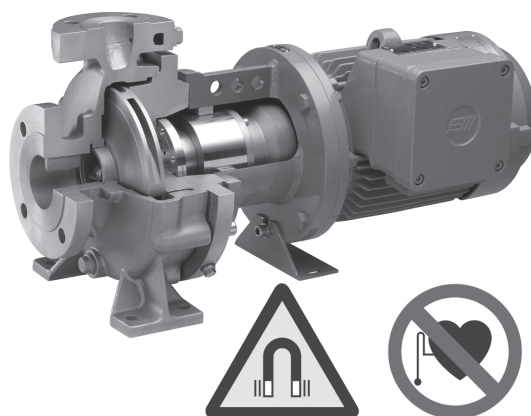
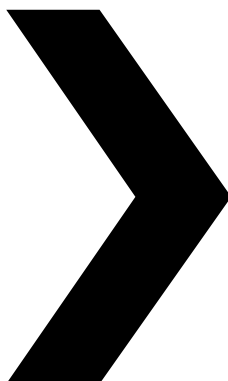


CombiMagBloc

Centrifugal pump with
magnetic coupling



REVISION: CMB/EN (2505) 4.0

EC Declaration of Conformity

(Directive 2006/42/EC, appendix II-A)

Manufacturer

SPX Flow Technology Assen B.V.
Dr. A.F. Philipsweg 51
9403 AD Assen
The Netherlands

hereby declares that all pumps member of product-families, CombiFlex(U)(B), CombiPrime H, CombiMag, CombiMagBloc, CombiPro(L)(M)(V), CombiPrime V, CombiSump, CombiTherm, CombiWell, FRE, FRES, FREF, FREM, KGE(L), KGEF, MCH(W)(S), MCHZ(W)(S), MCV(S) whether delivered without drive, or delivered as an assembly with drive, are in conformity with the provisions of Directive 2006/42/EC (as altered most recently) and where applicable the following directives and standards:

- EC directive 2014/35/EU, "Electric equipment for use within certain voltage limits"
- EC directive 2014/30/EU, "ElectroMagnetic Compatibility"
- standards EN-ISO 12100, EN 809
- standard EN 60204-1 if applicable

The pumps to which this declaration refers may only be put into operation after they have been installed in the way prescribed by the manufacturer, and, as the case may be, after the complete system of which these pumps form part, has been made to fulfil all applicable essential Health & Safety requirements.

EC Declaration of Incorporation

(Directive 2006/42/EC, appendix II-B)

Manufacturer

SPX Flow Technology Assen B.V.
Dr. A.F. Philipsweg 51
9403 AD Assen
The Netherlands

hereby declares that the partly completed pump (Back-Pull-Out unit), member of product-families CombiFlex(U)(B), CombiPrime H, CombiMag, CombiMagBloc, CombiTherm, CombiPro(L)(M)(V), CombiPrime V, FRE, FRES, FREF, FREM, KGE(L), KGEF is in conformity with the provisions of Directive 2006/42/EC as well as with the following standards:

- EN-ISO 12100, EN 809

and that this partly completed pump is meant to be incorporated into the specified pump unit and may only be put into use after the complete machine of which the pump under consideration forms part has been made and declared to comply with all Directives.

These declarations are issued under the sole responsibility of the manufacturer
Assen, October 1st 2024



H. Hoving,
Director Operations.

Instruction manual

All technical and technological information in this manual as well as possible drawings made available by us remain our property and shall not be used (otherwise than for the operation of this pump), copied, duplicated, made available to or brought to the notice of third parties without our prior written consent.

SPX FLOW is a global multi-industry manufacturing leader. The company's highly-specialized, engineered products and innovative technologies are helping to meet rising global demand for electricity and processed foods and beverages, particularly in emerging markets.

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1 Introduction

1.1 Preface

This manual contains important and useful information for the proper functioning and maintenance of this pump. It also contains important instructions to prevent possible accidents and serious damage and to ensure the safe and smooth functioning of this pump.



Read this manual carefully before commissioning the pump. Familiarize yourself with the operation of the pump and strictly obey the instructions!

The data published here comply with the most recent information at the time of going to press. However they may be subject to later modifications.

SPXFLOW reserves the right to change the construction and design of the products at any time without being obliged to change earlier deliveries accordingly.

1.2 Safety

1.2.1 Magnetic field

Because of the presence of strong magnetic fields, a number of points must be observed:



Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!




Always keep electronic equipment with memory, cheque cards with magnetic strip, and such like at least 1 metre away from the coupling!

1.2.2 Instructions


The manual contains instructions for the safe operation of the pump. Operators and maintenance staff shall be familiarized with these instructions.

Installation, operation and maintenance has to be done by qualified and well prepared personnel.


A list of the symbols used in the aforementioned instructions as well as their meaning is stated below:




Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!




Personal danger for the user. Strict and prompt observance of the corresponding instruction is imperative!



Risk of damage to or bad functioning of the pump. Obey the corresponding instruction to avoid this risk.



Danger of magnetic radiation. Stand equipment which is sensitive to this away from the area around the pump.



Useful direction or tip for the user.

Subjects that require extra attention are printed in **bold** typeface.

This manual has been compiled by SPXFLOW with the utmost care. Nevertheless SPXFLOW cannot guarantee the completeness of this information and therefore assumes no liability for possible deficiencies in this manual. The buyer/user shall at all times be responsible for testing the information and for taking possible additional and/or deviating safety measures.

SPXFLOW reserves the right to change the safety instructions at any time.

1.3 Guarantee

SPXFLOW shall not be bound to any guarantee other than the guarantee accepted by SPXFLOW. In particular, SPXFLOW will not assume any liability for explicit and/or implicit guarantees such as but not limited to the marketability and/or suitability of the articles supplied.

The guarantee shall forthwith and legally defunct in case:

- Service and/or maintenance has not been carried out strictly in accordance with the instructions.
- The pump has not been installed and put into in accordance with the instructions in this manual.
- Necessary repairs have not been carried out by our personnel or have been carried out without our prior written consent.
- The articles supplied have been changed without our prior written consent.
- The spare parts used are not original SPXFLOW parts.
- Additives or lubricants used are other than those prescribed.
- The articles supplied are not used according to their nature and/or destination.
- The articles supplied are used amateurishly, carelessly, improperly and/or negligently.
- The articles supplied become defective due to outside circumstances beyond our control.

All wearing parts shall be excluded from guarantee.

Furthermore, all deliveries are subject to our "General conditions of delivery and payment (last edition)", which will be forwarded to you free of charge on request.

1.4 Service and support

This manual is intended for technicians and maintenance staff and for those who are in charge of ordering spare parts.

1.4.1 Ordering spare parts

This manual contains the spare - and replacement parts recommended by SPXFLOW. A fax-order form is included in this manual. If you have questions or require further information about specific items, please don't hesitate to contact SPXFLOW.

1.4.2 Pump number

The pump number is stated on the pumps type plate. Please refer to this number and the other data mentioned on the type plate when corresponding or ordering parts.

➤ *These pump data are also stated on the label in the beginning of this manual.*

1.5 Inspection of delivered items

Check the consignment immediately on arrival for damage and conformity with the advice note. In case of damage and/or missing parts, have a report drawn up by the carrier at once.

1.6 Forwarding instructions



Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!



Always keep electronic equipment with memory, cheque cards with magnetic strip, and such like at least 1 metre away from the coupling!

1.6.1 Weight

The larger pump types of the CombiMagBloc family are too heavy to move them by hand. So use proper forwarding and lifting equipment.

Weight of the pump are stated on the label in the beginning of this manual.

1.6.2 Use of pallets

In most cases the pump is packed on a pallet. In that case leave the pump on the pallet as long as possible in order to avoid damage and to facilitate further transport of the pump during installation.



When using a forklift: Always place the shovels of the forklift as far apart as possible and lift the box with both levels to prevent it from toppling over.

1.6.3 Lifting

If a pump or a complete pump unit has to be lifted, the slings should be fixed as shown in figure 1.



Never stand underneath a load that is being lifted!

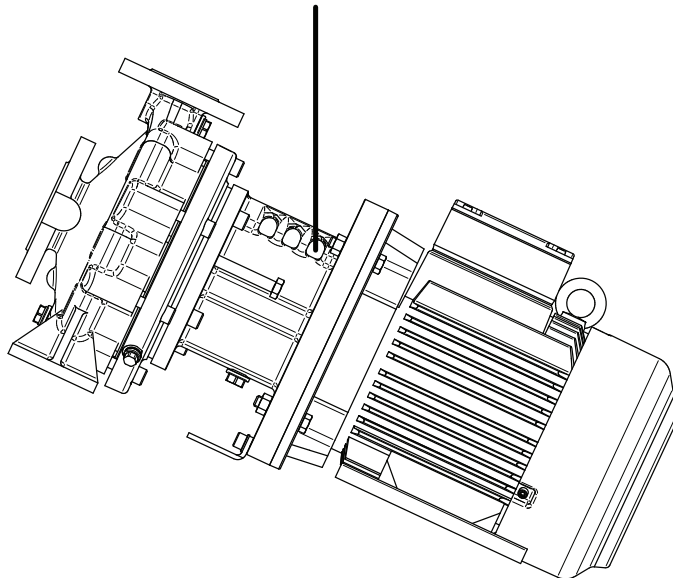


Figure 1: Lifting instructions pump.

1.6.4 Storage

In case the pump is not immediately being used, the pump shaft has to be rotated manually twice a week.



Do not turn the pump shaft when the impeller is still parked, see chapter 3.2 "Preservation".

2 General

2.1 Pump description

The CombiMagBloc is a series of close-coupled leak-free horizontal centrifugal pumps according to ISO 2858 / EN 22858 (DIN 24256). The pump is driven by a standard IEC flange motor. The pump and the motor are fitted together as a compact unit by means of a lantern piece.

2.2 Type code

Pumps of the CombiMagBloc family are available in various designs. The main characteristics of the pump are shown in the type code.

Example: **CMB 32-250 R6 M3 110-4**

Pump range				
CMB	CombiMagBloc			
Pump size				
32-250	diameter pressure discharge [mm] - nominal impeller diameter [mm]			
Pump casing material				
G	cast iron			
NG	nodular cast iron			
R	stainless steel	stainless steel ISO 7005 PN20	stainless steel half-open	stainless steel half-open ISO 7005 PN20
Impeller material				
1	cast iron			
2	bronze			
6	stainless steel			
6A	stainless steel half-open			
Containment can - plain bearings				
M3	Hastelloy C® + silicon carbide (SiC)			
T3	Inconel® + silicon carbide (SiC)			
Magnetic coupling				
	MAG 75-2	MAG 75-4	MAG 75-6	
	MAG 110-2	MAG 110-4	MAG 110-6	
	MAG 135-4	MAG 135-6	MAG 135-8	

2.3 Serial number

Serial number of the pump or pump unit are shown on the name plate off the pump and on the label on the cover of this manual.

Example: **19-001160**

19	year of manufacture
001160	unique number

2.4 Applications

- In general, CombiMagBloc pumps are suitable for thin, clean and lightly contaminated liquids, without particles which can get magnetized.
- The maximum permissible system pressure and temperature and the maximum speed are dependent upon the pump type and design. You can find data concerning this in paragraph 10.1 "Permissible pressure and temperature" and paragraph 10.4 "Maximum speed". Further information about the application options of your specific pump can be found in the order confirmation and/or the accompanying datasheet.
- Please do not use the pump for purposes other than those for which it is delivered without prior consultation with your supplier.



Using a pump in a system or under system conditions (liquid, working pressure, temperature, etc.) for which it has not been designed may hazard the user!

2.5 Operation principle

The CombiMagBloc is directly driven by a standard IEC motor. The motor drives the outer rotor. Inside this outer rotor a number of magnets is fitted, set to the power to be transmitted. The inner rotor, fitted to the impeller shaft, contains the same number of magnets. The magnets of inner and outer rotor face each other a pole pairs. Once the outer rotor starts rotating the inner rotor is driven by the outer rotor. In this way the motor power is transmitted to the inner rotor and the impeller shaft via the outer rotor. A static containment can, located between both rotors, separates the liquid from the atmosphere.

2.6 Design

The CombiMagBloc is designed according to a strongly implemented modular construction method. Many parts are interchangeable with parts from other pumps of the Combi-range. This interchangeability makes it possible to convert existing CombiBloc, CombiChem or CombiNorm pumps, fitted with mechanical seals, to magnetic coupled pumps.

The construction is characterised by its compact build. A standard IEC electric motor (model IM3001(B5) to 112M, model IM2001(B3/B5) for larger types) is fitted to the pump by means of a lantern piece. The intermediate cover is fitted directly to the pump casing.

2.7 Construction

The most important parts are:

2.7.1 Pump casing / Impeller

For every pump type, the pump casing and the impeller in the various material types are structurally similar and interchangeable. A replaceable wear ring is fitted in the pump casing at the location of the impeller inlet. The rear side of the impeller is fitted with back vanes. These provide a partial balancing of the axial forces acting on the impeller. At the same time, the back vanes support the circulation of liquid through the slide bearings. An important feature is the Back Pull Out construction. The impeller section, with the shaft and containment can, can be removed and the pump casing remains in the pipe system.

2.7.2 Intermediate cover

The intermediate cover is the connecting piece between the pump section and the magnetic coupling. The stationary part of the slide bearings and the containment can both are fitted to the intermediate cover. The intermediate cover is connected to the pump casing as a separate element. The intermediate cover is provided with apertures in such a manner that the pumped medium can circulate around the magnets of the inner rotor and the slide bearings. The circulation is kept going by the pressure difference between the external circumference of the impeller and the impeller hub. The intermediate cover is provided with a connection to fit a temperature sensor to the containment can. The bottom of the intermediate cover is fitted with a connection to fit a pressure gauge, but which can also serve as a drain for the lantern piece.

2.7.3 Magnetic coupling

The maximum torque which can be transferred by the magnetic coupling is 168 Nm. This is comparable to a force of 45 kW at a speed of 3000 min⁻¹. The CombiMagBloc programme includes 3 magnetic coupling sizes, namely: MAG 75, MAG 110 and MAG 135. The selection of the coupling depends upon the torque to be transferred. Each coupling size can transfer a number of different torques by varying the magnet length in steps of 20 mm. The magnets of the inner rotor are encapsulated by a thin Hastelloy C® or Inconel® jacket which prevents exposure to the liquid.

2.7.4 Liquid lubricated bearings

All axial and radial forces which are generated by the impeller are absorbed by the liquid lubricated bearings. These bearings contain grooves which ensure optimum lubrication and cooling. To ensure a constant lubrication and cooling of the bearing, **solid, non-abrasive particles may not be larger than 0,25 mm** (=the groove cross-section). The slide bearings are shrunk fit into a stainless steel holder and fitted to a silicon carbide shaft sleeve. The shaft sleeve is centred in the axial bearing construction.

2.7.5 Containment can

The containment can is a deep drawn metal can. This can is designed for system pressures up to 2500 kPa (25 bar). The wall thickness of the containment can is such that the torque loss, caused by the occurring eddy currents, is minimal. The containment can material has a decisive influence on the production of heat on site. The can may be supplied in Hastelloy® or Inconel®. The containment can is fixed to the intermediate stage by means of a welded-on flange and is sealed by a gasket. The containment can separates the liquid to be pumped from the atmosphere.

2.7.6 Outer rotor and self-centring coupling

The outer rotor is fitted directly to the motor shaft by means of a self-centring "Taper-Lock" coupling.

2.8 Application area

The application area globally looks as follows:

Table 1: Application area.

Maximum capacity	280 m ³ /h
Maximum delivery head	140 m
Maximum system pressure	16 bar
Temperature range	-50°C to 200°C
Viscosity	0,3 mPas to 150 mPas
Slurry	maximum 5% weight, maximum size 0,25 mm
Solids	maximum diameter 0,1 mm, hardness 700 HV

2.9 Re-use



Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!



Always keep electronic equipment with memory, cheque cards with magnetic strip, and such like at least 1 metre away from the coupling!

The pump may only be used for other applications after prior consultation with SPXFLOW or your supplier. Since the lastly pumped medium is not always known, the following instructions should be observed:

- Flush the pump properly
- Make sure the flushing liquid is discharged safely (environment!)



Take adequate precautions and use the appropriate personal protection means (rubber gloves, spectacles)!

2.10 Scrapping

If it has been decided to scrap a pump, the same procedure as for paragraph 2.9 "Re-use" should be followed.

3 Installation

3.1 Safety

Read this manual carefully before installing and commissioning the pump. Non-observance of these instructions may cause serious damage to the pump that is not covered by our guarantee terms. Follow the instructions step by step.

3.1.1 Magnetic coupling

Because of the presence of strong magnetic fields, a number of points must be observed:



Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!



Do not subject the pump to any jolting loads. This can cause damage to the magnets or the ceramic slide bearings on account of their brittleness.



Always keep electronic equipment with memory, cheque cards with magnetic strip, and such like at least 1 metre away from the coupling!

3.1.2 Pump unit

- Make sure the motor cannot be started when work is done to the pump- motor combination and running parts are insufficiently shielded.
- The pumps are suitable for liquids with a temperature up to 200°C. As from 65°C the user, when installing the pump unit, should take appropriate protection and warning measures to prevent contact with hot pump parts.
- If danger arises in case of static electricity, the entire pump unit should be earthed properly.
- If there is a danger that the pumped liquid might be harmful to men or the environment, the user should take appropriate measures for safe drainage.

3.2 Preservation



To prevent damage during transportation, the impeller is parked on the inlet flange with a flange. Remove this flange before connecting the inlet pipe. Check whether the pump shaft can be rotated by hand. Keep the flange for subsequent transport, checks or repair work.

To prevent corrosion, the pump is flushed with a preserving agent before leaving the works. Before putting the pump into operation, drain off any preservative agent and flush the pump thoroughly with hot water.

3.3 Environment

- The foundation must be hard, level and flat.
- The area in which the pump unit is to be placed should be adequately ventilated. A too high ambient temperature and air humidity, as well as a dusty environment may have a negative effect on the functioning of the motor.
- Around the pump unit there should be enough space to operate and if necessary repair the pump.
- Behind the cooling air inlet of the motor there should be a free area of at least 1/4 of the electric motor diameter, to ensure unobstructed air supply.
- In case the pump is provided with an isolation, special attention has to be paid To temperature limits of shaft seal and bearing.

3.4 Installation of the set

If the unit is delivered as a complete set, pump and motor are assembled in the works. In case of permanent arrangement, level the pump on the foundation by means of shims and carefully tighten the nuts of the foundation bolts.

3.5 Piping

- The CombiMagBloc is not a self-priming pump, normally the liquid should flow into the pump.
- The piping to the suction and delivery connections must fit exactly and must not be subject to stress during operation. The maximum allowable forces and moments on the pump flanges are stated in paragraph 10.5 "Permitted forces and torques on the flanges, based on EN-ISO 5199".
- The passage of the suction pipe must be amply dimensioned. This pipe should be as short as possible and run towards the pump in such a way that no air pockets can arise. If this is not possible, a venting facility should be provided at the highest point of the pipe. If the inside diameter of the suction pipe is larger than the suction connection of the pump, an excentric reducer should be applied to prevent air pockets and whirls.

See figure 2.

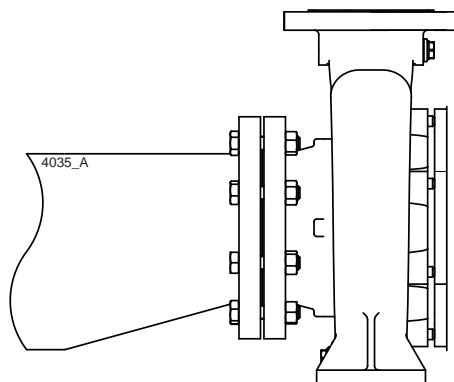


Figure 2: Excentric reducer to suction flange.

- The maximum allowable system pressure is stated in paragraph 10.1 "Permissible pressure and temperature". If there is a risk that this pressure might be exceeded, for instance because of an excessive inlet pressure, appropriate measures should be taken by mounting a safety valve in the piping.
- Sudden changes in the rate of flow can lead to high pressure impulses in the pump and the piping (water shock). Therefore, do not use quick-acting closing devices, valves etc.
- Before installing the pump, first flush the piping thoroughly to clean out any dirt, grease or possible particles.
- When mounting, place temporarily (for the first 24 operating hours) a fine gauze between suction flange and suction pipe so as to prevent internal pump parts from being damaged by foreign matter. If the risk of damage continues to exist, mount a permanent filter.

3.6 Temperature sensor

In case the pump is provided with a temperature sensor, the connections to the transmitter in the connection head must be made by an approved electrician.

The connection head is provided with a cable gland M20 x 1,5.

See the following wiring diagram for the appropriate connections.

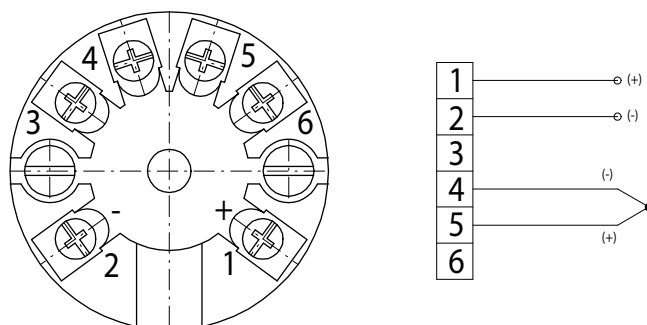


Figure 3: Connecting the transmitter

3.7 Connection of the electric motor



The electric motor must be connected to the mains by an approved electrician, according to the locally prevailing regulations of the electricity company.

- Refer to the instruction manual belonging to the electric motor.
- If possible, mount a working switch as close as possible to the pump.

4 Commissioning

4.1 Preparation



Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!



Always keep electronic equipment with memory, cheque cards with magnetic strip, and such like at least 1 metre away from the coupling!

- Check whether the fuses have been mounted.
- Check that the setting for the thermal protection switch corresponds with the specification on the type plate on the electric motor.

4.2 Preparing for commissioning

Proceed as follows, both when the unit is put into operation for the first time and after the pump has been repaired:

- 1 Close the outlet valve, though not entirely, so that air bubbles are always allowed to develop when the pump fills up with liquid via the inlet opening.



If a non-return valve is fitted to the outlet flange then provide this with a hole (Ø4mm), with the same purpose.

- 2 Fully open the stop valve in the suction pipe. Fill the pump and the suction pipe with the liquid to be pumped. Some liquid will get into the outlet pipe (approximately 0,5 m static). It may be useful to vent the system to the atmosphere via the connection for this purpose on the outlet flange.
- 3 Rotate the pump shaft vigorously a few times by hand in a clockwise direction and then a few times anti-clockwise. Stop turning and wait ± 3 minutes to allow the air to escape. Repeat this procedure at least 5 times. Top up the pump as necessary.

4.3 Checking the sense of rotation



Beware of possible non-screened rotating parts when checking the sense of rotation!

- 1 The sense of rotation of the pump is indicated by an arrow. Check if the sense of rotation of the motor corresponds to that of the pump.
- 2 Let the motor run for only a short time and check the sense of rotation.
- 3 If the sense of rotation is **not** correct, alter the sense of rotation. See the instructions in the user manual, shipped with the electric motor.

4.4 Switching on the pump

- 1 Open the valve in the flushing, cooling or heating liquid supply pipe if the pump is fitted with flushing, cooling or jacket heating.
- 2 Switch on the pump.
- 3 Once the pump is up to pressure, slowly open the pressure cock. Check the power consumption of the electric motor.
- 4 Now open the outlet valve fully until the pump reaches the correct duty point. Check the power consumption again.



Make sure that the rotating parts are always sufficiently guarded when the pump is running!

4.5 Check

If a pump is in operation pay attention to the following:



The pump should never run dry.



The pump must never run with a fully closed outlet valve! The following is a guideline for the minimum liquid flow: 20% of the capacity at Q_{BEP} .

When running with a fully closed outlet valve the heat which is generated by the impeller, magnetic coupling and slide bearings will result in the liquid boiling or evaporating. This will result in cavitation/vibration of the pump, serious damage to the impeller and abrupt seizure of the slide bearings.

- Check if the system pressure always remains below the maximum permissible working pressure. For the correct values, see paragraph 10.1 "Permissible pressure and temperature".
- The delivery from the pump must never be controlled by using the stop cock in the suction pipe. This must always be fully open.
- Check if the differential pressure between the suction and the pressure connections corresponds with the specifications of the working point of the pump.
- Check if the absolute inlet pressure is sufficient so that no condensation can form in the pump. This can result in cavitation. The **minimum required inlet pressure** (in m) above the vapour pressure of the liquid being pumped at pump temperature must be **at least 0,5 - 1 m above the NPSH values** of the CombiMagBloc pump (NPSH = Net Positive Suction Head).
- If the motor is running, the valves are not closed and the pressure and capacity of the pump are collapsing while a knocking sound is heard, the magnets are probably slipping and the motor has to be shut off immediately.



Cavitation must always be prevented, since this is very harmful to the pump.

4.6 Noise

The noise production of a pump depends to a great extent on the operating conditions. The values stated in paragraph 10.7 "Noise data" are based on normal operation of the pump, driven by an electric motor. In case the pump is used outside the normal operation area, as well as in case of cavitation, the noise level may exceed 85 dB(A). In that case precautions should be taken, like building a noise-barrier around the unit or wearing hearing protection.

5 Maintenance



Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!



Always keep electronic equipment with memory, cheque cards with magnetic strip, and such like at least 1 metre away from the coupling.



If the pump chamber is sprayed clean, water must not enter the terminal box of the electric motor! Never spray water on hot pump parts! These parts can burst if subject to sudden cooling and the hot pump liquid can then come out.



When the pump must be moved for checking or maintenance, then the impeller should first be fixed to the accompanying flange to prevent damage to the liquid lubricated bearings.



Flawed maintenance will result in shorter lifespan, possible break down and in any event loss of warranty.

5.1 Environmental influences

- Regularly clean the filter in the suction pipe or the suction strainer at the bottom of the suction pipe, because the inlet pressure may
- become too low if the filter or the suction strainer is blocked.
- If the unit is out of operation and there is the danger that the pumped liquid will expand as a result of solidifying or freezing, it should be drained and if necessary be flushed.
- If the pump is put out of operation for a longer period it should be treated with a preserving agent and periodically the pump shaft has to be turned several times.
- Check motor for accumulation of dust or dirt, which might influence motor temperature.

5.2 Noise

If, after some time, the pump starts making a noise this may indicate that something is wrong with the pump. A crackling noise in the pump may indicate cavitation, an excessive motor noise can be an indication of decreasing bearing quality.

5.3 Motor

Check motor specifications for start-stop frequency.

5.4 Fault



If you want to establish the nature of a fault, remember that the pump may be under pressure or the contents may be hot, poisonous, aggressive or flammable. Take the correct safety measures and protect yourself (gloves, safety goggles,..). Make sure that sufficient safety measures have been taken in area around the pump (collection tray, fire-blankets, eye bath, etc.).



The cause of electrical faults can also be in the wiring. In that case call in a recognized electrical contractor.

If you are sure that the problem concerns the pump, then proceed as follows:

- 1 Firstly, switch off the power supply to the pump. Secure the operating switch using a lock or remove the fuses.
- 2 Close the stop cocks.
- 3 Take a note of the nature of the fault.
- 4 Using chapter 6 "Problem solving" try to trace the cause. Then take the appropriate measures,

or:

Contact your installer!

6 Problem solving

Faults in a pump installation can have various causes. The fault may not be in the pump, it may also be caused by the pipe system or the operating conditions. Firstly, always check that installation has been executed in accordance with the instructions in this manual and that the operating conditions still correspond with the specifications for which the pump was purchased.

In general, breakdowns in a pump installation are attributable to the following causes:

- 1 Faults with the pump.
- 2 Breakdowns or faults in the pipe system.
- 3 Faults due to incorrect installation or commissioning.
- 4 Faults due to incorrect choice of pump.

A number of the most frequently occurring failures as well as their possible causes are shown in the table below.



Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!

Most common faults	Possible causes
Pump delivers no liquid	1 2 3 4 8 9 10 11 13 14 17 19 20 21 27 29 43
Pump has insufficient volume flow	1 2 3 4 8 9 10 11 13 14 15 17 19 20 21 28 29
Pump has insufficient head	2 4 13 14 17 19 28 29
Pump stops after start up	1 2 3 4 5 6 7 8 9 10 11
Pump has higher power consumption than normal	12 15 16 17 18 22 24 25 26 27 38 39
Pump has lower power consumption than normal	13 14 15 16 17 18 20 21 28 29 43
Pump vibrates or is noisy	1 9 10 11 15 18 19 20 22 24 25 26 27 28 29 37 38 39 40
Motor bearings wear too much or become hot	24 25 26 27 37 38 39 40 42
Pump running rough hot or seizes	18 24 25 26 27 37 38 39 40 42

	Possible causes
1	Pump or suction pipe not sufficiently filled or vented
2	Gas or air coming from the liquid
3	Air lock in the suction pipe
4	Suction pipe leaks air
8	The manometric suction head is too high
9	Suction pipe or suction strainer is blocked
10	Insufficient immersion of foot valve or suction pipe during operation of the pump
11	NPSH available too low
12	Speed too high
13	Speed too low
14	Wrong sense of rotation
15	Pump does not work at the correct duty point
16	Liquid density differs from the calculated density
17	Liquid viscosity differs from the calculated viscosity
18	Pump operates with too low liquid flow
19	Wrong pump selection
20	Obstruction in impeller or pump casing
21	Obstruction in the piping system
22	Wrong installation of the pump unit
24	Rotating part running out of true
25	Rotating parts out of balance (i.e. impeller, magnetic coupling)
26	Pump shaft running out of true
27	Bearings faulty or worn / Slide bearings faulty or worn
28	Wear ring faulty or worn
29	Impeller is damaged
37	Axial retaining of impeller or pump shaft is defective
38	The bearings have been fitted incorrectly
39	Too much or too little bearing lubrication
40	Wrong or polluted lubricant
41	Contaminants in the liquid
42	Too high axial force due to worn back blades or excessive inlet pressure
43	Magnetic coupling slips as a result of points 24, 27, 28, 29 or 37 amongst others

7 Disassembly and assembly

7.1 Safety measures

7.1.1 Magnetic coupling



Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 2 metre!



Always keep electronic equipment with memory, cheque cards with magnetic strip, and such like at least 1 metre away from the coupling!

7.1.2 Electrical connections



Take adequate measures to prevent the motor from being started whilst you are working on the pump. This is particularly important for electric motors which are remote started:

- Place the pump operating switch, if fitted, in the "OFF" position.
- Place the pump switch in the switch box in the "OFF" position.
- If necessary, remove the fuses.
- Fit a warning board onto the switch box.

7.2 Draining the pump



If the liquid being pumped is hot, then allow the pump to cool down before proceeding. Make sure you do not come into contact with the pumped liquid if this is hot or of an unknown composition!

- 1 Close the relevant shut-off valves in the outlet and inlet piping.
- 2 Drain the pump via the drain plug (0310).

If the pump is pumping hazardous liquids, the following safety measures must also be adopted:

- Wear protective gloves, safety goggles, etc.
- Flush the pump properly.
- Ensure that no liquid enters the environment.
- Re-fit the drain plug (0310).

7.3 Precautions

7.3.1 Assembly location

- Remove parts from the workbench which are not necessary for assembly. Magnetic materials (grindings, bolts and such like) can suddenly be attracted to the coupling resulting in damage to the coupling or personal injury.
- In cases where metal workbenches are used, mask the workbench with corrugated fibreboard or another soft material.

7.3.2 Special tools

Special tools are necessary for carrying out assembly and disassembly. These will be specified when appropriate.

7.3.3 Cleaning parts

Cleanse and degrease all joint faces and centring surfaces with methyl alcohol. Preferably use cellulose cleaning cloths for this.



Do not use any solvent for the removal of possible dirt. This can affect the non-encapsulated magnets. Any dirt can be removed from the magnets with masking tape!

7.3.4 Impact loading

The materials used for magnets and slide bearings are highly vulnerable during current surge loading. Therefore pay close attention to the following points:



Do not exercise any impact loads on the magnets during assembly and disassembly. This can cause damage to the magnets on account of their brittleness.



Do not exercise any impact load directly on the slide bearing during assembly and disassembly. This can cause the formation of micro-cracks which can lead to serious damage of the bearing.



Impact loads should at all times be prevented during the installation and transportation of the pump or components thereof. The magnets and the slide bearings can be damaged by impact loading.

7.4 Dismantling the pump

In most cases the entire pump is dismantled, to inspect respectively repair it in the work shop, under clean conditions.

- 1 Ensure the shut-off valves are closed and the pump is drained.
- 2 Open the junction box and disconnect the wiring.



If the pump is equipped with a temperature sensor do not loosen and do not remove the temperature sensor on the outside of the pump before disassembly of the inner rotor (see chapter 7.9 "Disassembly of the inner rotor" point 3)!

- 3 In case a foot/flange motor (IM2001 - B3/B5) is mounted: remove the fixation bolts of the motor feet.
- 4 Disassemble the appropriate bolts and nuts and disconnect the discharge and suction flanges from the piping system.
- 5 Remove the fixation bolts of the pump feet.
- 6 Remove the pump, using a hoisting device, and place it on a pallet for further internal transport.



Place a warning sign close to the pump on the pallet, warning against the hazards of the magnetic field!



Place a warning sign close to the pump on the pallet warning against the harmful effects of the magnetic field!

7.5 References

If no specific figure number is stated, all item numbers mentioned in the instructions below, refer to the parts lists and sectional drawings in chapter 9.

7.6 Disassembly of the outer rotor

- 1 Place the pump vertically on a work bench, resting on the suction flange.
- 2 Disassemble bolts (0950) and nuts (0900).
- 3 Remove the fan protective cover of the electric motor and screw a lifting lug into the threaded hole in the shaft end.
- 4 Fix a hook or a lifting belt to the lifting lug and pull off the motor and the outer rotor from the pump casing, using a hoisting device. Initial resistance is experienced due to the strong magnetic forces.

Be prepared for a sudden jolt of the load!

7.7 Disassembly of the Taper Lock coupling

Once the outer rotor is removed from the pump, the Taper Lock coupling can be disassembled and the outer rotor removed from the motor shaft.

- 1 Remove bolts (2815) and remove the outer rotor.
- 2 Slacken set screws (1900) by several turns, using a hexagon wrench, and remove one set screw entirely.
- 3 Put a drop of oil on the thread and under the head of the set screw and insert this screw into the removal hole in the Taper Lock adapter (1890).
- 4 Tighten this screw carefully until the Taper Lock bush is loosened (1895) in the Taper Lock adapter. Remove the rotor coupling (1880) from the motor shaft.
- 5 Remove the key from the key way of the motor shaft.

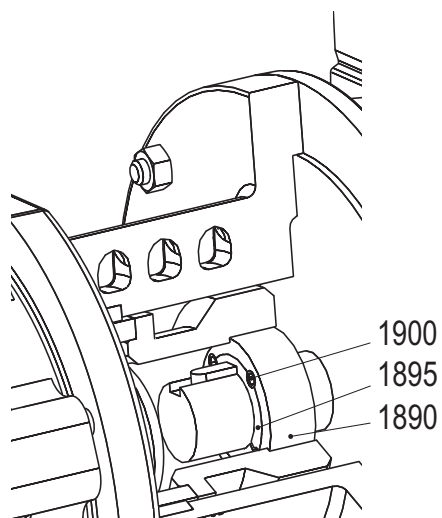


Figure 4: Taper Lock coupling.

7.8 Disassembly of the impeller

Subsequently the impeller is removed to remove the inner rotor afterwards.

- 1 Remove Allen screws (0800) and lift the complete intermediate cover with containment can and impeller from the pump casing, using a hoisting device, attached to the lantern piece.
- 2 Put the intermediate cover straight up, resting sideways on the lantern piece.
- 3 Block the impeller with a screw driver and remove the cap nut (1820). It may be necessary to heat up the nut previously to break the Loctite connection.
- 4 Remove impeller (0120) using a proper puller (or wriggle the impeller loose by inserting e.g. 2 large screw drivers between the impeller and the intermediate cover (1000).
- 5 Remove the impeller key (1860).

7.9 Disassembly of the inner rotor

- 1 Put the intermediate cover flat down. The work bench top must be provided with a hole to place the shaft end into. If this is not present, have the intermediate cover rest on e.g. 2 beams.
- 2 Remove Allen screws (0850) and remove the lantern piece (0250). Remove the gasket (0330).
- 3 If the pump is equipped with a temperature sensor carefully remove the hose clamp by untightening screw A (figure 5). Then loosen first B then C and remove the connection head together with the connection tube, guiding at the same time the temperature sensor from the inside through the hole.

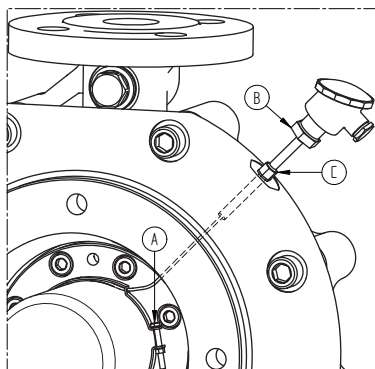


Figure 5: Inside connection of temperature sensor.

- 4 Remove Allen screws (1270) and remove the containment can (1320). Remove the gasket (0230).
- 5 Cover the jaws of the vice with copper or brass sheet to protect the shaft end and place the entire intermediate cover onto the vice and clamp the shaft end at impeller side.
- 6 MAG 75: Remove nut (1300) and washer (1290). Remove the inner rotor (1200).
- 7 MAG 110 / 135: Remove Allen screws (1290). Remove the inner rotor (1200).
- 8 MAG 110 / 135: Remove bolt (1300), washer (1290) and cupped spring washer (1305).

For all types:

- 9 Disassemble the axial bearing at motor side (1240). Remove key (1840).

- 10 Release the shaft end from the vice and place the intermediate cover on one side. Pull the shaft (2450) forward out of the intermediate cover. Remove the shaft sleeve (1220).
- 11 Put the intermediate cover flat down. Remove Allen screws (1260) and remove the entire plain bearing (1230).
- 12 Remove the axial bearing at pump side (1250).

7.10 Wear ring

The gap between the impeller and the wear ring is 0,3 mm on supply. When the gap has increased to 0,5 - 0,7 mm due to wear, then the impeller and the wear ring must be replaced.

7.10.1 Disassembly of the wear ring

The wear ring can be disassembled after assembly of the complete pump and disassembly of the Back Pull Out unit. This ring usually fits so tight that it cannot be disassembled undamaged.

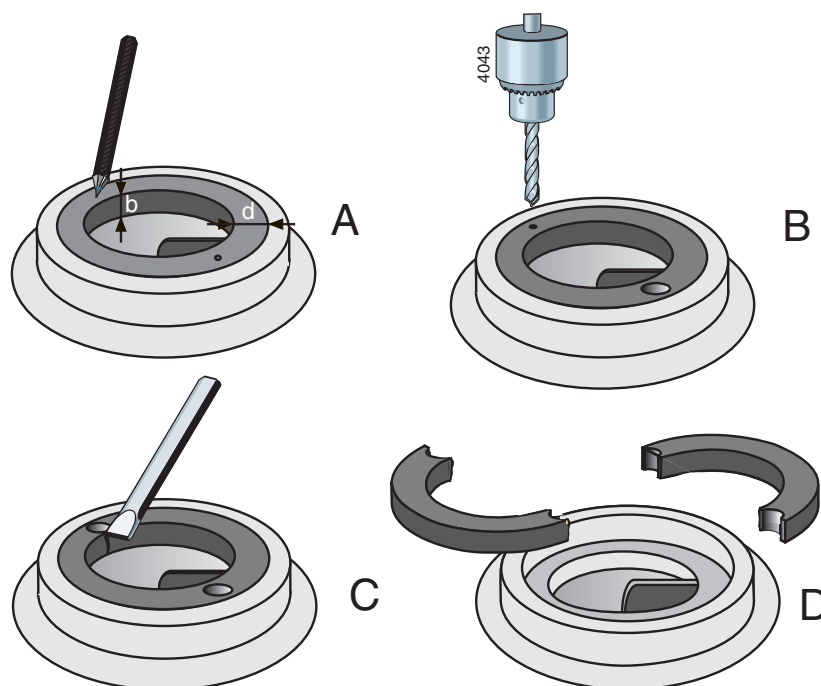


Figure 6: Disassembly of wear ring.

- 1 Measure the thickness **d** and the width **b** of the ring, see figure 6A.
- 2 Make a small centre hole in the middle of the rim of the ring in 2 positions which face one another, see figure 6B.
- 3 Select a drill with a somewhat smaller diameter than the thickness **d** of the ring and drill 2 holes in the rim of the ring, see figure 6C. **Do not drill deeper than the width b of the ring.** Ensure that the fitting edge of the pump casing is not damaged.
- 4 Cut away the remainder of the ring thickness with a chisel. The ring can then be removed from the pump casing in 2 sections, see figure 6D.
- 5 Clean the pump casing and carefully remove all drill shavings and metal splinters.

7.10.2 Assembly of the wear ring

- 1 Clean and degrease the rim of the pump casing, where the wear ring is to be fitted.
- 2 Degrease the outside of the wear ring and apply a few drops of Loctite 641.
- 3 Fit the wear ring into the pump casing. **Ensure that it is not fitted obliquely!**
- 4 **In accordance with ISO 5199, for version R6 the wear ring must be fixed by a couple of tack welds.**

7.11 Assembly of the inner rotor and the impeller



For every assembly always use NEW gaskets!

- 1 Fit the impeller key (1860) into the key way at the impeller side of the pump shaft (2450).
- 2 Fit the impeller (0120) onto the shaft end. Apply a few drops of Loctite 243 on the thread and fit the cap nut (1820). Tighten the cap nut with the correct torque, see paragraph 10.2 "Torque settings".
- 3 Fit the carrier pin (1310) into the pump shaft.
- 4 Put the impeller flat down, the shaft end pointing upward.
- 5 Place 0,5 mm shims on the back vanes of the impeller. Place the intermediate cover (1000) over the impeller and the pump shaft.
- 6 Fit the axial bearing at pump side (1250) onto the pump shaft. Ensure the carrier pin (1310) corresponds to the slot in the axial bearing!
- 7 Fit the shaft sleeve (1220) onto the pump shaft.
- 8 Fit the plain bearing (1230) onto the shaft sleeve on the intermediate cover and fit the Allen screws (1260). Tighten them crosswise.
- 9 Fit the key (1840) and fit the axial bearing at motor side (1240).
- 10 MAG 75: Fit the outer rotor (1200) onto the axial bearing at motor side. Fit the washer (1290), apply a few drops of Loctite 243 to the thread and fit the nut (1300). Tighten it with the appropriate torque, see paragraph 10.2 "Torque settings".
- 11 MAG 110/135: Fit the cupped spring washer (1305) and the washer (1290), apply a few drops of Loctite 243 to the thread and fit the bolt (1300). Tighten it with the appropriate torque, see paragraph 10.2 "Torque settings".
- 12 MAG 110/135: Fit the inner rotor (1200) onto the axial bearing at motor side and fit the Allen screws (1280). Tighten them crosswise.



Pay attention not to damage the magnets!

- 13 Fit a new gasket (0230) and place the containment can (1320) onto the intermediate cover. Fit the Allen screws (1270) and tighten them crosswise. Tighten them with the appropriate torque, see paragraph 10.2 "Torque settings".



Pay attention not to damage the containment can!

- 14 If the pump is equipped with a temperature sensor, guide the temperature sensor from the outside through the hole and mount the connection head and tube to the intermediate cover. Then guide the temperature sensor through the hole in the hose clamp and mount the hose clamp in the position as shown in figure 5.
- 15 Remove the shims from between the impeller and the intermediate cover.

7.12 Assembly of the outer rotor and the lantern piece



For every assembly always use NEW gaskets!



Ensure all parts of the Taper Lock coupling are clean, dry and free from grease!

- 1 Insert the Taper Lock adapter (1890) into the rotor coupling (1880).
- 2 Insert the Taper Lock bush (1895) into the Taper Lock adapter, ensure the threaded holes line up.
- 3 Put a few drops of oil on the thread and under the screw head and insert both set screws (1900) into the opposite threaded holes.
- 4 Fit the key into the key way of the motor shaft. Put the electric motor vertically, the shaft pointing upwards.
- 5 Fit the entire rotor coupling assembly onto the motor shaft. **Ensure there is a clearance between the top of the key and the Taper Lock bush!**
- 6 Adjust the rotor coupling according to value X3 or X4, see figure 7 and the table below.

Table 2: Settings for X3 and X4 (welded lantern piece)

MAG type	Pump size	80		90S/L		100L/112M		132S/M		160M/L		180M/L		200L		225S/M	
		X3	X4	X3	X4	X3	X4	X3	X4	X3	X4	X3	X4	X3	X4	X3	X4
MAG75	25/32/40/50/65 - 125	84 (88)	49 (53)	84 (88)	29 (43)	91,5 (88)	36,5 (33)	99 (88)	24 (13)								
	25/32/40/50 - 160																
	32/40/50 - 200																
MAG110	32/40/50 - 160									123 (122)	18 (17)	123 (122)	18 (17)				
	32/40/50 - 200																
	65/80 - 160					108 (124)	53 (69)	116 (124)	40,5 (49)	123 (124)	18 (19)	123 (124)	18 (19)				
	65/80 - 200																
	32/40/50/65 - 250																
MAG135	65/80 - 160													130 (122)	25 (17)	138 (122)	32,5 (17)
	65/80 - 200																
	32/40/50/65 - 250																

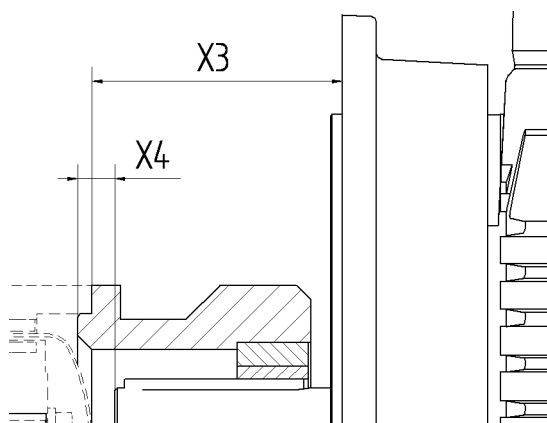


Figure 7: Setting X3 or X4.

- 7 Ensure the coupling is fit straight onto the shaft and tighten the set screws crosswise. Tighten the screws with the appropriate torque, see paragraph 10.2 "Torque settings".
- 8 Ensure the fitting rims are clean and fit the outer rotor (1210) to the rotor coupling. Fit the Allen screws (2815) and tighten them crosswise, applying the appropriate torque, see paragraph 10.2 "Torque settings".
- 9 Carefully guide the lantern piece (0250) over the outer rotor and place it onto the motor flange. The outside of the outer rotor will guide the bronze ring (0255) at the inside of the lantern piece. The strip with the hoisting holes on the lantern piece must be located at 180 degrees with respect to the possible motor feet. Fit bolts (0950) and nuts (0900) and tighten them crosswise.
- 10 For a final check measure the distance X1 or X2 (see figure 8) between the end of the outer rotor and the fitting edge of the lantern piece and compare it with the corresponding value in the table below.

Table 3: Settings for X1 and X2.

Magnet length	X1	X2
MAG 75-2	15	
MAG 75-4		5
MAG 75-6		25
MAG 110-2	33	
MAG 110-4	13	
MAG 110-6		7
MAG 135-4	9	
MAG 135-6		11
MAG 135-8		31

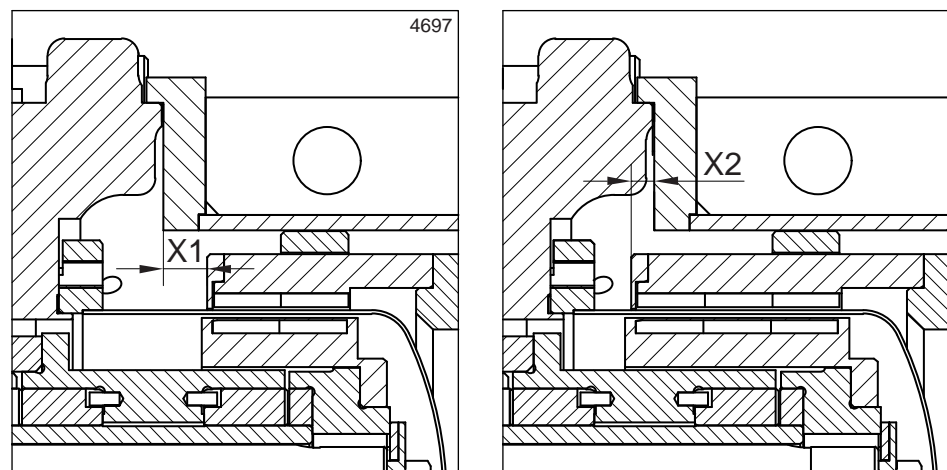


Figure 8: Settings X1 or X2.

- 11 Turn the outer rotor a couple of turns and check the oscillation. This may not exceed 0,3 mm. If the measured oscillation is too much loosen the set screws (1900) using a long hexagon wrench and subsequently tighten them crosswise again.

!

The magnetic forces may pull the tools to the magnets. Cover the inside of the outer rotor with corrugated cardboard, or wrap the tool with a cloth, to avoid possible damage to the magnets.

7.13 Assembly



For every assembly always use NEW gaskets!

- 1 Place a new gasket (0330) on the fitting edge of the intermediate cover.
- 2 Screw a lifting lug into the motor shaft end at fan side. If necessary first remove the fan cover.
- 3 Hoist the motor with the lantern piece to the lifting lug and carefully lower the assembly onto the intermediate cover. The strip with the hoisting holes of the lantern piece must be positioned at 180 degrees with regard to the drain plug (1010).



Pay attention not to damage the containment can and the magnets of the outer rotor!



Make quite sure that no parts of the body or objects are placed between the intermediate stage and the bearing bracket! The magnetic forces are very strong and act quite suddenly!

- 4 Once the lantern piece rests on the intermediate cover fit Allen screws (0850) and tighten them crosswise.

7.14 Checking after assembly

- Check, in case back vanes are present, the axial play behind the impeller. The minimum gap is 0,2 mm.
- Check the axial play of the bearing, this is $0,25 \pm 0,1$ mm.
- Check if the impeller runs smoothly and evenly.

7.15 Assembly of the pump casing

- 1 Put the pump casing on the suction flange. Place a new gasket (0300) into the rim of the pump casing.
- 2 Hoist the Back Pull Out unit to the lantern piece and subsequently lower the Back Pull Out unit carefully into the pump casing. The strip with the hoisting holes of the lantern piece must be positioned at discharge side.
- 3 Fit Allen screws (0800) and tighten them crosswise with the appropriate torque, see paragraph 10.2 "Torque settings"
- 4 Remove the lifting lug from the motor shaft end and fit the fan cover.

7.16 Checking for leakage



Once the entire pump unit is assembled, check it for leakage. Pressurize the pump with water at a pression of 1,5x the maximum working pressure. See paragraph 10.1 "Permissible pressure and temperature" for the appropriate pressures.

8 Dimensions

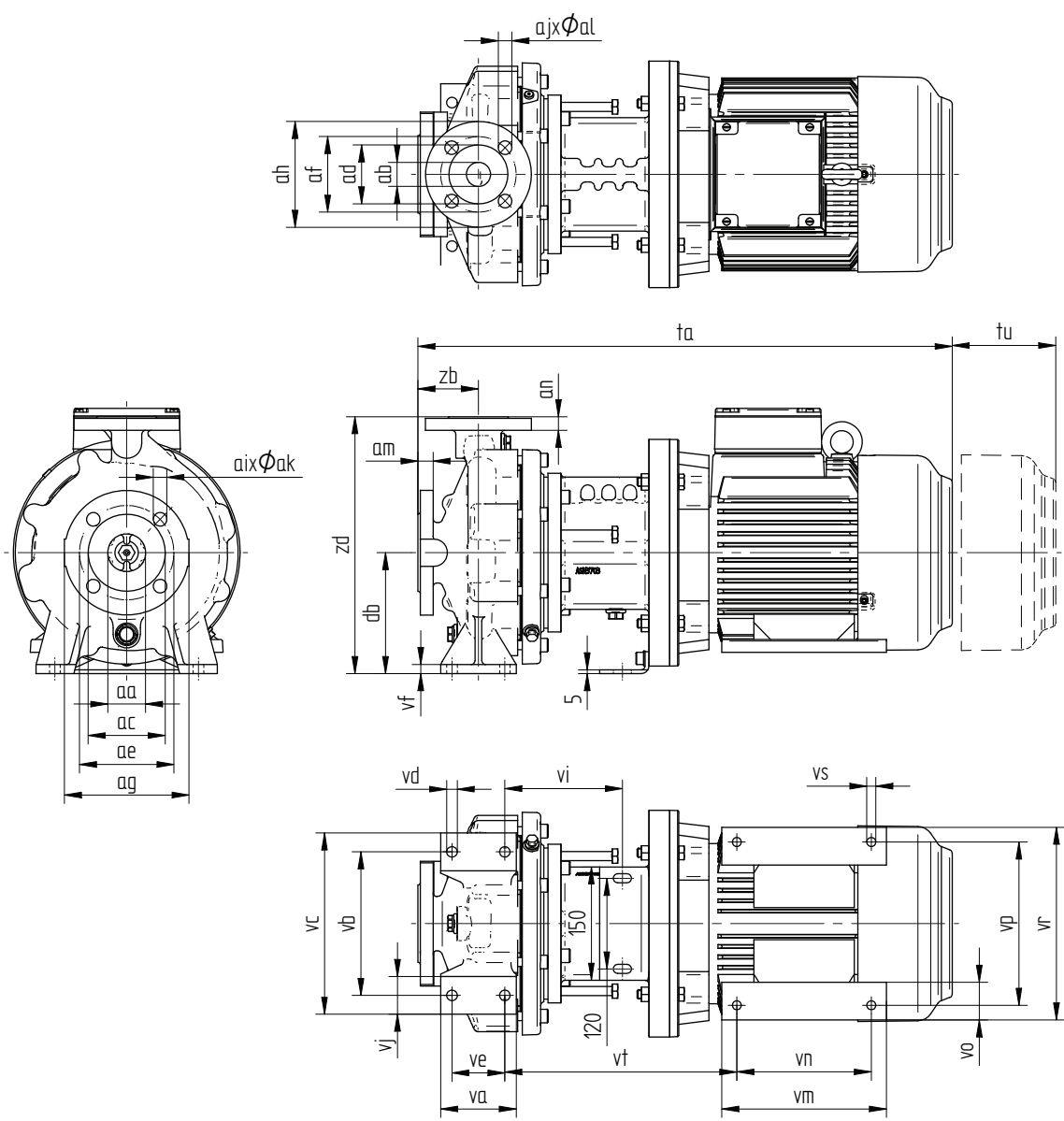


Figure 9: Pump dimensions.

8.1 Flange dimensions - cast iron (G) and nodular cast iron (NG)

ISO 7005 PN 16											
aa	ab	ac	ad	ae	af	ag	ah	ai x ak	aj x al	am	an
50	32	102	78	125	100	165	140	4 x 18	4 x 18	20	18
65	40	122	88	145	110	185	150	4 x 18	4 x 18	20	18
80	50	138	102	160	125	200	165	8 x 18	4 x 18	22	20
100	65	158	122	180	145	220	185	8 x 18	4 x 18	24	20
125	80	188	138	210	160	250	200	8 x 18	8 x 18	26	22
125	100	188	158	210	180	250	220	8 x 18	8 x 18	26	24
150	125	212	188	240	210	285	250	8 x 22	8 x 18	26	26

8.2 Flange dimensions - stainless steel R

ISO 7005 PN 6											
aa	ab	ac	ad	ae	af	ag	ah	ai x ak	aj x al	am	an
32	25	63,5	50,8	90	75	117,5	108	4 x 14	4 x 11	12	12

ISO 7005 PN 16											
aa	ab	ac	ad	ae	af	ag	ah	ai x ak	aj x al	am	an
25	25	68	68	85	85	115	115	4 x 14	4 x 14	16	16
50	32	99	76	125	100	165	140	4 x 18	4 x 18	22,5	20,5
65	40	118	84	145	110	185	150	4 x 18	4 x 18	22,5	20,5
80	50	132	99	160	125	200	165	8 x 18	4 x 18	22,5	22,5
100	65	156	118	180	145	230	185	8 x 18	4 x 18	26,5	22,5
125	80	184	132	210	160	255	200	8 x 18	8 x 18	26,7	23,1
125	100	184	156	210	180	255	230	8 x 18	8 x 18	26,5	26,9
150	125	216	186	240	210	285	255	8 x 22	8 x 18	28	27,1

8.3 Flange dimensions - stainless steel ISO 7005 PN20 R

ISO 7005 PN20 (ASME B16.5 150 lbs RF)											
aa	ab	ac	ad	ae	af	ag	ah	ai x ak	aj x al	am	an
25	25	51	51	79,5	79,5	115	115	4 x 16	4 x 16	16	16
32	25	63,5	50,8	88,9	79,4	117,5	108	4 x 12	4 x 12	12	12
50	32	92	63,5	120,5	89	165	140	4 x 18	4 x 16	22,5	20,5
65	40	105	73	139,5	98,5	185	150	4 x 18	4 x 16	22,5	20,5
80	50	127	92	152,5	120,5	200	165	4 x 18	4 x 18	22,5	22,5
100	65	157,5	105	190,5	139,5	230	185	8 x 18	4 x 18	26,5	22,5
125	80	186	127	216	152,5	255	200	8 x 22	4 x 18	26,7	23,1
125	100	184	156	216	190,5	255	230	8 x 22	4 x 18	26,5	26,9
150	125	216	186	241,5	216	285	255	8 x 22	8 x 22	28	27,1

8.4 Motor feet dimensions

IEC IM2001 (B3/B5)	vm	vn	vo	vp	vr	vs
132S	191	140	55	216	262	12
132M	229	178	55	216	262	12
160M	260	210	65	254	314	15
160L	300	254	65	254	314	15
180M	310	241	70	279	350	15
180L	350	279	70	279	350	15
200L	369	305	70	318	390	19
225S	368	286	75	356	431	19
225M	393	311	75	356	431	19

8.5 Pump dimensions

CMB	aa	ab	db	tu	va	vb	vc	vd	ve	vf*	vf**	vj	zb	zd
25-125	32	25	100	100	100	140	170	12	70	-	10	35	62	215
25-160	25		132	100	95	190	220	14	70	-	10	30	64,5	284
32-125	50	32	112	100	100	140	190	14	70	10	14	50	80	252
32C-125			112	100	100	140	190	14	70	10	14	50	80	252
32-160			132	100	100	190	240	14	70	12	14	50	80	292
32A-160			132	100	100	190	240	14	70	12	14	50	80	292
32C-160			132	100	100	190	240	14	70	12	14	50	80	292
32-200			160	100	100	190	240	14	70	12	14	50	80	340
32C-200			160	100	100	190	240	14	70	12	14	50	80	340
32-250			180	100	125	250	320	14	95	14	16	65	100	405
40C-125	65	40	112	100	100	160	210	14	70	10	14	50	80	252
40C-160			132	100	100	190	240	14	70	12	14	50	80	292
40C-200			160	100	100	212	265	14	70	12	14	50	100	340
40-250			180	100	125	250	320	14	95	14	16	65	100	405
50C-125	80	50	132	100	100	190	240	14	70	10	12	50	100	292
50C-160			160	100	100	212	265	14	70	12	14	50	100	340
50C-200			160	100	100	212	265	14	70	12	14	50	100	360
50-250			180	100	125	250	320	14	95	14	16	65	125	405
65C-125	100	65	160	100	125	212	280	14	95	10	15	65	100	340
65C-160			160	100	125	212	280	14	95	12	14	65	100	360
65C-200			180	140	125	250	320	14	95	14	16	65	100	405
65A-250			200	140	160	280	360	18	120	14	16	80	125	450
80C-160	125	80	180	140	125	250	320	14	95	14	16	65	125	405
80C-200			180	140	125	280	345	14	95	14	16	65	125	430

* cast iron and nodular cast iron

** stainless steel and stainless steel ISO 7005 PN20 (ASME B16.5 150 lbs)

CMB	vi										
	welded lantern piece			casting lantern piece							
	MAG75	MAG110	MAG135	80	90 S/L	100L 112M	132 S/M	160 M/L	180 M/L	200L	225 S/M
25-125	158			160	160	160	160				
25-160	149			150	150	150	150				
32-125	154			156	156	156	156				
32C-125	154			156	156	156	156				
32-160	154	211		156	156	156	156	198			
32A-160	154	211		156	156	156	156	198			
32C-160	154	211		156	156	156	156	198			
32-200	154	211		156	156	156	156	198	198		
32C-200	154	211		156	156	156	156	198	198		
32-250		209	231			195	195	195	195	239	293
40C-125	154			156	156	156					
40C-160	154	211		156	156	156	156	198			
40-C200	154	211		156	156	156	156	198	198		
40-250		209	231			195	195	195	195	239	293

CMB	vi										
	welded lantern piece			casting lantern piece							
	MAG75	MAG110	MAG135	80	90 S/L	100L 112M	132 S/M	160 M/L	180 M/L	200L	225 S/M
50C-125	154			156	156	156	156				
50C-160	154	211		156	156	156	156	198			
50C-200	154	211		156	156	156	156	198	198		
50-250		209	231			195	195	195	195	239	293
65C-125	142			143	143	143	143				
65C-160		209	231			195	195	195	195	239	
65C-200		209	231			195	195	195	195	239	293
65A-250		196	218			183	183	183	183	226	280
80C-160		209	231			195	195	195	195	239	
80C-200		209	231			195	195	195	195	239	293

CMB	ta (*)															
	welded lantern piece								casting lantern piece							
	80	90 S/L	100L 112M	132 S/M	160 M/L	180 M/L	200L	225 S/M	80	90 S/L	100L 112M	132 S/M	160 M/L	180 M/L	200L	225 S/M
25-125	594	640	674	796					590	636	678	807				
25-160	617	635	669	719					585	631	673	802				
32-125	608	654	688	810					604	650	692	821				
32C-125	608	654	688	810					604	650	692	821				
32-160	608	654	688	810	971				604	650	692	821	972			
32A-160	608	654	688	810	971				604	650	692	821	972			
32C-160	608	654	688	810	971				604	650	692	821	972			
32-200	608	654	688	810	971	1041			604	650	692	821	972	1042		
32C-200	608	654	688	810	971	1041			604	650	692	821	972	1042		
32-250			775	897	1001	1071	1185	1223			761	891	1002	1072	1193	1239
40C-125	608	654	688	810					604	650	692	821				
40C-160	608	654	688	810	971				604	650	692	821	972			
40C-200	628	674	708	830	991	1061			624	670	712	841	992	1062		
40-250			775	897	1001	1071	1185	1223			761	891	1002	1072	1193	1239
50C-125	628	674	708	830					624	670	712	841				
50C-160	628	674	708	830	991				624	670	712	841	992			
50C-200	628	674	708	830	991	1061			624	670	712	841	992	1062		
50-250			800	922	1026	1096	1210	1248			786	916	1027	1097	1218	1264
65C-125	628	674	708	830					624	670	712	841				
65C-160			775	897	1001	1071	1185				761	891	1002	1072	1193	
65C-200			775	897	1001	1071	1185	1223			761	891	1002	1072	1193	1239
65A-250			800	922	1026	1096	1210	1248			786	916	1027	1097	1218	1264
80C-160			800	922	1026	1096	1210				786	916	1027	1097	1218	
80C-200			800	922	1026	1096	1210	1248			786	916	1027	1097	1218	1264

(*): Motor length based on DIN 42677, may be different due to applied motor make.

CMB	vt									
	welded lantern piece					casting lantern piece				
	132S/M	160M/L	180M/L	200L	225S/M	132S/M	160M/L	180M/L	200L	225S/M
25-125	300					311				
25-160	291					302				
32-125	296					307				
32C-125	296					307				
32-160	396	372				307	373			
32A-160	396	372				307	373			
32C-160	396	372				307	373			
32-200	396	372	385			307	373	386		
32C-200	396	372	385			307	373	386		
32-250	351	370	383	417	433	344	371	384	425	448
40C-125	296					307				
40C-160	396	372				307	373			
40C-200	296	372	385			307	373	386		
40-250	351	370	383	417	433	344	371	384	425	448
50C-125	296					307				
50C-160	296	372				307	373			
50C-200	296	372	385			307	373	386		
50-250	351	370	383	417	433	344	371	384	425	448
65C-125	284					295				
65C-160	351	370	383	417		344	371	384	425	
65C-200	351	370	383	417	433	344	371	384	425	448
65A-250	338	357	370	404	420	332	358	371	412	436
80C-160	351	370	383	417		344	371	384	425	
80C-200	351	370	383	417	433	344	371	384	425	448

8.6 Shims for assembly with motor IM3001 (B5)

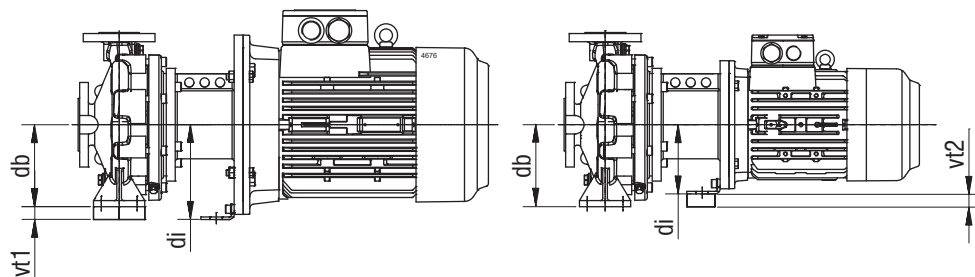


Figure 10: Assembly with motor IM 3001 (B5).

		motor IM3001 (B5)					
		80		90S/L		100L/112M	
CMB	db	vt1	vt2	vt1	vt2	vt1	vt2
25-125	100	12		12		32	
25-160	132		20		20		
32-125	112					20	
32C-125	112					20	
32-160	132		20		20		
32A-160	132		20		20		
32C-160	132		20		20		
32-200	160		48		48		28
32C-200	160		48		48		28
32-250	180						48
40C-125	112					20	
40C-160	132		20		20		
40C-200	160		48		48		28
40-250	180						48
50C-125	132		20		20		
50C-160	160		48		48		28
50C-200	160		48		48		28
50-250	180						48
65C-125	160		48		48		28
65C-160	160						28
65C-200	180						48
65A-250	200						68
80C-160	180						48
80C-200	180						48

	80	90 S/L	100 L	112 M	132 S/M	160 M/L	180 M/L	200 L	225 S/M
di	112	112	132	132	160	180	180	200	225

8.7 Shims for assembly with motor IM2001 (B3/B5)

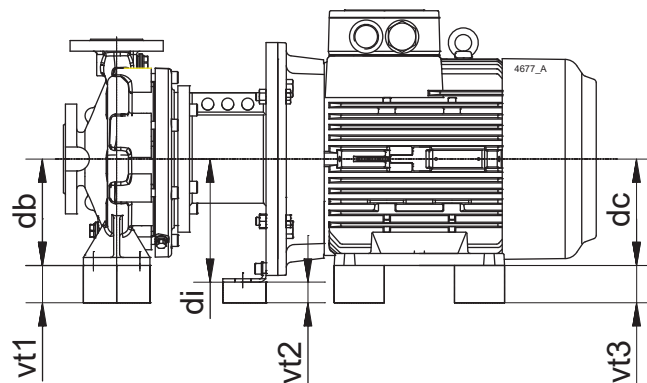


Figure 11: Assembly with motor IM 2001 (B3/B5).

		motor IM2001 (B3/B5)														
		132S/M			160M/L			180M/L			200L			225S/M		
CMB	db	vt1	vt2	vt3	vt1	vt2	vt3	vt1	vt2	vt3	vt1	vt2	vt3	vt1	vt2	vt3
25-125	100	60		28												
25-160	132	28		28												
32-125	112	48		28												
32C-125	112	48		28												
32-160	132	28		28	48		20									
32A-160	132	28		28	48		20									
32C-160	132	28		28	48		20									
32-200	160			28	20		20	20								
32C-200	160			28	20		20	20								
32-250	180		20	48			20				20			45		
40C-125	112	48		28												
40C-160	132	28		28	48		20									
40C-200	160			28	20		20	20								
40-250	180		20	48			20				20			45		
50C-125	132	28		28												
50C-160	160			28	20		20									
50C-200	160			28	20		20	20								
50-250	180		20	48			20				20			45		
65C-125	160			28												
65C-160	160			28	20		20	20			40					
65C-200	180		20	48			20				20			45		
65A-250	200		40	68		20	40		20	20				25		
80C-160	180		20	48			20				20			45		
80C-200	180		20	48			20				20			45		

	80	90 S/L	100 L	112 M	132 S/M	160 M/L	180 M/L	200 L	225 S/M
dc	80	90	100	112	132	160	180	200	225
di	112	112	132	132	160	180	180	200	225

8.8 Pump weight

Pump weight in [kg] excluding weight of motor and shims

	Assembled with motor:						
	80 90S/L	100L 112M	132S/M	160M/L	180M/L	200L	225S/M
25-125	49	53	60				
25-160	50	54	61				
32-125	63	68	75				
32C-125	63	68	75				
32-160	68	73	80	99			
32A-160	68	73	80	99			
32C-160	68	73	80	99			
32-200	71	76	83	106	106		
32C-200	71	76	83	106	106		
32-250		113	120	131	131	138	151
40C-125	63	68					
40C-160	68	73	80	99			
40C-200	75	80	87	110	110		
40-250		116	123	134	134	141	149
50C-125	66	71	78				
50C-160	73	78	85	104			
50C-200	77	82	89	112	112		
50-250		121	128	139	139	146	159
65C-125	73	78	85				
65C-160		93	100	111	111	123	
65C-200		93	100	111	111	122	135
65A-250		123	130	141	141	148	161
80C-160		102	110	121	121	133	
80C-200		117	124	135	135	146	159

9 Parts

9.1 Ordering parts

9.1.1 Order form

You can use the order form included in this manual for ordering parts.

When ordering parts always quote the following data:

- 1 Your **address**.
- 2 The **Quantity, the item number and the Description** of the part.
- 3 The **pump number**. The pump number is stated on the label on the cover of this manual and on the type plate of the pump.
- 4 In the event of different electric motor voltage you should state the correct voltage.

9.1.2 Recommended spare parts

Parts marked with a * are recommended spare parts.

9.2 CMB with closed impeller and MAG 75

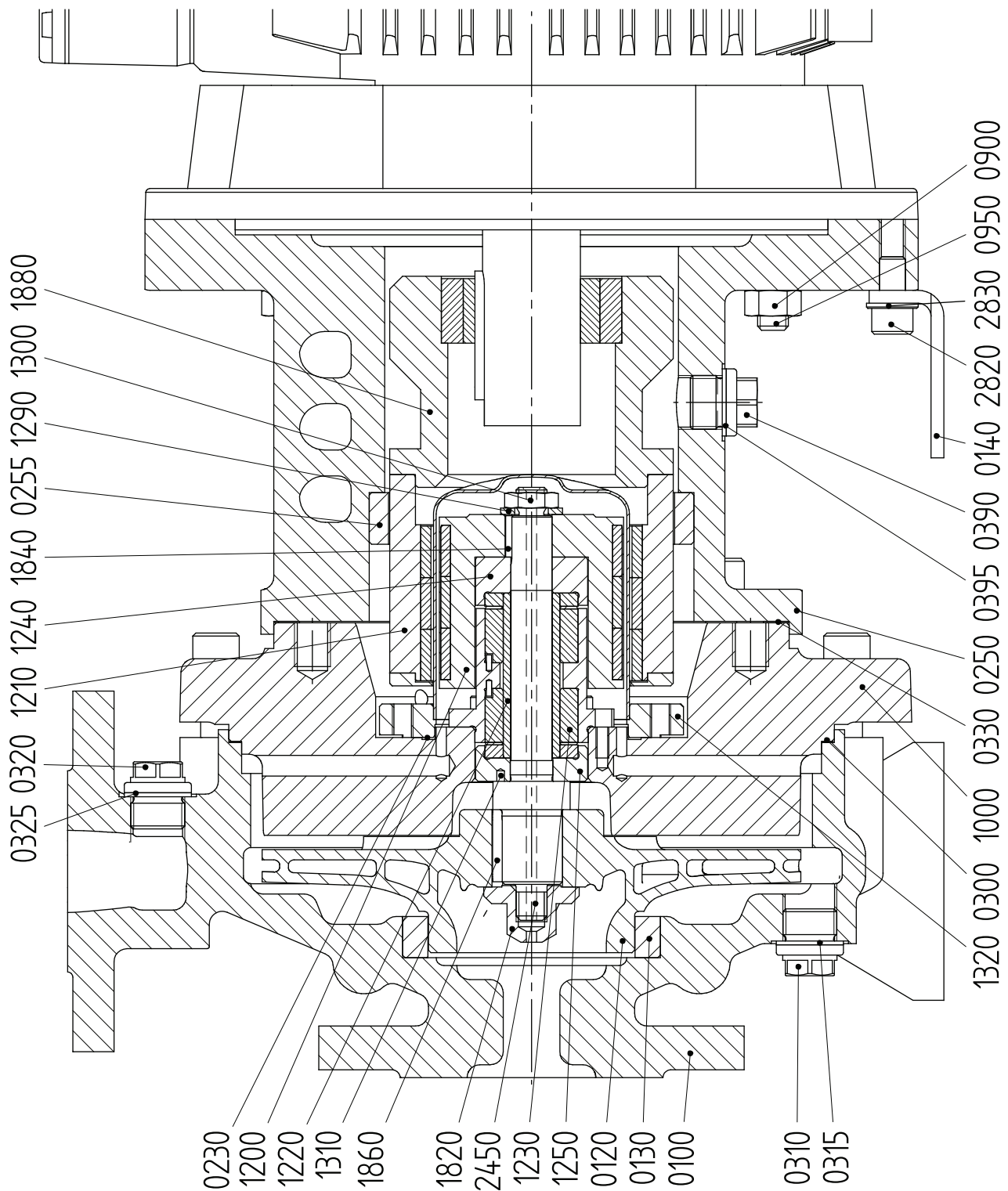


Figure 12: Sectional drawing pump.

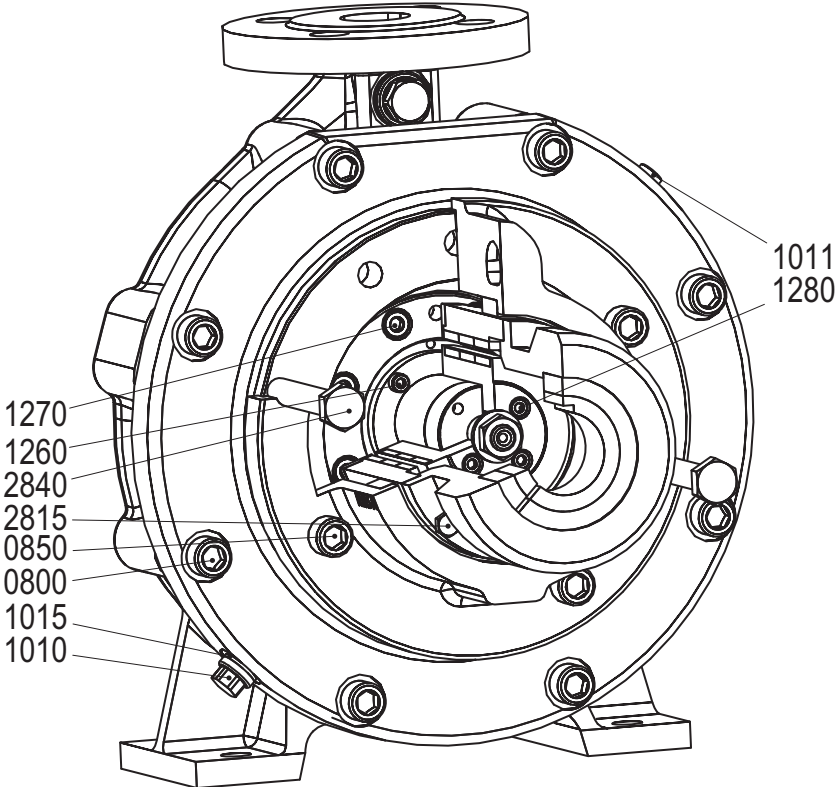


Figure 13: Magnetic coupling.

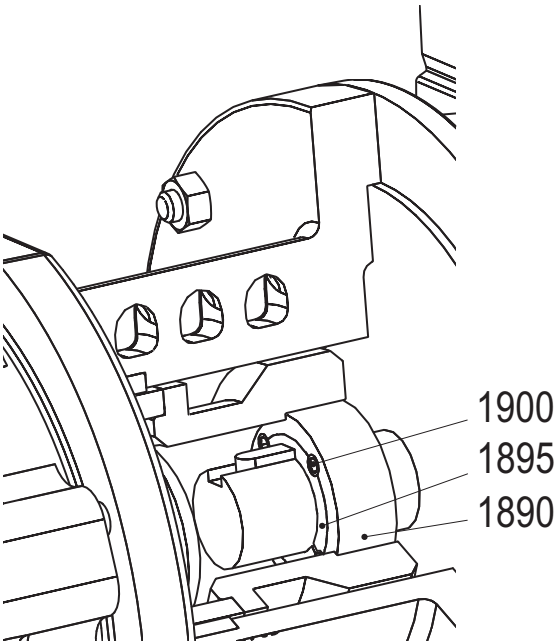


Figure 14: Taper Lock.

9.2.1 Parts list CMB with closed impeller and MAG 75

Item	Quantity	Description	Materials				
			G		NG		R6
0100	1	pump casing	cast iron		nodular c.i.		st.st.
0120*	1	impeller	c.i.	bronze	c.i.	bronze	st.st.
0130*	1	wear ring	c.i.	bronze	c.i.	bronze	st.st.
0140	1	bracket support	steel				
0230*	1	gasket	- -				
0250	1	lantern piece	nodular cast iron				
0255	1	protection ring	bronze				
0300*	1	gasket	- -				
0310	1	plug	steel				st.st.
0315	1	sealing ring	copper				gylon
0320	1	plug	steel				st.st.
0325	1	sealing ring	copper				gylon
0330*	1	gasket	- -				
0390	1	plug	stainless steel				
0395	1	sealing ring	gylon				
0800	1)	Allen screw	stainless steel				
0850	4	Allen screw	stainless steel				
0900	4	nut	steel				
0950	4	bolt	steel				
1000	1	intermediate cover	nodular cast iron				st.st.
1010	1	plug	stainless steel				
1011	1	plug / temperature sensor	stainless steel / - -				
1015	1	sealing ring	gylon				
1820*	1	cap nut	stainless steel				
1840	1	key	stainless steel				
1860	1	key	stainless steel				
1880	1	rotor coupling	cast iron				
1890	1	taper lock adaptor	steel				
1895	1	taper lock bush	steel				
1900	2	set screw	steel				
2450	1	impeller shaft	stainless steel				
2815	4	bolt	stainless steel				
2820	1	Allen screw	stainless steel				
2830	1	washer	stainless steel				
2840	2	bolt	stainless steel				

¹⁾Quantity depending on pump type 4 or 8

Item 0900: not for motor IEC 80 and 90S/L

c.i. = cast iron, st.st. = stainless steel

9.2.2 Parts list complete magnetic coupling MAG 75

Item	Quantity	Description	Materials
1200	1	inner rotor	stainless steel
1210	1	outer rotor	steel
1220	1	shaft sleeve	silicon-carbide
1230	1	plain bearing	silicon-carbide / stainless steel
1240	1	axial bearing, motor side	silicon-carbide / stainless steel
1250	1	axial bearing, pump side	silicon-carbide / stainless steel
1260	5	Allen screw	stainless steel
1270	8	Allen screw	stainless steel
1280	4	Allen screw	stainless steel
1290	1	washer	stainless steel
1300	1	nut	stainless steel
1310**	1	carrier pin	stainless steel
1320	1	containment can	- -

** Part of complete delivery

9.3 CMB with closed impeller and MAG 110 / MAG 135

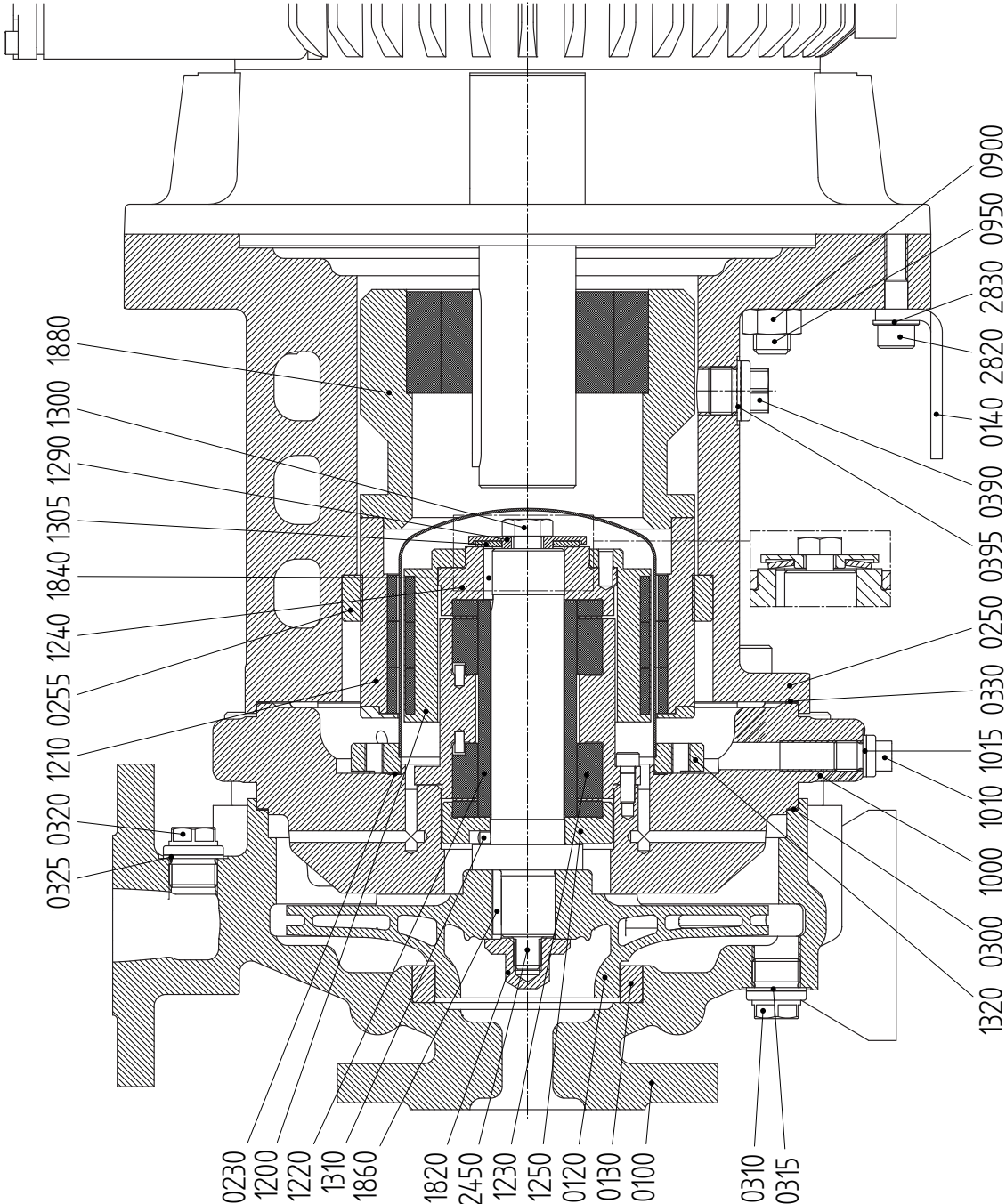


Figure 15: Sectional drawing pump.

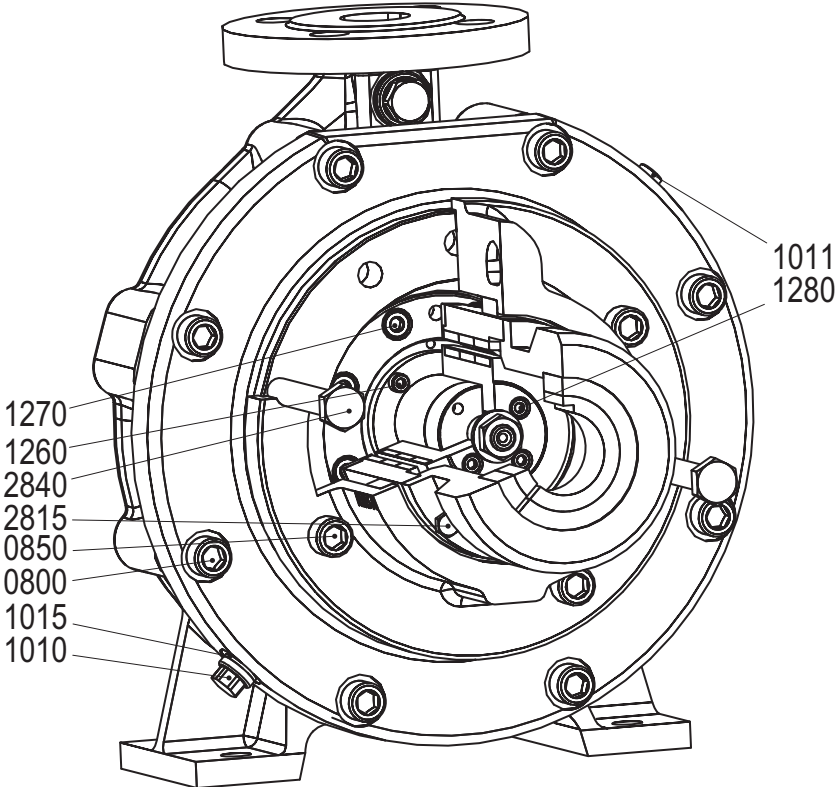


Figure 16: Magnetic coupling.

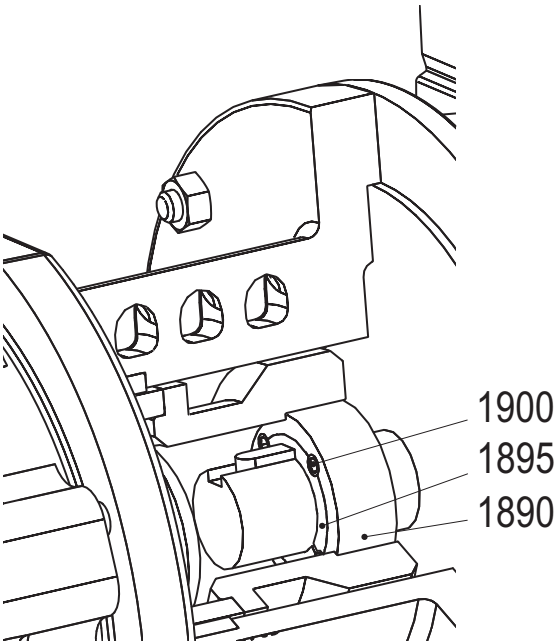


Figure 17: Taper Lock.

9.3.1 Parts list CMB with closed impeller and MAG 110 / MAG 135

Item	Quantity	Description	Materials				
			G		NG		R6
0100	1	pump casing	cast iron		nodular c.i.		st.st.
0120*	1	impeller	c.i.	bronze	c.i.	bronze	st.st.
0130*	1	wear ring	c.i.	bronze	c.i.	bronze	st.st.
0140	1	bracket support	steel				
0230*	1	gasket	- -				
0250	1	lantern piece	nodular cast iron				
0255	1	protection ring	bronze				
0300*	1	gasket	- -				
0310	1	plug	steel				st.st.
0315	1	sealing ring	copper				gylon
0320	1	plug	steel				st.st.
0325	1	sealing ring	copper				gylon
0330*	1	gasket	- -				
0390	1	plug	stainless steel				
0395	1	sealing ring	gylon				
0800	1)	Allen screw	stainless steel				
0850	2)	Allen screw	stainless steel				
0900	4	nut	steel				
0950	4	bolt	steel				
1000	1	intermediate cover	nodular cast iron				st.st.
1010	1	plug	stainless steel				
1011	1	plug / temperature sensor	stainless steel / - -				
1015	1	sealing ring	gylon				
1820*	1	cap nut	stainless steel				
1840	1	key	stainless steel				
1860	1	key	stainless steel				
1880	1	rotor coupling	cast iron				
1890	1	taper lock adaptor	steel				
1895	1	taper lock bush	steel				
1900	2	set screw	steel				
2450	1	impeller shaft	stainless steel				
2815	4	bolt	stainless steel				
2820	1	Allen screw	stainless steel				
2830	1	washer	stainless steel				
2840	2	bolt	stainless steel				

1) Quantity depending on pump type 4, 8 or 12

2) Quantity depending on pump type 4 or 8

9.3.2 Parts list complete magnetic coupling MAG 110 / MAG 135

Item	Quantity	Description	Materials
1200	1	inner rotor	stainless steel
1210	1	outer rotor	steel
1220	1	shaft sleeve	silicon-carbide
1230	1	plain bearing	silicon-carbide / stainless steel
1240	1	axial bearing, motor side	silicon-carbide / stainless steel
1250	1	axial bearing, pump side	silicon-carbide / stainless steel
1260	5	Allen screw	stainless steel
1270	1 ¹⁾	Allen screw	stainless steel
1280	4	Allen screw	stainless steel
1290	1	washer	stainless steel
1300	1	bolt	stainless steel
1305	1	disc spring	stainless steel
1310	1	carrier pin	stainless steel
1320	1	containment can	- -

¹⁾ MAG 110: 12, MAG 135: 16

9.4 CMB 25-125/160 with half open impeller and MAG 75

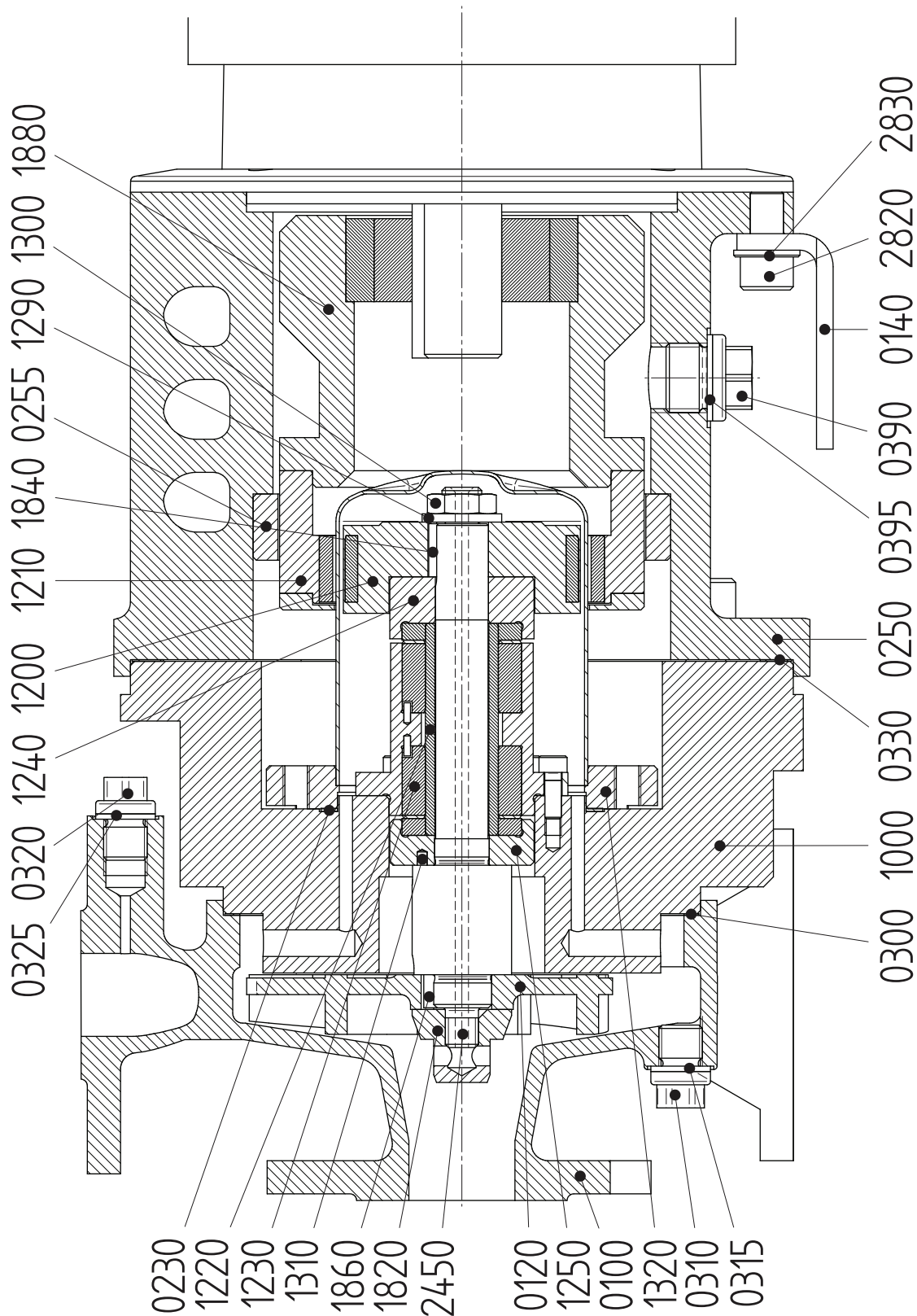


Figure 18: Sectional drawing pump.

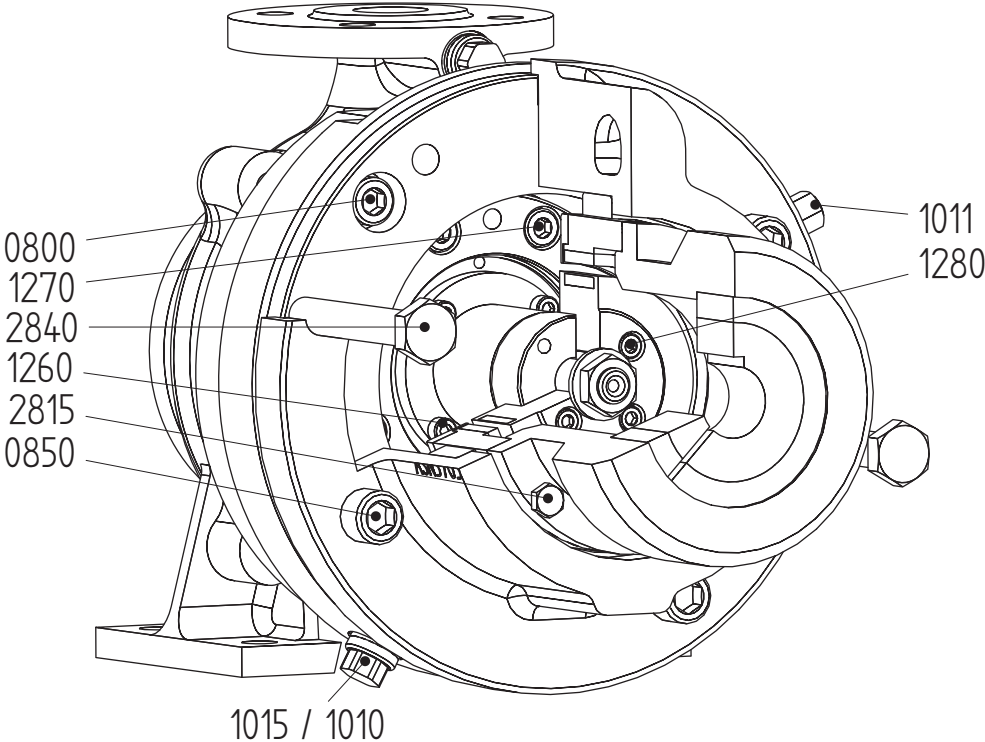


Figure 19: Magnetic coupling.

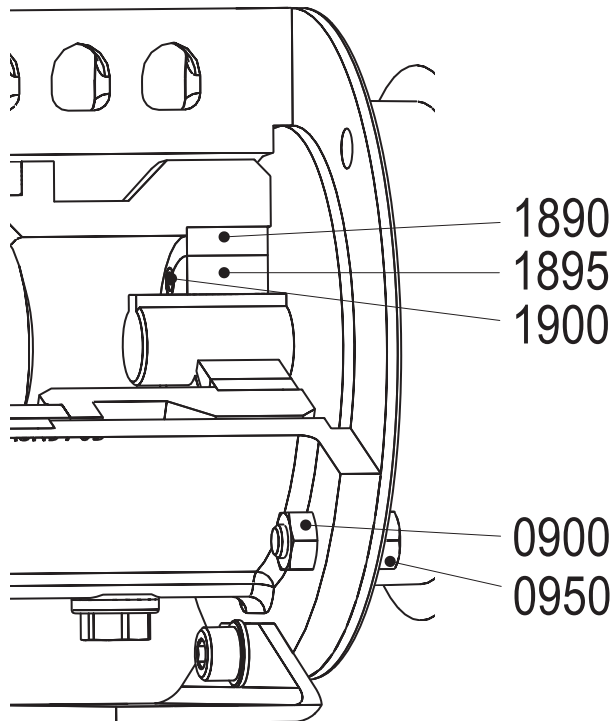


Figure 20: Taper Lock.

9.4.1 Parts list CMB 25-125/160 with half open impeller and MAG 75

Item	Quantity	Description	Materials
			R6A
0100	1	pump casing	stainless steel
0120*	1	half open impeller	stainless steel
0140	1	bracket support	steel
0230*	1	gasket	- -
0250	1	lantern piece	nodular cast iron
0255	1	protection ring	bronze
0300*	1	gasket	- -
0310	1	plug	stainless steel
0315	1	sealing ring	gylon
0320	1	plug	stainless steel
0325	1	sealing ring	gylon
0330*	1	gasket	- -
0390	1	plug	stainless steel
0395	1	sealing ring	gylon
0800	4	Allen screw	stainless steel
0850	4	Allen screw	stainless steel
0900	4	nut	steel
0950	4	bolt	steel
1000	1	intermediate cover	stainless steel
1010	1	plug	stainless steel
1011	1	plug / temperature sensor	stainless steel / - -
1015	1	sealing ring	gylon
1820*	1	cap nut	stainless steel
1840	1	key	stainless steel
1860	1	key	stainless steel
1880	1	rotor coupling	cast iron
1890	1	taper lock adaptor	steel
1895	1	taper lock bush	steel
1900	2	set screw	steel
2450	1	impeller shaft	stainless steel
2815	4	bolt	stainless steel
2820	1	Allen screw	stainless steel
2830	1	washer	stainless steel
2840	2	bolt	stainless steel

Item 0900: not for motor IEC 80 and 90S/L

9.4.2 Parts list complete magnetic coupling MAG 75

Item	Quantity	Description	Materials
1200	1	inner rotor	stainless steel
1210	1	outer rotor	steel
1220	1	shaft sleeve	silicon-carbide
1230	1	plain bearing	silicon-carbide / stainless steel
1240	1	axial bearing, motor side	silicon-carbide / stainless steel
1250	1	axial bearing, pump side	silicon-carbide / stainless steel
1260	5	Allen screw	stainless steel
1270	8	Allen screw	stainless steel
1280	4	Allen screw	stainless steel
1290	1	washer	stainless steel
1300	1	nut	stainless steel
1310**	1	carrier pin	stainless steel
1320	1	containment can	- -

** Part of complete delivery

9.5 Temperature sensor

9.5.1 Composite drawing

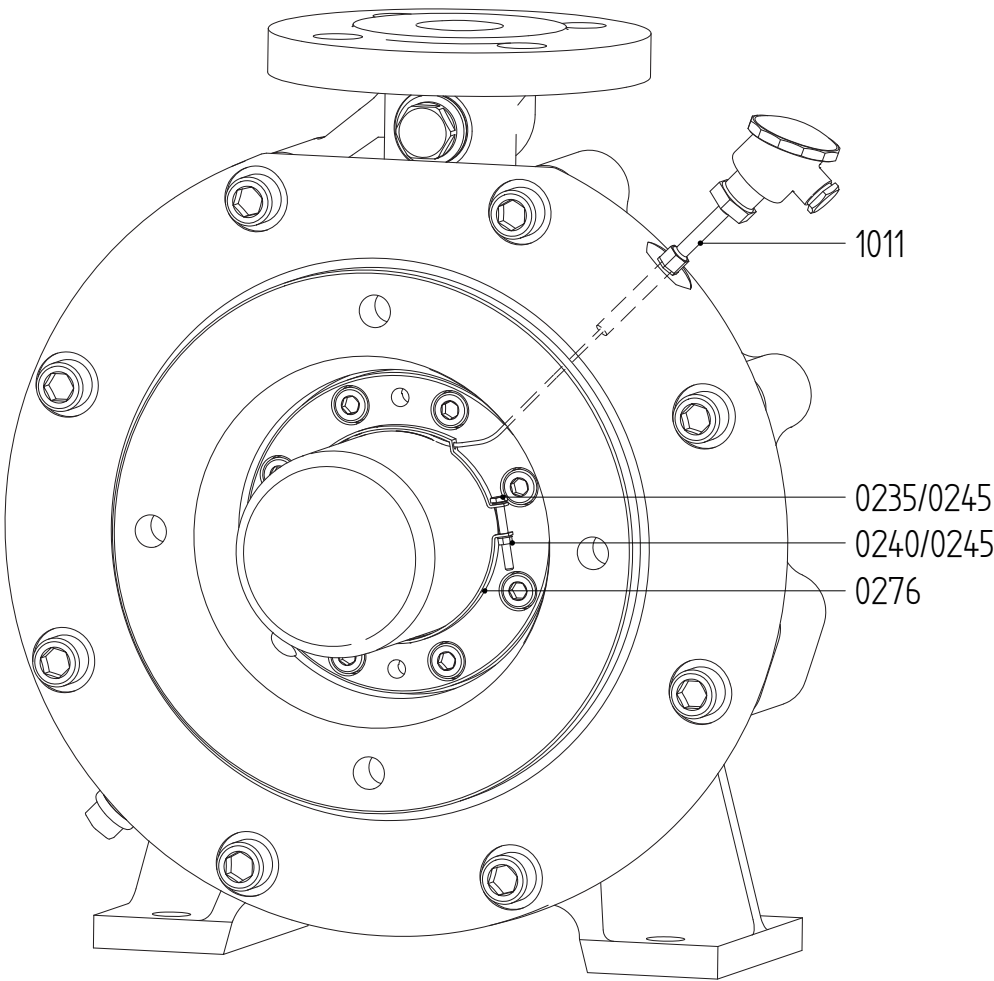


Figure 21: *Temperature sensor.*

9.5.2 Parts list

Item	Quantity	Description	Material
0235	1	bolt	stainless steel
0240	1	nut	stainless steel
0245	2	washer	stainless steel
0276	1	clamp	stainless steel
1011	1	temperature sensor	- -

10 Technical data

10.1 Permissible pressure and temperature

Table 4: Maximum allowable working pressure [kPa] (according to ISO 7005)

Materials	Max. system pressure [kPa]	Maximum temperature [°C]				
		50	120	150	180	200
G	1600	1600	1600	1440	1340	1280
NG	1600	1600	1600	1550	1500	1470
R	1600	1600	1440	1360	1300	1260
25-125 R	600	600	525	490	450	450
25-160 R	800	800	700	650	600	600

100 kPa = 1 bar

Test pressure: 1,5 x maximum working pressure.

10.2 Torque settings

10.2.1 Torque settings for bolts and Allen screws

Torque settings in Nm for stainless steel (A4-70) bolts and Allen screws.

Thread	lubricated	dry
M5	4	4,5
M6	7	7,5
M8	16	18
M10	32	must not be fitted dry
M12	43	must not be fitted dry

10.2.2 Torque settings for containment can bolts

Torque settings in Nm for stainless steel 18.10 Allen screws (1270), for fitting the containment can.

Thread	MAG 75	MAG 110	MAG 135
M8	16	16	16

10.2.3 Tightening moments for cap nut

Thread	Tightening moment [Nm]
M12 (bearing bracket 1)	43
M16 (bearing bracket 2)	104

10.2.4 Tightening moments for Taper Lock bolts (1900)

Type Taper Lock	Tightening moment [Nm]
1610	20
2514	50

10.3 Recommended liquid locking agents

Component	Locking liquid
cap nut (1820)	Loctite 243
nut / bolt (1300)	Loctite 243
wear ring (0130)	Loctite 641

10.4 Maximum speed

CMB	Max. impeller diameter [mm]	Back vane diameter [mm]	Max. speed [min ⁻¹]
25-125	130	130	3600
25-160	174	174	3600
32-125	139	76*	3600
32C-125	139	76	3600
32-160	169	76*	3600
32A-160	169	--	3600
32C-160	169	76	3600
32-200	209	133*	3600
32C-200	209	133	3600
32-250	260	161	3600
40C-125	130	76	3600
40C-160	175	120	3600
40C-200	210	111	3600
40-250	260	150	3600
50C-125	139	115	3600
50C-160	169	118	3600
50C-200	209	155	3600
50-250	260	160	3600
65C-125	139	139	3600
65C-160	175	156	3600

* stainless steel impeller: no back vanes

10.5 Permitted forces and torques on the flanges, based on EN-ISO 5199

Forces and moments acting on the pump flanges due to pipe loads can cause misalignment of the pump, deformation and overstressing of the pump casing, or overstressing of the fixing bolts between the pump and the baseplate.

The values can be applied simultaneously in all directions with positive or negative signs, or separately on each flange (suction and discharge).

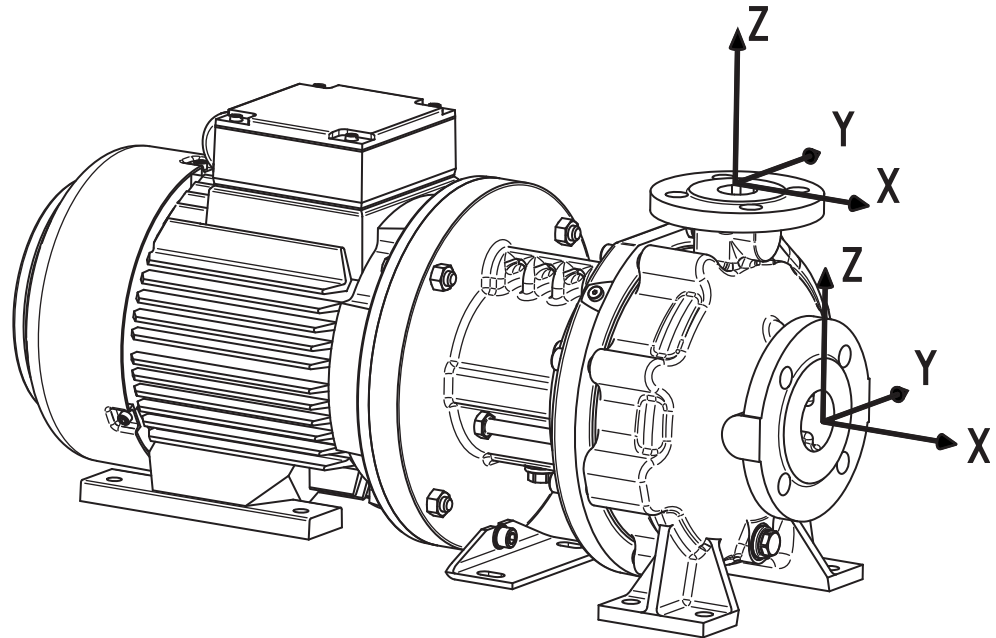


Figure 22: Coordinate system.

Table 5: Permitted forces and torques on the flanges, based on EN-ISO 5199.

CMB	Pump unit rigid mounted															
	Horizontal Pump, End branch, x-Axis								Horizontal Pump, Top branch, z-Axis							
	Force (N)				Moment (N.m)				Force (N)				Moment (N.m)			
	Fy	Fz	Fx	ΣF	My	Mz	Mx	ΣM	Fy	Fz	Fx	ΣF	My	Mz	Mx	ΣM
25-125*	630	595	735	1155	525	595	770	1120	490	595	525	910	420	490	630	910
25-160*	525	490	595	910	420	490	630	910	490	595	525	910	420	490	630	910
32-125	1050	945	1155	1820	700	805	980	1435	595	735	630	1155	525	595	770	1120
32C-125	1050	945	1155	1820	700	805	980	1435	595	735	630	1155	525	595	770	1120
32-160	1050	945	1155	1820	700	805	980	1435	595	735	630	1155	525	595	770	1120
32A-160	1050	945	1155	1820	700	805	980	1435	595	735	630	1155	525	595	770	1120
32C-160	1050	945	1155	1820	700	805	980	1435	595	735	630	1155	525	595	770	1120
32-200	1050	945	1155	1820	700	805	980	1435	595	735	630	1155	525	595	770	1120
32C-200	1050	945	1155	1820	700	805	980	1435	595	735	630	1155	525	595	770	1120
32-250	1050	945	1155	1820	700	805	980	1435	595	735	630	1155	525	595	770	1120
40C-125	1295	1190	1470	2310	770	840	1050	1540	700	875	770	1365	630	735	910	1330
40C-160	1295	1190	1470	2310	770	840	1050	1540	700	875	770	1365	630	735	910	1330
40C-200	1295	1190	1470	2310	770	840	1050	1540	700	875	770	1365	630	735	910	1330
40-250	1295	1190	1470	2310	770	840	1050	1540	700	875	770	1365	630	735	910	1330
50C-125	1575	1435	1750	2765	805	910	1120	1645	945	1155	1050	1820	700	805	980	1435
50C-160	1575	1435	1750	2765	805	910	1120	1645	945	1155	1050	1820	700	805	980	1435
50C-200	1575	1435	1750	2765	805	910	1120	1645	945	1155	1050	1820	700	805	980	1435
50-250	1575	1435	1750	2765	805	910	1120	1645	945	1155	1050	1820	700	805	980	1435
65C-125	2100	1890	2345	3675	875	1015	1225	1820	1190	1470	1295	2310	770	840	1050	1540
65C-160	2100	1890	2345	3675	875	1015	1225	1820	1190	1470	1295	2310	770	840	1050	1540
65C-200	2100	1890	2345	3675	875	1015	1225	1820	1190	1470	1295	2310	770	840	1050	1540
65A-250	2100	1890	2345	3675	875	1015	1225	1820	1190	1470	1295	2310	770	840	1050	1540
80C-160	2485	2240	2765	4340	1050	1330	1470	2135	1435	1750	1575	2765	805	910	1120	1645
80C-200	2485	2240	2765	4340	1050	1330	1470	2135	1435	1750	1575	2765	805	910	1120	1645

* Not available in G and NG

The basic values mentioned in the previous table should be multiplied with the following coefficients in relation to the relevant pump casing materials:

Cast iron	0,5
Nodular cast iron	0,8
Stainless steel	1

10.6 Performance overview

10.6.1 Performance overview G, NG

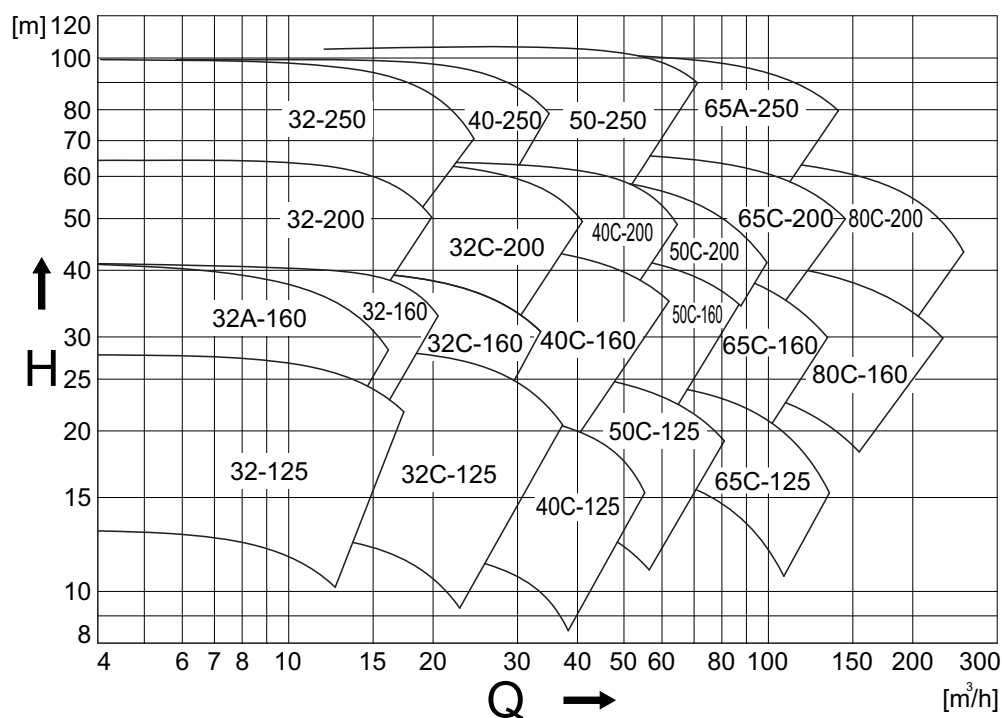


Figure 23: Performance overview 3000 min⁻¹ (G, NG).

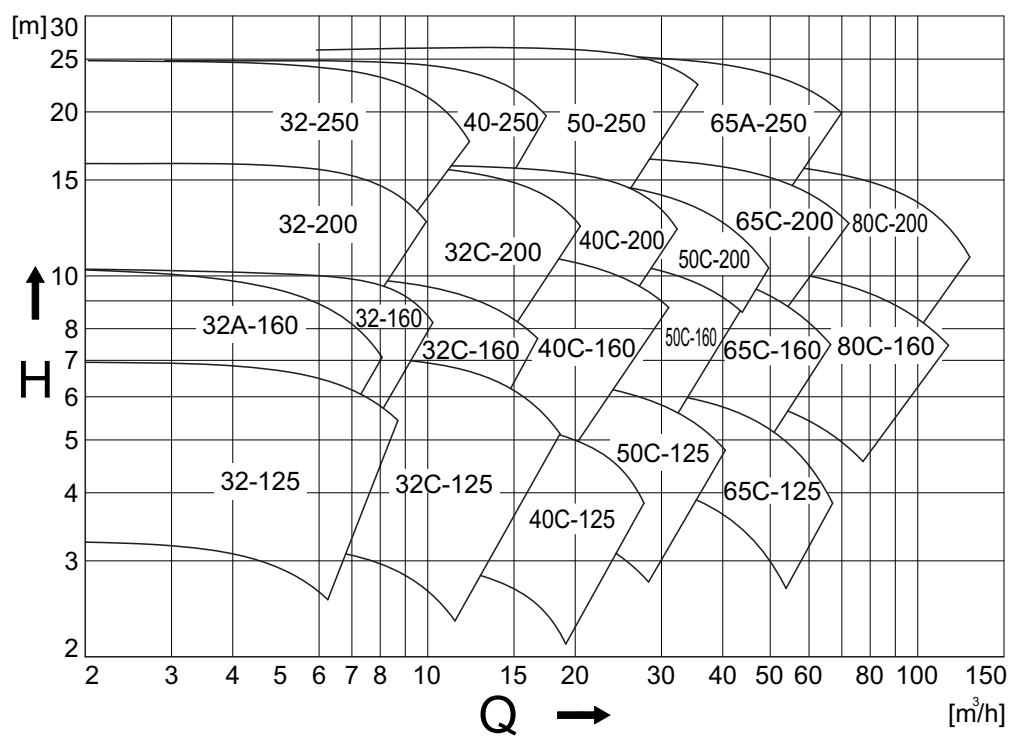


Figure 24: Performance overview 1500 min⁻¹ (G, NG).

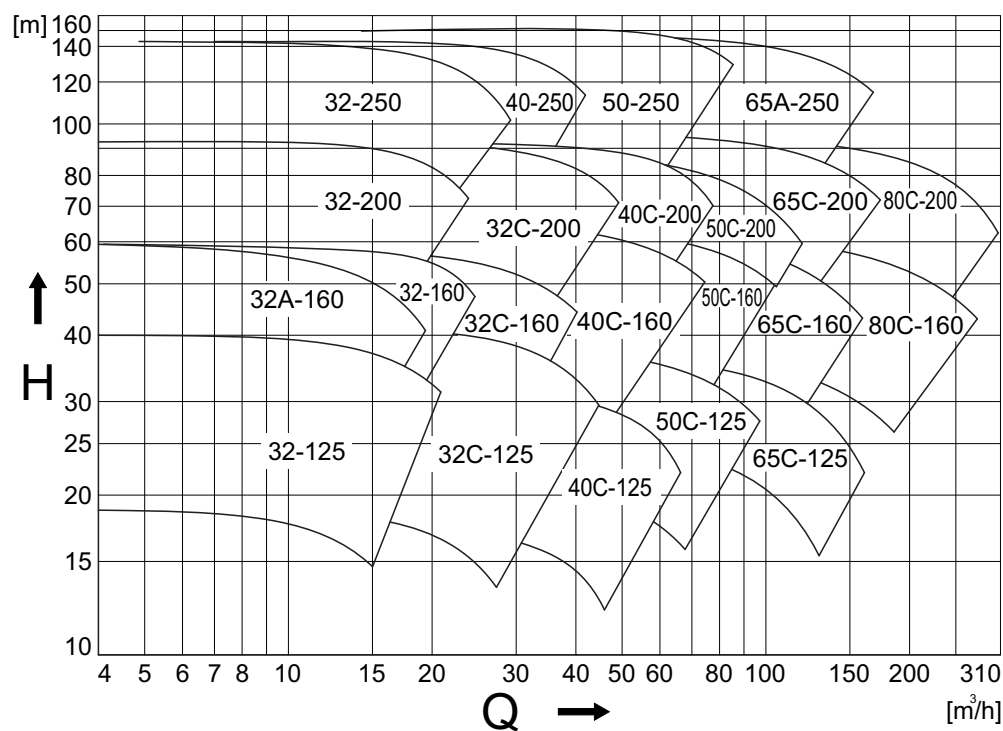


Figure 25: Performance overview 3600 min⁻¹ (G, NG).

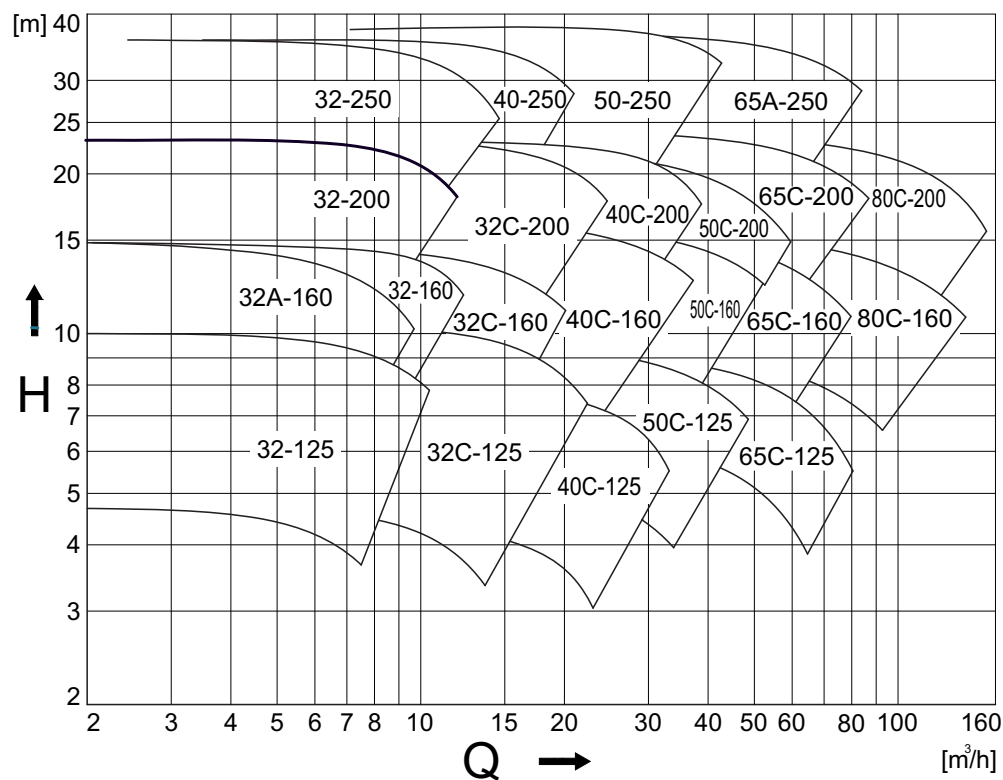


Figure 26: Performance overview 1800 min⁻¹ (G, NG).

10.6.2 Performance overview R

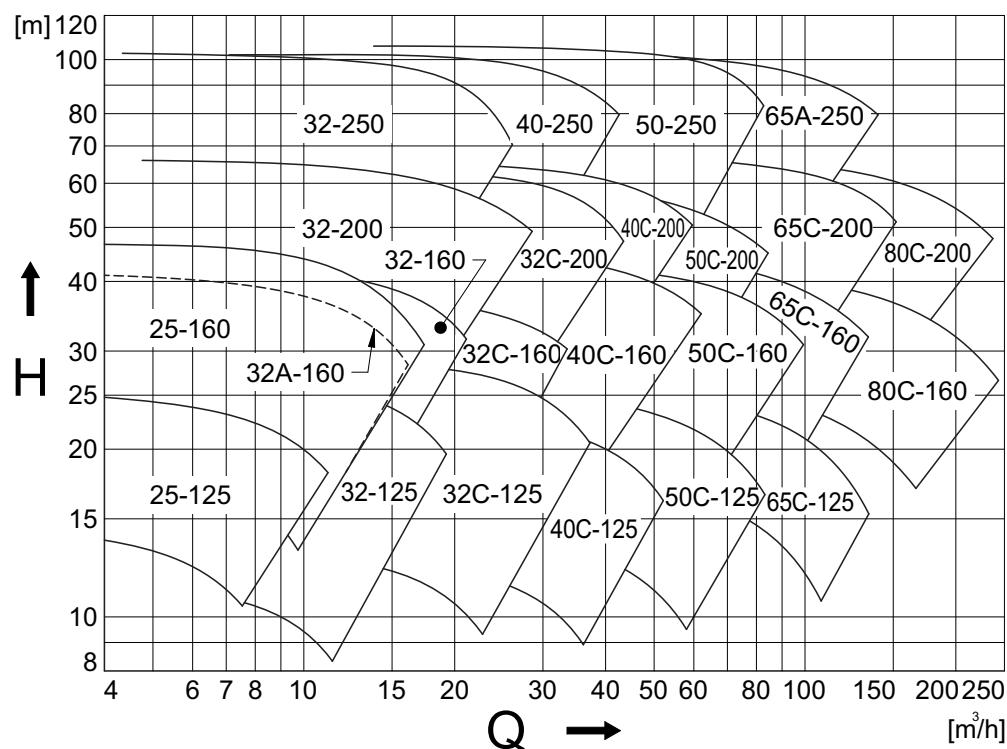


Figure 27: Performance overview 3000 min⁻¹ (R).

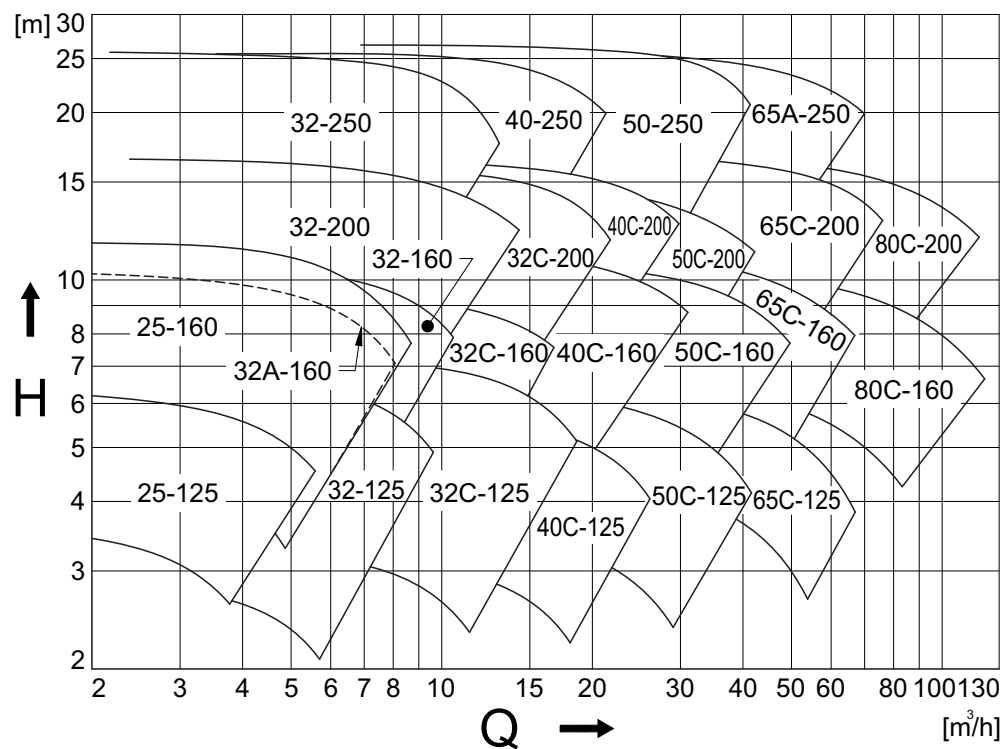


Figure 28: Performance overview 1500 min⁻¹ (R).

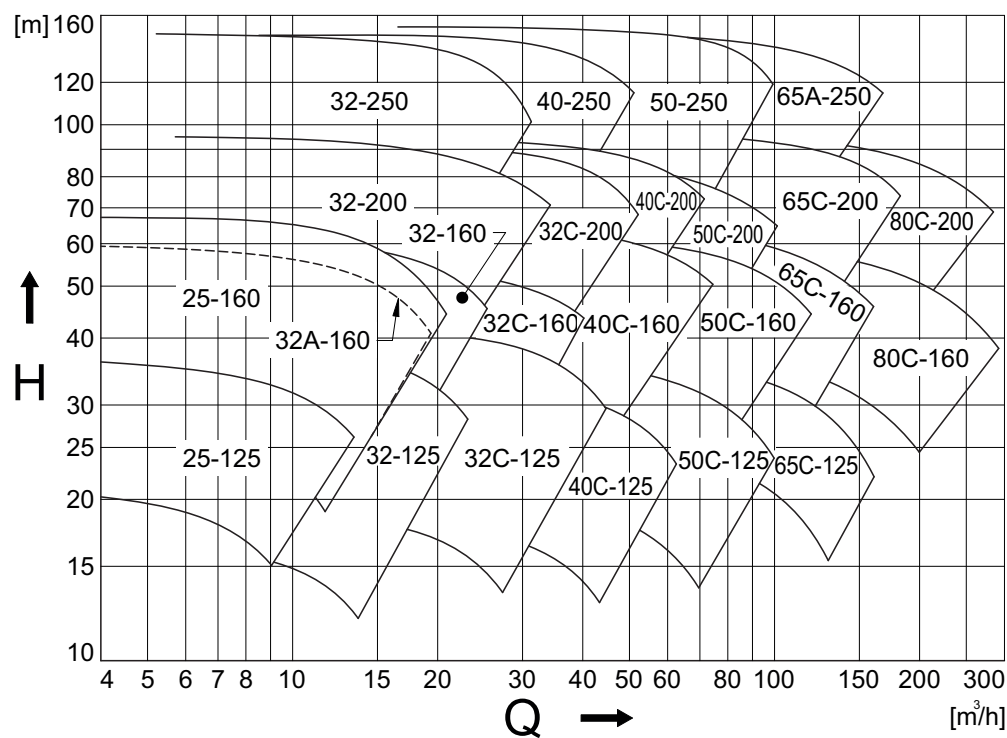


Figure 29: Performance overview 3600 min⁻¹ (R).

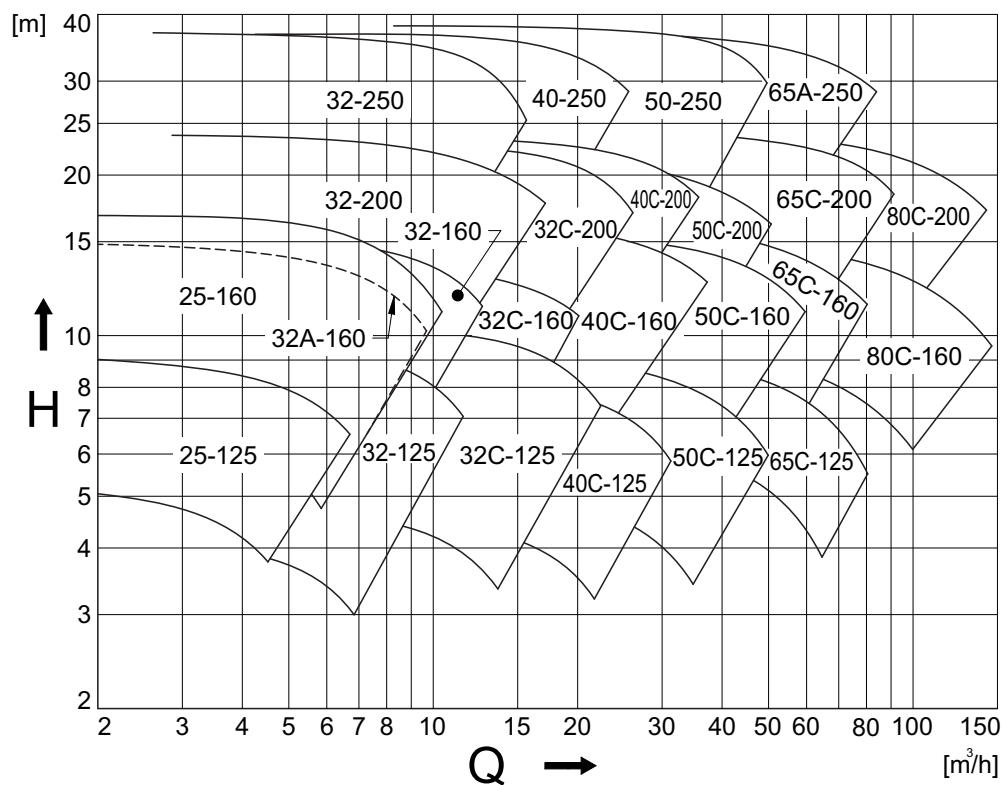


Figure 30: Performance overview 1800 min⁻¹ (R).

10.7 Noise data

10.7.1 Pump noise as a function of pump power

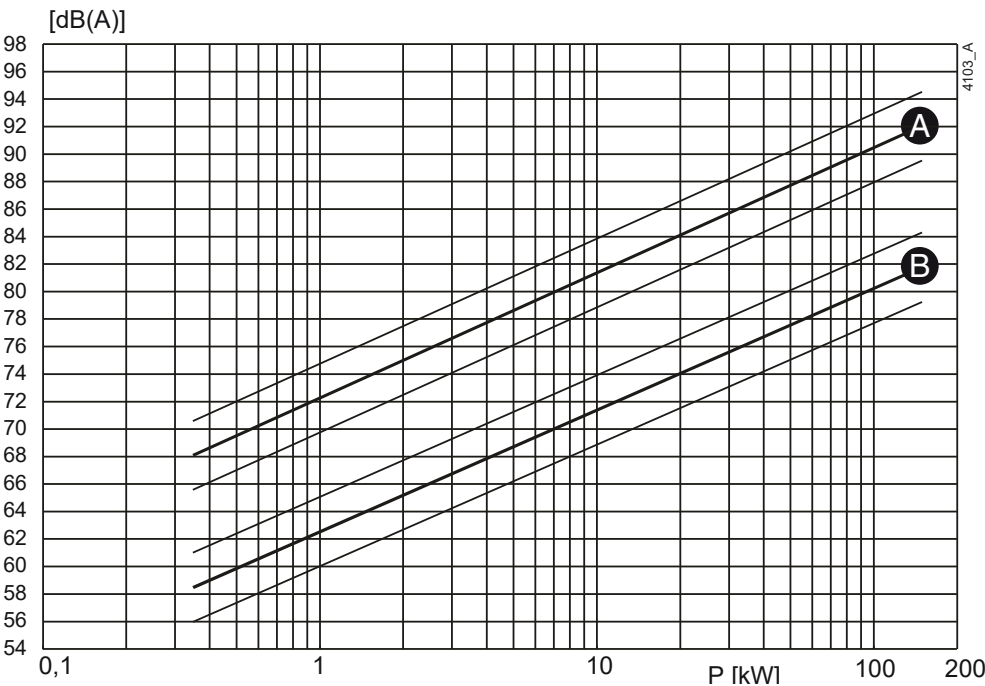


Figure 31: Noise level as function of pump power [kW] at 1450 min^{-1}
A = sound power level, B = sound pressure level.

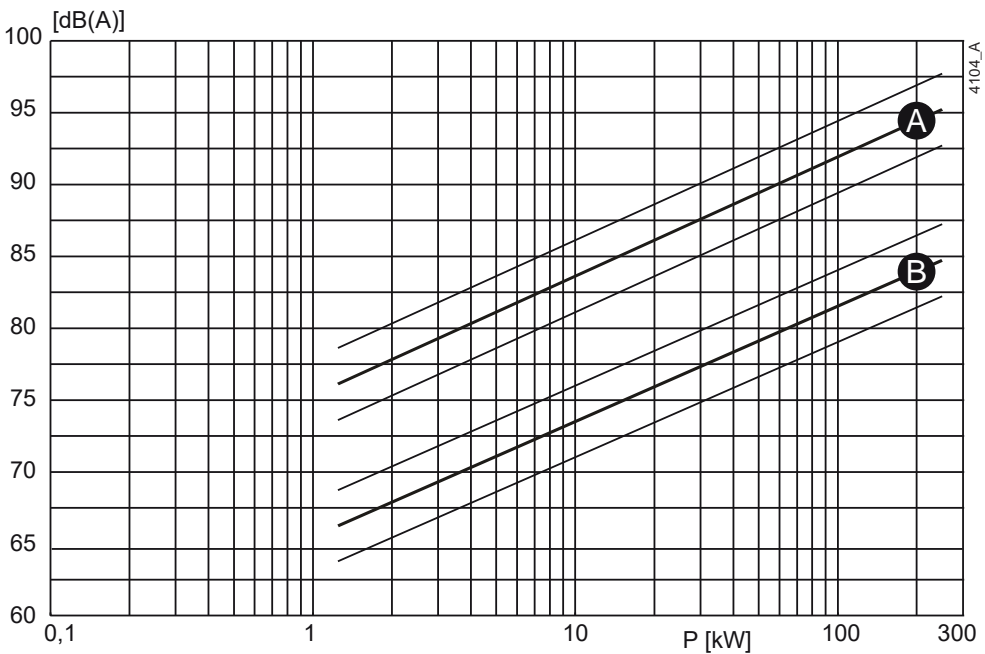


Figure 32: Noise level as function of pump power [kW] at 2900 min^{-1}
A = sound power level, B = sound pressure level.

10.7.2 Noise level of entire pump unit

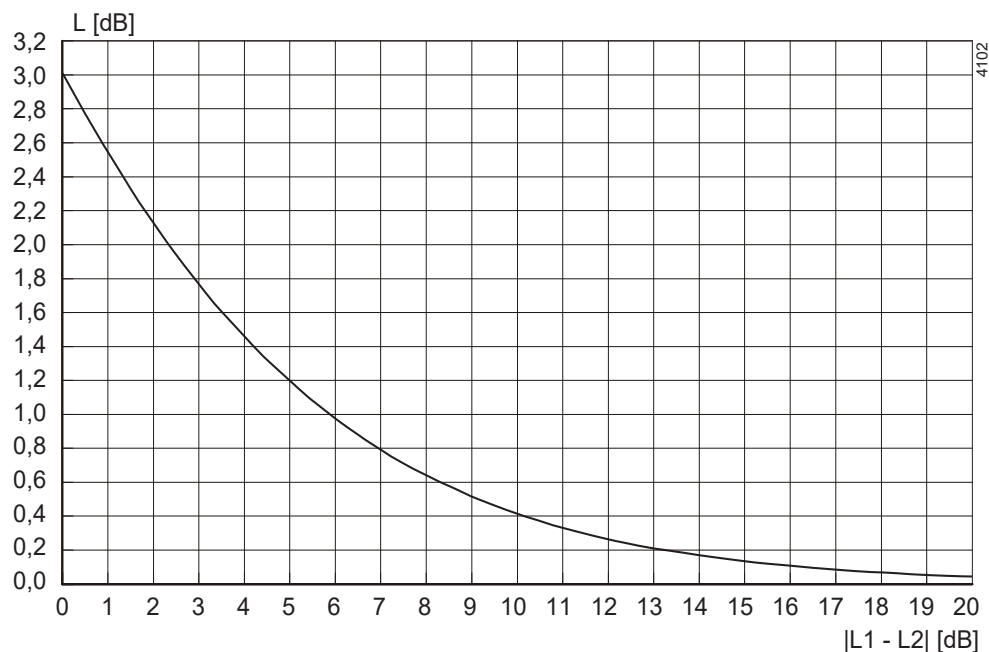


Figure 33: Noise level of entire pump unit.

In order to determine the total noise level of the entire pump unit, the noise level of the motor must be added to that of the pump. This can be easily done by using the graph above.

- 1 Determine the noise level (L_1) of the pump, see figure 31 or figure 32.
- 2 Determine the noise level (L_2) of the motor, see documentation of the motor.
- 3 Determine the difference between both levels $|L_1 - L_2|$.
- 4 Find the differential value on the $|L_1 - L_2|$ -axis and go up to the curve.
- 5 From the curve go left to the L [dB] -axis and read out the value.
- 6 Add this value to the highest value of both noise levels (L_1 or L_2).

Example:

- 1 Pump 75 dB; motor 78 dB.
- 2 $|75-78| = 3$ dB.
- 3 3 dB on the X-axis = 1,75 dB on the Y-axis.
- 4 Highest noise level + 1,75 dB = $78 + 1,75 = 79,75$ dB.

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Order form for spare parts

FAX Nr.	
ADDRESS	

Your order will only be dealt with if this order form has been correctly completed and signed.

Order date:	
Your order number:	
Pump type:	
Execution:	

Quantity	Item. No.	Part	Article number pump

Delivery address:	Invoicing address:

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