the surface temperature of the bearing frame, if the pump is used in potentially explosive environment.

NOTICE:

- Risk of equipment damage due to dry operation. Immediately observe the pressure gauges. If discharge pressure is not quickly attained, stop the driver immediately, reprime, and attempt to restart the pump.

1. Fully close the discharge valve, depending on system conditions.
2. Start the driver.
3. Slowly open the discharge valve until the pump reaches the desired flow.
4. Immediately check the pressure gauge to ensure that the pump quickly reaches the correct discharge pressure.
5. If the pump fails to reach the correct pressure, perform these steps:
   a) Stop the driver.
   b) Restart the driver.
6. Monitor the pump while it is operating:
   a) Check the pump for excessive vibration, and noise.
   b) If the pump exceeds normal levels, then shut down the pump immediately and correct the problem.
7. Repeat steps 5 and 6 until the pump runs properly.

5.6 Pump operation precautions

General considerations

WARNING:

- Risk of serious personal injury or property damage. Dry running may cause rotating parts within the pump to seize to non-moving parts. Do not run dry.
- Risk of explosion and serious physical injury. Do not operate pump with blocked system piping or with suction or discharge valves closed. This can result in rapid heating and vaporization of pumpage.

NOTICE:

- Vary the capacity with the regulating valve in the discharge line. Never throttle the flow from the suction side. This action can result in decreased performance, unexpected heat generation, and equipment damage.
- Risk of equipment damage from unexpected heat generation. Do not overload the driver. Ensure that the pump operating conditions are suitable for the driver. The driver can overload in these circumstances:
  - The specific gravity or viscosity of the fluid is greater than expected
  - The pumped fluid exceeds the rated flow rate.

Operation at reduced capacity

WARNING:

- Risk of breach of containment and equipment damage. Excessive vibration levels can cause damage to bearings, seal chamber, and/or mechanical seal. Observe pump for vibration levels, bearing temperature, and excessive noise. If normal levels are exceeded, shut down and resolve.
- Risk of explosion and serious physical injury. Do not operate pump with blocked system piping or with suction or discharge valves closed. This can result in rapid heating and vaporization of pumpage.
- Risk of equipment damage and serious physical injury. Heat build-up can cause rotating parts to score or seize. Observe pump for excessive heat build-up. If normal levels are exceeded, shut down and resolve.

NOTICE:

- Cavitation can cause damage to the internal surfaces of the pump. Ensure net positive suction head available ($NPSH_A$) always exceeds NPSH required ($NPSH_R$) as shown on the published performance curve of the pump.
- Do not run pump below minimum pressure at the suction side. Provide monitoring device with automatic switch-off function in case of low pressure.

Operation under freezing conditions

NOTICE:
Do not expose an idle pump to freezing conditions. Drain all liquid that will freeze that is inside the pump and any auxiliary equipment. Failure to do so can cause liquid to freeze and damage the pump. Note that different liquids freeze at different temperatures. Some pump designs do not drain completely and may require flushing with a liquid that doesn't freeze.

5.7 Inadmissible modes of operations and their consequences (examples)

CAUTION:
Inadmissible modes of operation, even for a short time, can result in serious damage to the unit.

In connection with explosion protection, potential sources of ignition (overheating, electrostatic and induced charges, mechanical and electric sparks) may result from these inadmissible modes of operation; their occurrence can only be prevented by adhering to the intended use.

Pump is started up without medium:

- Other pump components may be destroyed due to overheating.

Suction line not opened or not opened fully:

- Pump suffers cavitation – material damage.
- Pump does not achieve the necessary head or flow rate.

- Pump may be destroyed due to overheating.

Discharge valve closed too much:

- Pump may be destroyed due to overheating.
- Axial thrust too great.

Discharge valve opened too much:

- Pump can cavitate. Particularly severe with an empty discharge line.
- Risk of pressure surge.
- Motor may be overloaded.

Suction valve and discharge valve closed:

Destruction due to rapid overheating and sharp rise in pressure.

Control of the pump with the suction valve:

Cavitation – the flow is only to be regulated on the discharge side.

5.8 Abrasive Media

Ⓔx On pumping liquids with abrasive components an increased wear at hydraulic and shaft sealing must be expected. The intervals of inspection should be reduced compared to the usual times.

5.9 Lubrication

The pump has no bearings and, therefore there´s no need for lubrication.

For possibly required lubrication of the motor bearings refer to the Operation and Maintenance Instructions of the motor supplier.

5.10 Shut down the pump

WARNING:
Precautions must be taken to prevent physical injury. The pump may handle hazardous and/or toxic fluids. Proper personal protective equipment should be worn. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.

1. Slowly close the discharge valve.
2. Shut down and lock out the driver to prevent accidental rotation.

6 Maintenance

6.1 Maintenance schedule

Maintenance inspections

A maintenance schedule includes these types of inspections:

- Routine maintenance
- Routine inspections
- Three-month inspections
- Annual inspections

Shorten the inspection intervals appropriately if the pumped fluid is abrasive or corrosive or if the environment is classified as potentially explosive.

Routine maintenance

Perform these tasks whenever you perform routine maintenance:

WARNING:
Move equipment to a safe/non Ex environment for repairs/adjustments or use spark resistant tools and work methods.

- Lubricate the bearings.

Routine inspections

Perform these tasks whenever you check the pump during routine inspections:

WARNING:
Move equipment to a safe/non Ex environment for repairs/adjustments or use spark resistant tools and work methods.

- Check the level and condition of the oil through the sight glass on the bearing frame.
- Check for unusual noise vibration.
- Check the pump and piping for leaks.
- Analyze the vibration.*
- Inspect the discharge pressure.
- Inspect the temperature.*

Three-month inspections

Perform these tasks every three months:

- Check that the foundation and the hold-down bolts are tight.

Annual inspections

Perform these inspections one time each year:

- Check the pump capacity.
- Check the pump pressure.
- Check the pump power.

If the pump performance does not satisfy your process requirements, and the process requirements have not changed, then perform these steps:

1. Disassemble the pump.
2. Inspect it.
3. Replace worn parts.

6.2 Shaft seal maintenance

6.2.1 Mechanical-seal maintenance

WARNING:

- Observe the requirements and operating limits in the manufacturers operating manual.

CAUTION:
Running a mechanical seal dry, even for a few seconds, can cause seal failure and physical injury. Never operate the pump without liquid supplied to the mechanical seal.

If the liquid being handled leaks out at the mechanical seal, it is damaged and must be replaced.

Cartridge-type mechanical seals

Cartridge-type mechanical seals are commonly used. Cartridge seals are preset by the seal manufacturer and require no field settings. Cartridge seals installed by the user require disengagement of the holding clips prior to operation, allowing the seal to slide into place. If the seal has been installed in the pump by ITT, these clips have already been disengaged.

Other mechanical seal types

For other types of mechanical seals, refer to the instructions provided by the seal manufacturer for installation and setting.

Reference drawing

The manufacturer supplies a reference drawing with the data package. Keep this drawing for future use when you perform maintenance and seal adjustments. The seal drawing specifies the required flush fluid and attachment points.

Before you start the pump

Check the seal and all flush piping.

Mechanical seal life

The life of a mechanical seal depends on the cleanliness of the pumped fluid. Due to the diversity of operating conditions, it is not possible to give definite indications as to the life of a mechanical seal.

6.3 Disassembly precautions

WARNING:

- Chemical hazard. You must individually decontaminate each component according to all federal, state, local, and company environmental regulations.
- A build up of gases within the pump, sealing system, or process-piping system can result in an explosive environment within the pump. Make sure that the process piping system, pump, and sealing system are properly vented prior to operation.
- Burn Hazard. use proper protection when handling bearings.
- Avoid injury. Worn pump components can have sharp edges. Wear appropriate gloves while handling these parts.
- Risk of serious personal injury from exposure to hazardous or toxic liquids. A small amount of liquid will be present in certain areas like the seal chamber upon disassembly.
- Process fluid leaks can result in an explosive atmosphere. Follow all pump and seal assembly procedures.
- Risk of serious personal injury. Applying heat to impellers, propellers, or their retaining devices can cause trapped liquid to rapidly expand and result in a violent explosion. This manual clearly identifies accepted methods for disassembling units. These methods must be adhered to. Never apply heat to aid in their removal unless explicitly stated in this manual.
- Risk of serious physical injury or death from rapid depressurization. Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
- Lifting and handling heavy equipment poses a crush hazard. Use caution during lifting and handling and wear appropriate Personal Protective Equipment (PPE, such as steel-toed shoes, gloves, etc.) at all times. Seek assistance if necessary.
- Precautions must be taken to prevent physical injury. The pump may handle hazardous and/or toxic fluids. Proper personal protective equipment should be worn. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.

6.4 Protective clothes

CAUTION:
Even if the pump has been properly evacuated and rinsed, residue of the medium may still remain in the pump.
Example: Between sealing surfaces or in the bearing seats.

Protective clothing in accordance with the regulations is to be worn.

6.5 Required tools

Tools

- Assorted metric open-end or socket sizes 13 mm, 17 mm, 18 mm, 19 mm, and 24 mm
- Hex wrenches, sizes 2.5 mm, 3 mm, 5 mm, and 6 mm with a 12.07 cm | 4.75 in. minimum reach
- Hex wrench, size 8 mm with 15 cm | 6 in. minimum reach
- Torque wrench
- Strap wrench

- 3/8 in. eyebolt

6.6 Prepare the pump for disassembly

1. Lock out power to the driver.

WARNING:

Failure to disconnect and lock out driver power may result in serious physical injury or death. Always disconnect and lock out power to the driver before performing any installation or maintenance tasks.

- Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.

CAUTION:

- Risk of physical injury. Allow all system and pump components to cool before handling.
- If the pumped fluid is non-conductive, drain and flush the pump with a conductive fluid under conditions that will not allow for a spark to be released to the atmosphere.

2. Shut off all valves that control flow to and from the pump.
3. Drain and flush the pump before you remove it from the piping.
4. Isolate the pump from the system and then flush the pump using a compatible liquid.
5. Disconnect all piping and auxiliary equipment.
6. Remove the pump from the baseplate.
7. Decontaminate the pump:
   a) Connect a clean-flush liquid supply to the discharge nozzle.
   b) Collect the flushed liquid as it drains out of the drain connection.
   c) Flush the pump in order to remove residue.

6.7 Removal and Installation of screen in the motor lantern

The guard plates (681) are fixed in the windows of the motor lantern (341).

For removing insert a screwdriver about 4 cm into the last row with punches of the guard plate. Then pull up the screwdriver until the lower edge of the guard plate lifts off the window. Now you can remove the screwdriver together with the guard plate from the window. .

On installation insert the screwdriver about 4 cm into the last row with punches of the guard plate. Then put the upper part of the guard plate into the upper edge of the window. Now pull up the screw driver until the guard plate is bent through so much, that it can be inserted into the lower edge of the window of the motor lantern.

NOTICE:
Pull up screw driver only so far as is absolutely necessary to insert the guard plate into the window. If the guard plate does not stick fast in the window after installation:

Dismantle guard plate once again, flatten it and install again.

6.8 Removal of the Back Pull Out Assembly

The back pull out assembly consists of all pump parts except the volute casing (102V). As the pumps are constructed in block design, the volute casing (102V) can remain on the foundation and in the piping, if it ´s not the volute casing itself, which must be repaired.

1. Drain volute casing (102V) via drain plug (912.11).
2. Loosen screws of existing sealing or flushing piping.
3. Loosen screws of support food (183) from the foundation (not existing on all sizes).
4. Hang the Back Pull Out Assembly onto a lifting device, so that it won´t sink down or press into the volute casing during the dismounting.

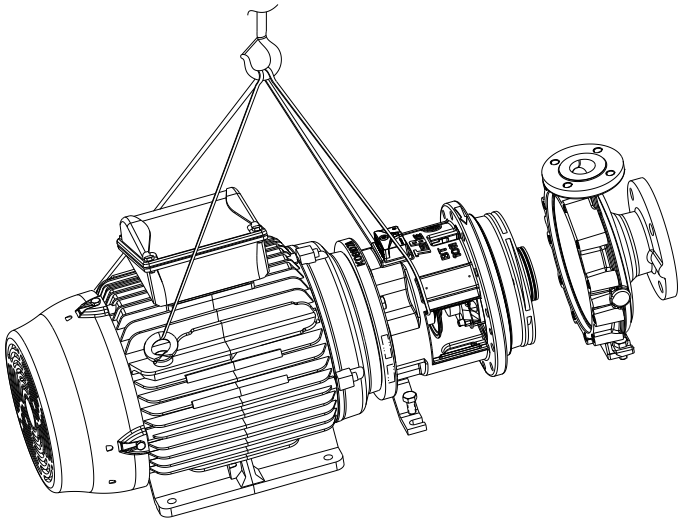


Figure 20: Back pull-out removal

5. Loosen hex head bolt (901.11) from the casing.
6. Using the jack screws provided (901.42), separate the Back Pull Out Assembly from the casing.

6.9 Removal of Impeller

CAUTION:
A worn impeller and/or pump housing can have very sharp edges. Wear protective gloves.

If the impeller has back vanes check the axial clearance "a" between the impeller (230) and casing cover (161) before you continue the dismounting. Refer to 6.12.1 Replacement guidelines on page 55.

NOTICE:
Be sure to locate pry bars under impeller vanes to prevent damage to the impeller.

For further dismounting, and for installation, the Back Pull Out Assembly should be placed in a vertical position. Prevent assembly from tipping!

1. Loosen impeller nut with a sensitive hit on the wrench (right-hand thread). If necessary back up with a pry bar in the cross boring of the stud shaft (in clamp area).
2. Draw off the impeller (230) with two screw drivers or pry bars. Remove key (940.31).

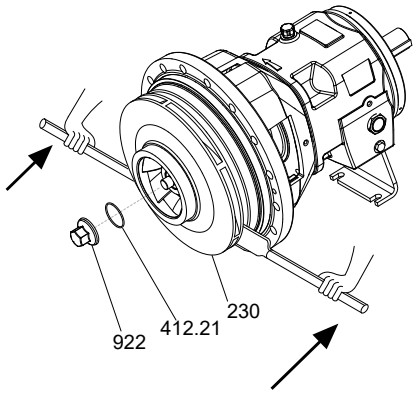


Figure 21: Impeller removal

6.10 Remove the Shaft Sealing

Before you remove casing cover refer to *Mounting Instructions for Shaft Sealing*.

1. Unfasten hexagonal nut (901.31) (not available on all pump sizes) and take casing cover (161) out of motor lantern (341).

6.11 Removal of Stub Shaft

1. Loosen nut (920.41) / screws (902.41) and pull motor with stub shaft (210) out of the motor lantern (341).
2. Loosen radial stub shaft screwing (904.41 and 904.42) (stud bolts) and deduct stub shaft (210) from motor shaft. For support (break loose) you can insert a solid screw driver into the cross boring, press it against the front face of the motor and move both shafts against each other.

6.12 Pre-assembly inspections

Guidelines

Before you assemble the pump parts, make sure you follow these guidelines:

- Inspect the pump parts according to the information in these pre-assembly topics before you reassemble your pump. Replace any part that does not meet the required criteria.
- Make sure that the parts are clean. Clean the pump parts in solvent in order to remove oil, grease, and dirt.

NOTICE:

Protect machined surfaces while cleaning the parts. Failure to do so may result in equipment damage.

6.12.1 Replacement guidelines

Casing check and replacement

WARNING:
Risk of death or serious injury. Leaking fluid can cause fire and/or burns. Inspect and ensure gasket sealing surfaces are not damaged and repair or replace as necessary.

Inspect the casing for cracks and excessive wear or pitting. Thoroughly clean gasket surfaces and alignment fits in order to remove rust and debris.

Repair or replace the casing if you notice any of these conditions:

- Localized wear or grooving that is greater than 3.2 mm | 1/8 in. deep
- Pitting that is greater than 3.2 mm | 1/8 in. deep

Casing areas to inspect

The arrows point to the areas to inspect for wear on the casing:

The arrows point to the areas to inspect for wear on the casing:

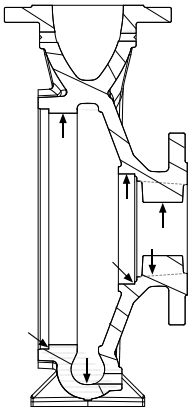
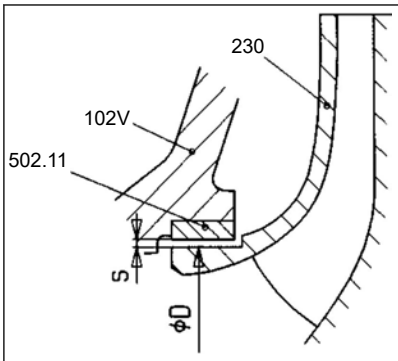


Figure 22: Areas to inspect on the casing

Impeller clearances and reconditioning

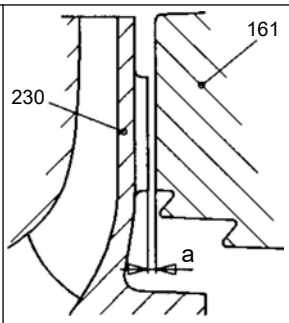
When you recondition the impeller, consider this information:

- For pumps installed in potentially explosive atmospheres, you must replace worn parts when the wear limits have been reached.
- For volute casings (102V) with a wear ring (502.11) and casing covers (161) with a wear ring (502.31), you can restore the correct clearance in one of two ways:
  - Replace the impeller and the wear ring.
  - Contact your ITT representative in order to acquire a customized wear ring (bored to fit) in order to avoid replacement of the impeller.
- When the volute casing (102V) or casing cover (161) without a wear ring must be repaired, you can install a wear ring in order to renew pump performance. The volute casing and/or the casing cover must be re-machined. Contact your ITT representative for assistance.



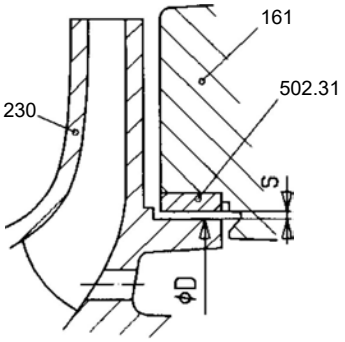
s	Radial clearance
D	Nominal diameter
102V	Volute casing
230	Impeller
502.11	Optional wear ring

Figure 23: Impeller clearance, suction side



a	Axial clearance
161	Seal chamber cover
230	Impeller

Figure 24: Impeller clearance, back vanes



s	Radial clearance
D	Nominal diameter
161	Seal chamber cover
230	Impeller
502.31	Optional wear ring

Figure 25: Impeller clearance, drive side

Measure the radial clearance (s) on the drive side of the impeller on the following sizes only:

- 100-65-315
- 125-80-315
- 125-80-400
- 125-100-315
- 125-100-400
- 150-125-315
- 150-125-400
- 200-150-315
- 200-150-400

Table 3: Impeller clearance limits

Nominal diameter D mm | in			60/68	85	100/120/135	155/175	220
Radial clearance (s)	New	Min.	0.15 mm | 0.005 in.	0.17 mm | 0.007 in.	0.20 mm | 0.008 in.	0.22 mm | 0.009 in.	0.25 mm | 0.010 in.
		Max.	0.19 mm | 0.007 in.	0.22 mm | 0.009 in.	0.24 mm | 0.009 in.	0.27 mm | 0.010 in.	0.30 mm | 0.012 in.
	Wear limits		0.78 mm | 0.030 in.	0.85 mm | 0.033 in.	0.90 mm | 0.035 in.	1.05 mm | 0.041 in.	1.15 mm | 0.045 in.
Axial clearance (a)	New		0.8 to 1.2 mm | 0.031 to 0.047 in.				
	Wear limits		1.7 mm | 0.067 in.				

Gaskets, O-rings, and seats replacement

WARNING:
Risk of death or serious injury. Leaking fluid can cause fire and/or burns. Replace all gaskets and O-rings at each overhaul or disassembly.

WARNING:
Risk of serious personal injury or property damage. Fasteners such as bolts and nuts are critical to the safe and reliable operation of the product. Ensure appropriate use of fasteners during installation or reassembly of the unit.

- Use fasteners of the proper size and material only.
- Replace all corroded fasteners.
- Ensure that all fasteners are properly tightened and that there are no missing fasteners.

6.12.2 Seal chamber inspection

Checklist

Perform these checks when you inspect the seal chamber.

- Make sure that these surfaces are clean:
  - Seal chamber
  - Mounting
- Make sure there is no pitting or wear greater than 3.2 mm | 1/8 in. deep.

  Replace the seal chamber if pitting or wear exceeds this measurement.
- Inspect the machined surfaces and mating faces noted in the figures.

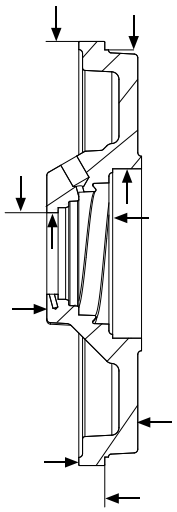


Figure 26: Seal chamber

6.13 Reassembly

A complete assembly operation is described in the following.

Sub-sections can be deduced from this.

- Good mechanical engineering practice is to be observed for assembly work.
- Use original spare parts. See also Conversion work and production of spare parts by the customer. Do not use defective parts.
-
- Check whether all parts fit and only then perform assembly.
- Important dimensions are to be checked before assembly, e.g. by fitting parts together as a test.
- These important dimensions are centerings, bearing seats or bearing clearances.
- During assembly, gaskets (400), (401) and (406) are to be replaced.
- Prior to assembly, remove any metallic particles adhering to parts fitted with magnets.

6.13.1 Mounting

General

Re-assemble the pumps using the reverse order of steps as completed for pump disassembly. However the following observations should be considered:

- Pay attention to the utmost cleanliness when reassembling the pump.
- For tight tolerances e.g. between stub shaft (210) and motor shaft or impeller (230) and shaft (210), as well as thread, use suitable anti-galling compound (e.g. Molykote / Never-Seeze), so that the next mounting and dismounting will be easier.

NOTICE:
Anti-galling compound must be compatible with the pumpage.

- Screws should be tightened, with the following torque:

Location	Screw Size	Screw torque in Nm	
		Lubricated threads	Dry threads
Casing Screws	M12	35	50
	M16	105	150
	M20	210	305
All other scres	M10	35	50
	M12	60	90
	M16	150	220

- Do not use excessive force.
- For mounting of stub shaft refer to *Mounting of Stub Shaft*.
- For mounting of mechanical seal refer to separate "Mounting Instruction of Shaft Sealing" and 6.9 Removal of Impeller on page 53.
- For impellers with back vanes the axial clearance between the back vanes and the casing cover (161) should be checked after mounting the impeller (230) and tightening the impeller nut (922) (see General remarks).
- After the mounting of the back pull out assembly, and its assembly into the volute casing, turn the shaft and control the free moving of the pump in this way. The shaft sealing will cause slightly resistance when turning, but there must not be any contact between metal parts.

NOTICE:
Before starting the pump do not forget to install and connect all security devices.

6.13.2 Mount the stub shaft

1. Insert key in the motor stump.
2. Put anti-galling compound onto the motor stump (see 6.13.1 Mounting on page 58, *General*).
3. Push stub shaft up the motor shaft to measure A (see *Stub shaft mounting* image and chart).
4. Drill countersink into motor shaft, approximately 2-3 mm depth, through the radial bore in the motor shaft (see *Stub shaft mounting* image), by using a twist-drill with 90° tip.
5. Remove cuttings out of the stud hole (e.g. with compressed-air), screw in and make safe thread pins (904.41 and 904.42) (e.g. with Omnifit 100 M or Loctite).
6. Check smooth running of stub shaft opposite to motor flange with a dial gauge. The pointer deflection of the dial gauge must not exceed 0,1 mm.

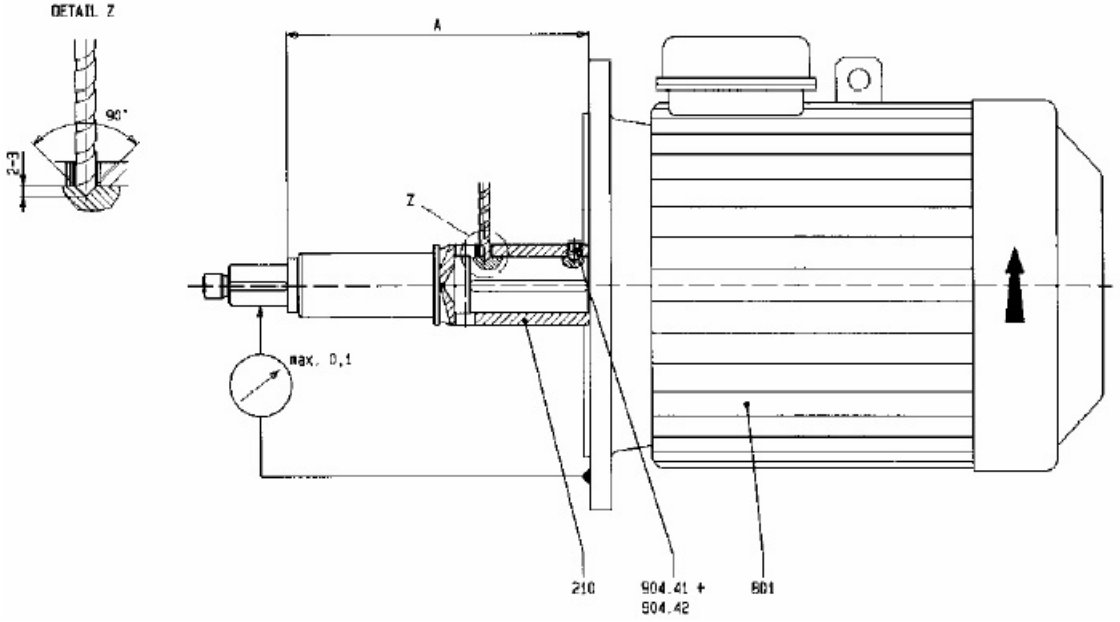


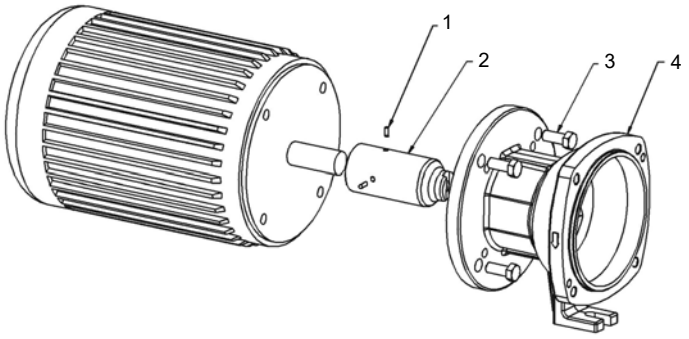
Figure 27: Stub shaft mounting

Type	Measure A by motor size							
	80	90	100	112	132	160	180	200
40-25-160	157	157	197	197	197	232	-	-
40-25-200	157	157	197	197	197	232	-	-
40-25-250	162	162	202	202	202	237	237	237
50-32-160	157	157	197	197	197	232	-	-
50-32-200	157	157	197	197	197	232	-	-
50-32-250	162	162	202	202	202	237	237	237
50-32-315	-	-	202	202	197	237	237	237
65-40-160	157	157	197	197	197	232	-	-
65-40-200	157	157	197	197	197	232	232	-
65-40-250	162	162	202	202	202	237	237	237
65-40-315	-	-	202	202	197	237	237	237
80-50-160	157	157	197	197	197	232	232	-
80-50-200	157	157	197	197	202	232	232	232
80-50-250	-	162	202	202	202	237	237	237
80-50-315	-	-	202	202	202	237	237	237
100-65-160	162	162	202	202	202	237	237	237

Type	Measure A by motor size							
	80	90	100	112	132	160	180	200
100-65-200	-	162	202	202	202	237	237	237
100-65-250	-	162	202	202	206	237	237	237
100-65-315	-	-	206	206	202	241	241	241
125-80-160	-	162	202	202	202	237	237	237
125-80-200	-	162	202	202	202	237	237	237
125-80-250	-	-	202	202	202	237	237	237
125-80-315	-	-	-	206	206	241	241	241
125-100-200	-	-	202	202	202	237	237	237
125-100-250	-	-	216	216	216	251	251	251
125-100-315	-	-	-	-	206	241	241	241
150-125-250	-	-	-	-	216	251	251	251
150-125-315	-	-	-	-	-	241	241	241
200-150-250	-	-	-	-	-	251	251	251

6.13.3 Reassemble the frame assembly and shaft

1. Slide the stub shaft onto the motor shaft and secure it with the setscrew .



1. Setscrew (904.41 and 904.42)
2. Stub shaft (210)
3. motor-to-lantern (902.41 and 920.41)
4. Motor lantern (341)

2. Mount the motor lantern onto the motor using hex screws (904.41 and 904.42).

6.13.4 Assemble the casing cover, shaft sealing and impeller

1. Place casing cover (161) into groove of lantern (341) (optional: tight with screw 901.31).
2. Insert shaft sealing (433).
3. Mount fixing ring (527) and secure with grub screw (904.31).
4. Insert key (940.31).
5. Mount impeller (230).
6. Insert O-ring (412.21) into the groove of the impeller nut (922).
7. Secure the impeller (230) with the impeller nut (922).

6.13.5 Final assembly

1. Secure the housing (102V) with the suction nozzle facing downwards on a workbench or worktop.
2. Insert the housing gasket (400) into the housing centering.

3. Insert the unit pre-assembled as described in 6.13.4 Assemble the casing cover, shaft sealing and impeller on page 60 into the housing so that the crane hook of the lantern faces the centre of the discharge nozzle.
4. Screw in the housing screw (901.11) with washer (554.41) and tighten.
5. Insert plastic plugs into the tapped bores for the jacking screws on the lantern (341).

6.14 Assembly references

6.14.1 Sound pressure levels

Sound pressure levels L_{pA} in dB(A)

Sound pressure level L_{PA} measured in 1 m distance from pump surface acc. to DIN 45635, part 1 and 24. Room and foundation influences are not considered. The tolerance for these values is ±3 dB(A).

Addition with 60 Hz-operation:

Pump alone: -

Pump with motor: +4 dB(A)

	Sound Pressure Level (dBa)			
	Speed (rpm)			
Pump Size	3600	2900	1750	1450
40−25−160	63	59.2	50.3	47
40−25−200	64.9	61.1	52.2	48.9
40−25−250	69	65.2	56.3	53
50−32−160	64.2	60.4	51.5	48.2
50−32−200	66.4	62.6	53.7	50.4
50−32−250	71	67.2	58.3	55
50−32−315	74.5	70.7	61.8	58.5
65−40−160	65.6	61.8	52.9	49.6
65−40−200	68.2	64.4	55.5	52.3
65−40−250	71.3	67.5	58.6	55.3
65−40−315	76	72.2	63.3	60
80−50−160	68.3	64.5	55.6	52.3
80−50−200	70.8	67	58.1	54.8
80−50−250	74.5	70.7	61.8	58.5
80−50−315	77.3	73.5	64.6	61.3
100−65−160	70.2	66.4	57.5	54.1
100−65−200	73.2	69.4	60.5	57.2
100−65−250	77	73.2	64.3	61
100−65−315	80.1	76.3	67.4	64.1
125−80−160	72.8	69	60.1	56.8
125−80−200	75.2	71.4	62.5	59.2
125−80−250	78.3	74.5	65.6	62.3
125−80−315	82	78.2	69.3	66
125−80−400	NA	NA	72.3	69
125−100−200	77.4	73.6	64.7	61.4

	Sound Pressure Level (dBa)			
	Speed (rpm)			
125−100−250	80.4	76.6	67.7	64.4
125−100−315	83.5	79.7	70.8	67.5
125−100−400	NA	NA	74.2	70.9
150−125−250	NA	NA	70.4	67.1
150−125−315	NA	NA	73.1	69.8
150−125−400	NA	NA	75.8	72.5
200−150−250	NA	NA	72.6	69.3
200−150−315	NA	NA	76.3	73
200−150−400	NA	NA	79	75.7

6.14.2 Bolt torque values

Screw torque values

This table provides the recommended screw torque values.

Location	Bolt size	Torque for lubricated threads in Nm | lb-ft	Torque for dry threads in Nm | lb-ft
Casing screws	M12	35 | 26	50 | 37
	M16	105 | 77	150 | 111
	M20	210 | 155	305 | 225
All other screws	M10	40 | 30	50 | 37
	M12	60 | 44	90 | 66
	M16	150 | 111	220 | 162

Nut torque values

This table provides the recommended nut torque values.

Location	Frame size	Torque for lubricated threads in Nm | lb-ft	Torque for dry threads in Nm | lb-ft
Impeller nut	24	35 | 26	45 | 33
	32	105 | 77	130 | 96
	42	210 | 155	260 | 192
	48	380 | 280	475 | 350

6.14.3 Spare parts

Spare parts order

Provide this information when you order spare parts. You can find the required information in the data sheet and the relevant sectional drawing:

- Pump model and size
- Serial number (order number)
- Part name
- Sectional drawing, item number

7 Troubleshooting

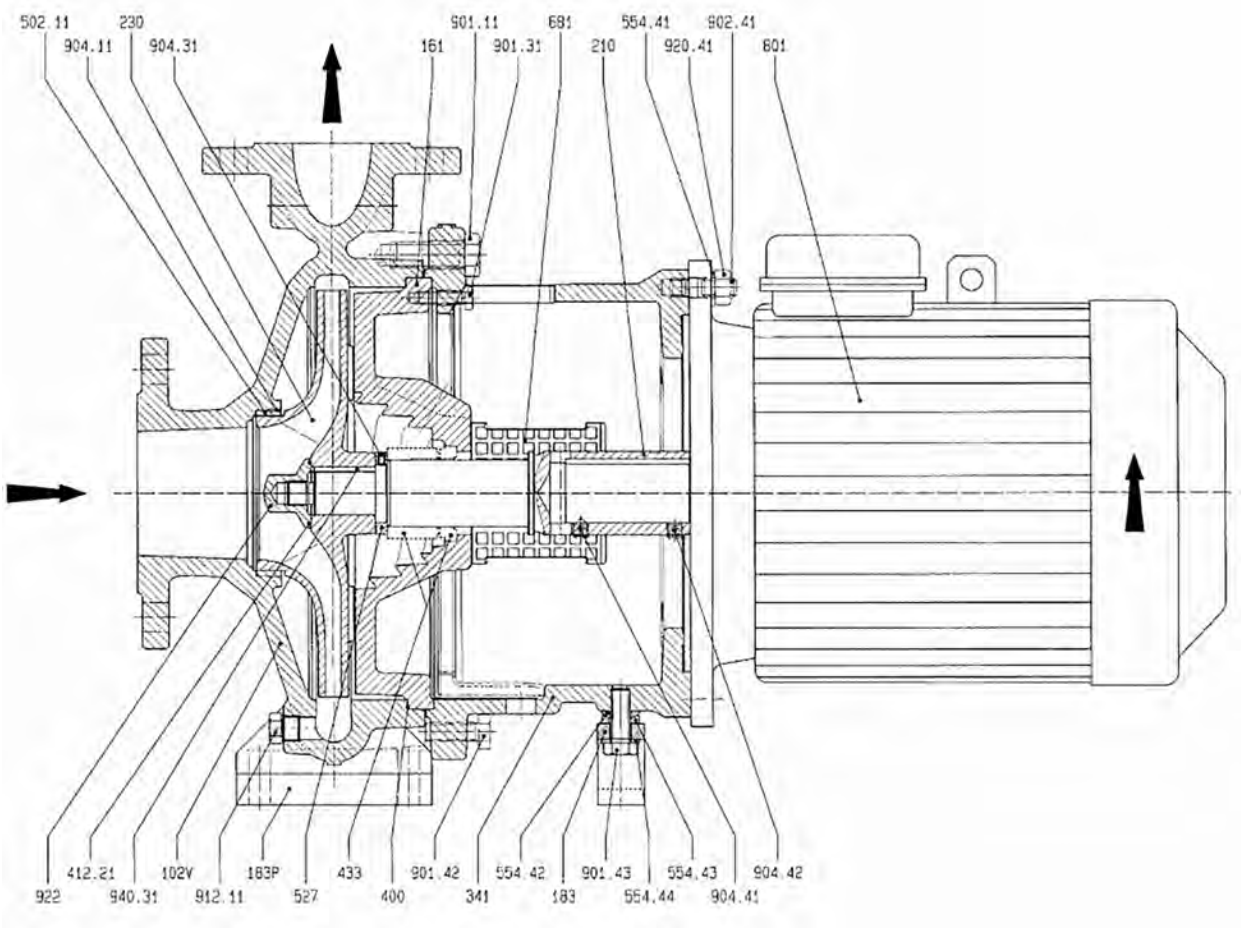
7.1 Operation troubleshooting

Symptom	Cause	Remedy
The pump is not delivering liquid.	The pump is not primed.	Reprime the pump and check that the pump and suction line are full of liquid.
	The suction line is clogged.	Check the suction line pressure. If it is low, locate and remove any obstructions.
	The impeller is clogged.	Disassemble the impeller and remove the blockage.
	The shaft is rotating in the wrong direction.	Change the rotation. The rotation must match the arrow on the bearing housing or pump casing.
	The foot valve or suction pipe opening is not submerged enough.	Consult an ITT representative for the proper submersion depth. Use a baffle in order to eliminate vortices.
	The suction lift is too high.	Shorten the suction pipe.
The pump is not producing rated flow or head.	There is an air leak in the suction line.	Check for leaks and repair the lines.
	The impeller is partly clogged.	Back flush the pump to clean the impeller.
	The impeller rings are worn.	Replace the defective ring as required.
	There is insufficient suction head.	Make sure that the suction line shutoff valve is fully open and the line is unobstructed. Check the suction pressure.
	The impeller is either worn or broken.	Inspect and replace the impeller if necessary.
	The rotation is wrong.	Correct the wiring.
Pump starts and then stops pumping.	The pump is not primed correctly.	Reprime the pump.
	There is an air leak in the suction line.	Check for leaks and correct.
	There are either air or vapor pockets in the suction line.	Rearrange the piping to eliminate air pockets.
Pump is noisy or vibrates.	The pump or driver is not aligned properly.	Align the shafts.
	There is a partially-clogged impeller causing the imbalance.	Disassemble the impeller and remove the blockage.
	There is a broken or bent impeller or shaft.	Replace as required.
	The base is not rigid enough.	Tighten the pump and motor hold-down bolts or adjust the stilts. Then check the grout.
	The suction or discharge piping is not anchored or properly supported.	Anchor the piping per the Hydraulic Institute Standards recommendations (Edition 14, centrifugal pump section).
	The pump is cavitating.	Increase the NPSH available.
The mechanical seal is leaking excessively.	The mechanical seal part are worn.	Replace the worn parts.
	The mechanical seal is over heating.	Check the lubrication and cooling lines.

Symptom	Cause	Remedy
The motor requires excessive power.	The head is lower than the rating and the pump has too much liquid.	Install a throttle valve.
	The liquid is heavier than expected.	Check the specific gravity and viscosity.
	The head is higher than the rating, which is at capacity.	Check the impeller diameter.
	The rotating parts are binding or are severely worn.	Check the internal wearing parts for proper clearances.
	The motor rotation is incorrect.	Correct the wiring.
	The impeller clearance is too tight.	Adjust the impeller clearance.
The condition monitoring device shuts down the pump.	The sleeve and thrust bearings are damaged.	Replace as required.
	There is a plugged recirculation circuit.	Disassemble and remove the blockage. Then determine and correct the cause of the blockage.
	There is recirculation liquid vaporization.	Correct all of these as necessary: • Check the actual liquid temperature versus the design temperature. • Check the actual NPSH available versus the design. • Check the minimum flow requirement for the pump size.
	The pump is running dry.	• Check the control device for proper operation. • Check the suction line for blockage. • Reprime the pump.
	There is excessive motor power.	The system head is lower than the rating and pumps too much liquid. Check the rotating parts for binding and wear. The liquid is heavier than expected.

8 Parts Lists and Cross-Sectionals

8.1 Parts List and Cross-Sectional Drawings



No.	Part name:
102V	Volute casing
161	Casing cover
183 ***)	Support foot
183P **)	Pump alignment
210	Stub shaft
230	Impeller
341	Motor lantern
400	Gasket
412.21	O-ring
433	Mechanical seal
502.11 *)	Wear ring
527 **	Fixing ring
554.41	Washer
554.42 ***)	Bevelwasher

No.	Part name:
554.43 ***)	Bevelcup
554.44 ***)	Washer
681	Guard plate
801	Flange motor
901.11	Hex screw
901.31 **)	Hex screw
901.42	Hex screw
901.43 ***)	Hex screw
902.41	Stud
904.11 *)	Grub screw
904.31**)	Grub screw
904.41	Grub screw
904.42	Grub screw
912.11	Drain plug
920.41	Hex nut
922	Impeller nut
940.31	Key

9 Decommissioning

9.1 Putting pump out of operation

This chapter contains information on decommissioning the pump. Decommissioning must be performed in the following situations:

- Before maintenance and servicing work
- Before removing the pump from the plant

Emptying

1. Switch the drive system off and secure it to prevent a restart/being switched on again
2. Make sure that all interfaces for the pumping process are securely closed.
3. Relieve the pump and operator side pipelines of pressure in the safe area.

NOTICE:
Always safely collect any pumped medium that leaks out and dispose of this in accordance with applicable local regulations.

Empty the pump and operator side pipelines completely in the safe area.

Clean

The following prerequisites for cleaning must be fulfilled:

- All interfaces for the pumping process are securely closed.
- The system is completely emptied and pressure-free.
    - Clean the pump thoroughly

9.2 Disposal

This chapter contains information on proper disposal. Ensure that the pump has been decommissioned properly prior to disposal

1. Drain lubricating oil from the bearing casing and collect it safely.
2. Thoroughly clean components and disassemble these in compliance with applicable local occupational safety and environmental protection regulations.

NOTICE:
If necessary, enclose a declaration of no objection (refer 10.1 Declaration of no objection on page 68 with each disassembled component.

3. Recycle disassembled components in accordance with local regulations. A typical procedure is:
    - Scrap metals
    - Give plastic elements to recycling
    - Dispose of remaining components

10 Certificates

10.1 Declaration of no objection

Please copy, fill it out and send it with the pump.

Statutory regulations oblige all commercial companies to protect their employees, the public and the environment from the hazardous effects of dangerous substances.

For this reason, repair and inspection of the components may only be undertaken once the following declaration has been correctly and fully filled out and signed by an authorised, qualified specialist.

If safety measures must be employed despite complete emptying and cleaning on the part of the operator, then this required information must be passed on. This declaration of no objection comprises part of the repair or inspection order.

We hereby declare that the enclosed component

Type: _____

Serial number: _____

- is free of hazardous materials. Special safety measures for further handling of the device are not necessary.
- The device has been fully emptied and thoroughly cleaned inside and out prior to dispatch.

The following media was previously conveyed by the pump: _____

The medium was hazardous:	❒ YES	❒ NO
The pump was emptied by the operating firm:	❒ YES	❒ NO
The pump was thoroughly cleaned inside and out by the operating firm:	❒ YES	❒ NO
The pump came into contact with hazardous substances:	❒ YES	❒ NO

If yes: Hazardous material number according to Ordinance on Hazardous Substances (GefStoffV): _____

or CAS registration number (Chemical Abstract Service): _____

Company/Institute: _____

Street: _____

Postcode, city: _____

Telephone: _____

Name: _____

Item: _____

Date: _____

Signature, Company stamp: _____

10.2 Declarations of conformity and incorporation

EC-Declaration of Conformity

We herewith declare,

ITT Bornemann GmbH
Postfach 11 62, 31676 Obernkirchen, Germany
Fon +49 (0) 5724 390-0, Fax +49 (0) 5724 390-290,

that the machinery (centrifugal pump):

Order - No.:
Denomination:
Quantity:
Serial - No.:
Year of manufacture:

Is in conformity with the following EC-Directives, provided that the site conditions for the commissioning are met as specified in the engineering documents, in particular in the operation manual:

Machinery - Directive (2006/42/EC)

☐ **EMC - Directive (2014/30/EU)**

Separate declarations of conformity are attached if marked below.

☐ **ATEX - Directive (2014/34/EU)**

☐ **PED- Directive (2014/68/EU)**

Harmonized standards used:

- **EN 349:1993+A1:2008**
- **EN 14120:2015**
- **EN 13732-1:2008**
- **EN 12162:2001+A1:2009**
- **EN ISO 12100:2010**
- **EN 809:1998+A1:2009+AC:2010**

Obernkirchen, date**:**

Managing Director

Technical Manager

UKCA-Declaration of Conformity

We herewith declare,

ITT Bornemann GmbH
Postfach 11 62, 31676 Obernkirchen, Germany
Fon +49 (0) 5724 390-0, Fax +49 (0) 5724 390-290,

that the machinery (centrifugal pump):

Order - No.: …
Denomination: …
Quantity: …
Serial - No.: …
Year of manufacture: …

Is in conformity with the following EC-Directives, provided that the site conditions for the commissioning are met as specified in the engineering documents, in particular in the operation manual:

Supply of Machinery (Safety) Regulations 2008 No 1597

☐ **ECR - Directive (2016 No. 1091)**

Separate declarations of conformity are attached if marked below.

☐ **UKEX - Directive (2016 No. 1107)**

☐ **PESR- Directive (2016 No 1105)**

Designated standards used:

- **EN 349:1993+A1:2008**
- **EN 14120:2015**
- **EN 13732-1:2008**
- **EN 12162:2001+A1:2009**
- **EN ISO 12100:2010**
- **EN 809:1998+A1:2009+AC:2010**

Obernkirchen, date**:**

Managing Director

Technical Manager

EC-Declaration of Incorporation

According to directive on machinery 2006/42 EC appendix II B

We herewith declare,

ITT Bornemann GmbH
Postfach 11 62, 31676 Obernkirchen, Germany
Fon +49 (0) 5724 390-0, Fax +49 (0) 5724 390-290,

that the incomplete machinery(centrifugal pump):
Order - No.:
Denomination:
Quantity:
Serial - No.:
Year of manufacture:

Conforms to the following basic requirements of the directive on machinery (2006/42/EC): appendix I, Article 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.3, 1.3.4, 1.3.7 and 1.7.3.

Harmonized standards used:

• **EN 13732-1:2008**	• **EN 12162:2001+A1 :2009** • **EN ISO 12100:2010** • **EN 809:1998+A1:2009+AC:2010**

The commissioning is prohibited until it has been established, that the machinery, into which the above mentioned machinery is to be installed, complies with the Directive machinery (2006/42/EC).

We also declare that the relevant technical documentation for this incomplete machine was prepared according to appendix VII, Part B and commit ourselves to provide them in copy on demand to the market surveillance authorities.

Obernkirchen, date**:**

Managing Director

Technical Manager

UKCA-Declaration of Incorporation

According to **Supply of Machinery (Safety) Regulations 2008 No 1597**

We herewith declare,

ITT Bornemann GmbH
Postfach 11 62, 31676 Obernkirchen, Germany
Fon +49 (0) 5724 390-0, Fax +49 (0) 5724 390-290,

that the incomplete machinery(centrifugal pump):
Order - No.:
Denomination:
Quantity:
Serial - No.:
Year of manufacture:

Conforms to the following basic requirements of the directive on Machinery (Safety) Regulations 2008 No 1597: Annex I, Article 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.3, 1.3.4, 1.3.7 and 1.7.3.

Designated standards used:

• **EN 13732-1:2008**	• **EN 12162:2001+A1 :2009** • **EN ISO 12100:2010** • **EN 809:1998+A1:2009+AC:2010**

The commissioning is prohibited until it has been established, that the machinery, into which the above mentioned machinery is to be installed, complies with the machinery directive (2008 No 1597).

We also declare that the relevant technical documentation for this incomplete machine was prepared according to appendix VII, Part B and commit ourselves to provide them in copy on demand to the market surveillance authorities.

Obernkirchen, date**:**

Managing Director

Technical Manager

11 Other Relevant Documentation or Manuals

11.1 For additional documentation

For any other relevant documentation or manuals, contact your ITT representative.

12 Local ITT Contacts

12.1 Regional offices

Region	Address	Telephone	Fax
North America (Headquarters)	ITT - Goulds Pumps 240 Fall Street Seneca Falls, NY 13148 USA	+1 315-568-2811	+1 315-568-2418
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Los Angeles	ITT - Goulds Pumps 880 W. Crowther Ave Placentia, CA 92870 USA	+1 562-908-4125	+1 562-695-8523
Asia Pacific	ITT Fluid Technology Asia Pte Ltd 1 Jalan Kilang Timor #04-06 Singapore 159303	+65 627-63693	+65 627-63685
Asia Pacific	ITT Goulds Pumps Ltd 35, Oksansandan-ro Oksan-myeon, Heungdeok-gu, Cheongju-si, Chungcheongbuk-do 28101, Rep. of KOREA	+82 234444202	
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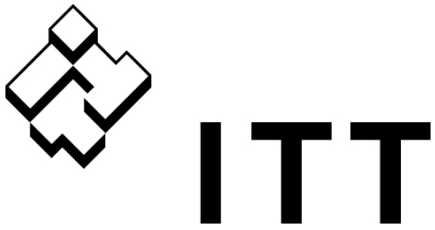

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