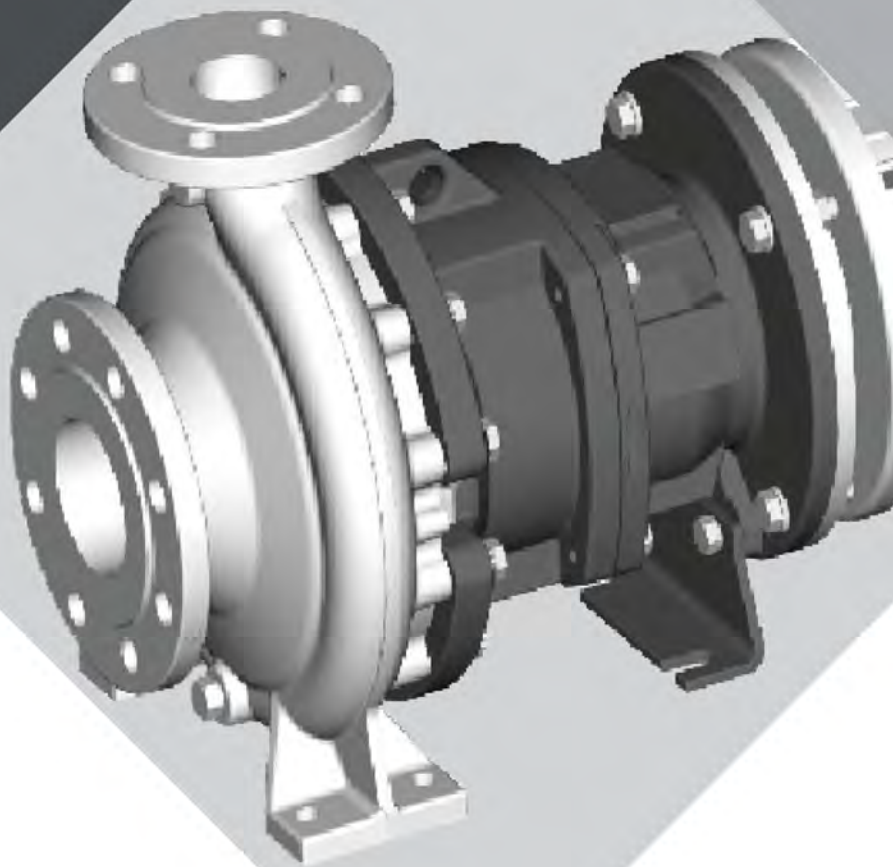
GOULDS PUMPS

Installation, Operation, and Maintenance Manual

Model ICMB



ITT

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1 Safety

1.1 Important Safety Notice

To: Our Valued Customers:

User safety is a major focus in the design of our products. Following the precautions outlined in this manual will minimize your risk of injury.

ITT Goulds pumps will provide safe, trouble-free service when properly installed, maintained, and operated.

Safe installation, operation, and maintenance of ITT Goulds Pumps equipment are an essential end user responsibility. This Pump Safety Manual identifies specific safety risks that must be considered at all times during product life. Understanding and adhering to these safety warnings is mandatory to ensure personnel, property, and/or the environment will not be harmed. Adherence to these warnings alone, however, is not sufficient — it is anticipated that the end user will also comply with industry and corporate safety standards. Identifying and eliminating unsafe installation, operating and maintenance practices is the responsibility of all individuals involved in the installation, operation, and maintenance of industrial equipment.

Please take the time to review and understand the safe installation, operation, and maintenance guidelines outlined in this Pump Safety Manual and the Instruction, Operation, and Maintenance (IOM) manual. Current manuals are available at https://www.gouldspumps.com/en-US/Tools-and-Resources/Literature/ or by contacting your nearest Goulds Pumps sales representative.

These manuals must be read and understood before installation and start-up.

For additional information, contact your nearest Goulds Pumps sales representative or visit our Web site at https://www.gouldspumps.com

1.2 Safety warnings

Specific to pumping equipment, significant risks bear reinforcement above and beyond normal safety precautions.

WARNING:
A pump is a pressure vessel with rotating parts that can be hazardous. Any pressure vessel can explode, rupture, or discharge its contents if sufficiently over pressurized causing death, personal injury, property damage, and/or damage to the environment. All necessary measures must be taken to ensure over pressurization does not occur.

WARNING:
Operation of any pumping system with a blocked suction and discharge must be avoided in all cases. Operation, even for a brief period under these conditions, can cause superheating of enclosed pumpage and result in a violent explosion. All necessary measures must be taken by the end user to ensure this condition is avoided.

WARNING:
The pump may handle hazardous and/or toxic fluids. Care must be taken to identify the contents of the pump and eliminate the possibility of exposure, particularly if hazardous and/or toxic. Potential hazards include, but are not limited to, high temperature, flammable, acidic, caustic, explosive, and other risks.

WARNING:
Pumping equipment Instruction, Operation, and Maintenance manuals clearly identify accepted methods for disassembling pumping units. These methods must be adhered to. Specifically, applying heat to impellers and/or impeller retaining devices to aid in their removal is strictly forbidden. Trapped liquid can rapidly expand and result in a violent explosion and injury.

ITT Goulds Pumps will not accept responsibility for physical injury, damage, or delays caused by a failure to observe the instructions for installation, operation, and maintenance contained in this Pump Safety Manual or the current IOM available at http://www.gouldspumps.com/literature.

1.3 Safety

Definitions

Throughout this manual the words Warning, Caution, Electrical, and ATEX are used to indicate where special operator attention is required.

Observe all Cautions and Warnings highlighted in the Pump Safety Manual and the IOM provided with your equipment.

WARNING:
Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
Example: Pump shall never be operated without coupling guard installed correctly.

CAUTION:
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
Example: Throttling flow from the suction side may cause cavitation and pump damage.

Electrical Hazard:

WARNING:
Indicates the possibility of electrical risks if directions are not followed.
Example: Lock out driver power to prevent electric shock, accidental start-up, and physical injury.

ATEX:

WARNING:
When installed in potentially explosive atmospheres, the instructions that follow 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 an ITT Goulds Pumps representative before proceeding.
Example: Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.

1.4 General precautions

WARNING:
A pump is a pressure vessel with rotating parts that can be hazardous. Hazardous fluids may be contained by the pump including high temperature, flammable, acidic, caustic, explosive, and other risks. Operators and maintenance personnel must realize this and follow safety measures. Personal injuries will result if procedures outlined in this manual are not followed. ITT Goulds Pumps will not accept responsibility for physical injury, damage or delays caused by a failure to observe the instructions in this manual and the IOM provided with your equipment.

Table 1: General Precautions

WARNING		NEVER APPLY HEAT TO REMOVE IMPELLER. It may explode due to trapped liquid.
WARNING		NEVER use heat to disassemble pump due to risk of explosion from tapped liquid.
WARNING		NEVER operate pump without coupling guard correctly installed.
WARNING		NEVER run pump below recommended minimum flow when dry, or without prime.
WARNING		ALWAYS lock out power to the driver before performing pump maintenance.
WARNING		NEVER operate pump without safety devices installed.
WARNING		NEVER operate pump with discharge valve closed.
WARNING		NEVER operate pump with suction valve closed.
WARNING		DO NOT change service application without approval of an authorized ITT Goulds Pumps representative.
WARNING		Safety Apparel: • Insulated work gloves when handling hot bearings or using bearing heater • Heavy work gloves when handling parts with sharp edges, especially impellers • Safety glasses (with side shields) for eye protection • Steel-toed shoes for foot protection when handling parts, heavy tools, etc. • Other personal protective equipment to protect against hazardous/toxic fluids
WARNING		Receiving: Assembled pumping units and their components are heavy. Failure to properly lift and support equipment can result in serious physical injury and/or

		equipment damage. Lift equipment only at specifically identified lifting points or as instructed in the current IOM. Current manuals are available at www.gouldspumps.com/literature_ioms.html or from your local ITT Goulds Pumps sales representative. Note: Lifting devices (eyebolts, slings, spreaders, etc.) must be rated, selected, and used for the entire load being lifted.
WARNING		Alignment: Shaft alignment procedures must be followed to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.
WARNING		Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.
CAUTION		Piping: Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.
WARNING		Flanged Connections: Use only fasteners of the proper size and material.
WARNING		Replace all corroded fasteners.
WARNING		Ensure all fasteners are properly tightened and there are no missing fasteners.
WARNING		Startup and Operation: When installing in a potentially explosive environment, please ensure that the motor is properly certified.
WARNING		Operating pump in reverse rotation may result in contact of metal parts, heat generation, and breach of containment.
WARNING		Lock out driver power to prevent accidental start-up and physical injury.
WARNING		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.
WARNING		If using a cartridge mechanical seal, the centering clips must be installed and set screws loosened prior to setting impeller clearance. Failure to do so could result in sparks, heat generation, and mechanical seal damage.
WARNING		The coupling used in an ATEX classified environment must be properly certified and must be constructed from a non-sparking material.
WARNING		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.

WARNING		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
CAUTION		The mechanical seal used in an ATEX classified environment must be properly certified. Prior to start up, ensure all points of potential leakage of process fluid to the work environment are closed.
CAUTION		Never operate the pump without liquid supplied to mechanical seal. Running a mechanical seal dry, even for a few seconds, can cause seal damage and must be avoided. Physical injury can occur if mechanical seal fails.
WARNING		Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.
WARNING		Dynamic seals are not allowed in an ATEX classified environment.
WARNING		DO NOT operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury
WARNING		Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
WARNING		Shutdown, Disassembly, and Reassembly: Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes must be worn at all times.
WARNING		The pump may handle hazardous and/or toxic fluids. Observe proper decontamination procedures. Proper personal protective equipment should be worn. Precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.
WARNING		Operator must be aware of pumpage and safety precautions to prevent physical injury.
WARNING		Lock out driver power to prevent accidental startup and physical injury.
CAUTION		Allow all system and pump components to cool before handling them to prevent physical injury.
CAUTION		If pump is a Model NM3171, NM3196, 3198, 3298, V3298, SP3298, 4150, 4550, or 3107, there may be a risk of static electric discharge from plastic parts that are not properly grounded. If pumped fluid is non-conductive, pump should be drained and flushed with a conductive fluid under conditions that will not allow for a spark to be released to the atmosphere.
WARNING		Never apply heat to remove an impeller. The use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and property damage.
CAUTION		Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.
CAUTION		Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

WARNING		Noise: 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.
WARNING		Temperature: 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.

1.5 ATEX 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:

Description of ATEX

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

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

The ATEX 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 ATEX classified environment, are identified by an ATEX tag secured to the pump or the baseplate on which it is mounted. A typical tag would look like this:

Figure 1: Typical ATEX pump nameplate

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.

The CE and the Ex designate the ATEX compliance. The code below reads as follows:

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.

1.6 Parts

The use of genuine Goulds parts will provide the safest and most reliable operation of your pump. ITT Goulds Pumps ISO certification and quality control procedures ensure the parts are manufactured to the highest quality and safety levels.

Please contact your local Goulds representative for details on genuine Goulds parts.

2 Technical data

2.1 Technical data

Manufacturer:

ITT Goulds Pumps
Millwey Rise Industrial Estate
Axminster, Devon,
EX13 5HU
UK
Tel: +44 (0)1297-639100
Fax: +44 (0)1297-630476

Designation:

Series ICMB, Magnetic Chemical Process Pump, close-coupled design
Technical specifications to ISO 15783 and DIN ISO 5199
Connecting dimensions to ISO 2858 / DIN EN 22858
Flange connecting dimensions:
DIN EN 1092-2, type B
(ISO 7005-2, type B) PN 16
ATEX 95 Directive 94/9/EC Machine
Directive 2006/42/EC

Housing materials:

Standard: Stainless steel (1.4408)
Optional: Ductile cast iron, Duplex, Hastelloy C, titanium

Flow rates:

up to 90 m^3/h (at 2900 rpm)

Delivery heads:

up to 65 m LC (at 2900 rpm)

Housing discharge pressure:

ICMB max. 16 bar

Temperature range:

- 40°C to + 180°C

Temperature classes:

see Temperature limits

Admissible ambient conditions for pumps acc. to directive 94/9/ EG (ATEX 95):

- Ambient temperature range: - 20 °C to + 40 °C (higher temperature after consulting the manufacturer)
- Ambient pressure range: 0,8 barabs to 1,1 barabs

Sizes:

40-25-160 *

50-32-160

65-40-160

80-50-160

40-25-200 *

50-32-200

65-40-200

80-50-200

***** Low-Flow sizes: not included in ISO 2858 / DIN EN 22858

Weight:

See installation drawing

Dimensions:

See installation drawing

Designation codes:

(example)

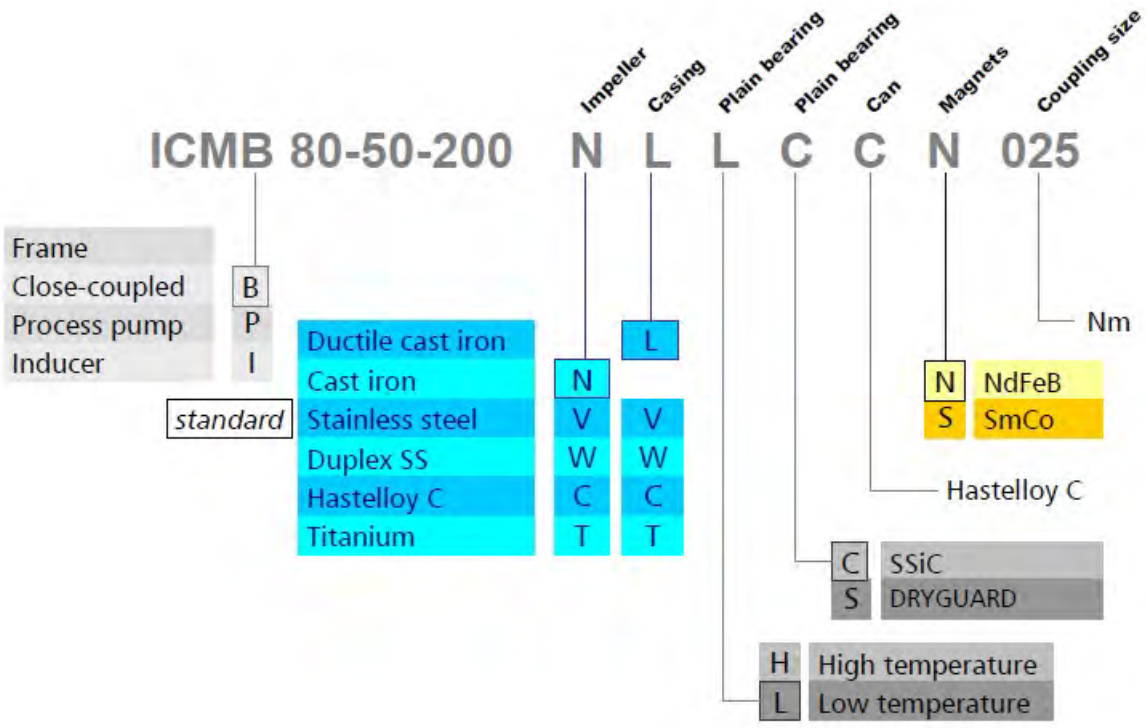


Figure 2: Designation codes (example)

2.2 Intended use

The pump is equipped with a permanent-magnet synchronous drive. It is suitable for the leak-free conveyance of aggressive, toxic, ignitable or hot liquids

Ⓔx The observance of the specified physical limits is important for perfect functioning and safe operation, especially with regard to explosion protection to prevent potential sources of ignition (see Explosion protection.

- It must be ensured that the pump is always filled with liquid during operation.
- For safe pump operation, we recommend a flow rate which lies between 0.3 and 1.1 Q_{opt}. The maximum operating temperature must never be exceeded. See Maintenance. In case of doubt, you must consult the manufacturer.
- The manufacturer must be consulted in the event of entrainment of gas >2% as well as solids in order to avoid a lack of lubrication and dry-running.
- The plant NPSH value (NPSHA) should be 0.5 m higher than the NPSH value of the pump (NPSHR). See also 5.4 Piping on page 18.

Ⓔx Inadmissible modes of operation, even for a short period, may 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.

Furthermore, reference is made in this connection to the Directive 95/C332/06 (ATEX 118a) which contains the minimum regulations for improving the occupational health and safety of the workers who may be at risk from an explosive atmosphere.

Ⓔx This unit must not be operated above the values specified in the data sheet as regards the fluid to be conveyed, flow rate, speed, density, delivery head and operating temperature as well as the motor rating.

NOTICE:
The instructions contained in the operating manual or contract documentation must be observed; if necessary consult the manufacturer.

All important features are documented in the data sheet included in the scope of delivery.

In the event of operating conditions other than those described in the data sheet, the following are to be checked again:

- design of the pump
- design of the accessories
- resistance of the materials

2.3 Tightening torques

Screws greased, tighten in diametrically opposite sequence.

Table 2: Housing screws 901/3

Pump size	No. x size	Nm
40-25-160	8 x M12	48
50-32-160	8 x M12	48
65-40-160	8 x M12	48
80-50-160	8 x M12	48
40-25-200	12 x M12	48
50-32-200	12 x M12	48
65-40-200	12 x M12	48
80-50-200	12 x M12	48

Table 3: Pipe screws, flanges to DIN/ISO

DN	No. x size	Nm
25	4x M12	12
32	4x M16	18
40	4x M16	22
50	4x M16	30
65	4x M16	40
80	8x M16	25

Table 4: Impeller nut 231

	No. x size	Nm
	1x M12x1,5	35

Table 5: Plain bearing cartridge screws 901/1

3x M8	12Nm

2.4 Type plate, dry-running, CE and housing markings

The stainless steel type plate is firmly riveted to the bearing pedestal:

If the operator attaches his identification, it must be ensured that the pump matches the application in question.

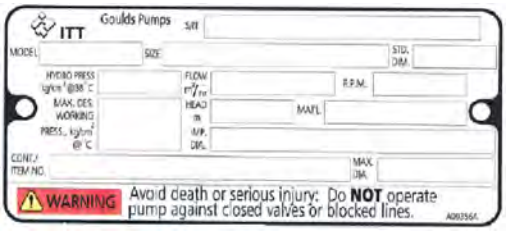


Figure 3: Example of type plate

CE-marking

Figure 4: When CE applies

Figure 5: When CE & ATEX applies

Housing identification

The following are visible on the housing according to DIN EN 19:

- Nominal size
- Rated pressure
- Housing material
- Manufacturer's identification
- Melt number/Foundry identification
- Foundry date

3 Transport and storage

3.1 Transport and storage

WARNING:
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.

A pump or motor can be suspended from the ring bolt provided for this purpose.

The suspension points are not suitable for transporting a complete unit, i.e. pump with base plate and motor.

In this case, the slinging points for the ropes on the base plate are to be used.

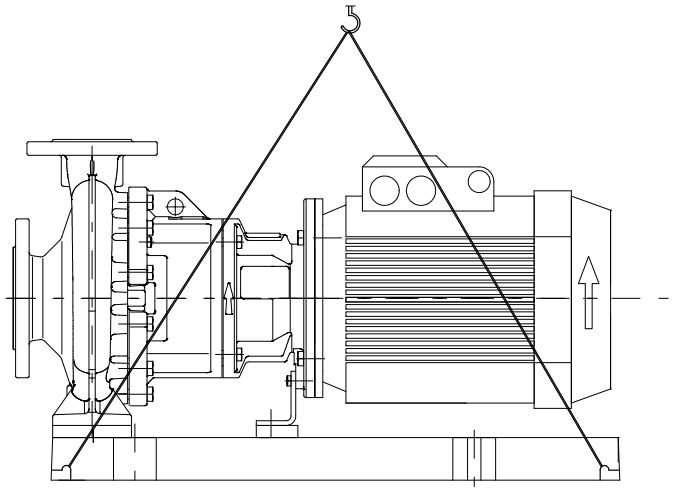


Figure 6: Slinging points for ropes on baseplate

The slinging ropes must not be attached to free shaft ends or to the ring bolt of the motor.

NOTICE:
Directly after receipt of the goods, the consignment must be checked for completeness and any in-transit damage.

Damaged pumps must not be installed in the plant.

CAUTION:
When unpacking magnetic drives as single parts, the relevant notes in 7.5 Notes on dismantling on page 25 must be observed.

Handle goods carefully to prevent damage.

Flange covers serve as protection during transport and must not be removed.

If the unit is not installed immediately after delivery, it must be put into proper storage.

It should be stored in a dry, vibration-free room as at constant a temperature as possible.

CAUTION:
If magnetic drives are stored as single parts, the relevant notes in 7.5 Notes on dismantling on page 25 are to be observed.

In the case of prolonged storage conservation agents on machined component surfaces and packing with a desiccant may be necessary.

3.1.1 Return consignments

WARNING:
Pumps which have conveyed aggressive or toxic media must be well flushed and cleaned before being returned to the manufacturer's works.

A General Safety Certificate on the field of application is to be enclosed with the returned goods.

Pre-printed forms are enclosed with the installation and operating manual.

Safety precautions and decontamination methods are to be mentioned.

4 Product description

4.1 General description

The housing dimensions of the pump model ICMB comply with ISO 2858 / DIN EN 22858.

The technical requirements and nominal ratings of the pump models ICMB comply with ISO 2858 / DIN EN 22858 / ISO 15783 / DIN ISO 5199.

The sectional drawing shows the pump set-up. See Sectional drawing.

- The metal housing (100) has an axial suction nozzle and radial discharge nozzle. The housing drain screw 103 permits the entire pump including the can interior to be drained.
- The impeller (230) is of closed design. The back vanes serve to offset the axial thrust. The impeller is attached to the magnet assembly shaft by an impeller nut (231) and key (940/2) and rests against the distance washer (551/1).
- The plain bearing pedestal (339) has flushing bores which serve to dissipate the heat on the can and lubricate the plain bearing cartridge (310). Depending on the pump design, connection tapped bores can be provided on the plain bearing pedestal to permit access to the pump interior (e.g. for monitoring devices or external flushing).
- The plain bearing cartridge (310) encapsulates all the individual parts of the bearing system and permits the exchange of the complete unit in one piece. It is attached to the plain bearing pedestal with hex. screws (901/1). The inner magnet assembly (859) is fitted with permanent magnets. These magnets of the inner magnet assembly are protected against the medium by a corrosion-resistant metallic cover. The inner magnet assembly and shaft are one piece.
- A parallel pin (562/1) serves as an anti-torsion insert for the plain bearing cartridge.
- The inner magnet assembly accommodates axial vanes to promote the flushing flow.
- The metallic can (159) seals the pump interior against the atmosphere to ensure it is leak-proof.
- The lantern (344) is screwed against the housing with hex. screws (901/3) and washers (554/3). Both the housing gasket (401) and the can gasket (406) are tightly sealed through the direct action of the bolting force.
- The lantern has a safety rubbing surface which protects the can against damage from the drive magnet assembly if the rolling bearings become defective.
- The hex. screws (901/5) prevent the individual parts from falling apart when the entire slide-in unit is being removed from the pump housing. These screws are not provided in some pump sizes. Instead the setscrews (904/2) perform this function.
- Should the can become defective, the flat gasket (400/1) at least seals the medium against the atmosphere for a short period.
- The adapter (346) joins the motor flange to the lantern. The torque is transmitted from the motor through the key (940/1) to the hollow drive shaft (216) and then to the drive magnet assembly (858).
- The magnets are stuck into the drive magnet assembly. It is axially secured by the hex. socket screw (914/1).
- The flushing/cooling flow is fed into the can chamber through the flushing bores in the plain bearing pedestal. The flushing flow passes through the plain bearings back into the housing. The rotating magnets generate an eddy current in the can which heats the flushing/cooling flow.

Design details are provided in the sectional drawing, Sectional drawing. Additional information is also contained in the Brochure and Pricebook.

5 Installation

5.1 Safety regulations

WARNING:

- Ⓔx Equipment which is operated in potentially explosive areas must satisfy the explosion protection regulations.
- People with a pacemaker are at risk from the strong magnetic field of the magnetic drive. It may be life-threatening for them to stay at a distance of less than 500 mm to the pump.

5.2 Installation of pump/unit

The structural work must be prepared in accordance with the dimensions in the installation drawing.

Method of installation: on a grouted base plate and firm foundation.

1. Align base plate on the ground foundation.
2. Insert foundation bolts and grout base plate.
3. Do not tighten the foundation bolts uniformly and firmly until the mortar has set.

5.3 Alignment of pump - coupling motor

NOTICE:

Ⓔx

The following information is of a general nature. If necessary, special notes of the coupling manufacturer are to be observed.

1. Prior to alignment work, loosen the support bracket 183. Align the unit with the housing so that there is no tension and retighten the support bracket.
2. Use supports in the direct vicinity of the bolts foundation/base plate.

WARNING:
Ensure that the unit cannot be started during work without the coupling guard.

5.4 Piping

Before the pump is installed, both, the suction and supply lines as well as the discharge line are to be cleaned.

Dirt or damage to the sealing surfaces is best avoided if the flange covers remain on the flanges until just before installation.

Use flange gaskets suitable for the medium.

The screw tightening torques in 2.3 Tightening torques on page 13 are to be observed for tightening the flange screws.

5.4.1 Nominal size

The operating design point of a centrifugal pump lies at the intersection of the pump curve and the pipe curve. The pump curve is provided by the pump manufacturer. The pipe curve is determined using diagrams or PC programs.

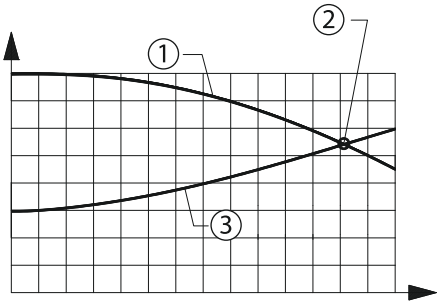


Figure 7: Pump curve diagram

1. Pump curve
2. Operating design point
3. Pipe curve

Under no circumstances can the nominal size of the piping be derived from the connected nominal size of the pump.

The pipe nominal size can also be determined using the flow rate as a rough guide.

$$v(m/s) = \frac{Q(m^3/s)}{A(m^2)}$$

The velocity in the suction line should not exceed 2.0 m/s and 5.0 m/s in the discharge line.

When determining the suction line nominal size, the NPSH value (net positive suction head) must also be observed. The NPSHR value required for the pump is specified in the data sheet.

CAUTION:

Ⓔx The NPSHR available in the plant should be at least 0.5 m higher than the NPSHR required for the pump. Otherwise, this will lead to a drop in the delivery head, cavitation or even failure of the pump.

5.4.2 Nozzle loads

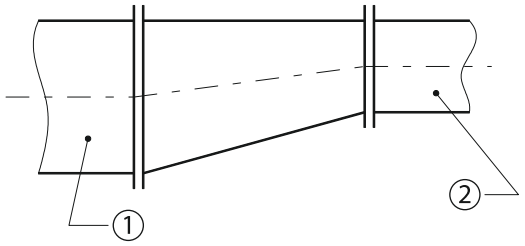
The pump can be subjected to nozzle loads in accordance with ISO 5199. See also Pricebook.

Changes in the length of the piping caused by temperature are to be allowed for by appropriate measures, e.g. the installation of expansion joints.

5.4.3 Suction line

The suction lines must always be laid on a rising gradient towards the pump. Otherwise, gas bubbles may form which considerably reduce the suction line cross section. Eccentric transition elements must be installed between different pipe diameters.

Valves which disrupt the course of flow should not be installed directly upstream of the pump.



1. Suction line
2. Suction nozzle of pump

Figure 8: Suction line

5.4.4 Supply lines

Supply lines should vent towards the reservoir and are therefore to be laid with a constant downward gradient towards the pump. Should the piping internals upstream of the pump be horizontal, a low point can, of course, be located upstream of these internals. From here the pipe is then laid with an upward gradient to the pump so that the gas bubbles which form here can escape through the pump.

Valves which disrupt the course of flow should not be installed directly upstream of the pump.

5.4.5 Discharge line

Do not arrange the shut-off valve directly above the pump but initially provide a transition section.

The discharge nozzle velocity of the medium can – if necessary – be reduced.

5.4.6 Venting and evacuating

Venting can take place into the discharge line or upstream of the discharge valve.

A venting line can also be used as a bypass, drain or flushing line.

The pump housing is fitted with a drain connection as a standard feature.

5.5 Monitoring facilities

Ⓔx Appropriate monitoring facilities are to be recommended, depending on the requirements placed on operational safety and availability of the unit.

Goulds provides information on request and can supply:

- Flow meters
- Filling level indicators
- Motor load monitors
- Temperature monitors
- Rolling bearing monitors
- Leak monitors
- Pump management "Pump Smart"®

5.6 Drive

The power consumption of the pump at the operating design point is specified in the data sheet and works certificate. If the operating design point was not known when the pump was dispatched, the power consumption can be read off the appropriate performance curves. The max. density, the max. viscosity and a safety margin are to be allowed for.

Care must be taken when selecting the motor size to ensure that the excess power is not too great. During start-up the magnetic drive could otherwise stop.

The magnetic drive rating at the nominal speed of 2900 rpm is given in the pump data sheet.

If the motor power exceeds this rating, it is necessary to check the stoppage of the magnetic drive.

The same also applies if the required drive rating exceeds 80 % of the magnetic drive rating.

Consult ITT Goulds if necessary.

Different operating data can be achieved without changing the pump through the use of different speeds, e.g. by means of a frequency converter.

The pump with base plate and motor is illustrated in the installation drawing.

The operating manual of the motor manufacturer must be observed.

Ⓔx A motor with a valid ATEX certificate is to be used if employed in zone 1 and 2.

5.7 Electric connection

WARNING:
Only have the electric connection performed by a qualified electrician. Compare the available mains voltage with the information on the type plate of the motor and select a suitable circuit.

It is urgently recommended to use motor protection facilities (motor protection switch).

Ⓔx In potentially explosive areas IEC 60079-14 must also be observed for the electrical installation.

Ⓔx It must be ensured that the pump is grounded. This can be achieved in the simplest case by using a toothed-lock washer or a contact disc at the housing support if the substructure itself is grounded. Otherwise, grounding must be ensured by other means, e.g. cable bridges.

Units supplied by Goulds (pump and base plates) are to be grounded using suitable devices on the base plate.

6 Commissioning/Shutdown

6.1 Initial commissioning

Normally, the pumps have already been test-run with water. Unless special agreements have been made, there could still be residual amounts of water in the pump. This must be noted in view of a possible reaction with the medium.

6.1.1 Filling the pump housing

Check to see whether the screws on the suction flange, discharge flange, housing flange and drain flange are tightened. When retightening the housing screws, make sure that the support bracket is undone. Otherwise, the pump could be deformed. For screw tightening torques see 2.3 Tightening torques on page 13.

1. Open the suction line fully so that the medium can flow into the pump.
2. Open the discharge valve so that the air in the pump can escape.

   If air cannot be vented into the discharge line, e.g. a drop in pressure in this line is not permitted, venting must be performed upstream of the discharge valve.
3. Monitor the venting operation until no air but only liquid emerges.
4. Ⓔx Close the discharge valve again until only the minimum flow rate is obtained after the motor has been started.

6.1.2 Start-up

1. Check the direction of rotation of the motor with a rotary field instrument.

   As viewed from the motor, the direction of rotation of the pump is clockwise. See also the direction of rotation arrow of the pump.

CAUTION:

If no rotating field instrument is available, the motor may also be activated briefly, with the pump filled, so that it does run up.

You can observe the direction of rotation through the fan hood.

CAUTION:

The pump must not run dry during the check of the direction of rotation.

NOTICE:

Ⓔx The pump must be completely filled with liquid. The maximum admissible flow rate must not be exceeded.

ⒺxOtherwise the plain bearings can run dry in both cases.

2. Switch the motor on.
3. Set the desired flow by opening the discharge valve.

CAUTION:

When the motor is running but the pump is not conveying, this means that the magnetic drive has stopped.

4. Switch the motor off immediately to prevent overheating of the magnets.

   Then proceeded as follows:

   a) Close discharge valve down to the position *minimum flow rate*.

   b) Start motor again.

   If the magnetic drive stops again, look for the cause.

6.2 Operating limits

CAUTION:

Ⓔx The operating limits of the pump/unit in terms of pressure, temperature, power and speed are entered in the data sheet and it is imperative to observe them.

6.2.1 Abrasive media

Ⓔx If liquids with abrasive constituents are conveyed, increased wear at the pump is to be expected.

The inspection intervals should be reduced compared with the usual times.

6.2.2 Min./max. flow rate

The operating range generally recommended lies at 0.3 Q_{opt} to 1.1 Q_{opt}. Consult the manufacturer for operation outside this range and observe Special operating conditions.

6.3 Shutdown

1. Close discharge valve down to the position *minimum flow rate*.
2. Switch motor off.
3. Close discharge valve completely.

   Only close the suction line if the pump is to be evacuated or dismantled.

   For all work on the machine, make sure that the motor cannot be inadvertently switched on.

   If the pump is to be evacuated or flushed, observe the local regulations.

CAUTION:

- It is recommended to wait one hour before the pump is dismantled from the plant to permit static peak charges to be eliminated.
- If the pump is returned to the manufacturer's, clean the pump very thoroughly.

6.4 Restarting

When the pump is restarted, it must be ensured that all the relative steps as described in 6.1 Initial commissioning on page 22 are repeated, depending on the progress of the shutdown operation.

6.5 Inadmissible modes of operations and their consequences (examples)

CAUTION:

Ⓔx 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:

- The plain bearings in the pump may be destroyed.
- 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.
- Possible damage to the plain bearings.
- Magnetic drive may stop.
- 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.

Operation with magnetic drive stopped:

If no heat is dissipated, damage to the inner and drive magnet assemblies may occur.

7 Maintenance

7.1 Screw connections of the housing

After initial loading by the operating pressure and operating temperature the tightening torques of all connection screws must be checked at the following points:

- housing flange
- suction flange
- discharge flange

See also 6.1 Initial commissioning on page 22.

Other inspections are to be performed regularly, depending on the operating requirements.

7.2 Motor

The operating manual of the motor manufacturer must be observed.

A motor with a valid ATEX certificate is to be used if employed in zone 1 and 2.

Observe the ATEX notes of the motor manufacturer.

7.3 Cleaning

Care must be taken when cleaning the pump to ensure that it is not exposed to a strong water jet.

The ingress of water into the bearing pedestal would substantially impair bearing lubrication.

7.4 Stand-by pumps

If a pump is on stand-by, it is to be started up from time to time. Regularly turn the shaft by hand in the direction of rotation.

This operation is to be performed more often for pumps which are exposed to very strong vibrations from the plant.

When dismantling the pump from the plant, drain it, thoroughly clean it, seal with flange covers and store in accordance with the instructions.

7.5 Notes on dismantling

All repair and maintenance work is to be performed by skilled staff using appropriate tools and original spare parts.

Is the necessary documentation available?

Has the pump been taken out of operation, evacuated and flushed correctly? See also 6.3 Shutdown on page 23.

7.5.1 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.

Protective clothing is also to be worn even if only the bearing pedestal is to be removed. It may be that medium has penetrated into the lantern chamber through the can.

7.5.2 Magnetic fields

WARNING:
People with an artificial pacemaker Keep torso at a minimum distance of 500 mm.

CAUTION:

- Strong magnetic fields.
- Risk during dismantling and in the vicinity of magnetic drives as single parts.
- Remove loose parts and other magnetisable metals from the work bench. They could otherwise be attracted: Risk of accident.
- Place any tools needed at a safe distance.
- Keep electronic equipment and measuring instruments at a distance. In cases of doubt ask the equipment manufacturer.
- Hold magnetic drives as single parts firmly or secure. Otherwise, they could be attracted, for example, by a vice: Risk of accident.
- Mechanical watches and electric data carriers as well as digital watches or pocket calculators: 150 mm distance.
- Data carriers such as credit cards, cheque cards, ID cards with magnetic strips or magnetic tapes: 150 mm distance.

7.6 Dismantling

There are three possibilities for dismantling:

1. Dismantling the entire pump from the plant.
2. Dismantling the entire slide-in unit, i.e. the housing remains in the plant.
3. Removing only the drive section, i.e. the pump does not need to be drained (back-pull-out design). Refer toCoupling.

   Dismantling of the entire pump is described.

7.6.1 Removal of drive section

CAUTION:
Magnetic forces. Risk of accident.

Axial forces are produced when the drive section is pulled out of the lantern. These forces diminish again abruptly after it has been removed.

The operating torque of the magnetic coupling installed is specified on the type plate.

1. Secure complete pump on a workbench or worktop.
2. Secure motor (800/1) to a crane by a lifting screw.

3. Undo adapter screwing (901/4, 554/4).
4. If necessary, remove adapter (346) from the centring of the lantern (344) using 2 levers.

   If required you have the possibility to use the two threaded holes in the beating frame for jacking screws (M12).
5. Lift unit with a crane out of the lantern.
6. Remove flat gasket (400/1).

7.6.2 Dismantling drive section

1. Undo hex. socket screw (914/1) in counterclockwise direction.
2. Pull off drive magnet assembly (858).
3. Undo screwing (901/7), (554/7), (920/7).
4. Pull adapter (346) off motor flange (possibly using two levers).
5. Undo setscrew (904/1).
6. Pull hollow drive shaft (216) off motor shaft.
7. Remove support bracket (183).

7.6.3 Removing lantern, can and plain bearing pedestal

1. Undo housing screwing (901/3), (554/3).
2. Do not undo the two screws (901/5) (if installed). They hold the lantern (344), can (159) and plain bearing pedestal (339) together.
3. Pull the entire slide-in unit out of the housing (100).
4. If the housing does not move (e.g. owing to corrosion at the centering), remove the two plastic plugs from the lantern (344).
5. Screw in jacking screws M8 and use them to press off the lantern.

7.6.4 Dismantling lantern, can and plain bearing pedestal

1. Place the unit lantern (344) / plain bearing pedestal (339) / impeller (230) on the workbench with the impeller facing upwards.
2. Remove the two hex. screws (901/5) or the 3 setscrews (904/2) (depending on size).
3. Remove lantern (344) and can (159).
4. Place remaining unit on the inner magnet assembly.
5. Place strap wrench around the impeller and undo the impeller nut (231) counterclockwise.
6. Pull off impeller (230).
7. Remove key (940/2), distance washer (551/1) and intermediate ring (509/2).
8. Pull the plain bearing cartridge (310) with plain bearing pedestal (339) out of the inner magnet assembly 859.
9. Remove 2nd intermediate ring (509/1) from the inner magnet assembly (859).
10. If the inner magnet assembly or inner magnet assembly shaft has to be replaced (split inner magnet assembly): Push the inner magnet assembly shaft (220) and key (940/2) out of the inner magnet assembly (859) with a hydraulic press. Make sure that the thread for the impeller nut is not damaged.
11. Undo screws (901/1) and remove plain bearing cartridge (310) from the plain bearing pedestal (339).

7.6.5 Dismantling the plain bearing

The plain bearing cartridge (310) is one unit which - if necessary - is replaced completely.

7.7 Notes on assembly

All the details in 7.5 Notes on dismantling on page 25 are to be observed, in particular the notes on safety.

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.

Apply Anti Seize paste to close-tolerance surfaces (not on stainless steel parts) and screw thread prior to assembly.

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, intermediate rings (509) must be replaced.

Prior to assembly, remove any metallic particles adhering to parts fitted with magnets.

7.8 Assembly

A complete assembly operation is described in the following.

Sub-sections can be deduced from this.

7.8.1 Drive section

1. Mount support bracket (183) with hex. screws (901/2) and contact discs (557/2) on adapter (346). The attachment slots of the support surface face towards the housing.
2. Insert key (940/3) into the motor shaft.
3. Push hollow drive shaft right onto the motor shaft, attach with setscrew (904/1) and secure with a drop of Loctite (234), for example.
4. Mount adapter (346) on motor.
5. Mount drive magnet assembly (858) onto the hollow drive shaft so that the driver cams engage.
6. Screw in hex. socket screw (914/1) with tooth lock washer (557/1). Secure thread, with a drop e.g of Loctite (234). A hex. socket screw key with a minimum length of 120 mm is required for tightening.

7.8.2 Plain bearing pedestal with impeller, inner magnet assembly and plain bearings

1. Insert the plain bearing cartridge (310) into the centering of the plain bearing pedestal (339).
2. Move the plain bearing cartridge into a position which permits all 3 hex. screws (901/1) to be inserted.
3. Tighten screws with an open-jaw wrench. For tightening torques, see 2.2 Intended use on page 12.
4. For single-part inner magnet assembly: If the parallel pin (562/1) in the clearance bore in the inner magnet assembly (859) has to be replaced, force it in carefully. It is to protrude by about 3 mm towards the impeller.

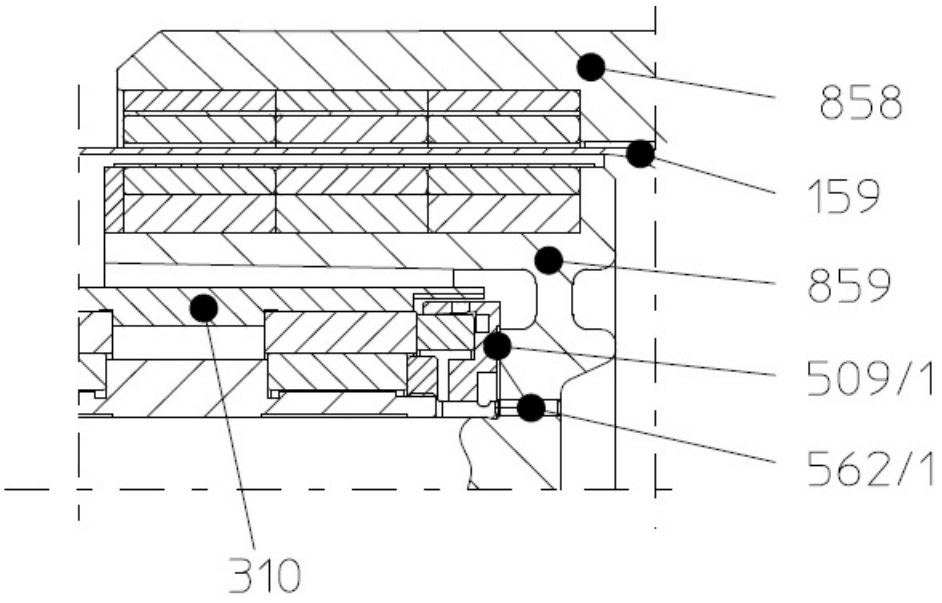


Figure 9: Single-part inner magnet assembly

5. For split inner magnet assembly (if necessary): Press the inner magnet assembly shaft (220) with key (940/4) fully into the inner magnet assembly (859). See sectional drawings in Sectional drawing.
6. Cut out a small corner on the inside diameter of the intermediate ring (509/1) so that a recess is produced for the parallel pin (562/1) (single-part inner magnet assembly) or the key (940/4) (split inner magnet assembly).
7. Then mount the intermediate ring (509/1) onto the shaft of the inner magnet assembly (859).
8. Apply Anti Seize assembly paste to the shaft and impeller holder.
9. Place inner magnet assembly on the workbench and mount the pre-assembled unit plain bearing pedestal / plain bearing cartridge from above onto the inner magnet assembly. Make sure that the parallel pin (562/1) engages in the carrier groove of the plain bearing cartridge. To facilitate alignment, the plain bearing pedestal can be turned to and fro slightly.
10. Mount 2nd intermediate ring (509/2) onto the drive shaft.
11. Mount distance washer (551/1).
12. Insert key (940/2).
13. Mount impeller (230).
14. Insert PTFE O-ring (912/1) into the groove of the impeller nut (231).
15. Tighten impeller nut. Secure it with a drop of e. g. Loctite (234). Counter check the inner magnet assembly with a strap wrench. For tightening torques, see 2.3 Tightening torques on page 13.
16. It must be possible to easily turn the plain bearing pedestal (339) by hand. When raising the plain bearing pedestal, a slight axial play of the plain bearing of up to 1 mm must be felt.
17. The axial play of the plain bearing is automatically set during assembly.

7.8.3 Can and lantern

1. Place the can gasket (406) in the centering on the plain bearing pedestal (339).
2. Mount can (159) and lantern (344).
3. Screw the two connection screws (901/5) or the 3 setscrews (904/2) (depending on size) of the lantern (344) into the plain bearing pedestal (339) and tighten.

7.8.4 Final assembly

1. Secure the housing (100) with the suction nozzle facing downwards on a workbench or worktop.
2. Insert the housing gasket (401) into the housing centering.

3. Insert the unit pre-assembled as described in 7.8.2 Plain bearing pedestal with impeller, inner magnet assembly and plain bearings on page 28 and 7.8.3 Can and lantern on page 29 into the housing so that the crane hook of the lantern faces the centre of the discharge nozzle.
4. Screw in the housing screws (901/3) with washers (554/3) and tighten.
5. Insert flat gasket (400/1) into the centering of the lantern (344).

CAUTION:

Introduce the drive section pre-assembled as per 7.8.1 Drive section on page 28 into the lantern.

It results in strong axial forces.

6. Screw in hex. screws (901/4) with washers (554/4) and tighten.
7. Insert plastic plugs into the tapped bores for the jacking screws on the lantern (344).
8. Turn the inner magnet assembly shaft by hand to check its function. Check by looking into the suction nozzle whether the impeller turns.

7.9 Tests

The pumps are tested with water at the manufacturer's.

The operating data measured are documented in a test certificate.

The following conveying data can be checked using the pump performance curves:

- Flow rate
- Head
- Power requirement
- NPSHR

8 Faults

8.1 Faults

Ⓔx Faults may result from inadmissible modes of operation. Such inadmissible modes of operation – even brief ones – may cause serious damage to the unit.

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

See also 6.5 Inadmissible modes of operations and their consequences (examples) on page 24.

Should there be any uncertainty about the remedy to be applied, please inquire at the in-house pump office or at the pump manufacturer's.

No delivery:

- Is the pump filled and vented?
- Is the suction line open, vented, cleaned and correctly laid?
- Is the discharge line open, vented, cleaned and correctly laid?
- Is the geodetic head too high?
- Is air being drawn in?
- Has the magnetic drive stopped?

Flow rate too low:

- Have the pump, suction line and discharge line been completely vented, filled and cleaned?
- Have any strainers installed been cleaned?
- Are all shut-off devices closed?
- Is the geodetic head too high?
- Is the NPSHA too low or the NPSHR too high?
- Are the pipe resistances too high?
- Is the viscosity too high?
- Is the direction of rotation correct?
- Is the speed too low or the impeller diameter too small?
- Are pump parts worn?
- Gas in the medium?

Flow rate too high:

- Is the geodetic head too low?
- Are the pipe or nozzle resistances too low?
- Is the pump speed too low or the impeller diameter too large?

Delivery pressure too high:

- Is the speed too high or the impeller diameter too large?
- Is the density too high?

Motor consumes too much electricity:

- Is the flow rate, density or viscosity too high?

- Is the flow rate, density or viscosity too high?
- Can the drive shaft be turned properly?

Pump does not run smoothly or creates noises:

- Are the rolling bearings of the motor damaged?
- Are parts of the hydraulics damaged?
- Is the flow rate too low or too high?
- Is the impeller balanced?
- Is the pump twisted?
- Is there foreign matter in the pump?

Leak from the pump:

- Are all screws tightened to the correct tightening torque?
- Were the sealing surfaces assembled in a clean state?
- Have approved gaskets been installed?

9 Sectional drawing

9.1 ICMB close-coupled design

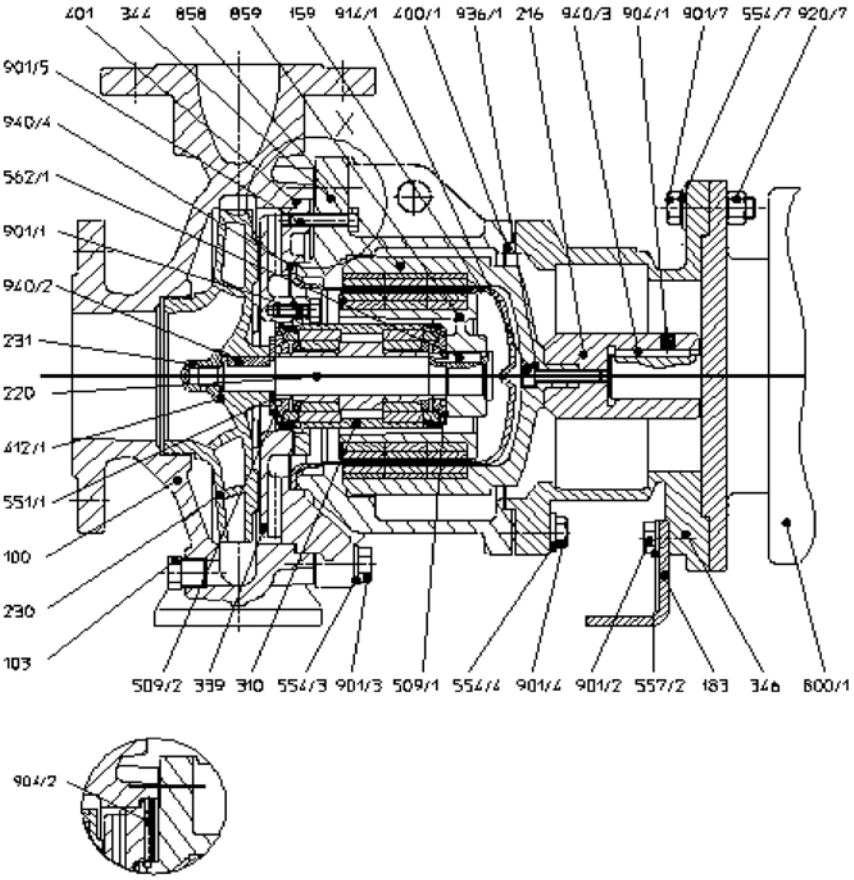


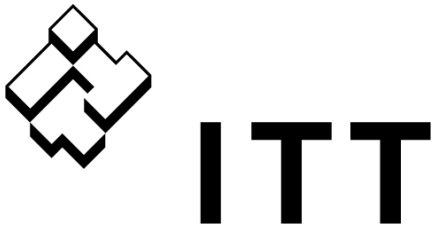
Figure 10: ICMB close-coupled design - cross section

Table 6: Parts list

Item No.	Description
100	Housing
103	Case drain plug
159	Can
183	Support bracket
216	Hollow drive shaft
220	Inner magnet assembly shell
230	Impeller
231	Impeller nut
310	Plain bearing cartridge
339	Plain bearing pedestal
344	Lantern
346	Adapter

Item No.	Description
400/1	Flat gasket
401	Housing gasket
406	Can gasket
412/1	O-ring
509/x	Intermediate ring
551/1	Distance washer
554/x	Washer
557/2	Contact disc
800/1	Motor
858	Drive magnet assembly
859	Inner magnet assembly
901/x	Hex screw
904/x	Setscrew
914/1	Hex socket screw
920/7	Hex nut
936/1	Tooth lock washer
940/x	Key

Visit our website for the latest version of this document and more information:
http://www.gouldspumps.com



ITT Goulds Pumps Inc.
240 Fall Street
Senenca Falls 13148
USA

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