Installation and maintenance manual

Vessel / Owner name:	# / Yilyak Yakit Pazarlama Tic. A.S.
IMO no:	
Yard / Hull no:	Yilyak Yakit Pazarlama Tic. A.S. / NB # 077
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1 Introduction

1 Introduction

1.1 Preface

This manual is intended as a reference for the Owner/Management as well as “qualified users” & “professional maintenance services” in order to install and maintain the pumps and equipment in correct running order.

This manual is property of Marflex and is therefore not to be traced, copied or published without written consent of Marflex, nor to be misused in any way.

1.2 Liability

This manual has been compiled with the utmost care and complies with the most up to date information at the time of publishing. This information however may be subject to modifications and/or improvements at a later date. Marflex therefore accepts no liability for possible discrepancies that might excist between this manual and the goods delivered.

With respect to liability, article 13 of the METAALUNIE CONDITIONS, being standard delivery conditions as issued by the “Metaalunie”, as well as the additions and changes to the aforementioned conditions applies.

These conditions have been registered at the Registry of the District Court in Rotterdam on 1th January 2001 (see 1.9).

1.3 Warranty

The warranty will be cancelled immediately and legally if:

1. When the systems/components are not commisioned under direction of Marflex
2. Modifications are carried out by the yard to the Marflex systems/components prior to commissioning without written approval of Marflex
3. Injudicious use of the Marflex systems/components occurs
4. One or more adjustments have been made to the pump installation, without prior approval of Marflex
5. The pump installation is not inspected periodically according to the maintenance schedule
6. A written report of defects/problems is not produced.

Other terms of the warranty are in accordance with article 14 of the METAALUNIE CONDITIONS, being standard delivery conditions as issued by the “Metaalunie” as well as the additions and changes to the aforementioned conditions applies.

These conditions have been registered at the Registry of the District Court in Rotterdam on the First of January 2001 (a copy will be forwarded to you, free of charge, upon request).

1.4 Spare parts

A recommended spare parts list is included in this manual as well as instructions for ordering parts.

A fax-order form is also included in this manual.

The fax-order form can also be send via e-mail (info@marflex.com).

1.4.1 Ordering spare parts

Upon ordering spare parts due to repairs, warranty claims or incorrect content delivery, Marflex requires the following information:

1. Yard / Hull no. / Vessel name
2. Yard / Vessel claim no
3. Marflex Sales Order no
4. Part no. with part name(description)
5. Required quantity
6. Required delivery date
7. Delivery address
8. VAT no.

1.5 Warranty claims

Warranty claims (if any) must be reported as soon as possible to the Marflex Project Engineering Department, to the attention of the Warranty claim coordinator.

Claims must contain the information as mentioned in 1.4.1

1.5.1 Contact during warranty period

After commisioning the warranty period starts. The duration of the warranty is limited according to the statements in the contract.

For a quick response on your warranty claim **only** use the following contact address, telefax or e-mail address (for the duration of the warranty period only):

MARFLEX
Project Engineering Department
Warranty Claim Coordinator

Louis Pasteurstraat 12
3261 LZ Oud-Beijerland
Netherlands(NL)

Telefax: (+31)186 – 890 229

Email: guarantee@marflex.com

1.5.2 Returning parts

The returning of parts to Marflex for repair, in connection with warranty claims, is always evaluated by the Warranty claim coordinator.

If parts are returned to Marflex the following information must be notified to Marflex:

1. Yard / Hull no. / Vessel name
2. Yard / Vessel claim no
3. Marflex Sales Order no
4. Part no. with part name(description).

1.5.3 Transport care

Any warranty claim can be discarded when the returned parts are not properly:

1. Protected against corrosion
2. Packed and marked for transport.

1.6 Contacts at Marflex

In order to handle your orders, questions & claims in a correct and swift manner, Marflex has designated departments to put you in contact with the proper persons.

Marflex will asign the designated department to you.

1.6.1 Project Engineering department

This department is responsible for the planning, engineering, installation & documentation of the Scope of Supply of the Contract.

After activation of the Contract a Project Engineer is appointed and will be the primary contact for this specific order.

1.6.2 Claims department

This department is responsible for handling claims during the warranty period after hand-over of the pumps & equipment to the Owner/Management.

1.6.3 Repair/Service department

This department is responsible for service & repair after the warranty period, spare parts can be ordered via this department.

1.6.4 Contact address:

MARFLEX
Louis Pasteurstraat 12
3261 LZ Oud-Beijerland
Netherlands(NL)

Telephone: (+31)186 – 890 200

Telefax: (+31)186 – 890 299

Email: info@marflex.com

Internet: www.marflex.com

1.7 Definitions & abbreviations

Table 1: Definitions & abbreviations

Definition / Abbreviation	Description
Qualified users	A person who has reached the minimum age of 18 years and has the permission of the person responsible for the pumps & equipment installation to carry out the instructed actions.
Professional maintenance services	A maintenance service that has theoratical and practical experience about pumps & equipment.
MDPD	Marflex Deepwell Pump Double, cargo pipe & drive shaft pipe are located next to each other.
MDPC	Marflex Deepwell Pump Concentrical, drive shaft pipe is located inside the cargo pipe.
E-motor	An electrical motor that drives the pump.
Top cover	Pump foundation on which the E-motor is mounted at deck side, a discharge flange is also located on this part.
Pipe stack	Stack of cargo, purging & stripping pipes, all rigidly fixed together, mounted between the top cover and the pump head.
Pump head	Part which physically displaces the cargo liquid into the pipe stack, part is mounted at the bottom end of the pipe stack.
Well	Part of the cargo tank construction in which the pump head is protruding. The bottom of this well is lower than the bottom of the cargo tank.
Barrel	A housing containing a ballast pump, mounted inside a tank with connections to the ballast tank(s)
Deck trunk	Welded pump foundation on the deck of the vessel, this part is an interface between the vessel construction and the top cover.
Discharging	The process in which the cargo liquid flows from the cargo tank into the vessels cargo piping system.
Purging	A routine that enables operation / maintenance personnel to check the working condition of the seals in the pump head.
Stripping	A routine that enables operating personnel to minimize the quantity of cargo liquid in the cargo tank.
Drive shaft	The connection shaft between E-motor and impeller in the pumphead.
Intermediate drive shaft	Part of the drive shaft between the top cover and the pump head.
Pump shaft	The part of the drive shaft inside the pump head, directly connected to the impeller
Packing & O-ring	Sealing rings made of compressible material having excellent sealing properties and resistance to most chemical liquids.

Table 1: Definitions & abbreviations (Continued)

Definition / Abbreviation	Description
Impeller	The part which physically moves the cargo liquid into the pump head and pipe stack. The impeller is driven by the E-motor through the drive shaft.
Dummy	A helpful tool to pre-install the deck trunk (and other interfaces) into the vessel's deck plating without needing the actual Marflex pump. This dummy is usually made of steel beams or pipes in which all connections of the actual Marflex pump are incorporated.
Laser tool	A helpful tool to pre-install the deck trunk into the vessels deck plating without needing the actual Marflex pump. The laser beam is used to align the deck trunk.
Power Pack	A compact, stand-alone hydraulic power delivering unit. There are two types a diesel and an electrical driven power pack.
Portable pump	Fully submersible hydraulic driven portable pump.
Tripod	A compact hoisting device to handle portable pumps.
Hose reel	A storage and transport device for cargo or hydraulic hoses.
Commissioning	All activities needed to put the pump system and/or equipment into first time operation, consists mostly of testing and fine tuning.
Butterworth hatch	A hatch opening in the top of a tank, used mostly for tank washing. Facilitates also entrance and lowering of the portable pump into the tank.
Dangerous zone	Area with a hazardous explosive atmosphere (an atmosphere where, if it explodes, causes damage.
Explosive atmosphere	Mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts, in which, after ignition has occured, combustion spreads to the entire unburned mixture

1.8 Spare parts order form

Customer and Marflex information:

Fax no.:			
To the attention off:			
Yard / Hull no.:			
Vessel name / IMO no.:			
Yard / Vessel Claim no.:			
Marflex Order no.:			
Your Purchase order no.:		VAT no.:	
Order date:			

Required parts:

Part no.	Part description	Quantity

Delivery address:	Invoicing address:

Ordered by:	Signature:	Tel.no. / Email address:

Your order will not be handled if this form is not signed.

1.9 “Metaalunie” conditions

METAALUNIE CONDITIONS

Standard conditions of delivery and payment issued by the 'Metaalunie'[*] , referred to as the METAALUNIE CONDITIONS and previously as the SMECOMA CONDITIONS,
filed at the Registry of the District Court in Rotterdam on 1 January 2001.
Publication of the Metaalunie, P.O. Box 2600, 3430 GA Nieuwegein.

Article 1: Applicability

1.1. These conditions apply to all offers made by members of the Metaalunie and to all agreements they conclude and to all agreements that may be the result thereof. The offeror/supplier is the Metaalunie member who uses these conditions. Such member is designated in these conditions as the contractor or seller. The other party is designated as the customer or buyer.

1.2. These conditions may be used only by members of the Metaalunie.

1.3. The standard conditions of the customer shall not apply and are expressly rejected.

Article 2: Offers

2.1. All offers are made without engagement.

2.2. If the customer supplies data, drawings etc. to the contractor, the contractor may assume them to be correct and may base his offer upon them. .

2.3. The prices referred to in the offer are based on delivery ex works in accordance with Incoterms 2000. The prices are exclusive of turnover tax and packaging.

2.4. If his offer is not accepted, the contractor has the right to charge the customer for all the costs which he has had to incur in order to make his offer.

Article 3: Intellectual property rights

3.1. Unless agreed otherwise, the contractor retains the copyright and all industrial property rights in the offers made by him and in designs, illustrations, drawings, models, test models, software etc. supplied by him.

3.2. The rights to the data referred to in paragraph 1 shall remain the property of the contractor irrespective of whether costs are charged to the customer for their production. Such data may not be copied, used or shown to third parties without the express consent of the contractor. If this provision is infringed, the customer shall owe the contractor a penalty of EUR 25,000. This penalty may be claimed in addition to any compensation owed by law.

3.3. The customer must return the data supplied to him as referred to in paragraph 1 at the first request of the contractor within the period specified by the contractor. In the event of an infringement of this provision the customer shall owe the contractor a penalty of EUR 1,000 per day. This penalty may be claimed in addition to any compensation owed by law.

Article 4: Advice, designs and materials

4.1. The customer cannot derive any rights from advice and information obtained from the contractor if they do not relate directly to the order.

4.2. The customer is responsible for the drawings and calculations made by him or on his behalf and for the functional suitability of the materials prescribed by him or on his behalf.

4.3. The customer shall indemnify the contractor against any claim by its third parties relating to the use of drawings, calculations, samples, models and so forth supplied by or on behalf of the customer.

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[*] *Dutch Organisation of Entrepreneurs in Small and Medium-Sized Businesses in the Metalworking and Mechanical Engineering Industry*

4.4. The customer may, at his own expense, examine (or arrange for the examination of) the materials which the contractor wishes to use before they are processed. If the contractor suffers damage as a result, this shall be borne by the customer.

Article 5: Delivery period

5.1. The delivery period quoted by the contractor is approximate.

5.2. In fixing the delivery period the contractor assumes that he can execute the order in the circumstances known to him at that time.

5.3. The delivery period starts when agreement has been reached on all technical details, all necessary data, final drawings etc. are in the possession of the contractor, the agreed payment or instalment has been received and the necessary conditions for execution of the order have been fulfilled.

5.4. (a) If circumstances occur other than those known to the contractor when he fixed the delivery period, the contractor may extend the delivery period by the time necessary to execute the order in the circumstances. If the work cannot be fitted into the planning schedule of the contractor, it shall be completed as soon as his planning schedule permits this.
(b) If there is extra work, the delivery period shall be extended by the time that is necessary to supply (or arrange for the supply of) the materials and parts for this purpose and to carry out the additional work. If the extra work cannot be fitted into the planning schedule of the contractor it shall be completed as soon as his planning schedule permits this.
(c) If there is a suspension of obligations by the contractor, the delivery period shall be extended for the duration of the suspension. If continuation of the work cannot be fitted into the planning schedule of the contractor, the work shall be completed as soon as his planning schedule permits this.
(d) If work is impossible owing to weather conditions, the delivery period shall be extended for the term of the delay that has occurred as a result.

5.5 If the agreed delivery period is exceeded, this shall not under any circumstances confer entitlement to compensation unless this has been agreed in writing.

Article 6: Transmission of risk

6.1 In the case of delivery ex works, in accordance with Incoterms 2000, the risk in relation to the goods shall pass at the moment when the seller makes them available to the buyer.

6. Irrespective of the provisions of the previous paragraph, the customer and the contractor agree that the contractor shall arrange for the carriage. The risk of storage, loading, carriage and unloading shall be borne by the customer in this case too. The customer may insure himself against these risks.

6.3. Even if the seller installs and/or assembles the goods sold, the risk in relation to the goods shall pass at the moment when the seller makes them available to the buyer at the business premises of the seller or at another agreed place.

6.4. If a purchase involves a trade-in and the buyer continues to use the goods to be traded in pending delivery of the new goods, the risk in relation to the goods to be traded in shall continue to be borne by the buyer until the moment at which he transfers them to the possession of the seller.

Article 7: Price changes

7.1. If four months have passed since the date on which the agreement was concluded and its performance has not yet been completed by the contractor, an increase in the price-determinants may be passed on to the customer.

7.2. Payment of the price increase as referred to in paragraph 1 shall take place together with payment of the principal or the last instalment.

7.3. If goods are supplied by the customer and the contractor is prepared to use them, the contractor may then charge a maximum of 20 percent of the market price of the delivered goods.

Article 8: Impossibility of performance

8.1. The contractor shall be entitled to suspend performance of his obligations if he is temporarily prevented from performing them by circumstances that could not be foreseen at the time of the conclusion of the agreement and which are beyond his control.

8.2. Circumstances which could not be foreseen by the contractor and which are beyond his control are deemed to include failure of his suppliers and/or subcontractors to fulfil their obligations or to do so in good time, weather conditions, earthquakes, fire, loss or theft of tools, loss of processed materials, road blockades, strikes or work stoppages and import or trade restrictions.

8.3 The contractor shall not be entitled to suspend performance if performance is permanently impossible or if a temporary impossibility has lasted for longer than six months. The agreement may then be terminated in respect of such part of the obligations as have not yet been performed. In that case the parties shall not be entitled to compensation for damage suffered or yet to be suffered as a result of the termination.

Article 9: Scope of the work

9.1. The contractor shall ensure that all licences, exemptions and other decisions that are necessary in order to carry out the work are obtained in good time.

9.2. The price of the work does not include:
(a) the costs of groundwork, pile-driving, cutting, breaking, foundation work, bricklaying, woodwork, plastering, painting, wallpapering, repairs or other construction work;
(b) the costs of gas, water or electricity connections and other infrastructure facilities;
(c) the costs of preventing or mitigating damage to goods present at or near the work;
(d) the costs of removing materials, building materials or refuse;
(e) travelling and accommodation expenses.

Article 10: Alterations to the work

10.1. Alterations to the work shall result in any event in extra work or reduced work if:
(a) there is an alteration to the design or the specifications;
(b) the information provided by the customer does not correspond with the reality;
(c) the quantities diverge by more than 10% from the estimates.

10.2. Extra work shall be calculated on the basis of the value of the price determinants applicable at the time when the extra work is carried out. Reduced work shall be calculated on the basis of the value of the price determinants applicable at the time when the agreement was concluded.

10.3. If the increase and decrease in the work results on balance in a decrease the contractor may charge the customer in the final invoice 10% of the difference in the balances. This provision does not apply in the case of a reduction in the work that is a result of a request of the contractor.

Article 11: Execution of the work

11.1. The customer shall ensure that the contractor can carry out his activities without interruption and at the agreed time and that in the execution of the work he has access to the requisite facilities such as:
- gas, water and electricity;
- heating;
- a lockable and dry storage room;
- facilities prescribed under the Working Conditions Act and other health and safety regulations under that Act.

11.2 The customer shall be liable for all damage as a result of the loss, theft or burning of or damage to tools, materials and other property of the contractor located at the place where the work is performed.

11.3 If the customer fails to discharge his obligations as referred to in the previous paragraphs and the work is delayed as a result, the work shall be executed as soon as the contractor's planning schedule permits this. In addition, the customer shall be liable for all loss or damage suffered by the contractor as a result.

Article 12: Completion of the work

12.1. The work shall be deemed to have been completed when:
(a) the customer has approved the work;
(b) the work has been used by the customer; if the customer uses only part of the work, such part shall be deemed to have been completed;
(c) the contractor gives written notice to the customer that the work has been completed and the customer does not indicate in writing within 14 days of the notice whether or not the work has been approved;
(d) the customer does not approve the work on account of minor defects or missing parts which can be repaired or supplied within 30 days and which do not prevent the use of the work.

12.2. If the customer does not approve the work, he shall be obliged to give written notice of this to the contractor specifying the reasons.

12.3. If the customer does not approve the work he shall give the contractor the opportunity to complete the work anew. The provisions of this article shall then apply once again.

Article 13: Liability

13.1. The contractor is liable for damage which the customer suffers and which is the direct and sole result of a failure attributable to the contractor. However, only loss or damage for which the contractor is insured or for which he should reasonably have been insured will be eligible for compensation.

13.2. The following are not eligible for compensation:
(a) consequential loss or damage, including for example loss or damage due to business standstills and loss of profit;
(b) damage to goods which are being worked on or to goods which are in the vicinity of the place where the work is being carried out;
(c) damage caused by the intent or deliberate recklessness of auxiliaries.

13.3. The customer indemnifies the contractor against all claims of third parties on account of product liability due to a defect in a product which has been supplied by the customer to a third party and consisted wholly or partly in products and/or materials supplied by the contractor.

Article 14: Warranty

14.1. The contractor warrants the proper execution of the agreed performance for a period of six months after delivery or completion.

14.2. If the agreed performance consists in the carrying out of contracted work, the contractor warrants the soundness of the delivered construction and the materials used in the construction for the period referred to in paragraph 1, provided that he was free to choose such materials.

If it transpires that the delivered construction or the materials used are unsound, the contractor shall repair or replace them. The parts which the contractor is to repair or replace must be sent to him free of charge. The dismantling and assembly of these parts and any travelling and accommodation expenses incurred shall be borne by the customer.

14. If the agreed performance consists in the processing by the contractor of materials supplied by the customer, the contractor warrants the soundness of the processing for the period referred to in paragraph 1.

If it transpires that processing has not been carried out in a sound manner, the contractor shall choose whether:
- to carry out the processing anew, in which case the customer must supply new material at his own expense;
- to repair the defect, in which case the customer must return the material free of charge to the contractor;
- to provide the customer with a credit note for a proportionate part of the invoiced amount.

14.4. If the agreed performance consists in the delivery of an item of goods, the contractor shall warrant the soundness of the delivered item during the period referred to in paragraph 1.

If it transpires that the delivery has not been sound, the item of goods must be returned free of charge to the contractor. Thereafter the contractor shall choose whether:
to repair the item of goods;
- to replace the item of goods;
- to provide the customer with a credit note for a proportionate part of the invoiced amount.

14.5 If the agreed performance consists in part or in whole of the installation and/or assembly of a delivered item of goods, the contractor warrants the soundness of the installation and/or assembly for the period referred to in paragraph 1.

If it transpires that the installation and/or assembly has not been carried out in a sound manner, the contractor shall repair it. Any travelling and accommodation expenses shall be borne by the customer.

14.6. The factory warranty shall apply to parts in respect of which this has been expressly agreed in writing by the customer and the contractor. If the customer has had the opportunity to take cognizance of the content of the factory warranty, this shall take the place of the warranty under this article.

14.7. The customer must in all cases offer the contractor the opportunity to repair the defect or to carry out the processing anew.

14.8. The customer may invoke the warranty only after he has complied with all his obligations to the contractor.

14.9. (a) No warranty is given for defects that are a result of:
- normal wear and tear;
- injudicious use;
- non-maintenance or defective maintenance;
- installation, assembly, modification or repair by the customer or by third parties.

(b) No warranty is given for delivered items of goods that were not new at the moment of delivery.

Article 15: Claims

The customer may no longer invoke an instance of non-performance if he does not lodge a written claim with the contractor within 14 days of the date on which he discovers the defect or could reasonably be expected to discover it.

Article 16: Uncollected goods

If goods have not been collected by the time the delivery period expires, they shall continue to be held available for the customer. Uncollected goods shall be stored at the expense and risk of the customer. The contractor may always make exercise the power referred to in article 6:90 Civil Code.

Article 17: Payment

17.1. Payment shall be made at the place of business of the contractor or by remittance to an account designated by the contractor.

17.2. Unless agreed otherwise, payment shall be made as follows:
(a) cash in the case of an over-the-counter sale;
(b) if payment in instalments has been agreed:
- 40% of the total price at the time the order is placed;
- 50% of the total price after the material is supplied;
- 10% of the total price upon completion;

(c) in all other cases: within 30 days of the date of the invoice.

17.3. Regardless of the agreed terms of payment, the customer shall be obliged, at the request of the contractor, to provide such security for the payment as the contractor deems sufficient for the payment. If the customer fails to do so within the specified period, he shall be deemed to be immediately in default. The contractor shall in that case have the right to terminate the agreement and recover his loss or damage from the customer.

17.4. The customer does not have the right to set off claims against the contractor, unless the contractor has been declared bankrupt.

17.5. The full claim for payment shall be immediately due and exigible if:
(a) a payment period has been exceeded;
(b) the customer has been declared bankrupt or has applied for a suspension of payments;
(c) the property or accounts receivable of the customer are seized;
(d) the customer (being a legal entity) is wound up or liquidated;
(e) the customer (being a natural person) is made the subject of a guardianship order or dies.

17.6. If payment has not been made within the agreed period for payment, the customer shall immediately owe interest to the contractor. The interest shall be 10% per year or the statutory rate of interest, whichever is the higher. For the purpose of calculating the interest, part of a month shall be treated as a full month.

17.7. If payment has not been made within the agreed period for payment, the customer shall owe the contractor all extrajudicial costs of recovery, subject to a minimum of EUR 50.

The costs shall be calculated on the basis of the following table:

on the first EUR 3,000	15%
on any additional amount up to EUR 6,000	10%
on any additional amount up to EUR 15,000	8%
on any additional amount up to EUR 60,000	5%
on any additional amount over EUR 60,000	3%

If the extrajudicial costs actually incurred are higher than those in the above-mentioned table, the costs actually incurred shall be owed.

17.8. If the contractor is held to be in the right in legal proceedings, all costs which he has incurred in connection with the proceedings shall be borne by the customer.

Article 18: Reservation of title and right of lien

18.1. After delivery of the goods the contractor shall retain title to them as long as the customer:
(a) fails or will fail to perform his obligations under this agreement or other similar agreements;
(b) fails or will fail to pay for activities performed or yet to be performed under such agreements;
(c) Has not paid claims that result from the non-observance of the above-mentioned agreements such as damage, penalties, interest and costs.

18.2. As long as title to delivered goods is retained by the contractor, the customer may not encumber them other than in the normal course of his business.

18.3. After the contractor has invoked his reservation of title, he may retake possession of the delivered goods. The customer shall allow the contractor to enter the place where the goods are situated.

18. If the contractor is unable to invoke the reention of title because the delivered goods have been mingled, distorted or changed by way of accession (*accessio*), the customer shall be obliged to grant the contractor a lien on the newly created goods.

Article 19: Termination

If the customer wishes to terminate the agreement in circumstances where the contractor is not in default and the contractor agrees to this, the agreement shall be terminated by mutual consent. The contractor shall in that case be entitled to compensation of all pecuniary damage, such as any loss suffered, loss of profit and costs incurred.

Article 20: Applicable law and choice of forum

20.1. The law of the Netherlands is applicable.

20.2. The Vienna Convention on Contracts for the International Sale of Goods (CIGS) is not applicable, nor is any other international regulation the exclusion of which is permissible.

20.3. Only the civil court that has jurisdiction in the place of establishment of the contractor may take cognizance of disputes, unless this would be contrary to peremptory law. The contractor may deviate from this rule of jurisdiction and apply the statutory rules governing jurisdiction.

20.4. The parties may agree a different form of dispute resolution such as arbitration or mediation.

2 Safety

1 Safety, handling & storage

Note:

Read this manual carefully before installing or servicing any of the components of the pumps and/ or equipment, familiarize yourself with the operation of the pump and strictly obey the described instructions!

1.1 Safety instructions

The following instructions should be strictly followed in order to prevent dangerous situations as well as personal and/or property damage and to ensure a successful installation and well functioning pump system.

Special attention should be paid to:

1.1.1 Authorities & Classification

These safety instructions are based on authorities requirements.

However, since these requirements are revised from time to time it is necessary for personnel working with Marflex pumps, to be informed about changes.

This also applies to any discrepancies between national authorities and classification societies.

1.1.2 Signs and notations

Throughout this manual additional signs and notations have been inserted to draw attention to possible dangerous situations as well as to give tips while working on the pumps and/or it's equipment:

Danger!

Safety symbol indicating safety instructions to point out possible personal and material damage if not followed strictly!

Warning!

Safety symbol indicating safety instructions to point out possible personal damage if not followed strictly!

Caution!

Indicates that all procedures, instructions and guidelines, as mentioned in this manual, need to be followed strictly in order to prevent damage to pump and/or equipment.

Tip.

Useful tips & instructions for the owner and/or mechanics.

Note:

General remarks or advices.

1.2 Safe installation / maintenance

1.2.1 Lifting equipment

Warning!

When using lifting equipment be aware of the following:

1. Always check whether the lifting equipment has been approved

2. Perform a visual inspection to check for damage

3. Never stand under a hoisted pump or equipment.

1.2.2 Electrical system

Warning!

Before starting installation or maintenance be sure to check that the main power feed to the electrical motor of the pump has been switched off. Do not forget the standstill heating to the electric motor.

1.2.3 Tank entry

Warning!

If installation or maintenance has to be carried out in the cargo tank be sure to:

1. Close & lock all cargo valves

2. Follow regulations as prescribed by law for entering enclosed spaces

3. Carry out a gas & oxygen test (when pump and tank have been used)

4. Know the characteristics of the product that was last pumped (if applicable) and take precautionary actions like wearing protective clothing as well as a ventilating system

5. Have a supervisor present at the tank entrance.

1.2.4 Hydraulic equipment

Warning!

Extreme care must be taken when handling the following equipment:

1. Hydraulic hoses

-. Visual inspect hoses for damages, never use a damaged hose

-. Avoid damages to hoses at the sharp edges of a hatch

2. Couplings

-. Visual inspect the couplings on hydraulic equipment and hoses.

1.3 Receipt of goods

Upon arrival, immediately check the goods for:

1. Transport damage
2. Missing parts (to be checked against packing list).

If transport damage has occurred, be sure to record & photograph the damages and report this to carrier and Marflex immediately.

Any missing parts must be reported to Marflex.

1.4 Packing of pumps and equipment

Caution!

Marflex pumps, frequency converters & equipment are assembled and packed with the greatest care and cleanliness, therefore be sure not to damage the packing provided.

1.4.1 Deepwell pumps

- Discharge, stripping & purging flange on top cover are covered with protective material
- Emotor mounting flange on top cover is covered with plywood
- Afterwards the pumps are sealed in protective plastic and, in most cases, packed in totally enclosed wooden boxes.

1.4.2 Electric motors

- Electric motors are, due to their weight, shipped separately from the deepwell pumps and secured on pallets.

1.4.3 Frequency converters

- Frequency converters are shipped separately from the deepwell pumps, sealed in protective plastic and secured on pallets.

1.4.4 Deck trunks and barrels

- Deck trunks and barrels are secured on pallets.

1.4.5 Portable pumps and hoses

- Portable pumps and hoses are packed in totally enclosed wooden boxes.

1.4.6 Power packs

- Power packs are covered with a canvas cover and packed in a wooden box.

1.5 Marking

Every dispatched shipment will contain the following information and/or documents:

1.5.1 Packing list

1. Delivery address
2. Yard / Hull no. / Vessel name
3. Marflex Sales Order no
4. Part no. with part name(description)
5. Colli no. with contents
6. Quantity delivered
7. Date of delivery.

1.5.2 Packing specifications

- Every wooden box or pallet shipped is marked with a colli no. which can be checked against the packing list.

1.6 Handling of pumps and equipment

Caution!

Pumps & equipment need to remain in their protective cover until installation, this will ensure maximum cleanliness of pumps & equipment.

Lifting & handling must be done in a controlled and careful manner to avoid shock or vibration damage to bearings.

Never step or climb on the pump parts or the equipment!

Due to the weight of the various components, use a forklift.

1.6.1 Deepwell pumps & deepwell ballast pumps

Deepwell pumps can be shipped & packed as:

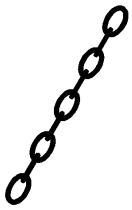
1. Pre-assembled at the factory (see 1.6.2)
2. To be assembled at the yard (see 1.6.3).

In both cases electric motors are, due to their weight, never assembled with the deepwell pump.

Caution!

To lift wooden boxes, use the marked lifting points and attach the lifting gear at the proper location underneath the box.
Any other location for the lifting gear may cause the box to tumble or fall.
(lifting gear is not supplied by Marflex supply).

Lifting points indicators.



1.6.2 Factory assembled

Top cover, pipe stack & pump head are assembled in the Marflex factory, this pre-assembled unit can be lifted from the wooden cases.

This assembled unit is equipped with transport supports, soft slings.

Transport supports are bolted on top cover & pump head side; soft slings are fitted on the pipe stack, ready to use instantly.

The pre-assembled unit rests on the transport supports in such a manner that no part of the pre-assembled unit can come in contact with the floor or loading platform.

Additional lifting eye nuts can be found in the toolbox.

1.6.3 Yard assembled

Make sure for lifting & handling of the various pump items to:

1. Use the delivered lifting eye nuts for the top cover & pump head
2. Use the delivered soft slings for the pipe stack.

Make sure to provide supports for the pipe stacks until the parts will be assembled just before installation.

Caution!

Never place the various pump parts on the floor without using pallets or plywood!

1.6.4 Electric motors

Caution!

Do not remove from their pallets on which they were delivered prior to installation!

1.6.5 Frequency converters

Caution!

Do not unpack and remove the frequency converters from their pallets on which they were delivered prior to installation!

1.6.6 Deck trunks for deepwell pumps & barrels for deepwell ballast pumps

Caution!

Do not remove the parts from their pallets on which they were delivered prior to installation!

1.6.7 Portable pumps & hoses

For handling purposes it is advisable to leave these items in the delivered wooden box as long as possible.

1.6.8 Electric driven power packs

Meant to be permanently installed in a dry & clean room onboard, lifting with a four-way lifting-gear (not supplied by Marflex).

The protection frame is capable of handling the weight of the power pack.

1.6.9 Diesel driven power pack

Meant to be used in various places onboard a vessel as well as onshore.

Equipped with a sturdy lifting lug for easy lifting onboard a vessel.

1.7 Storage at yard

Caution!

Marflex pumps & equipment are assembled & packed with the utmost care & cleanliness, therefore, be sure not to damage the packing provided.

Although Marflex pumps & equipment are mostly made out of stainless steel, it is advisable to store the pumps & equipment indoors.

Caution!

Be sure not to store the pumps & equipment in areas where welding, grinding, blasting or painting activities are carried out.

If stored improperly, Marflex accepts no liability and all warranty claims will be discarded!

Protective materials & plywood may not be removed until installation.

The following conditions have to be met to ensure proper storage for Marflex pumps & equipment.

1.7.1 Dry & clean room storage

A dry & clean room where the temperature is kept steady above dew point.

Components to be stored here are:

- Electric motors
- Frequency converters
- Frequency controller cabinets
- Electrically driven power packs.

1.7.2 Warehouse storage

Components to be stored in a dry & clean warehouse are:

- Factory & yard assembled pumps
- Electrical motors
- Deck trunks for deepwell & ballast pumps
- Barrels for deepwell ballast pumps
- Portable pumps, tripods & hoses
- Mounting sets (includes bolts, nuts and packings)
- Toolboxes
- Manuals.

1.7.3 Outdoor storage

Below noted components may be stored outside, only if protected by a canvas cover:

- Factory assembled pumps
- Stainless steel deck trunks for deepwell & ballast pumps
- Barrels for deepwell ballast pumps.

1.8 Disposal

Danger!

Do NOT dispose of components of the deepwell pump system containing cargo remains!

When disposing the deepwell pump system, the following actions must be taken in order to prevent any environmental pollutions:

1. Be sure to inspect the pump system in order to make sure that no cargo residue is present in the pump system before dismantling the pump system
2. All lubricants have to be drained from the pump and delivered to a chemical waste station
3. Packing & O-ring material is considered chemical waste as well
4. Stainless steel parts & electrical motors can be disposed of via a scrap yard.

3 General descriptions

1 Functional description

1.1 The Marflex deepwell pump system

1.1.1 Cargo pumps

The Marflex deepwell pump system is designed to discharge (liquid chemical) cargoes from cargo tank carriers.

Additionally the Marflex deepwell pump system ican be used as a:

- Slop pump
- Retention pump
- Residual pump.

The Marflex deepwell pump system contains a range of vertical centrifugal pumps, each type having a specific performance range.

The pumps are normally electrically driven* and optionally controlled through a:

- Soft starter
- Speed regulated generator
- Frequency converter system.

For removal of the last cargo remains a method of stripping over the impeller is used. Optionally a pneumatically driven draining pump can be installed.

* Optionally pumps can be hydraulically driven.

1.1.2 Ballast pumps

Marflex deepwell pumps can also be used for other purposes like pumping ballast (sea) water.

1.1.3 Optional

The Marflex deepwell pump system can be expanded with the following options:

- Hydraulic power pack
- Hydraulically driven portable, submersible, pumps
- Tank cleaning pump.

The portable equipment can also be used for several civil purposes.

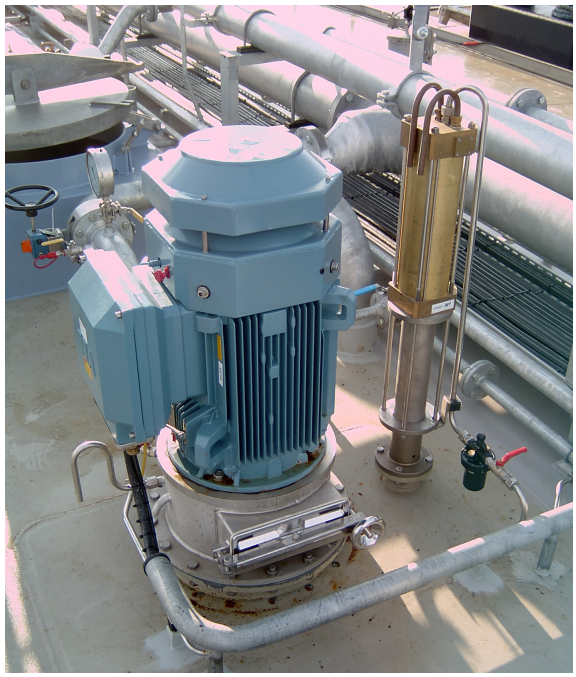
1.2 Basic system overview and operation

1.2.1 Cargo pump

On deck an explosion proof electric motor is installed on a top cover.

The electric motor drives, through an intermediate shaft, the centrifugal pump inside the cargo tank.

The pump transports the cargo through pipes to the manifold on deck to discharge the cargo.



1.2.2 Ballast pump

When the pump is used as a ballast pump a barrel is used to allow pump installation outside the tank.

Installation inside the tank is also an option.

1.3 System control

1.3.1 Basic control functions

(Control and operation of the pumps is determined by the yard / owner of the vessel.)

The electric motors are normally not directly connected online but through a control system. Connection of the electric motors to the control system has to be star-delta.

The control system can be equipped with on/off switches.

To reduce a high start current soft starters can be applied.

PTC-resistors are used for thermal protection of the electric motor.

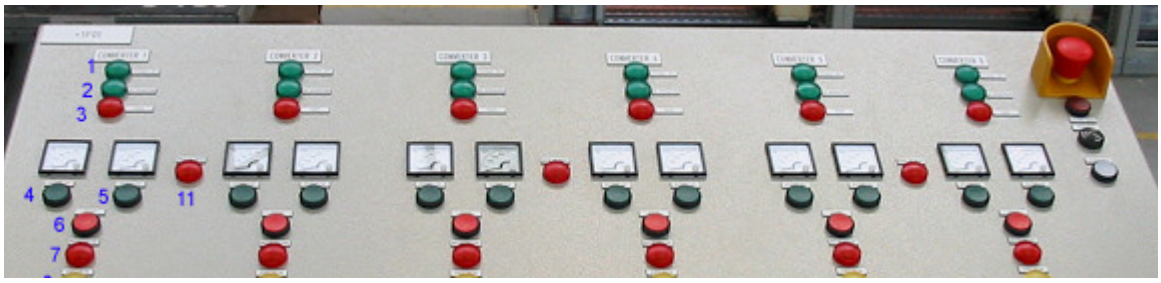
Also, emergency switches can be (remotely) installed to stop the pump system if necessary.

1.3.2 Optional control functions

The electric motor control system can, optionally, be equipped with:

- Soft starters, to reduce the high start current
- A speed controlled generator, to control the pump speed
- Frequency converters, to control the pump speed.

Pump control can be done from an operators desk.



1.4 System configurations

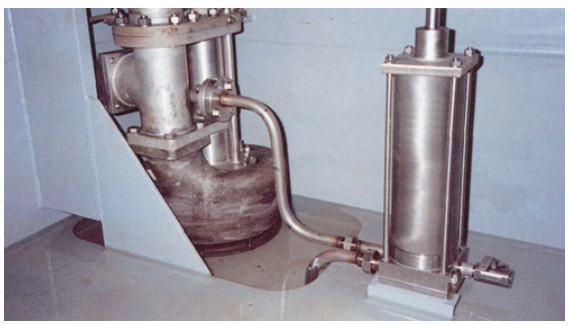
1.4.1 Stripping (standard)

To remove as much cargo from the cargo tank as possible a stripping procedure can be carried out. Pressurized air is then used to blow remaining cargo in the main cargo discharge pipe through stripping pipes from the tank to the piping manifold.

1.4.2 Draining pump (optional)

On deck an air cylinder is installed on a deck arrangement. The air cylinder drives through a shaft the (double action) pump in the cargo tank.

The pump removes the last remains of the cargo from the tank to the piping manifold.



1.5 Portable equipment (system backup)

1.5.1 Portable submersible pump

As backup of the pump system or for civil purposes (fire brigade) a portable pump can be used.

There are several different types of portable pumps.

The portable pump can be submerged in the cargo (fluid) inside the tank and discharge the cargo through flexible hoses out of the tank.

The portable pumps are hydraulically driven using hydraulic pressure from the ships hydraulic system or from a Marflex power pack.

Control is done using a flow controller.

1.5.2 Hydraulic power pack

To supply pressurized hydraulic oil for the operation of the portable pump a Marflex power pack is used.

The Marflex power pack can be an electric motor driven power pack or a diesel engine driven power pack.

1.5.3 Stand alone pumping system

The Marflex power pack in combination with a Marflex portable submersible pump can also be used as a stand-alone pump system.

2 Deepwell cargo pumps

2.1 Introduction

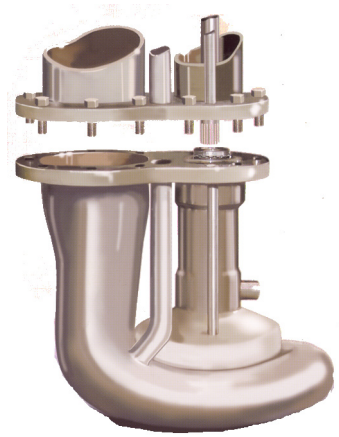
The Marflex deepwell cargo pump is a range of electrically driven, vertical single stage centrifugal pumps, each type of pump has a specific performance range.

The special multiple, modular stack design (with non cargo lubricated drive shaft) allows for immersion depths up to 40 meters.

The Marflex deepwell cargo pumps can be divided into two different types, which differ in their drive shaft layout.

First the most specific differences between the two types will be explained, followed by a general explanation of the pump layout which is identical for both types.

2.2 Marflex Deepwell Pump Double, type MDPD



The drive shaft is located next to the cargo transportation pipe in the pipestack.

The picture on the left shows the pumphead with a part of the pipestack.

This layout is used for the smaller types of Marflex deepwell cargo pumps.

2.3 Marflex Deepwell Pump Concentrically, type MDPC

The drive shaft is located inside the cargo transportation pipe in the pipestack.

The picture on the left shows the pumphead with a part of the pipestack.

This layout is used for the larger types of Marflex deepwell cargo pumps.

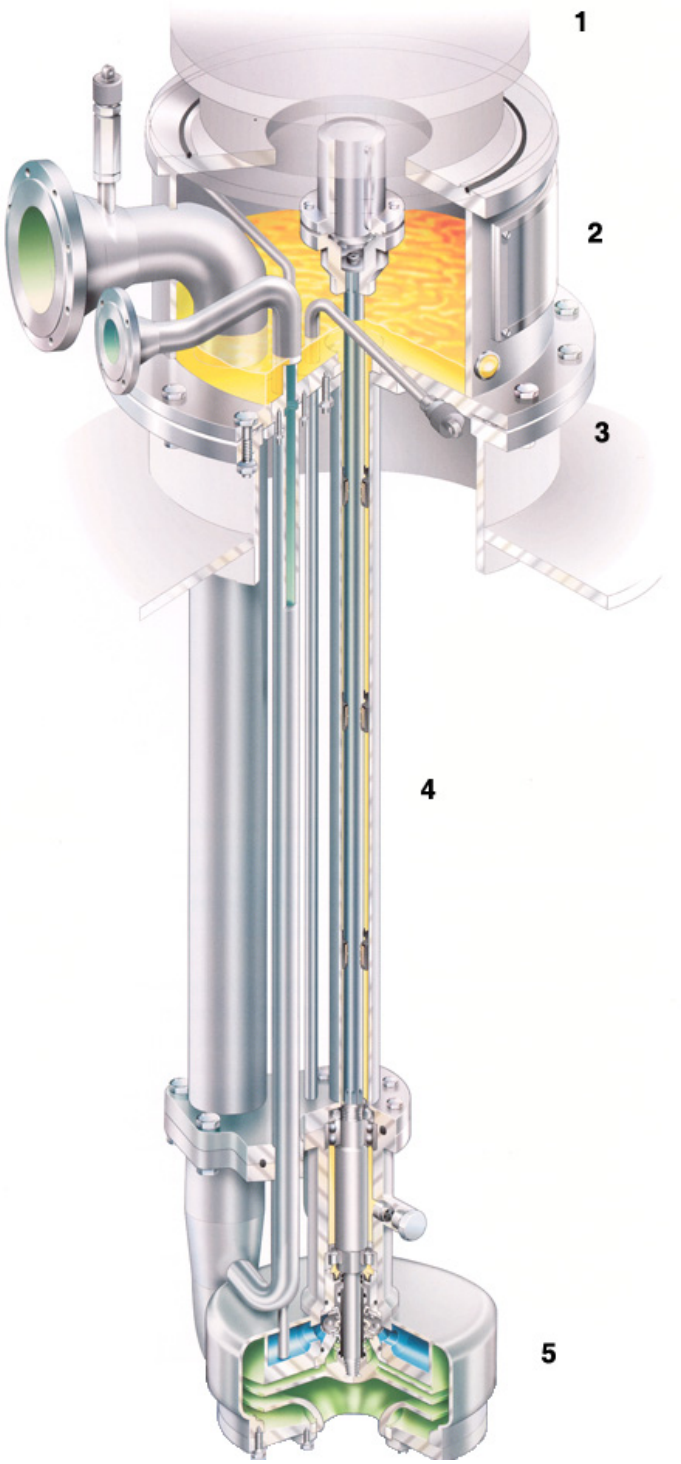
2.4 General layout

The Marflex deepwell cargo pumps are equipped with a “oil lubricated drive shaft” running in a separate supporting pipe. The service life of this ‘oil lubricated drive shaft arrangement’ is more than 10.000 running hours and is based on the service life of the bearings in the electric motor.

The 10.000 running hours are normally sufficient to last the lifespan of a sea-going vessel (20-25 years).

To explain the Marflex deepwell pump in details we divide the total pump layout in 5 sections:

1. Electric motor
2. Top cover
3. Deck trunk
4. Pipe stack
5. Pump head.



2.4.1 Electric motor

The Marflex deepwell cargo pump is driven by class-approved electric motors. Their main characteristics are in compliance with EExde IIC T4 & EExd IIC T4 explosion classes.

These explosion classes describe the environment in which the approved motors may operate, in this case being explosive atmospheres with incidental presence of gas.

Table 1: Explosion classes

EEx	de	IIC	T4	Description
Environment				Explosive atmosphere
	Protection-class			de: Motor with flameproof enclosure combined with increased safety terminal box d: Motor & terminal box with flameproof enclosure, highest possible protection
		Group of electrical machines		Machines for explosive atmospheres, highest possible rating which automatically covers all lower ratings
			Temperature-class	Ignition temperature for the gas/vapor: >135°C <200°C

All motors delivered according to above mentioned explosion classes are designed in such a way that no internal explosion can be transmitted to the surrounding explosive atmosphere; therefore the motor & terminal box enclosure, as well as the cable glands are able to withstand, without damage, any pressure level caused by an internal explosion.

A standard Marflex electric motor includes the following:

- Thermal overload device
- Anti-condensation heating
- Special surface treatment
- Protective cover.

Optionally the electric motor can be equipped with:

- Thermal overload device at bearings
- Thermal measuring devices at bearings & stator
- Saltwater environment protection
- Tropical environment protection
- Low-noise emission insulation.

The control of the electric motors is done using a star/delta starter, a soft starter or a frequency converter system. When using a frequency converter system, the control of the pumps characteristics can easily be changed to match client's requirements such as:

- Minimizing discharging time, minimizing cavitations & specific gravity of cargo
- Enabling a connection to a cargo monitoring system.

Additional advantages of a frequency converter system are:

- Soft start-up without any load peaks imposed on the drive shaft
- Low mechanical wear
- Low cavitation.

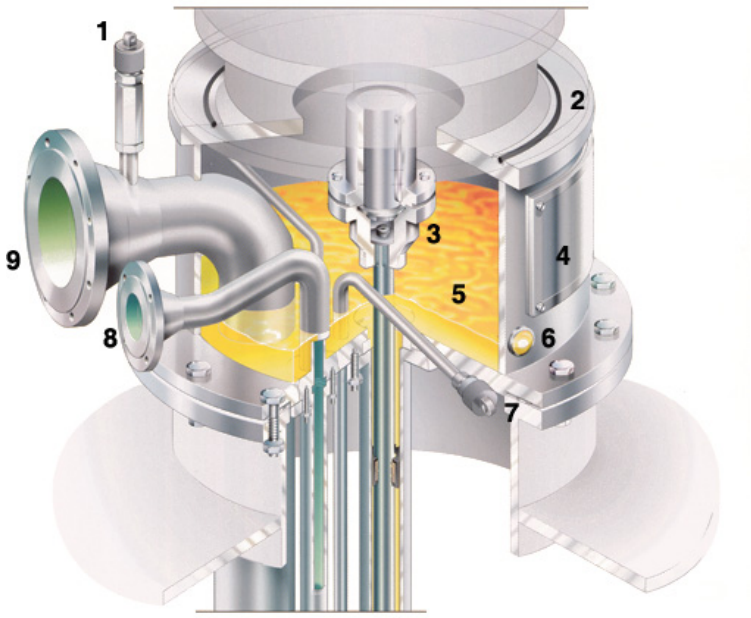
2.4.2 Top cover

The part on which the electrical motor is being mounted is called the top cover. This top cover has the following functions:

- Connecting an electrical motor onto the drive shaft by means of rigid couplings; this drive shaft runs through the pipe stack and drives the impeller located in the pump head at the lower end of the pipe stack in the cargo tank well
- Providing the discharge of cargo to the deck piping
- Connection of stripping pipe and/or super stripping pipe through discharge flanges
- Providing connection to the purging line to the cofferdam (½" quick coupling)
- Providing connection to the outlet of the purging line from the cofferdam (½" BSP screw thread, male)
- Acts as reservoir for the lubricant oil
- Contains a level gauge for the lubricant oil
- Holds a lubricant oil filling device
- Is equiped with an inspection hatch
- Contains an overflow/ventilation valve
- Allowing for connection of cargo temperature sensor(s) (3 sensors maximum)
- Connects the pipe stack to top cover; allowing for an easy-to-install pre-assembled deepwell pump. The top cover with pipe stack can easily be lowered through the pre-installed deck trunk (Marflex supply) and bolted onto the deck trunk
- Consists of AISI 316L (1.4404) as standard material, higher grade materials on request.

Deck arrangement components:

1. Non return valve
2. Sealing between electric motor & top cover
3. Connection electric motor to drive shaft
4. Inspection hatch
5. Lubricant oil reservoir
6. Level gauge for lubricant oil
7. Purge line
8. Stripping flange
9. Main cargo discharge flange



2.4.3 Deck trunk

The Deck trunk is a welded and machined part that forms the most important interface between the pump and the ship.

It has the following important functions:

- Providing the foundation on which the top cover is installed
- Allowing for feed-through of the pre-assembled deep well pump (top cover, pipe stack and pump head) through the ships deck.

In order to ensure proper operation of the deep well pump, as well as a rigid deck trunk installation, the following requirements must be met:

- At least three(3) deck stiffeners, preferable four(4) must be installed (dimensions of deck stiffeners are shown on the Marflex installation drawings, these dimensions are always minimal requirements)
- Fabrication and welding of the deck stiffeners must be carried out by the yard, following Marflex instructions as indicated in the Marflex manual
- Welding on the deck trunk flange is strictly prohibited.

To accommodate the ship's structure, the deck trunk can be supplied in materials like St.37-2 (1.0037) and AISI 316L (1.4404), higher grade materials can also be supplied on request.

2.4.4 Pipe stack

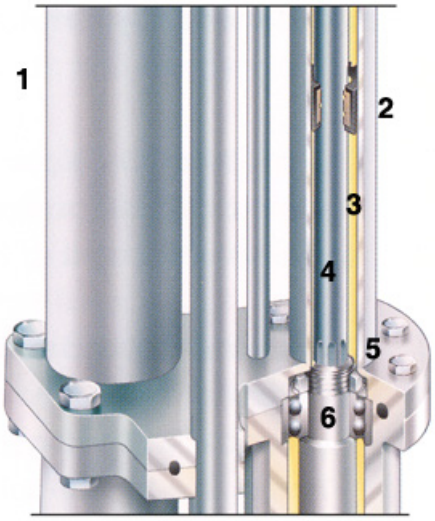
The design of the Marflex deepwell pump is based on a drive shaft which is separated from the cargo. The pipe stack consists of one cargo discharge pipe and one enclosing pipe for the drive shaft, shaft bearings & lubricating oil. Standard material is AISI 316L (1.4404), higher grade materials are available on request.

As the drive shaft is not exposed to the cargo, the advantages are:

- No need to use AISI 316L (1.4404) material for the drive shaft, instead 42CrMo4V can be used which is a heat treatable steel
- No danger of “dry running” the pump during stripping or tank cleaning actions as the drive shaft is fully oil lubricated
- No explosion danger from dry running or overheated bearings
- An extended life time of the drive shaft bearings as these are fully enclosed by the lubricating oil
- A relative high running speed of the pump as the drive shaft bearings are fully enclosed by lubricating oil
- The length of the pipe stack has no restrictions. However, every 6 meters of pipe stack requires an intermediate support that holds a ball bearing to take up axial load of each 6 meters shaft length only
- The axial thrust/load of the impeller will be taken up by the pump head shaft bearings and is not transferred to the drive shaft due to the “spline” connection between the pump head shaft and the drive shaft
  (a “spline” connection is a machined, toothed form with the teeth running axially on the shaft, one shaft end has internal teeth while the other shaft has external teeth. This connection allows for axial movement between the two connecting shafts).

Pipestack components:

1. Cargo pipe
2. Drive shaft bearing, made of Railko®, held within Viton®
3. Lubricant oil
4. Drive shaft
5. Spline connection
6. Intermediate support ball bearing.



2.4.5 Pump head

The Marflex pump head is designed in such a way that the pump head can be disconnected from the pipe stack while leaving the electric motor and pipe stack in the cargo tank, thus making maintenance very easy.

The so called “spline” connection, as mentioned in the previous chapter, is used to enable the pump head to be lowered by 30mm in order to be disconnected from the pipe stack. Therefore we only require approximately 40mm of clearance underneath the pump head.

The pump head’s standard material is AISI 316L (1.4404), higher grade materials are available on request.

Pump shaft:

Like the pipe stack drive shaft, the pump head drive shaft is not exposed to the cargo, therefore there is no need for AISI 316L (1.4404) material for the drive shaft either, instead 42CrMo4V can be used.

The pump shaft is mounted in two sets of bearings. These bearings are fully lubricated through the pipe stack lubricant, any heat build-up in the bearings is immediately discarded into the lubricant thus extending its life time to approximately 10.000 running hours.

Seal arrangement:

The Marflex deepwell pump is equipped with a special seal arrangement to separate cargo from lubrication oil and vice-versa; over the past 20 years this has proven to be a simple and reliable seal for all chemicals and mineral oil products.

Seal arrangement layout:

Primary oil seal is a Viton® lip seal running on a hard chromium sleeve.

Secondary cargo seal is a Teflon® lip seal running on a silicon carbide sleeve.

Secondary oil seal is a Teflon® lip seal running on a silicon carbide sleeve.

Primary cargo seal is a Teflon® lip seal running on a silicon carbide sleeve.

Between the two secondary seals an atmospheric drainage chamber is present, the so called “cofferdam”. This chamber acts as a buffer between the oil and the cargo seals. Any leakage that might occur is collected in the cofferdam. The cofferdam is connected (through the pipe stack) to the top cover on the main deck by two purge pipes.

By purging the cofferdam with air or nitrogen (at a pressure of approx. 3½bar), the contents of the cofferdam can be blown out and collected on the main deck where it can be analized. By following a regular purging routine the condition of the seals is constantly monitored.

Advantages of this seal arrangement are:

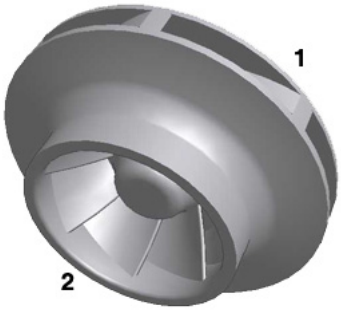
- Double protection with an atmospheric drainage chamber between cargo and lubrication side
- Reliable & simple
- Easy replacement by ship’s crew (low cost)
- Seal condition can be monitored from the main deck.

Impeller:

A wear ring is fitted in the dismountable suction cover to ensure the smooth running of the impeller. The impeller itself is fully casted and machined afterwards to meet client's specific flow (m³/h) & head (m1).

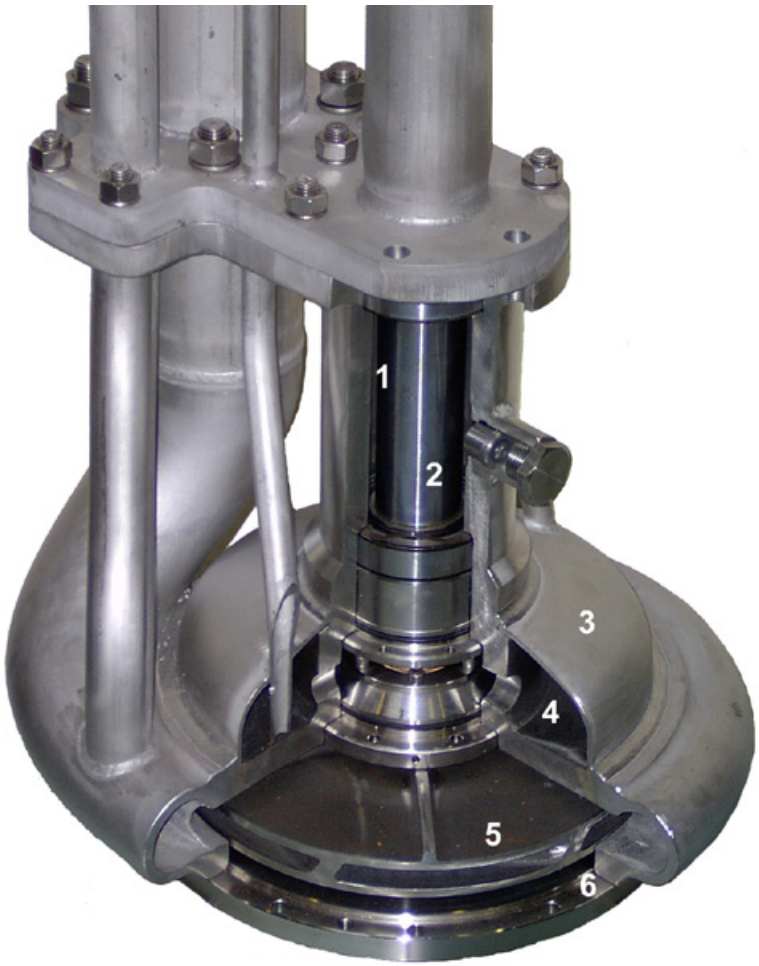
Impeller components:

1. Discharge vanes
2. Suction vanes.



Pumphead components:

1. Lubricant oil
2. Pump head shaft
3. Pump head casing
4. Cofferdam
5. Impeller
6. Wear ring.



3 Power packs

3.1 Introduction

The Marflex power pack is a range of self-contained, extremely compact and light weight built power supply equipment designed to drive the Marflex portable submersible pumps.

The Marflex power pack can be divided into two different types, these types differ only in type of drive, namely electrical or diesel driven.

Characteristics of all power packs:

- All components enclosed within a protection / lifting frame
- The protection / lifting frame is made from high tensile, sea water resistant aluminium and coated with a two component paint system
- A dashboard is incorporated in the protection / lifting frame to check and control the:
- engine / motor speed & temperature
- lubricating oil pressure
- hydraulic oil pressure & temperature
- dirt level

Furthermore the power packs consists of:

- A hydraulic oil tank
- A hydraulic oil cooler, thermostat controlled
- A hydraulic oil filter
- A protective high pressure relief valve
- Hydraulic connections for extensions hoses, most commonly used are:
- Self closing quick couplings with a locking device to prevent the couplings from separating accidentally
- SAE flanges.

The table below shows the various types of power packs with their designated portable pump.

Type	Type of drive	MSP 80	MSP 100	MSP 150	MSP 200	MSP 500	Mono	Weight incl. Hydr. oil
EHP-45	Electric	X	X					625 kg
EHP-75	Electric			X	X	X	X	1370 kg
EHP-100	Electric			X	X	X	X	2300 kg
DHP-50	Diesel	X	X					650 kg
DHP-120	Diesel			X	X	X	X	1025 kg

3.2 Electric motor driven power pack (EHP) description

A variable displacement hydraulic oil pump is installed on the electric motor using a lantern ring. Both shafts are connected to each other using a flexible coupling.

The hydraulic pump is fed with oil from the hydraulic oil tank.

The hydraulic pressure is set using a pressure relief valve on the operating panel of the power pack.

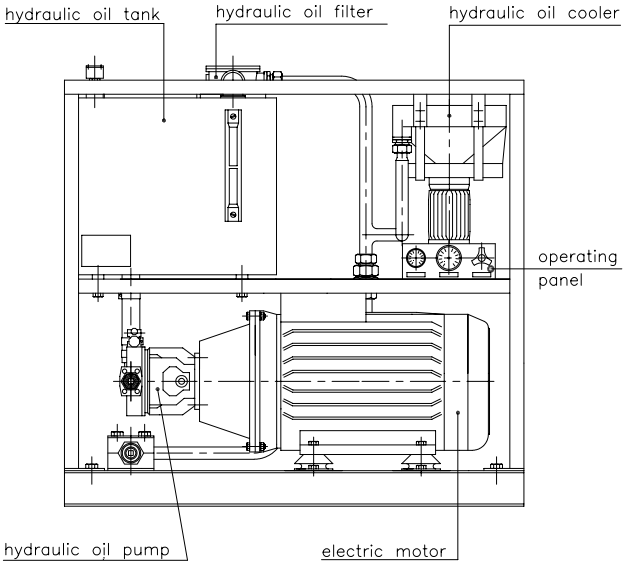
The variable displacement hydraulic oil pump increases the hydraulic pressure to the value set by the pressure relief valve. The hydraulic oil flow will, however, adapt to the quantity of hydraulic oil delivered, and allow for a constant pressure.

The pressurized hydraulic oil is transported to the consumer (hydraulically driven pump or a hydraulically driven crane or winch etc.) and will return to the power pack via the return system.

The hydraulic oil will increase in temperature during operation. The temperature is monitored by a temperature switch, set at a temperature of 40° Celsius. If this value is reached the temperature switch activates a relay switching on the electric motor of the hydraulic oil cooler.

The electrically driven hydraulic power pack consists of three main parts:

1. **Electric motor:**
   The electric motor is installed in a frame and drives the hydraulic oil pump.
   The electric motor is equipped with an anti-condensation heating. This facility is needed to prevent condensation and maintain the electric motor in good condition.
   A coupling is mounted over the electric motor shaft.
2. **Hydraulic Oil Pump:**
   The variable displacement, axial piston pump (swashplate design) is designed for hydrostatic transmissions in open loop circuits.
   The flow is proportional to the drive speed and the displacement. By adjusting the position of the swash plate it is possible to vary the flows smoothly.



3. **Hydraulic oil system:**
   For a correct operation of the power pack, a perfect clean hydraulic system is needed.
   The power pack is equipped with a hydraulic oil tank with a volume of 150 ltr.
   The pressurized oil flows through the hydraulic system to a consumer, for example a pump, and returns to the power pack.
   A temperature switch monitors the oil temperature and switches on the hydraulic oil cooler unit when the temperature of the hydraulic oil is above 40° C.
   The cooled hydraulic oil flows back in the hydraulic oil tank through a filter.
   The operating panel (dashboard) has:
   - a high pressure manometer showing the pressure of the hydraulic system
   - a temperature gauge displaying the oil temperature of the returned oil to the hydraulic oil tank.
   - a pressure relief valve, controls the hydraulic oil pressure.
   On the hydraulic oil filter, a dirt Indicator is installed.
   In the hydraulic oil tank, a level sensor switches off the power pack in case of a low oil level in the tank.

Components EHP:

1. Hydraulic oil cooler
2. Operation panel
3. Electric motor
4. Connections to consumers
5. Hydraulic pump
6. Hydraulic tank
7. Hydraulic filter assy.

3.3 Diesel motor driven power pack (DHP) description

The DHP is an extremely compact designed diesel engine driven hydraulic unit.

A variable displacement, axial piston hydraulic pump is driven by an air cooled diesel engine.

The diesel engine and hydraulic system are installed on the fuel tank to make a compact unit. The fuel tank is designed to contain fuel for a long operating time (190 ltr [± 42 UK gallon]). The hydraulic pump is fed with oil from the hydraulic oil tank.

An operating panel is used for control and operation.The hydraulic pressure is set using a pressure relief valve on the operating panel of the power pack.

The variable displacement hydraulic oil pump increases the hydraulic pressure to the value set by the pressure relief valve. The hydraulic oil flow will, however, adapt to the quantity of hydraulic oil delivered, so allowing a constant pressure.

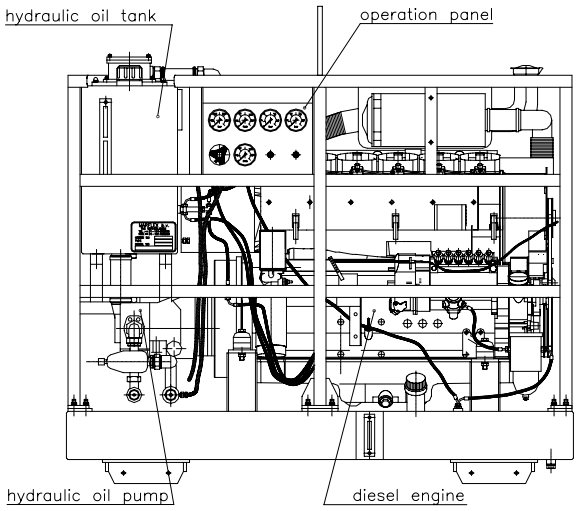
To prevent sparks between the power pack and the environment the base of power pack is equipped with four wooden blocks mounted at the bottom of fuel tank.

To check the level of fuel, the fuel tank is equipped with a level indicator.

The power pack frame is equipped with a hoisting eye, hoisting of the power pack is only allowed by means of this hoisting eye.

The diesel motor driven hydraulic power pack consists of three main parts:

1. **Diesel engine:**
   The diesel engine is mounted on four cushy floats at the foundation to absorb vibrations.
   A V-belt drives an air fan to cool the engine. A hydraulic oil cooler is mounted at the engine in such a way that also a part of cooling air of the engine flows to the hydraulic oil cooler.
   At the flywheel of engine a flexible coupling is mounted. A flexible coupling is used to eliminate the vibration of hydraulic oil pump to the diesel engine.
   A spring starter is used to start the engine.
   A too low engine oil pressure or a too high engine oil temperature switches off the power pack.
   An automatic diesel shutdown valve is, optionally, installed in the air inlet system.
   The exhaust of the engine is fully isolated and acts as a spark arrester and silencer.

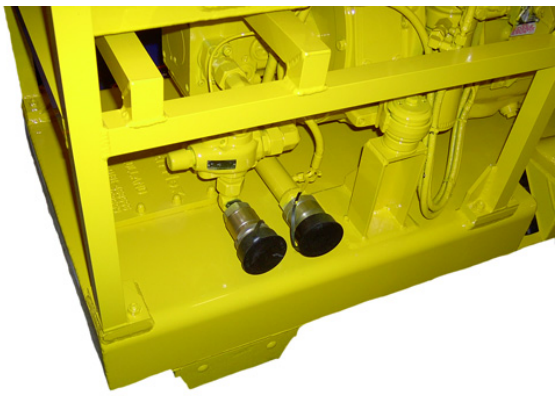


2. **Hydraulic Oil Pump:**
   The variable displacement, axial piston pump (swashplate design) is designed for hydrostatic transmissions in open loop circuits.
   The flow is proportional to the drive speed and the displacement.By adjusting the position of the swash plate, it is possible to smoothly vary the flow.
3. **Hydraulic oil system:**
   For a correct operation of the power pack, a perfect clean hydraulic system is needed.
   The power pack is equipped with a hydraulic oil tank with a volume of 90 ltr.
   The pressurized oil flows through the hydraulic system to a consumer, for example a pump, and returns to the power pack.
   The oil temperature is monitored by a three-way temperature valve set at a temperature of 40° C. The three-way temperature valve controls the hydraulic oil flow to the hydraulic oil cooler
   The cooled hydraulic oil flows back in the hydraulic oil tank through a filter.

Normal operating temperature of the hydraulic oil is 60 to 70 °C. A higher temperature switches off the power pack.
The operating panel (dashboard) has a high pressure manometer showing the pressure of the hydraulic system and a temperature gauge displaying the oil temperature of the returned oil to the hydraulic oil tank.
A pressure relief valve, controls the hydraulic oil pressure.
On the hydraulic oil filter, a dirt Indicator is installed.
In the hydraulic oil tank, a level sensor switches off the power pack in case of a low level of hydraulic oil in the tank.

Components DHP:

1. Lifting lug
2. Exhaust
3. Protection / lifting frame
4. Fuel tank
5. Operating panel
6. Connections to consumers



4 Portable pumps

4.1 Introduction

The Marflex Portable pumps are a range of hydraulically driven, portable centrifugal pumps

Each type of pump has a specific performance range , and/or application (see Table 1:).

4.2 Marflex Submersible Pump, type MSP

The Marflex Portable pumps are all of compact and light design. This enables it to be handled through a standard 12” tank cleaning hatch, a so-called Butterworth hatch; except for the MSP150 which has a larger outer diameter to cope with its specific application.

Furthermore, all Marflex Submersible pumps are suitable for operation in hazardous areas, all have a zero overload risk when the pump is blocked and all portable pumps can be driven by a ship’s hydraulic system or a portable power pack.

In the next table you will find an overview of the various Marflex Submersible pumps with their specific performance and application.

Table 1: Overview specific performance and application MSP's

Type	Products	Application	Performance	Materials	Outer diam.	Weight, ex. hoses
MSP-80	Chemicals, acids, solvents, petroleum products, crude oil & edible oils.	Backup cargo, fire fighting, tank cleaning.	70 m³/hr at 70 mlc*	Housing: AISI 316L. Seals: Teflon	250mm	38 kg
MSP-100	Suitable for liquids that require minimal motion and turbulence to avoid coagulation and/or emulsification.	Shipping, industry, oil recovery, salvage, sewage pumping, agriculture, tank cleaning.	150 m³/hr at 30 mlc*	Housing: Aluminum or Bronze Seals: Viton	305mm	Aluminum: 28 kg Bronze: 46 kg
MSP-150	Suitable for liquids that require minimal motion and turbulence to avoid coagulation and/or emulsification.	Shipping, industry, oil recovery, salvage, sewage pumping, agriculture, tank cleaning.	360 m³/hr at 40 mlc*	Housing: Aluminum Seals: Nitrile	490mm	85 kg
MSP-200	Chemicals, acids, solvents, petroleum products, crude oil & edible oils.	Backup cargo, fire fighting, tank cleaning, booster pump.	180 m³/hr at 70 mlc*	Housing: AISI 316L. Seals: Teflon	300mm	135 kg
MSP-500	Suitable for liquids that require minimal motion and turbulence to avoid coagulation and/or emulsification.	Salvage, oil transfer, deballasting, booster pump.	500 m³/hr at 30 mlc*	Housing: AISI 316L. Seals: Teflon	306mm	67 kg
MSP-EH 16/200, Mono	Molasses, unheated fuel oil, lub oil additives, clay slurries.	Shipping, industry.	1,6 liter per revolution.	Housing: Aluminum	300mm	98 kg

* mlc stands for meters liquid column

4.3 General description

To explain the differences between the various submersible pumps the main characteristics will be explained per pump type.

4.3.1 MSP-80

The MSP-80 is a light and compact high capacity hydraulic driven, single stage centrifugal pump. The pump impeller is keyed directly to the hydraulic motor shaft enabling a very compact design. Between the hydraulic motor and the pump impeller there is a double mechanical seal arrangement to ensure a proper separation of hydraulic oil and product.

For connection to a ship's hydraulic system or a portable power pack, the MSP-80 is standard equipped with 18 meter length pressure & return hoses; these hoses are equipped with self closing quick couplings with a locking device to prevent the couplings from separating accidentally.

A distribution piece is installed on the hoses. This distribution piece divides the two concentric hoses into two separate connections.

1. Pressure hose located inside return hose
2. Return hose
3. Quick coupling
4. Distribution piece
5. Discharge connection
6. Pump casing

For discharge connections Marflex can supply the following sizes:

- Flange DN100-PN10
- Flange JIS10K100A
- Camlock 4”

(standpipe with flange DN100-PN10 shown as example)

4.3.2 MSP-100

The MSP-100 is a light and compact high capacity hydraulic driven, single stage centrifugal screw pump, based on a Hydrostal® Centrifugal Screw impeller; this type of impeller combines the properties of a screw pump with those of a centrifugal pump.

Slow liquid speeds and low shear forces in the cargo are a direct consequence of the shape of the impeller, this makes the pump suitable for liquids which have to be handled carefully and without excessive motion and turbulence; thus avoiding emulsification like water & oil mixtures. This specific quality of the pump makes it perfect for oil recovery operations and has led several Coast Guards to standardize on this type of pump.

For connection to a ship's hydraulic system or a portable power pack, the MSP-150 is standard equipped with self closing quick couplings with a locking device to prevent the couplings from separating accidentally. Additional extensions hoses are available, at a length of 18 meters.

1. Discharge connection
2. Pressure & Return hose
3. Pump casing

4.3.3 MSP-150

The MSP-150 is a light and compact high capacity hydraulic driven, single stage centrifugal screw pump, based on a Hydrostal® Centrifugal Screw impeller; this type of impeller combines the properties of a screw pump with those of a centrifugal pump.

Slow liquid speeds and low shear forces in the cargo are a direct consequence of the shape of the impeller, this makes the pump suitable for liquids which have to be handled carefully and without excessive motion and turbulence; thus avoiding coagulation of natural Latex and emulsification like water & oil mixtures. The natural Latex version of this pump is equipped with a special arrangement which includes a Knife edge seal on cargo side.

This last specific quality of the pump makes it perfect for oil recovery operations and has led several Coast Guards to standardize on this type of pump.

For very viscous products like Molasses and heavy Fuel oil more powerful hydraulic motors are available.

For connection to a ship's hydraulic system or a portable power pack, the MSP-100 is standard equipped with 0,5 meter length pressure & return hoses; these hoses are equipped with self closing quick couplings with a locking device to prevent the couplings from separating accidentally. Additional extensions hoses are available, length 18 meters.

1. Discharge connection
2. Pressure & Return hose
3. Pump casing

4.3.4 MSP-200

The MSP-200 is a light and compact high capacity hydraulic driven, single stage centrifugal pump. The pump impeller is keyed directly to the hydraulic motor shaft enabling a very compact design. Between the hydraulic motor and the pump impeller is a double mechanical seal arrangement to ensure a proper segregation of hydraulic oil and product.

For connection to a ship's hydraulic system or a portable power pack, the MSP-200 is standard equipped with 18 meter length pressure & return hoses; these hoses are equipped with self closing quick couplings with a locking device to prevent the couplings from separating accidentally.

A distribution piece is installed on the hoses, this distribution piece divides the two concentric hoses into two separate connections. On this distribution piece a needle valve is installed for start, stop & pressure regulation. Pressure can be read on the pressure gauge.

1. Pump casing
2. Pressure hose located inside return hose
3. Distribution piece with start-stop valve & pressure gauge
4. Quick coupling
5. For discharge connections Marflex can supply the following sizes

- Flange 6" DN150-PN10
- Flange JIS10K150A
- Camlock 6"
- 5" Sandvik coupling "L"
- 6" Sandvik coupling "L"

(standpipe with 6" Camlock connection shown as example)

4.3.5 MSP-500

The MSP-500 is a light and compact high capacity hydraulic driven, single stage centrifugal pump. The pump impeller is keyed directly to the hydraulic motor shaft enabling a very compact design. Between the hydraulic motor and the pump impeller is a double mechanical seal arrangement to ensure a proper segregation of hydraulic oil and product.

For connection to a ship's hydraulic system or a portable power pack, the MSP-500 is standard equipped with 18 meter length pressure & return hoses; these hoses are equipped with self closing quick couplings with a locking device to prevent the couplings from separating accidentally.

A distribution piece is installed on the hoses, this distribution piece divides the two concentric hoses into two separate connections. On this distribution piece a needle valve is installed for start, stop & pressure regulation. Pressure can be read on the pressure gauge.

1. Quick coupling
2. Pump casing
3. For discharge connections Marflex can supply the following sizes:

- Camlock 6”

4.3.6 MSP-EH 16/200 (mono pump).

The MSP-EH 16/200, Mono pump is a hydraulic driven, eccentric helical pump, using the positive displacement principle. The pump consists of a rotating element (worm or rotor) and a static element (stator).

The rotor(chromium steel) is shaped as a worm having a relative coarse pitch, on the contrary, the stator (NBR rubber) has the same shape but with a pitch exactly half a coarse as the rotor's pitch. This difference in pitch creates so-called chambers between the rotor and the stator. As soon as the pump the pump starts running these chambers will move from the suction side of the pump and accordingly cargo will move into the same direction.

Sealing between the stator and rotor is always available, independent from the position of the stator and rotor with regard to each other. This means that at any position of the rotor the pressure side is always separated from the suction side.

For connection to a ship's hydraulic system or a portable power pack, the MSP-EH 16/200, Mono pump is standard equipped with 0,5 meter length pressure & return hoses; these hoses are equipped with self-closing quick couplings with a locking device to prevent the couplings from separating accidentally. Additional extensions hoses are available, at a length of 18 meters.

1. Quick coupling
2. Pump casing
3. For discharge connections Marflex can supply the following sizes:

- Camlock 4”
- DN 100- PN 10
- Sandvik FCL 4” flange
- JIS 10K 100A flange

5 Tripod

The Marflex Tripod is a compact and sturdy hoisting device, designed to handle portable pumps, cargo and hydraulic hoses during overtop off-loading.

The tripod has a Safe Working Load (SWL) of 500 kg and can be equipped with a manual-, air- or electric motor driven winch. Each winch is fitted with 35 meters of stainless steel wire.

The tripod has two fixed legs and one hinged leg for easy storage. Two wheels enable one man to carry the tripod over deck. The tripod is also equipped with safety chains that limits the opening of the separate legs of the tripod.

Weight of the tripod with:

- Manual winch:62 kg
- Air driven winch:78 kg

1. Wheels for manual transport
2. Winch
3. Safety chain, protection against too wide opening of the Tripod's legs

4 Operation and control

1 Cargo pump operation

Caution!

It is NOT allowed to operate the pump in the wrong rotational direction!

Caution!

Maximum operating temperature is 100 °C! When using seawater maximum operating temperature is 30 °C!

Caution!

Prevent dry operation of the pump! (maximum duration is 3 minutes!)

Caution!

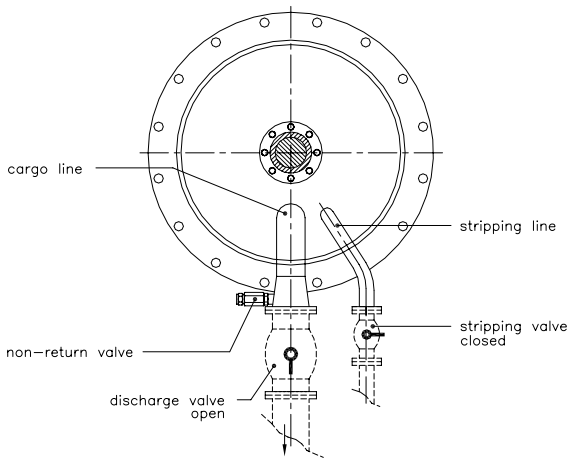
It is NOT allowed to operate the pump with the electric motor cover installed!

1.1 Preparation

1. Remove the electric motor cover
2. Check the oil level in the top cover and correct if necessary
3. Check connections and valves in the pump system for discrepancies
4. Carry out a purging procedure (see chapter “Pump seal monitoring”) and record result
5. Make sure the discharge valve is closed
6. Verify all other valves in the pump system are positioned correctly.

1.2 Operation (first start and parallel operation)

1. Start the pump
2. Check the electric motor for operation
3. Check the pressure indicator for pressure increase (if applicable)
4. Open the discharge valve if pressure is above manifold pressure
5. Allow pump to operate
6. Check pump is discharging and no back-flow occurs.

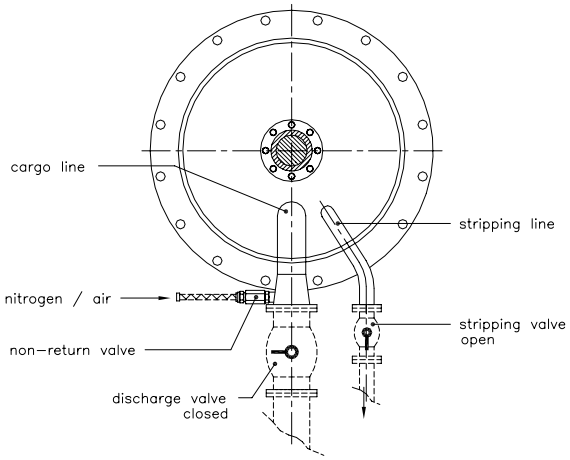


1.3 Monitoring

1. During operation monitor the electric motor for vibrations or excessive heating
2. During operation monitor the pump assembly for vibrations or excessive heating
3. During operation monitor the top cover, lines, connections and valves for leakage or discrepancies

1.4 Operation (stop)

1. Carry out a stripping procedure (see chapter “Stripping routine”) (if applicable)
2. Close the discharge valve
3. Stop the pump



1.5 Finishing

1. Carry out a purging procedure (see chapter “Pump seal monitoring”) and record result
2. Check the oil level in the top cover and adjusts it if necessary
3. Install the electric motor cover once the system has cooled down (± 3 hours)

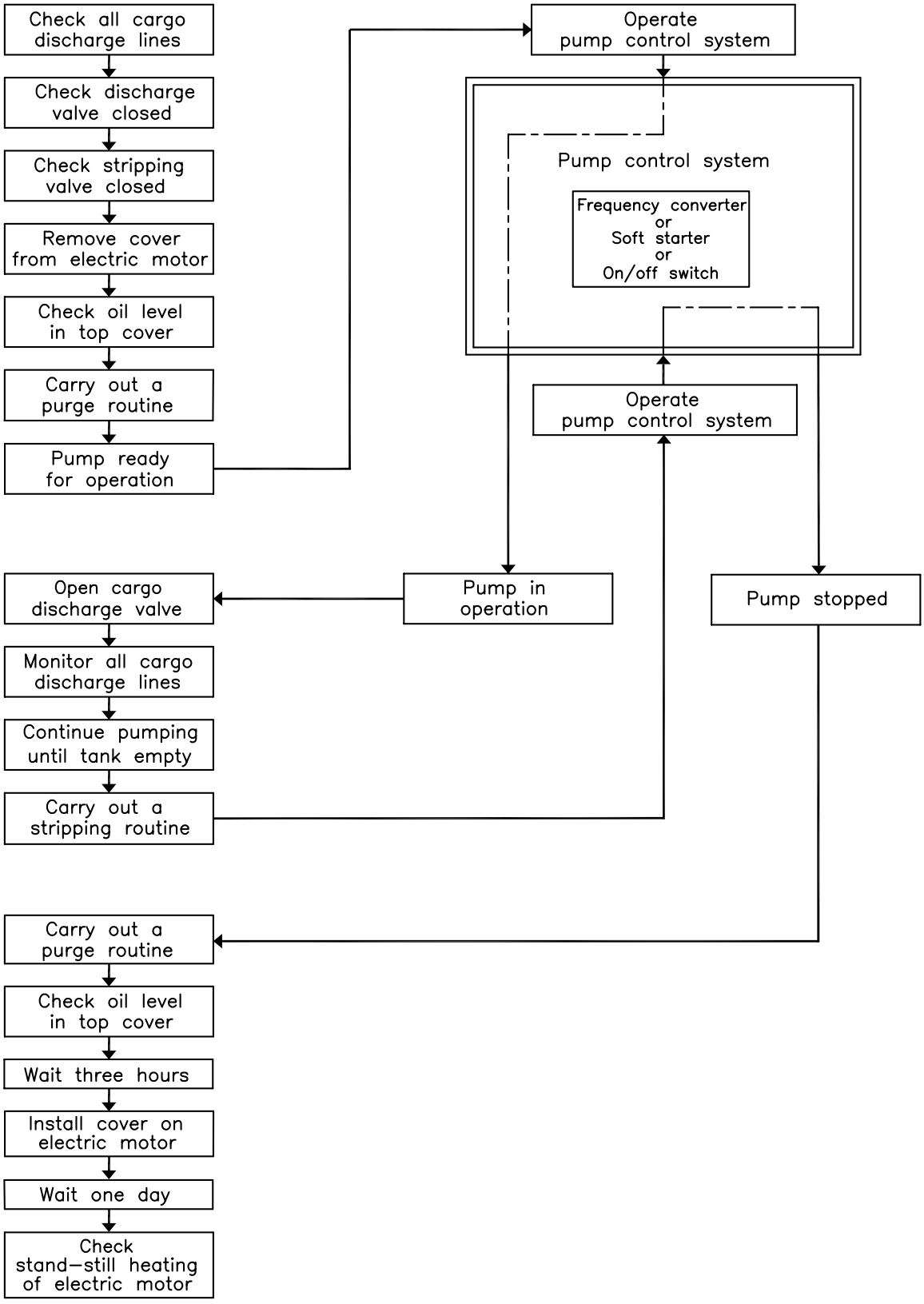
1.6 Stationary checks

Danger!

Do NOT open terminal boxes in the hazardous area!

1. Check the standstill heating of the electric motor (regularly) for operation while the pump is switched off
2. During cargo loading make sure the electric motor (=pump) is NOT rotating
3. During voyage carry out a purging procedure regularly (see chapter “Pump seal monitoring”)

1.7 Operation procedure (schematic)



1.8 Handling special types of cargo

1.8.1 Heavy products

When products with a higher specific gravity then specified for the pump are transported, the advised discharge pressure is then calculated as follows:

Multiply the specific gravity of the product by the discharge head of the pump as mentioned in the specification and divide this product by 9.8. The result is a discharge pressure in bar.

For example: A product has a s.g. = 1.2, and a discharge head of the pump = 80 mlc.
Advised discharge pressure is then: 1.2 x 80 = 96, 96 : 9.8 = 9,8 bar.

1.8.2 Solidifying products

When transporting products with a tendency towards solidification due to environmental / seasonal influences, a stringent purging policy is required. See also 1.9 (Pump cleaning / tank washing).

1.8.3 Liquid filled cofferdam

Normally the cofferdam is clean, dry and ventilating to ambient.
This makes it possible to detect leakages during the purging routine.

When handling some specific products however it is beter to fill the cofferdam with a liquid to prelong the seal life-time and prevent solidified product to cause blockage.
See chapter “Pump seal monitoring” for system set up examples.
The table below gives a few recommendations for the type of liquid that can be used in the cofferdam related to the product in the cargo.

Table 1: Cofferdam filling procedure for some special products

Product	Procedure
Acid products	After discharging and purging flush the cofferdam with fresh water to remove all residue in case of a leakage
Crystallizing products (molasses, e.g.)	Fill the cofferdam with fresh water (5 - 10 litres) The cofferdam may also be filled completely with some circulation arrangement
Heated oil products (fuel oil, crude oil, e.g.)	Fill the cofferdam with dieseloil / white spirit (± 5 - 10 litres) keeping any leakage into the cofferdam in liquid form Particular after stripping and during tank cleaning
Phenol, caustic, e.g.	Circulate hot water through the cofferdam to prevent clogging Be aware of the danger of these products (poisenous, e.g.)
Polymerising products	Fill the cofferdam with a special product (± 5 - 10 litres) (Dioctyl phthalate, DOP) to prevent blockage

1.9 Pump cleaning / tank washing

Caution!

Remove all cleaning fluid from the tank after cleaning / washing to prevent severe corrosion of the tank or the pump!

Caution!

When using steam to clean the pump limit the cleaning time (max. 10 minutes) to prevent damage to the seals!
Always carry out a purging routine before cleaning / washing with steam!

Caution!

When using sea water for cleaning / washing note the precautions in 1.10!

1.9.1 Viscous / solidifying products

1. Supply a continous flow of cleaning water / liquid into the tank
2. Operate the pump at approximately the same flow rate as the supply
3. Stop the pump halfway during the washing procedure
4. Allow the level of cleaning fluid to rise to 5 - 10 cm
5. Operate the pump at full speed to thoroughly clean the wear ring, impeller and other pump parts (± 3 - 5minutes)
6. Close the discharge valve and open the stripping valve to clean the stripping line (± 2 - 3 minutes)
7. Close the stripping valve and open the discharge valve
8. Operate the pump at full speed to empty the tank
9. Carry out a stripping routine to empty the pump discharge line.

1.9.2 Corrosive products

1. Flush the tank with a large amount of water as soon as possible to reduce the exposure time of the tank and pump to extreme corrosive product concentrations
2. After flushing carry out the procedure for viscous / solidifying products according to 1.9.1.

1.10 Precautions when using pumps with sea water

Caution!

Avoid contaminated harbour water! Use fresh seawater from the open sea (if possible)!

Seawater can be used for various purposes in the tank and piping systems:

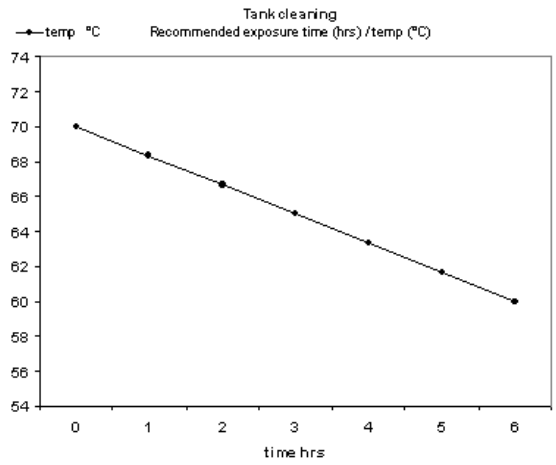
- Tank cleaning
- Heavy weather ballast
- System testing.

In general seawater has no effect on the used materials of the cargo pump. However, in some circumstances corrosion can occur locally:

- Pitting corosion on places with stationary sea water, particularly at high temperatures
- Crecive corrosion
- Stress corosion cracks at temperatures above 70 ºC.

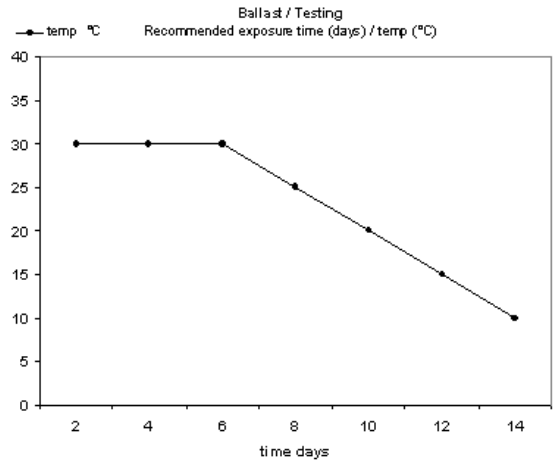
1.10.1 Using seawater for tank cleaning / washing

- Check carefully the nature of the previous cargo load (acid?)
- Keep the temperature below 60 °C
- A temperature of 70 °C is allowed for a limited period of time
- Keep the cleaning / washing water circulating continuously
- Prevent usage of chlorinated water
- Prevent pH values below 7
- Flush the tank and pump with fresh water after using seawater.



1.10.2 Using seawater for testing or ballast

- Empty the the tank as soon as possible when testing is complete or ballast is no longer required
- Flush the tank and pump with fresh water after using seawater.



2 Pump seal monitoring

2.1 Introduction

The shaft seals in a Marflex deepwell pump separate the cargo from the lubrication oil inside the pump.

Any leakage through the shaft seals of cargo or lubricating oil is collected in a drainage chamber, called the cofferdam.

To check the condition of the shaft seals in a Marflex deepwell pump the cofferdam is frequently blown-through with clean and dry air or nitrogen.

The air or nitrogen enters the pump via the purge inlet on the topcover and purges the cofferdam through the purge pipe.
Via the purge outlet on the topcover the content of the cofferdam is collected.

By inspecting this content the condition of the shaft seals can be determined.

Caution!

Failure to follow a strict purging regime, using the mandatory interval frequency in 2.2.1 as minimum, can result in blocked purge lines, incorrect purge results, pump performance decrease or pump failure!
Marflex can not be hold liable for any damage in these cases.

2.2 Purging of a deepwel pump

Warning!

Take proper precautions when purging a pump used with dangerous cargo and observe the prescribed regulations for handling dangerous goods.

Warning!

The air / nitrogen exhausted from the purge outlet can contain (dangerous) cargo.
Use proper protection for eyes, clothes, skin, etc..

Warning!

Observe the prescribed environmental regulations.
Dispose of contaminated collected purged air / nitrogen according to prescribed rules.

2.2.1 Interval frequency

To monitor the condition of the shaft seals in the deepwell pump, purging is carried out at frequent intervals.

Carry out purging:

- before loading cargo
- 12 hours after loading cargo (when residues are discovered, then purge daily)
- during transport, every week
- prior to unloading cargo
- after unloading cargo.

The intervals above are mandatory.
A higher interval frequency can reduce the possibility of defects.

2.2.2 Limits

During purging observe the limitations in following table:

Table 1: Limits

Product	Quantity	Action
lubricant	0 - 0,2 ltr.*	pump may continue to operate check lubricant level and replenish
lubricant	> 0,2 ltr.*	determine cause of leakage and repair
cargo	0 – 0,5 ltr.*	pump may continue to operate monitor pump operation precise
cargo	> 0,5 ltr.*	determine cause of leakage and repair

* Depending on the specific gravity of the cargo and the pump size a larger quantity is allowed.

2.2.3 Precautions and preparations

Danger!

The purge outlet must ALWAYS be open and connected to ambient!

Caution!

It is NOT allowed to connect the purge inlet permanently to an air or nitrogen source!

Caution!

Use ONLY clean / dry nitrogen or air when purging a deepwell pump!

Caution!

Use the Marflex supplied purge set to clean the air or nitrogen and to reduce the pressure to a maximum of 3,5 bar.
To only reduce pressure a Marflex supplied pressure reducer and relief valve can be installed on each pump's top cover.

Note:

A dirty / polluted air- or nitrogen supply system affects the purge results.

Prepare an air or nitrogen source to connect to the purge inlet of the pump's topcover.

Make sure used hoses are not polluted by products.

Determine the pump's top cover layout.
When no pressure reducer and relief valve (see 2.5.2) is installed on the top cover the Marflex supplied purge set (see 2.5.1) must be used!

2.2.4 System setup (typical)

Caution!

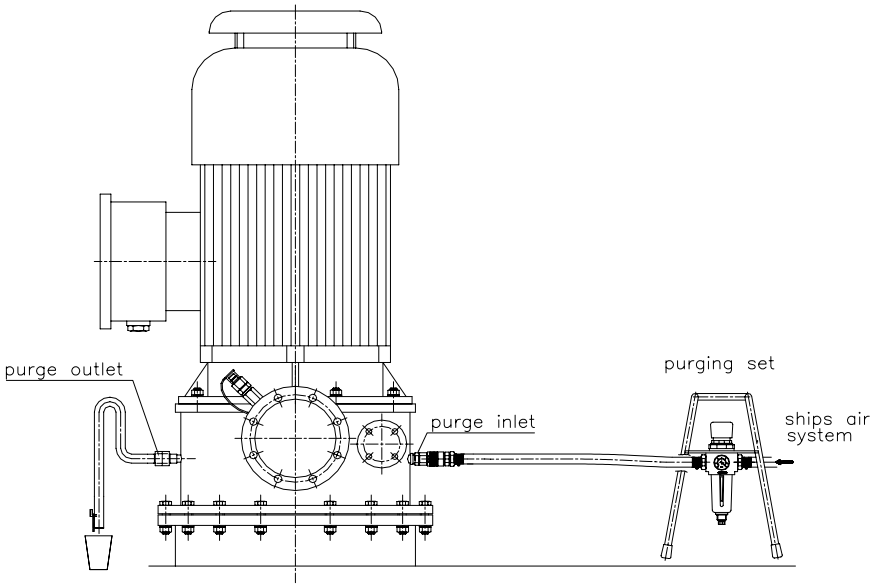
To prevent contamination of the ships air system it is not allowed to connect the purge inlet directly to the ships air system.

Use the Marflex purge set to connect the ships air / nitrogen system to the purge inlet and connect the purge set to the purge inlet quick coupling.

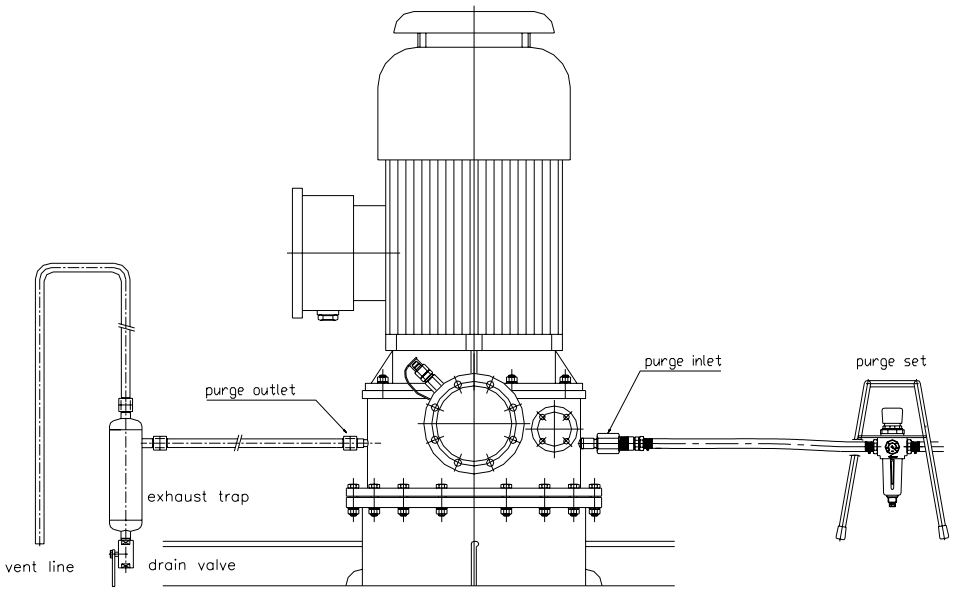
The purge set reduces the pressure (max. 3,5 bar), cleans the air / nitrogen and separates from the ships air / nitrogen system.

The content from the cofferdam is collected using several methods depending on the cargo carried.

System set-up (typical)



System set-up using an exhaust-trap



2.2.5 System setup with headertank

Caution!

To prevent contamination of the ships air system it is not allowed to connect the purge inlet directly to the ships air system.

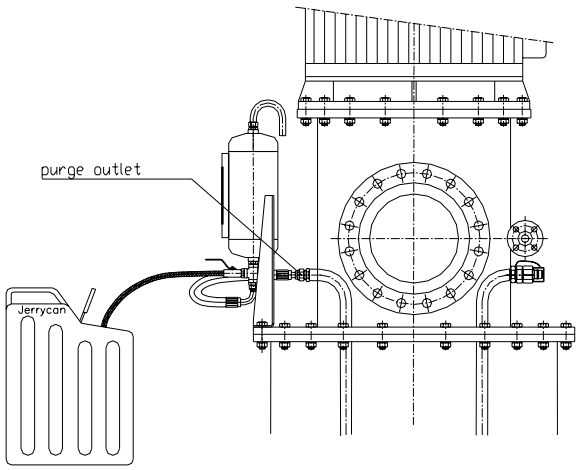
In a pump system equipped with a headertank the cofferdam and the purge pipes are completely filled with oil or a special, cargo soluble, liquid.

Monitor the level through the sight glass in the headertank to get an indication of the condition of the shaft seals.

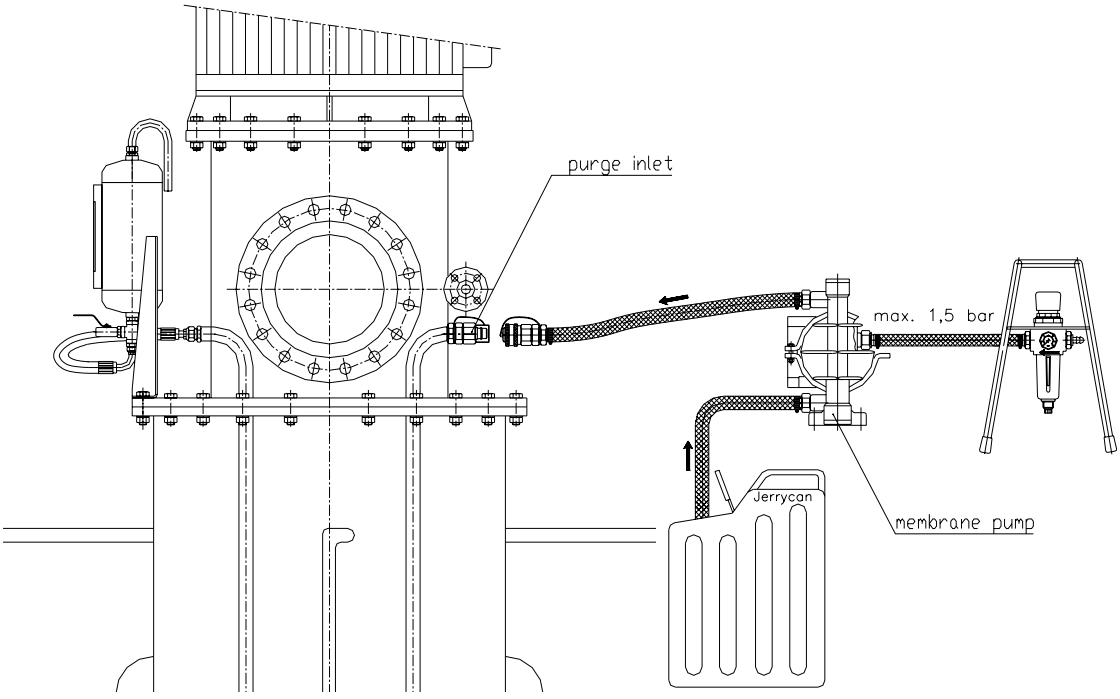
Blow through using the purge set to remove the oil from the system.

Collect the oil from the cofferdam and purge pipes in a suitable container for inspection and analysing.

Refill the system with oil using the membrane pump (max. air press. 1.5 bar).



System set-up with a headertank



2.2.6 System setup with a closed circuit purge unit

Danger!

Make sure to follow the operating instructions of the closed circuit purge unit to prevent injury and / or damage!
A closed circuit purge unit is delivered with distinct user instructions.

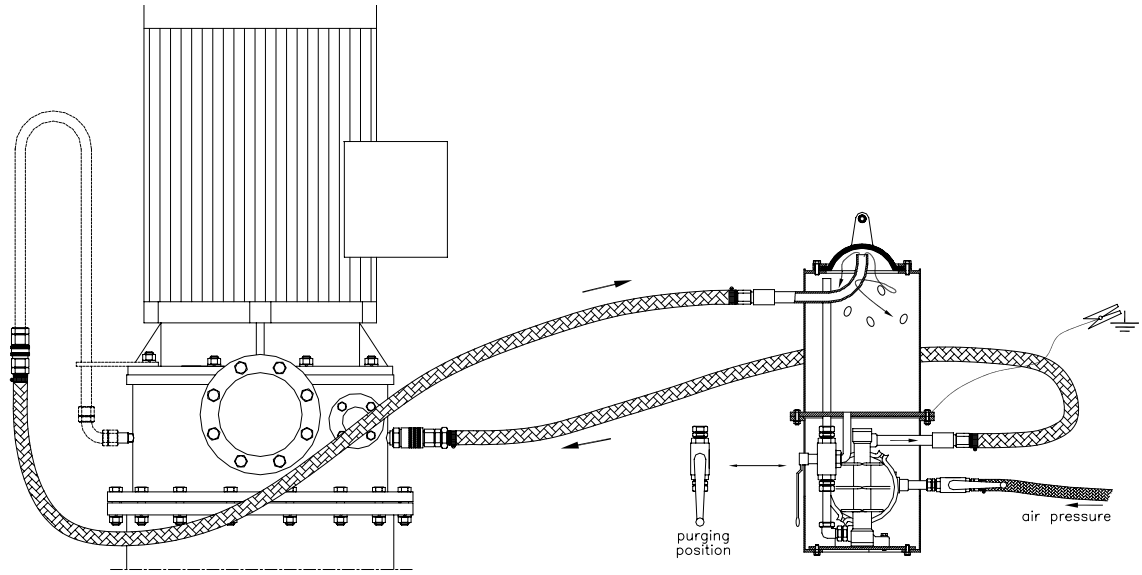
A closed circuit purge unit is used when transporting dangerous, poisonous or aggressive cargo.

Using this unit prevents contact with the cargo when carrying out a purging routine.

The result of the purging routine is visible through a sight glass on top of the unit when operating the pump inside the unit.

The collected purge results in the closed circuit purge unit are drained in a slop tank or a drum using the pump inside the unit.

System set-up with closed circuit purge unit



2.3 Inspection and reports

Tip.

Acurate recording of purging results allows for close monitoring of the pumps condition and anticipating maintenance schedules.

Collect the contents of the cofferdam in a suitable container or sample bottle.

Inspect the presence of lubricant or cargo and observe the limits using table 2.2.2.

Register the results on a "Purging report form" (see 2.5.3 for an example).

Send the results regularly to the Marflex service department (mail, fax, e-mail or Chembase).

A “Pump seal monitoring” computer program (Chembase) can be obtained from Marflex and gives the oppertunity to send the results to Marflex directly through e-mail.

2.4 Monitoring shaft seal and oil condition between purge intervals

Note:

Be aware that the ships trim position has an effect on the indication of the oil level!

During the time between two purge actions the condition of the shaft seals and the condition of the lubricating oil can be monitored.

By observing the oil and the oil level through the sight glass in the top cover (see figure) these conditions can be determined.

Changes in oil level, discoloration, foaming or otherwise can indicate a possible problem in the pump.

Record the oil level when starting monitoring.

Table 2: shows some possible causes and solutions when monitoring the oil.

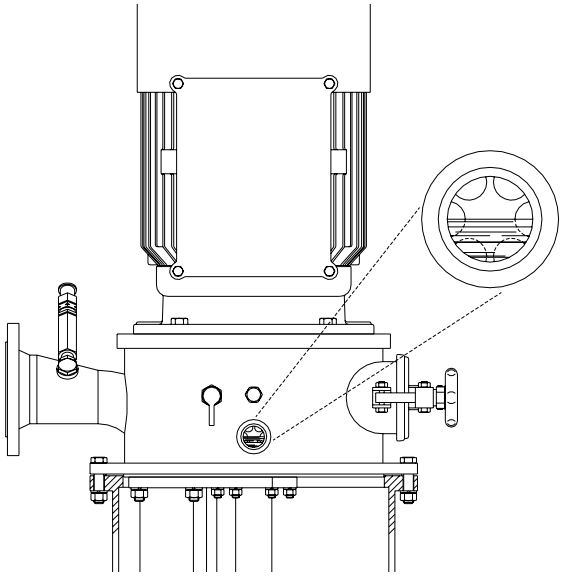


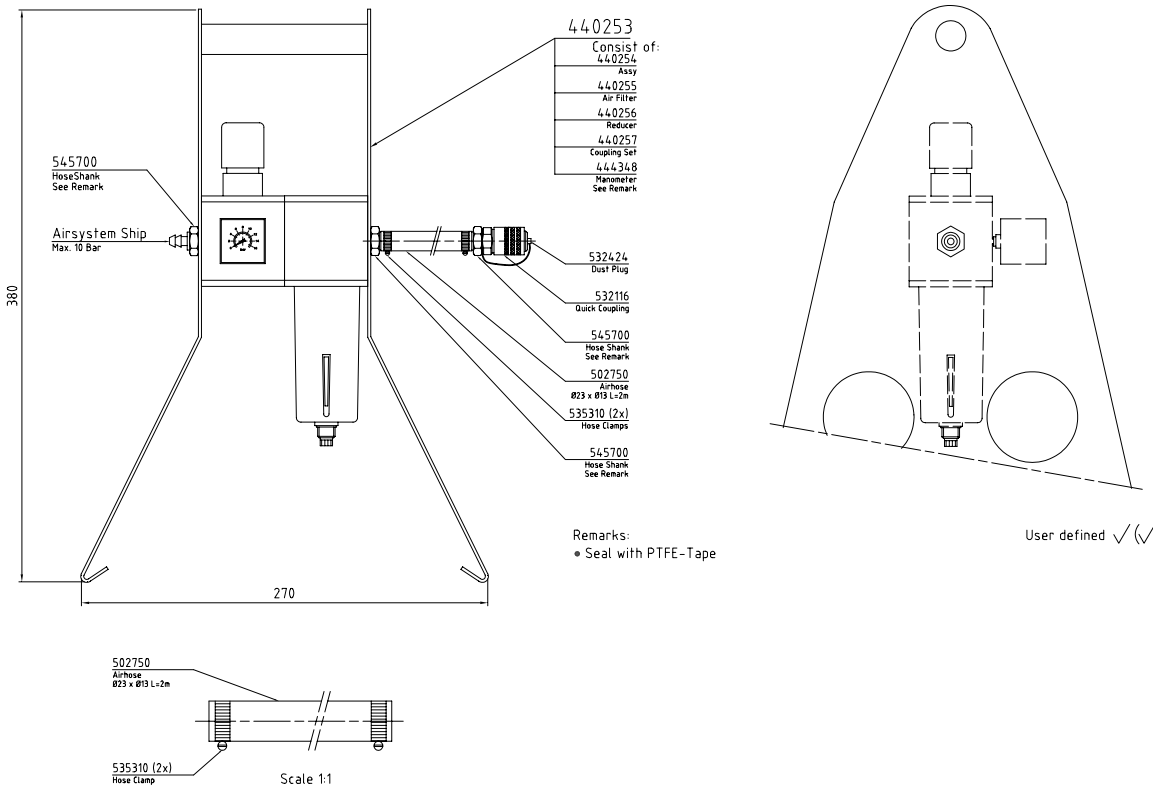
Table 2: Indications

Indication	Probable cause	Action required
Low oil level.	Possible shaft seal leakage of oil to the cofferdam.	Check the contents of the cofferdam through purging. Observe the limits.
High oil level.	Possible shaft seal leakage of cargo through the cofferdam to pipestack.	Check the contents of the cofferdam through purging. Observe the limits.
High oil level, light color.	Possible contamination of the oil with (sea) water.	Take a sample of the oil to determine contamination. Depending on the sample results, replace the oil a.s.a.p.
Foam.	Possible contamination of the oil with (sea) water.	Take a sample of the oil to determine contamination. Depending on the sample results, replace the oil a.s.a.p.
Discoloration.	Possible contamination of the oil by unknown source.	Replace the oil a.s.a.p.

2.5 Drawings and examples

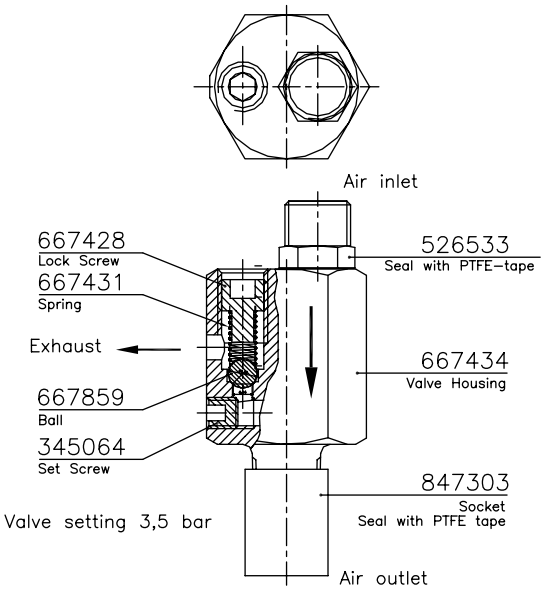
2.5.1 Purge set

Drawing 901753 rev. 1



2.5.2 Pressure reducer and relief valve

Drawing 667858 rev. 2



PURGING ROUTINE FOR MARFLEX DEEP WELL CHEMICAL PUMPS

Ships name: _____ No.: 20001

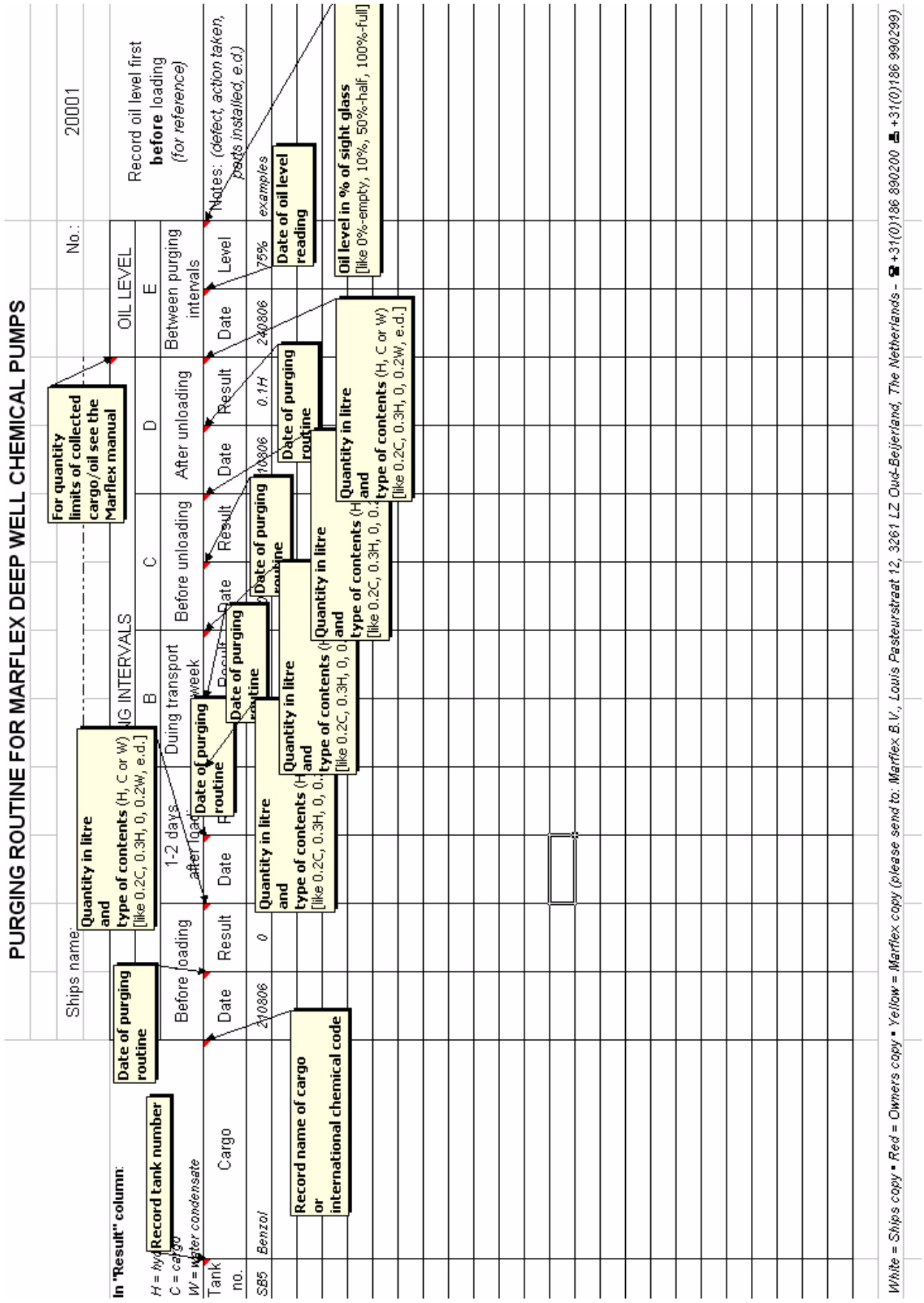
In "Result" column:

H = hydraulic oil
C = cargo
W = water condensate

		PURGING INTERVALS										OIL LEVEL		Record oil level first **before** loading *(for reference)*
		A				B		C		D		E		
		Before loading		1-2 days after loading		Duing transport every week		Before unloading		After unloading		Between purging intervals		
Tank no.	Cargo	Date	Result	Date	Result	Date	Result	Date	Result	Date	Result	Date	Level	Notes: *(defect, action taken, parts installed, e.d.)*
SB5	*Benzol*	*210806*	*0*	*220806*	*0*	*290806*	*0*	*300806*	*0.02C*	*310806*	*0.1H*	*240806*	*75%*	*examples*

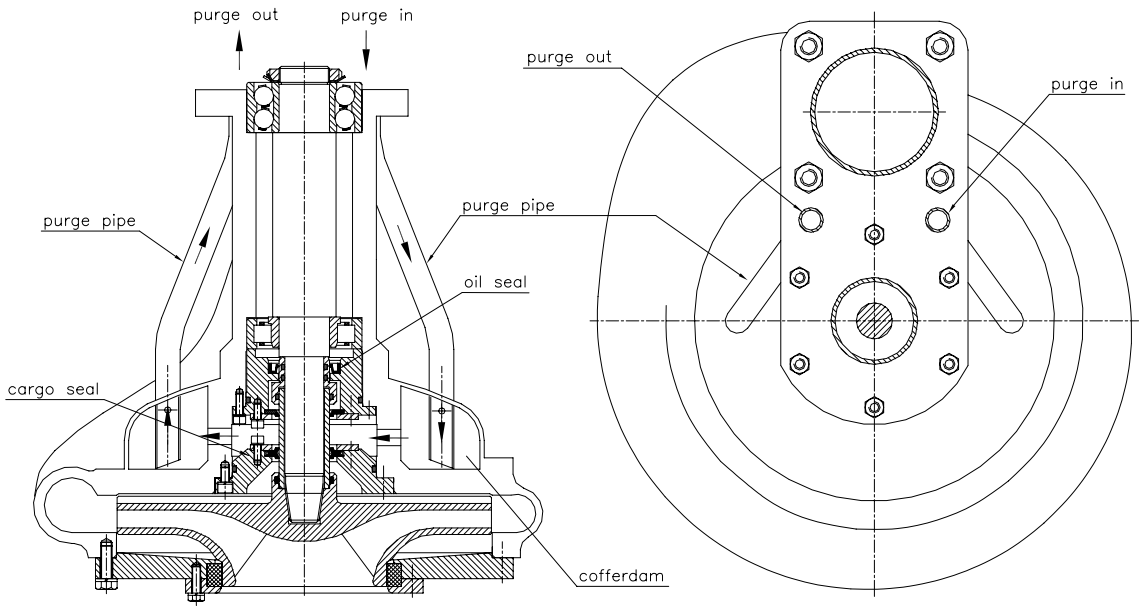
White = Ships copy • Red = Owners copy • Yellow = Marflex copy (please send to: Marflex B.V., Louis Pasteurstraat 12, 3261 LZ Oud-Beijerland, The Netherlands - ☎+31(0)186 890200 🖷 +31(0)186 990299)

Purge report form explanation

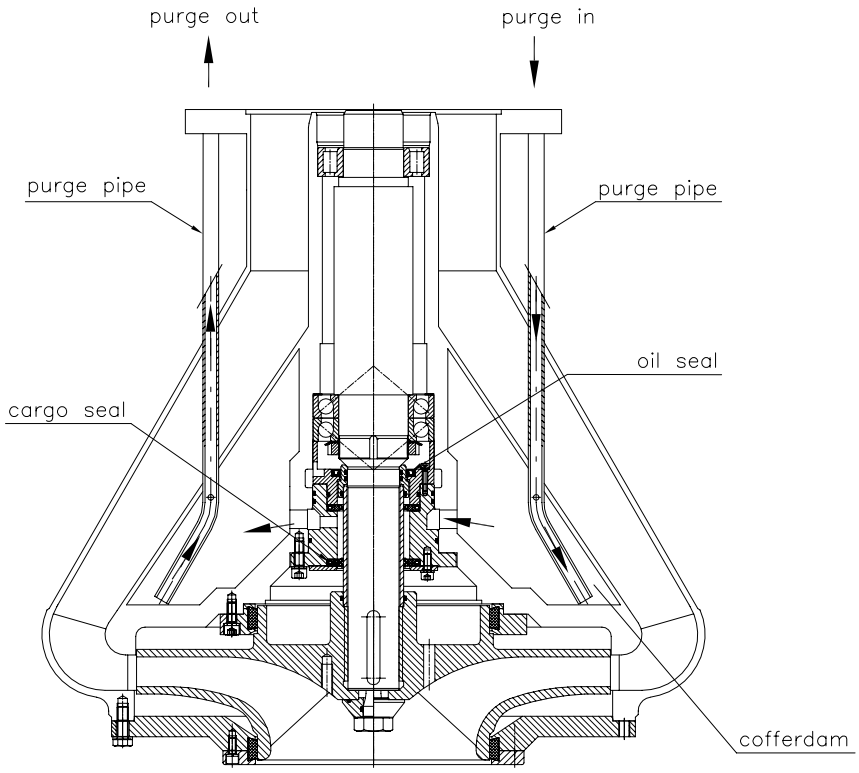


2.5.4 Examples of the airflow through the pump

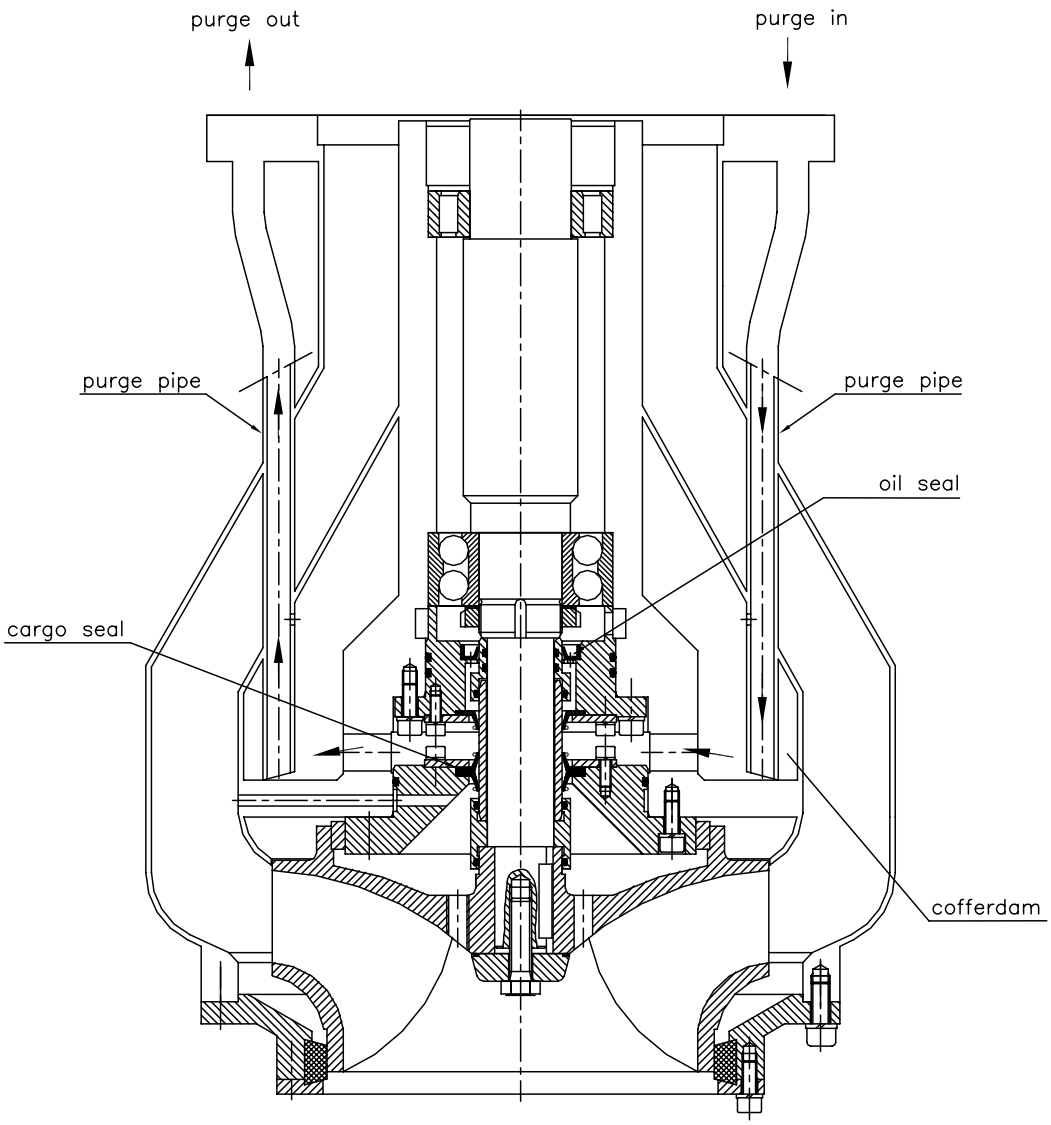
MDPD



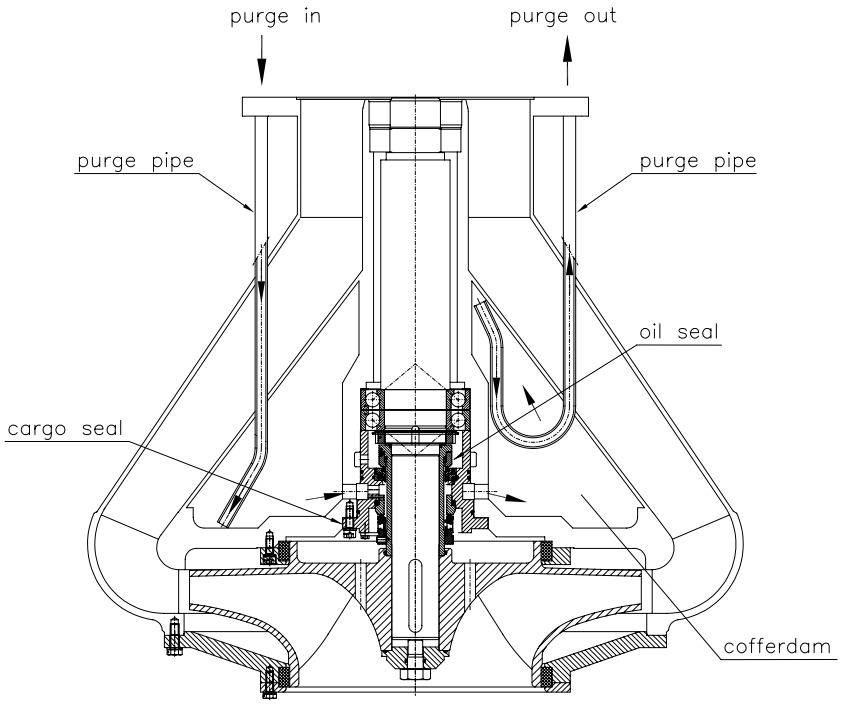
MDPC



MBDPC


purge out
purge in
purge pipe
purge pipe
oil seal
cargo seal
cofferdam

MDPC 300 with mechanical seals and oil filled

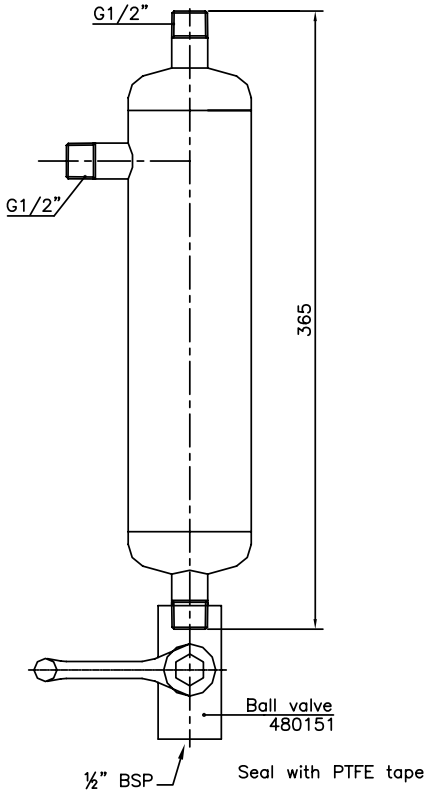


Example with mechanical seals and filled with oil or cargo soluble liquid.

The arrows indicate the oil flow when filling the cofferdam and purge pipes, see 2.2.5.

2.5.5 Options

Exhaust trap (purge container), Drawing 667071-rev. 2



3 Stripping routine

3.1 Stripping of the tanks

3.1.1 Description

During the last stage of cargo offloading, the pump starts to pump air, the current (Amps) drops (discharge pressure drops) and a certain amount of cargo is left in the pump well and pipe stack.

To remove as much of the remaining cargo as possible and to clean the cargo discharge pipe a stripping procedure is carried out. This procedure reduces the amount of remaining cargo in the pump well to a minimum. Present and future IMO rules are hereby achieved.

Pressurized air or nitrogen is blown through the main cargo discharge pipe and, with an operating deepwell pump, pushes the remaining cargo through the stripping pipe out of the tank. The pump is kept running until the cargo pipe is empty.

In general it will not take more than 2 – 5 minutes to carry out the stripping procedure, depending on the dry run limitations, the size of the pump and pump well, .

For the quantities of cargo remaining in the tank after stripping see Table 1.

3.1.2 Remaining cargo after stripping

Note:

The quantity of the remaining cargo largely depends on the size and shape of the installed pump well in the tank.

Table 1: Remaining cargo

Type of pump	Quantity after stripping
MDP-100	± 12 ltr
MDP-125	± 20 ltr
MDP-150	± 30 ltr
MDP-200	± 30 ltr
MDP-250	± 50 ltr
MDP-300	± 50 ltr

3.1.3 Procedure

Caution!

The Marflex Deepwell pump is allowed to run dry for a limited period (normal ± 1 minute, max. 3 minutes)!
To prevent unnecessary wear on seals and wear ring do not let the pump operate dry longer than necessary to remove the remaining cargo because the pump is then no longer lubricated and cooled by the product (cargo).

Tip.

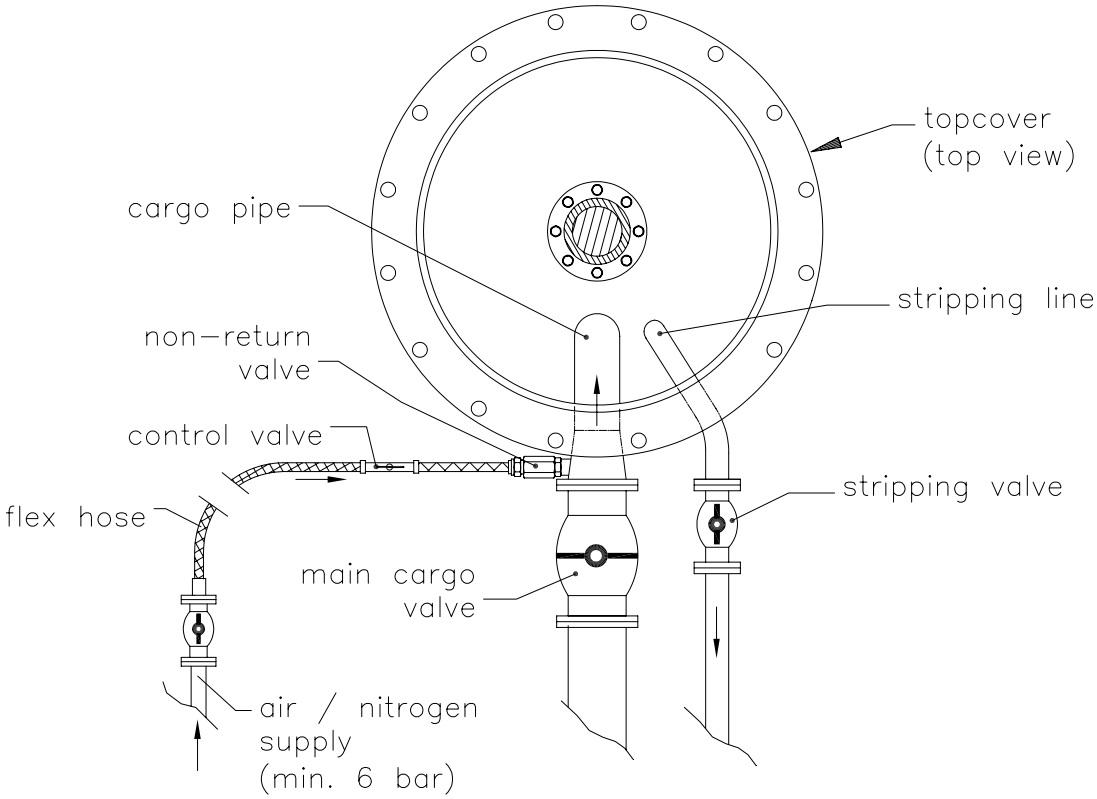
Make sure the main discharge line to the manifold is empty before stripping.
An empty main discharge line prevents unneccesary pressure build up and improves stripping results.

1. When the cargo tank is empty at the end of the normal discharge procedure, close the main cargo valve
2. Stop the cargo pump
3. Connect the air / nitrogen pressure source to the stripping air inlet coupling (with a flexible hose)
4. Check the pressure of the air / nitrogen supply (min. 6 bar)
5. Start the cargo pump (cargo is pumped through the stripping valve)
6.
7. Open the stripping valve when (cargo) pressure is rising
8. When the cargo tank is empty open the air / nitrogen supply control valve to supply pressure to the stripping air inlet coupling
9. When the remaining cargo is removed close the stripping valve
10. Stop the air / nitrogen pressure supply
11. Repeat step 7. through 10. if neccesary
12. Stop the cargo pump
13. Disconnect the pressure source.

3.2 Drawings and schematics

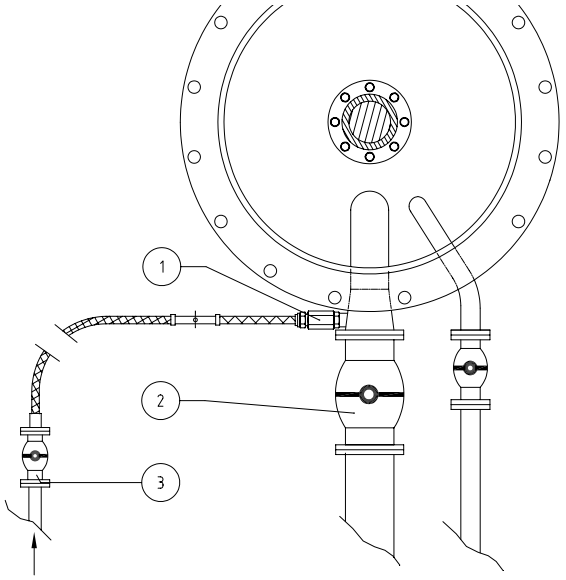
3.2.1 System setup (typical)

System set-up (typical)

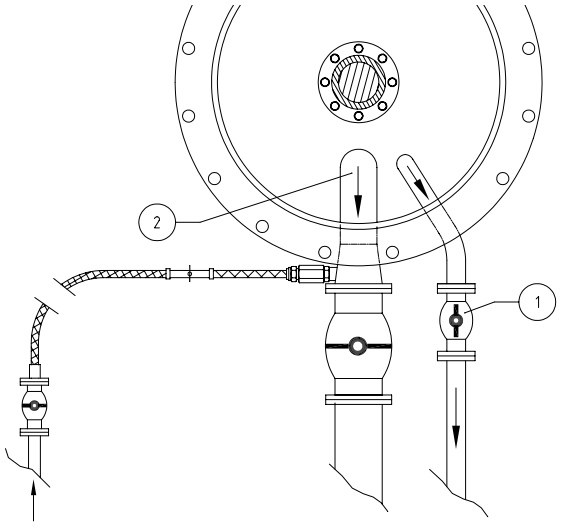


3.2.2 Stripping procedure (steps)

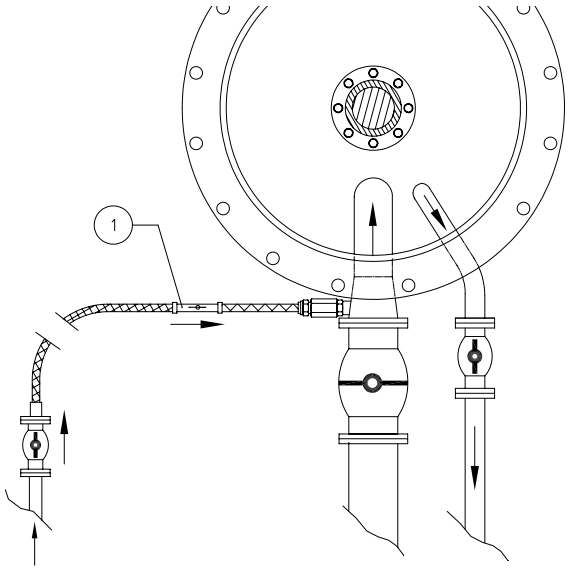
1. After normal discharge close the main cargo valve (2) when the cargo tank is empty
2. Make sure there is a minimum of cargo in the main discharge line
3. Stop the cargo pump
4. Connect an air / nitrogen pressure source, with a flexible hose, to the coupling on the cargo pipe (1)
5. Check the pressure of the pressure source (3) (min. 6 bar)



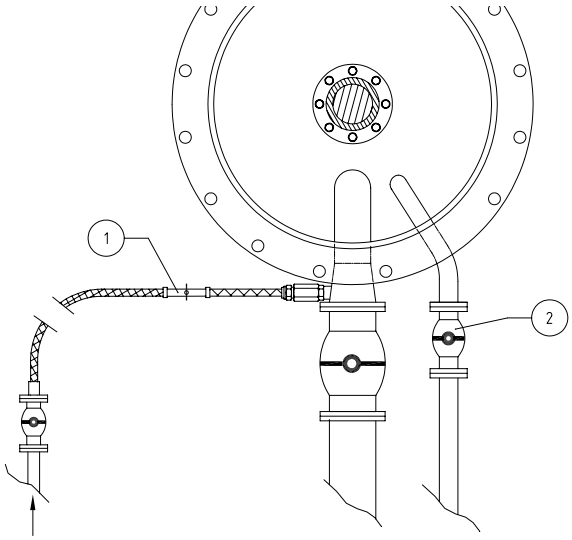
6. Start the cargo pump
7. Open the stripping valve (1) when (cargo) pressure (2) increases



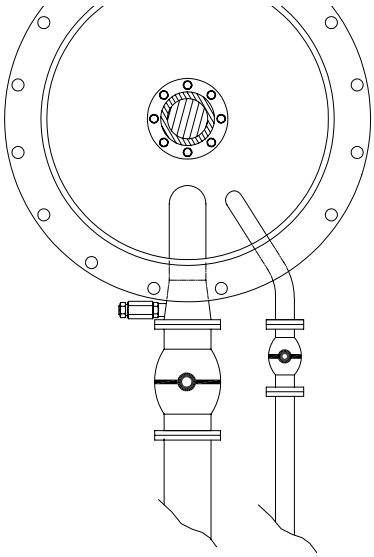
8. When the cargo tank is empty open the air pressure control valve (1)



9. Close the stripping valve (2) when the remaining cargo has been discharged
10. Close the air pressure control valve (1)
11. Repeat step 7. to 10. if neccesary (e.g. still (cargo) pressure increase)

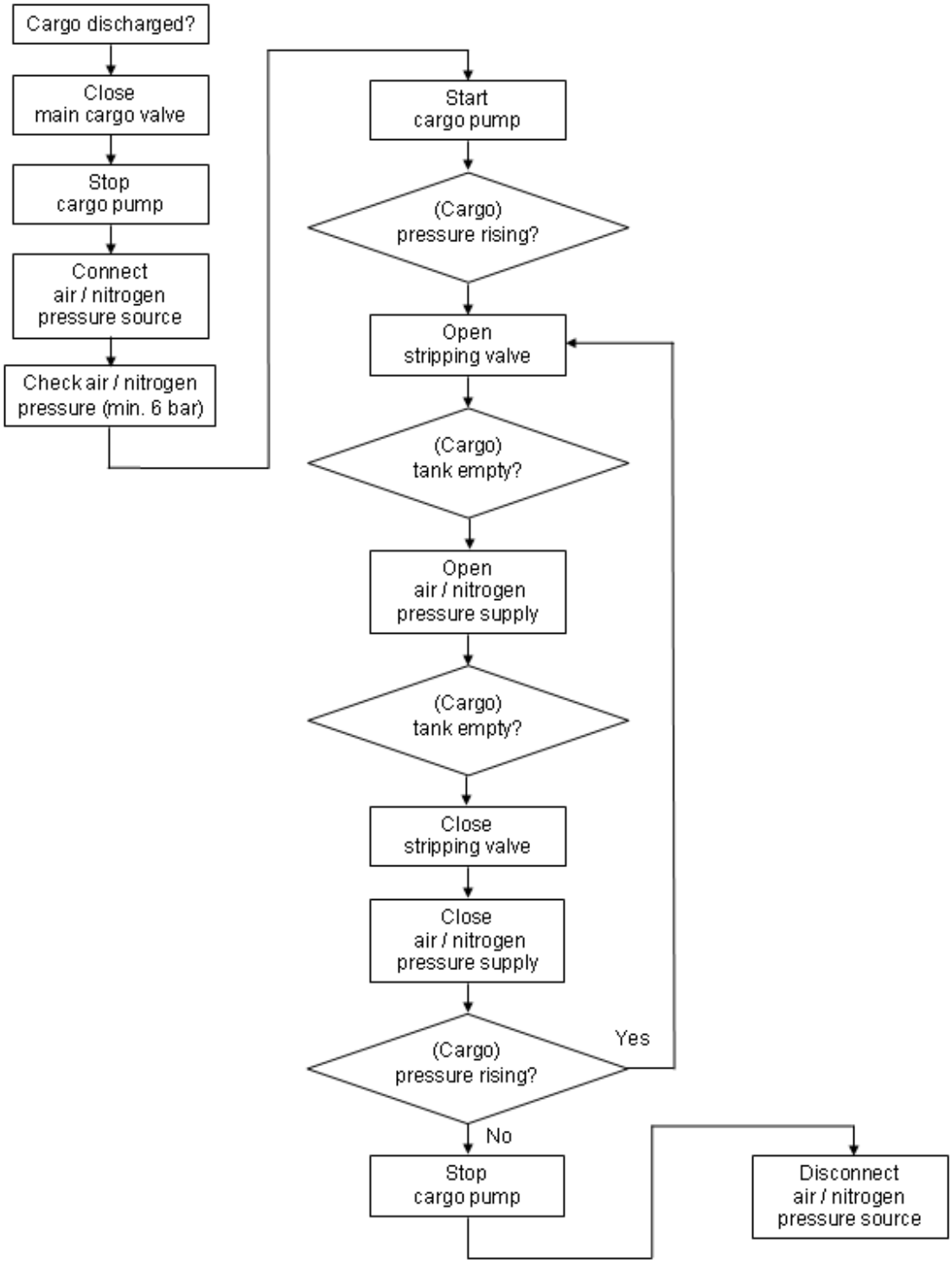


12. Stop the cargo pump
13. Disconnect the air / nitrogen pressure source
14. Cover / cap off open lines (if applicable).



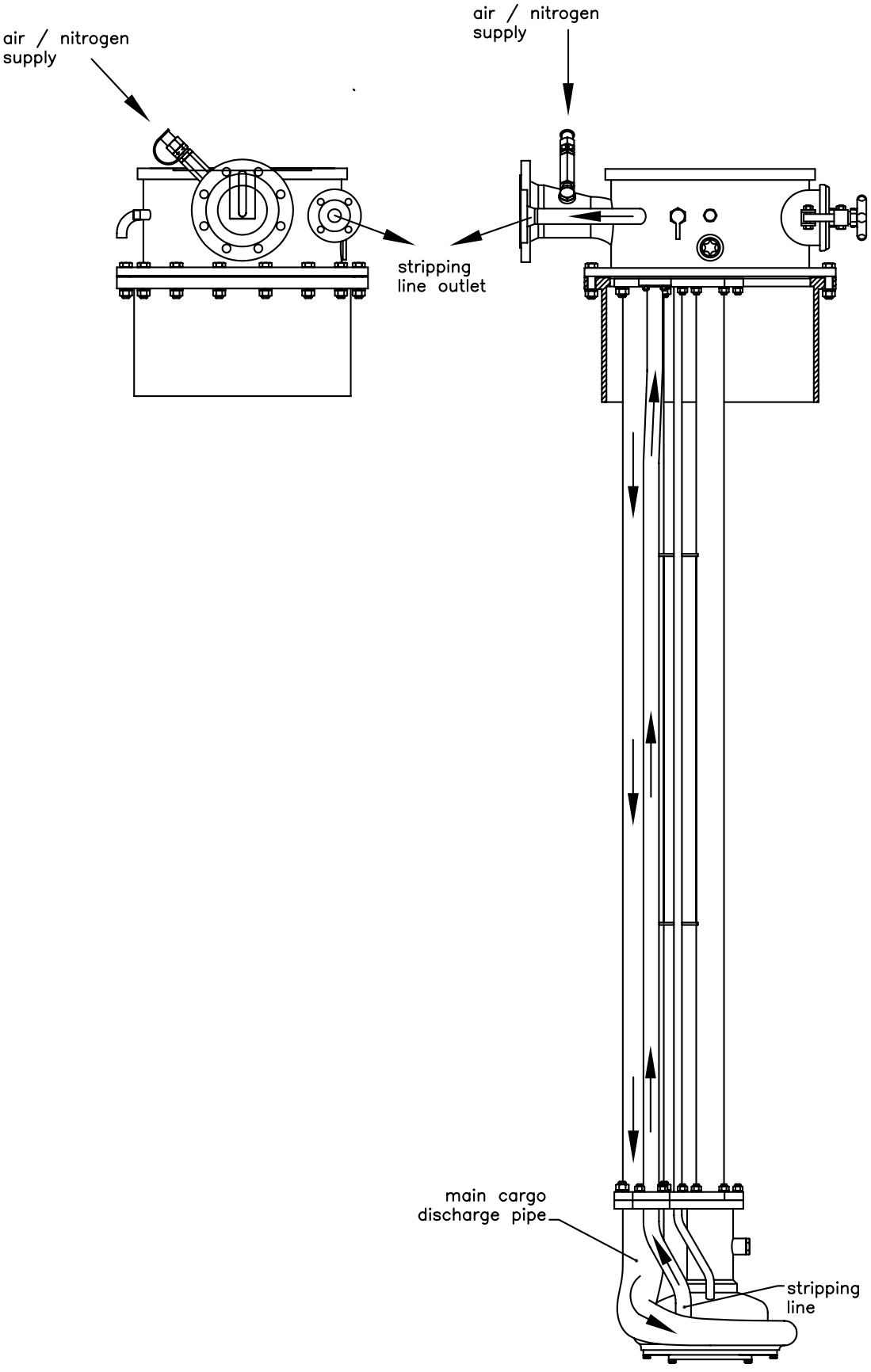
3.2.3 Stripping procedure (flow chart)

Stripping procedure

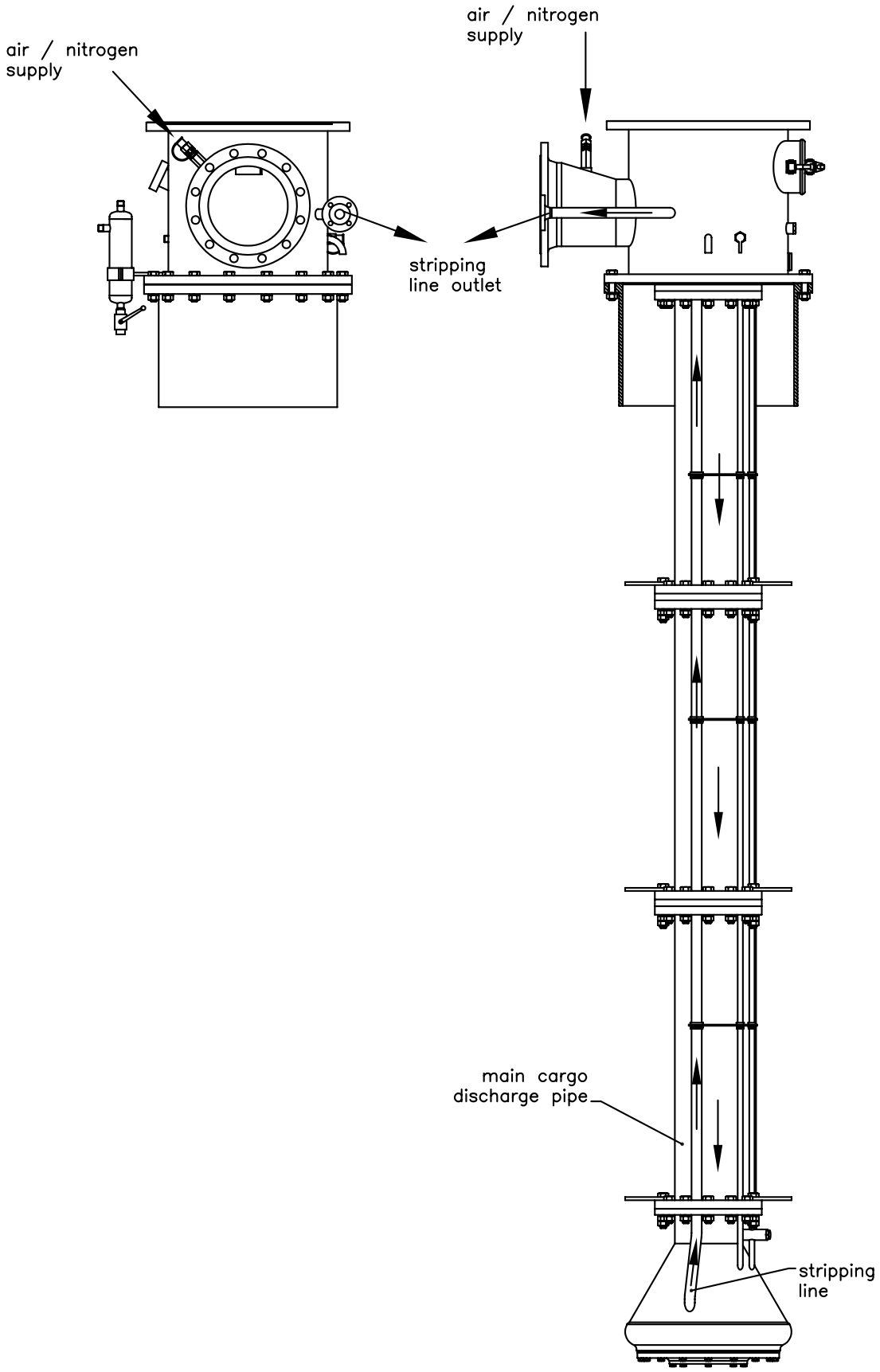


3.2.4 Airflow through the pump (examples)

MDPD

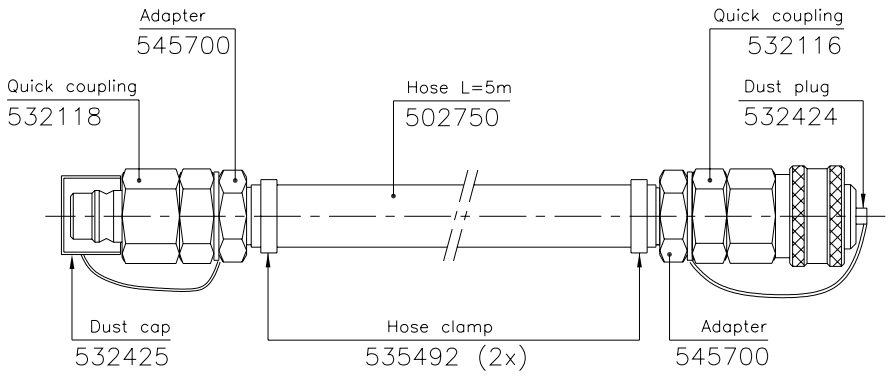


MDPC



3.2.5 Stripping / purging hose ½" L=5m

Drawing 950400 rev. 1



4 Electric hydraulic power pack operation

Danger!

The hydraulic power pack supplies hydraulic oil under very high pressure!
Any leakage can cause injury or damage!

Caution!

The hydraulic power pack must be installed at the highest position in the hydraulic system!

Caution!

Make sure all hydraulic lines in the system are properly connected!

Caution!

No restrictions are allowed in the hydraulic return system!

4.1 Installation and usage conditions

The power pack is not to be operated in a dangerous zone. Install the power pack in a (dry) room where a well-ventilated air system is available.

Supply sufficient cooling air to the electric motors and hydraulic oil cooler, the capacity of the air ventilation system should be no less than 125 M³/minute.

For dimensions see the drawing in “Drawings and partlists”.

Connect the electrical power only according to specifications.

4.1.1 Power pack as ships main hydraulic system

Caution!

Install the power pack in a clean environment and use the boltholes in the frame for attachment.

Caution!

Connect the power pack to the ships hydraulic system using two flexible hydraulic hoses with a minimum length of 0,75 mtr to protect the power pack against vibrations and unnecessary forces.

Caution!

If installation of the power pack at the highest point in the hydraulic system is not possible then install a non-return valve, with an opening pressure of 1 bar, in the correct direction in the return system, just before the hydraulic oil enters the power pack. This protects the hydraulic oil tank against overflow. (Open hydraulic system)

Caution!

It is not allowed to fit valves or restrictions in the hydraulic return system which can not be locked into the open position!

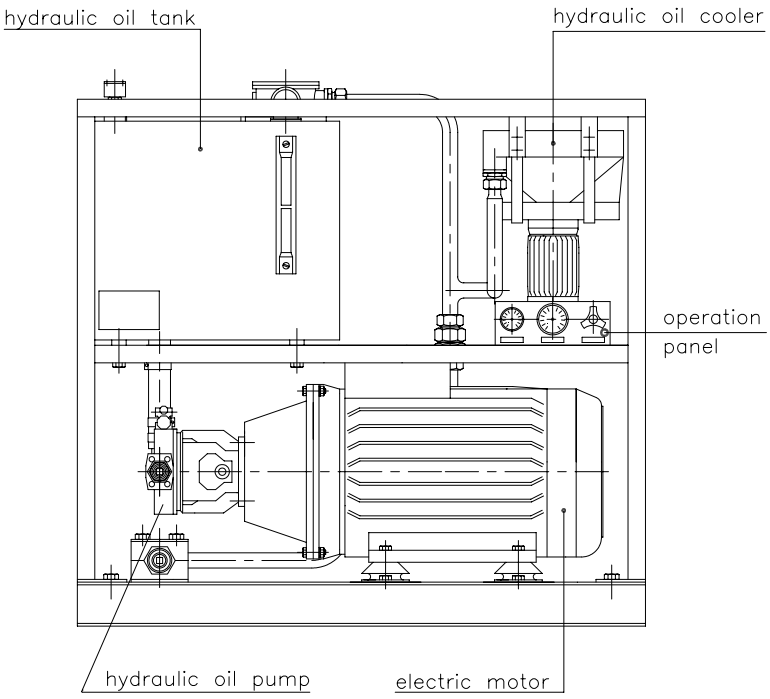
Caution!

After filling the hydraulic oil system for the first time, bleed air from the hydraulic oil pump by unscrewing the nut of the flushing hose (hose from hydraulic pump casing to oil tank).

4.2 Preparation

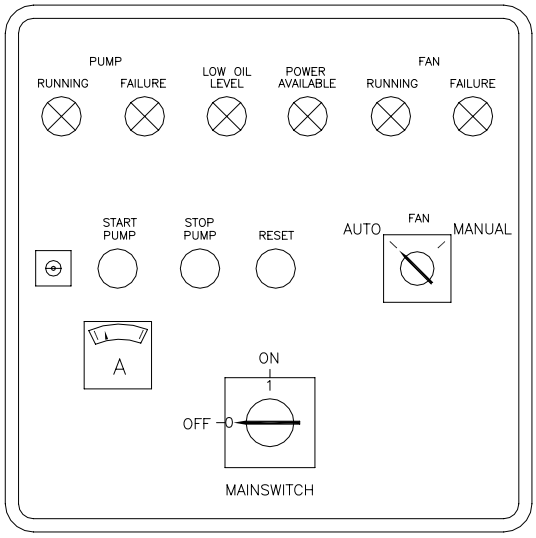
1. Check that the electric motor is ready for operation (power supply, e.g.)
2. Check that cooling openings are not obstructed
3. Check that the hydraulic oil level in the hydraulic oil tank is sufficient (± 3/4 full)
4. Verify that the hydraulic lines to be used are properly connected
5. Verify that the hydraulic consumers (portable pumps, e.g.) are properly connected
6. Inspect the installation for leaks
7. Rotate the pilot control valve on the operating panel counter clockwise to a minimal pressure position.

EHP main components



4.3 Operation (start)

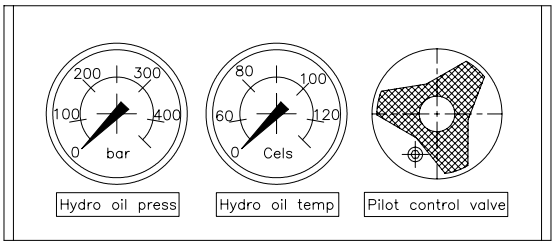
Control panel (typical)



1. Set the mainswitch on the control panel to “ON”
2. Verify that the “POWER AVAILABLE” light is switched on
3. Set the fan switch to “AUTO”
4. Verify that the fan “RUNNING” light is switched on
5. Press the “START PUMP” push button
6. Verify that the pump is operating and that the pump “RUNNING” light is switched on
7. Rotate the pilot control valve on the operating panel clockwise until the desired pressure is reached
8. Check the system for leakage or other failures
9. Start the hydraulic consumers.

4.4 Monitoring

Operating panel (typical)



1. During operation, monitor the pressure and the temperature on the operating panel. (During normal operation oil temperature should be between 40 ºC and 75 ºC)
2. Monitor the hydraulic oil filter differential pressure indicator (if applicable)
3. Monitor the power pack, hydraulic lines and consumers for leakage or other discrepancies.

4.5 Operation (stop)

1. Stop the hydraulic consumers
2. Rotate the pilot control valve on the operating panel until a minimal pressure is reached
3. Press the “STOP PUMP” push button on the control panel
4. Set the mainswitch to “OFF”

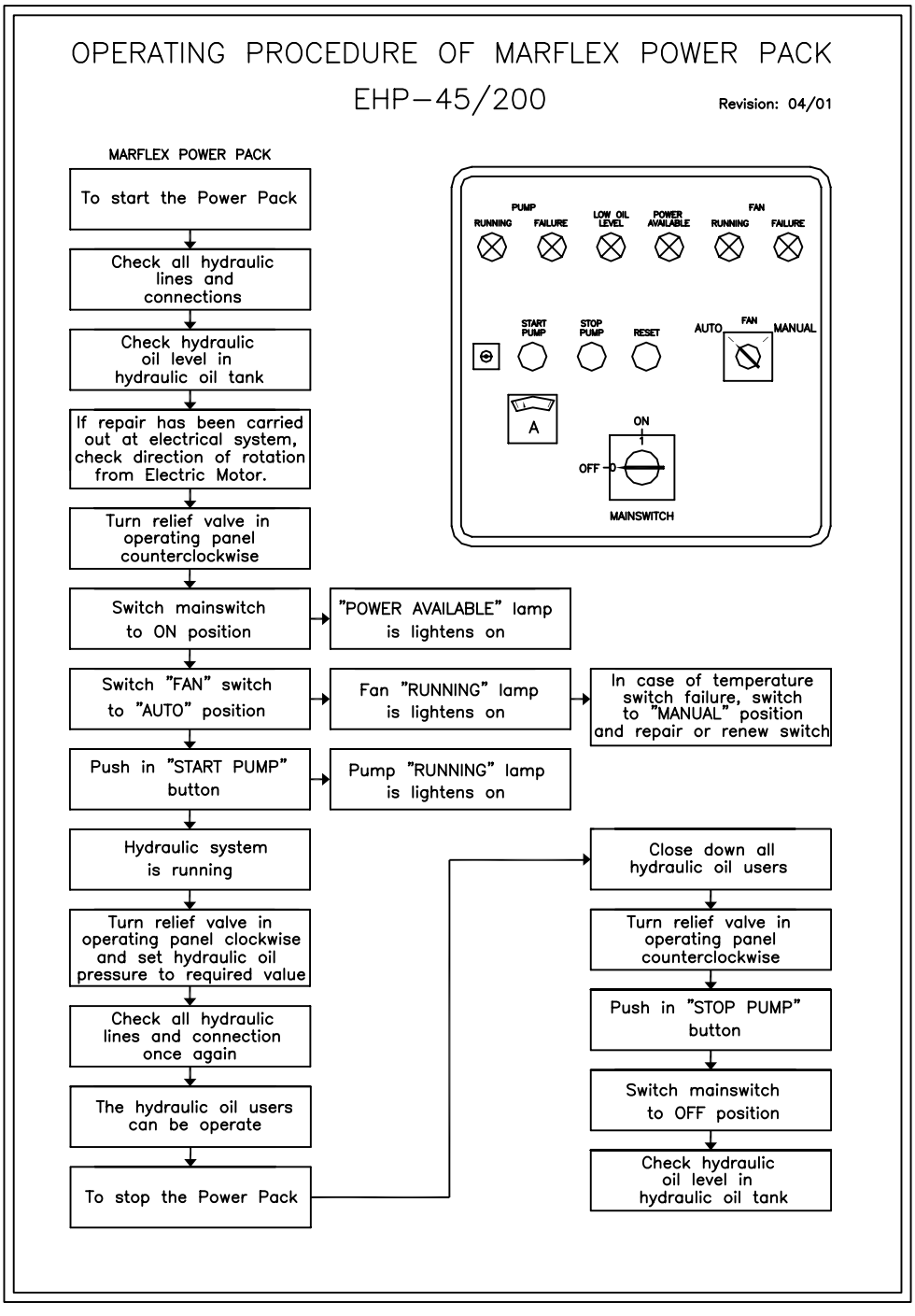
4.6 Finishing

Danger!

Disconnect hydraulic lines carefully!
Pressure may still be present in the lines!

1. Disconnect the hydraulic consumers and place dust plugs on the different connections
2. Check the hydraulic filter differential pressure indicator and replace the filter if necessary
3. Check the hydraulic oil level in the hydraulic oil tank and adjust it if necessary (± 3/4 full)

4.7 Operating procedure (schematic)



5 Portable pump operation

Danger!

Make sure hydraulic lines / hoses are depressurized before conecting or disconnecting!

Caution!

Always use the tripod or a sling to lower the portable pump into the tank!
Do NOT lower the portable pump using the hydraulic hoses!

Caution!

Make sure the cargo properties are compatible with the hydraulic hoses or cargo hose material!
When in doubt do NOT lower the hoses into the cargo.

Caution!

To avoid unwanted pressure build up in the hydraulic motor or the return hose, always connect the hydraulic return hose first! This prevents damage to motor and hoses!

Caution!

Use a flow control to adjust and limit the flow through the portable pump. See the specifications on flow limitations.

Caution!

Do not lower the hose more than necessary to prevent the portable pump to tumble or creation of nicks in the hoses!

Caution!

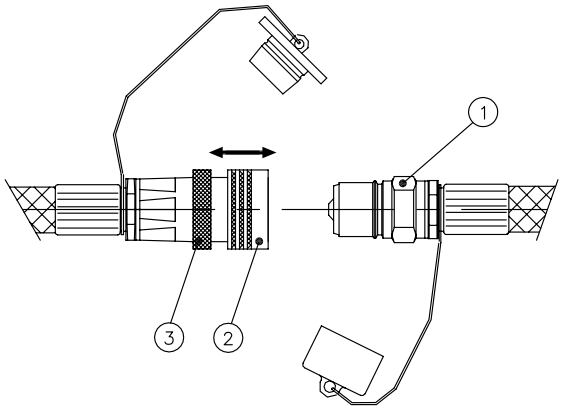
Use protective equipment to prevent damage to the hydraulic hoses and the cargo hose when lowering the portable pump through the tank access hatch!

Note:

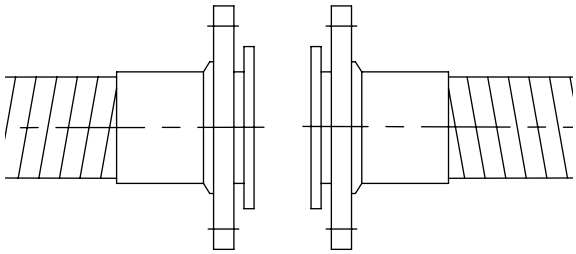
The pictures shown are general examples and can differ from your own configuration.

5.1 Preparation

1. Remove the dust caps from the hydraulic couplings of the return hose(s) and the portable pump
2. Clean the couplings
3. Slide the retaining ring (2) and the lock ring backwards
4. Fit the female coupling over the male coupling (1) and release the retaining ring
5. Push and turn the lock ring (3) clockwise to lock the couplings
6. Verify the couplings are properly locked
7. Connect the pressure hose(s) accordingly

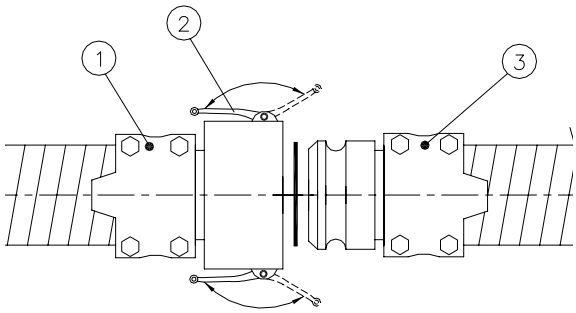


8. Remove the dust caps from the couplings of the cargo hose(s) and the portable pump
9. Clean the couplings
10. Connect the cargo hose(s)

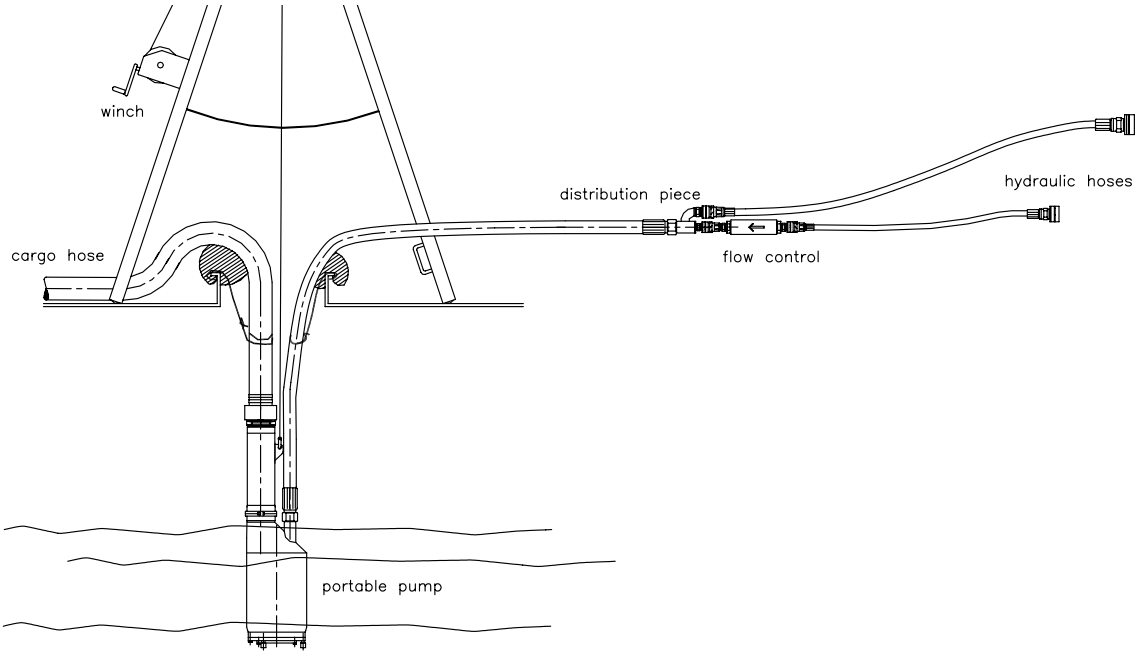


if applicable:

11. Move the lock handles (2) forward
12. Fit the female coupling (1) over the male coupling (3)
13. Pull the lock handles backwards to lock the couplings
14. Verify the couplings are properly locked
15. Secure the lock handles in their position using a locking wire, e.g.



5.2 Installation



1. Connect the tripod or a sling to the portable pump
2. Hoist and lower the portable pump through the tank access hole into the cargo
3. Place protective equipment between the hoses and the tank access hatch
4. Use ropes or straps to assist when lowering and securing the hoses.

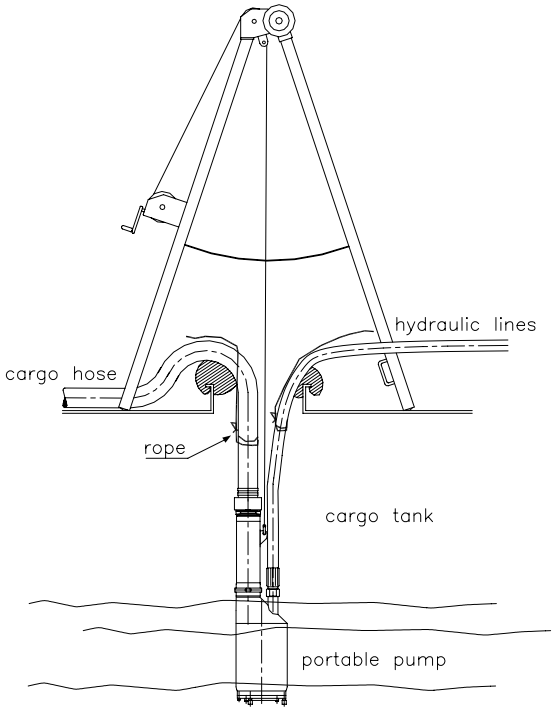
5.3 Operation

5.3.1 Start

1. Provide hydraulic pressure to the portable pump and limit the flow according to the specifications
2. Operate the portable pump to empty the cargo tank.

5.3.2 Monitoring during operation

1. Check the hydraulic pressure and flow
2. Check the hydraulic hoses regularly for leakage
3. Check the cargo hose regularly for leakage
4. Make sure the portable pump operates smoothly and steadily.



5.3.3 Stop

1. Reduce the hydraulic pressure and flow to zero
2. Verify that there is no more hydraulic pressure
3. Verify that the portable pump has stopped.

5.4 Removal

Warning!

The cargo hoses may contain dangerous cargo if they have been plunged in the (dangerous?) cargo!
Determine the type of cargo pumped and take precautions **before** *handling the lines and hoses!*

Warning!

The weight of the cargo hoses is increased by the weight of the contents in the hoses!

1. Operate the winch or sling to hoist the portable pump out of the tank
2. Use the ropes or straps to guide the cargo hose and the hydraulic lines out of the tank properly
3. Lower and place the pump in a suitable place
4. Remove the ropes or straps from the cargo hose and hydraulic lines
5. Disconnect the winch or sling.

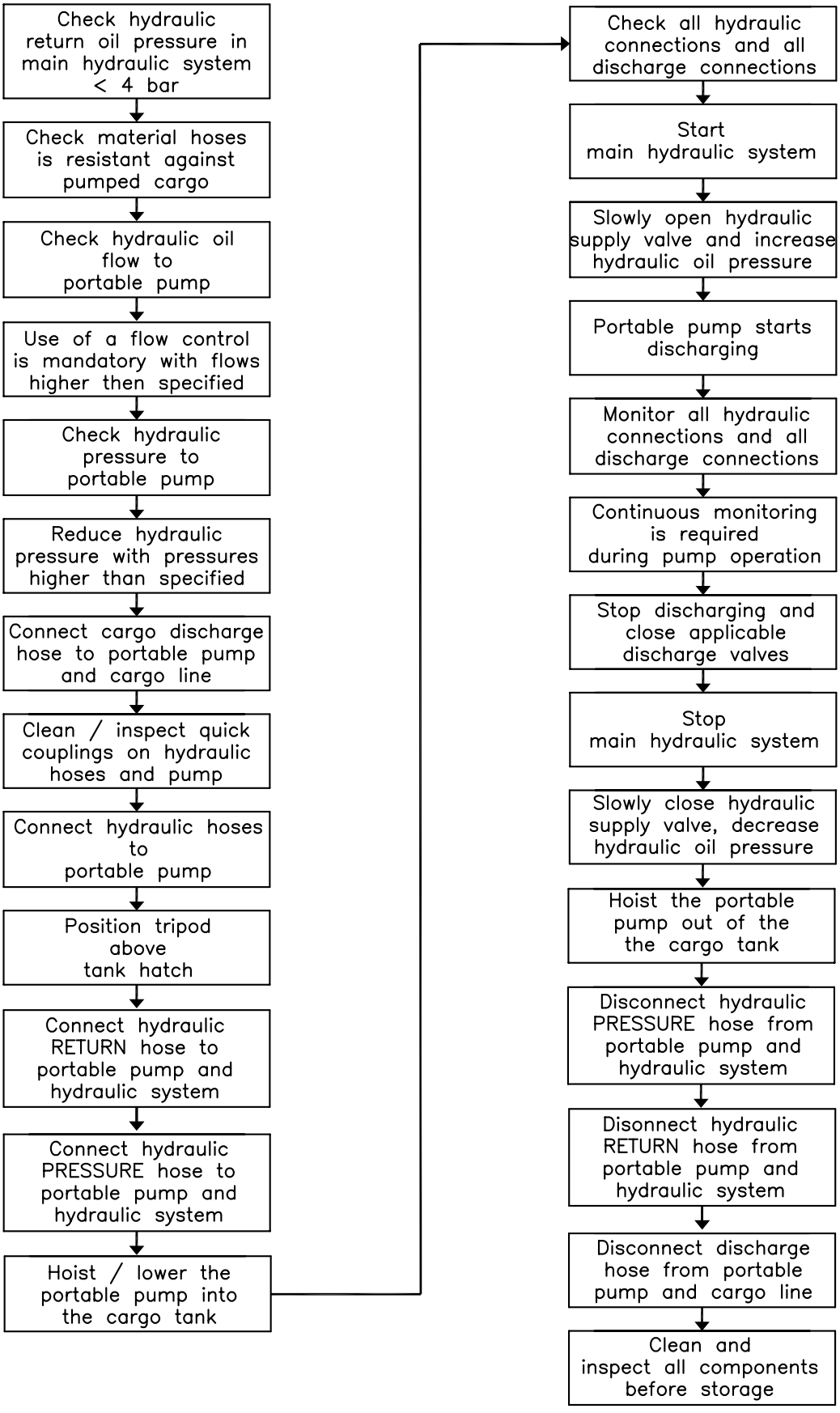
5.5 Cleaning and storage

Caution!

After operating the MSP-100/150 portable pump (with aluminum housing) in seawater:
- rinse the pump thoroughly with fresh water
- disassemble the impeller, dry and lubricate all contact surfaces!

1. Remove the locking wire from the cargo hose lock handles and unlock (if applicable)
2. Disconnect the cargo hose couplings
3. Clean the cargo hose and couplings thoroughly before storing them
4. Rotate the locking ring on the hydraulic couplings counter clockwise and slide the retaining ring backwards
5. Disconnect the hydraulic couplings (hydraulic pressure line first)
6. Clean the hydraulic hoses and couplings thoroughly before storing them
7. Clean the portable pump thoroughly before storage
8. Install dust caps on all couplings and open ports
9. Store the portable pump, hydraulic lines and cargo hoses in a suitable place.

5.6 Operating procedure (schematic, typical)



6 Tripod operation

Danger!

The Marflex tripod is ONLY designed for hoisting Marflex portable pumps!
Maximum hoist weight is 500 kg!

Danger!

Do NOT apply forces on the tripod in a horizontal direction during operation!

Warning!

Do NOT walk or work below the tripod during hoisting!

Warning!

Make sure the tripod is positioned and set up correctly before usage!

Caution!

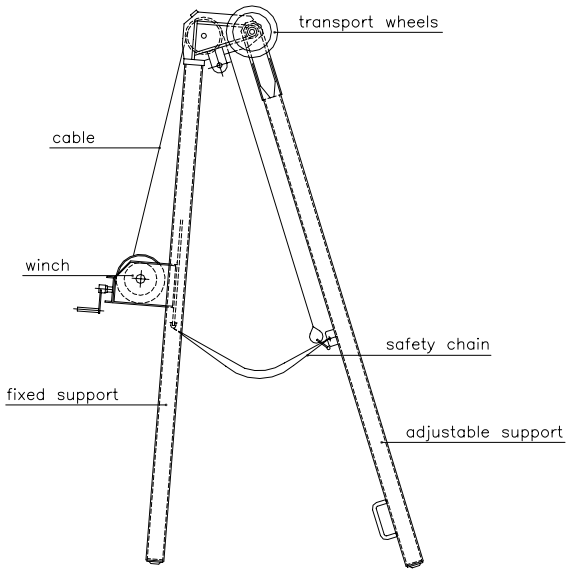
Protect the edges of the access hole to the tank to prevent damage or leakage of the hydraulic lines and cargo hose!

Note:

When using an air driven winch or an electric motor driven winch use the applicable manual for operation (see section "Maintenance").
Use an airline lubricator in the air supply line.

6.1 Installation and operation

1. Move the tripod to the required location
2. Verify that the safety chains are attached properly
3. Unfold the tripod supports
4. Place the tripod in position above the tank opening
5. Move the adjustable support to centre the hoisting point
6. Make sure the safety chains keep the supports stable in position
7. Disconnect the shackle on the cable from the transport position
8. Operate the winch and slacken the cable to connect the portable pump
9. Connect the cable to the hoisting point on the portable pump (with connected hydraulic lines and cargo hose)
10. Attach ropes or straps to the lines and hose to allow proper guidance in and out of the tank
11. Operate the winch to hoist and lower the pump into the tank
12. Operate the pump to discharge the cargo.



6.2 Removal and storage

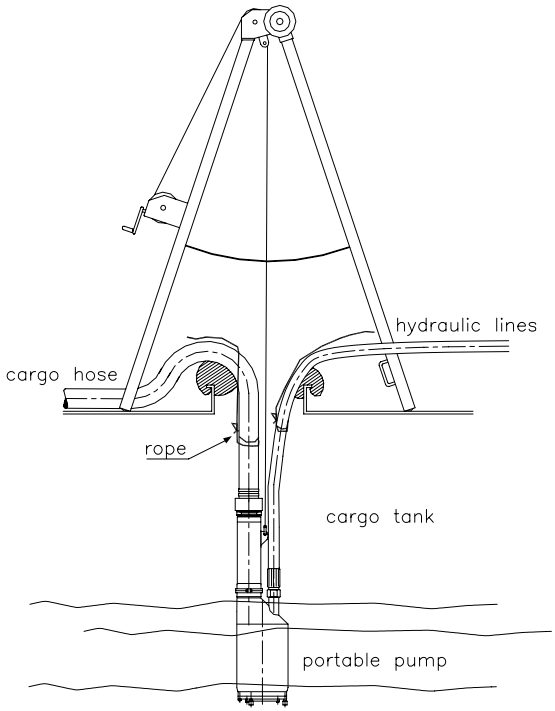
Warning!

The cargo hose and hydraulic lines may contain dangerous cargo if they have been plunged in the (dangerous?) cargo!
Determine the type of cargo pumped and take precautions **before** *handling the lines and hoses!*

Warning!

The weight of the cargo hose is increased by the weight of the content in the hose!

1. After the portable pump has been stopped, operate the winch to hoist the pump out of the tank
2. Use the ropes or straps to guide the cargo hose and hydraulic lines out of the tank properly
3. Place the pump in a suitable place
4. Remove the ropes or straps from the cargo hose and hydraulic lines
5. Disconnect the shackle on the cable from the pump and place in the transport position
6. Wind the cable as far as possible on the winch
7. Fold the tripod supports
8. Remove the tripod
9. Clean the tripod before storage.



5 Maintenance & inspection

1 General maintenance (MDPD)

1.1 Oil draining / filling

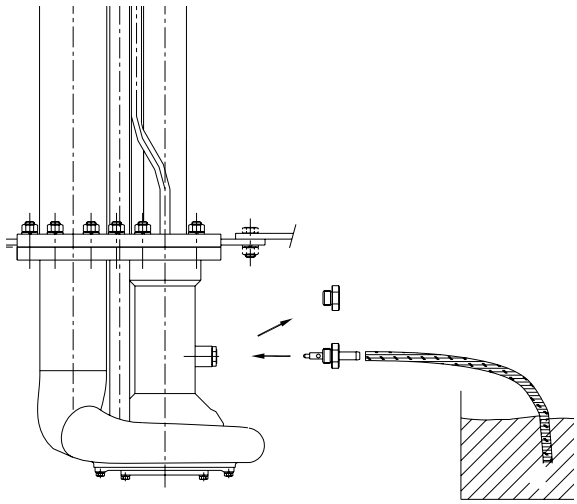
Note:

At some “B”-type pumps (MDPD-80) it is not posible to remove all of the oil through the drain opening because of the position of the opening. (for details see the applicable pump head drawing) Removal of the pump head from the pipe stack is required to remove the oil below the drain opening position.

1.1.1 Oil draining Deepwell Pump (gravity method)

To drain the oil from the Deepwell Pump:

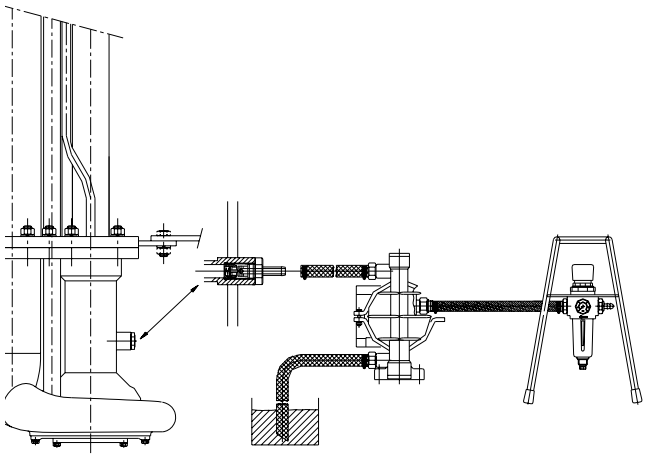
1. Remove the blind plug from the drain opening in the pump casing
2. Use a suitable container to collect the drained oil
3. Install the drain plug (a special tool) (the drain plug opens a check valve inside the drain opening)
4. Open the discharge end of the hose and allow the oil to flow in the container
5. Reinstall the blind plug after draining.



Note:

For the advised oil type used in the Marflex Deepwell Pump see the list "Advised lubricant types for pipe stack" in the section “Specifications”.

1.1.2 Oil filling Deepwell Pump (via pump head)



To fill the Deepwell Pump with oil through the drain opening in the pumphead:

1. Remove the blind plug from the drain opening in the pump casing
2. Install the drain plug (a special tool) (the drain plug opens a check valve inside the drain opening)
3. Connect the pressure side of the oil pump to the hose from the drain plug
4. Put the suction hose of the oil pump in a container filled with the advised oil type
5. Operate the oil pump using air pressure of max. 1,5 bar and fill the pump with oil
6. Monitor the oil level sight glass in the top cover
7. Continue filling oil until the oil covers the sight glass halfway
8. Allow the oil level to stabilize (cool down, foam decrease)
9. Check the sight glass again and add oil if necessary
10. Replace the gasket on the blind plug
11. Reinstall the blind plug after filling the oil.

1.1.3 Oil filling Deepwell Pump (via top cover access panel).

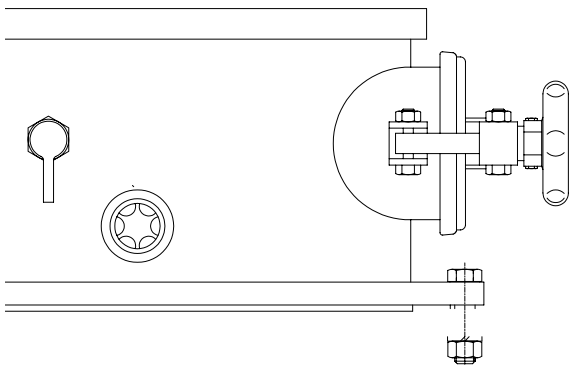
Caution!

Make sure the pipe stack and pump are completely filled with oil before operating the pump! Air pockets can prevent the oil from lowering through the pipe stack.

Note:

This procedure is NOT advised for filling a complete empty pipe stack and pump head because of the risk of the forming of air pockets.
Replenishing an operational pump through the access panel is a standard procedure.

To fill the Deepwell Pump with oil through the access panel in the top cover:

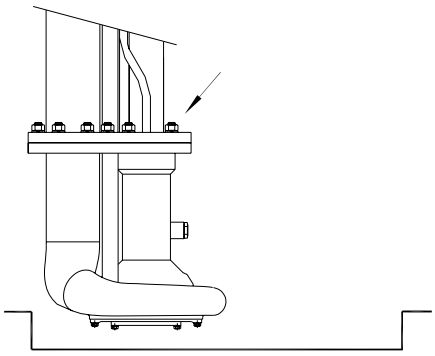


1. Open the access panel on the top cover
2. Pour the oil into the top cover
3. Monitor the oil level sight glass in the top cover
4. Continue filling oil until the oil covers the sight glass halfway
5. Allow the oil level to stabilize (cool down, foam decrease)
6. Check the sight glass again and add oil if necessary
7. Close the access panel.

1.2 Pumphead removal / installation

1.2.1 Pumphead removal

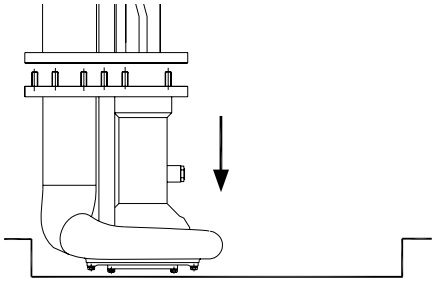
1. Drain the oil from the pump assembly according to paragraph 1.1
2. Put a soft cloth or some other soft material under the pumphead to prevent damage of the suction well in the tank
3. Support the pumphead
4. Remove the nuts and washers



Caution!

Make sure not to damage or scratch the tank, suction well or other coated surfaces when lowering the pumphead!

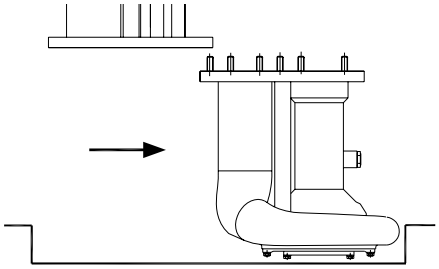
5. Carrefully lower the pumphead on the cloth in the suction well



Caution!

Make sure not to damage or scratch the tank, suction well or other coated surfaces when sliding the pumphead!

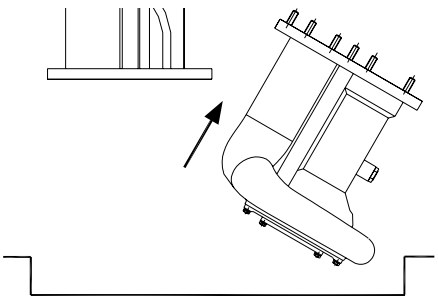
6. Carefully slide the pumphead sideways and free from the pipestack



Caution!

Make sure not to damage or scratch the tank, suction well or other coated surfaces when lifting the pumphead out of the suction well!

7. Carefully tilt the pumphead towards you and lift the pumphead out of the suction well
8. Remove and discard O-rings, seals and packings.

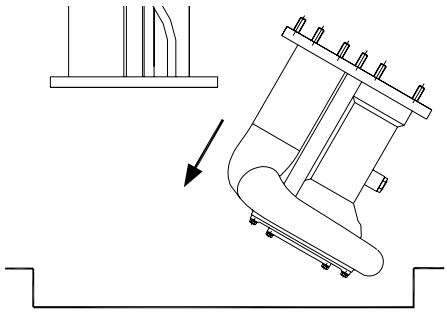


1.2.2 Pumphead installation

Caution!

Make sure not to damage or scratch the tank, suction well or other coated surfaces when putting the pumphead into the suction well!

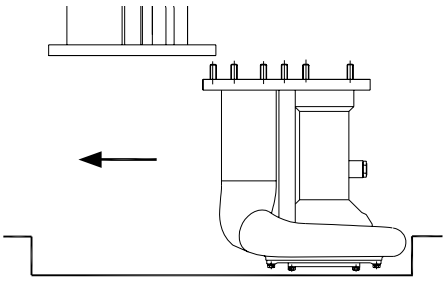
1. Place a soft cloth or some other soft material in the suction well to prevent damage
2. Place the pumphead in the suction well



Caution!

Make sure not to damage or scratch the tank, suction well or other coated surfaces when sliding the pumphead under the pipestack!

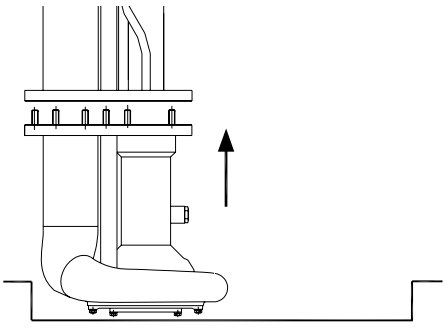
3. Slide the pumphead under the pipestack and put it in the correct position for installation

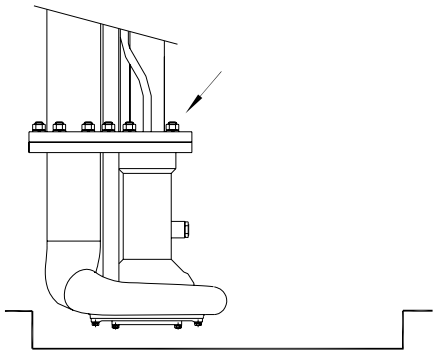


Caution!

Make sure to use new O-rings, seals, packings, lockwashers and / or locknuts for installation of the pumphead!

4. Install the O-rings, seals and / or packings between the flanges of the pump and pipestack
5. Lift the pumphead upwards on the pipestack and loosely install some of the washers and nuts to keep the pumphead underneath the pipestack.
6. Tighten the nuts in sequence to the proper torque value (see chapter "Standard practices and torque values")
7. Fill the pump assembly with oil according to paragraph 1.1.





1.2.3 Electric motor coupling spacer removal (if applicable)

Note:

To reduce the distance between pump head and tank bottom and still make pump head removal / installation possible, an extra spacer between the electric motor coupling half and the intermediate shaft coupling half can be installed. This allows the intermediate shaft spline to be raised upwards, away from the pump head during removal / installation.
Also, the inserted threads of the pump head attachment must be removed to allow the pump head to be removed.

Caution!

Make sure to cover all openings inside the topcover **before** *carrying out any maintenance is inside the top cover!*

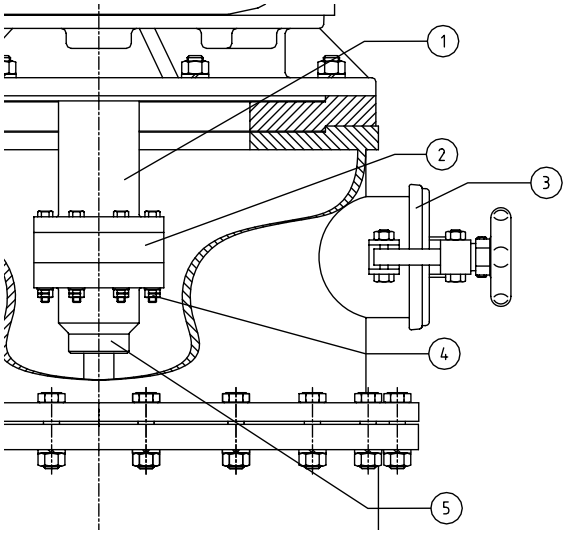
Caution!

Take care not to damage the coupling halves when raising / lowering the intermediate shaft!

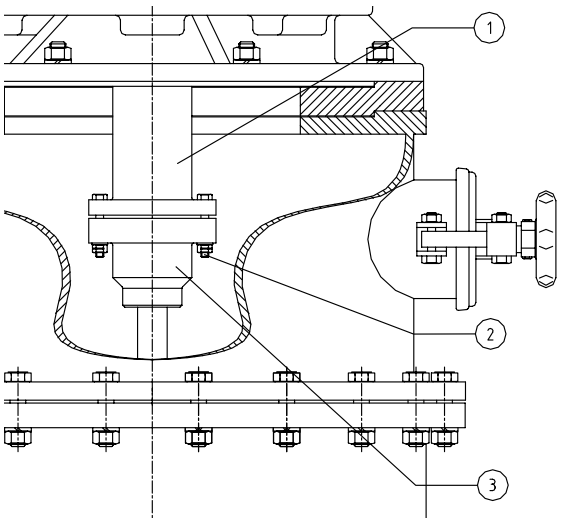
Caution!

Make sure the inserted threads of the pump head attachment are removed from the pump head before sliding the pumphead sideways away from the pipe stack!

1. Drain the oil from the pump assembly and disconnect the pumphead from the pipe stack according to the normal removal procedure (see 1.2.1)
2. Remove the inserted threads of the pump head attachment from the pumphead
3. Gain access to the electric motor coupling halves and spacer (2) through the access panel (3) in the top cover
4. Cover all openings inside the topcover
5. Prepare to support the lower coupling half (and the intermediate shaft) (5)
6. Remove the attachment bolts and nuts (4) from the coupling halves (1 and 5)
7. Lower the coupling half (5) and remove the spacer (2)



8. Raise the coupling half (5) (and the intermediate shaft) (3) and connect then temporarly to the coupling half (1) with two bolts (2)
9. The pump head is now free to slide away from the pipe stack.



1.2.4 Electric motor coupling spacer installation (if applicable)

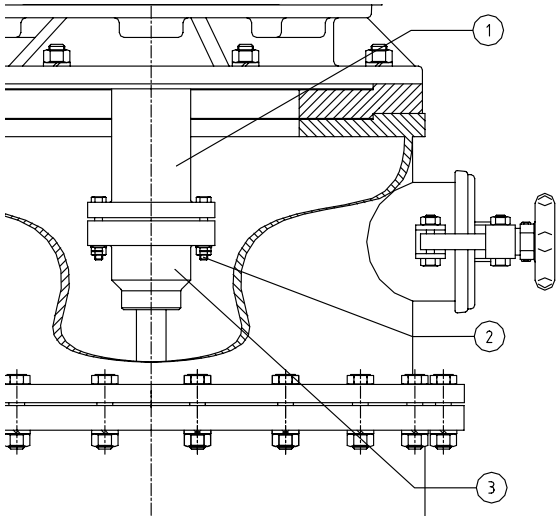
Caution!

Take care not to damage the splines of the intermediate shaft when lowering the lower coupling half and intermediate shaft! The splines connect with the pump head!

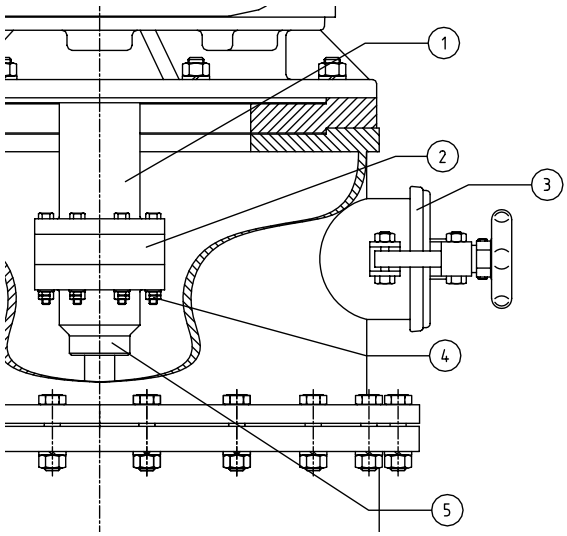
Caution!

Make sure to remove all objects and covers from inside the top cover **before** *closing the access panel!*

1. Prepare the pump head for installation and slide it in position underneath the pipe stack
2. Insert the attachment threads in the pump head
3. Prepare to support the lower coupling half and the intermediate shaft temporarly
4. Remove the installed bolts (2) from the lower coupling half (3) and the upper coupling half (1)
5. Carefully align the splines from the intermediate shaft with the splines in the pump head
6. Lower the lower coupling half and the intermediate shaft



7. Put the spacer (2) in position and raise the lower coupling half
8. Install the attachment bolts (4) on the spacer, upper- (1) and lower (5) coupling halves and tighten
9. Remove all covers from the openings inside the top cover and close the access panel
10. Connect the pump head to the pipe stack and fill the pump assembly with oil according to the normal installation procedure (see 1.2.2).



1.3 Pumphead inspection / overhaul

Note:

The described procedures are appicable to most of the Marflex Deepwell Pumps.
There can be slight differences between the actual situation and the illustrations in this manual.

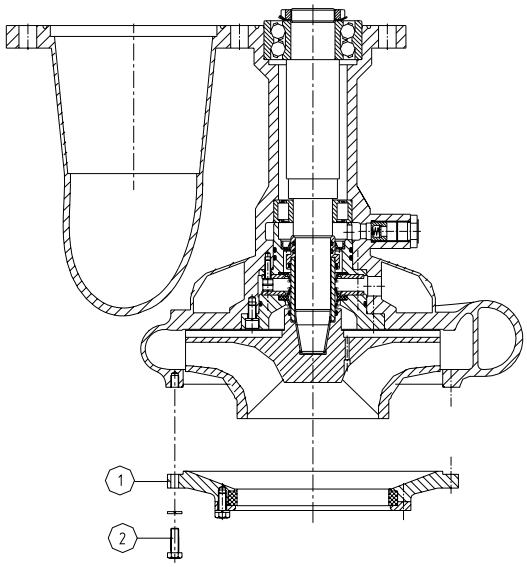
1.3.1 Suction cover removal

1. Remove the pumphead according to paragraph 1.2
2. Clean the pumphead before disassembling

Warning!

Before sending the pumphead to a workshop label it with the information about the last used product!

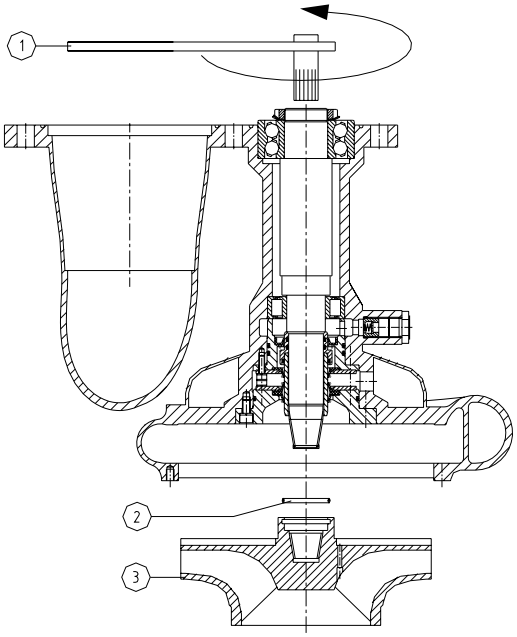
3. Place the pumphead upside down, on a proper flat working surface, preferably on a workbench in a workshop
4. Remove the bolts (2) with the washers
5. Remove the suction cover (1).



1.3.2 Impeller removal

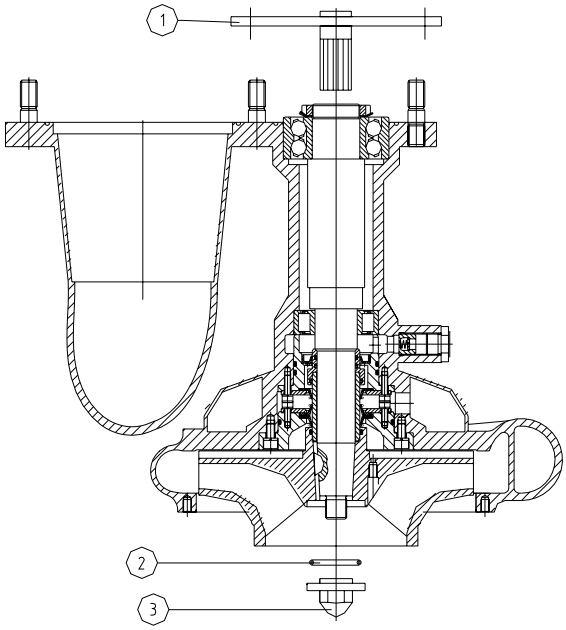
Only for a pumphead with conical thread (X-type).

1. Place the pumphead flat on the working surface
2. Insert the shaft spanner (1) in the pump shaft
3. Remove the impeller (3) by rotating the shaft spanner counterclockwise and holding the impeller in position
4. To assist in loosening the pump shaft from the impeller, lightly tap the shaft spanner using a hammer
5. Remove the O-ring (2).

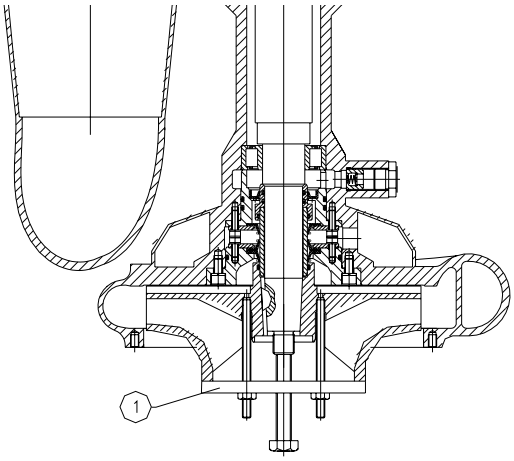


Only for a pumphead with conical shaft end (W-type).

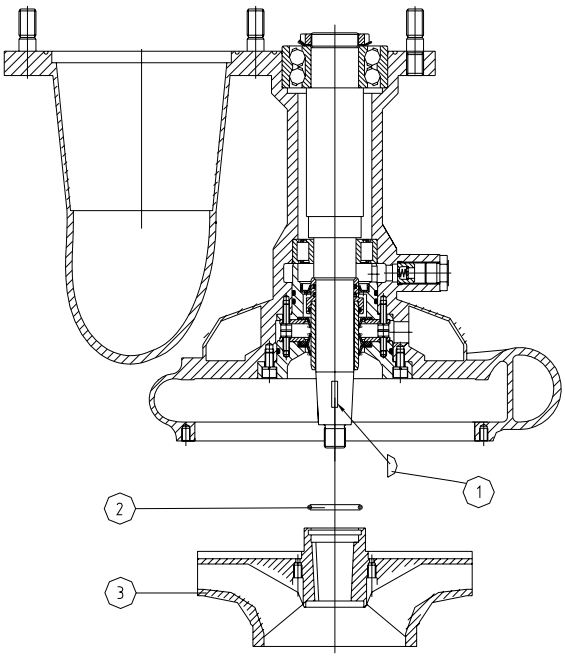
1. Place the pumphead flat on the working surface
2. Insert the shaft spanner (1) in the pump shaft
3. Remove the impeller nut (3). Rotation counterclockwise
4. Remove the O-ring (2)



5. Install the impeller extractor (1)
6. Pull the impeller from the pump shaft with the use of the extractor



7. Remove the impeller (3) from the pumphead
8. Remove the woodruff key (1) from the pump shaft
9. Remove the (O)-ring (2).



1.3.3 Lower seal support removal

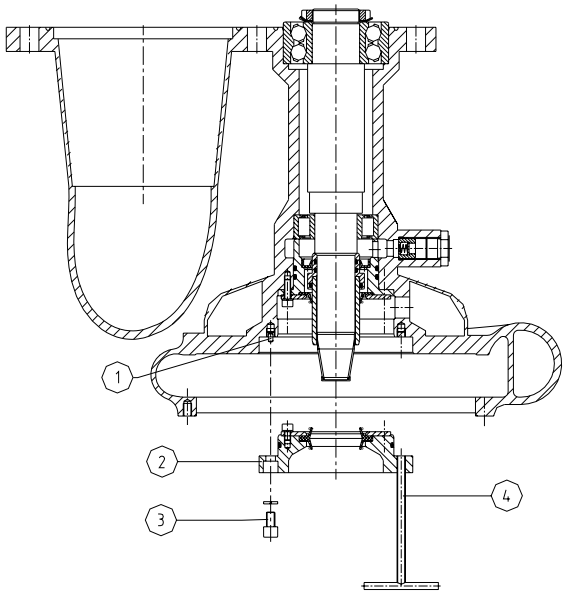
Warning!

The cofferdam can still contain product remains!

Note:

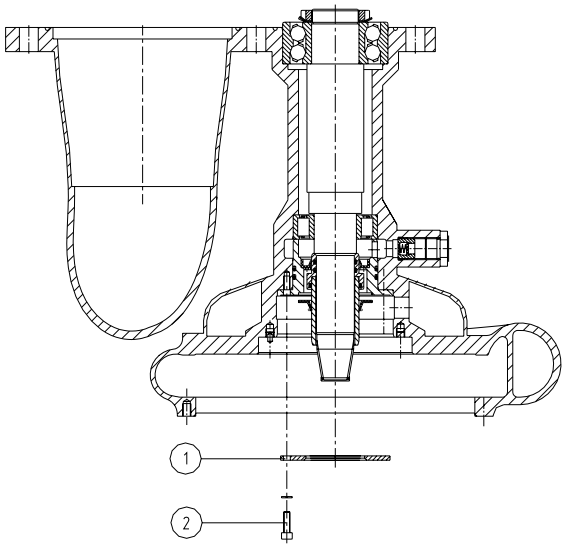
Some pump casings are equipped with a dowel pin (1).

1. Remove the socket head screws (3) and washers
2. Screw the two extractors (4) into the lower seal support (2)
3. Pull the lower seal support out of the pump casing using the two extractors.

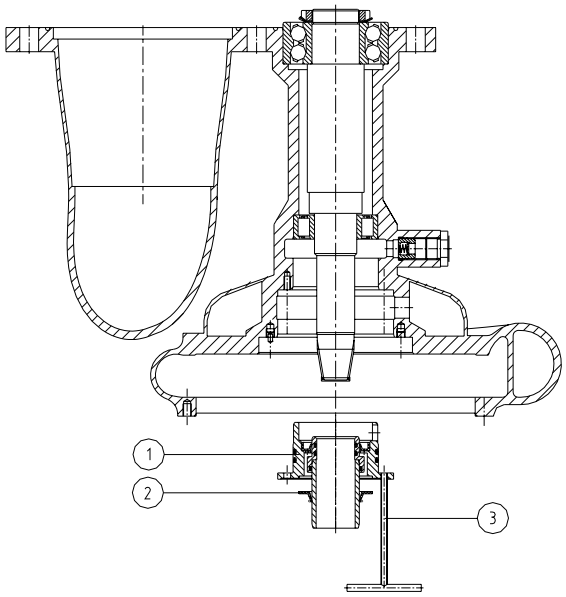


1.3.4 Upper seal support removal

1. Remove the socket head screws (2) and washers
2. Remove the seal support ring (1)

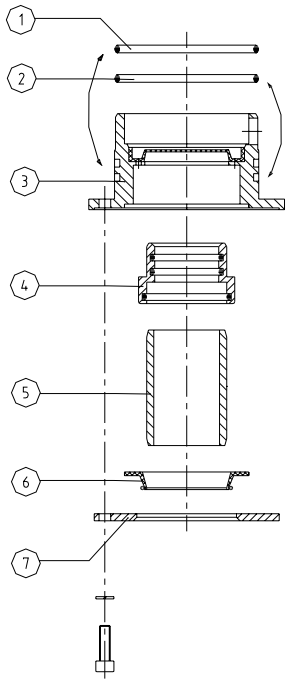


3. Remove the single cargo seal (2)
4. Screw the two extractors (3) into the upper seal support (1)
5. Pull the upper seal support out of the pump casing using the two extractors.

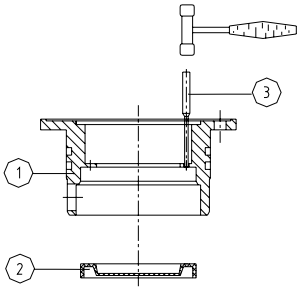


1.3.5 Upper seal support inspection / seal replacement

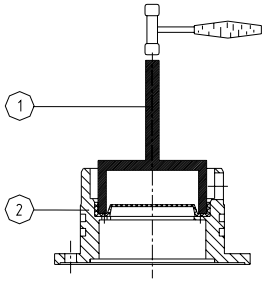
1. Disassemble and inspect all parts of the seal support
2. Inspect the upper seal support (3) for wear and damage
3. Inspect the upper sleeve (4) for wear and damage. Inspect especially for grooves that may have been caused by the seals
4. Inspect the ceramic sleeve (5) for wear and damage. Inspect especially for grooves that may have been caused by the seals
5. Inspect the seal support ring (7) for damage
6. Discard any damaged part and replace with a new one
7. Discard the O-rings (1 and 2) and the single cargo seal (6)



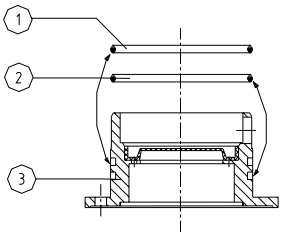
8. Remove the oil seal (2) out of the upper seal support (1)
9. To assist in the removal of the oil seal use a 2 mm drive (3) and lightly tap it with a hammer



10. Take a new oil seal and apply some lubricant before installation
11. Install a new oil seal in the upper seal support (2) using the mounting tool (1)



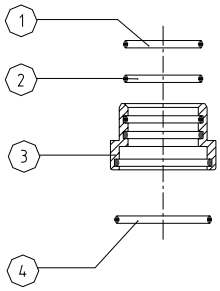
12. Install new O-rings (1 and 2) on the upper seal support (3)



Caution!

Do NOT use oil or grease when installing the O-rings in the upper sleeve!

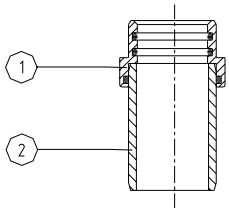
13. Install new O-rings (1, 2 and 4) in the upper sleeve (3)



Caution!

Do NOT use oil or grease when installing the ceramic sleeve in the upper sleeve!

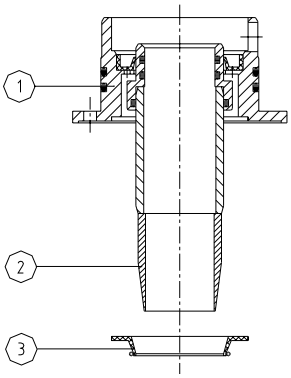
14. Fit the ceramic sleeve (2) in the upper sleeve (1)



Caution!

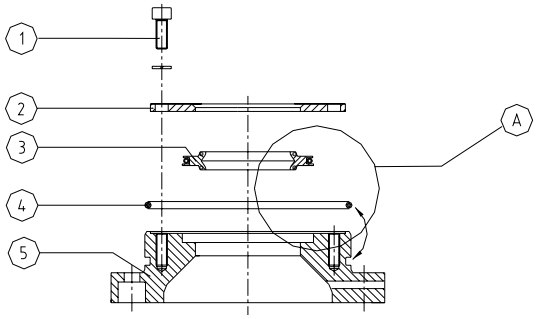
Make sure the single cargo seal is installed in the correct position!

15. Fit the assembled upper sleeve (slightly greased) in the upper seal support (1)
16. Place the single cargo seal (3) over the ceramic sleeve using the mounting tool (2).



1.3.6 Lower seal support inspection / seal replacement

1. Remove the socket head screws (1) and the seal support ring (2)
2. Remove and discard the O-ring (4) and the double cargo seal (3)
3. Clean and inspect the lower seal support (5)



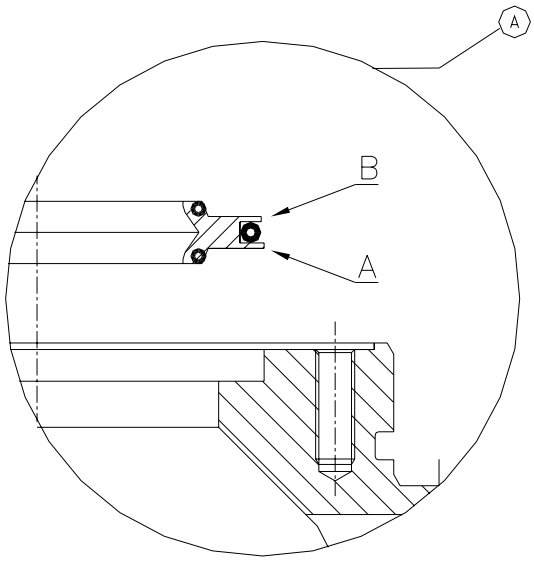
Caution!

Do NOT use oil or grease when installing the double cargo seal in the lower seal support!

Caution!

Make sure the double cargo seal is installed in the correct position!
Diameter A is larger the diameter B (see detail).

4. Install a new double cargo seal in the lower seal support
5. Re-install the seal support ring
6. Install a new O-ring.

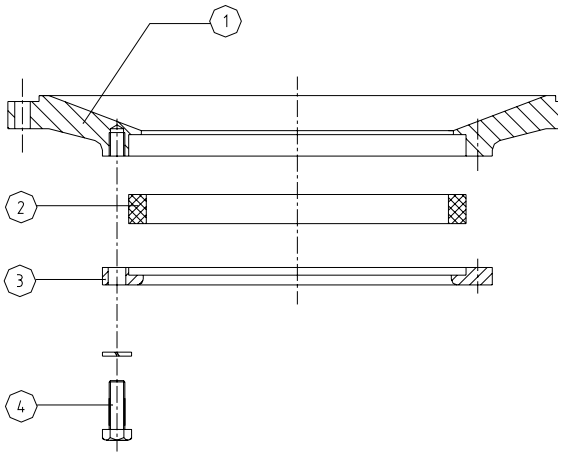


1.3.7 Suction cover wear ring inspection / replacement

Tip.

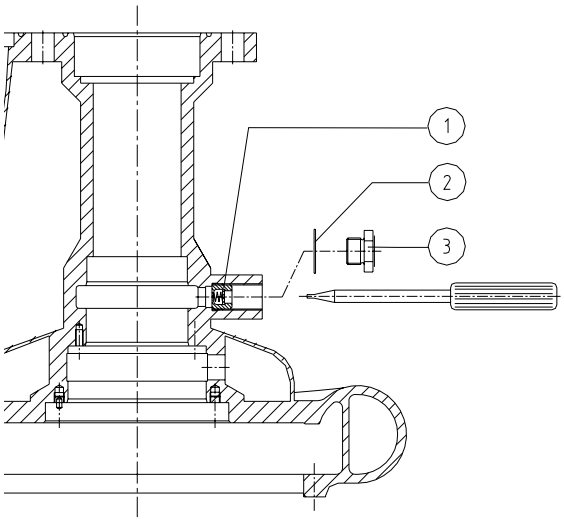
If necessary cool the PTFE wear ring down before installation to ease installation. Use a fridge, coolbox, ice, etc..

1. Remove the hex head screws (4) from the wear ring support (3) on the suction cover (1)
2. Remove the wear ring support
3. Remove the wear ring (2) from the suction cover
4. Install the new wear ring in the suction cover by pressing the cooled wear ring in place
5. Re-install the wear ring support and secure with the hex head screws.



1.3.8 Filling nipple non return valve replacement

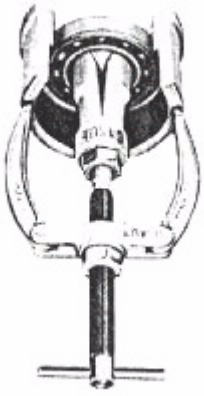
1. Remove the blanking plug (3) and the gasket (2)
2. Discard the gasket
3. Remove the non return valve (1) from the pumphead using a large type screwdriver rotating counterclockwise
4. Clean the housing of the non return valve
5. When the pump shaft is removed clean also the interior of the pumpcasing, especially the purge pipes and the cofferdam
6. Install a new non return valve and tighten it with a large screwdriver rotating clockwise
7. Install the blanking plug and new gasket.

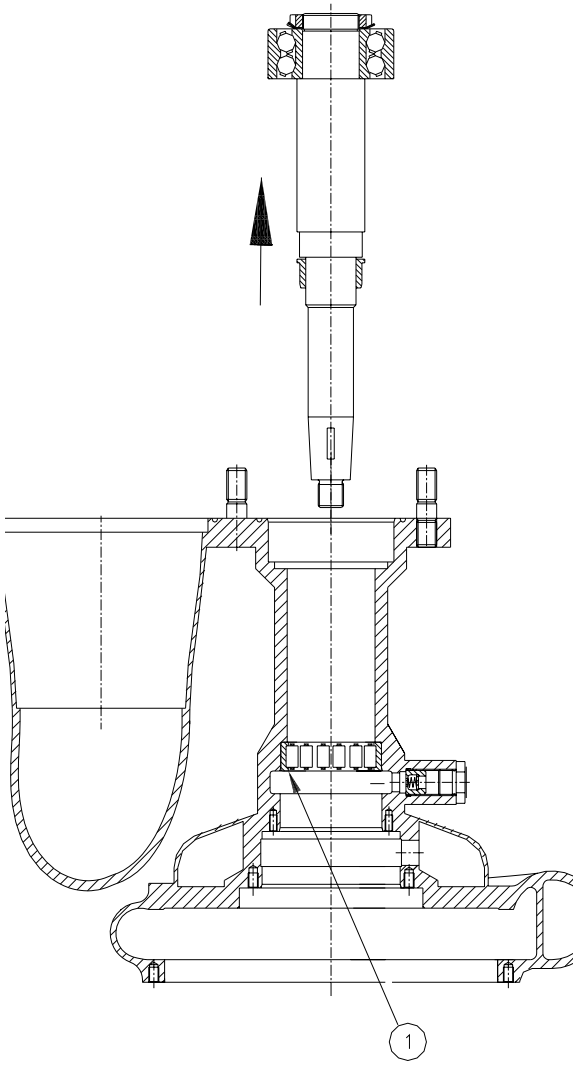


1.3.9 Pump shaft bearings replacement

1. Push the pump shaft (together with the upper bearing and the lower bearing inner ring) out of the pump casing manually
2. Remove the outer ring of the lower bearing (1) using an "inside impeller extractor"

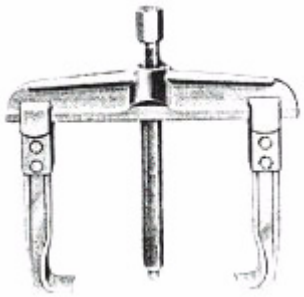
Inside impeller extractor

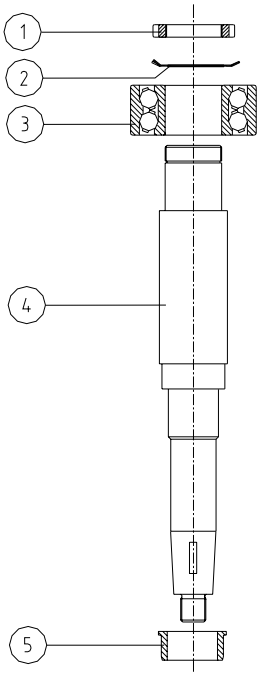




3. Release the lock washer (2) from the bearing nut (1)
4. Remove the bearing nut
5. Remove the upper bearing (3) and the lower bearing inner ring (5) from the pump shaft (4) using a "bearing extractor"

Bearing extractor





6. Inspect and replace relevant components

7. Separate the inner ring from the new lower bearing.

Caution!

It is not allowed to heat up the bearings with a burner, torch, etc.!

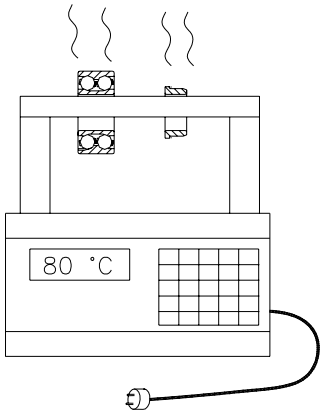
Caution!

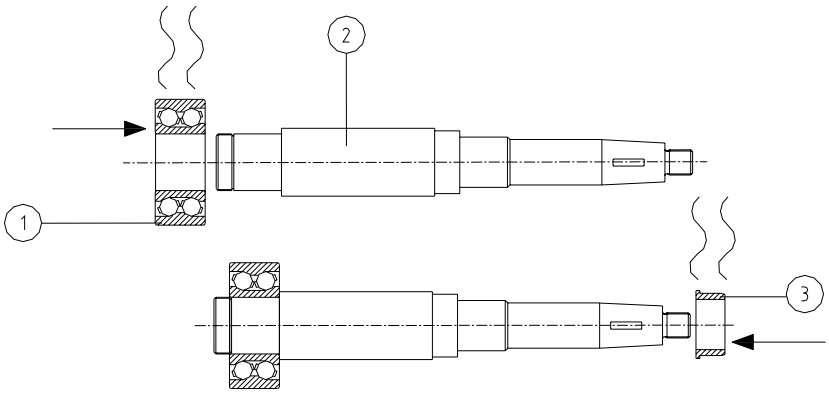
Never heat a bearing to a temperature above 125 ºC (255 ºF)!

Tip.

To prevent sticking make sure the heated bearings slide loosely over the shaft or reheat.

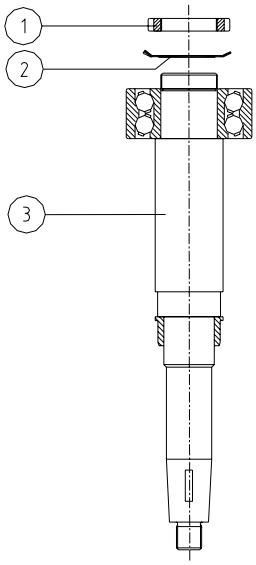
8. Use an electrical bearing heater to warm the inner ring of the lower bearing and the new upper bearing.
   Normally a bearing temperature of 80 to 90 ºC (175 to 195 ºF) **above** the temperature of the shaft is sufficient for mounting
9. Slide the heated upper bearing (1) over the pump shaft (2) up to the shaft collar and allow it to cool down
10. Slide the heated inner ring (3) over the pump shaft up to the shaft collar and allow it to cool down





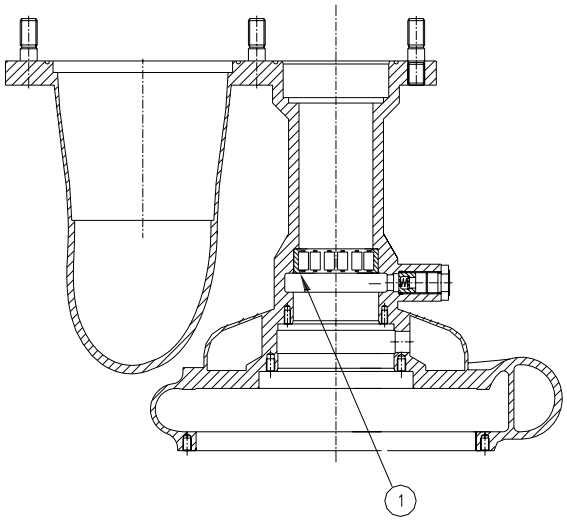
11. Place the lock washer (2) over the pump shaft (3) and install the bearing nut (1)
12. Tighten the bearing nut using a "C-spanner"

C-spanner

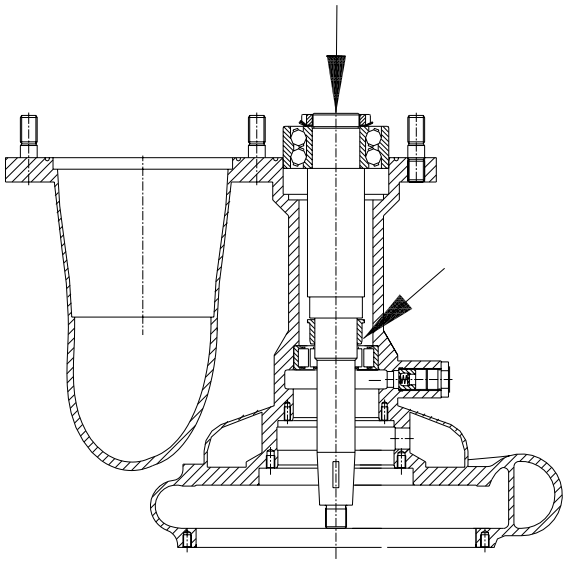


13. Check the bearing for rotation using the outer ring
14. Lock the bearing nut in position by bending a lip of the lock washer

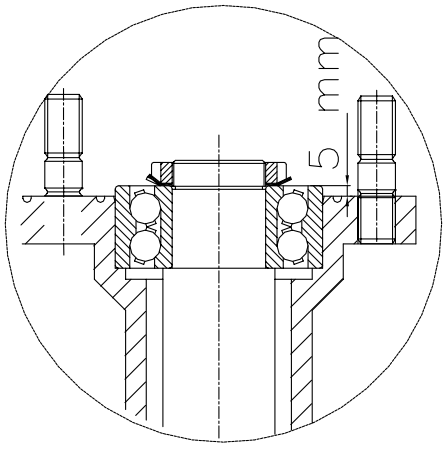
15. Clean and inspect the pump casing thoroughly especially the purge pipes and the cofferdam
16. When required replace the non return valve according to 1.3.8
17. Add some grease at the location of the lower bearing and on the outer ring of the lower bearing
18. Slide the outer ring of the lower bearing (1) in position



19. Add some grease in the pump casing at the locations of the upper bearing and the lower bearing inner ring
20. Slide the assembled pump shaft carefully in the pump casing
21. Position the inner ring of the lower bearing with care in the already installed outer ring of the lower bearing
22. Check that the pump shaft rotates smoothly by rotating it manually

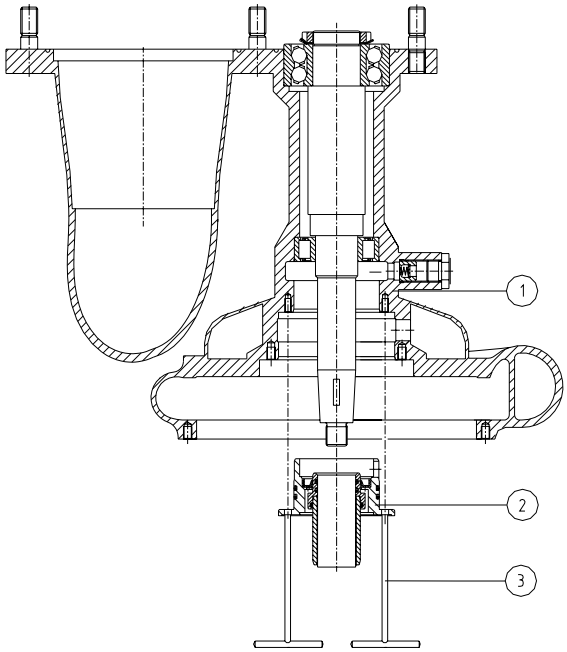


23. Measure the height of the protrusion of the upper bearing in the pump flange (5 mm.)



1.3.10 Upper seal support installation

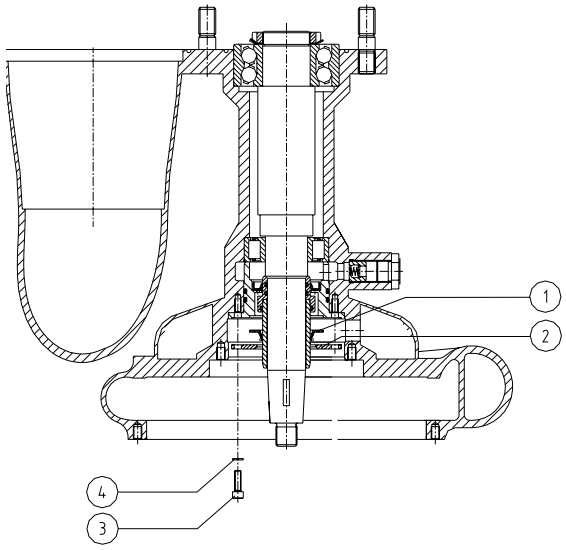
1. Slide the, lightly greased, assembled upper seal support (2) into the pump casing (1)
2. Place the upper seal support in position using the two extractors (3)



Caution!

The single cargo seal can be easily damaged. Take care when installing the seal support ring!

3. Slide the single cargo seal (1) over the ceramic sleeve
4. Place the seal support ring (2) in the pump casing and secure with the socket head screws (3) and lock washers (4).

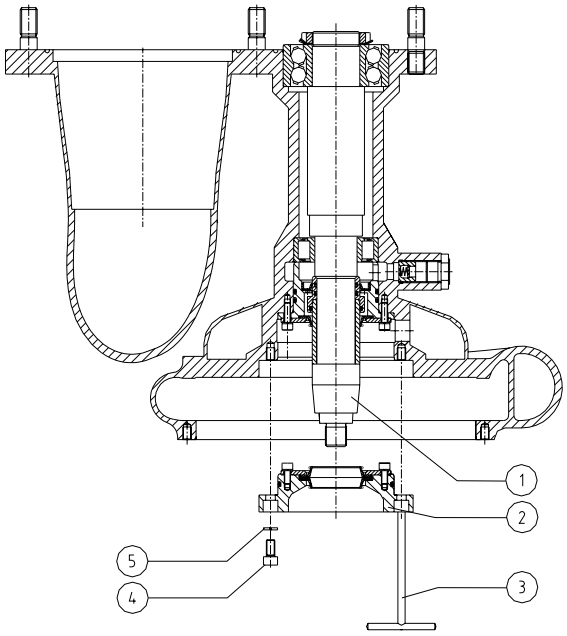


1.3.11 Lower seal support installation

Caution!

The double cargo seal can be easily damaged. Take care when installing the seal support!

1. Install the mounting tool (1) for the cargo seal over the pump shaft (if applicable)
2. Slide the (slightly greased) assembled lower seal support (2) over the mounting tool in the pump casing
3. Place the lower seal support in position using the two extractors (3)
4. Secure the lower seal support with the socket head screws (4) and lock washers (5)
5. Remove the mounting tool for the cargo seal.



1.3.12 Impeller inspection

Inspect the impeller for damage and replace if necessary.

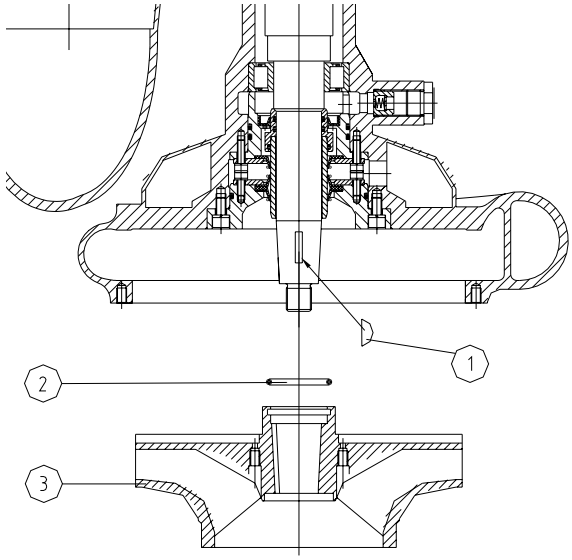
The impeller is a long life component. Replacement is only necessary when damaged or when there is a significant decrease in capacity (loss of performance).

Contact the Marflex engineering department for advice on repair when no spare part is available.

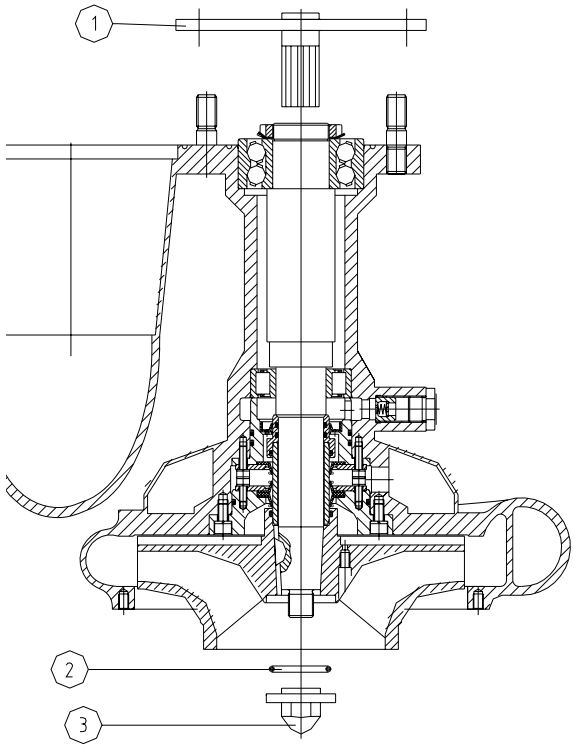
1.3.13 Impeller installation

Only for a pumphead with conical shaft end (W-type).

1. Clean the tapered end and the key slot of the pump shaft thoroughly
2. Place the O-ring (2) in the groove of the impeller (1)
3. Put the woodruff key (1) in the key slot of the pump shaft
4. Align the keyway in the impeller with woodruff key in the pump shaft and slide the impeller on the pump shaft

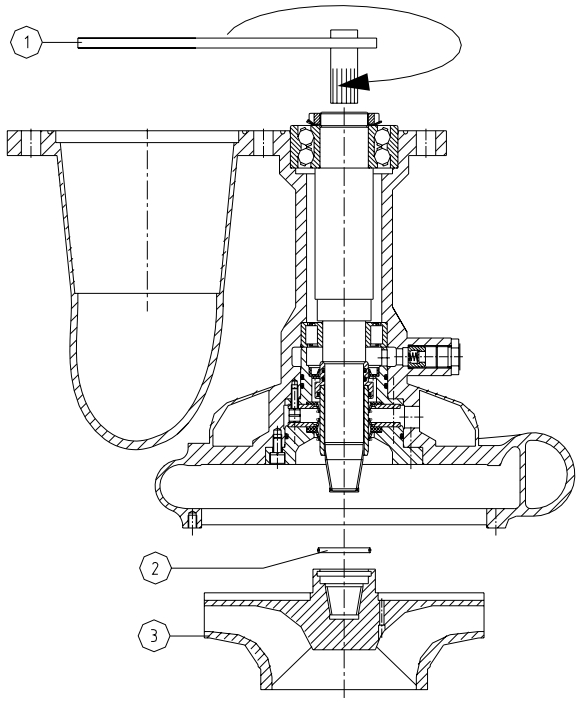


5. Put the pumphead on its side on a proper flat working surface
6. Place the O-ring (2) in the groove of the impeller nut (3)
7. Install the impeller nut on the pump shaft
8. Insert the shaft spanner (1) in the pump shaft
9. Tighten the impeller nut (clockwise) to the prescribed torque value (see drawing pumphead) using a suitable torque wrench
10. Check that the impeller rotates smoothly by rotating it manually.



Only for a pumphead with conical thread (X-type).

1. Clean the thread of the pump shaft and the thread inside the impeller thoroughly
2. Place the O-ring (2) in the groove of the impeller (3)
3. Install the impeller by rotating it clockwise (manually) on the pump shaft
4. Put the pumphead on its side on a proper flat working surface
5. Insert the shaft spanner (1) in the pump shaft
6. Tighten the impeller to the pump shaft by tapping the shaft spanner with a metal hammer in a clockwise direction
7. Check that the impeller rotates smoothly by rotating it manually.

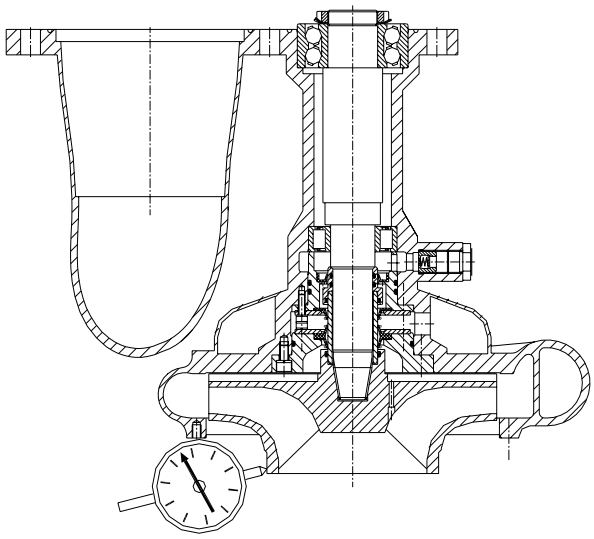


All types of pumphead.

Check (using a dial gauge) the oscillation of the impeller by rotating the impeller manually.

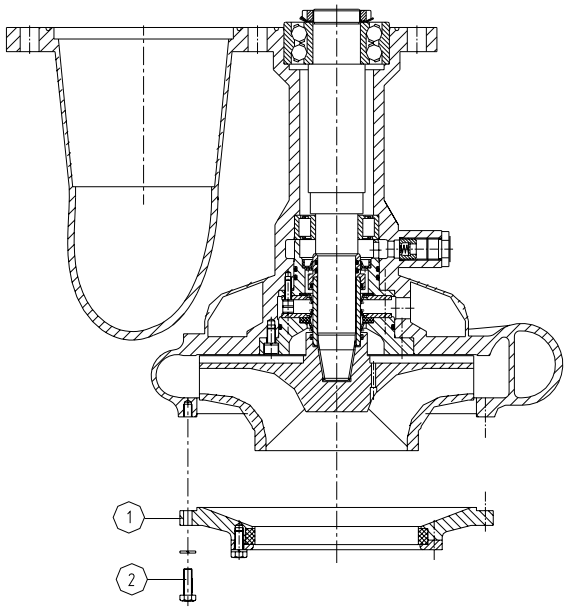
Deflection (=imbalance) must be < 0,05 mm.

When the deflection exceeds this limit check the pump shaft and the impeller. Replace if necessary.

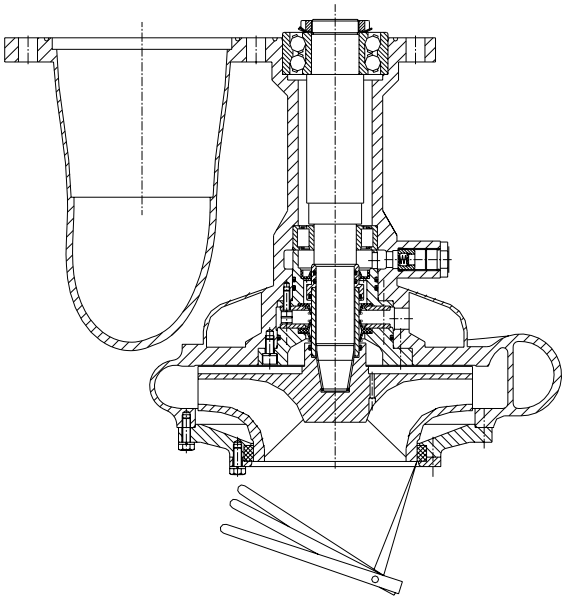


1.3.14 Suction cover installation

1. Place the pumphead, upside down, on a proper flat working surface
2. Place the assembled suction cover (1) over the impeller
3. Install the suction cover with the hex head screws (2) and lock washers
4. Make sure the impeller is not locked as a result of a to small clearance with the (new) wearring.



5. Check the clearance between the wearing in the suction cover and the impeller with a feeler gauge (new wearring < 0,25 mm, used wearring < 1 mm)
6. Check that the impeller can rotate freely.



1.4 Maintenance schedule

Table 1: Maintenance cycle and actions

Maintenance interval		Maintenance action	
M	Monthly	C	Check
Q	Every 3 months	A	Adjust
S	Every 6 months	W	Clean
Y	Yearly	L	Lubricate
D	When disassembled	R	Replace

Note:

Marflex advises to carry out an extensive overhaul of the complete pump assembly once every 5 year!

1.4.1 Top cover

Table 2: Maintenance top cover

Interval	Component / material	Action(s)
M	Oil level	C, A
M	Coupling attachment bolts torque value (once after installation)	C, A
Y	Interior	C, W
Y	Coupling attachment bolts torque value	C, A
Y	Lubrication oil	R
Y	Top cover general condition	C

1.4.2 Pipe stack

Table 3: Maintenance pipe stack

Interval	Component / material	Action(s)
Y	Lubrication oil	R
Y	Pipe stack supports	C
Y	Pipe stack general condition	C
D	Ball Bearings (in case of a multi part pipe stack)	R

1.4.3 Pump head

Table 4: Maintenance pump head

Interval	Component / material	Action(s)
Y	Lubrication oil	R
Y	Drain plug gasket	R
Y	Bearings	C
Y	Impeller	C
Y	Pump head general condition	C
D	O-rings (between pump head and pipe stack)	R
D	Ceramic sleeve	C
D	Upper sleeve	C
D	Single cargo seal	R
D	Double cargo seal	R
D	O-rings (inside the pump head)	R
D	Wear ring	C

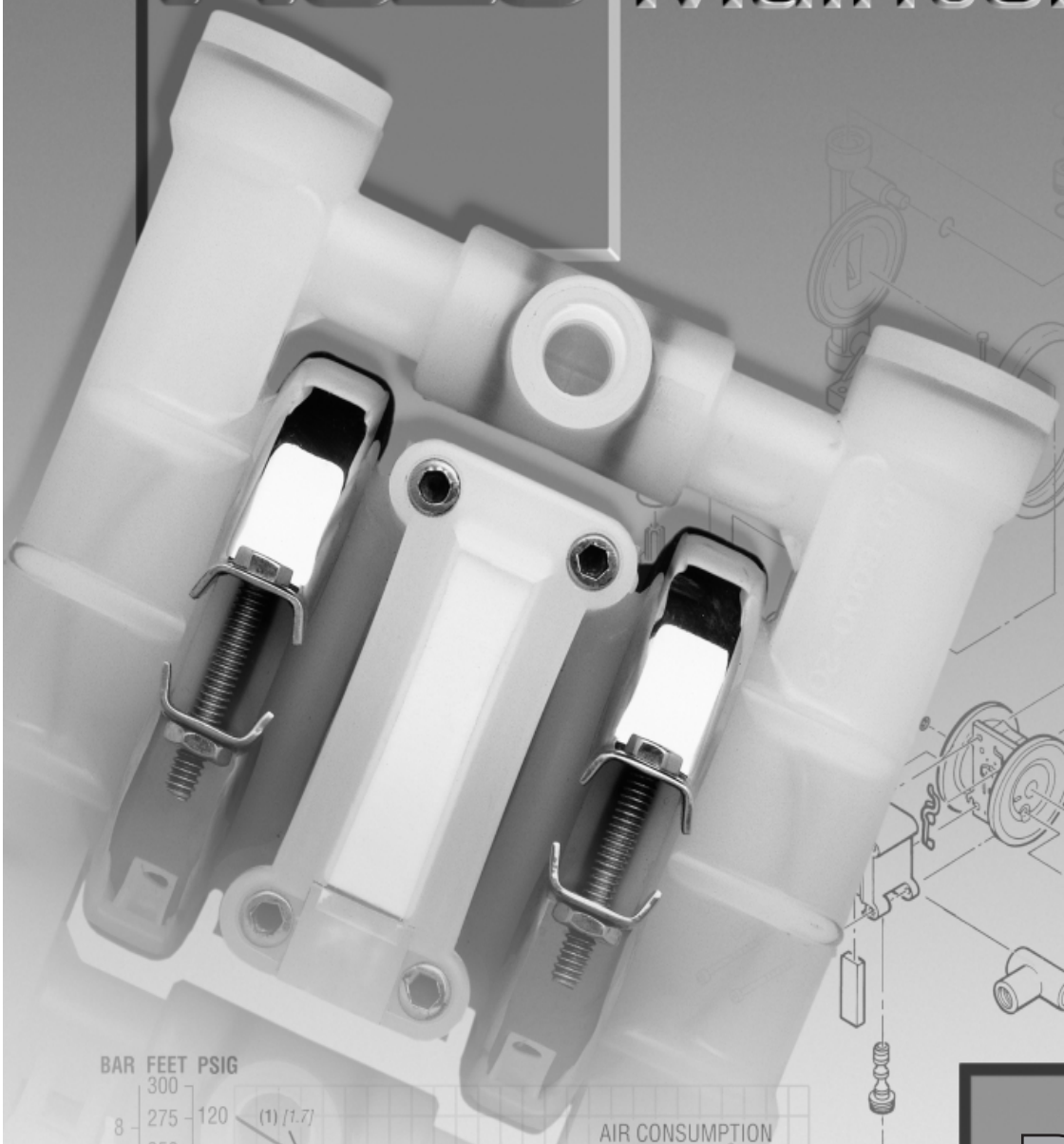
1.4.4 Electro motor

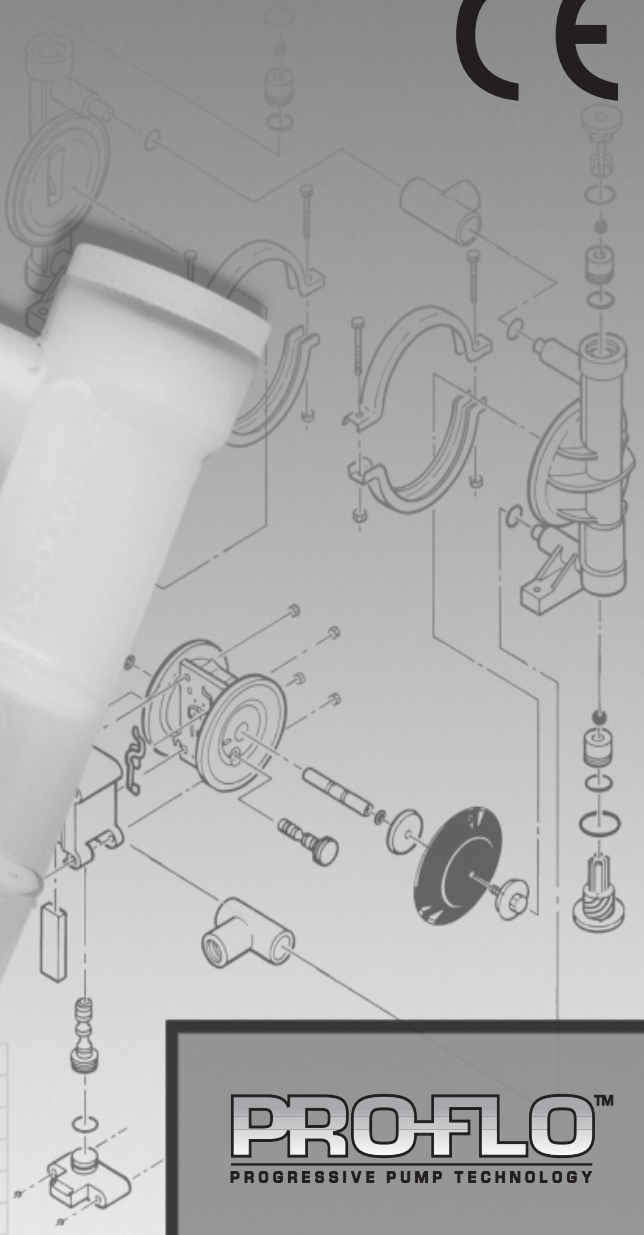
Table 5: Maintenance electro motor

Interval	Component / material	Action(s)
M	Cooling fan	C
M	Electro motor general condition	C
Y	Sealing of terminal box	C
Y	Sealing of cable glands	C
Y	Bearing lubrication (frame size > 280) (check manufacturer manual)	L, R

P.025 Engineering Operation & Maintenance

CE





WILDEN®

A DOVER COMPANY

PRO-FLO™

PROGRESSIVE PUMP TECHNOLOGY

Plastic Pumps

EOM-P.025P 9/02
REPLACES EOM-P.025P 4/02

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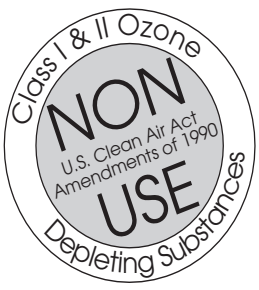
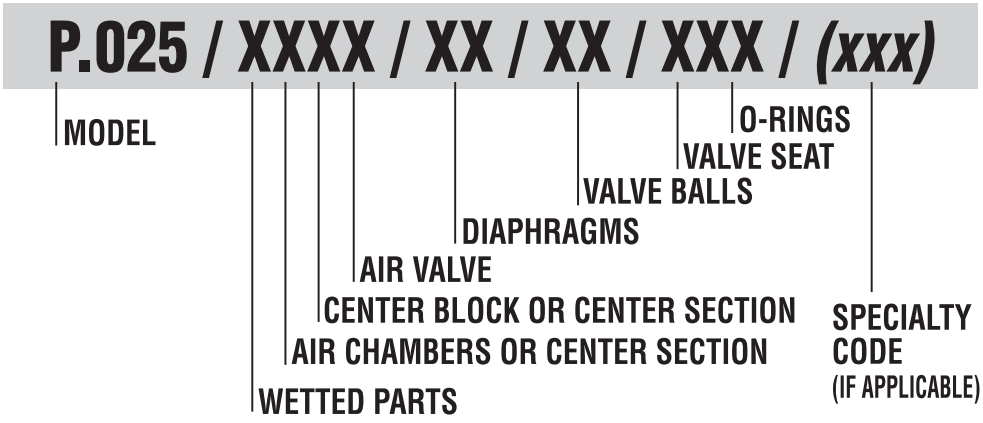
Member of: Hydraulic INSTITUTE



SECTION 1

WILDEN PUMP DESIGNATION SYSTEM



In the case where a center section is used instead of a center block and air chambers, the designation will be as follows: Acetal = LL

MODEL P.025 PLASTIC MATERIAL CODES

WETTED PARTS
G = CARBON-FILLED ACETAL
K = PVDF
P = POLYPROPYLENE

AIR CHAMBERS
L = ACETAL
P = POLYPROPYLENE

CENTER SECTION
L = ACETAL
P = POLYPROPYLENE

AIR VALVE
L = ACETAL
P = POLYPROPYLENE

DIAPHRAGMS
BN = BUNA-N (Red Dot)
TX = TEFLON® PTFE with integral outer piston (White)
WF = WIL-FLEX™ (Orange)

VALVE BALL
TF = TEFLON® PTFE (White)

VALVE SEAT
G = CARBON-FILLED ACETAL
K = PVDF
P = POLYPROPYLENE

VALVE SEAT O-RING*
BN = BUNA-N
TF = TEFLON® PTFE
TS = TEFLON® ENCAP. SILICON
TV = TEFLON® ENCAP. VITON®
WF = WIL-FLEX™

*Carbon-filled Acetal pumps utilize a Fluoro-Seal™ O-ring in the tee section only.

NOTE: MOST ELASTOMERIC MATERIALS USE COLORED DOTS FOR IDENTIFICATION.

SECTION 2

THE WILDEN PUMP — HOW IT WORKS

The Wilden diaphragm pump is an air-operated, positive displacement, self-priming pump. These drawings show flow pattern through the pump upon its initial stroke. It is assumed the pump has no fluid in it prior to its initial stroke.

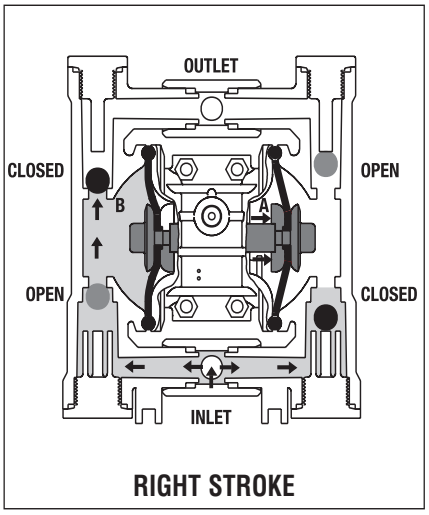


FIGURE 1 The air valve directs pressurized air to the back side of diaphragm A. The compressed air is applied directly to the liquid column separated by elastomeric diaphragms. The diaphragm acts as a separation membrane between the compressed air and liquid, balancing the load and removing mechanical stress from the diaphragm. The compressed air moves the diaphragm away from the center block of the pump. The opposite diaphragm is pulled in by the shaft connected to the pressurized diaphragm. Diaphragm B is on its suction stroke; air behind the diaphragm has been forced out to the atmosphere through the exhaust port of the pump. The movement of diaphragm B toward the center block of the pump creates a vacuum within chamber B. Atmospheric pressure forces fluid into the inlet manifold forcing the inlet valve ball off its seat. Liquid is free to move past the inlet valve ball and fill the liquid chamber (see shaded area).

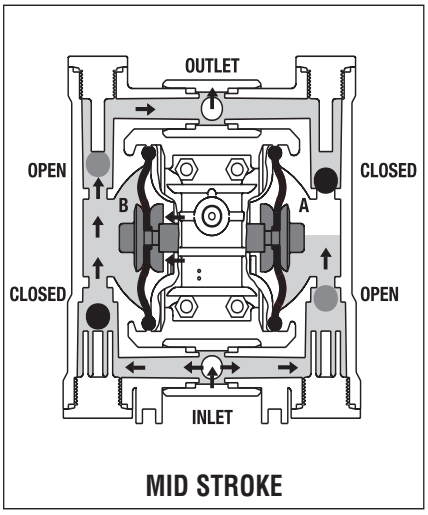


FIGURE 2 When the pressurized diaphragm, diaphragm A, reaches the limit of its discharge stroke, the air valve redirects pressurized air to the back side of diaphragm B. The pressurized air forces diaphragm B away from the center block while pulling diaphragm A to the center block. Diaphragm B is now on its discharge stroke. Diaphragm B forces the inlet valve ball onto its seat due to the hydraulic forces developed in the liquid chamber and manifold of the pump. These same hydraulic forces lift the discharge valve ball off its seat, while the opposite discharge valve ball is forced onto its seat, forcing fluid to flow through the pump discharge. The movement of diaphragm A toward the center block of the pump creates a vacuum within liquid chamber A. Atmospheric pressure forces fluid into the inlet manifold of the pump. The inlet valve ball is forced off its seat allowing the fluid being pumped to fill the liquid chamber.

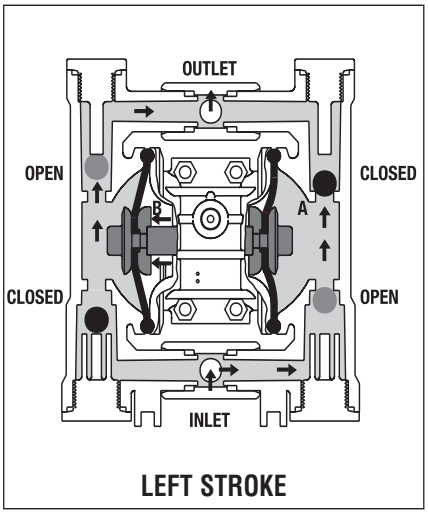
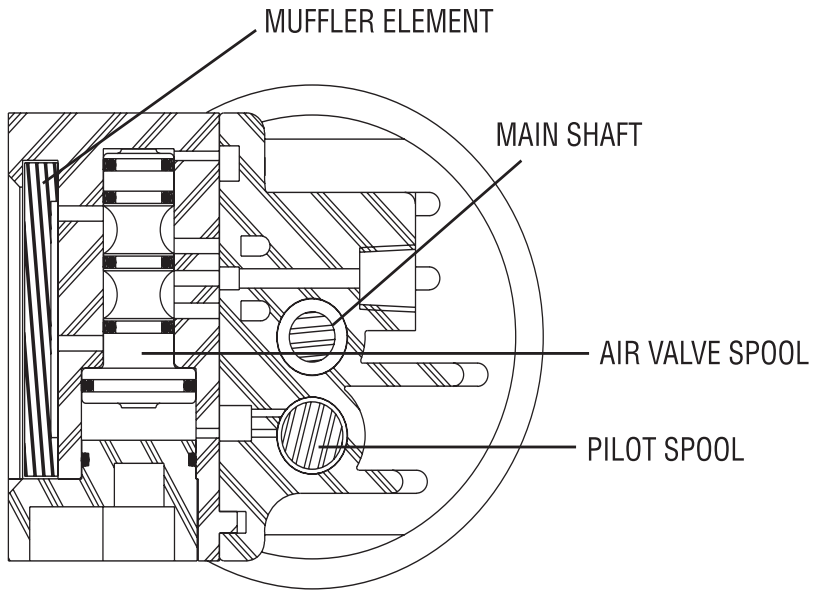


FIGURE 3 At completion of the stroke, the air valve again redirects air to the back side of diaphragm A, which starts diaphragm B on its exhaust stroke. As the pump reaches its original starting point, each diaphragm has gone through one exhaust and one discharge stroke. This constitutes one complete pumping cycle. The pump may take several cycles to completely prime depending on the conditions of the application.

PRO-FLO™ AIR DISTRIBUTION SYSTEM OPERATION — HOW IT WORKS

Figure 1



The Pro-Flo™ patented air distribution system incorporates three moving parts: the air valve spool, the pilot spool, and the main shaft/diaphragm assembly. The heart of the system is the air valve spool and air valve. As shown in Figure 1, this valve design incorporates an unbalanced spool. The smaller end of the spool is pressurized continuously, while the large end is alternately pressurized and exhausted to move the spool. The spool directs pressurized air to one chamber while exhausting the other. The air causes the main shaft/diaphragm assembly to shift to one side — discharging liquid on one side and pulling liquid in on the other side. When the shaft reaches the end of its stroke, it actuates the pilot spool, which pressurizes and exhausts the large end of the air valve spool. The pump then changes direction and the same process occurs in the opposite direction, thus reciprocating the pump.

SECTION 3

WILDEN MODEL P.025 PLASTIC CAUTIONS – READ FIRST!

TEMPERATURE LIMITS:

Polypropylene	0°C to 79°C	+32°F to 175°F
PVDF	–12°C to 107°C	+10°F to 225°F
Carbon Filled Acetal	–28.9°C to 82.2°C	–20°F to 180°F
Buna-N	–12.2°C to 82.2°C	+10°F to +180°F
Viton®	–40°C to 176.7°C	–40°F to +350°F
Wil-Flex™	–40°C to 107.2°C	–40°F to +225°F
Teflon® PTFE	+4.4°C to 104.4°C	+40°F to +220°F

CAUTION: When choosing pump materials, be sure to check the temperature limits for all wetted components. Example: Viton® has a maximum limit of 176.7°C (350°F) but polypropylene has a maximum limit of only 79°C (175°F).

CAUTION: Maximum temperature limits are based upon mechanical stress only. Certain chemicals will significantly reduce maximum safe operating temperatures. Consult engineering guide for chemical compatibility and temperature limits.

CAUTION: Always wear safety glasses when operating pump. If diaphragm rupture occurs, material being pumped may be forced out air exhaust.

WARNING: Prevention of static sparking — If static sparking occurs, fire or explosion could result. Pump, valves, and containers must be properly grounded when handling flammable fluids and whenever discharge of static electricity is a hazard.

CAUTION: Do not exceed 8.6 Bar (125 psig) air supply pressure.

CAUTION: Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from pump. Disconnect all intake, discharge and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container.

CAUTION: Blow out air line for 10 to 20 seconds before attaching to pump to make sure all pipe line debris is clear. Use an in-line air filter. **A 5µ (micron) air filter is recommended.**

NOTE: Tighten clamp bands and retainers prior to installation. Fittings may loosen during transportation.

NOTE: When installing Teflon® diaphragms, it is important to tighten outer pistons simultaneously (turning in opposite directions) to ensure tight fit.

NOTE: Before starting disassembly, mark a line from each liquid chamber to its corresponding air chamber. This line will assist in proper alignment during reassembly.

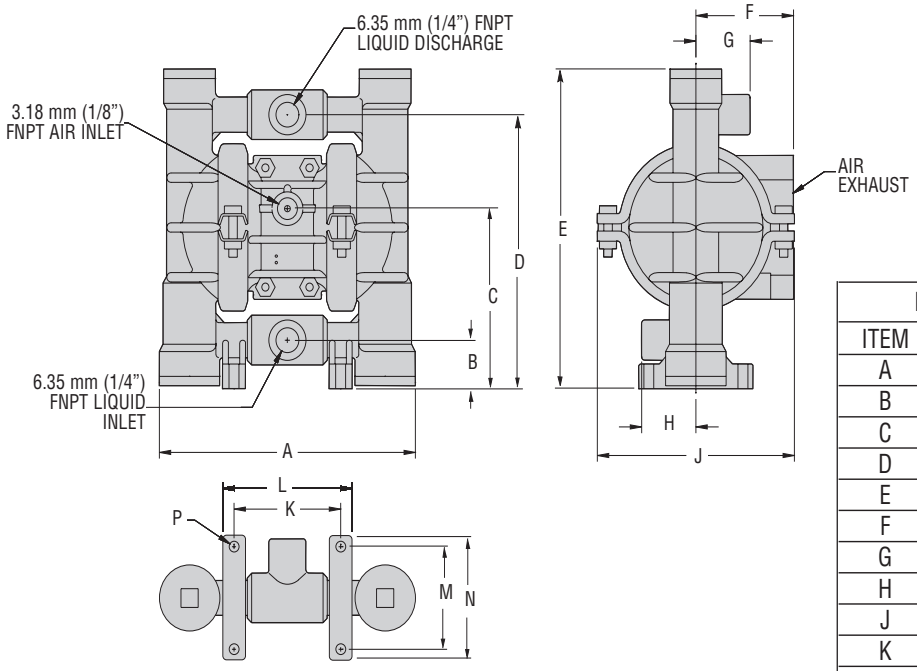
CAUTION: Verify the chemical compatibility of the process and cleaning fluid to the pump's component materials in the Chemical Resistance Guide. (see E4).

NOTE: Plastic series pumps are made of virgin plastic and are not UV stabilized. Direct sunlight for prolonged periods can cause deterioration of plastics.

NOTE: Carbon-filled Acetal pumps are shipped with a grounding strap. The strap is attached to the manifold clamp band bolt. This strap must be attached via the clip to a proper grounding point.

CAUTION: The P.025 pump is not submersible.

SECTION 4
DIMENSIONAL DRAWING
WILDEN MODEL P.025 PLASTIC



DIMENSIONS – P.025 Pro-Flo™		
ITEM	METRIC (mm)	STANDARD (inch)
A	144.5	5.68
B	25.0	1
C	92.9	3.65
D	140.5	5.53
E	163.1	6.43
F	56.7	2.23
G	30.2	1.18
H	30.2	1.18
J	115.1	4.53
K	61.1	2.40
L	74.6	2.93
M	52.8	2.09
N	64.3	2.53
P	Ø5.6	Ø.53

SECTION 5A

PERFORMANCE CURVES

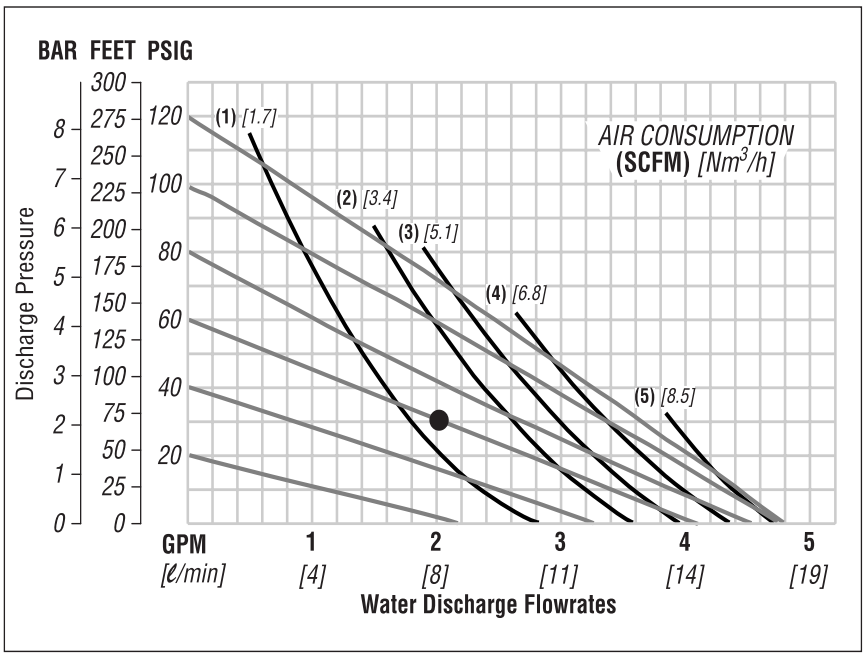
MODEL P.025 PLASTIC RUBBER-FITTED

Height .....163 mm (6 7/16")
Width .....144.5 mm (5 11/16")
Depth .....115.1 mm (4 17/32")
Ship Weight.....Polypropylene 1.4 kg (3 lbs.)
PVDF 1.4 kg (3 lbs.)
CFA 1.4 kg (3 lbs.)
Air Inlet .....3.18 mm (1/8")
Inlet .....6.35 mm (1/4")
Outlet.....6.35 mm (1/4")
Suction Lift .....2.74 m Dry (9')
9.45 m Wet (31')
Displacement per
Stroke .....0.02 l (0.004 gal.)[1]
Max. Flow Rate.....18.1 lpm (4.8 gpm)
Max. Size Solids..... .4 mm (1/64")

[1]Displacement per stroke was calculated at 4.8 Bar (70 psig) air inlet pressure against a 2 Bar (30 psig) head pressure.

Example: To pump 7.6 lpm (2 gpm) against a discharge pressure head of 2 Bar (30 psig) requires 4.1 Bar (60 psig) and 2.0 Nm³/h (1.2 scfm) air consumption. (See dot on chart.)

Caution: Do not exceed 8.6 Bar (125 psig) air supply pressure.



Flow rates indicated on chart were determined by pumping water.

For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump performance curve.

SECTION 5B

PERFORMANCE CURVES

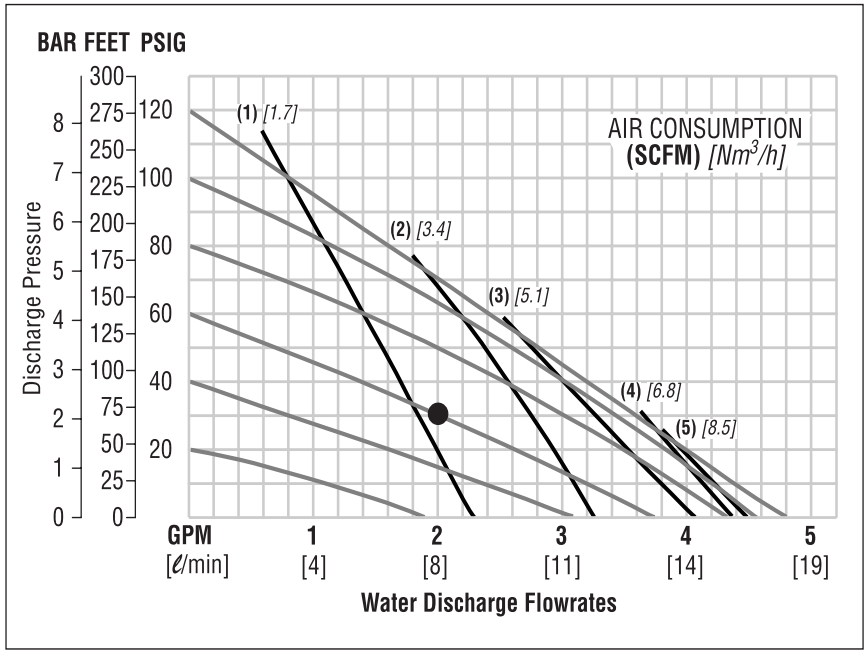
MODEL P.025 PLASTIC TPE-FITTED

Height .....163 mm (6 7/16")
Width .....144.5 mm (5 11/16")
Depth .....115.1 mm (4 17/32")
Ship Weight.....Polypropylene 1.4 kg (3 lbs.)
PVDF 1.4 kg (3 lbs.)
CFA 1.4 kg (3 lbs.)
Air Inlet .....3.18 mm (1/8")
Inlet .....6.35 mm (1/4")
Outlet.....6.35 mm (1/4")
Suction Lift .....3.05 m Dry (10')
8.84 m Wet (29')
Displacement per
Stroke ..... 0.02 l gal. (0.005)[1]
Max. Flow Rate.....18.1 lpm (4.8 gpm)
Max. Size Solids..... .4 mm (1/64")

[1]Displacement per stroke was calculated at 4.8 Bar (70 psig) air inlet pressure against a 2 Bar (30 psig) head pressure.

Example: To pump 7.6 lpm (2 gpm) against a discharge pressure head of 2 Bar (30 psig) requires 4.1 Bar (60 psig) and 2.0 Nm³/h (1.2 scfm) air consumption. (See dot on chart.)

Caution: Do not exceed 8.6 Bar (125 psig) air supply pressure.



Flow rates indicated on chart were determined by pumping water.

For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump performance curve.

SECTION 5C

PERFORMANCE CURVES

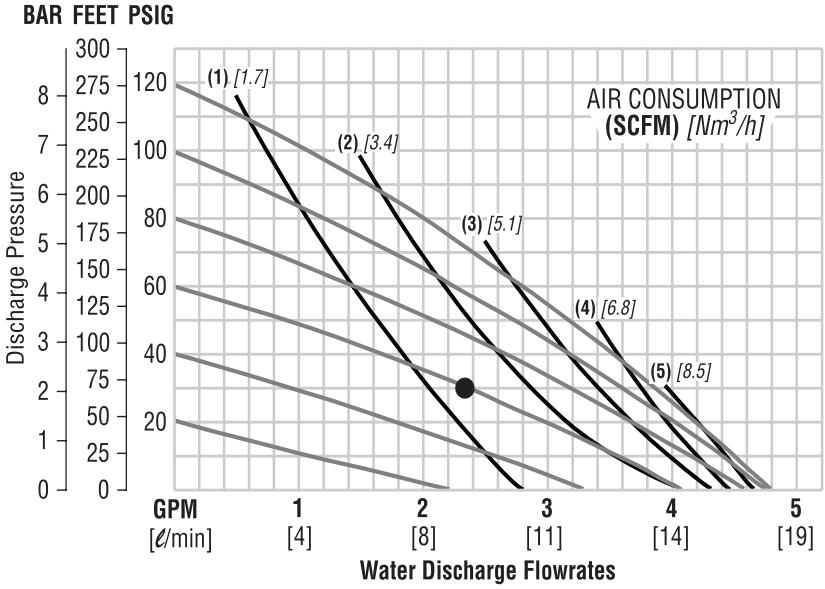
MODEL P.025 PLASTIC TEFLON®-FITTED

Height .....163 mm (6 7/16")
Width .....144.5 mm (5 11/16")
Depth .....115.1 mm (4 17/32")
Ship Weight.....Polypropylene 1.4 kg (3 lbs.)
PVDF 1.4 kg (3 lbs.)
CFA 1.4 kg (3 lbs.)
Air Inlet .....3.18 mm (1/8")
Inlet.....6.35 mm (1/4")
Outlet.....6.35 mm (1/4")
Suction Lift .....2.44 m Dry (8')
8.84 m Wet (29')
Displacement per
Stroke ..... 0.02 l (0.005 gal.)[1]
Max. Flow Rate.....18.1 lpm (4.8 gpm)
Max. Size Solids..... .4 mm (1/64")

[1]Displacement per stroke was calculated at 4.8 Bar (70 psig) air inlet pressure against a 2 Bar (30 psig) head pressure.

Example: To pump 8.7 lpm (2.3 gpm) against a discharge pressure head of 2 Bar (30 psig) requires 4.1 Bar (60 psig) and 2.4 Nm^3/h (1.4 scfm) air consumption. (See dot on chart.)

Caution: Do not exceed 8.6 Bar (125 psig) air supply pressure.

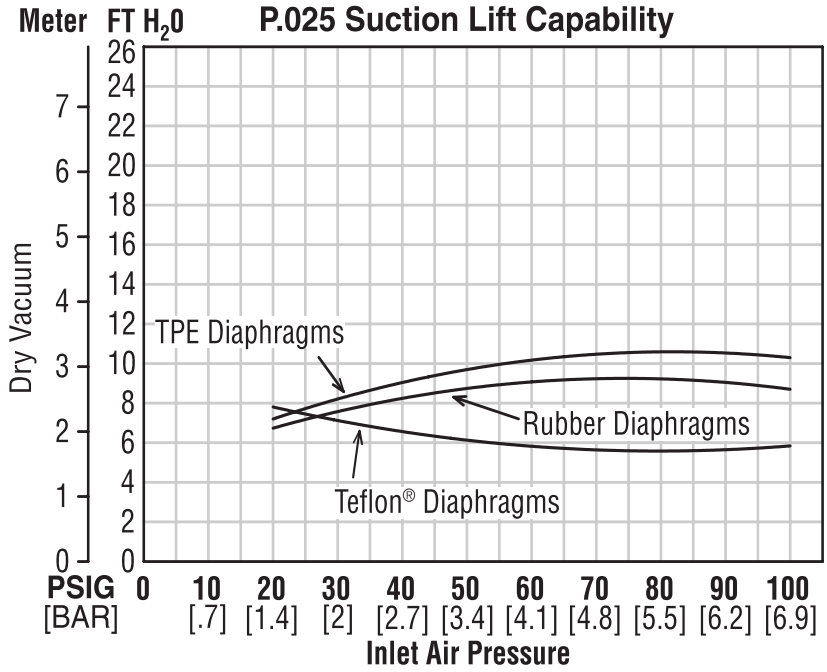


Flow rates indicated on chart were determined by pumping water.

For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump performance curve.

SECTION 6

SUCTION LIFT CURVES & DATA



Suction lift curves are calibrated for pumps operating at 1,000' (305 m) above sea level. This chart is meant to be a guide only. There are many variables which can affect your pump's operating characteristics. The number of intake and discharge elbows, viscosity of pumping fluid, elevation (atmospheric pressure) and pipe friction loss all affect the amount of suction lift your pump will attain.

SECTION 7A
INSTALLATION

The Pro-Flo™ model P.025 has a 6.35 mm (¼") inlet and 6.35 mm (¼") outlet and is designed for flows to 18.7 l/m (4.8 gpm). The **P.025 Plastic** pump is manufactured with wetted parts of pure, unpigmented PVDF, carbon-filled Acetal, or polypropylene. The center section of the **P.025 Plastic** is constructed of virgin Acetal or polypropylene. A variety of diaphragms and O-rings are available to satisfy temperature, chemical compatibility, abrasion and flex concerns.

The suction pipe size should be at least 6.35 mm (¼") diameter or larger if highly viscous material is being pumped. The suction hose must be non-collapsible, reinforced type as the P.025 is capable of pulling a high vacuum. Discharge piping should be at least 6.35 mm (¼"); larger diameter can be used to reduce friction losses. It is critical that all fittings and connections are airtight or a reduction or loss of pump suction capability will result.

INSTALLATION: Months of careful planning, study, and selection efforts can result in unsatisfactory pump performance if installation details are left to chance.

Premature failure and long term dissatisfaction can be avoided if reasonable care is exercised throughout the installation process.

LOCATION: Noise, safety, and other logistical factors usually dictate that “utility” equipment be situated away from the production floor. Multiple installations with conflicting requirements can result in congestion of utility areas, leaving few choices for siting of additional pumps.

Within the framework of these and other existing conditions, every pump should be located in such a way that four key factors are balanced against each other to maximum advantage.

1. ACCESS: First of all, the location should be accessible. If it’s easy to reach the pump, maintenance personnel will have an easier time carrying out routine inspections and adjustments. Should major repairs become necessary, ease of access can play a key role in speeding the repair process and reducing total downtime.

2. AIR SUPPLY: Every pump location should have an air line large enough to supply the volume of air necessary to achieve the desired pumping rate (see pump performance chart). Use air pressure up to a maximum of 8.6 Bar (125 psi) depending on pumping requirements.

Sound levels are reduced below OSHA specifications using the standard Wilden muffler element.

3. ELEVATION: Selecting a site that is well within the pump’s dynamic lift capability will assure that loss-of-prime troubles will be eliminated. In addition, pump efficiency can be adversely affected if proper attention is not given to site location.

4. PIPING: Final determination of the pump site should not be made until the piping problems of each possible location have been evaluated. The impact of current and future installations should be considered ahead of time to make sure that inadvertent restrictions are not created for any remaining sites.

The best choice possible will be a site involving the shortest and straightest hook-up of suction and discharge piping. Unnecessary elbows, bends, and fittings should be avoided. Pipe sizes should be selected so as to keep friction losses within practical limits. All piping should be supported independently of the pump. In addition, the piping should be aligned so as to avoid placing stresses on the pump fittings.

Flexible hose can be installed to aid in absorbing the forces created by the natural reciprocating action of the pump. If the pump is to be bolted down to a solid location, a mounting pad placed between the pump and the foundation will assist in minimizing pump vibration. Flexible connections between the pump and rigid piping will also assist in minimizing pump vibration. If quick-closing valves are installed at any point in the discharge system, or if pulsation within a system becomes a problem, a Wilden SD½ Equalizer surge dampener should be installed to protect the pump, piping and gauges from surges and water hammer.

When pumps are installed in applications involving flooded suction or suction head pressures, a gate valve should be installed in the suction line to permit closing of the line for pump service.

The P.025 cannot be used in submersible applications.

If the pump is to be used in a self-priming application, be sure that all connections are airtight and that the suction lift is within the model’s ability. Note: Materials of construction and elastomer material have an effect on suction lift parameters. Please consult Wilden distributors for specifics.

Pumps in service with a positive suction head are most efficient when inlet pressure is limited to .4–.7 Bar (7–10 psig). Premature diaphragm failure may occur if positive suction is .7 Bar (10 psi) and higher.

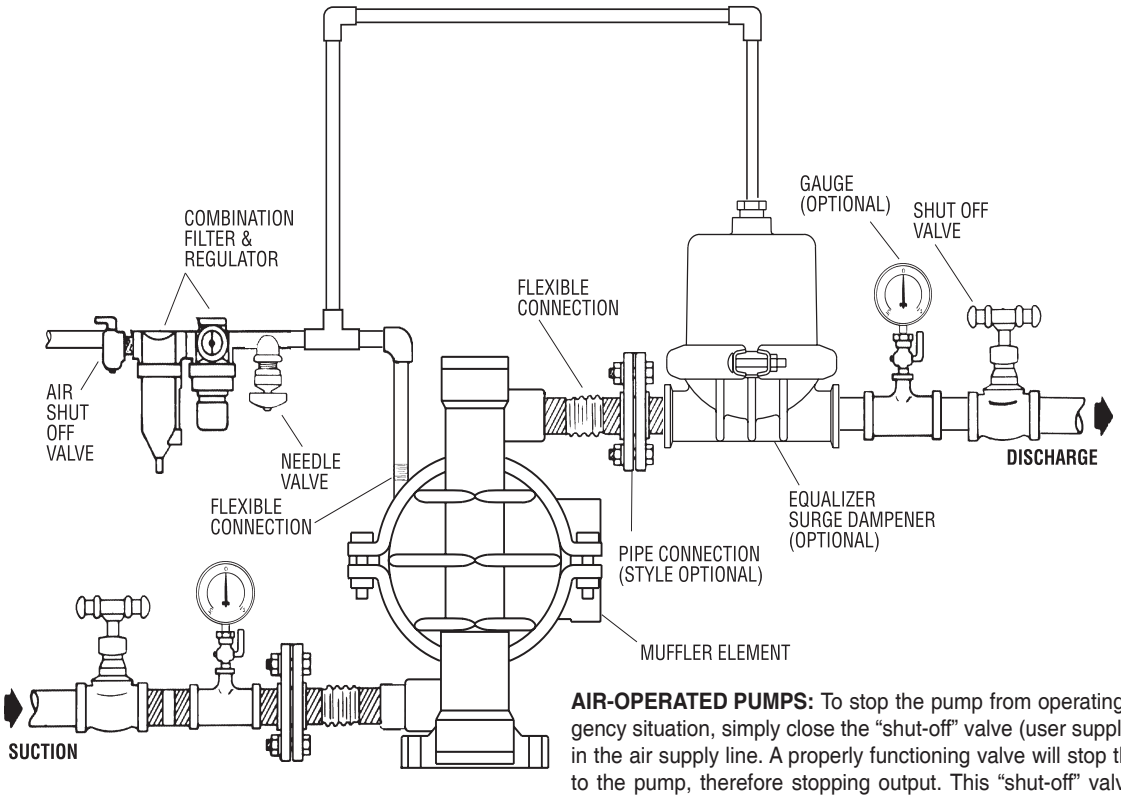
THE MODEL P.025 WILL PASS .4 MM (1/64") SOLIDS. WHENEVER THE POSSIBILITY EXISTS THAT LARGER SOLID OBJECTS MAY BE SUCKED INTO THE PUMP, A STRAINER SHOULD BE USED ON THE SUCTION LINE.

CAUTION: DO NOT EXCEED 8.6 BAR (125 PSIG) AIR SUPPLY PRESSURE.

BLOW OUT AIR LINE FOR 10 TO 20 SECONDS BEFORE ATTACHING TO PUMP TO MAKE SURE ALL PIPE LINE DEBRIS IS CLEAR.

The Pro-Flo™ pump is not submersible.

SUGGESTED INSTALLATION



AIR-OPERATED PUMPS: To stop the pump from operating in an emergency situation, simply close the "shut-off" valve (user supplied) installed in the air supply line. A properly functioning valve will stop the air supply to the pump, therefore stopping output. This "shut-off" valve should be located far enough away from the pumping equipment such that it can be reached safely in an emergency situation.

NOTE: In the event of a power failure, the shutoff valve should be closed, if the restarting of the pump is not desirable once power is regained.

SECTION 7B

SUGGESTED OPERATION AND MAINTENANCE INSTRUCTIONS

For best results, the pumps should use an air filter and regulator. The use of an air filter before the pump will insure that the majority of any pipeline contaminants will be eliminated. The P.025 is permanently lubricated, and does not require in-line lubrication. Additional lubrication will not damage the pump, however if the pump is heavily lubricated by an external source, the pump's internal lubrication may be washed away. If the pump is then moved to a non-lubricated location, it may need to be disassembled and re-lubricated as described in the ASSEMBLY/DISASSEMBLY INSTRUCTIONS.

Pump discharge rate can be controlled by limiting the volume and/or pressure of the air supply to the pump (preferred method). A regulator is used to regulate air pressure. A needle valve is used to regulate air volume. Pump discharge rate can also be controlled by throttling the pump discharge by installing a valve in the discharge line of the pump. This is useful when the need exists to control the pump from a remote location. When the pump discharge pressure equals or exceeds the air supply pressure, the pump will stop; no bypass or pressure relief valve is needed, and pump damage will not occur. When operation is controlled by a solenoid valve in the air line, two-way or three-way valves may be used. Pumping volume can be set by counting the number of strokes per minute.

INSPECTIONS: Periodic inspections have been found to offer the best means for preventing unscheduled pump downtime. Personnel familiar with the pump's construction and service should be informed of any abnormalities that are detected during operation.

RECORDS: When service is required, a record should be made of all necessary repairs and replacements. Over a period of time, such records can become a valuable tool for predicting and preventing future maintenance problems and unscheduled downtime. In addition, accurate records make it possible to identify pumps that are poorly suited to their applications.

SECTION 7C
TROUBLESHOOTING

Pump will not run or runs slowly.

1. Ensure that the air inlet pressure is at least 5 psig above startup pressure and that the differential pressure (the difference between inlet and discharge pressures) is not less than 10 psig.
2. Check air inlet filter for debris (see recommended installation).
3. Check for extreme air leakage which would indicate worn out seals/bores.
4. Disassemble pump and check for obstructions in the air passageways or objects which would obstruct the movement of internal parts.
5. Check for sticking ball check valves. If material being pumped is not compatible with pump elastomers, swelling may occur. Replace ball check valves and seals with proper elastomers. Also, as the check valve balls wear out, they become smaller and can become stuck in the seats. In this case, replace balls and seats.

Pump runs but little or no product flows.

1. Check for pump cavitation; slow pump speed down to match thickness of material being pumped.
2. Verify that vacuum required to lift liquid is not greater than the vapor pressure of the material being pumped (cavitation).
3. Check for sticking ball check valves. If material being pumped is not compatible with pump elastomers, swelling may occur. Replace ball check valves and seals with proper elastomers. Also, as the check valve balls wear out, they become smaller and can become stuck in the seats. In this case, replace balls and seats.
4. Ensure that all suction connections are tight, especially lower valve ball retainers.

Pump air valve freezes.

1. Check for excessive moisture in compressed air. Either install a dryer or hot air generator for compressed air. Alternatively, a coalescing filter may be used to remove the water from the compressed air in some applications.

Air bubbles in pump discharge.

1. Check for ruptured diaphragm.
2. Check tightness of outer pistons.
3. Check tightness of clamp bands and integrity of O-rings and seals, especially at intake manifold.
4. Ensure pipe connections are airtight.

Product comes out air exhaust.

1. Check for diaphragm rupture.
2. Check tightness of pistons to shaft.

Pump rattles.

1. Create false discharge head or suction lift.

SECTION 8A
MODEL P.025 PLASTIC
DIRECTIONS FOR DISASSEMBLY/REASSEMBLY

CAUTION: Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from pump. Disconnect all intake, discharge, and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container. Wetted flushing of parts may be required prior to handling.

The Wilden model P.025 *(Figure 1)* is an air-operated, double-diaphragm pump with all wetted parts of polypropylene, Carbon-filled Acetal, or PVDF. The single-piece center section, consisting of center block and air chambers, is molded from Acetal or polypropylene. All fasteners and hardware are stainless steel. The air valve is manufactured of Acetal or polypropylene. All O-rings used in the pump are of special materials and should only be replaced with factory-supplied parts.

To expedite parts ordering, please find an exploded view of the P.025 model at the back of this manual.

PLEASE read all directions before starting disassembly.

TOOLS REQUIRED:

5/32" Hex Key (Allen wrench)
7/16" Wrench or Socket (Qty. 2)
5/16" Wrench
3/8" Wrench
1/4" Socket Drive
O-ring Pick
3/16" Rod or Equivalent

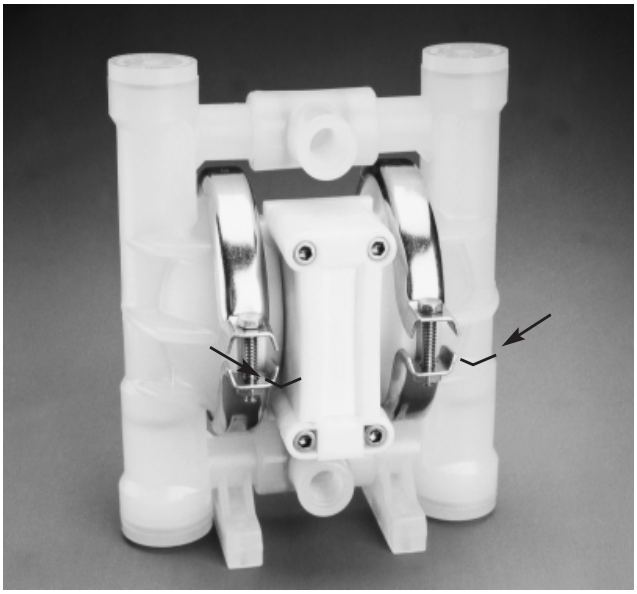
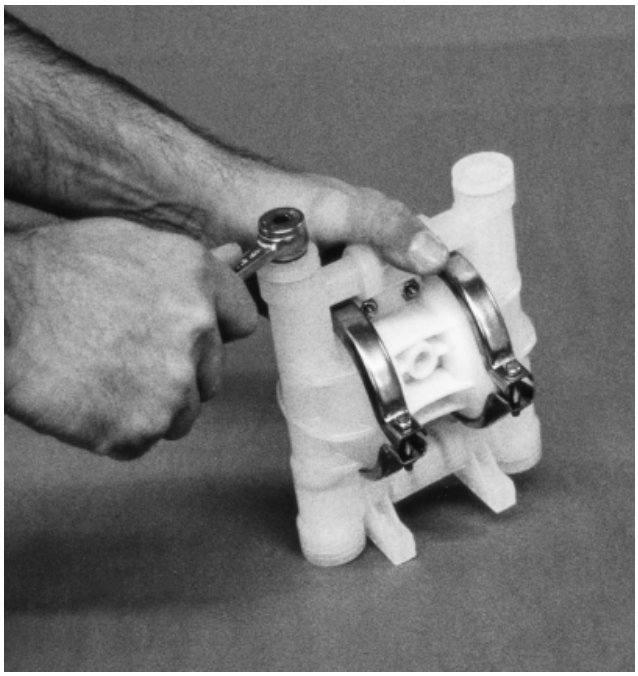


Figure 1

DISASSEMBLY:

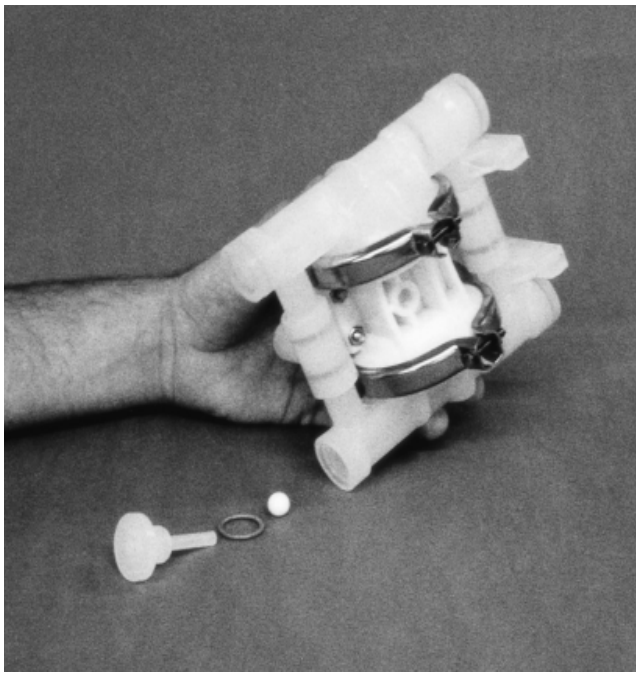
Step 1.

Before actual disassembly is started, turn pump upside down and drain all liquid trapped in the pump into a suitable container. Be sure to use proper caution if liquid is corrosive or toxic.



Step 2. *Figure 2*

Remove top retainer with 1/4" socket wrench *(Figure 2).*

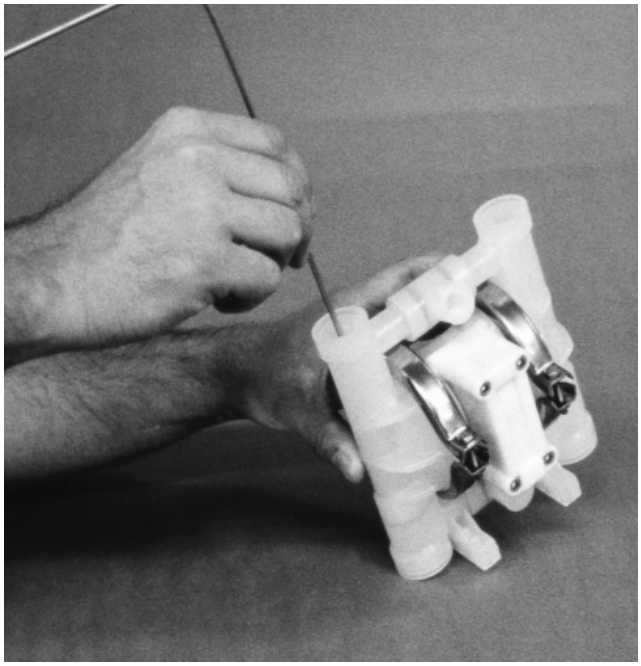


Step 3. *Figure 3*

Inspect the ball retainer, retainer O-ring, and valve ball *(Figure 3).* If swelling, cracking or other damage is apparent, these parts must be replaced with genuine Wilden parts.

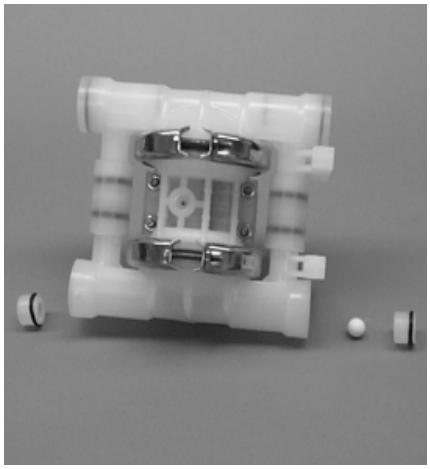
Step 4. *Figure 4*

Turn pump upside down and loosen bottom retainer *(Figure 4).*



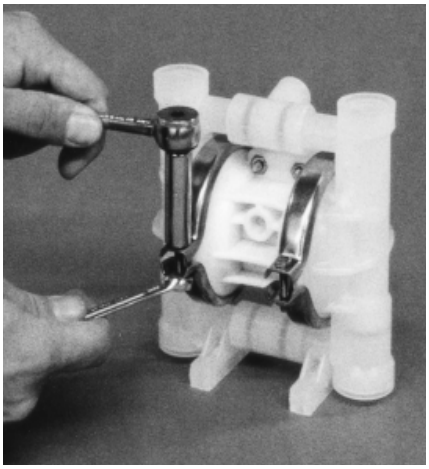
Step 5. *Figure 5*

To remove valve seats, use approximately 3⁄16" rod or equivalent and push seats out from top to bottom *(Figure 5).*



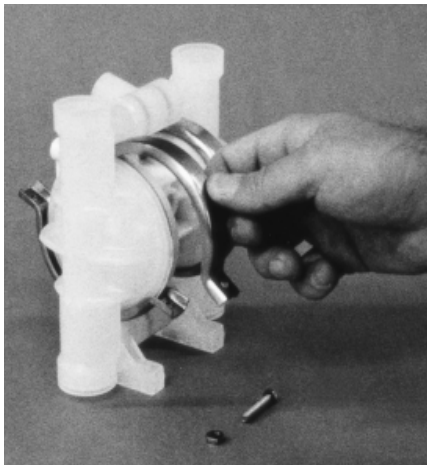
Step 6. *Figure 6*

Inspect ball and seats for abrasion. Inspect seat O-rings and bottom retainer O-rings for swelling, cracking, or other damage. These parts should be replaced if damage is observed *(Figure 6).*



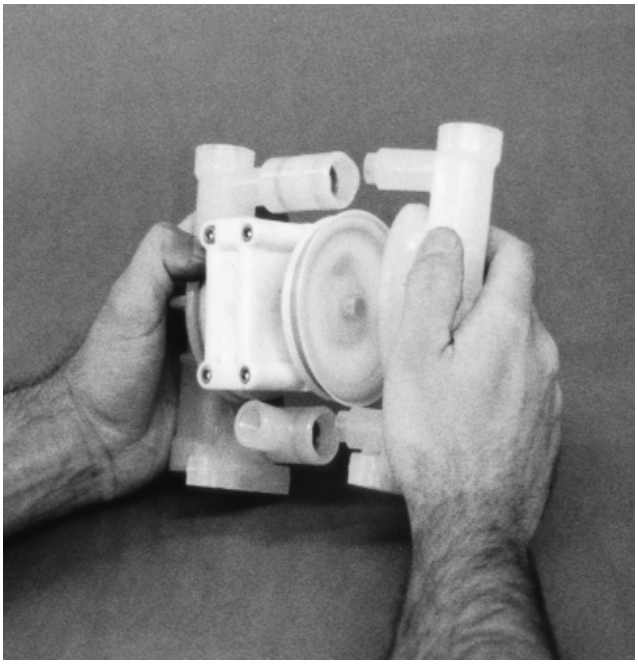
Step 7. *Figure 7*

Loosen clamp band with 5⁄16" socket and 3⁄8" wrench *(Figure 7).* Remove screw and nut.



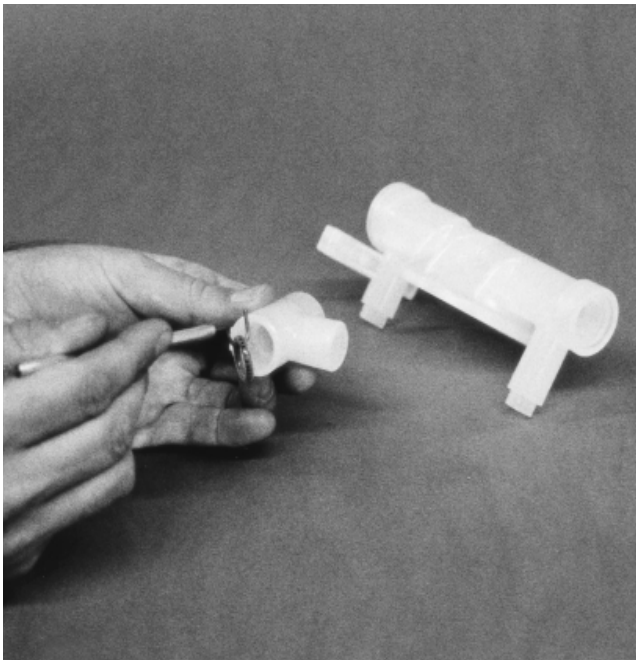
Step 8. *Figure 8*

Rotate clamp band as shown in *Figure 8* and remove by sliding the clamp band up.



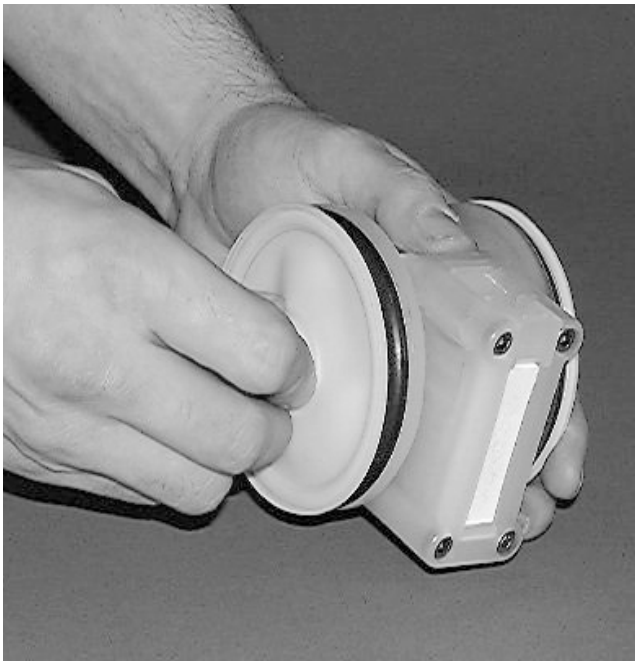
Step 9. *Figure 9*

Remove liquid chambers by pulling chamber away from center section and inlet-discharge T-sections *(Figure 9).*



Step 10. *Figure 10*

Remove T-section from liquid chamber. Remove T-section O-rings from T-section with an O-ring pick *(Figure 10).* Care should be utilized to not damage O-ring. Inspect and replace as necessary.

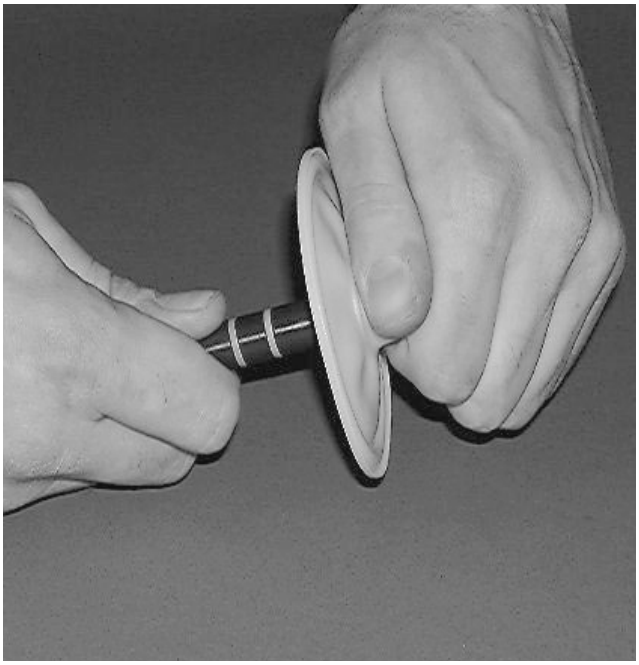


Step 11. *Figure 11*

Loosen outer piston, with 7/16" wrench and 7/16" socket and twist off outer piston. Remove diaphragm and inner piston.

NOTE: Teflon®-fitted pumps (shown in Step 11) employ a Teflon® diaphragm with an integral outer piston. Turn diaphragm counterclockwise to loosen.

NOTE: Teflon®-fitted pumps utilize a neoprene back-up O-ring. Rubber- or TPE-fitted pumps do not.



Step 12. *Figure 12*

Pull the remaining diaphragm which is attached to the shaft through the center section. Hold diaphragm and remove outer piston with 7/16" wrench for rubber/TPE fitted pumps (not shown) *(Figure 12).* Inspection of diaphragms, inner pistons, disc spring, outer pistons and shaft is now possible.

SECTION 8B
PRO-FLO™ AIR VALVE/CENTER SECTION
DISASSEMBLY, CLEANING, INSPECTION

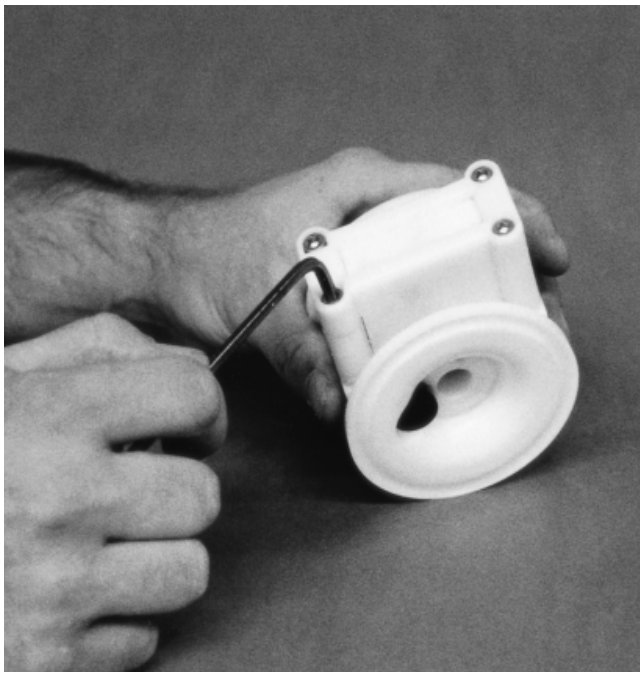
AIR VALVE DISASSEMBLY:

CAUTION: Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from the pump. Disconnect all intake, discharge, and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container. Be aware of hazardous effects of contact with your process fluid.

The Wilden Metal P.025 utilizes a revolutionary Pro-Flo™ air distribution system. A 3.18 mm (⅛") air inlet connects the air supply to the center section. Proprietary composite seals reduce the coefficient of friction and allow the P.025 to run lube-free. Constructed of Acetal or polypropylene, the Pro-Flo™ air distribution system is designed to perform in on/off, non-freezing, non-stalling, tough duty applications.

TOOLS REQUIRED:

5⁄32" Hex Head Wrench
O-Ring Pick



Step 1. *Figure 1*

Remove air valve screws from center section with a 5⁄32" hex key (Allen wrench) *(Figure 1).*

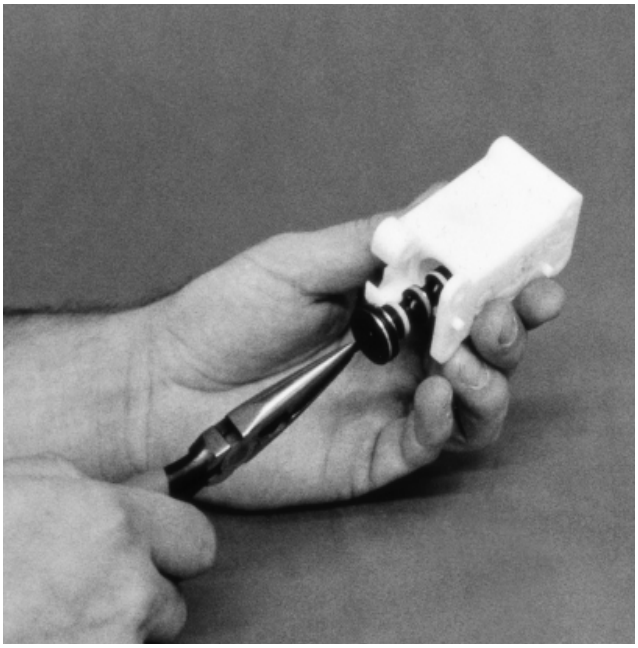
Step 2. *Figure 2*

Take care while removing air valve not to damage gasket *(Figure 2).*

NOTE: Air valve has molded-in alignment pins for proper positioning during assembly.

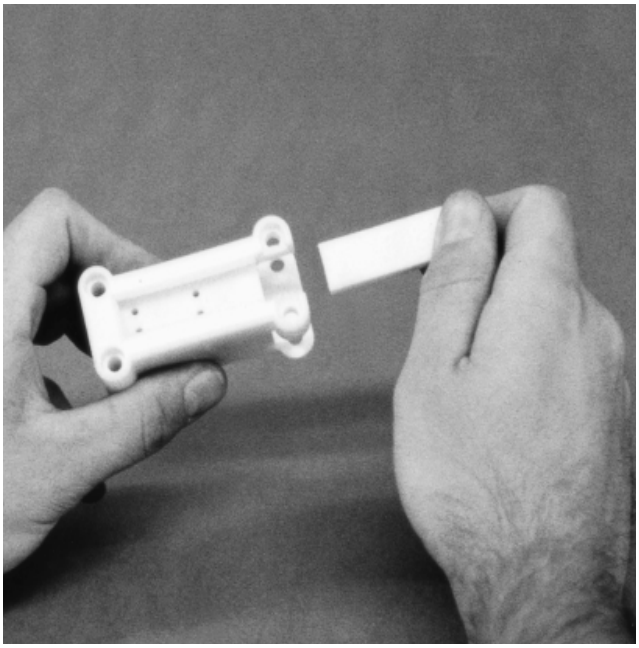
Step 3. *Figure 3*

Remove air valve end cap by simply pulling it away from air valve body (no tools required) *(Figure 3).* Inspect O-ring and replace as needed with genuine Wilden parts.



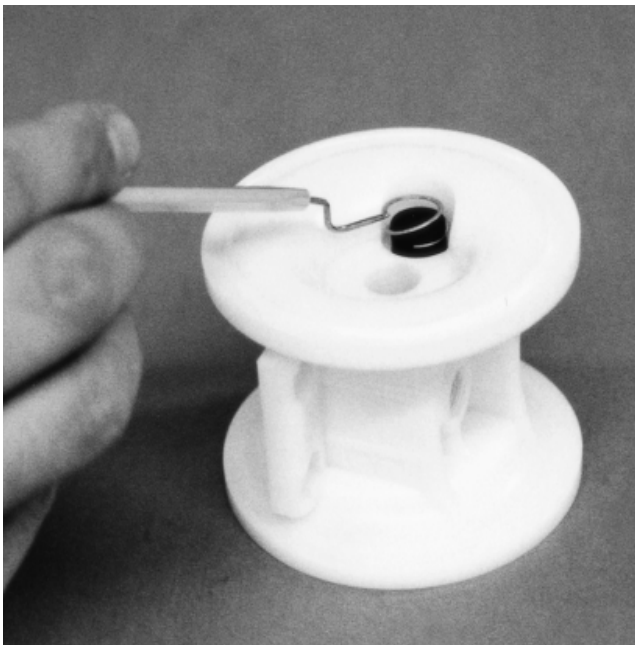
Step 4. *Figure 4*

The air valve spool can now be removed. A 4-40 UNC (Unified National Coarse thread) screw can be screwed into the threaded hole located in the center of the spool. Grip the screw with pliers and remove. If a 4-40 UNC screw is not available, the spool can be tapped out against a wood block or blown out with compressed air. Upon reassembly, lubricate air valve with NLGI grade 2 molybdenum disulfide based grease or equivalent *(Figure 4).*



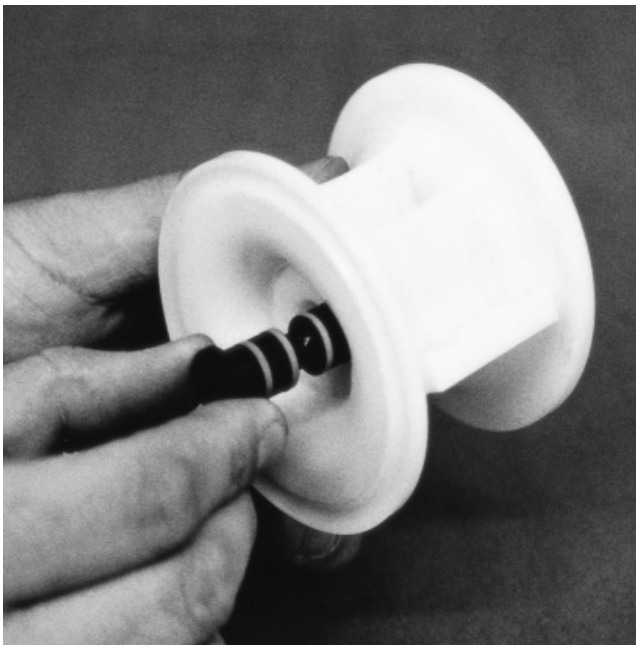
Step 5. *Figure 5*

Remove the porous polyethylene muffler element by sliding it toward the end cap opening *(Figure 5).* The element can be cleaned by soaking it in a cleaning solution (no solvents). If the muffler restricts the air exhaust, replace muffler element.



Step 6. *Figure 6*

Remove pilot spool retaining ring with an O-ring pick *(Figure 6).*



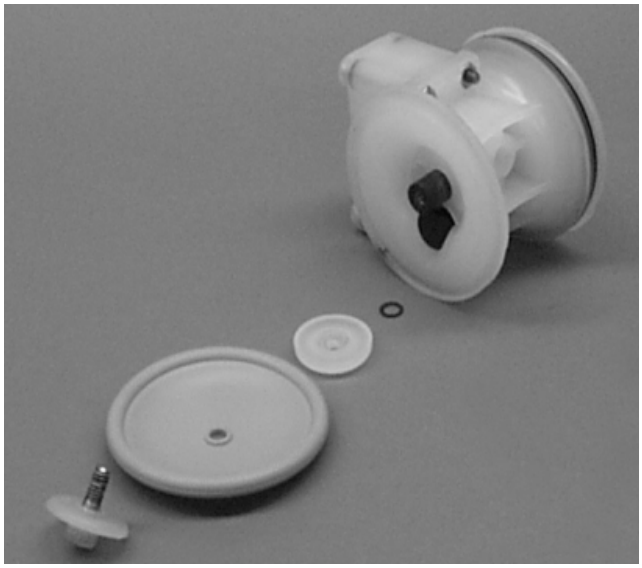
Step 7. *Figure 7*

Push pilot spool through center section and remove. Inspect seals for integrity and spool for damage. Replace pilot spool assembly if necessary. Upon reassembly of spool, apply a film of NLGI grade 2 molybdenum disulfide based grease or equivalent *(Figure 7).*

SECTION 8C
REASSEMBLY

Upon performing applicable maintenance to the air distribution system, the pump can now be reassembled. Please refer to the disassembly instructions for photos and parts placement. To reassemble pump, follow the disassembly instructions in reverse order. The air distribution system needs to be assembled first, then the diaphragms, and finally the wetted parts. Please find applicable torque specifications in this section.

When O-rings have been replaced, all P.025s require a break-in period of 2–3 minutes at air pressure above 60 psi.



Rubber/TPE diaphragm configuration *Figure 1*

There are two types of diaphragm configurations available for the P.025: 1) Rubber or TPE diaphragm, and 2) Teflon® primary diaphragm with back-up O-ring. Observe the "This Side Out" marking on the convex side of the diaphragm. Install the disc spring, inner piston, diaphragm, back-up O-ring (Teflon®-fitted models only). **NOTE:** Teflon® fitted pumps employ an integral piston diaphragm. Add a small amount of Loctite 242 to the bore of the main shaft. Set up time is 20 minutes. Tighten outer piston to torque value found below.

Teflon® diaphragm configuration *Figure 2*

Lubricate the main shaft assembly with NLGI grade 2 molybdenum disulfide based grease or equivalent and insert through main shaft bore in center section. Assemble the other side and torque to proper value as listed below. Please review the photos above for proper alignment.

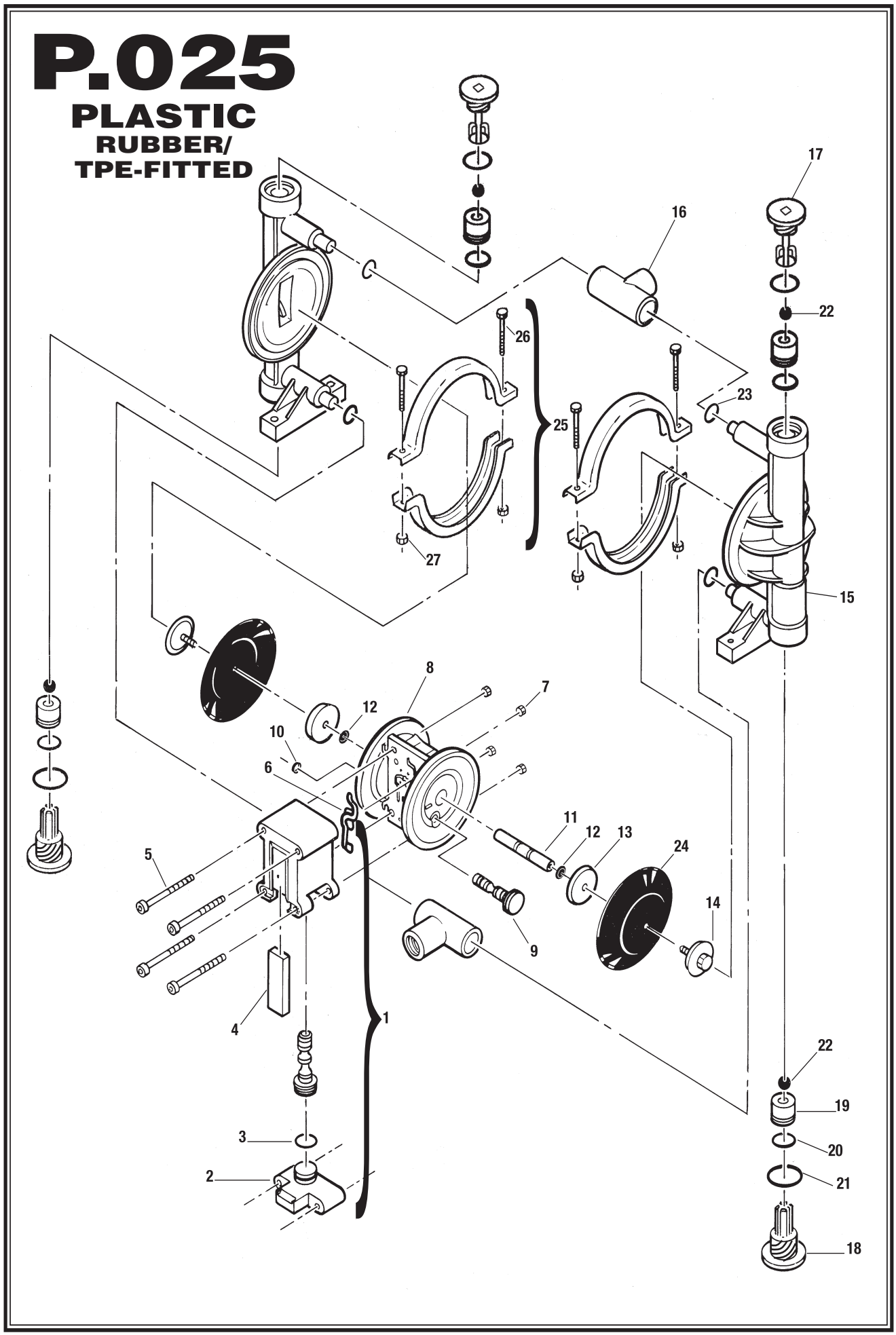
TORQUE SPECIFICATIONS FOR MODEL P.025 PUMPS

Description of Part	Maximum Torque
Air Valve	2.3 N•m [20 in.-lbs.]
Outer Piston, Rubber and TPE Diaphragms	6.3 N•m [55 in.-lbs.]
Clamp Band	2.3 N•m [20 in.-lbs.]
Top and Bottom Retainer, Poly	5.1 N•m [45 in.-lbs.]
Top and Bottom Retainer, Kynar	5.1 N•m [45 in.-lbs.]
Top and Bottom Retainer	5.1 N•m [45 in.-lbs.]

- Apply a small amount of Loctite 242 to the steel bore of the shaft from the diaphragm assembly.

SECTION 9A

EXPLODED VIEW/PARTS LISTING



Wilden Model P.025 Plastic Rubber/TPE-Fitted Pumps

Item #	Description	Qty. per Pump	P.025/PPPP P/N	P.025/GLLL P/N	P.025/KPPP P/N
1	Pro-Flo™ Air Valve Assembly[1]	1	00-2000-20-700	00-2000-13-700	02-2000-20-700
2	Pro-Flo™ Air Valve End Cap	1	00-2300-20-700	00-2300-13-700	00-2300-20-700
3	End Cap O-Ring (–017)	1	00-2390-52-700	00-2390-52-700	00-2390-52-700
4	Muffler Element	1	00-3240-26-700	00-3240-26-700	00-3240-26-700
5	Air Valve Bolt	4	00-6000-03-700	00-6000-03-700	00-6000-03-700
6	Air Valve Gasket	1	00-2600-52-700	00-2600-52-700	00-2600-52-700
7	Air Valve Nut	4	01-6400-03	01-6400-03	01-6400-03
8	Pro-Flo™ Center Section	1	00-3150-20-700	00-3150-13-700	00-3150-20-700
9	**Pilot Spool Assembly**	**1**	**00-3850-99-700**	**00-3850-99-700**	**00-3850-99-700**
10	Pilot Spool Retaining Ring	1	00-2650-03-700	00-2650-03-700	00-2650-03-700
11	Shaft	1	00-3800-99-700	00-3800-99-700	00-3800-99-700
12	Disc Spring	2	00-6800-08	00-6800-08	00-6800-08
13	Inner Piston for Rubber/TPE	2	00-3700-20-700	00-3700-13-700	00-3700-20-700
14	Outer Piston	2	00-4570-20	00-4570-16	00-4570-21
15	Liquid Chamber	2	00-5001-20	00-5001-16	00-5001-21
16	Manifold Tee-Section	2	00-5160-20	00-5160-16	00-5160-21
17	Top Retainer	2	00-5411-20	00-5411-16	00-5411-21
18	Bottom Retainer	2	00-5420-20	00-5420-16	00-5420-21
19	**Valve Seat**	**2**	**00-1130-20**	**00-1130-16**	**00-1130-21**
20	**Valve Seat O-Ring***	**2**	*	*	*
21	**Combo Retainer O-Ring***	**2**	*	*	*
22	**Valve Ball**	**4**	**00-1080-55**	**00-1080-55**	**00-1080-55**
23	**Tee Section O-Ring***	**4**	*	*	*
24	**Diaphragm***	**2**	*	*	*
25	Clamp Band Assembly	2	00-7300-03	00-7300-03	00-7300-03
26	– Clamp Band Bolt	4	01-6100-03	01-6100-03	01-6100-03
27	– Clamp Band Nut	4	01-6400-03	01-6400-03	01-6400-03

*Refer to Elastomer Options in Section 10.

[1]Air Valve Assembly includes items 2, 3, and 4.

All boldface items are primary wear parts.

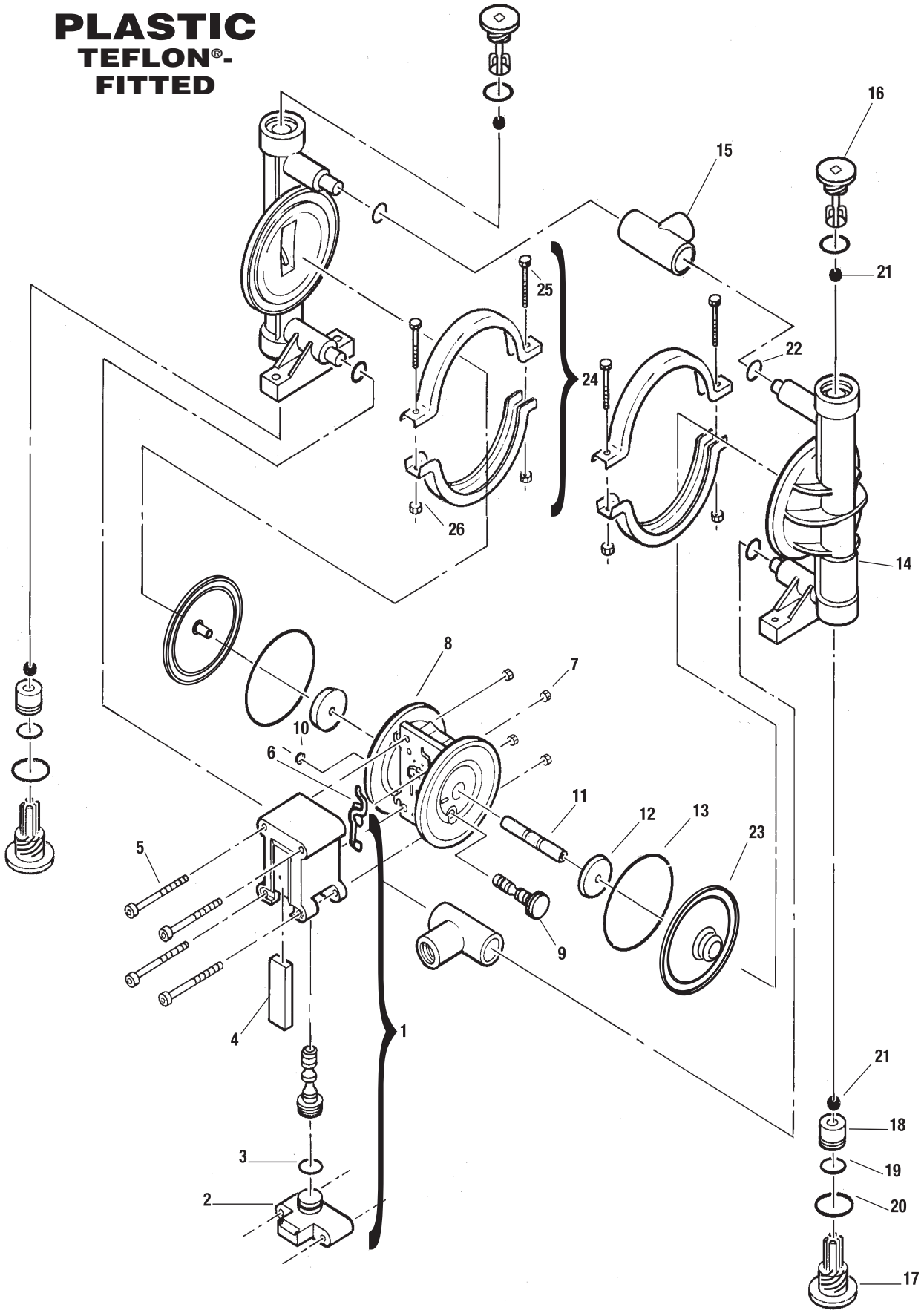
SECTION 9B

EXPLODED VIEW/PARTS LISTING

P.025

PLASTIC

TEFLON®-FITTED



Wilden Model P.025 Pumps — Teflon®-Coated Hardware

Item #	Description	Qty. per Pump	P.025/PPPP-502 P/N	P.025/GLLL-502 P/N	P.025/KPPP-502 P/N
1	Pro-Flo™ Air Valve Assembly[1]	1	00-2000-20-700	00-2000-13-700	00-2000-20-700
2	Pro-Flo™ Air Valve End Cap	1	00-2300-20-700	00-2300-13-700	00-2300-20-700
3	End Cap O-Ring (–017)	1	00-2390-52-700	00-2390-52-700	00-2390-52-700
4	Muffler Element	1	00-3240-26-700	00-3240-26-700	00-3240-26-700
5	Air Valve Bolt	4	00-6000-05-700	00-6000-05-700	00-6000-05-700
6	Air Valve Gasket	1	00-2600-52-700	00-2600-52-700	00-2600-52-700
7	Air Valve Nut	4	01-6400-05	01-6400-05	01-6400-05
8	Pro-Flo™ Center Section	1	00-3150-20-700	00-3150-13-700	00-3150-20-700
9	**Pilot Spool Assembly**	**1**	**00-3850-99-700**	**00-3850-99-700**	**00-3850-99-700**
10	Pilot Spool Retaining Ring	1	00-2650-03-700	00-2650-03-700	00-2650-03-700
11	Shaft	1	00-3800-99-700	00-3800-99-700	00-3800-99-700
12	Inner Piston for Teflon® Fitted	2	00-3750-20-700	00-3750-13-700	00-3750-20-700
13	Back-Up O-Ring*[2]	2	00-1070-51	*	*
14	Liquid Chamber	2	00-5001-20	00-5001-16	00-5001-21
15	Manifold Tee-Section	2	00-5160-20	00-5160-16	00-5160-21
16	Top Retainer	2	00-5411-20	00-5411-16	00-5411-21
17	Bottom Retainer	2	00-5420-20	00-5420-16	00-5420-21
18	**Valve Seat**	**2**	**00-1130-20**	**00-1130-16**	**00-1130-21**
19	**Valve Seat O-Ring***	**2**	*	*	*
20	**Combo Retainer O-Ring***	**2**	*	*	*
21	**Valve Ball***	**4**	**00-1080-55**	**00-1080-55**	**00-1080-55**
22	**Tee Section O-Ring***	**2**	*	*	*
23	**Diaphragm**	**2**	**00-1030-55**	**00-1030-55**	**00-1030-55**
24	Clamp Band Assembly	2	00-7300-05	00-7300-05	00-7300-05
25	– Clamp Band Bolt	4	01-6100-05	01-6100-05	01-6100-05
26	– Clamp Band Nut	4	01-6400-05	01-6400-05	01-6400-05

*Refer to Elastomer Options in Section 10.

[1]Air Valve Assembly includes items 2, 3, and 4.

[2]Part used only on Teflon®-fitted pumps.

[3]Neoprene back-up O-ring standard (P/N 00-1070-51).

All boldface items are primary wear parts.

SECTION 10
ELASTOMER OPTIONS

Model P.025 Pumps

Material	Valve Seat O-Ring	Combo Retainer O-Ring	Diaphragm	Back-Up Diaphragm O-Ring	Valve Ball	Tee Section O-Ring
Wil-Flex™	00-1200-58	00-1260-58	00-1010-58	00-1070-58	00-1080-58	00-1300-58
Buna-N	00-1200-52	00-1260-52	00-1010-52	—	00-1080-52	00-1300-52
Viton®	—	—	—	—	00-1080-53	—
Teflon® PTFE	—	—	00-1030-55	—	00-1080-55	—
Stainless Steel	—	—	—	—	00-1080-03	—
Teflon®-Encapsulated Viton®	00-1200-60[1]	00-1260-60[1]	—	—	—	00-1300-60[1]
Fluoro-Seal™	—	—	—	—	—	00-1300-34[2]
Neoprene	—	—	—	00-1070-51	—	—

[1] For PVDF and carbon-filled Acetal pumps only.
[2] For PVDF pumps only.

WARRANTY

Each and every product manufactured by Wilden Pump and Engineering Company is built to meet the highest standards of quality. Every pump is functionally tested to insure integrity of operation.

Wilden Pump and Engineering Company warrants that pumps, accessories and parts manufactured of supplied by it to be free from defects in material and workmanship for a period of one year from date of startup or two years from date of shipment, whichever comes first. Failure due to normal wear, misapplication, or abuse is, or course, excluded from this warranty.

Since the use of Wilden pumps and parts is beyond our control, we cannot guarantee the suitability of any pump or part for a particular application and Wilden Pump and Engineering Company shall not be liable for any consequential damage or expense arising form the use or misuse of its products on any application. Responsibility is limited solely to replacement or repair of defective Wilden pumps and parts.

All decisions as to the cause of failure are the sole determination of Wilden Pump and Engineering Company.

Prior approval must be obtained from Wilden for return of any items for warranty consideration and must be accompanied by the appropriate MSDS for the product(s) involved. A Return Goods Tag, obtained from an authorized Wilden distributor, must be included with the items which must be shipped freight prepaid.

The foregoing warranty is exclusive and in lieu of all other warranties expressed or implied (whether written or oral) including all implied warranties of merchantability and fitness for any particular purpose. No distributor or other person is authorized to assume any liability or obligation for Wilden Pump and Engineering Company other than expressly provided herein.

PLEASE PRINT OR TYPE AND FAX TO WILDEN

Item #_____ Serial # _____

Company Purchased From _____

Your Company Name_____

Industry _____

Your Name _____ Title _____

Your Address (Street)_____

(City)_____ (State)_____ (Postal Code)_____ (Country) _____

(Telephone)_____ (Fax)_____ (e-mail) _____

Number of pumps in facility? _____Diaphragm _____Centrifugal

_____Gear _____Submersible _____Lobe _____Other _____

Chemical(s) being pumped _____

How did you hear of Wilden Pump? _____Trade Journal _____Trade Show

_____Internet/E-mail _____Distributor _____Other _____

ONCE COMPLETE, FAX TO (909) 783-3440

NOTE: WARRANTY VOID IF PAGE IS NOT FAXED TO WILDEN

2 Electric motor

2.1 General practices

2.1.1 Cable connections and grounding

Danger!

It is NOT allowed to connect pipes etc. to the electric motor terminal box as feed through the power cables!
Cables must be fed into the electric motor terminal box using cable glands only!

Danger!

For a safe ground connection use a cable with a core diameter of at least 50% of the core diameter of the power cables!

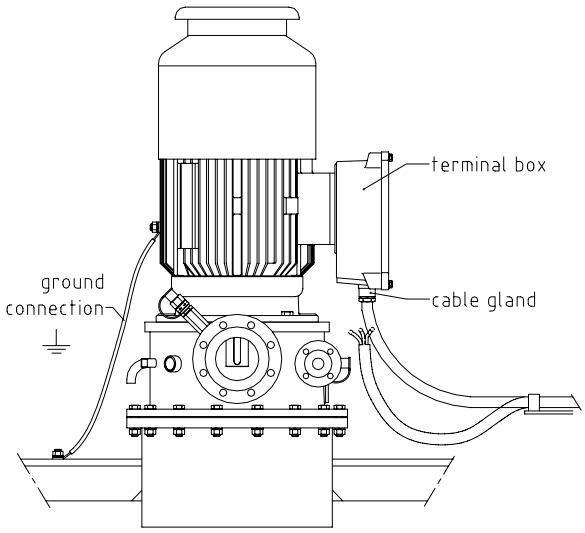
Caution!

To facilitate maintenance operations use cables of sufficient length!

Caution!

Secure the cables properly to prevent shaving of the cables!

Cable connection example



Note:

For specific electric motor details review the supplied operating, maintenance and / or repair manuals of the electric motor manufacturer.

2.2 Electric motor operating and repair manuals

Operating Manual

Explosion-Proof
F&G Three-Phase-Motors
II2G EEx d(e) IIC(B) T3-6
II2D T80–120°C IP 65(66)

BA01.05-E

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1. 2001 Edition, Date of Publication 02/ 01
2. 2002 Edition, Date of Publication 03/ 02
3. 2003 Edition, Date of Publication 06/ 03
4. 2004 Edition, Date of Publication 04/ 04
5. 2005 Edition, Date of Publication 02/ 05

Author: Wolfgang Sobel

Printed on paper chlorine-free and acid-free bleached cellulose.

Warning!
Hazardous electrical current!
Ensure protection against explosions!

Before installing

- Switch off the power to the device.
- Make sure that device cannot be switched on again by accident.
- Make sure that the device is de-energized.
- Connect to earth and short out.
- Cover or close off any neighboring live parts with a barrier.
- Follow carefully the assembly instructions provided for the device.
- Only qualified personnel as per EN 50110-1/-2 (VDE 0105, part 100) can perform any work on this device/system.
- The electrical connections are to be made as per the relevant specifications (e.g. cross-section of the supply line, fuses, protective connection).
- Opening the motor - save for the terminal box - during the warranty period without the manufacturer's permission shall lead to the termination of the warranty.
- Original spare parts are to be used for the approved repairs or repairs not falling under the warranty.
- Live and rotating parts of electrical motors can cause major or deadly injuries.
- Any shipping, installation, start-up and maintenance works are to be carried out only by qualified personnel (follow carefully any regulations on explosion protection such as EN 60079-14 and SeitenEN 50821-1-2 as well as any other national accident prevention regulations).
- As regards any equipment subject to these guidelines, it is important to adopt the necessary safety precautions to protect the personnel against possible injuries.
- The personnel must be duly instructed to proceed with caution and according to regulations during shipping, hoisting, and positioning and while repairing the motor.
- Do not lift the motor together with the drive equipment by the motor lifting eyebolts.
- Do not use the supplied lifting eye bolts at ambient temperatures below –20°C, in accordance with DIN 580. Lower temperatures could lead to the ring screws breaking and consequent breaking and consequent injury to personnel and/ or damage to the installation.
- Do not load the eyebolts as per DIN 580 no more than 45° compared to the screwing direction. The use of crossbeams is recommended. See the operating instructions for the layout dimensions of the lifting eyebolts and the minimum dimensions of the loading crossbeams and chain lengths.
- In the case of motors with built-in brake appropriate safety measures are to be adopted against the possible failure of the brake especially in applications involving the pulling of loads.
- Operating the motor with the supplied shaft protection cover alone is forbidden.
- Contact with the capacitor for the start-up and running of single-phase motors is to be avoided until the unloading procedure is carried out securely.
- If a high-voltage test is necessary, the procedures and precautionary measures set forth in accident prevention regulations are to be followed.

Table of Contents

About this Manual

These operating instructions apply to AC motors of the following series: CD...; dCD...; CEIGL...; BD... and dBD....

Besides the general assembly instructions, these guidelines are to be followed for the installation, start-up and maintenance of explosion-protected AC motors with a degree of protection of "pressure-resistant encapsulation" marked:  (II..), EEx de II. T or EEx d II. T.
Any independent manufacturing equipment mounted on or built into the motors like brakes, rotary encoders or frequency converters, etc. have their own operating instructions which are to be duly followed.

Target audience

This manual is addressed to the specialists in charge of installing, operating and servicing the motors. Besides conventional technical training they must possess knowledge in the field of explosion protection.

Abbreviations and symbols

This manual uses abbreviations and symbols having the following meanings:

> indicates handling instructions

➔ draws your attention to interesting tips and additional information

Please note!
warns against minor damages to property.

Caution!
warns against major damages to property and minor injuries.

Warning!
warns against major damages to property and major injuries or death.

All of the dimensions are in mm unless otherwise specified.

In order to ensure clarity, at the top of every page you will find the name of the chapter on the left hand and the current section on the right hand; the only exceptions are the first page of each chapter and the blank pages at the end of the chapter.

1 Explosion-protected Motors

Intended use

The motors are to be operated only according to the data specified on the rating plate. According to the relevant marking on the rating plate, the motors are fit for use in areas subject to explosion hazards.
The motors are fit to be built into another machine. Start-up is forbidden until the conformity of the final product with Directive 89/392/EEC as amended by 98/37/EC is determined.

Liability and Warranty Guarantee

We cannot be held liable for any damage or malfunctions resulting from assembly errors, the failure to follow these operating instructions or improper repairs.
Original spare parts are manufactured and tested specifically for these motors.
We recommend that you obtain any spare parts and accessories only from the manufacturer.
We hereby specify that any spare parts and accessories not supplied by the manufacturer require our approval.
Under any circumstances the mounting and use of third-party products can negatively affect the motor's original structural properties and impair the safety for persons, the motor or other real values (explosion protection).
The manufacturer shall not be liable for any damages resulting from the use of spare parts or accessories not authorized by the manufacturer.
Any unauthorized conversions and alterations to the motor shall not be approved for safety reasons and the manufacturer cannot be held liable for any resulting damages.

Servicing

For any technical information on F&G motors ATB's customer service is always at your disposal.

Should any difficulties with our motors be encountered, please contact our factory or local branch office. Log on to our website to find at the address of our local branch office nearest your.

ATB Motorentechnik
Helgoländer Damm 75
D-26954 Nordenham

Tel.: +49 (0) 47 31/ 3 65-0
Fax.: +49 (0) 47 31/ 3 65-1 59
E-Mail: info@atb-nordenham.de
Internet: www.atb-nordenham.de

Spare parts

When ordering spare parts, besides the name of the required part, specify also the motor type and serial number.

Delivery, Storage, Transport

Delivery

> Check the motor for damages during transportation.

In case of damage during transportation an investigation of fault is to be performed by the forwarding agent.

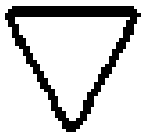
> Report any covert damages to the forwarding agent or manufacturer no later than seven days from the transfer of the motor.

The entire packaging material can be recycled by means of the Dual System.

Storage

Storage up to a maximum of 36 months is possible in the following conditions:

- In order to prevent a drop in the insulation resistance, the surrounding environment must be dry and dust-free.
- The room temperatures should not drop below +5 °C or exceed +30 °C with an air humidity of < 70 % and register changes in temperature greater than 10 °C/day.
- In order to prevent damage during storage any occurring oscillations must amount to V_{eff} < 0.2 mm/s.
- For motors with regreasing systems repress an amount of grease double that specified on the motor at standstill before storage.



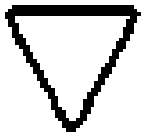
Please note!
In case of storage conditions deviating from those specified above the measures set forth in the separate AR9 storage instructions must be adopted.

Transport

Do not lift the motor together with mounted driven machines such as, for instance, pumps, gearing, etc. by the motor lifting eyebolts.

Do not use eyebolts as per DIN 580 at ambient temperatures lower than – 20 °C.

At these temperatures the eyebolts may break and hence injure the personnel and/or damage the machinery. Do not load the eyebolts as per DIN 580 no more than 45° compared to the screwing direction. The use of crossbeams is recommended. Layout dimensions of the lifting eyebolts and the minimum dimensions of the loading crossbeams and chain lengths. (➔ Fig. 1).



Please note!
When mounting vertical motors from the horizontal position, the shaft must not touch the floor to avoid damaging the bearings.

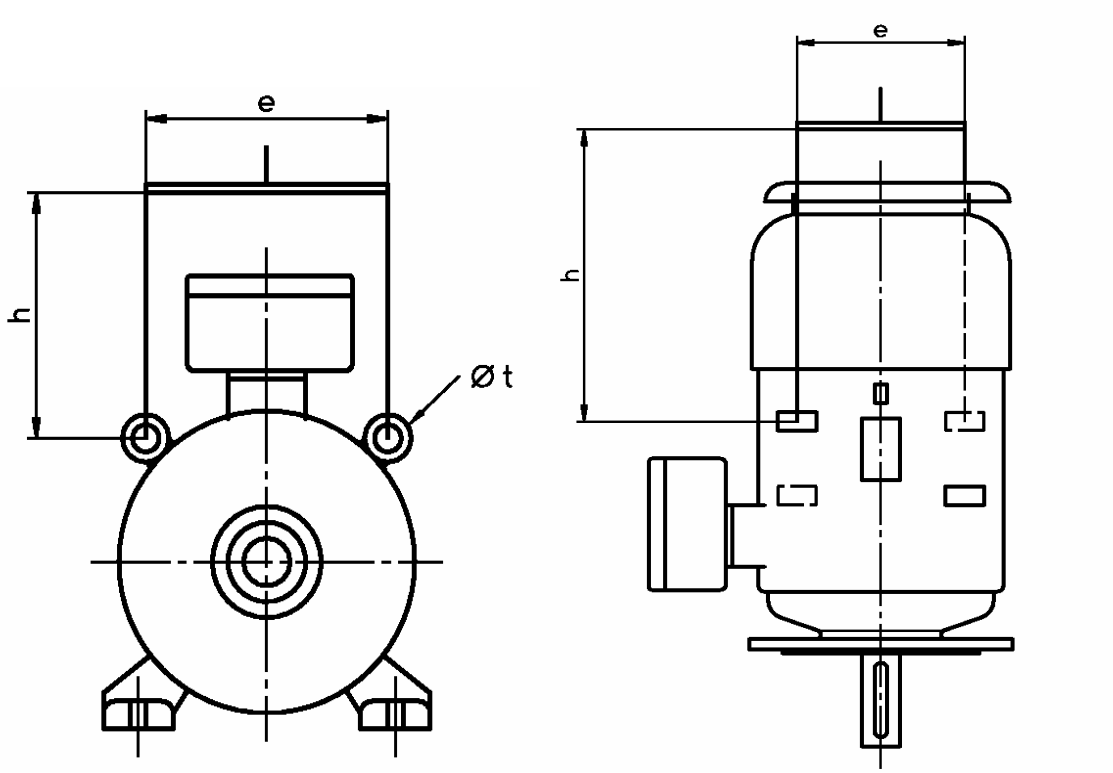


Figure 1: Eyebolt dimensions

Table 1: Minimum dimensions for lifting eyebolts and crossbeams

Frame size	**Ø t**	**horizontal**		**vertical**	
		e	**h**	**e**	**h**
90	20	167	100	220	187
100	20	185	112	242	201
112	20	202	103	262	236
132	25	243	170	307	247
160	30	262	206	314	293
180	30	294	223	402	372
200	35	390	219	451	399
225	40	366	230	510	490
250	40	435	282	546	548
280	40	498	301	600	574
315	50	640	337	700	595
355	60	629	397	816	893
400	60	790	312	890	771
450	60	833	317	980	660

2 Installation

Mechanical checks

After removing the shipping braces and shaft blocks (see also the marking on the motor), the motor shaft must be rotated by hand. In the case of brakemotors the brake must be vented at standstill (maximum of 10 min). This must be performed after applying voltage as per the circuit diagram from page 39.

Please note!
Save the shipping braces and shaft blocks for subsequent transportation, as the bearings risk being damaged during transportation.

Site

The completely closed motors are intended for operating sites in which they are exposed to soiling, humidity and other open air conditions as per the relevant degree of protection.
The motors must be installed in a place with ambient temperatures of –20 °C to a maximum of +40 °C and a max. of 1000m above sea level. Any permissible ambient temperatures (T_a) and heights (MSL) other than those indicated above must be specified on the rating plate. Lower temperatures and values not found on the rating plate require the use of space heaters.
➔ Section 3 “Operation and Repairs”

Please note!
The ventilator hood air inlet and outlet must not be obstructed, as there is the risk of heating beyond the permissible temperature class and of reducing the life of the winding insulation ➔ Fig. 2 and ➔ Table 2.

This applies in particular to the use of soundproof covers. The air ducts must checked and cleaned regularly in factories with heavy soiling.

Table 2:
Minimum distance (LE) of an obstacle from the air opening, see Fig. 2.

Shaft height	**LE [mm]**
up to 160	35
180 to 225	85
over 250	125

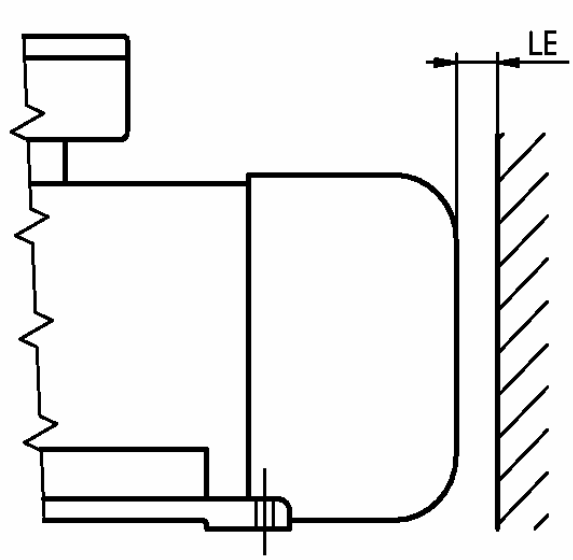


Figure 2: Minimum distance of obstacles from the air opening

The motors are intended for use in areas subject to explosion hazards. The following data on the rating plate distinguish the motor as explosion-protected equipment:

- Degree of protection
- Explosion group
- Temperature class

Depending on the appliance category the motor is assigned to the relevant zone of the operating site.

Mounting

The motors are mounted either on the motor feet or on the flange at the installation site. All motors with shaft heights of up to 355 mm can be mounted either horizontally or vertically thanks to their bearing layout. This applies also for motors to be mounted with the feet on roofs and side walls. Motors with reinforced bearings are to be operated at a minimum load to ensure the smooth operating of the anti-friction bearings (➔ Table 3).

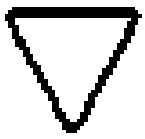
Table 3: Minimum load on the shaft collar for motors with reinforced bearing

Shaft height	Minimum load	Shaft height	Minimum load	Shaft height	Minimum load
112	1100N	200	3400N	315	8000N
132	1600N	225	3800N	355	2000N
160	1900N	250	4900N	400	2000N
180	2700N	280	5500N	450	2300N

The bearings may be damaged if the minimum load is exceeded. Trial runs with no-load should last only a few minutes.

You can find the max. permissible loads in our catalogue "Explosion-Protected High and Low Voltage AC Motors" or contact the manufacturer.

Align the motors according to the requirements of the coupling or pulley manufacturer. The feet are to be positioned evenly and, if necessary, lined.



Please note!
Make sure that the fastening screws are duly dimensioned.

Data on the foundation loading generated by the motor can be requested from the manufacturer by specifying the motor number. The fastening screws must be duly tightened according to their layout and secured to prevent loosening during operation and hence the damaging of the drive. (➔ Table 4, page 17).

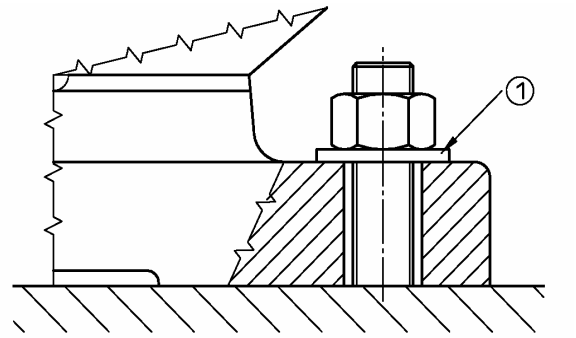


Figure 3: Motor Fastening
① Large-surface Washer

In order to achieve an adequately large contact surface, apply a large-surface washer under each nut or screw head
(Fig. 3).

➔ Alternatively use flange nuts or bolts.

If the motors shaft end points up or down (vertical mounting arrangement), it is necessary to fit an appropriate cover to prevent any foreign bodies from dropping in the driven machine through the air inlet and outlet openings in the ventilator hood.

Please note!
The flow of cooling air through the motor must not be limited by said cover (➔ Section "Site", page 10).

The balance of the motors is specified on the shaft end plate and/or on the rating plate (H = half key, F = full key, N = no key).

The design of the coupling or pulley must match the motor's balance.

Please note!
If balancing with half key (H), work on the vertical (visible) key components on the shaft diameter or cover these with washers with keyway along the relevant length.

If the coupling is longer than the key, it is necessary to fill the keyway in the remaining part of the coupling.

In case of failure to comply with the foregoing, out-of-balances liable of causing excessive vibrations may occur.

Please note!
Mount the pulleys or couplings only through the threaded bores in the shaft end to avoid damaging the anti-friction bearings (➔ Fig. 4).

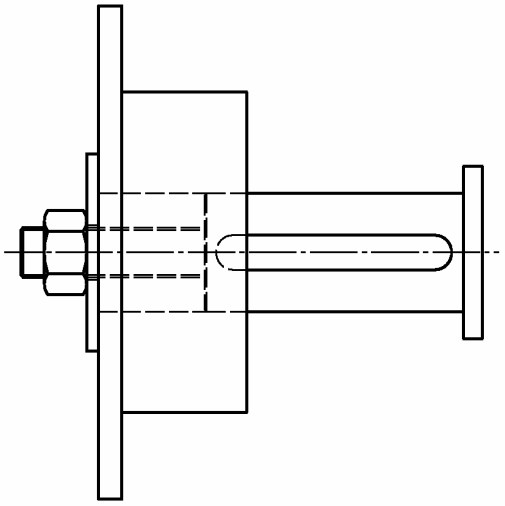


Fig. 4: Fastening of the pulley or coupling

> Screw the threaded bolts in the threaded bore.

> Then mount the pulley or coupling on the shaft end: make sure to screw a nut with a washer having at least the same diameter of the pulley hub or coupling on the threaded bolt.

Use the utmost care in mounting dynamically balanced pulleys or couplings on the shaft end. Machines to be connected to the motor by means of couplings are to be aligned according to the specifications of the coupling's manufacturer.

➔ Only use flexible couplings!

Mains and other electrical connections

The motors work as per VDE 0530 with mains voltage oscillations of up to ±10 % or frequency oscillations of up to –5 % to +3 %. The mains ratings must match the voltage and frequency data specified on the ratings plate. Connect the motors according to the connection diagrams attached to the terminal box (➔ Figure 11 page 34). Use only the supplied original connection components, (➔ Section " Mains and guard circuit connection", page 21).

▽ **Please note!**
Carry out the motor, controller, overload protection and earthing connection operations in compliance with local installation requirements.

▽ **Please note!**
If the accidental starting of the system may expose the personnel to danger, do not use any automatically restarting motor protective equipment.

Mains connection of explosion-protected motors

Besides any general installation regulations, follow carefully EN 60079-14 and EN 50281-1-2. Afterwards suitable overload protection is to be provided either with a motor circuit breaker or similar protective devices. These may include also PTC thermistors with tripping devices (➔ Section "Motors with temperature monitoring“, page 25). These must be specified on the rating plate together with a tripping time t_A.

In addition, any "Special Requirements" specified in the test certificate are to be complied with. These are marked with an "X" after the test certificate number on the rating plate.

Motors with direct line lead-in

The free end of the cable inserted in the motor must be connected according to the regulations in force concerning the connection area. If the line lead-in used on the motor is provided with pull relief, the cable can be laid freely; otherwise the cable must be secured with a pull relief device in the near vicinity.

The maximum operating temperature at the line lead-in must not exceed 90° C.

Terminal box

Open the box by loosening the screws on the cover (Fig. 5) or, in the case of models with grub screw (Fig. 6), by turning the grub screw counter-clockwise and then loosening the tapped cover.
Close the terminal box again after connecting the mains by following the same instructions in the opposite order.

In order to change the position of the cable and line lead-ins, you can turn the terminal box by 4 x 90°.

> Loosen either
  – the four fastening screws (➔Fig. 5) or
  – the anti-rotation pins by means of the grub screw (➔ Fig. 6).

> Turn the terminal box to the desired position.

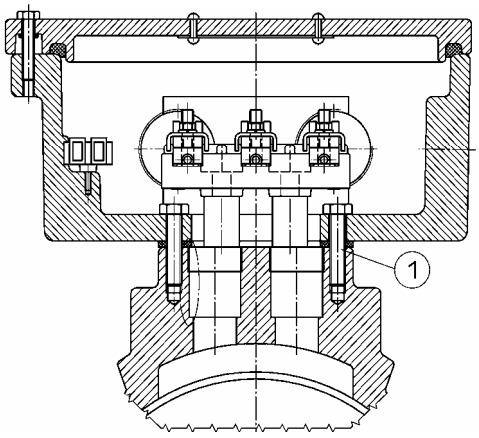


Figure 5: Terminal box with fastening screw ①

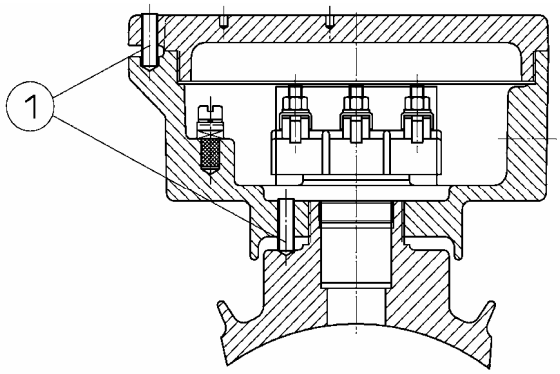


Figure 6: Terminal box with grub screw ①

> Then tighten the fastening components to the relevant torque, see the following table.

Table 4: Torque values for 8.8-type screws

Thread size	Torque
M5	6 Nm
M6	10 Nm
M8	25 Nm
M10	49 Nm
M12	85 Nm
M16	210 Nm
M20	425 Nm

Please note!
Terminal boxes fastened as per Fig. 6 are to be turned counter-clockwise by a maximum of one turn away from the thread end stop. Screwed-on covers must be duly secured.

Anti-corrosion protection can be achieved with non-hardening sealing materials or sealing grease in particular on the processed sealing surfaces of the covers of terminal boxes having the following degree of protection: "pressure-resistant encapsulation, EEx d IIC(B) marking".

The approved sealing materials are:

- For threads and surfaces:
  Hylomar, by Marston-Domsel or

- for surfaces:
  Admosit and Fluid-D, by Teroson.

Please note!
In the case of "increased safety" terminal boxes the gaskets used are included in the approval. Only original gaskets are to be used.

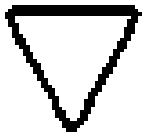
Please note!
"Pressure-resistant encapsulation“ terminal boxes must be sealed by means of approved cable or line lead-ins.

Cable and line lead-ins

Connect the motors with cable and line lead-ins or by means of a duct system as per EN 60079-14. These must meet the following requirements:

- EN 50019 for wiring spaces with a degree of protection of "increased safety", (EEx e II marking on the component)
- EN 50018 for a degree of protection of "pressure-resistant encapsulation", (component EEx d IIC(B) marking on the component)

Specific test certificates must be provided for cable and line lead-ins.



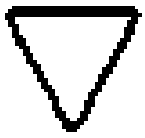
Please note!
In case of motors complying with the new Directive 94/9/EC, (e.g. marking II 2G ...), these must be mounted only with the supplied original lead-ins or lead-ins that meet the requirements of the new directive.

Any openings that are not used must be closed with sealing plugs for which the relevant test certificates and/or the aforementioned markings must be provided.

The supplied sealing plugs for the line lead-ins serve only as protection during transportation and are not an approved sealing means. This applies also for the storage of motors outdoors. In this case additional rain protection is required.

The lead-ins supplied as a standard (version 1) are used for the insertion of firmly secured lines.

Version 3 available as a special accessory, with additional pull relief, is used for the insertion of lines in movable motors.



Please note!
Cable lead-ins and sealing plugs that fail to meet these requirements are prohibited. The cable and line diameters used must comply with the clamping range specified on the lead-in.
Follow carefully the operating instructions of the cable and line lead-ins.

Motors with terminal boxes whose mains lead is located in the layer separating the upper and lower parts

Use only the supplied original gaskets to ensure compliance with the “Ex e II” degree of protection. Depending on the type (see marking on the plug), the plugs are fit for the following diameters (➔Table 5).
Follow carefully the operating instructions for the lead-in parts and sealing plugs.

Table 5: Cable diameter

Type	Cable diameter
RS-75	26 to 48 mm
RS-100	48 to 70 mm

> After connecting the mains lead close the terminal box with the upper part.

> Strip the skins of the plugs so that the following condition is fulfilled:
By stripping the skin, the plugs are adapted to the cable diameter so that a gap of less than 1 mm is obtained between the cable and the plug applied on the cable.
Therefore, an extra layer of skin must be removed from one half of the module compared to other.

> Lubricate the cutting edge and the sealing surfaces of the plug with the supplied grease.

> Insert the plug halves over the cable and completely in the bushing opening.

> Brace it with the screws until a perceivable resistance (maximum torque: 6 Nm) is achieved.

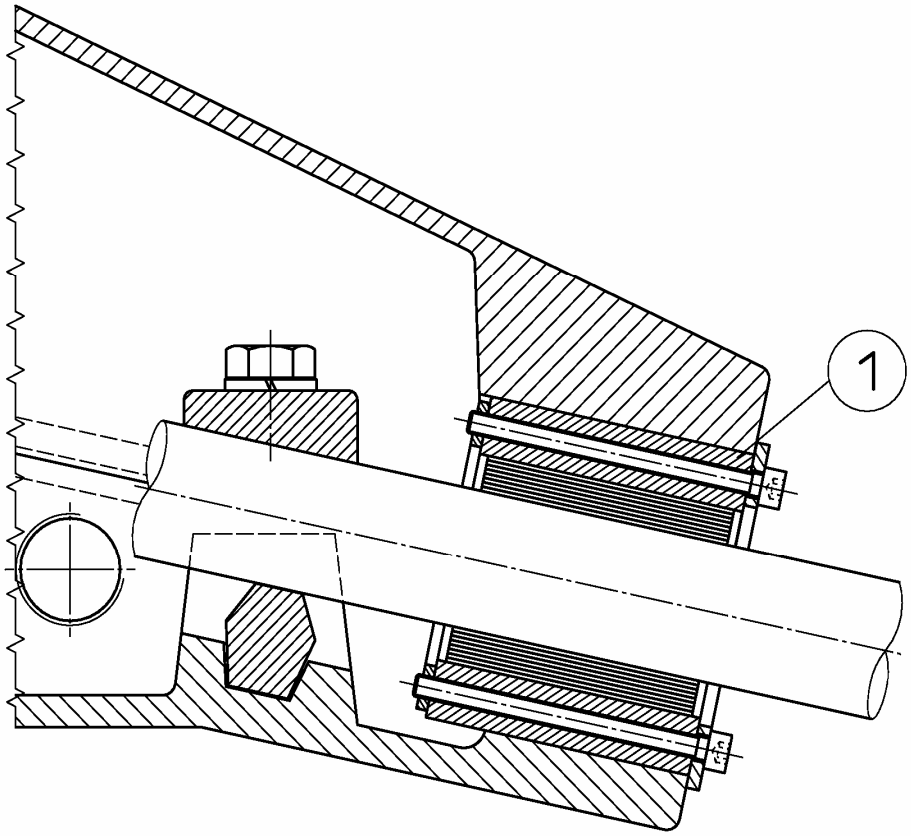


Figure 7: Cable lead-in

① Maximum two line lead-ins, Roxtec, RS Type plugs

Mains and guard circuit connection

The mains can be connected either with or without cable lug both in models with terminal board (➔ Fig. 8) and in those with single-conductor bushings (➔Fig. 9) (➔Section "Connection Diagrams", page 39).

① Connect the power line to the relevant terminals as per the supplied wiring diagram.

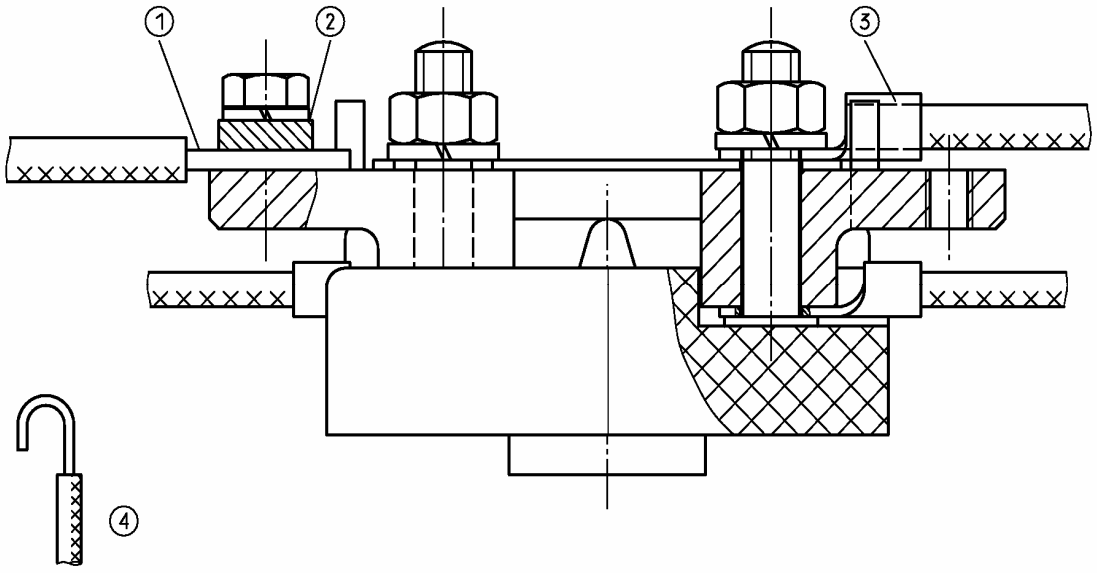


Figure 8: Line connection
① Connection without cable lug
② Clamp
③ Connection with cable lug
④ Single-wire conductor without cable lug

> When connecting a single-wire conductor without cable lug to terminals with just one screw, bend the conductor end as illustrated④.

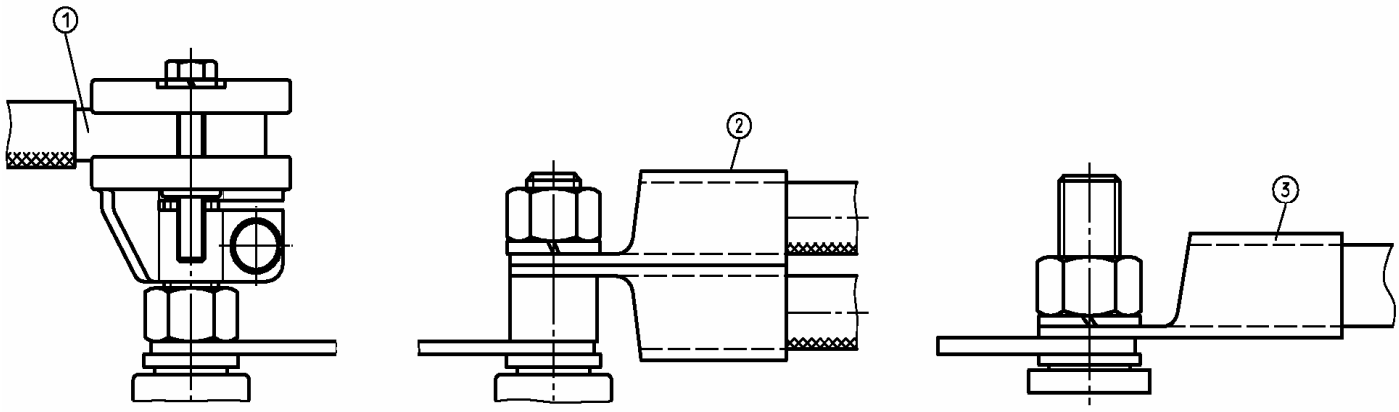


Figure 9: Conductor bushing
① Connection without cable lug
② Connection with two cable lugs
③ Connection with one cable lug

Take note of the maximum connectable conductor cross-section for the terminals. If no other data is available on the terminals, refer to the following table.

Table 6: Rated cross-sections

Shaft height	**Rated cross-section [mm^2]**
63 to 112	4
132 to 160	10 (r)
180 to 225	70
250 to 280	120
315	150/ 300 (depending on the model)
over 355	300

In the case of "increased safety" terminal boxes, make sure to comply with the clearances specified in EN 50019 (➔ Table 7) between conductive parts having different potentials. Tighten the screws and nuts on the live parts to the specified torque (➔Table 8).

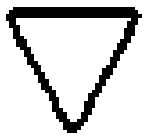
Table 7: Clearances

Rated voltage, *U* [V]	**Minimum clearance [mm]**
175 < *U* ≤ 275	5
275 < *U* ≤ 420	6
420 < *U* ≤ 550	8
550 < *U* ≤ 750	10
750 < *U* ≤ 1100	14
2200 < *U* ≤ 3300	36
5500 < *U* ≤ 6600	60
8300 < *U* ≤ 11000	100

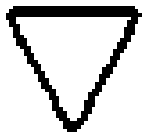
Table 8: Torques and current intensities for live pins

Thread size	**Torque [Nm]**	**Permissible continuous current [A]**	
		Brass	Copper
M4	1.2	16	-
M5	2	25	-
M6	3	63	-
M8	6	100	-
M10	10	160	200
M12	15.5	250	315
M16	30	315	400
M20	52	400	630

Depending on the model, additional terminals for instance for temperature monitoring or space heater are located either in the main terminal box or in additional terminal boxes; see the supplied wiring diagram.



Please note!
Take note of the rating data imprinted on the terminals.



Please note!
Keep the wiring diagram supplied in the terminal box in the enclosure with the documents belonging to the drive.

Motors with unidirectional fan

Make sure that the fan's direction of rotation matches that of the motor.

Motors with separate cooling via separately powered external fans

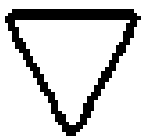
Make sure by means of the electric control that the main motor can be operated with the motor switched-on for separate cooling.

Motors with temperature monitoring

Terminals 1TP1-1TP2 or 2TP1-2TP2

The motors are equipped with PTC's as per DIN 44081. Take note of the temperature data and tripping time t_A on the rating plate.

Connect the PTC to an approved tripping device with marking PTB 3.53-PTC/A or Ex II(2) G.



Please note!
The tripping device is not explosion-protected. For this reason install them outside the areas subject to explosion hazards.

The marking confirms whether the electrical data on the interface between the temperature sensor circuit and the tripping device have been fulfilled. The use of the tripping device with PTC temperature sensors as per DIN 44081 is allowed for the thermal monitoring of explosion-protected electrical machinery.

Being the only overload protection as set forth in EN 60079-14, the temperature sensors herein described can be used together with an approved tripping device only if the tripping time t_A is specified on the motor rating plate. (Refer to Section 3, Operation & Repairs, page 42)

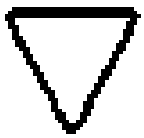
Motors with space heater

Terminals HE1-HE2 or U1-V1

The rating data for the space heater are specified either on the rating plate or on a separate plate. Depending on the model, there are two heating variants:

- by means of heater bands powered via terminals HE1-HE2 or
- by means of the stator winding by feeding AC voltage to terminals U1-V1.

Please note!
Make sure by means of the electric control that the motor voltage and the heater voltage are not fed simultaneously.



Please note!
The heater is not explosion-protected. It must not be switched on at motor temperatures below -20°C to heat the motor to at least –20°C. On the contrary, its purpose is that of preventing that the motor temperature falls below –20°C when idle.

Motors for operating on frequency converters

For operating on frequency converters, motors with temperature monitoring must be protected by PTC temperature sensors (➔ Section "Motors with temperature monitoring", page 25). The rating data for this operating mode are specified either on the rating plate or on a separate plate. If the relevant plate is missing, see the data provided in the manufacturer catalogue "Explosion-protected high and low voltage AC motors in II 2 G/D EEx d(e) IIC(B) T4...T6“
(➔ Torque curves see diagram 1 to 6, page 28+29).
Check the drive's "electromagnetic compatibility" as per EMC directive no. 89/336/EEC when operating on frequency converters.

Make sure when operating motors on frequency converters that the admissible voltage peak value named below are not exceeded by the

periodically occurring commutation voltage peaks (threshold value for terminals and winding insulation):

1. **Terminals** have effective clearance and creepage distances to withstand a voltage of 750V based on DIN EN50019 - increased safety type "e". The maximum transient over voltage from the frequency inverter to the motor is 2.15 kV (phase to phase and phase to earth).

2. **Standing winding** for 230/400V and 500V can withstand a peak voltage of 1.6 kV (phase to phase and phase to earth) with winding temperature rise corresponding to class F, our standard windings can be used with frequency inverters **without** the need for additional filter.

3. **Standing winding** for 400/690V can withstand a peak voltage of 1.6 kV (phase to phase and phase to earth) with winding temperature rise corresponding to class F, our standard windings can be used with frequency inverters **with** additional filter.

4. **Special winding** for a single nominal voltage of 690V can withstand a peak voltage of 2.15 kV (phase to phase and phase to earth) with winding temperature rise corresponding to class F, this windings can be used with frequency inverters **without** the need for additional filter. These motors will be marked with an “U” in the type code on the rating plate.

In the case of a converter output non-galvanically separated from the mains and with current limitation, follow the requirements of DIN EN 50178 and VDE 0160 (equipment of high voltage installations with electronic devices) on the overload protection of the protective earth conductor.

In rating the protective device in the outer conductors, bear in mind that the protective earth conductor current can be greater than the outer conductor current in fault condition. The protective earth conductor is to be dimensioned according to this fault current.

Take note of all of the data of the converter manufacturer for said fault condition.

Torque curves on frequency operation 2p=2

Diagram 1: frame size 63 - 160

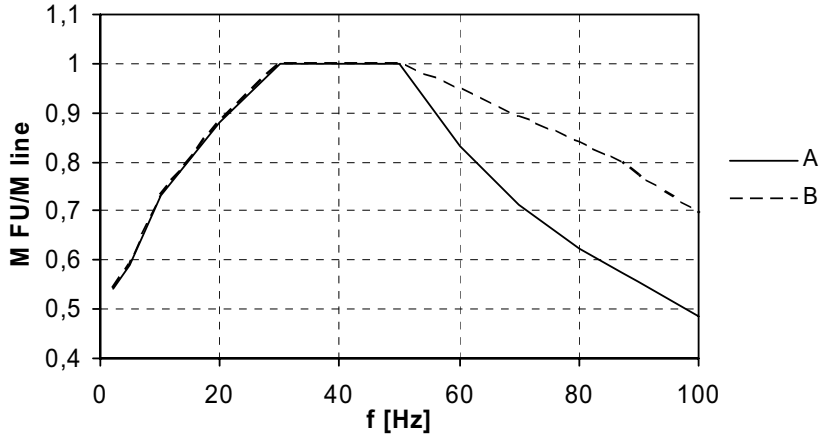


Diagram 2: frame size 180 - 225

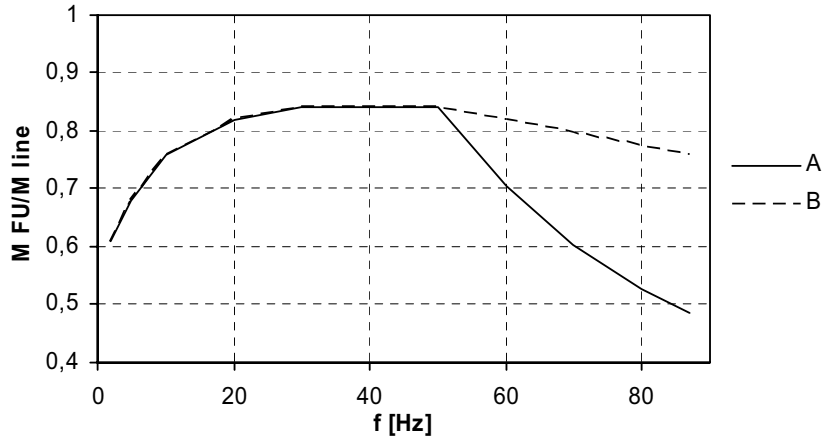
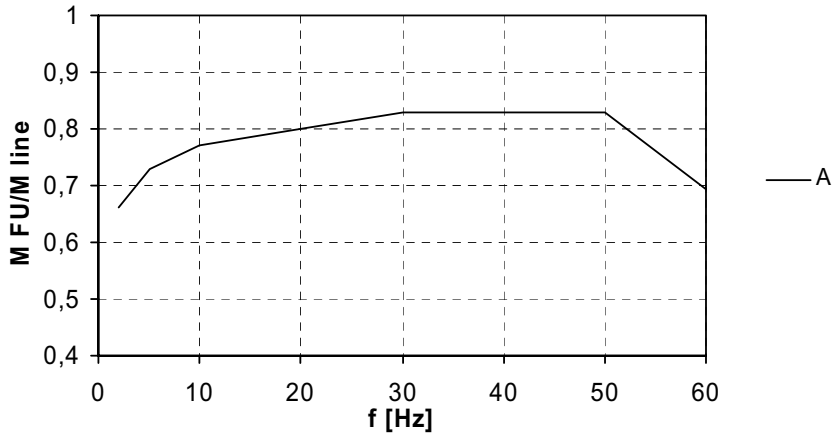


Diagram 3: frame size 250 - 400



A: Field weakening range above 50 Hz
B: Field weakening range above 87 Hz

Torque curves on frequency operation 2p=4 to 2p=8

Diagram 4: frame size 63 - 160

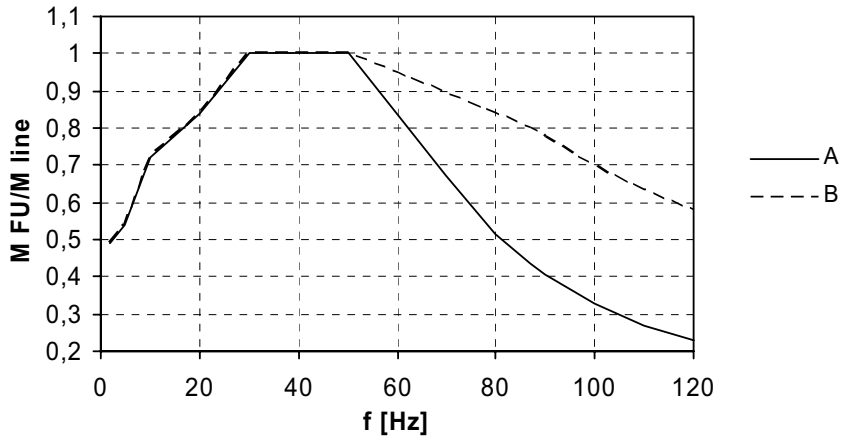


Diagram 5: frame size 180 - 225

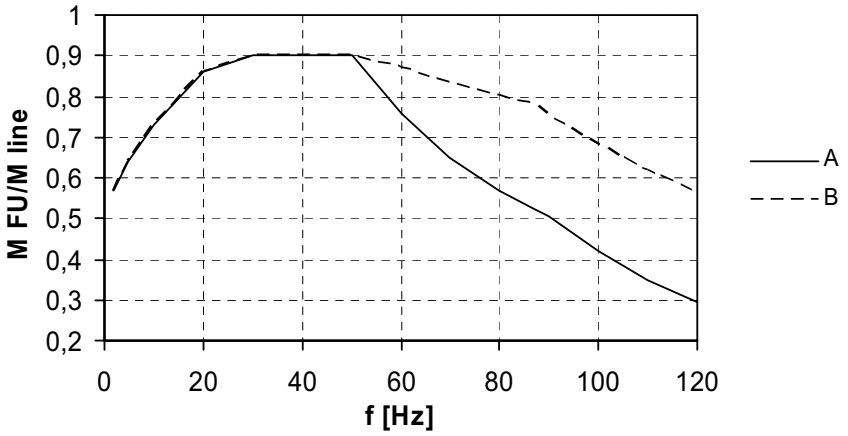
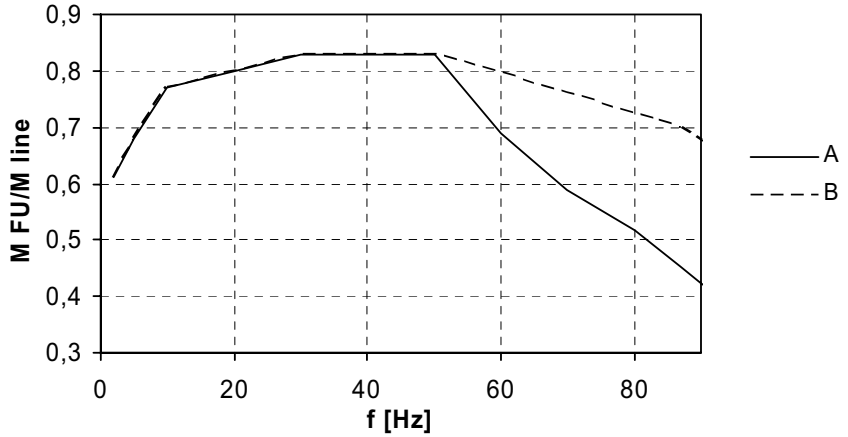
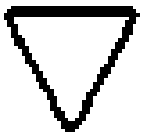


Diagram 6: frame size 250 - 400



A: Field weakening range above 50 Hz
B: Field weakening range above 87 Hz

Motors with built-in frequency converter (compact drive)



Please note!

Wait at least 3 min. after disconnecting the drive from the mains before connecting it again; otherwise there is the risk of damaging the input current limitation.

Warning!

After disconnecting the drive from the mains, the conductive parts of the frequency converter and the connected conductor may still be live for up to 180 sec. Wait at least 3 min. after disconnecting before opening the casing or touching the drain screw. Follow the operating instructions or the instructions provided in the converter's manual as well as the relevant safety regulations.
In some models an automatic restarting of the drive takes place after a power failure.

Parameter setting

The parameters of the incorporated converter were set by the manufacturer for the relevant application.

This setting does not correspond to the original factory setting made by the converter manufacturer. A list of parameters is found in the attached converter manual. Changing specific parameters can cause a drive operation in a critical area. This may lead to a fault trip of the converter or the tripping of the PTC temperature monitoring. A change in the motor voltage and clock frequency parameters is prohibited. The motors can be operated in a frequency range of 2 Hz (limited torque) to 100 Hz. The converter's clock frequency amounts to 4 kHz.

The parameters can be changed with the keypad according to the instructions provided in the converter manual. Insert the keypad plug in the test socket of terminals 5-6-15-16.
The keypad is not approved for use in the area subject to explosion risk.

Operating on unearthed network (IT)

Motors with an incorporated CEIGL ... IT type frequency converter can be operated on the IT network. In case of a short circuit in the drive the tripping must take place as quickly as possible.

Explosion protection

The explosion protection is ensured in all conditions, since the motor and converter are to be monitored by the PTC temperature sensors (➔Section "Motors for operating on frequency converters" , page 26). In the case of motors with incorporated frequency converter equipped with a PTC tripping device and relay, said protection is provided for without external tripping.

All the screws are to be tightened to the envisaged torque (➔ Table 4, page 17) and just as many screws as necessary for the envisaged fastening boreholes are provided. Any damaged screws are to be replaced only with screws of the same dimensions and quality (at least 8.8).

Relay and PTC tripping device

Motors with incorporated frequency converters can be equipped either with a relay or a PTC tripping device to ensure protection against overheating as required by IEC 60079-14. The PTC tripping device is accessible by means of a hexagon locking screw (SW 67) on the upper face of the pressure-resistant casing. The locking screw must be completely screwed in during operation and is to be secured with anaerobic adhesive for screws.

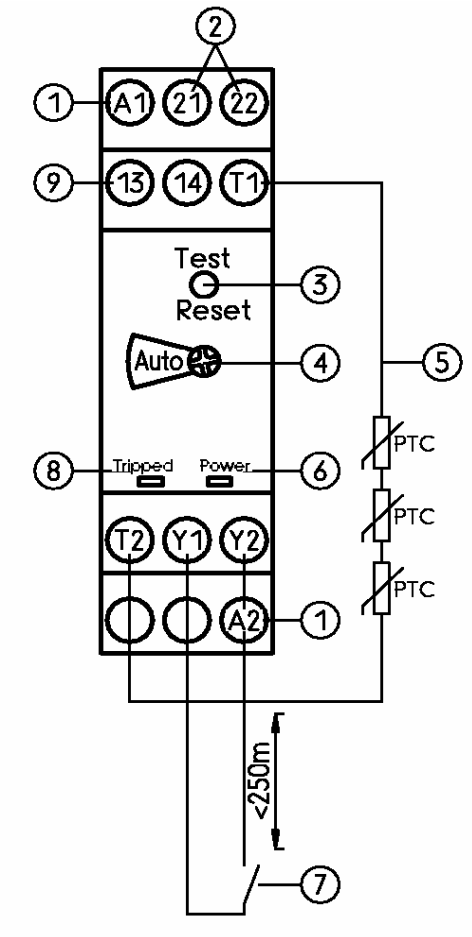


Figure 10: PTC tripping device

① Rated control supply voltage (A1-A2)
② Normally closed auxiliary contacts (21-22)
③ Test/Reset
④ Manual/automatic reset
⑤ Thermistor (T1-T2)
⑥ Mains LED (green)
⑦ Remote reset (Y1-Y2)
⑧ Trip LED (red)
⑨ Normally open auxiliary contact (13-14)

In case of a device with shared power and control voltage supply (➔ Fig. 12) no automatic restarting of the drive takes place after a power failure or the tripping of the protective device.

Caution!
In case of a device with a separate control voltage supply (➔Fig. 13) an automatic restart of the drive takes place after a failure in the power supply.
After a power failure in the control voltage supply there is no automatic restart of the drive.
A failure in the control voltage triggers the reset of the PTC tripping device.

Warning!
The compact drive feeds voltage also when the device is off. Before performing work on the device or external control unit, disconnect the mains line.

G1: Frequency converter
R: approx. 0Ω in TN and TT network version
R = 10M Ω in IT network version
L1, L2, L3: Power supply input
K11, K12, K14: Converter relay outputs
Br 1, Br 2: Brake rheostat
2TP1, 2TP2:
PTC connection
5, 6, 15, 16: Keypad connection (parameter setting)

① PROFIBUS-DP at choice

② Systembus (CAN) at choice

③ Interbus at choice

④ Standard I/O at choice

⑤ Applications I/O at choice

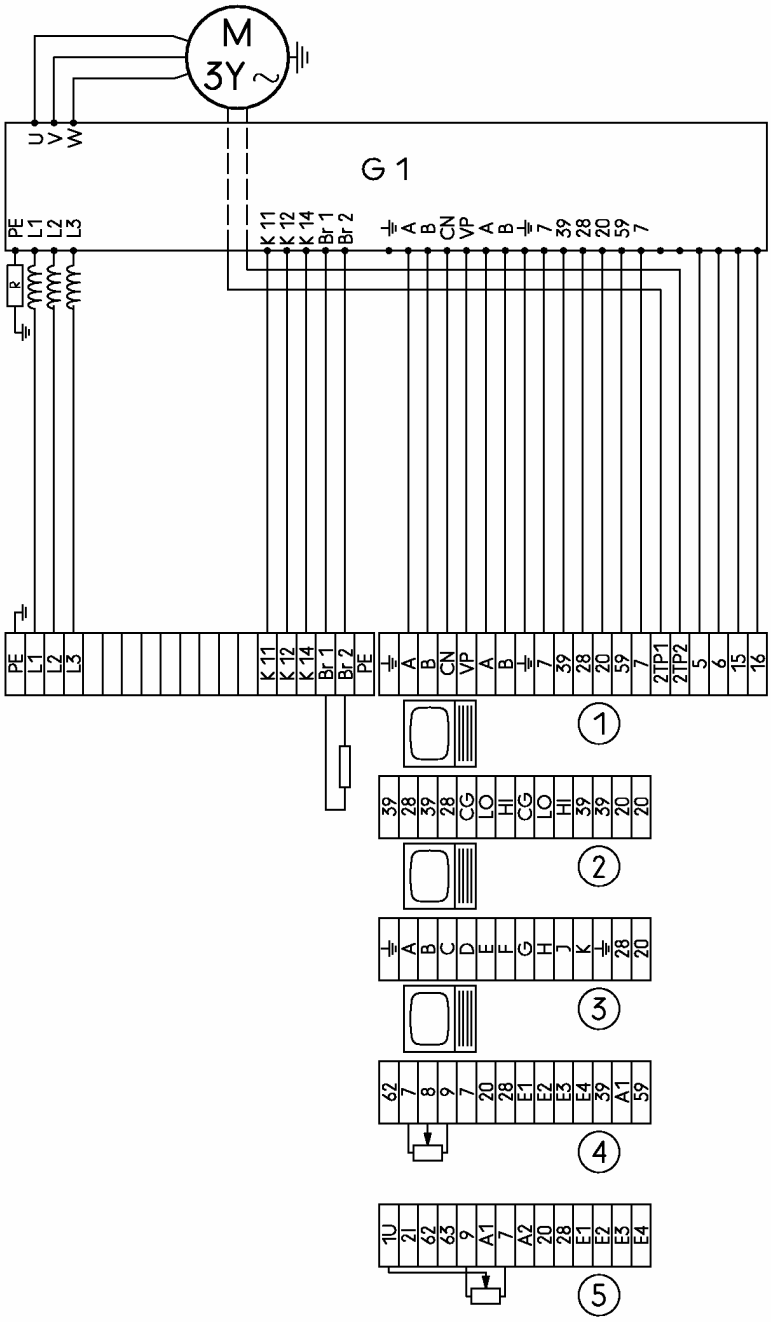


Figure 11:

Overview circuit diagram of the compact drive without relay and PTC tripping device for all network versions.
For details, see the converter installation instructions and the circuit diagram for functional unit 1-5

G1: Frequency converter
G2: Relay
G3: PTC tripping device
L1, L2, L3, N: Power supply input: converter, relay, PTC tripping device
14, 13/32, 31: I/O keys
Y1, Y2: PTC tripping device reset
21, 2N: "Failure" message
14, 2N: "On" message
K11, K12, K14: Converter relay outputs
Br 1, Br 2: Brake rheostat
5, 6, 15, 16: Keypad connection (parameter setting)

① PROFIBUS-DP at choice
② Systembus (CAN) at choice
③ Interbus at choice
④ Standard I/O at choice
⑤ Applications I/O at choice

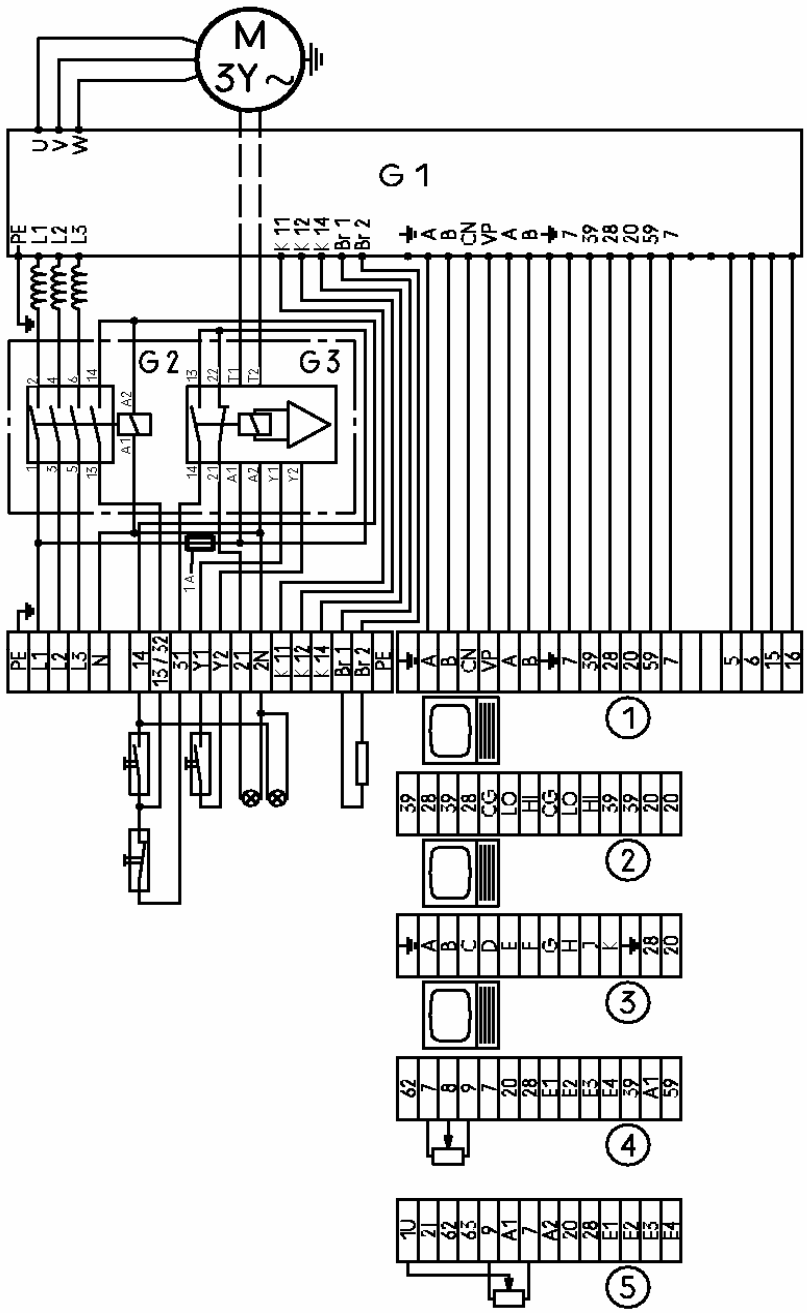


Figure 12:

Overview circuit diagram of the compact drive with relay, PTC tripping device and internal control voltage supply for the TN network.
For details, see the converter installation instructions and the circuit diagram for functional unit 1-5

G1: Frequency converter
R: approx. 0 Ω for the TN and TT network versions
R = 10M Ω for IT-network version
G2: Relay
G3: PTC tripping device
L1, L2, L3: Power supply input: power and control
N/-, L/+: control voltage 220 - 240V~ or 24V=, fuse maximum 16A
14, 13/32, 31: I/O keys
Y1, Y2: PTC tripping device reset
21, 2N: "Failure" message
14, 2N: "On" message
K11, K12, K14: Converter relay outputs
Br 1, Br 2: Brake rheostat
5, 6, 15, 16: Keypad connection (parameter setting)

① PROFIBUS-DP at choice
② Systembus (CAN) at choice
③ Interbus at choice
④ Standard I/O at choice
⑤ Applications I/O at choice

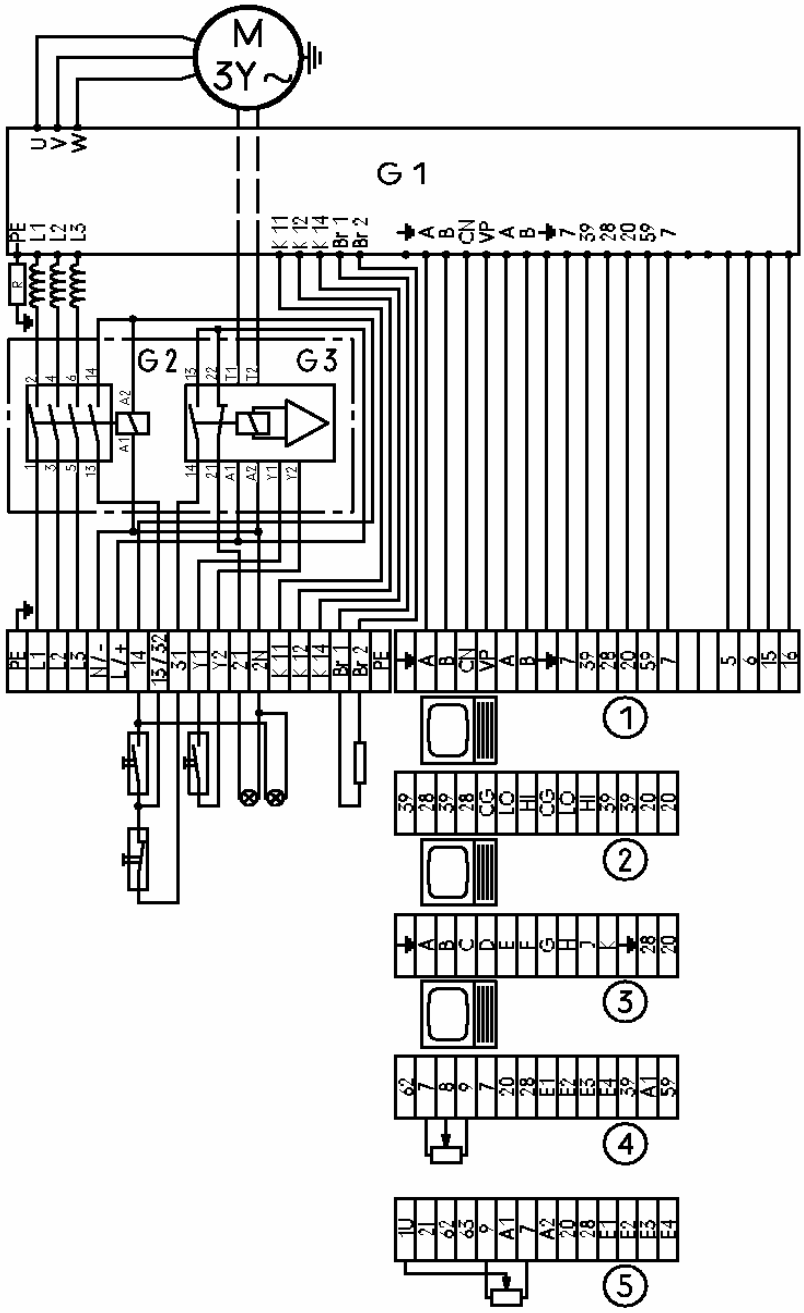


Figure 13:

Overview circuit diagram of the compact drive with relay, PTC tripping device and separate power supply of the control voltage for all of the network versions. For details, see the converter installation instructions and the circuit diagram for functional unit 1-5

Motors with brake

The mains line in the version with incorporated brake is connected in the motor terminal box and in the version with the built-on brake in the separate brake terminal box. Observe the supplied connection diagram and the rated voltage visible on the rating plate. In the presence of an AC connection the brake coil is energized by means of a silicon rectifier accommodated inside the explosion-proof encapsulation.

➔ The temperature sensors applied both in the motor and brake are to be connected as envisaged in Section "Motors with temperature monitoring", page 25.

Motors with brake or tachometer mounted under the ventilator hood

In order to connect brakes or tachometers mounted under the motor ventilator hood, the latter must be disassembled.
Unscrew any shock pulse sensors or regreasing devices. Loosen the fastening screws on the hood and remove the hood from the motor.

Connect the brake of tachometer as per the attached circuit diagram and pass the cable along the shortest route through the motor fins towards the main terminal box. It is recommended to insert a protective tube over the connection cable in the fin area to prevent wearing.

Fit the ventilator hood back on the motor and check the position of the boreholes for any shock pulse sensors and regreasing devices. In the case of motors with an axial fan running into a nozzle, make sure that there is a uniform air gap all around between the fan and nozzle. Secure the hood with the fastening hoods, (torque as per Table 4, page 17)
Check manually that the fan runs freely once the mounting is completely.

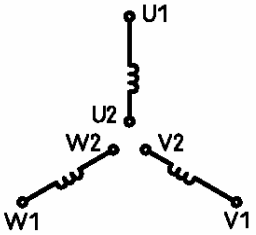
Motors with water cooling

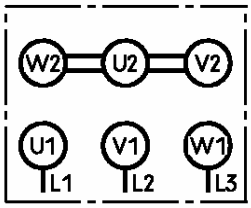
Before connecting, check the cleanness of the cooling water (max. permissible content of deposits: 30 mg/l). The water connections are to be connected according to the signs on the motor. The quantity of cooling water necessary for cooling the motor is to be complied with (see the sign on the water inlet). To eliminate any entrapped air, the motor's counter-drive side is provided with a bleed valve. The cooling water quantity control must shut off the motor if there is less cooling water than required.
The water chambers must be cleaned regularly depending on the content of deposits. They can be cleaned without disassembling the motor. After unscrewing the sealing ring on the motor casing's counter-drive side, it is possible to clean the casing. The explosion protection is not affected by unscrewing the sealing ring, as the water chamber is not located in the pressure-resistant section.
Make sure by means of the electric control that the motor can be operated only with the water flow on and that the water jacket is always perfectly vented. The maximum inflowing water temperature amounts to 30 °C.

Connection diagrams

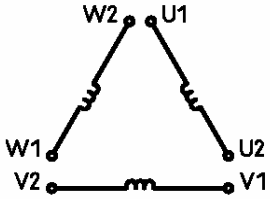
The circuit diagram on the motor is to be followed.

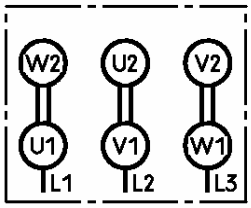
Single-speed – one pole





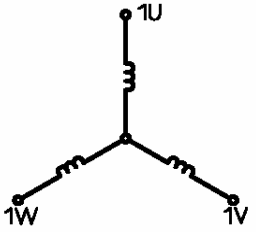
Y circuit

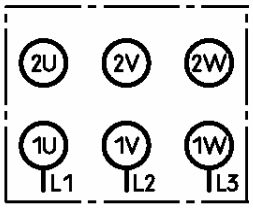




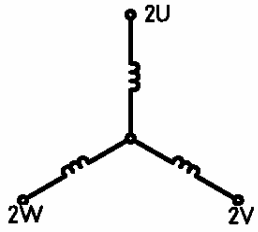
Δ circuit

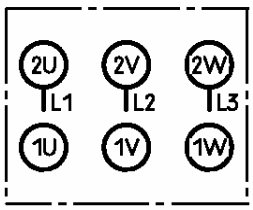
Pole changing





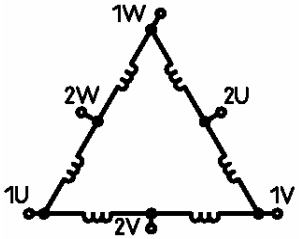
Low rpm

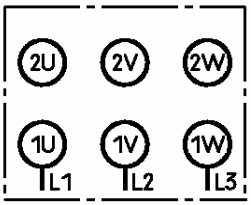




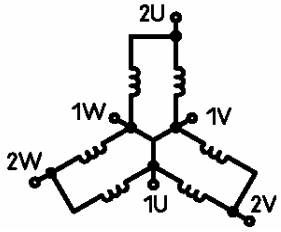
High rpm

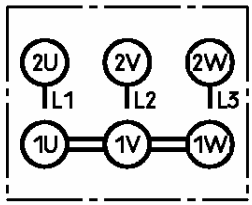
Dahlander connection





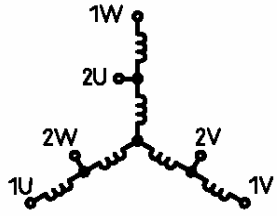
Low rpm

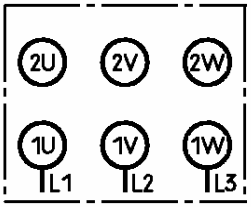




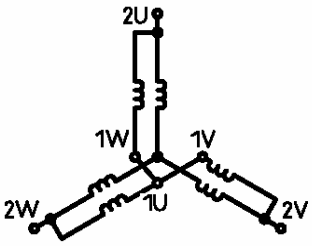
High rpm

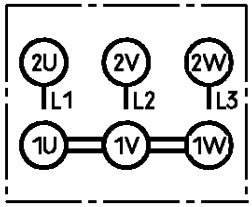
Dahlander connection



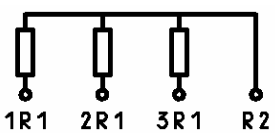


Low rpm



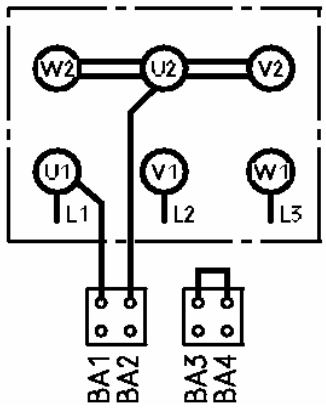


High rpm

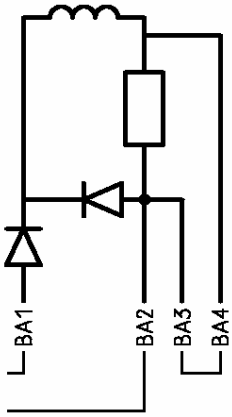
1TP1-1TP2	Pre-alarm PTC	U>2.5V not allowed	Use tripping device with PTB number or marking II (2)G
2TP1-2TP2	Tripping PTC		
1R1-R2	PT 100 resistance temperature sensor		
HE1-HE2	Space heater		

Brakemotors with incorporated brake
Brake connection via motor winding

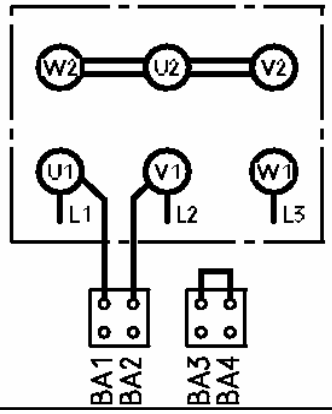
Y circuit



Terminals BA1-BA2 can be connected directly to the motor terminals to supply the brake. Compare the motor/brake voltages to determine whether the connection is to be made on U1-U2 or U1-V1.
Terminals BA3-BA4 must be bridged.

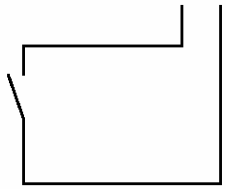


Y circuit
Brake

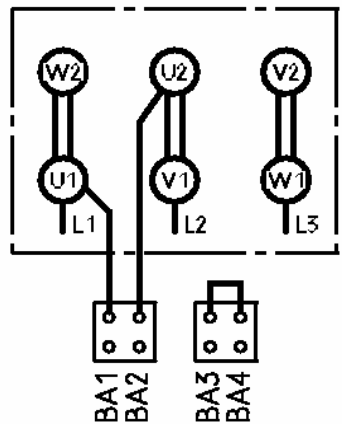


An external power supply can be applied on terminals BA1-BA2. Check the voltage data on the rating plate.
Terminals BA3-BA4 must be bridged.

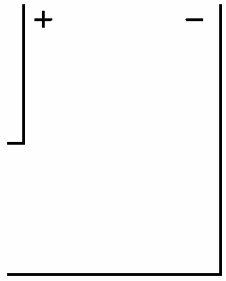
For a rapid engagement of the brake (DC-voltage side tripping) bridge BA3-BA4 can be replaced by a contact. The contact must be tripped simultaneously with the brake power supply.



Δ circuit



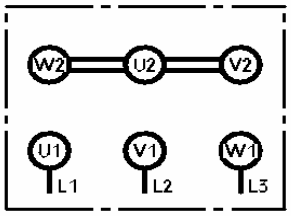
In order to provide for the emergency venting of the brake, e.g. to turn the motor manually, you can apply a DC voltage source to terminal BA1 + BA4 (remove any other wiring before hand and observe the polarity).
U voltage = = U~ x 0.45
U voltage~see brake voltage on the rating plate.



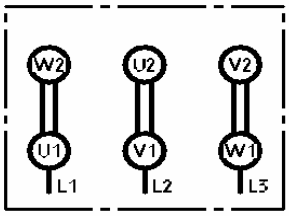
BA1-BA4	Brake		
1TP1-1TP2	Pre-alarm PTC	U>2.5V not allowed	Use tripping device with PTB number or marking II(2)G
2TP1-2TP2	Tripping PTC		
HE1-HE2	Space heater		

Brake connection via external power supply

Y circuit

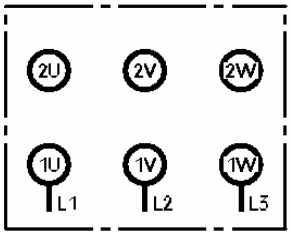


Δ circuit

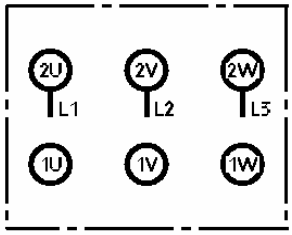


Pole changing

Low rpm
Y circuit

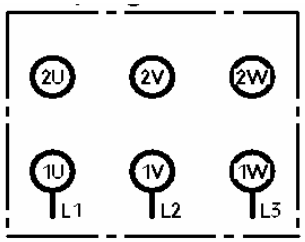


High rpm
Y circuit

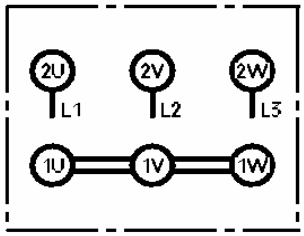


Pole changing Dahlander connection

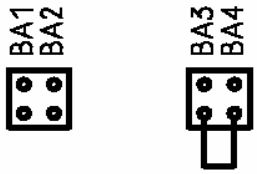
Low rpm
Δ circuit



High rpm
Y Y circuit

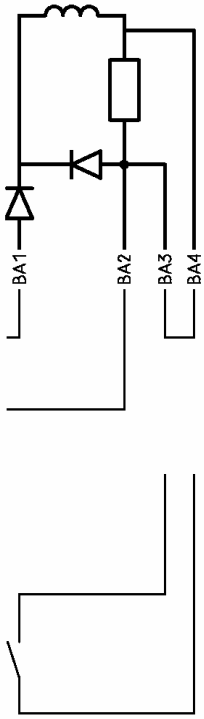


Brake connection



Brake power supply via terminals BA1-BA2. Observe the voltage data on the rating plate. Terminal BA3-BA4 must be bridged.

For a rapid engagement of the brake (DC-voltage side tripping) bridge BA3/ BA4 can be replaced by a contact. The contact must be tripped simultaneously with the brake power supply.



BA1-BA4 BD1-BD2	Brake		
1TP1-1TP2	Pre-alarm PTC	U>2.5V not allowed	Use tripping device with PTB number or marking II (2)G
2TP1-2TP2	Tripping PTC		
HE1-HE2	Space heater		
TB1-TB2	Temperature monitoring: Microtherm T 10		

3 Operation and Repairs

Duty types and thermal protection

- In S1 duty class motors a temperature sensor (TS) can be used in addition to the motor circuit breaker as required by DIN EN 60079-14, VDE 0165.

- If in S1 duty cycle motors protection is to be provided against overheating only by means of the TS, a proven combination of TS and tripping device is to be used for said purpose.

- In the case of non-S1 duty cycle motors proven combinations of TS and tripping device must be used as protection against overheating.

- The supplying of power to the motors via the frequency converter is permissible only if a proven combination of TS on the windings and tripping device is used.

The temperature sensors must be connected as specified in the Section "Motors with temperature monitoring", page 25.

Special operating conditions

The operating of the motors at ambient temperatures outside the generally valid range of –20 to +40 °C is allowed also without heater if an appropriate temperature range – e.g. –55 °C ≤ T_{amb} ≤ 60 °C – is specified on the rating plate.

Operation at less than –20°C is allowed also without any additional indication if the temperature of the entire motor is maintained at least at -20 °C by means of a space heater.

At motor temperatures of less than -20°C the heater must not be started, as these are not explosion-protected.
(➔ Section "Motors with space heater", page 26).

Motors with backstop

Motors with built-in backstop must be operated at a minimum rpm higher than the value specified on the rating plate – e.g. FXM 850 min $^{-1}$ – to prevent excessively high temperatures.

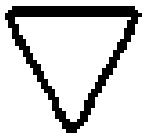
Heat input through the driven machine

It must be ensured that no quantities of heat greater than the maximum heating values specified in table are conveyed from a mounted machine to the interface with the motor (e.g. shaft and motor flange). This way it is guaranteed that no point of the motor exceeds the temperature class.

Table 9:
Permissible surface heating at an ambient temperature of 40°C:

	Temperature class		
	T6 = 85°C	T5 = 100°C	T4 =135°C
Permissible heating on the shaft	30K	45K	65K
Permissible heating on the flange	30K	45K	65K

Start-up



Please note!
Before mounting or start-up the insulation resistance is to be measured by qualified technicians. The resistance must be greater than 1 MΩ. A critical value is reached at 0.5 MΩ. If this value is not reached, the motors must be dried.

The best way to do it is in an oven at temperatures up to 100 °C. To eliminate any humidity, open the motor. To be entitled to any warranty claims, contact the manufacturer in advance.

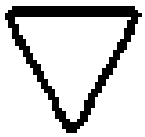
These works must be carried out by qualified technicians; in the course of said works the manufacturer shall instruct said technicians on how to ensure the explosion protection during reassembly. For the assembly and disassembly, see the relevant repair instructions.

- Check the direction of rotation and operation during idle running. In case of unidirectional external fans (axial fans) observe the sign for the direction of rotation on the motor. If the direction of rotation needs to be changed, invert the two power lines and the fan.

- If the motor was stored and an additional quantity of grease was applied in the anti-friction bearings, the motor must be run with no load for at least 0.5 h to ensure an adequate distribution of the grease and to avoid the overheating of the anti-friction bearings.

- Make sure that the operating current matches the specified current values on the rating plate.

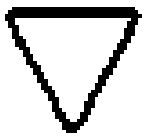
  The protective equipment required as per EN 60079-14 is to be set according to the motor rating values specified on the rating plate. The specified current value on the rating plate must not be exceeded in continuous duty conditions.



Please note!
Run the motor with load for at least 1 hour and check that there is no unusual noise or heating exceeding the specified temperature class values.

Relubricate motors with regreasing equipment with the specified amount of grease during start-up.

Vibration severity values of $V_{eff} \leq 3.5$ mm/s ($P_N \leq 15$ kW) or 4.5 mm/s ($P_N > 15$ kW) in coupled operating mode are not allowed. In case of deviations from normal operating conditions – e.g. higher temperatures or greater noise and vibrations – find the cause and, if necessary, contact Producent.



Please note!
The protective equipment must always be kept in service also during trial runs. In case of doubt switch off the machine.

Maintenance

Inspection

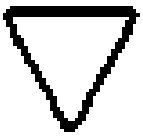
- The motors are to be constantly monitored depending on the operating conditions.
- Keep the motors clean and the venting openings free

(➔ Section "Site", page 10)

Any national regulations valid for the maintenance/repair of electrical equipment in areas subject to explosion hazards - e.g. in Germany the Operational Safety Order, etc - are to be complied with.

During maintenance especially those parts on which the degree of protection depends must be checked; these include, for instance, the integrity of the lead-in components and gaskets.

Lubrication



Please note!
In order to avoid damage the bearings and grease must be kept clean.

The deep groove ball bearings of motors up to frame size 280 are sealed on both sides and filled by the bearing manufacturer with a grease which is enough for normal operating conditions in 4 or multi-pole motors for 40000 operating hours or in 2-pole motors for 20000 operating hours.

When changing the bearings, change also the shaft seals. To do so, dismount the motor so that the winding can be cleaned at the same time. Disassembly and assembly as per the specific manufacturer repair instructions.

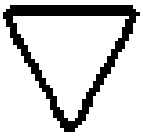
Motors starting from frame size 315 and motors with reinforced bearings are to be equipped with regreasing devices. The bearings are to be regreased preferably with the motor running with a grease gun through the grease nipples located over the bearing plates or bearing caps.

The drip space in the bearing cap for outflowing old grease is large enough to collect the outflowing grease during the nominal bearing service life with state-of-the art regreasing.

See the plate on the motor for the specified lubricating intervals and the type and quantity of grease to be used. The manufacturer normally uses ESSO Unirex N3, a lithium complex soap/mineral oil grease.

Table 10: Standard regreasing intervals in hours

Ambient temperature	**Rpm up to 1800 min^{-1}**	**Rpm up to 3600 min^{-1}**
40 °C	5000 h	2500 h
50 °C	2500 h	1000 h



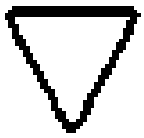
Please note!
In motors with enhanced performance (motor type ...X), in heavy drive conditions like belt and gear drive with additional bearing loads and in vertical designs the lubricating intervals are to be reduced by 50%.

Observe the specified quantity of grease. Overgreasing can lead to a sharp increase in the bearing temperature and hence to the failure of the bearing.

Caution!
If regreasing is carried out while the motor is running, provide for adequate protection against rotating parts!
Only resin-free and acid-free anti-friction bearing grease with a drop point of approx. 200°C is to be used.

Explosion protection

The marking  (II2G), EEx de IIC T4, for instance, indicates where the motor is to be used and that it has been designed, built and approved according to the relevant European standards required for operation in areas subject to explosion hazards.



Please note!
The motor must not be altered in any way whatsoever and the operating instructions set forth herein are to be complied with always.

If the motor is altered or repairs need to be made, these are to be performed by the manufacturer or by repair workshops or factories that possess the necessary know-how. Before the starting the motors again, conformity with the requirements of EC directives 76/117/EEC or 94/9/EC and 99/92/EC by said sites is to be ascertained and confirmed by means of an appropriate marking on the motor or by issuing a test report.

If these requirements are not met, the motor is no longer classified as explosion-protected and the marking - see above - is to be removed.

Instructions for ensuring explosion protection during operation

• All of the contact screws and nuts of the electrical connections are to be tightened securely to prevent excessively high contact resistance values that may lead to an excessive degree of overheating of the contact point; torque values (➔ Table 8, page 24).

• Use the utmost caution when connecting the mains cable. Observe the creep distances and clearances. Use duly the sealing parts of the cable lead-ins and connections spaces as well as the lead-in parts envisaged for the pull relief or as protection against torsion in order to maintain the degree of protection of the connection spaces
(➔ Section "Mains and guard circuit connection ", page 21).

• Eliminate any damages immediately and use only original spare parts. The proper performance of the works by the aforementioned sites is to be examined as per the relevant EC directives, in Germany by a qualified expert as per “Betriebssicherheitsverordnung”, abroad as per the relevant national regulations in force and to be confirmed by means of an appropriate marking

on the motor or by issuing a test report.

• The surfaces of ignition-protected gaps must not be reworked. Keep these surfaces metallically clean. Corrosion protection can be achieved by means of non-hardening sealing materials or sealing grease. The approved sealing materials include besides the corrosion protection greases available on the market: Hylomar, by Marston-Domsel
or Admosit and Fluid-D, by Teroson (follow the manufacturer's usage instructions). This must be observed in particular for the openings in the cover for connection spaces having a pressure-resistant encapsulation degree of protection, marking EEx d IIC(B).

• All the screws are to be tightened to the envisaged torque (➔Table 4, page 17) and just as many screws as necessary for the envisaged fastening boreholes are provided. Any damaged screws are to be replaced only with screws of the same dimensions and quality (at least A2-70).

Repairs

Repairs and changes to explosion-protected machines are to be carried out by one of the aforementioned sites as per EC directives 94/9/EC and 99/92/EC, in Germany in compliance with the “Betriebssicherheitsverordnung” as well as with the safety regulations and requirements of the repair instructions.
Any works relating to the explosion protection must be carried out by the manufacturer or by a specialized workshop for electrical machinery. If said works are not performed by the manufacturer, these must be surveyed by an authorized qualified person.
In Germany a written certificate as per the Operational Safety Order is required for restarting. In foreign countries the national regulations in force are to be complied with.

4 Additional dust protection requirements
(application in zones 21 and 22)

Intended use

A marking of at least IP 65 and  II 2D T …° C must be found on the motor's rating plate.

Installation and Operation

Cable and line lead-ins

Separately approved lead-ins belonging to category 2G with at least IP 65 or category 2D are to be used. Any openings that are not used are to be closed with duly approved plugs.

Operation and Repairs

The motors must not be operated with excessive dust deposits, as these may lead to the exceeding of the admissible surface temperature. Regular cleaning must be performed.

The radial shaft seal rings are included in the approval. Only original gaskets are to be used.

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Repair Manual
Explosion-Proof F&G Three-Phase Motors

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Explosion-Proof F&G Three-Phase Motors

Warning!
Dangerous electrical voltage!
Observe explosion protection measures!

Before commencing repair work

The following safety instructions for the repair of explosion-proof three-phase motors in flameproof enclosures – designation: *Ex* II 2.EEx d(e) IIC(B) T – must be observed in addition to the general installation instructions and the provisions of the operating manual. The operating manual provides instructions on the installation of the standard motor types and is not a substitute for any specialist training in the sense of the relevant explosion protection standards.

- Disconnect the power supply of the device
- Ensure that the device cannot be accidentally restarted
- Verify isolation from the supply
- Earth and short-circuit
- Cover or enclose neighbouring units that are live.
- Follow the installation instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- The electrical installation must be carried out in accordance with the relevant regulations (e.g. for cable cross-sections, fuses, protective conductor connections).
- The opening of the motor without the manufacturer's consent, apart from the opening of terminal boxes, will invalidate the warranty during the warranty period.
- Original spare parts must be used for approved repairs or repairs outside of the warranty period.
- Electrically conducting and rotating parts of electric machines may cause serious and/or fatal injury.
- All transport, installation, commissioning and maintenance activities must only be carried out by qualified personnel. Observe the relevant standards for explosion protection such as EN 60079-14 and EN 50281-1-2, as well as national work safety regulations.
- Where installations are subject to these guidelines, appropriate safety measures must be taken in order to protect personnel from injury.
- Personnel must be instructed in how to proceed with care and observe the regulations in the transport, lifting and installation of the motor, as well as in recommissioning and repair.
- Do not use the lifting eye bolts to lift the motor together with the drive device.
- Do not use the supplied lifting eye bolts at ambient temperatures below –20 °C, in accordance with DIN 580. Lower temperatures could lead to the ring screws breaking and consequent injury to personnel and/or damage to the installation.
- The eye bolts should also not be loaded at an angle of more than 45 ° from the vertical direction and outside the plane of the ring, in accordance with DIN 580. In this case use transverse rods. Dimensions for positioning lifting eyes and minimum dimensions of transverse rods and chain lengths, see our operating manual.
- Suitable safety measures should be taken against possible brake failure on motors fitted with an external brake. This particularly applies to brake motors used in lifting applications.
- Avoid contact with the start and operation capacitors in single-phase motors until a secure discharge has occurred.
- If high-voltage tests are required, follow the procedures and precautionary measures laid down in the accident prevention regulations.

Contents

About This Manual

This manual describes the disassembly and assembly of CD.../BD... and dCD.../dBD... explosion-proof motors.

Abbreviations and symbols

This manual uses the following abbreviations and symbols:

DE: **D**rive **e**nd
FS: **F**rame **s**ize
NDE: **N**on-**d**rive **e**nd

▶ Indicates instructions on what to do

→ Draws your attention to useful tips and additional information

▽ **Important!**
Indicates the possibility of minor material damage.

⚠ **Caution!**
Indicates the possibility of major damage to property or slight injury.

⚠ **Warning!**
Indicates the possibility of major damage to property or serious or fatal injury.

Except for the first page of chapters and empty pages at the end, the top left of the page shows the chapter title and the top right of the page shows the current section for greater clarity.

1 Explosion Protection

Warning!
The repair and recommissioning of explosion-proof motors in flameproof enclosures must comply with the relevant legal provisions:

These are the Directive 94/9/EEC; this has been implemented in Germany by the draft for electrical equipment in hazardous areas Elex V, DIN EN 50014, 50018 and 50019 and VDE 0170/0171 etc.

This particularly applies when work is carried out on parts on which explosion protection depends.

Parts on which explosion protection depends are:

- Gap connections and shaft bushings,
- Fastening screws,
- Seals,
- Cable glands and entries,
- Terminal points.

Working on explosion-proof components

Joint connections and shaft bushings

Caution!
Gap surfaces (joint surfaces of components) must not be machined, coated or painted. Keep the surface metal clean. Surfaces must not have any surface damage (e.g. fractures or grooves).

Corrosion protection can be achieved using non-curing sealant (static gap surfaces) or sealant grease (static or rotating gap surfaces). Permissible sealing materials are Hylomar from Marston-Domsel, or Admosit and Fluid-D from Teroson.

Fastening screws

Damaged screws must be replaced by new parts with the same material quality and must be sufficient for the number of fastening holes provided.

Seals, cable glands, entries and terminal points

Damaged parts must be replaced by original parts.

After repair work

If a part of a motor has been repaired on which explosion protection depends, the following requirements must be fulfilled for commissioning:

An appointed inspector must verify that the essential explosion protection features of the motor meet the requirements of the applicable regulations. This inspector must issue the operator of the motor with appropriate certification of this compliance. The inspector must attach an appropriate approval mark on the motor or by issuing a test report.

Warning!
All components used on the motor must comply with the protection type of the motor concerned and the relevant standards. This is denoted by designations such as II 2 G EEx d IIC(B) T4, on motor and components.

Prior to recommissioning carry out the tests specified in Chapter "Tests", Page 24.

2 Maintenance Instructions

The following components form a flameproof enclosure depending on axle height:

- Housing,
- End shield,
- Bearing cover,
- Bushing plate with core or cable gland,
- Shaft sections in the vicinity of shaft bushings in the
  - Housing,
  - End shield or,
  - Bearing cover.

If these parts are damaged, such as due to fractures or grooves in the flameproof gaps (joints of individual components) they must be replaced with original parts. In accordance with EN 50018 gap surfaces must have a maximum average peak-to-valley height of Ra = 6.3 µm (ISO 468). Only original spare parts must be used.

If unmachined blanks are supplied and are finished by users themselves according to original drawings, these parts must be subject to parts tests in accordance with EN 50018.

Always renew shaft seals and roller bearings every time the motor is disassembled. The roller bearings must be covered at both ends, depending on type, and filled with anti-friction roller bearing grease for lifetime lubrication or must be open.

Replace damaged screws with screws of the same strength. These must be sufficient for the number of fastening holes provided.

Check the stator winding and dry or repair it if necessary. To do this refer to the enclosed instructions for assembly, commissioning and maintenance of three-phase squirrel-cage motors housed in a flameproof enclosure and in → Chapter "Tests", Page 24 of these instructions.

3 Mechanical Design

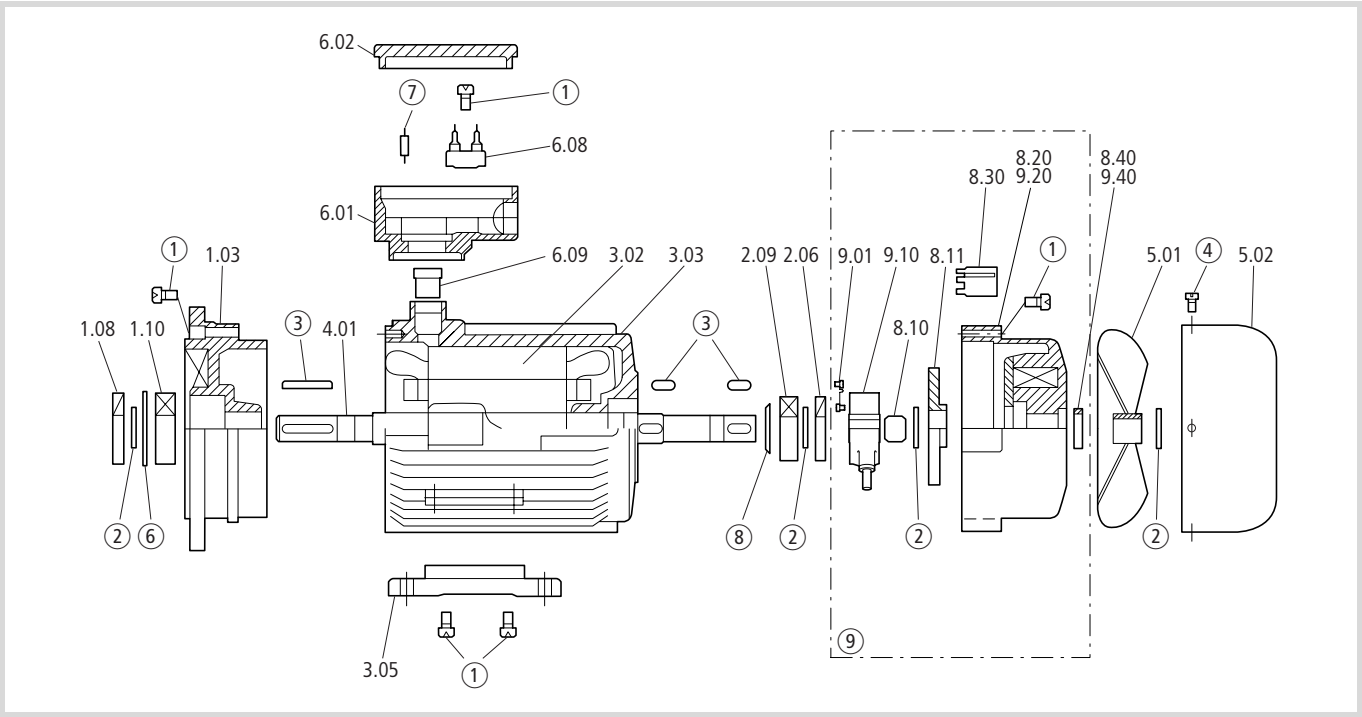


Figure 1: Explosion drawing for frame size 63 to 132

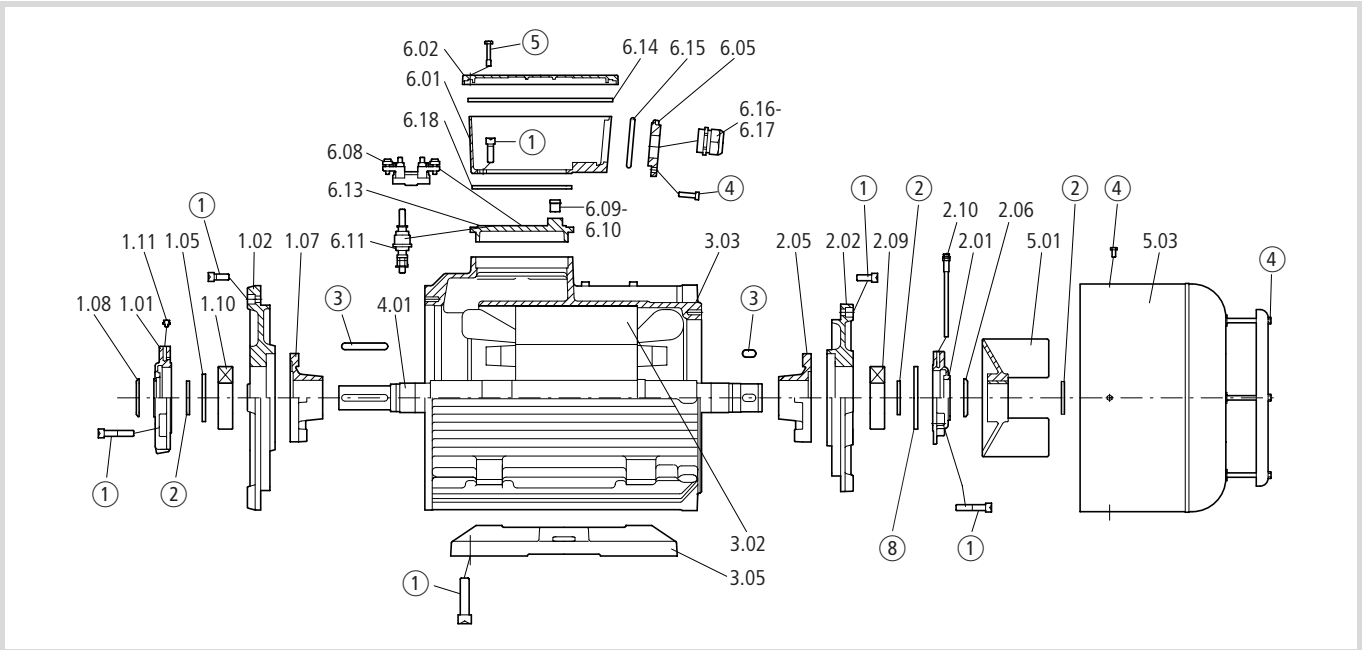


Figure 2: Explosion drawing for frame size 160 upwards

Legend for Figure 1 and 2:

① Screw to DIN 912
② Retaining ring to DIN 417
③ Featherkey to DIN 6885
④ Screw to DIN EN 24017
⑤ Screw to DIN 7964
⑥ Retaining ring to DIN 472
⑦ Set screw to DIN 914
⑧ Cup spring or compensating plate
⑨ Only with brake motors and motors with an integral tacho-generator

English

Spare parts

The listed parts are available from the factory. The type and combination depends on the motor supplied. When making enquiries and orders for spare parts, please state the following:

- Spare part designation,
- Motor type and construction type,
- Motor no.

Part no.	Designation
1	**DE bearing assembly**
1.01	DE bearing cover, external
1.02	DE end shield
1.03	DE flange end shield
1.05	DE grease distribution disc, external
1.07	DE bearing cover, internal
1.08	DE shaft seal
1.10	DE roller bearing
1.11	DE relubrication device
2	**NDE bearing assembly**
2.01	NDE bearing cover, external
2.02	NDE end shield
2.05	NDE bearing cover, internal
2.06	NDE shaft seal
2.08	Cup spring
2.09	NDE roller bearing
2.10	NDE relubrication device
3	**Housing**
3.02	Stator winding, complete
3.03	Housing
3.05	Housing feet (1 pair)

Part no.	Designation
4	**Rotor**
4.01	Rotor, complete
5	**Ventilation**
5.01	Fan
5.02-03	Fan cowl
6	**Terminal compartment**
6.01	Terminal box
6.02	Terminal box cover
6.05	Cable bushing plate
6.08	Terminal plate
6.09	Core bushing
6.11	Cable gland
6.13	Bushing plate
6.14	Seal for terminal box cover
6.15	Seal for entry plate
6.16-17	Cable entry
6.18	Seal for bushing plate
8	**Brake**
8.10	Friction plate driver
8.11	Friction plate
8.20	Brake housing with coil, complete
8.30	One-way rectifier
8.40	Shaft seal
9	**Tacho-generator**
9.01	Tacho-generator
9.10	Torque arm
9.20	Tacho-generator housing
9.40	Shaft seal

4 Disassembly

→ Dismantle the individual groups of components in the order specified below.

Ventilation system

- ▶ Remove the fastening screws ④ of the fan cowl (5.02-03) and remove it (→ Fig. 3).
- ▶ Remove the retaining ring ② from the fan (5.01).

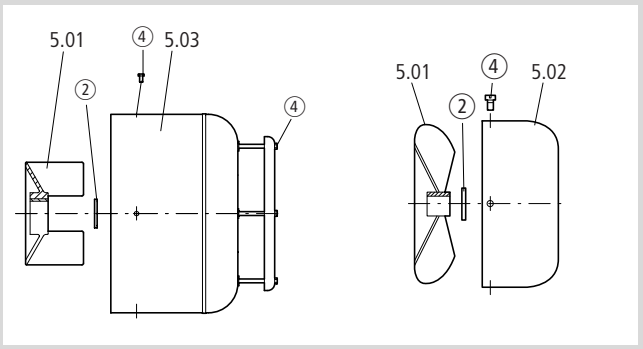


Figure 3: Undoing cowl screws and removing the retaining ring

▽ **Important!**
When removing the fan use an intermediate plate ② to protect the shaft centre hole. The extractor ① must engage behind the fan hub, otherwise the fan may break.

- ▶ Use the extractor ① to remove the fan (5.01) from the shaft. Remove small fans manually (→ Fig. 4).

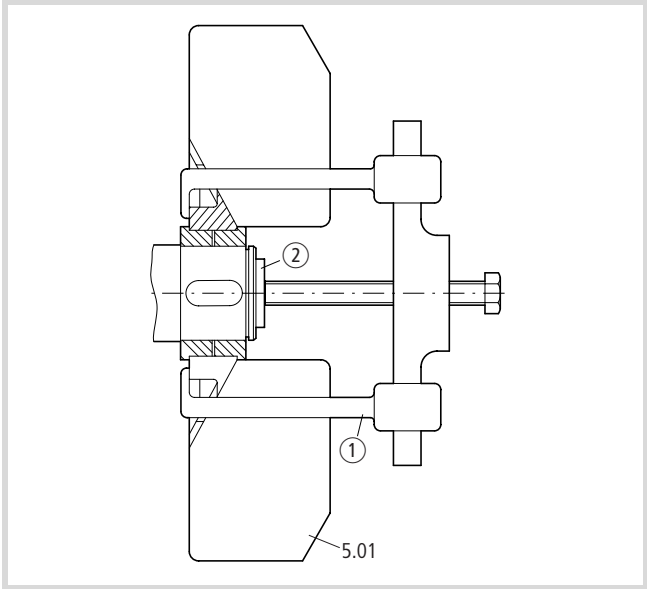


Figure 4: Removing the fan (5.01)

① Extractor
② Intermediate plate

▽ **Important!**
When removing the featherkeys use an intermediate plate to protect the shaft.

- ▶ Use the featherkey removal device to remove the featherkeys of the fan (5.01) from the shaft and the second retaining ring if fitted.

Further dismantling steps are required for motors without an integrated brake or tacho-generator, refer to → Section "End shields, rotors and roller bearings", Page 8.

English

Integrated brake and rectifier, frame size 80 to 132

The following requirements must be fulfilled in order to dismantle the integrated brake and rectifier:
The fan must have already been removed.

- ▶ Remove the fastening screws of the brake housing.
- ▶ Force the brake housing (8.20) from the motor housing centre the forcing-off thread in the fastening cams.

Important!
Insert a metal strip (→ item ① in Fig. 5) under the forcing-off screws as soon as the housings have come apart, in order to protect the thread in the motor housing.

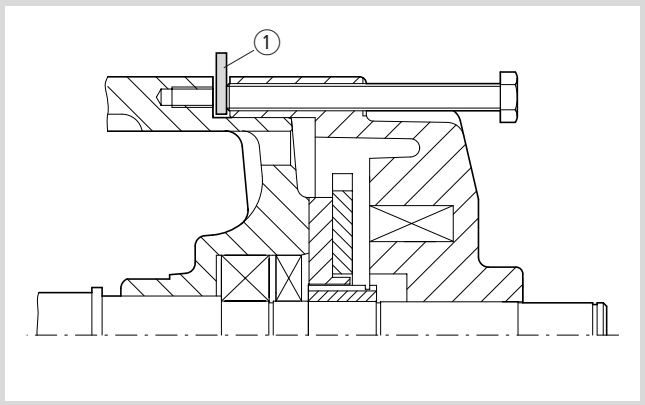


Figure 5: Inserting a metal strip

① 3 mm metal strip

- ▶ Lift off the brake housing (8.20) and rectifier and place it next to the motor.

The required cable length is provided in the motor housing.

To change the rectifier:

- ▶ Sever the cable to the motor directly at the board.
- ▶ Undo the cable to the brake coil at the terminal strip.

The additional wires moulded into the brake are for temperature monitoring and must be severed at the crimp connections or the terminal strip (depending on type) when the brake housing is exchanged.

Important!
When removing the friction plate use an intermediate plate ② to protect the shaft centre hole.

- ▶ Remove the friction plate from the friction plate driver (8.10).
- ▶ Remove the retaining ring positioned in front of the friction plate driver.
- ▶ Remove the friction plate driver (8.10) with the extractor ① (→ Fig. 6).

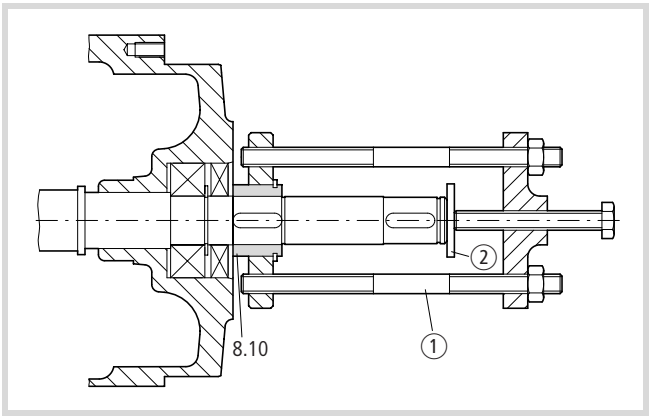


Figure 6: Removing the friction plate driver (8.10)

① Extractor

② Intermediate plate

Important!
When removing the featherkeys use an intermediate plate protect the shaft.

- ▶ Remove the featherkeys. With frame size 100, 112 and 132 remove the second retaining ring on the shaft.

Integrated tacho-generator, frame size 80 to 132

The following requirements must be fulfilled:
The fan must have already been removed.

Follow the same dismantling procedure as for the brake.

To remove the tacho-generator (9.01) from the shaft undo the torque arm (9.10) and then carry out one of the following steps, depending on the type concerned:

- ▶ Remove the retaining ring in front of the tacho-generator (9.01) or
- ▶ Undo the terminal bolt on the hub of the tacho-generator.

The tachometer cable is drawn through the motor housing into the motor terminal compartment, so that the drive end must be opened before it can be withdrawn to exchange the tacho-generator (9.01).

End shields, rotors and roller bearings

Frame size 56 to 225

Frame size 56 to 160

The following requirements must be fulfilled before dismantling:
The fan and brake must have already been removed.

The NDE shaft seal (2.06) and retaining ring are located in front of the NDE roller bearing (2.09).

- ▶ Remove the NDE shaft seal (2.06) and the retaining ring (not with frame sizes 56 to 71).

Frame size 180 to 225

The following requirements must be fulfilled before dismantling: The fan and brake must have already been removed.

The NDE shaft seal (2.06) is located in front of the NDE roller bearing (2.09).

- ▶ Remove the NDE shaft seal (2.06) together with the external NDE bearing cover (2.01) by undoing the screws.
- ▶ Remove the cup springs (2.08) from the DE end shield (1.02).
- ▶ Unscrew the fastening screws from the DE end shield (1.02).

Important!
To protect the threaded holes, insert a metal strip (→ item ② in Fig. 7) under the forcing-off screws as soon as the end shield has separated from the motor housing. Both DE roller bearing (1.10) and NDE roller bearing (2.09) are damaged in the removal process on FS 80 to 225, and must be replaced with new bearings.

- ▶ Use the forcing-off thread holes ① in the holes of the end shield (normally one thread size larger than the fastening thread) to force the end shield and rotor from the housing spigot recess (→ Fig. 7).

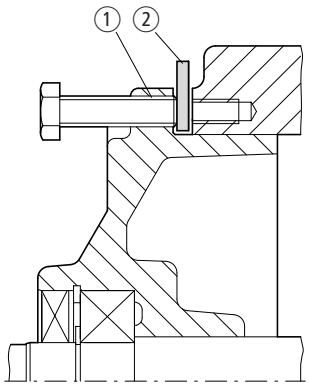


Figure 7: Forcing the end shield from the housing spigot recess

① Forcing-off thread holes
② 3 mm metal strip

- ▶ Remove the rotor carefully from the housing in order to avoid any damage!

Important!
When removing the featherkeys use an intermediate plate to protect the shaft.

- ▶ Extract the DE featherkey ③ from the shaft.
- ▶ Depending on the type concerned, remove
  - – the DE shaft seal (1.08), with or without the external DE bearing cover (1.01)
  - – the retaining rings ② and up to FS 160 ⑥ (→ Fig. 8)

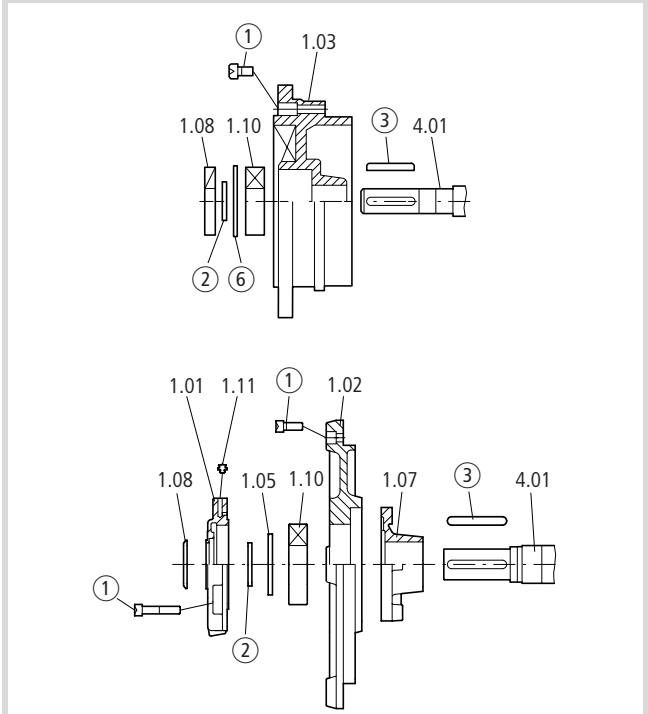


Figure 8: Position of DE shaft seal (1.08) and external DE bearing cover (1.01)

- ▶ Remove the DE end shield (1.02) and the DE roller bearing (1.10) from the shaft using an extractor (→ Fig. 9).

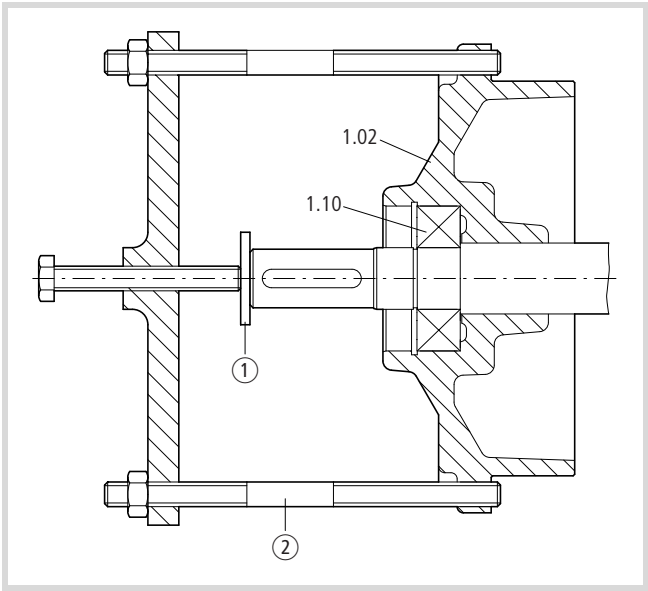


Figure 9: Removing the DE end shield (1.02) and DE roller bearing (1.10) from the shaft

① Intermediate plate
② Extractor

English

Important!
This will damage the DE roller bearing (1.10). It must be replaced with a new bearing. Use an intermediate plate ① to protect the shaft centre.

Important!
In order to prevent damage to the shaft bushing in the housing and end shield, use a soft (e.g. copper) mandrel to knock out the NDE roller bearing (2.09)! Use an intermediate plate ① to protect the shaft centre.

- ▶ With FS 80 to 132 use a mandrel to knock the NDE roller bearing (2.09) out of the housing through the shaft bushing.
  With FS 160 to 225 use a mandrel to knock the NDE roller bearing (2.09) out of the NDE end shield (2.02).
  With FS 56 to 71 the DE roller bearing (2.09) must be removed from the shaft using an extractor.

This will damage the bearings which must therefore be replaced.

- ▶ Unscrew and remove the fastening screws (frame sizes 160 to 225) from the NDE end shield (2.02).

Important!
Insert a metal strip under the forcing-off screws as soon as the end shield has separated from the motor housing holes in order to protect the threaded holes in the housing.

- ▶ Use the forcing-off thread holes in the end shield to force the NDE end shield (2.02) from the housing spigot recess (→ Fig. 7).

From frame size 250

- ▶ Unscrew the fastening screws of the external DE (1.01) and NDE (2.01) bearing covers.
- ▶ Remove the DE shaft seal (1.08) in front of the DE roller bearing (1.10) to be removed together with DE (1.01) and NDE (2.01) external bearing covers.
- ▶ Remove cup springs, depending on type.
- ▶ Unscrew and remove the fastening screws of the DE (1.02 or 1.03) and NDE (2.02) end shield.

Only bearing point for frame size 250, NDE

- ▶ Use the forcing-off thread holes to force the NDE end shield (2.02) together with the NDE roller bearings (2.09) from the housing spigot recess.

This will damage the NDE roller bearings which must be replaced.

All other bearing points

- ▶ Secure the end shield, for example, with threaded rods ① in the screw holes.
- ▶ Use the forcing-off thread holes to force the end shield from the housing spigot recess and from the roller bearing (→ Fig. 10).

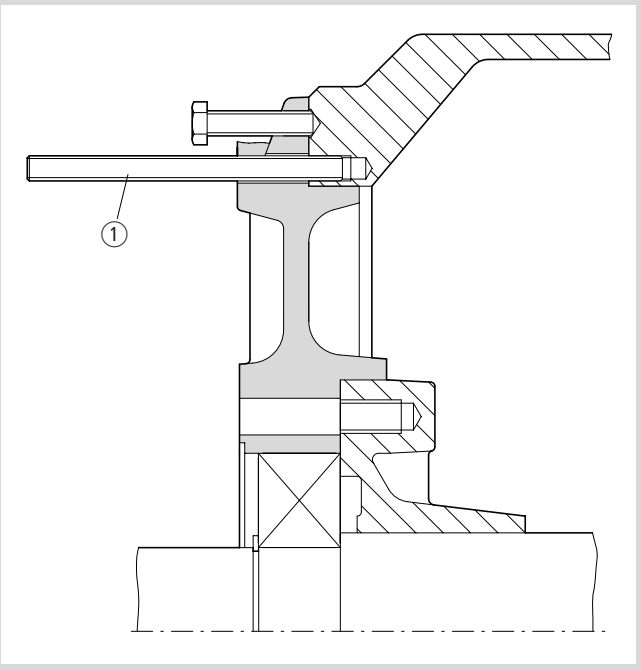


Figure 10: Forcing the end shield from the bearing

① Threaded rod

Warning!
The seating surfaces of the end shields on the housing must not be damaged by the forcing-off screws (e.g. deformations), in order to ensure perfect contact of the flameproof joints on the end shields on subsequent assembly.

- ▶ Remove the retaining rings located in front of the roller bearing.
- ▶ Remove the grease distribution disc if fitted.

Important!
When removing the bearing cover and roller bearing use an intermediate plate ① to protect the shaft.

▶ Remove the internal DE (1.07) or NDE (2.05) bearing cover together with the roller bearing from the shaft (→ Fig. 11).

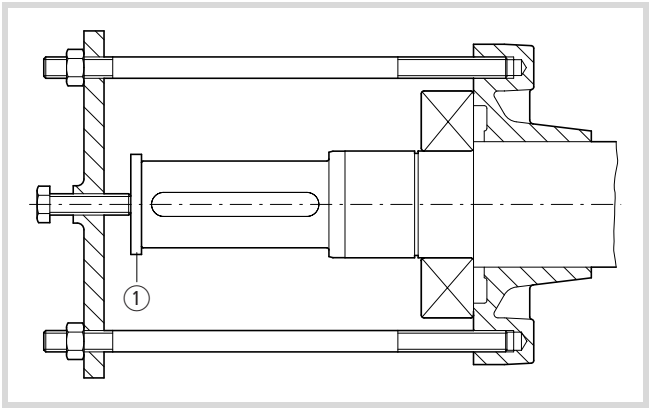


Figure 11: Removing the internal bearing cover and the roller bearing

① Intermediate plate

Terminal box

Warning!
All seals, cable entries, cable glands, and terminal points are elements of the explosion protection system and must only be replaced with original spare parts.

Removing the terminal box

▶ Remove the terminal box cover (6.02).

Frame size 63 to 112
With terminal boxes fastened with four screws, proceed as described in Section "Frame sizes 132 and 160", Page 11.

▶ Undo the terminals ① (→ Fig. 12) from the terminal plate (6.08).
▶ Unscrew the set screw ③ until the terminal box can be rotated easily.
▶ Unscrew the terminal box from the connecting piece of the housing.

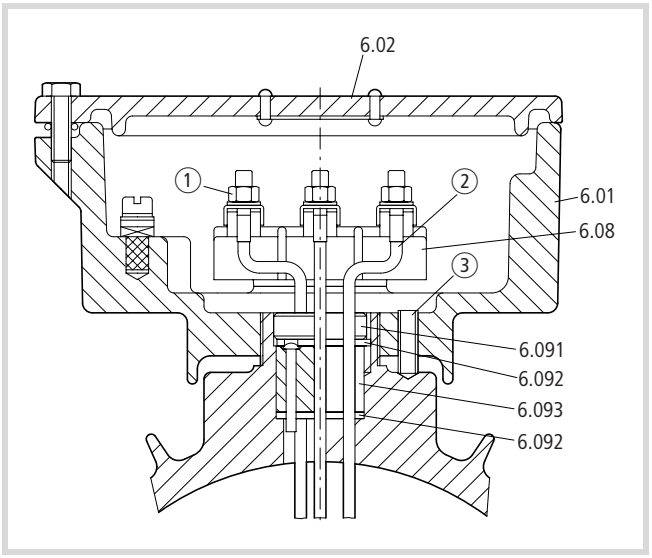


Figure 12: Undoing the terminals from the terminal plate (6.08)

① Terminals
② Disconnection point
③ Set screw to DIN 914

Frame sizes 132 and 160
With flameproof terminal boxes, designation EEx d, proceed as described in Section "Frame size 63 to 112", Page 11.

▶ Undo the terminals ① (→ Fig. 13) from the terminal plate (6.08).

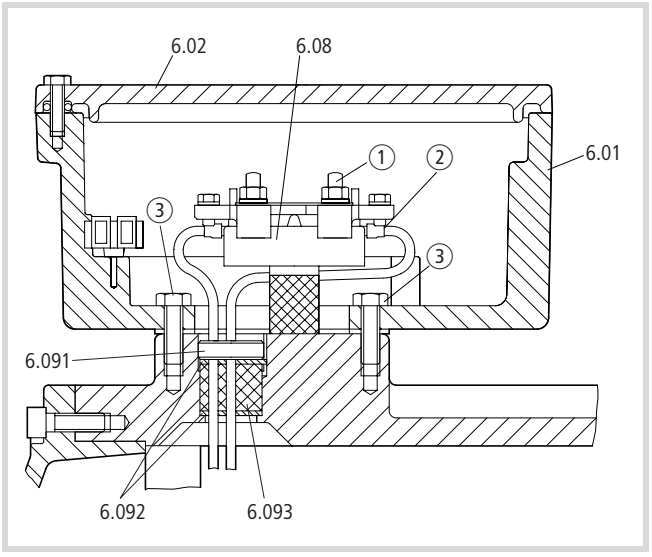


Figure 13: Undoing the terminals from the terminal plate (6.08)

① Terminals
② Disconnection point
③ Fastening screw

▶ Once you have unscrewed the four screws ③, lift the terminal box from the housing.

English

From frame size 180

- ▶ Undo the fastening screws ① (⟶ Fig. 14).
- ▶ Remove the terminal box (6.01) from the bushing plate (6.13).
- ▶ Using two forcing-off threads to force the bushing plate (6.13) with the cable glands (6.09) from the housing spigot recess.

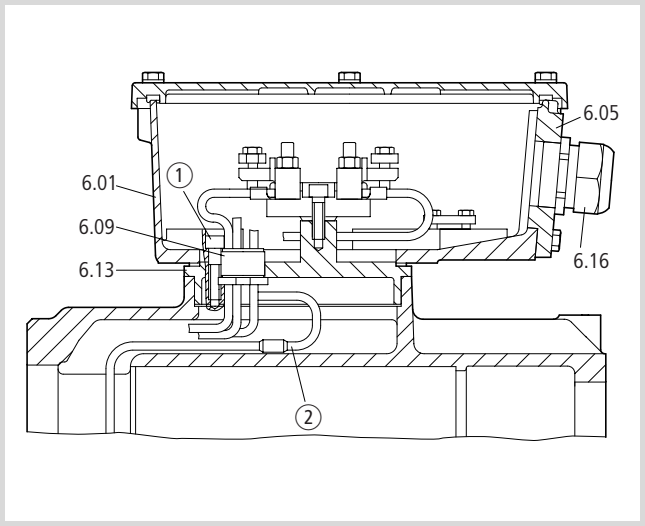


Figure 14: Removing the terminal box from the bushing plate

① Fastening screws

② Disconnection point

Important!
The seating surface of the bushing plate on the housing must not be damaged by the forcing-off threads (e.g. deformations), in order to ensure perfect contact of the flameproof joints on the bushing plate on subsequent assembly.

Flameproof core bushing

Frame size 63 to 160

- ▶ Undo the terminals ① (⟶ Fig. 12, Page 11 and Fig. 13, Page 11) on the terminal plate (6.08).
- ▶ Sever the winding cables directly on the cable lug ②.
- ▶ Loosen the pressure ring (6.091).
- ▶ Pull the winding cables through the pressure plates (6.092) and the sealing ring (6.093) into the housing.
- ▶ Remove the sealing ring and the pressure plates from the housing.

The pressure ring is secured with adhesive. It can be removed by overcoming the locking torque.

From frame size 180

Proceed as follows to disconnect the stator winding of motors with moulded core bushings (⟶ Fig. 14):

- ▶ Disconnect the winding cables directly next to the crimp connections ②.

If the winding cables are passed through the entries directly to the terminal plate, proceed as follows (⟶ Fig. 15):

- ▶ 1 Disconnect the winding cables directly on the cable lug.
- ▶ 2 Undo the gland for the core bushing (6.09).
- ▶ 3 Pull back the winding cables into the housing.

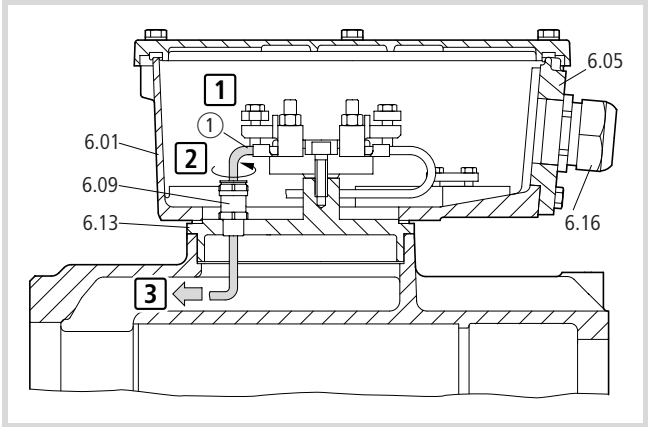


Figure 15: Undoing the terminals from the terminal plate (6.08)

① Disconnection point

Motors with bolt-type glands

- ▶ Undo the retaining plate ① and nut (⟶ Fig. 16).
- ▶ Disconnect the winding cables from the threaded bolts.

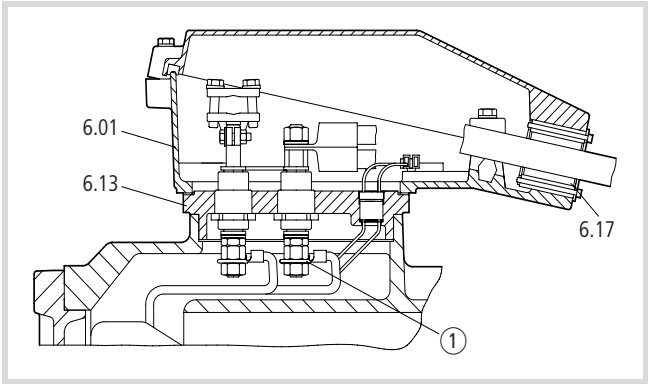


Figure 16: Terminal box with bolt-type gland

① Retaining plate

The glands or entries are secured with adhesive. They can be removed by overcoming the locking torque.

For the cores of the additional conductor, proceed as described in Section "Frame size 63 to 160", Page 12.

Forcing out stator cores, frame size 63 to 132

The motor must be dismantled completely, in order to force out the stator core.

→ A special removal device can be ordered from Moeller for forcing out a stator core from a pot-type housing.

▶ Push the removal device into the housing.
▶ Rotate the spindle ③. This will cause the arms ② (→ Fig. 17) to spread.

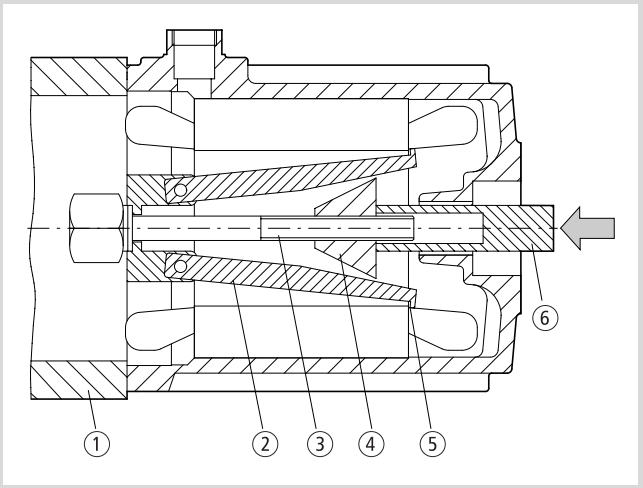


Figure 17: Removal device for stator cores

① Tube
② Arms
③ Spindle
④ Expander element
⑤ Shoulders
⑥ Sleeve

Different expander elements are available for different core diameters.

Important!
Ensure that the shoulders ⑤ of the arms ② completely engage behind the stator core and that the arms themselves are positioned correctly in the core. Pre-tighten the spindle ③ so that the device is secure and does not slide. This could otherwise damage the device.

▶ Place the device prepared in this way on a tube ① with an internal diameter larger than the internal diameter of the housing.
The surface of the tube must be clean and smooth so that the contact surfaces of the motor housing are not damaged.
▶ Press with the sleeve ⑥ through the non-drive end of the shaft bushing onto the expander element ④ in order to push the stator core out of the housing.

Caution!
Do not damage the shaft bushing. This may make the housing unsuitable for further use!

English

5 Assembly

The following parts are those on which explosion protection depends:

- Screws,
- Seals,
- Cable entries and glands,
- Terminal points.

Caution!
Only use original spares to replace parts on which explosion protection depends. Explosion protection will otherwise be lost.

Important!
Protect all machined mounting surfaces against corrosion by greasing.

Screw connections

Ensure that the screws are fitted without washers or other securing elements, and are sufficient for the number of fastening holes provided. The following tightening torques are required to prevent accidental loosening, unless otherwise specified:

Tabelle 1: Tightening torques for grade 8.8 screws

Screw size	Tightening torque Nm
M5	6
M6	10
M8	25
M10	49
M12	85
M16	210
M20	425

Tabelle 2: Tightening torques for conductive bolts

Thread size	Tightening torque Nm
M4	1.2
M5	2
M6	3
M8	6
M10	10
M12	15.5
M16	30

Frame size 80 to 132

Motors with integral brake

The following steps must be carried out as shown in Figure 18:

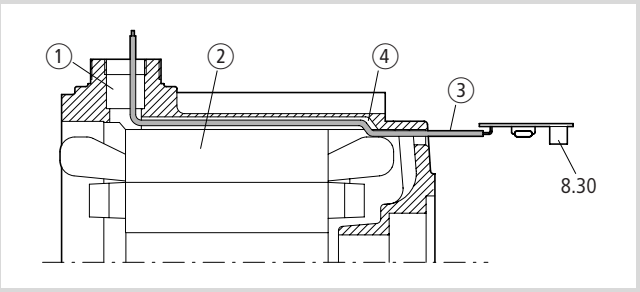


Figure 18: Cabling the rectifier (8.30)

① Core bushing
② Stator core
③ Connection cores of the rectifier
④ Groove in the housing

▶ Pass the connection cores ③ of the rectifer (8.30)
  – from the non-drive end
  – through a groove ④ in the housing
  – over the stator core ②
  – through the hole of core bushing ① to the drive end of the housing.

Two cores are for temperature monitoring, the other four are used for the brake power supply.

With versions without a rectifier, only four cores are required, two for temperature monitoring and two for the brake.

The core connection is described in Section "Fitting the terminal box using screws", Page 17.

Motors with an integral tacho-generator

The following steps must be carried out as shown in Figure 19, Page 15:

▶ Insert the rotor into the motor housing.
▶ Push the NDE roller bearing (2.09) with the internal cup spring (2.08) onto the shaft and into the housing at the same time.
▶ Depending on type, secure the roller bearing with a retaining ring.
▶ Push the tacho-generator (9.01) onto the shaft.
▶ Tighten the torque arm (9.10) of the tacho-generator (9.01) on the housing. Do not, however, secure the tacho-generator axially on the shaft.

→ The tacho-generator should not be secured on the shaft until the drive-end and thus the rotor have been completely assembled!

Type with flameproof terminal boxes

Flameproof terminal boxes, designation, EEx d IIB+H2 T., do not require a flameproof core bushing. The terminal box and the motor housing form one complete flameproof compartment.

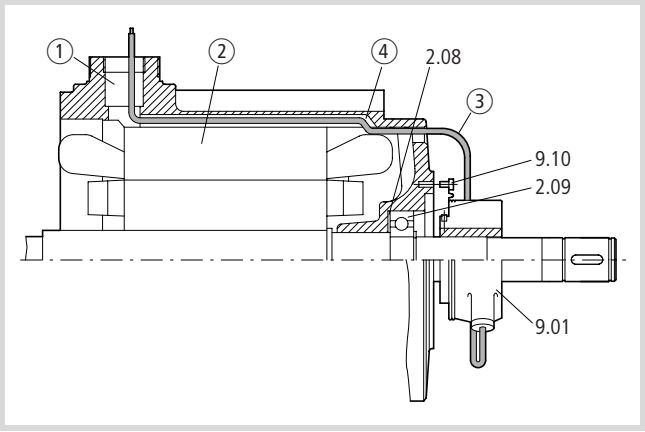


Figure 19: Mounting the tacho-generator (9.01)

① Core bushing
② Stator core
③ Tacho-generator connection cable (9.01)
④ Groove in the housing

▽ **Important!**
Do not pull the cable of the tacho-generator too strongly as it is not provided with strain relief for the cable.

▶ Pass the connection cable ③ of the tacho-generator (9.01)
- from the non-drive end
- through a groove ④ in the housing
- over the stator core ②
- through the wire hole of the core bushing ① to the terminal box.

Save a loop of the cable between the tacho-generator and the housing so that the housing (9.20) of the tacho-generator can be mounted without damaging the cable.

Depending on the type, secure the cable on the motor housing with a clip (→ Fig. 20).

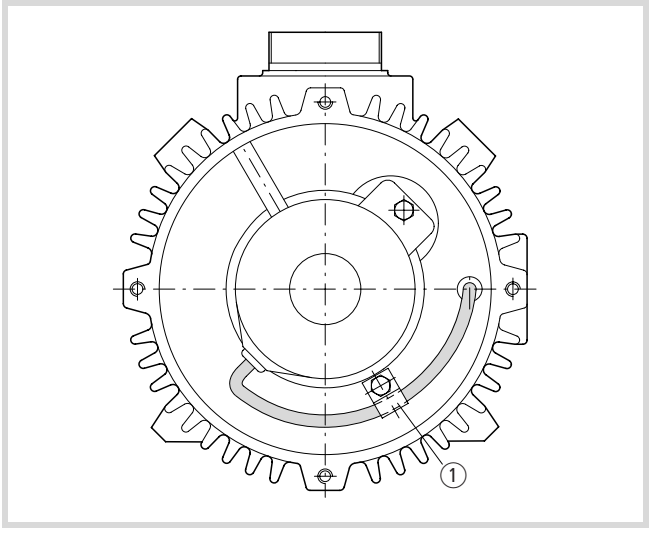


Figure 20: Securing the cable

① Clip

Type with terminal box for increased safety

▶ With types with terminal boxes for increased safety, designation EEx de IIC(B) T., route the tacho-generator cable in the following way:
- from the tacho-generator (9.01) and tacho-generator housing (9.20) with flameproof cable entry ①
- to the terminal box (6.01) through a cable entry with increased safety protection ②.

Save a loop of the cable between the tacho-generator and the housing so that the housing (9.20) of the tacho-generator can be mounted without damaging the cable.

Depending on the type, secure the cable on the motor housing with a clip (→ Fig. 20).

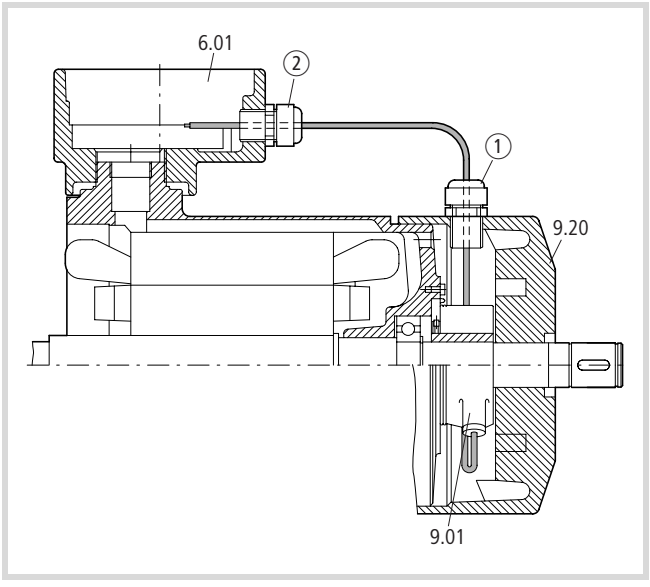


Figure 21: Cable route from the tacho-generator to the terminal box

① Flameproof cable entry
② Cable entry with protection type for increased safety ②.

English

Flameproof cable glands, bushing plate

Frame size 63 to 160

→ The correct mounting of the core bushing must be checked by an appointed specialist.

▶ Pass the stator winding leads and the additional cores through the sealing ring (6.093) located between two pressure plates (6.092) (→ Fig. 22).

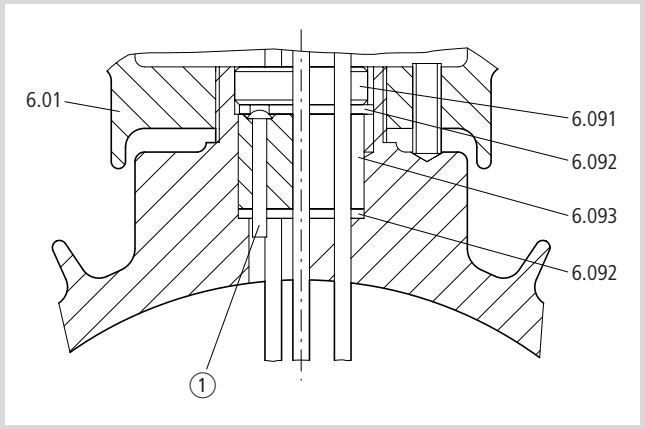


Figure 22: Passing the stator winding lead to terminal box

① Cu rivet to DIN 660

The upper pressure plate must have an anti-rotation feature if this is provided in the housing.

▶ Tighten the thrust ring (6.091) to at least 20 Nm.
▶ Secure it with an anaerobic adhesive (observe manufacturer's instructions).

Only wire supplied by Elumeg (type 155-U) can be used as winding cable, depending on the hole size in the sealing ring:

- Minimum external diameter 2.4 mm for 3 mm holes,
- Minimum external diameter 3.1 mm for 4 mm holes.

▶ Seal unused holes with Cu rivets 3 × 25 and 4 × 25 to DIN 660.

The rivet head must lie under the upper pressure plate (6.092) (→ Fig. 22).

From frame size 180

▶ Screw the moulded core bushings and bolt-type glands (6.09) (→ Fig. 14 and Fig. 16) from the motor end into the bushing plate (6.13) and secure with anaerobic adhesive (observe manufacturers' instructions).
▶ Screw in rubber sealing cable entries (6.09, Fig. 15) from the terminal box side and secure with anaerobic adhesive.
▶ Connect the winding cables to the cables of the moulded core bushing using crimp connections.
▶ Insulate this using class F heat shrinkable tubing.
▶ Connect the winding cables to the bolt-type glands by using crimp cable lugs.
▶ Use a retaining plate ① (→ Fig. 23) to prevent the fastening nut from working loose.

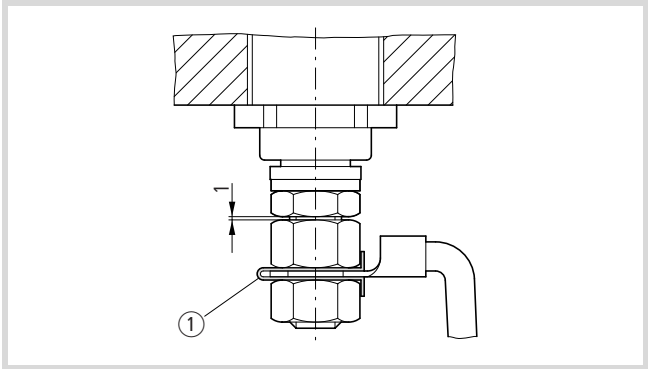


Figure 23: Securing the fastening nut

① Retaining plate

When using rubber sealed entries:

▶ Pass the winding cables with crimp cable lugs directly to the terminal plate (6.08) (→ Section "Terminal box", Page 11).

For the cores of the additional conductors, proceed as described in Section "Frame size 63 to 160", Page 12.

After fitting the bushings and connecting them to the winding cables:

▶ Insert the bushing plate (6.13) into the connecting piece of the housing.
▶ Depending on type, secure the bushing plate (6.13) on its own or together with the terminal box (6.01) in the housing.

Terminal box

Fitting the terminal box using a thread

Proceed as follows in order to fit the terminal box via a thread (⟶ Fig. 24):

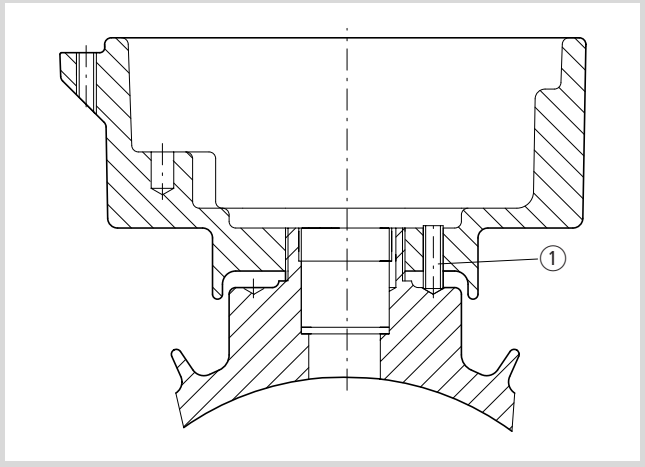


Figure 24: Fastening the terminal box (6.01) via a thread

① Set screw to DIN 914

- ▶ Screw in the terminal box up to the stop of the thread on the connecting piece of the housing.
- ▶ Now rotate the terminal box back up to one turn to the required location of the entries.
- ▶ Tighten the set screws ① for securing.
- ▶ Secure this with a contact anaerobic adhesive (observe manufacturer's instructions).

Fitting the terminal box using screws

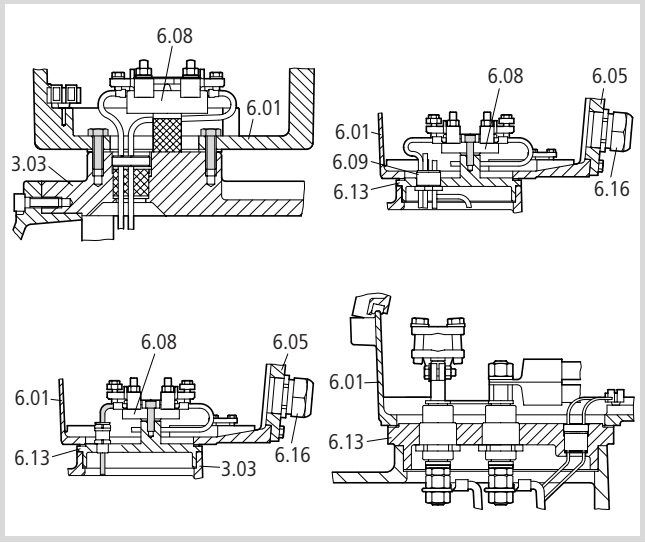


Figure 25: Fitting the terminal box using screws

Proceed as follows in order to fit the terminal box (6.01) using screws (⟶ Fig. 25):

- ▶ Place the terminal box (6.01) with a rubber seal (only use original seal) on the housing and the bushing plate (6.13).
- ▶ Fasten the terminal box with screws

Proceed as follows with terminal boxes with a terminal plate:

- ▶ Screw the terminal plate (6.08) with two cylinder head screws.
- ▶ Crimp the terminal plate cable lugs onto the ends of the winding cables.
- ▶ Fasten the cable lugs using nuts and spring washers on the terminal plate, together with:
  - – terminal clamp and terminal parts,
  - – connection rails.

Remaining procedure for all terminal boxes:

- ▶ Fasten the measuring and control cables in the mini-terminals.
- ▶ Screw the mini-terminals with the appropriate special screw.
- ▶ Request a circuit diagram (⟶ Section "Connection diagrams", Page 18) if none are available!

Tabelle 3: Cable markings

U1	red
U2	white and red
V1	black
V2	white and black
W1	blue
W2	white and blue
1 to 4	Brake
5 and 6	Tacho-generator
10 to 13	PTC thermistor temperature sensor
20 to 23	Resistance temperature sensor
70 and 71	Heater

- ▶ Place the terminal box cover (6.02) on the terminal box (6.01) and fasten it with screws.

With terminal boxes for increased safety, designation EEx e ensure the correct seating of the seal, if necessary secure in the cover with contact adhesive.

Proceed as follows with terminal box covers fastened via a thread:

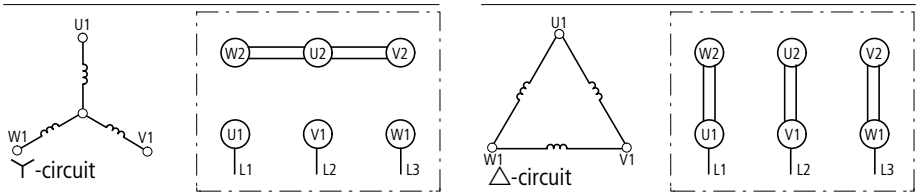
- ▶ Screw in the cover up to the stop of the thread of the box.
- ▶ Depending on type, rotate the cover a maximum of ¼ turns up to the next stop and secure immediately with the set screw.

English

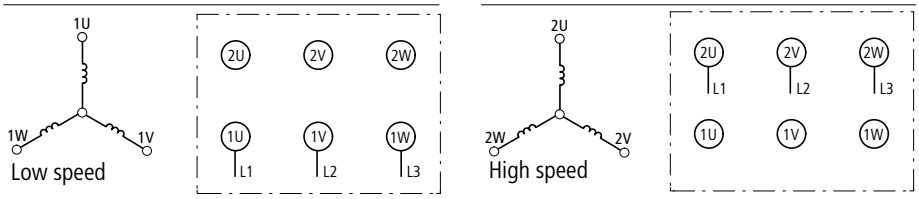
Connection diagrams

→ The circuit diagram provided with the motor must be observed.

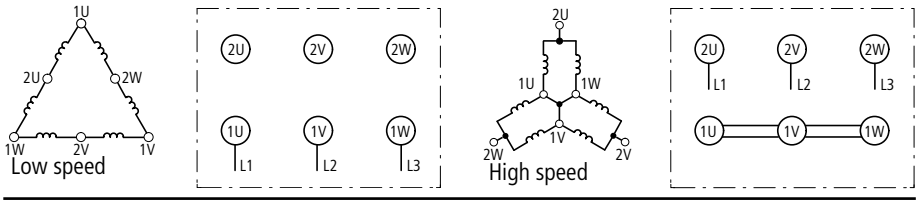
Single-speed – one pole



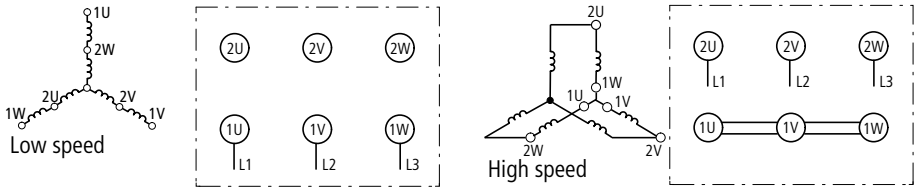
Pole-changing

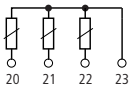


Dahlander circuit



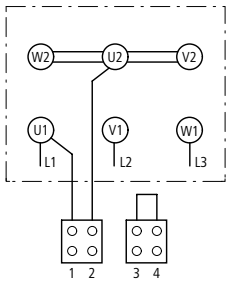
Dahlander circuit



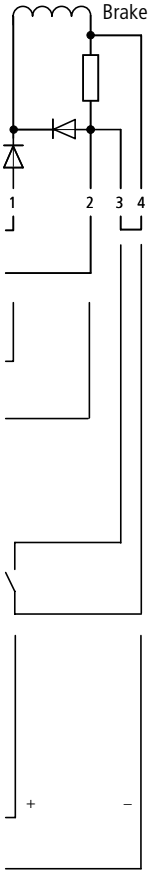
5-6	Tacho-generator		
10-11	PTC thermistor disconnection	PTC thermistor, advance warning	Use tripping device with PTB number
12-13		PTC thermistor disconnection	
20 to 23	PT 100 resistance temperature sensor		
70-71	Anti-condensation heater		

Brake Motors With Integral Brake
Brake Connection Via Motor Winding

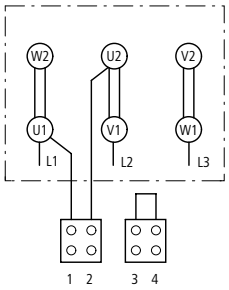
Y-circuit



Terminals 1-2 can be connected directly with the motor terminals to supply the brake. Check the voltages of the motor/brake to determine whether terminals U1-U2 or U1-V1 should be used.
Terminals 3 and 4 must be bridged.



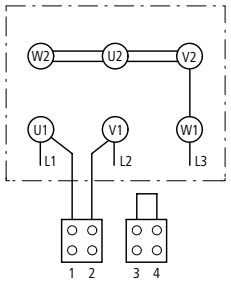
Y-circuit



An external voltage can also be applied to terminals 1-2. Observe the voltage on the rating plate. Terminals 3 and 4 must be bridged.

For a fast brake response (DC-side operation), the bridge between 3 and 4 can be replaced with a contact. The contact must switch at the same time as the brake voltage supply.

△-circuit

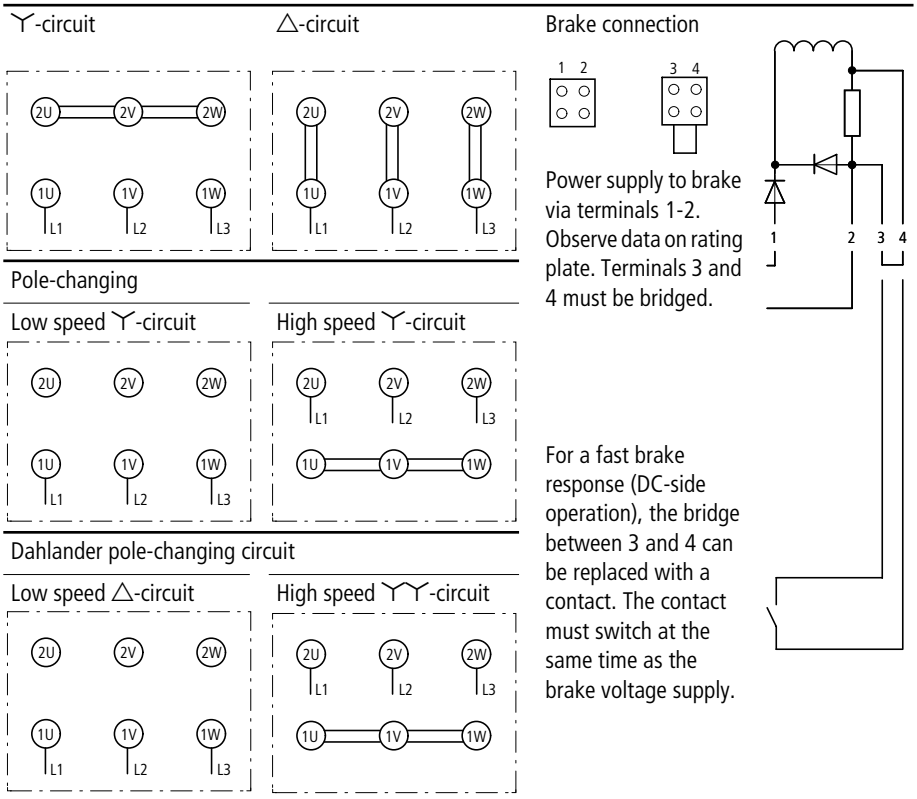


To release the break in an emergency, e.g. to turn the motor by hand, a DC voltage can be applied across terminals 1 and 4 (disconnect other wiring first and observe polarity).
Voltage $U_{\text{⎓}} = U_{\sim} \times 0.45$
Voltage U see brake voltage on the rating plate.

1-4	Brake		
10-11	PTC thermistor disconnection	PTC thermistor, advance warning	Use tripping device with PTB number
12-13		PTC thermistor disconnection	
70-71	Anti-condensation heater		
P1-P2	Temperature monitoring: Microtherm T 10		

English

Brake Connection Via External Power Supply



1-4	Brake		
10-11	PTC thermistor disconnection	PTC thermistor, advance warning	Use tripping device with PTB number
12-13		PTC thermistor disconnection	
70-71	Anti-condensation heater		
P1-P2	Temperature monitoring: Microtherm T 10		

End shields, rotors and roller bearings

Important!
During the remaining assembly steps, ensure that the roller bearings are fitted straight, are not offset and always support both rings at the same time. The bearings will be damaged if axial forces are only exerted on one ring (especially hammer blows)!

Important!
Clean and grease well the joints of the individual assembly parts so that the joint surfaces are not damaged on assembly.

Frame size 63 to 160

Frame sizes 160

▶ Push the NDE end shield (2.02) into the housing spigot recess and tighten it on the housing.

Motors with integral tacho-generator → Fig. 26.

▶ Push the DE end shield (1.02) into the housing spigot recess and tighten it on the housing.

▶ Whilst supporting the shaft at the non-drive end, push the DE roller bearing (1.10) using the mounting sleeve ① onto the shaft and into the end shield, and secure it with retaining rings.

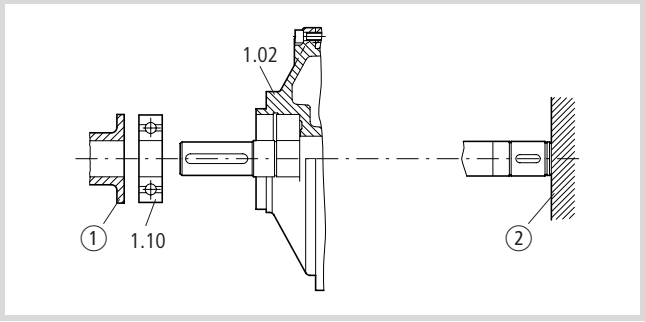


Figure 26: Fitting end shield and bearings

① Mounting sleeve
② Counter bearing

All other types (→ Fig. 27)
(not applicable to types with integral tacho-generator)

- ▶ Push the DE roller bearing (1.10) into the DE end shield (1.02).
- ▶ Push the DE end shield with the DE roller bearing onto the rotor.

Important!
Push the rotor carefully into the housing. This will prevent any damage to the rotor winding and the shaft bushing at the non-drive end.

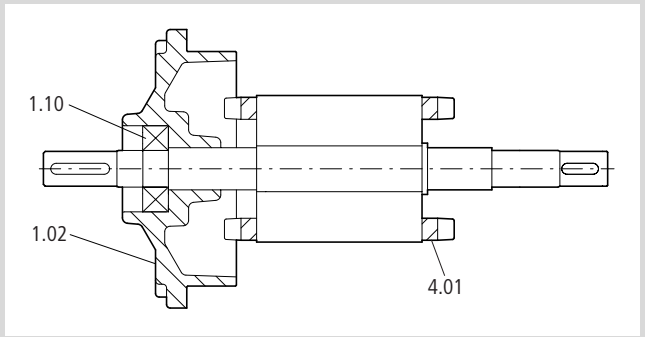


Figure 27: Rotor (4.01) with DE roller bearing (1.10) and DE end shield (1.02)

- ▶ Push the whole unit into the housing and fasten the end shield with screws.
- ▶ Insert a cup spring at the non-drive end in the bearing seat of the housing.
- ▶ Fit the DE roller bearing (1.10) whilst supporting the shaft at the drive end.
- ▶ Depending on type, secure the DE roller bearing, with a retaining ring in the shaft and in the housing.
- ▶ Depending on type, secure the NDE roller bearing, with a retaining ring in the shaft.

Important!
When inserting the shaft end seals, cover the featherkey and retaining ring grooves in order to prevent any damage to the seal lips!

- ▶ Fit the DE (1.08) and NDE (2.06) shaft end seals in the housing as follows (→ Fig. 28):
  - – with the seal lip facing outward,
  - – flush on the drive side,
  - – countersunk 2 mm at the non-drive end.

- ▶ Support the shaft and insert the featherkey ① in the drive end of the shaft.

Figure 28: Shaft seal

① Featherkey

Frame size 180 to 225

Important!
Insert the rotor carefully into the housing in order to avoid any damage to the stator coil!

- ▶ Push both the DE (1.02) and NDE (2.02) end shields into the housing centre holes.
- ▶ Secure these with screws.
- ▶ Heat the inner rings of the roller bearing.
- ▶ Insert them at the same time onto the shaft and into the end shields.
- ▶ Secure the DE roller bearing with a retaining ring in the shaft.
- ▶ Insert four cup springs (2.08) at the non-drive end in an >><< arrangement with two in the NDE end shield (2.0) and two outside of the NDE bearing cover (2.01).

Important!
Cover the featherkey and retaining ring grooves when fitting the bearing cover, in order to prevent any damage to the seal lips!

- ▶ Screw the external DE (1.01) and NDE (2.01) bearing covers with radial shaft seals fitted.
- ▶ Fit any DE (1.08) or NDE (2.06) axial shaft seals using a suitable sleeve bush① (→ Fig. 29).

English

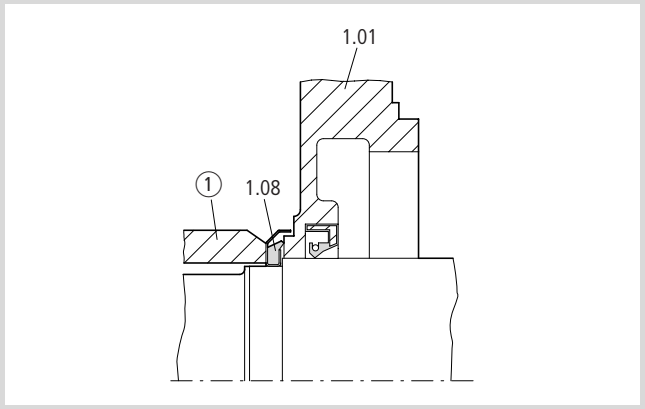


Figure 29: Fitting axial shaft seals

① Sleeve bush

▶ Support the shaft and insert the featherkey in the drive end of the shaft.

From frame size 250

Important!
Insert the rotor carefully into the housing in order to avoid any damage to the stator coil!

▶ Fit the internal DE (1.07) or NDE (2.05) bearing cover onto the shaft (with FS 250 only at the drive end).
▶ Heat up the roller bearing inner rings and fit them onto the shaft.
▶ Depending on type, insert the external DE grease distribution disc (1.05) and the retaining ring into the shaft.
▶ For easier fitting, screw a threaded bolt in one of the tapped blind holes of the inner bearing cover (→ Fig. 30).

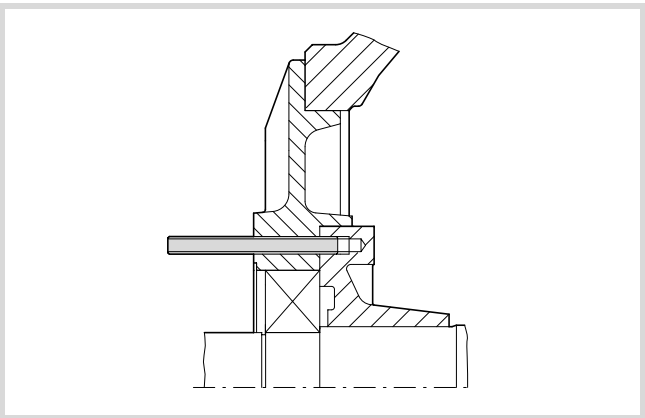


Figure 30: Screwing in a threaded bolt

When the end shields are fitted on the outer ring of the roller bearings, these bolts are guided into one of the four through holes in the end shield.

→ Ensure the correct location of greasing grooves on motors with a lubrication device (→ Fig. 31).

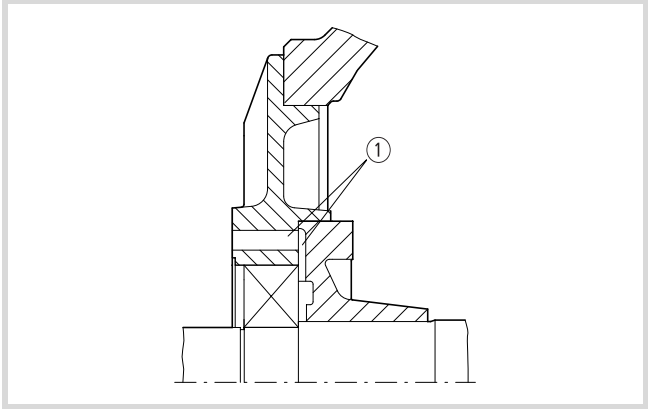


Figure 31: Location of the greasing channel

① Greasing channel

▶ Lift the rotor when centering the DE (1.02)/GS (2.02) end shields on the outer ring of the roller bearing and housing.
▶ Tighten the screws for the DE/NDE end shields.
▶ Depending on type, insert four cup springs (2.08) in an >><< arrangement with two in the DE or NDE end shield and external DE or NDE bearing cover.
▶ Tighten the external bearing covers with an integral radial shaft seal.
▶ Screw in at least one bearing cover fastening screw before removing the threaded bolt (→ Fig. 30).
▶ Depending on type, insert any axial sealing rings with a sleeve bush (→ Fig. 29).
▶ Support the shaft and insert the featherkey in the drive end of the shaft.

Brake

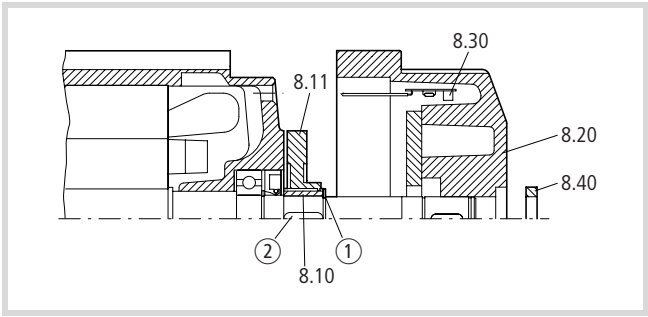


Figure 32: Motor with brake

① Retaining ring
② Featherkey

▶ With frame size 100 and 112 insert a retaining ring directly in front of the NDE drive seal.

This ring is not required for frame size 80, 90 and 132.

→ Support the shaft to protect the shaft bearings.

- ▶ Insert the featherkey ② for the friction plate driver (8.10) (→ Fig. 32).
- ▶ Fit the friction plate driver (8.10) and secure it with the retaining ring ①.
- ▶ Fit the friction plate (8.11).

→ Ensure that all featherkeys are fitted completely and symmetrically, in order to maintain the required braking torque!

- ▶ Solder the single-wave rectifier (8.30) to the wires coming out of the housing at the non-drive end according to the circuit diagram.
- ▶ Connect the brake coil and the temperature monitoring on the terminal strip of the single-wave rectifier (8.30).
- ▶ Insulate the entire single-wave rectifier with heat shrinkable tubing.
- ▶ Insert the single-wave rectifier in the recess provided in the brake housing.
- ▶ Fit the brake housing on the motor housing spigot recess and push the rectifier connection cable into the motor housing at the same time.
- ▶ Screw in the fastening screws and tighten.
- ▶ Push the shaft seal (8.40) into the brake housing with the seal lip facing outward.

Tacho-generator

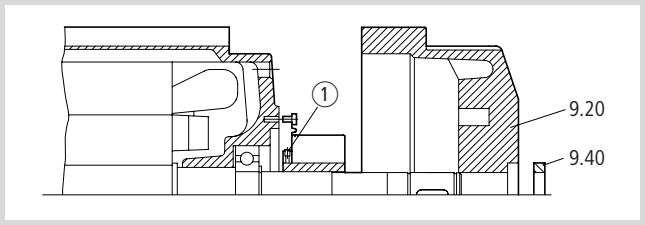


Figure 33: Tacho-generator

① Set screw to DIN 914

- ▶ After the drive end has been assembled completely secure the tacho-generator (9.01) axially on the shaft, depending on type,
  - – with a retaining ring
  - – with one or two set screws ① (→ Fig. 33).
- ▶ Tighten the housing of the tacho-generator (9.20) on the motor housing.
- ▶ Push the NDE shaft seal (9.40) into the tacho-generator housing with the seal lip facing outward.

Ventilation system

▽ **Important!**
Support the shaft in order to prevent damage to the roller bearings when fitting on the fan!

- ▶ Insert the featherkey into the shaft.

→ When fitting the fan, ensure that pressure is only applied to the fan hub and not to the blades.

- ▶ Push the fan (5.01) onto the shaft up to the stop (shaft shoulder or retaining ring, depending on type).
- ▶ Secure the fan with a retaining ring in the shaft.
- ▶ Fit the fan cowl (5.02-5.03).
- ▶ Tighten the screws for the fan cowl.
- ▶ Depending on type, fit any relubrication tubes and impulse measuring nipples for monitoring the bearings.

English

6 Tests

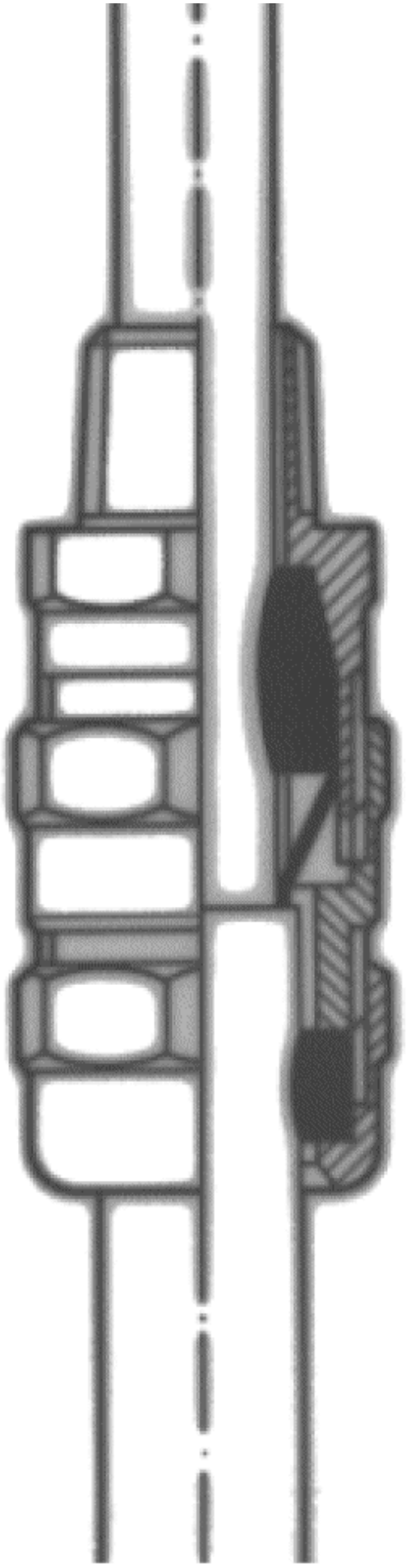
After assembly, it must be possible to turn the rotor by hand without it scraping or sticking. With brake motors, it must also be possible to release the brake at standstill in less than ten minutes. This is possible by applying a DC voltage at the terminals 1-2, according to the circuit diagram.

Prior to recommissioning carry out the following tests:

Type of test	Part tested	Test procedure	Requirement[1)]
Resistance	Winding	• Contact • Check that resistance on all lines matches the reference values	Permissible deviation from value specified for winding: max. ±5 %
	PTC thermistor	• Continuity ($U_{Test} \leqq 2$ V) • Type • Response temperature	$R_{erf} \leqq 1$ kΩ specified in winding
Insulation	Winding	• Winding to iron • Phase windings to each other	New winding: 2 × rated voltage +1000 V. Used or partly renewed windings after cleaning and drying: 75 % of test voltage of a new winding
	PTC thermistor	PTC resistor to winding	500 V
Insulation value (resistance)	Winding insulation	• Winding to iron • Phase windings to each other	New windings: $R_{iso} \geqq 50$ MΩ Used and partly renewed windings after cleaning and drying: $R_{iso} \geqq 5$ MΩ
Rotation field (only with new winding)	Connection	• Mark connection wires • With 2 p ≧ 12 and motors with several speeds: find out poles of winding with DC current	Rotation direction, clockwise with UVW on L1, L2, L3 (observe bearing of the switching side)
Visual inspection	Winding	• End-winding overhang • Winding bandage • Groove and phase insulation • Groove closure • Wire insulation	Proper and complete condition
	Motor, complete	• Terminal designation • Cold connection of terminals • Cable entry parts • Seals • Fan, fan cowl fastening	Proper and complete condition
Test run	Motor, complete	• Rotation direction, phase sequence • Check that the no-load current on all lines matches the reference values • No-load power consumption • With axial-flow fan, cooling air direction • Check even running with careful attention to bearings	• Running in time approx. 20 minutes • Deviation from no-load currents max. ±10 % and output values max. ±15 %. • Rotation direction arrow on fan cowl • According to empirical values and DIN/VDE 0530 T 14
PTC thermistor function	PTC thermistor	• Blocked rotor up to response of PTC thermistor	• $t_A$time ±20 %

1) The data on the nameplate applies. If required, request additional characteristic data by stating motor type and production number

2.3 Electric system components / accessories



“RCN”
Presse-étoupes et accessoires.

Cable glands And accessoires.

A complete range available for every use

Catalogo edizione 02/2004 EDITION

INDEX	REFERENCE	CONTENTS	PAGE

INTRODUCTION

Tous les produits construit par la Societé, sont étudiés et réalisé en accord aux Normes Europeenne CENELEC et Recommandations IEC.
Les presse-étoupes et les accessoires sont construits par installation dans les zones suivantes:
- Zones sures: éxécution éthanche industrielle
- Zones de classe 1 div. 1 and 2: éxécution EExd/EExe
- Groupes II 2 G/D

NORMES DE REFERENCE

- CENELEC EN 50.018 (2000)
  Constructions électriques pour atmosphére potentiellement explosive. Enveloppes à épreuve d'explosion "d".
- CENELEC EN 50.019 (2000)
  Constructions électriques pour atmosphére potentiellement explosive. Mode de protection à sécuritè augmentée "e"
- CENELEC EN 50.014 + amendement 1 et 2
  Constructions électriques pour atmosphére potentiellement explosive. Régles générales.
- Recomandations IEC 144/79-1.

SERVICE D'ASSISTANCE TECHNIQUE

La Société met à votre disposition un Service Technique pour résoudre les problèmes et vous conseiller le juste choix des produits en accord avec les conditions d'installation .
Toutes les demandes devront être envoyées à notre adresse.

CERTIFICATIONS

En accord aux NORMES EUROPEENNE CENELEC/ATEX.
Certificat: LCIE. 02 ATEX 6160X (FRANCE)
Notification Assurance Qualité du Produit:
INERIS 03 ATEX Q702

GARANTIE

La Société garanti la qualité et la fabrication des produits exempt de tout défaut.
La garantie a une durée de 12 mois à compter de la date d'épreuve auprès de l'usine ou de la date de consigne en cas de renonciation à l'épreuve par l'Acquéreur.
Entre le susdit terme de 12 mois la Societè s'engage à sostituer ou reparer gratuitment auprés de l'usine, les produits que par defaut ne soyant pas conform à l'utilisation, et si les defaut ne sont pas provoquè par manomission ou utilisation erronée de la part de l'Acquéreur.
Les frais et risques de transport sont à la charge de l'Acquéreur.

CARACTERISTIQUES DES PRODUITS

Les descriptions, illustrations et dimensions des produits de la présent brochure sont donnés à titre indicatifs et n'engagent en aucun cas la responsabilité de la Societè.
Dans tous les cas la Société se réserve le droit de changer ou modifier les descriptif et les produits pour leur amélioration.

INTRODUCTION

Every products manufactured by Company are designed and realized i.a.w. CENELEC European Rules and IEC Recommandations.
Cable glands and accessories are manuafactured for installation in the following areas:
- Safe areas: W.P. industrial execution
- Class 1 div. 1 and 2 areas: EExd/EExe execution
- Groups II 2 G/D

REFERENCE RULES

- CENELEC EN 50.018 (2000)
  Electrical apparatus for potentially explosive atmosphere. Flameproof enclosure "d".
- CENELEC EN 50.019 (2000)
  Electrical apparatus for potentially explosive atmosphere. Increased safety "e" mode of protection.
- CENELEC EN 50.014 + 1 and 2 amendment
  Electrical apparatus for potentially explosive atmosphere. General requirements.
  IEC 144/79-1 Recommandations.

TECHNICAL ADVISORY SERVICE

The Company maintains a Technical Advisory Service to assist you with problems concerning the correct selection of products according to required installation conditions.
All enquires should be sent to our address.

CERTIFICATIONS

In accordance with CENELEC/ATEX EUROPEAN RULES.
Certificate: LCIE. 02 ATEX 6160X (FRANCE)
Product Quality Assurance Notification:
INERIS 03 ATEX Q702

GUARANTEE

The Company assures guarantee for products high quality and fault exempt manufacturing.
Guarantie duration is 12 months from the date of product testing at the factory or from the date of delivery in case of Customer's disclaim of testing.
Within the said term of 12 months, the Company will assume the charge to replace or repair faulty products at the factory, provided that defaults are not caused by Customer's touch or improper use of products.

Costs and risks of transports are at Customer charge.

CHARACTERISTICS OF PRODUCTS

Descriptions, drawings and dimensions of this publication are to be intended as products information only, not engaging nor binding the Company.
However, the Company reserves the right to alter or modify specifications and products for their improvement.

RCN s.a.s. di Lissa M. G. & C.
Regione Torame – Via Crevacuore
13011 BORGOSESIA (VC) - ITALY
Phone +39 163 458 028 Fax +39 163 458 533

INFORMATIONS

MATERIELS
Parties metalliques:
- laiton marin CW 614N
- alliage léger
- acier inoxidable AISI 316

Traitment de protection
Laiton: nickelé/chromé
(sa protection augment la résistance à la corrosion en zone specialement corrosive)

Garnitures
- EPDM (cautchouc antinvieillissement, dureté 50-60 Shore apte pour température de -40° +120°C)

FILETAGES
- UNI6125 GK (ISO 7/1)
- BSPP/UNI338 (ISO R228)
- NPT (ANSI B1 20.1)
- ISO Mx1,5 (ISO 261)
- Pg (DIN 40430)

ACCESSOIRES
- Ecrous de fixation
- Joints d'étainchéité en nylon
- Platines de mise à terre
- Protections en PCP

NOTES
Les presse-étoupe fournis en version standard sont utilisables pour cables armés de tresse, feuillard ou fils de 0,3 à 0,9mm.

Sur demande, nous pouvons fournir des presse-étoupes pour cable armé de fils de 1 à 2,5mm.

Pour des informations complémentaires sur la fermeture de l'armure demander à notre SERVICE TECHNIQUE ou préciser les dimensions et le type de l'armure.

INFORMATIONS

MATERIALS
Metallic parts:
- CW 614N marine brass
- light alloy
- AISI 316 stainless steel

Corrosion protection
Brass:nickel/chrome plated
(this surface protection increase the corrosion resistance of brass installed in particularly corrosive environments)

Seals
- EPDM (antiageing rubber, 50-60 Shore hardness, suitable for -40° +120°C temperature)

THREADS
- UNI6125 GK (ISO 7/1)
- BSPP/UNI338 (ISO R228)
- NPT (ANSI B1 20.1)
- ISO Mx1,5 (ISO 261)
- Pg (DIN 40430)

ACCESSORIES
- Locknuts
- Nylon gaskets
- Earthing tags
- PCP shrouds

NOTES
Cable glands for armoured cables are supplied in normal execution, suitable for 0,3-0,9mm braid or wire armour.

On request, cable glands can be supplied for 1-2,5mm armour wires.

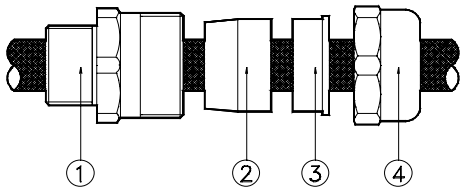
For more detail concerning clamping of armour, please contact our TECHNICAL SERVICE or specify with order, armour type and dimensions.

TABLEAU COMPARATIF DES FILETAGES / **THREADS COMPARISON TABLE**

SIZE	UNI6125 ISO 7/1	L	BSPP/UNI338 ISO R228	L	NPT ANSI B1 20.1	L	ISO Mx1,5 ISO 261	L	Pg DIN 40430	L
0			3/8"	15	3/8"	15	M16	15	Pg9 Pg11	12 12
1	1/2"	18	1/2"	15	1/2"	18	M20	15	Pg13,5 Pg16	12 12
2	3/4"	18	3/4"	15	3/4"	18	M25	15	Pg16 Pg21	12 12
3	1"	22	1"	15	1"	22	M32	15	Pg21 Pg29	12 14
4	1"1/4	22	1"1/4	15	1"1/4	22	M40	15	Pg29	14
5	1"1/2	22	1"1/2	15	1"1/2	22	M50	15	Pg36	14
6	2"	22	2"	15	2"	22	M63	15	Pg42 Pg48	14 14
7	2"1/2	27	2"1/2	15	2"1/2	27	M75	15		
8	3"	27	3"	15	3"	27	M75	15		

REFERENCE DES PRESSE-ETOUPES — CABLE GLANDS REFERENCE

A - CABLE NON ARME

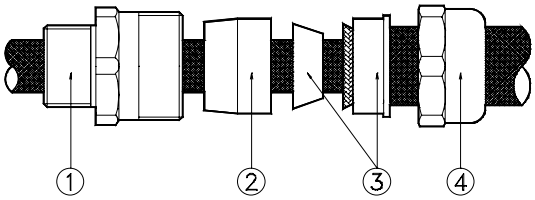


1 - Corps
2 - Bague d'étanchéité
3 - Fouloir
4 - Chapeau

A - UNARMOURED CABLE

1 - Body
2 - Seal
3 - Press-ring
4 - Gland nut

B - CABLE ARME

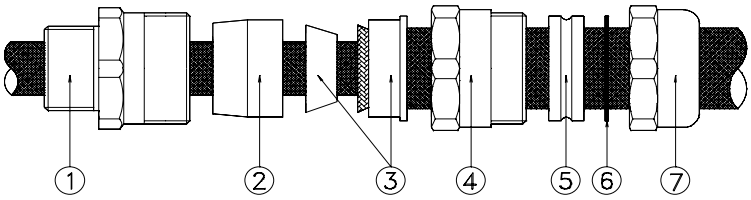


1 - Corps
2 - Bague d'étanchéité
3 - Amarrage de l'armure
4 - Chapeau

B - ARMOURED CABLE

1 - Body
2 - Seal
3 - Armour clamping rings
4 - Gland nut

C - CABLE ARME

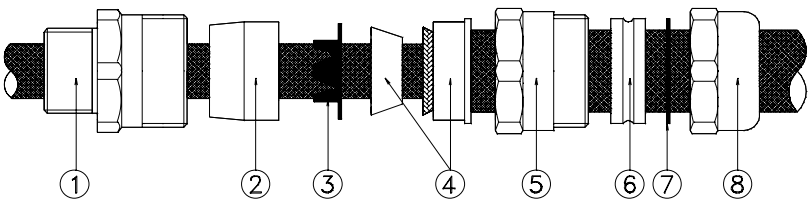


1 - Corps
2 - Bague d'étanchéité interne
3 - Amarrage de l'armure
4 - Corps intermédiaire
5 - Bague d'étanchéité externe
6 - Grain
7 - Chapeau

C - ARMOURED CABLE

1 - Body
2 - Inner seal
3 - Armour clamping ring
4 - Middle body
5 - Outer seal
6 - Washer
7 - Gland nut

D - CABLE ARME ET SOUS PLOMB



1 - Corps
2 - Bague d'étanchéité interne
3 - Rondelle de plomb
4 - Amarrage de l'armure
5 - Corps intermédiaire
6 - Bague d'étanchéité externe
7 - Grain
8 - Chapeau

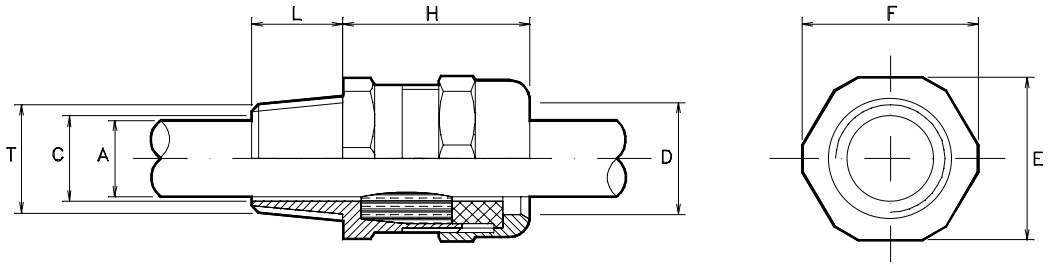
D - ARMOURED AND LEAD SHEATHED CABLE

1 - Body
2 - Inner seal
3 - Lead ring
4 - Armour clamping ring
5 - Middle body
6 - Outer seal
7 - Washer
8 - Gland nut

Pour câble souple, fermeture extérieur.
Execution pour **zone sure**.

For unarmoured cable, outer seal.
Execution for **safe area**.

REFERENCE: A



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions		Dimension des presse-étoupes Gland dimensions				
SIZE	T	TYPE	A min	 max	C mm	D mm	H mm	E mm	F mm
0	3/8"NPT-M16x1,5-Pg9/11 1/2"NPT-M20x1,5-Pg13,5	SN0.7 SN0.10	3 6	7 10	11	16	33	24	26
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	SN1.8 SN1.10 SN1.13	4 6 9	8 10,5 13	14	20	41	32	35
2	3/4"NPT-M25x1,5-Pg16	SN2.13 SN2.15 SN2.18	9 11 14	13 15,5 18	19	25	41	36	39
3	1"NPT-M32x1,5-Pg21	SN3.18 SN3.21 SN3.24	13 16 19	18 21 24	25	32	52	45	49
4	1"1/4NPT-M40x1,5-Pg29	SN4.24 SN4.27 SN4.30	19 22 25	24 27 30	31	38	53	50	55
5	1"1/2NPT-M50x1,5-Pg36	SN5.27 SN5.30 SN5.33 SN5.36	22 25 28 31	27 30 33 36	37	44	53	57	62
6	2"NPT-M63x1,5-Pg42	SN6.39 SN6.42 SN6.45	34 37 40	39 42 45	47	54	53	67	73
7	2"1/2NPT-M75x1,5-Pg48	SN7.48 SN7.51 SN7.54	43 46 49	48 51 54	57	65	53	80	88
8	3"NPT-M75x1,5	SN8.58 SN8.62 SN8.64	52 56 58	58 62 64	64	74	70	102	107
	3"NPT-M75x1,5	SN8.68	62	68	70	80	70	102	107

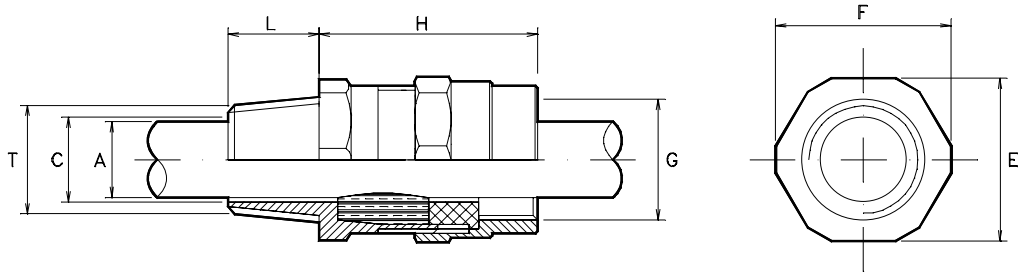
***** Exemple de désignation: **SN1.10 M20x1,5**
APPLICATION
Pour usage général en intérieur et extérieu.
Protection IP66.

***** Sample of designation: **SN1.10 M20x1,5**
APPLICATION
For general use, indoors and outdoors.
IP66 protection.

Pour câble souple, fermeture extérieur.
Apte pour union à tuyau flexible.
Execution pour **zone sure**.

For unarmoured cable, outer seal.
Suitable for fexible conduit coupling.
Execution for **safe area**.

REFERENCE: A



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions		Dimension des presse-étoupes Gland dimensions				
SIZE	T	TYPE	A min	 max	C mm	H mm	E mm	F mm	G
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	SNC1.8 SNC1.10 SNC1.13	4 6 9	8 10,5 13	14	45	32	35	1/2"
2	3/4"NPT-M25x1,5-Pg16	SNC2.13 SNC2.15 SNC2.18	9 11 14	13 15,5 18	19	45	36	39	3/4"
3	1"NPT-M32x1,5-Pg21	SNC3.18 SNC3.21 SNC3.24	13 16 19	18 21 24	25	54	45	49	1"
4	1"1/4NPT-M40x1,5-Pg29	SNC4.24 SNC4.27 SNC4.30	19 22 25	24 27 30	31	55	50	55	1"1/4
5	1"1/2NPT-M50x1,5-Pg36	SNC5.27 SNC5.30 SNC5.33 SNC5.36	22 25 28 31	27 30 33 36	37	55	57	62	1"1/2
6	2"NPT-M63x1,5-Pg42	SNC6.39 SNC6.42 SNC6.45	34 37 40	39 42 45	47	55	67	73	2"
7	2"1/2NPT-M75x1,5-Pg48	SNC7.48 SNC7.51 SNC7.54	43 46 49	48 51 54	57	60	80	88	2"1/2

NOTE: filetage **G**=ISO 7/1 RP-BSPP
Autres filetages sur demande.

NOTE: thread **G**=ISO 7/1 RP-BSPP
Other threads on request.

***** Exemple de désignation: **SNC1.10 M20x1,5**

***** Sample of designation: **SNC1.10 M20x1,5**

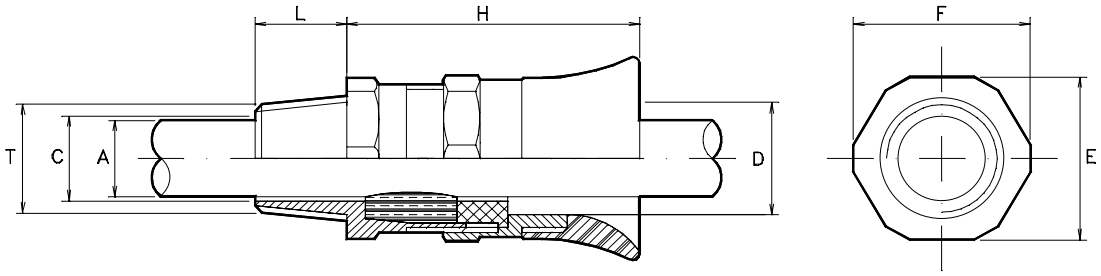
APPLICATION
Pour usage général en intérieur et extérieur.
Protection IP66.

APPLICATION
For general use, indoors and outdoors.
IP66 protection.

Pour câble souple, fermeture extérieur.
Execution pour **zone sure**.

For unarmoured cable, outer seal.
Execution for **safe area**.

REFERENCE: A



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions		Dimension des presse-étoupes Gland dimensions				
SIZE	T	TYPE	A min	 max	C mm	D mm	H mm	E mm	F mm
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	SNT1.8 SNT1.10 SNT1.13	4 6 9	8 10,5 13	14	20	66	32	35
2	3/4"NPT-M25x1,5-Pg16	SNT2.13 SNT2.15 SNT2.18	9 11 14	13 15,5 18	19	25	66	36	39
3	1"NPT-M32x1,5-Pg21	SNT3.18 SNT3.21 SNT3.24	13 16 19	18 21 24	25	32	80	45	49
4	1"1/4NPT-M40x1,5-Pg29	SNT4.24 SNT4.27 SNT4.30	19 22 25	24 27 30	31	38	80	50	5
5	1"1/2NPT-M50x1,5-Pg36	SNT5.27 SNT5.30 SNT5.33 SNT5.36	22 25 28 31	27 30 33 36	37	44	80	57	62
6	2"NPT-M63x1,5-Pg42	SNT6.39 SNT6.42 SNT6.45	34 37 40	39 42 45	47	54	80	67	73

***** Exemple de désignation: **SNT1.10 M20x1,5**

***** Sample of designation: **SNT1.10 M20x1,5**

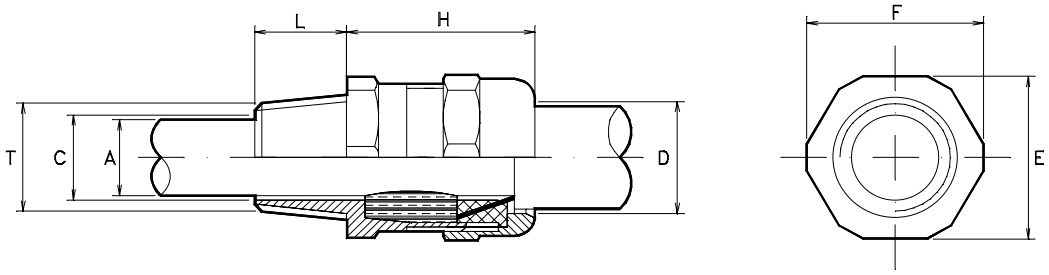
APPLICATION
Pour usage général en intérieur et extérieur.
Protection IP66.

APPLICATION
For general use, indoors and outdoors.
IP66 protection.

Pour câble armé, fermeture sous armure et mise à terre de l'armure.
Execution pour **zone sure**.

For armoured cable, inner seal under armour and armour grounding.
Execution for **safe area**.

REFERENCE: B



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions		Dimension des presse-étoupes Gland dimensions				
SIZE	T	TYPE	A min	 max	C mm	D mm	H mm	E mm	F mm
0	3/8"NPT-M16x1,5-Pg9/11 1/2"NPT-M20x1,5-Pg13,5	SAS0.7 SAS0.10	3 6	7 10	11	16	33	24	26
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	SAS1.8 SAS1.10 SAS1.13	4 6 9	8 10,5 13	14	20	41	32	35
2	3/4"NPT-M25x1,5-Pg16	SAS2.13 SAS2.15 SAS2.18	9 11 14	13 15,5 18	19	25	41	36	39
3	1"NPT-M32x1,5-Pg21	SAS3.18 SAS3.21 SAS3.24	13 16 19	18 21 24	25	32	52	45	49
4	1"1/4NPT-M40x1,5-Pg29	SAS4.24 SAS4.27 SAS4.30	19 22 25	24 27 30	31	38	53	50	55
5	1"1/2NPT-M50x1,5-Pg36	SAS5.27 SAS5.30 SAS5.33 SAS5.36	22 25 28 31	27 30 33 36	37	44	53	57	62
6	2"NPT-M63x1,5-Pg42	SAS6.39 SAS6.42 SAS6.45	34 37 40	39 42 45	47	54	53	67	73
7	2"1/2NPT-M75x1,5-Pg48	SAS7.48 SAS7.51 SAS7.54	43 46 49	48 51 54	57	65	53	80	88
8	3"NPT-M75x1,5 3"NPT-M75x1,5	SAS8.58 SAS8.62 SAS8.64 SAS8.68	52 56 58 62	58 62 64 68	64 70	74 80	70 70	102 102	107 107

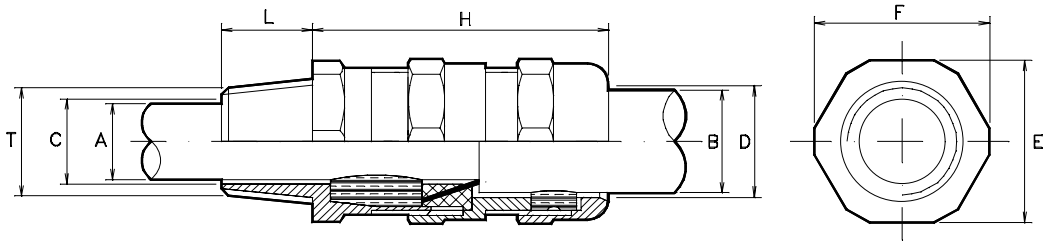
***** Exemple de désignation: **SAS1.10 M20x1,5**
APPLICATION
Pour usage en intérieur, sans protection de l'armure.
Protection IP66.

***** Sample of designation: **SAS1.10 M20x1,5**
APPLICATION
For indoors, without armour protection.
IP66 protection.

Pour câble armé, fermeture sous armure et extérieur, mise à terre de l'armure.
Execution pour **zone sure**.

For armoured cable, inner and outer seals, armour grounding.
Execution for **safe area**.

REFERENCE: C



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions				Dimension des presse-étoupes Gland dimensions				
			A		B		C	D	H	E	F
SIZE		TYPE	min	max	min	max	mm	mm	mm	mm	mm
0	3/8"NPT-M16x1,5-Pg9/11 1/2"NPT-M20x1,5-Pg13,5	SAD0.7 * SAD0.10 *	3 6	7 10	10 10	15 15	11	16	53	24	26
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	SAD1.8 * SAD1.10 * SAD1.13 *	4 6 9	8 10,5 13	10 14	15 19	14	20	65	32	35
2	3/4"NPT-M25x1,5-Pg16	SAD2.13 * SAD2.15 * SAD2.18 *	9 11 14	13 15,5 18	15 19	20 24	19	25	65	36	39
3	1"NPT-M32x1,5-Pg21	SAD3.18 * SAD3.21 * SAD3.24 *	13 16 19	18 21 24	20 25	26 31	25	32	82	45	49
4	1"1/4NPT-M40x1,5-Pg29	SAD4.24 * SAD4.27 * SAD4.30 *	19 22 25	24 27 30	26 31	32 37	31	38	83	50	55
5	1"1/2NPT-M50x1,5-Pg36	SAD5.27 * SAD5.30 * SAD5.33 * SAD5.36 *	22 25 28 31	27 30 33 36	31 36	37 43	37	44	83	57	62
6	2"NPT-M63x1,5-Pg42	SAD6.39 * SAD6.42 * SAD6.45 *	34 37 40	39 42 45	42 47	48 53	47	54	83	67	73
7	2"1/2NPT-M75x1,5-Pg48	SAD7.48 * SAD7.51 * SAD7.54 *	43 46 49	48 51 54	52 58	58 64	57	65	83	80	88
8	3"NPT-M75x1,5 3"NPT-M75x1,5	SAD8.58 * SAD8.62 * SAD8.64 * SAD8.68 *	52 56 58 62	58 62 64 68	64 70	72 78	64 70	74 80	115 115	102 102	107 107

***** Exemple de désignation: **SAD1.1015 M20x1,5**

***** Sample of designation: **SAD1.1015 M20x1,5**

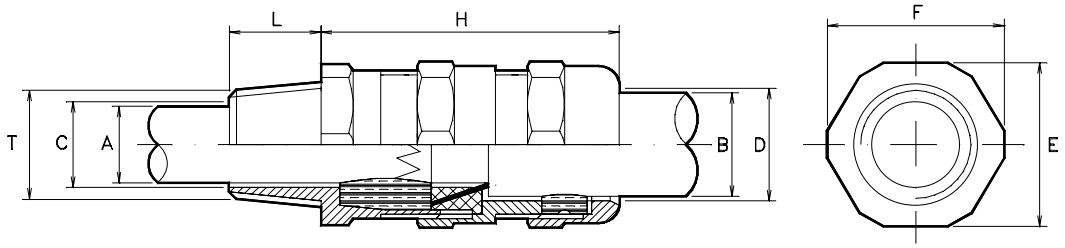
APPLICATION
Pour usage à l'extérieur avec protection de l'armure.
Protection IP66.

APPLICATION
For outdoors with complete protection of cable armour.
IP66 protection.

Pour câble armé et sous plomb, fermeture sous armure et extérieur, mise à terre de l'armure et plomb.
Execution pour **zone sure**.

For armoured and lead sheated cable, inner and outer seals, armour and lead grounding.
Execution for **safe area**.

REFERENCE: D



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions				Dimension des presse-étoupes Gland dimensions				
			A		B		C	D	H	E	F
SIZE		TYPE	min	max	min	max	mm	mm	mm	mm	mm
		SALD1.8 *	3	6	10	15					
1	1/2"NPT-M20x1,5-Pg13,5	SALD1.10 *	4	8,5			14	20	65	32	35
	3/4"NPT-M25x1,5-Pg16	SALD1.13 *	6	11	14	19					
		SALD2.13 *	6	11	15	20					
2	3/4"NPT-M25x1,5-Pg16	SALD2.15 *	9	13,5			19	25	65	36	39
		SALD2.18 *	12	16	19	24					
		SALD3.18 *	11	16	20	26					
3	1"NPT-M32x1,5-Pg21	SALD3.21 *	14	19			25	32	82	45	49
		SALD3.24 *	17	22	25	31					
		SALD4.24 *	17	22	26	32					
4	1"1/4NPT-M40x1,5-Pg29	SALD4.27 *	20	25			31	38	83	50	55
		SALD4.30 *	23	28	31	37					
		SALD5.27 *	20	25	31	37					
5	1"1/2NPT-M50x1,5-Pg36	SALD5.30 *	23	28			37	44	83	57	62
		SALD5.33 *	26	30							
		SALD5.36 *	29	34	36	43					
		SALD6.39 *	32	37	42	48					
6	2"NPT-M63x1,5-Pg42	SALD6.42 *	35	40			47	54	83	67	73
		SALD6.45 *	38	43	47	53					
		SALD7.48 *	41	46	52	58					
7	2"1/2NPT-M75x1,5-Pg48	SALD7.51 *	44	49			57	65	83	80	88
		SALD7.54 *	47	52	58	64					
	3"NPT-M75x1,5	SALD8.58 *	50	58	64	72	64	74	115	102	107
8		SALD8.62 *	54	62							
		SALD8.64 *	56	64							
	3"NPT-M75x1,5	SALD8.68 *	60	68	70	78	70	80	115	102	107

***** Exemple de désignation: **SALD1.1015 M20x1,5**

***** Sample of designation: **SALD1.1015 M20x1,5**

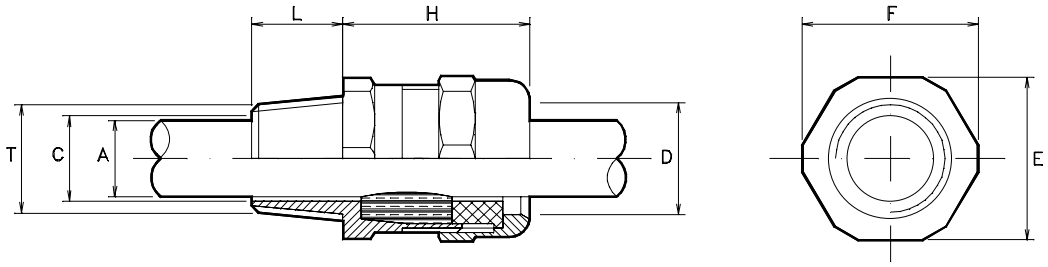
APPLICATION
Pour usage à l'extérieur avec protection de l'armure.
Protection IP66.

APPLICATION
For outdoors with complete protection of cable armour.
IP66 protection.

Pour câble souple, fermeture extérieur.
Execution **EExd/EExe**

For unarmoured cable, outer seal.
EExd/EExe execution

REFERENCE: A



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions		Dimension des presse-étoupes Gland dimensions				
SIZE	T	TYPE	A min	 max	C mm	D mm	H mm	E mm	F mm
0	3/8"NPT-M16x1,5-Pg9/11 1/2"NPT-M20x1,5-Pg13,5	DN0.7 DN0.10	4 7	7 10	11	16	33	24	26
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	DN1.8 DN1.10 DN1.13	5,5 8 10,5	8 10,5 13	14	20	41	32	35
2	3/4"NPT-M25x1,5-Pg16	DN2.13 DN2.15 DN2.18	10,5 13 15,5	13 15,5 18	19	25	41	36	39
3	1"NPT-M32x1,5-Pg21	DN3.18 DN3.21 DN3.24	15 18 21	18 21 24	25	32	52	45	49
4	1"1/4NPT-M40x1,5-Pg29	DN4.24 DN4.27 DN4.30	21 24 27	24 27 30	31	38	53	50	55
5	1"1/2NPT-M50x1,5-Pg36	DN5.27 DN5.30 DN5.33 DN5.36	24 27 30 33	27 30 33 36	37	44	53	57	62
6	2"NPT-M63x1,5-Pg42	DN6.39 DN6.42 DN6.45	36 39 42	39 42 45	47	54	53	67	73
7	2"1/2NPT-M75x1,5-Pg48	DN7.48 DN7.51 DN7.54	45 48 51	48 51 54	57	65	53	80	88

***** Exemple de désignation: **DN1.10 M20x1,5**

***** Sample of designation: **DN1.10 M20x1,5**

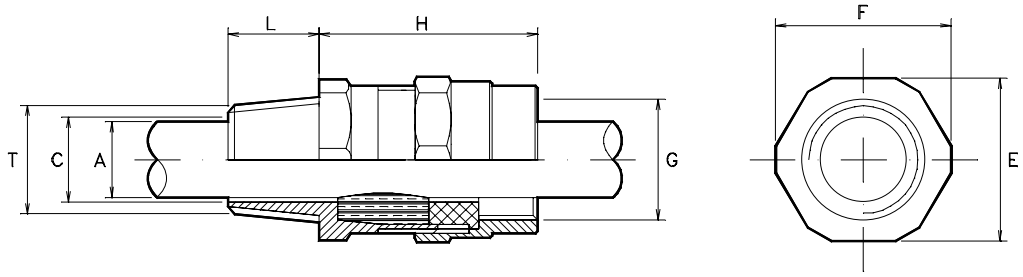
APPLICATION
Pour usage général en intérieur et extérieur.
Protection IP66.

APPLICATION
For general use, indoors and outdoors.
IP66 protection.

Pour câble souple, fermeture extérieur.
Apte pour union à tuyau flexible.
Execution **EExd/EExe**.

For unarmoured cable, outer seal.
Suitable for fexible conduit coupling.
EExd/EExe execution.

REFERENCE: A



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions		Dimension des presse-étoupes Gland dimensions				
SIZE	T	TYPE	A min	 max	C mm	H mm	E mm	F mm	G
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	DNC1.8 DNC1.10 DNC1.13	5,5 8 10,5	8 10,5 13	14	45	32	35	1/2"
2	3/4"NPT-M25x1,5-Pg16	DNC2.13 DNC2.15 DNC2.18	10,5 13 15,5	13 15,5 18	19	45	36	39	3/4"
3	1"NPT-M32x1,5-Pg21	DNC3.18 DNC3.21 DNC3.24	15 18 21	18 21 24	25	54	45	49	1"
4	1"1/4NPT-M40x1,5-Pg29	DNC4.24 DNC4.27 DNC4.30	21 24 27	24 27 30	31	55	50	55	1"1/4
5	1"1/2NPT-M50x1,5-Pg36	DNC5.27 DNC5.30 DNC5.33 DNC5.36	24 27 30 33	27 30 33 36	37	55	57	62	1"1/2
6	2"NPT-M63x1,5-Pg42	DNC6.39 DNC6.42 DNC6.45	36 39 42	39 42 45	47	55	67	73	2"

NOTE: filetage **G**=ISO 7/1 RP-BSPP
Autres filetages sur demande.

NOTE: thread **G**=ISO 7/1 RP-BSPP
Other threads on request.

***** Exemple de désignation: **DNC1.10 M20x1,5**

***** Sample of designation: **DNC1.10 M20x1,5**

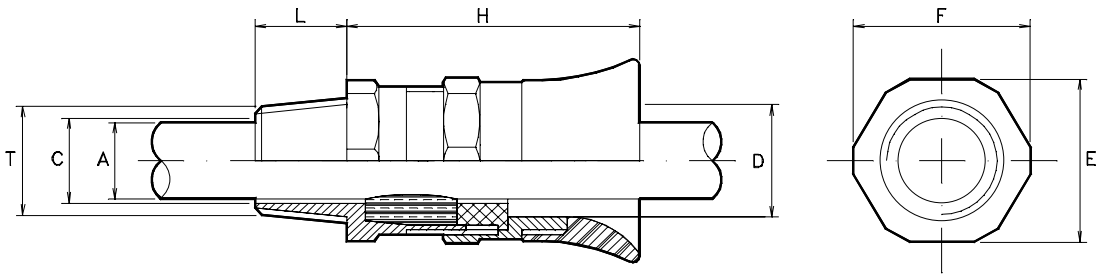
APPLICATION
Pour usage général en intérieur et extérieur.
Protection IP66.

APPLICATION
For general use, indoors and outdoors.
IP66 protection.

Pour câble souple, fermeture extérieur.
Execution **EExd/EExe**.

For unarmoured cable, outer seal.
EExd/EExe execution.

REFERENCE: A



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions		Dimension des presse-étoupes Gland dimensions				
SIZE	T	TYPE	A min	 max	C mm	D mm	H mm	E mm	F mm
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	DNT1.8 DNT1.10 DNT1.13	5,5 8 10,5	8 10,5 13	14	20	66	32	35
2	3/4"NPT-M25x1,5-Pg16	DNT2.13 DNT2.15 DNT2.18	10,5 13 15,5	13 15,5 18	19	25	66	36	39
3	1"NPT-M32x1,5-Pg21	DNT3.18 DNT3.21 DNT3.24	15 18 21	18 21 24	25	32	80	45	49
4	1"1/4NPT-M40x1,5-Pg29	DNT4.24 DNT4.27 DNT4.30	21 24 27	24 27 30	31	38	80	50	55
5	1"1/2NPT-M50x1,5-Pg36	DNT5.27 DNT5.30 DNT5.33 DNT5.36	24 27 30 33	27 30 33 36	37	44	80	57	62
6	2"NPT-M63x1,5-Pg42	DNT6.39 DNT6.42 DNT6.45	36 39 42	39 42 45	47	54	80	67	73

***** Exemple de désignation: **DNT1.10 M20x1,5**

***** Sample of designation: **DNT1.10 M20x1,5**

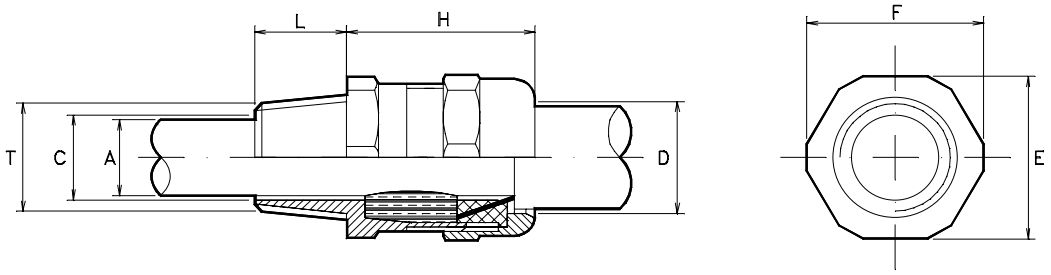
APPLICATION
Pour usage général en intérieur et extérieur.
Protection IP66.

APPLICATION
For general use, indoors and outdoors.
IP66 protection.

Pour câble armé, fermeture sous armure et mise à terre de l'armure.
Execution **EExd/EExe**.

For armoured cable, inner seal under armour and armour grounding.
EExd/EExe execution.

REFERENCE: B



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions		Dimension des presse-étoupes Gland dimensions				
SIZE	T	TYPE	A min	 max	C mm	D mm	H mm	E mm	F mm
0	3/8"NPT-M16x1,5-Pg9/11 1/2"NPT-M20x1,5-Pg13,5	DAS0.7 DAS0.10	4 7	7 10	11	16	33	24	26
1	1/2"NPT-M20x1,5-Pg13,5 3/4"NPT-M25x1,5-Pg16	DAS1.8 DAS1.10 DAS1.13	5,5 8 10,5	8 10,5 13	14	20	41	32	35
2	3/4"NPT-M25x1,5-Pg16	DAS2.13 DAS2.15 DAS2.18	10,5 13 15,5	13 15,5 18	19	25	41	36	39
3	1"NPT-M32x1,5-Pg21	DAS3.18 DAS3.21 DAS3.24	15 18 21	18 21 24	25	32	52	45	49
4	1"1/4NPT-M40x1,5-Pg29	DAS4.24 DAS4.27 DAS4.30	21 24 27	24 27 30	31	38	53	50	55
5	1"1/2NPT-M50x1,5-Pg36	DAS5.27 DAS5.30 DAS5.33 DAS5.36	24 27 30 33	27 30 33 36	37	44	53	57	62
6	2"NPT-M63x1,5-Pg42	DAS6.39 DAS6.42 DAS6.45	36 39 42	39 42 45	47	54	53	67	73
7	2"1/2NPT-M75x1,5-Pg48	DAS7.48 DAS7.51 DAS7.54	45 48 51	48 51 54	57	65	53	80	88

***** Exemple de désignation: **DAS1.10 M20x1,5**

***** Sample of designation: **DAS1.10 M20x1,5**

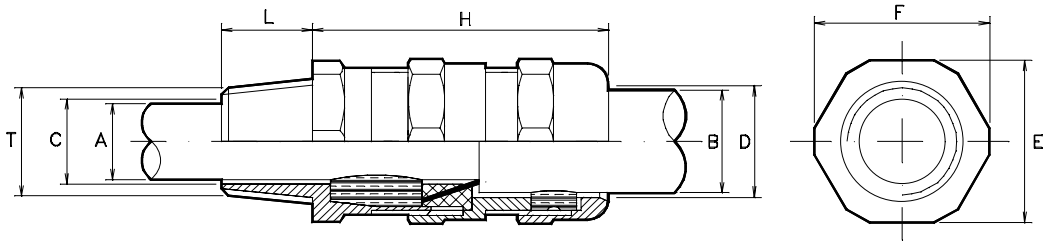
APPLICATION
Pour usage en intérieur, sans protection de l'armure.
Protection IP66.

APPLICATION
For indoors, without armour protection.
IP66 protection.

Pour câble armé, fermeture sous armure et extérieur, mise à terre de l'armure.
Execution **EExd/EExe**.

For armoured cable, inner and outer seals, armour grounding.
EExd/EExe execution.

REFERENCE: C



L=Longueur du filetage: voir tableau comparatif.

L=Thread lenght: see comparison table.

	Filetages Threads		Dimensions des câbles Cable dimensions				Dimension des presse-étoupes Gland dimensions				
SIZE		TYPE	A min	 max	B min	 max	C mm	D mm	H mm	E mm	F mm
0	3/8”NPT-M16x1,5-Pg9/11	DAD0.7 *	4	7	10	15	11	16	53	24	26
	1/2"NPT-M20x1,5-Pg13,5	DAD0.10 *	7	10	10	15					
1	1/2"NPT-M20x1,5-Pg13,5	DAD1.8 *	5,5	8	10	15	14	20	65	32	35
		DAD1.10 *	8	10,5							
	3/4"NPT-M25x1,5-Pg16	DAD1.13 *	10,5	13	14	19					
2	3/4"NPT-M25x1,5-Pg16	DAD2.13 *	10,5	13	15	20	19	25	65	36	39
		DAD2.15 *	13	15,5							
		DAD2.18 *	15,5	18	19	24					
3	1"NPT-M32x1,5-Pg21	DAD3.18 *	15	18	20	26	25	32	82	45	49
		DAD3.21 *	18	21							
		DAD3.24 *	21	24	25	31					
4	1"1/4NPT-M40x1,5-Pg29	DAD4.24 *	21	24	26	32	31	38	83	50	55
		DAD4.27 *	24	27							
		DAD4.30 *	27	30	31	37					
5	1"1/2NPT-M50x1,5-Pg36	DAD5.27 *	24	27	31	37	37	44	83	57	62
		DAD5.30 *	27	30							
		DAD5.33 *	30	33							
		DAD5.36 *	33	36	36	43					
6	2"NPT-M63x1,5-Pg42	DAD6.39 *	36	39	42	48	47	54	83	67	73
		DAD6.42 *	39	42							
		DAD6.45 *	42	45	47	53					
7	2"1/2NPT-M75x1,5-Pg48	DAD7.48 *	45	48	52	58	57	65	83	80	88
		DAD7.51 *	48	51							
		DAD7.54 *	51	54	58	64					

***** Exemple de désignation: **DAD1.1015 M20x1,5**

***** Sample of designation: **DAD1.1015 M20x1,5**

APPLICATION
Pour usage à l'extérieur avec protection de l'armure.
Protection IP66.

APPLICATION
For outdoors with complete protection of cable armour.
IP66 protection.

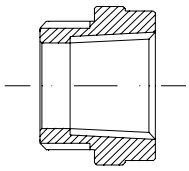
ACCESSOIRES

ADAPTATEURS DE FILETAGE

Adaptateurs de filetage des tous les types des filetages, aptes pour reduir ou agrandir les entrées des enveloppes.

SERIES

AR adaptateur réducteur
AE adaptateur agradisseur

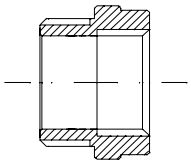


REDUCTEURS DE FILETAGE

Réducteurs de filetage du même type de filetage, aptes pour reduir ou agrandir les entrées des enveloppes.

SERIES

R réducteur
E agradisseur

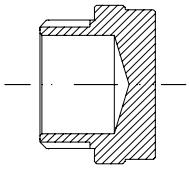


BOUCHONS

Bouchons mâles des tous les types des filetages, aptes pour les entrées des enveloppes.

SERIES

T bouchon mâle



NOTES

Tous les adaptateurs, réducteurs et bouchons sont certifiè pour execution EExd/EExe.
Certificat LCIE 02 ATEX 6160X.

Designation des filetages

B BSPP/UNI338 (ISO R228)
U UNI6125 (ISO 7/1)
N NPT (ANSI B1 20.1)
I ISO Mx1,5 (ISO 261)
P Pg (DIN 40430)

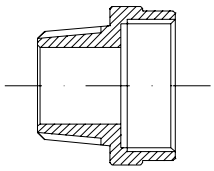
ACCESSORIES

THREAD ADAPTORS

Thread adptors of all kind of threads suitable to reduce or enlarge the enclosures entries.

SERIES

AR reducer adaptor
AE enlarger adaptor

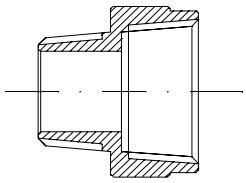


THREAD REDUCERS

Thread reducers of the type of thread, suitable to reduce or enlarge the enclosure entries.

SERIES

R reducer
E enlarger

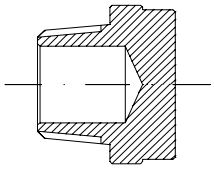


STOPPING PLUGS

Male stopping plugs of all kind of threads, suitable for enclosure entries.

SERIES

T male stopping plug



NOTES

All adaptors, reducers and stopping plugs are certified for EExd/EExe execution.
Certificate LCIE 02 ATEX 6160X.

Threads designation

B BSPP/UNI338 (ISO R228)
U UNI6125 (ISO 7/1)
N NPT (ANSI B1 20.1)
I ISO Mx1,5 (ISO 261)
P Pg (DIN 40430)

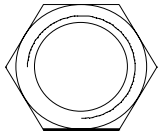
ACCESSOIRES

ECROUS DE FIXATION

Ecrous de fixation pour presse-étoupes, adaptateurs, réducteurs de filetage et bouchons.

SERIES

LB filetage BSPP/UNI338
LI filetage ISO Mx1,5
LP filetage Pg

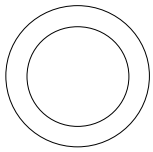


JOINTS D'ETANCHEITE

Joints d'etanchéité en NYLON

SERIES

GB pour filetage BSPP/UNI338
GI pour filetage ISO Mx1,5
GP pour filetage Pg

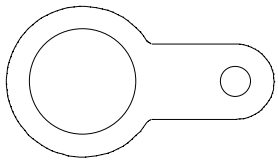


PLATINES DE TERRE

Platines de mise à terre des presse-étoupes.

SERIES

ETB pour filetage BSPP/UNI338
ETI pour filetage ISO Mx1,5
ETP pour filetage Pg

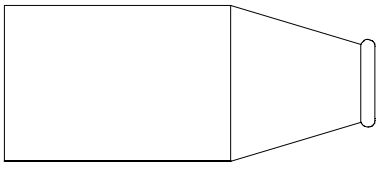


PROTECTIONS POUR PRESSE-ETOUPES

Protections en cautchouc PCP pour presse-étoupes comme protection additionnel pour condition d'ambiant lourd.

SERIES

PTD sizes 0 au 7



ACCESSORIES

LOCKNUTS

Locknuts for cable glands, thread adaptors, reducers and stopping plugs.

SERIES

LB BSPP/UNI338 thread
LI ISO Mx1,5 thread
LP Pg thread

GASKETS

NYLON gaskets

SERIES

GB for BSPP/UNI338 thread
GI for ISO Mx1,5 thread
GP for Pg thread

EARTHING-TAGS

Earthing-tags for cable glands grounding.

SERIES

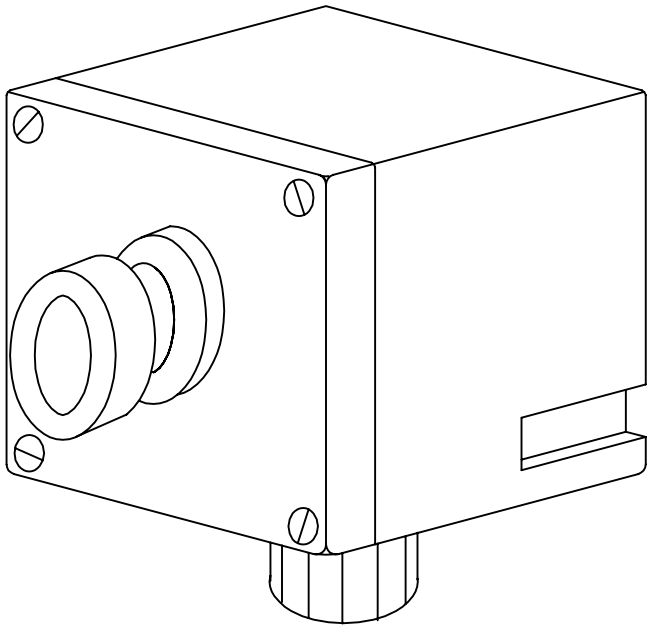
ETB for BSPP/UNI338 thread
ETI for ISO Mx1,5 thread
ETP for Pg thread

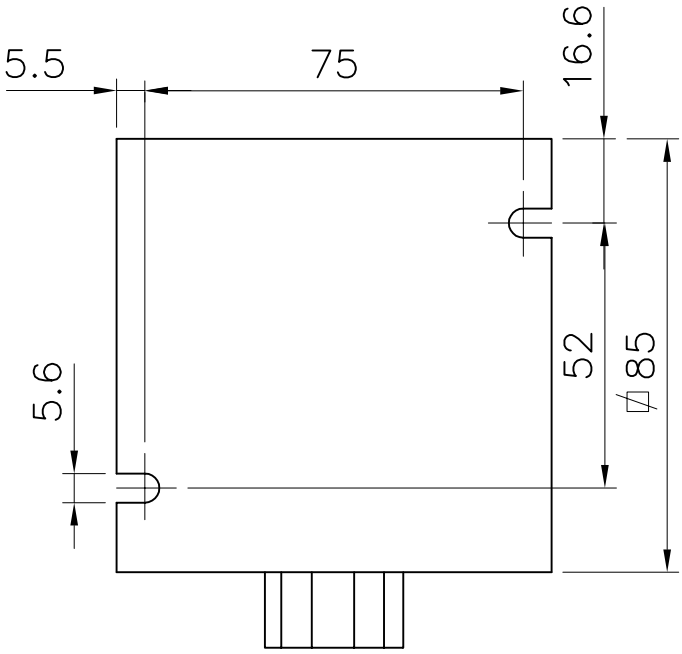
SHROUDS

PCP rubber shrouds for cable glands as addidtional protection against onerous weather conditions.

SERIES

PTD sizes 0 to 7

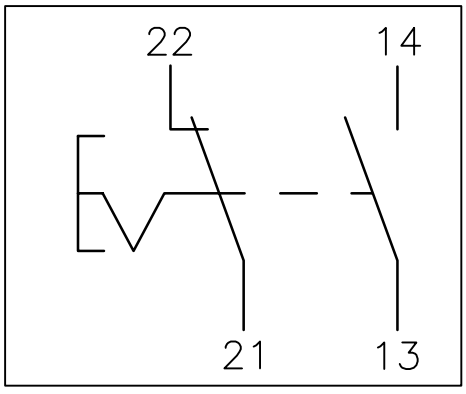




TECHNICAL DATA:

Explosion category	:EEx de II C T6
Certificate of conformity	:PTB 00 ATEX 3117
Protection category	:IP 66 acc. to EN 60529
Rated voltage	:690 V AC
Rated current	:Max. 16 A
Cable glands	:1xM25x1,5 for cables from ø8–ø17mm
Terminals	:2x2,5 mm^2
PE terminal	:4x4 mm^2
Dimensions	:Highxwidthxdepth=85x85x107 mm

Connection diagram



1 NO + 1 NC

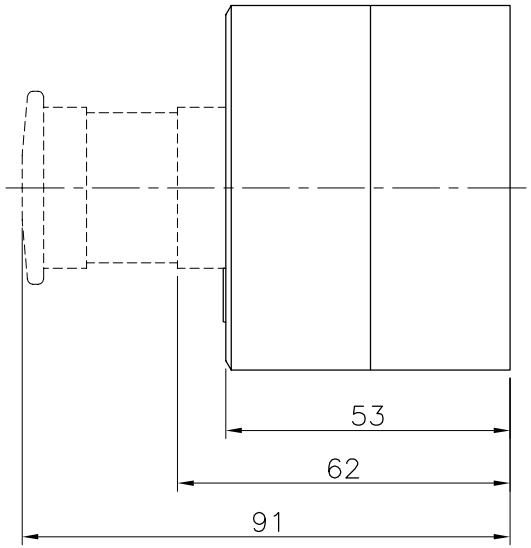
2	EH			Changed dimensions 75 was 74 and 52 was 51,8				
	06-04-06			Changed certificate of conformity and protection category				
1	B.M.							
	18-04-96							
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION				
PROJECTION		MATERIAL Art.No. Wnr.		ROUGHNESS	MASS 0,4 kg	SCALE	UNIT mm	SIZE A4

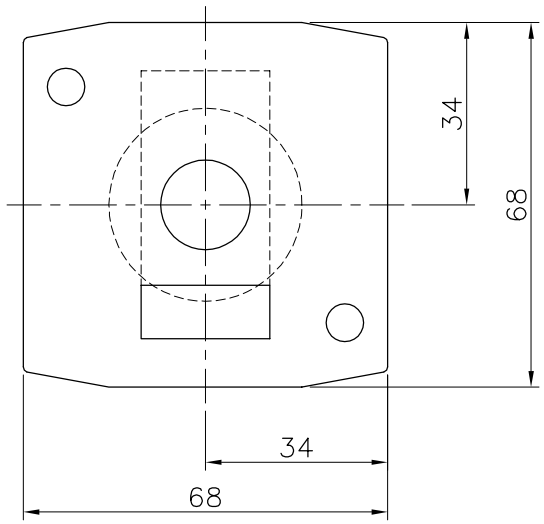
TITLE / DESCRIPTION

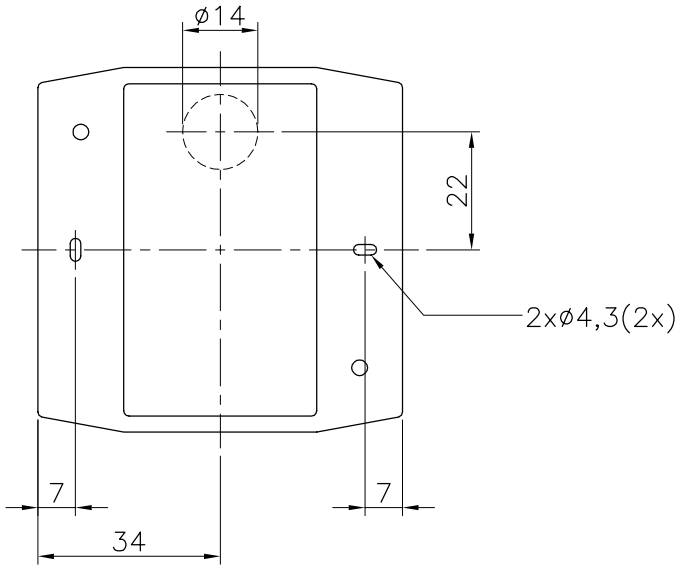
EMERGENCY STOP

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO. DEEPWELL PUMPS	SHEET 1
DOCUMENT NO. / ITEM NO. 430104	OF 1







3				
2	EH 23-06-05			Changed document number 430105 was 430104 and description of drawing. Added new drawing of emergency stop control station.
1	B.M 18-04-96			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:2	mm	A3

TITLE / DESCRIPTION

EMERGENCY STOP XAL K178E

MarFlex b.v.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : 0186-890200
Fax: 0186-890299

PROJECT/ALT. No.	SHEET
	1
DOCUMENT No. / ITEM No.	OF
430105	1

3 General maintenance power pack (EHP)

The power pack is designed for as little maintenance as possible.
Maintenance is limited to the below mentioned procedures.

Danger!

Make sure the electrical power supply is disconnected before carying out any inspection or maintenance action!

Danger!

Make sure the hydraulic system is depressurized before carying out any inspection or maintenance action!

3.1 Normal periodic inspection intervals and maintenance

Replace hydraulic filter element:

- When the indicator points to the red area
- After 1000 operating hours or
- At least twice a year.

Replace hydraulic oil:

- When contaminated
- First oil after 300 – 500 hours
- After 4000 operating hours.

Inspection and maintenance hydraulic pump:

- See hydraulic pump manufacturer manuals.

Inspection and cleaning main electric motor:

- See electric motor manufacturer manuals.

Inspection and cleaning hydraulic oil cooler electric motor:

- See electric motor manufacturer manuals.

Clean fan blades and air openings hydraulic oil cooler with compressed air:

- When contaminated
- After 1000 operating hours
- Once a year.

3.2 Electric motor maintenance

Danger!

High-voltage and rotating parts of electrical machinery can cause serious or fatal injury. The machinery may be installed, operated and maintained only by qualified personnel. The relevant VDE regulations and accident prevention regulations applicable to installation, operation and use of electrical machinery must be observed.

Note:

Dismantling or opening the electric motors during the warranty period without the manufacturer's consent will render the warranty null and void.

3.2.1 Connections and location

Warning!

Failure to properly ground the motor may cause serious injury to personnel. Grounding should be in accordance with the VDE regulations and local wiring regulations.

The personnel should be instructed to:

- Avoid contacts with live parts
- Disconnect all power sources before attempting maintenance or repair
- Avoid contact with rotating parts
- Avoid contact with the start or run capacitor in single-phase motors until a safe discharge procedure has been followed
- Act with care and in accordance with prescribed procedures in handling, lifting, operating and maintaining the equipment. Do not lift the motor and drive equipment at the motor lifting eyebolts. Do not use eyebolts at ambient temperatures less then - 20°C. At the lower temperatures, the eyebolt could fail, resulting in injury to personnel and/or damage to the equipment. Drop-forged eyebolts in accordance with DIN 580 must be used
- Provide proper safeguards for personnel against possible failure of the motor-mounted brake, in particular in applications involving overhauling loads.

Location:

The air inlet and outlet on the fan cowl must not be obstructed since, otherwise, this would cause overheating and shorten the service life of the winding insulation.

Check and clean the air ventilation paths to the electric motors.

Power supply and connections:

The power supply must correspond to the voltage and frequency specified on the rating plate. The electric motors will operate adequately with line voltage or frequency fluctuations of up to ± 5 %, and a combined fluctuation of not greater than 10 %. Dual-voltage and pole changing motors must be connected for the required voltage by following the instructions on the connecting diagram supplied.

The wiring of motor and control system, overload protection and grounding must comply with wiring regulations.

3.2.2 Test before operation

Warning!

Where unexpected starting would be hazardous to personnel, use automatic restart protection!

Caution!

Before operating the power pack check the direction of rotation of the electric motor!

Procedure:

- Start the power pack momentarily and check the direction of the electric motor.
- Reverse two line leads in order to reverse the direction of rotation.
- Operate under no-load in order to check rotation and free running.

3.2.3 Storage

Caution!

If the motors have been stored for longer than 3 months before operation, a qualified person must measure the insulation resistance. The resistance of a clean, dry motor should be greater than 5 MOhm.
0.5 MOhm is the critical value. If this value is not reached, the motors must be dried.

Storing the electric motors:

In order to avoid the insulation resistance dropping, the motors must be accommodated in enclosed, dry spaces when stored for long periods. Before placing the electric motor into storage, regrease with the motor stationary.

3.3 Trouble shooting

Table 1: Power pack failures

Indication	Probable cause	Corrective action
Electric motor fails to operate.	Electric power. Low hydraulic level.	Check electric power supply. Check oil level in hydraulic tank.
Electric motor thermal protection activated.	Insufficient cooling of electric motor.	Check for uninterupted cooling air flow arround electric motor.
Hydraulic filter indicator in red area.	Hydraulic filter normal contaminated. Hydraulic filter contaminated with metal parts.	Replace hydraulic filter. Inspect power pack and hydraulic system for damaged components. Replace damaged components if neccesary. Carry out a flushing procedure on the complete hydraulic system.
Abnormal noise in hydraulic system.	Air in hydraulic system. Hydraulic pump internal defect. Vibration isolators electric motor damaged.	Bleed air from hydraulic system at highest point or at bleed port on hydraulic pump. Replace hydraulic pump. Repace vibration isolators.

Table 1: Power pack failures

Indication	Probable cause	Corrective action
Hydraulic oil over-heated. (normal temp: 40° to 75° C)	Hydraulic oil cooler failure. Temperature switch failure.	Check hydraulic oil cooler (electric motor) for operation. Check hydraulic oil cooler air openings for blockage. Check temperature switch for operation.
Hydraulic pressure not possible above 14 bar.	Orifice in the pressure side of the pump is blocked	Clean orifice in the pressure side of the pump.
Coupling hydraulic lines difficult to connect.	Coupling contaminated. Coupling damaged.	Clean coupling thoroughly (inside and out). Replace coupling or compleet hydraulic line.
Hydraulic powered component not functioning properly.	Distance to hydraulic driven component to much. Hydraulic oil too high viscosity.	Use shorter hydraulic lines when possible. Length of hydraulic lines effects flow and pressure. Fill the hydraulic system with the advised oil type.

maintenance and operation instructions

type rotor nl® elektromotoren type 4AP, RN, XC, XF, XK, XV, 3AF

maintenance

general

In general rotor nl® motors require very little maintenance. Usually this can be limited to:

- cleaning the surface and the cooling air openings for a proper cooling.
- timely relubrication and replacement of the 2Z bearings.

bearings general

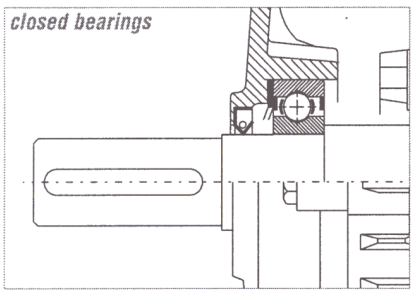
The bearings applied are mentioned in table 1. The motors are fitted as standard with C3 bearings. Motors which will be exposed to excessive high or low temperatures have to be provided with special grease and/or bearings.

bearing lubrication

closed bearings

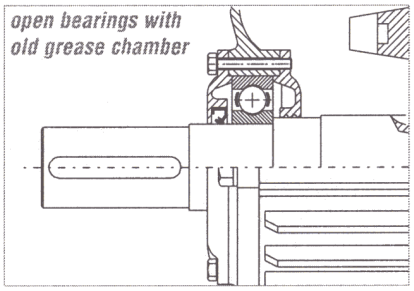
The smaller motors have been fitted with closed bearings and as such they cannot be relubricated. They must be replaced at the end of the fatigue period or at the end of the grease life (see table 2).

When replacing bearings it is recommended to choose bearings with a grease filling of a higher grease reference temperature (e.g. 85°C). The grease life of these bearings is considerably longer than the life of normal ball bearing grease (70°C) and usually it will exceed the fatigue period of the bearing material. The rotor nl® motors are delivered as standard with 2Z bearings with a high-temperature grease with a reference temperature of 85°C. It is recommended to replace 2Z bearings every 4 years and additionaly with reference to other factors such as pollution and the influence of air humidity.



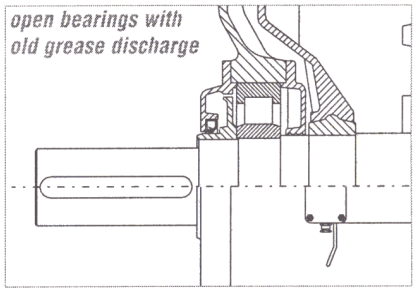
open bearings with old grease chamber

The larger motors are fitted with open bearings which have been filled with ball bearing grease based on lithium soap and mineral oil. These bearings can be relubricated several times; the old grease will be collected in the old grease chamber in the bearing cover. Relubricate the bearing when the motor is turning. When you relubricate the bearing for the first time take into account that the grease channel from the nipple to the chamber is still empty. During the first relubrication this empty channel will be filled first and subsequently the bearing will be refilled using some counterpressure. When the bearing has been relubricated a few times the old grease chamber must be cleaned and if required the bearings must be replaced. If the bearings have only be subjected to little load and the bearings still have life left, the bearings and the bearing covers should be washed and partly be filled again (bearings 50% and bearing covers 30%). EEx-e and EEx-n motors with open bearings and chamber of old grease are delivered without grease nipple.



open bearings with old grease discharge

If the motors have been fitted with an automatic old grease discharge, the bearings can always be relubricated. The operation of the automatic old grease discharge is based on an oscillating wheel which discharges the excess grease to the chamber for old grease. In order to discharge excess grease a closed old grease chamber should be open when the motor is in operation as well as during and one hour after relubrication.



relubrication interval

The relubrication interval largely depends on the speed, bearing load, environmental conditions and the set-up of the motor. Relubrication should be carried out in accordance with the recommendations of the bearing and grease supplier. The enclosed relubrication table only gives a general guideline. The guide values given in table 3 only apply to motors with a horizontal set-up, at a bearing temperature of approx. 70°C (normal load and ambient temperature). The relubrication interval should be halved for motors with a vertical set-up. When the bearing temperatures are higher than the reference temperature of the grease applied the relubrication interval should be halved for an increase of 15°C. For lower temperatures a longer relubrication interval suffices, although not longer than twice the indicated value. In case of heavy and/or highly alternating loads the relubrication interval should be reduced.

type of grease

Rotor nl® motors which have been fitted with open bearings are standard supplied with lithium complex grease as a lubricant. For relubrication lithium soap based types of grease with a mineral basic oil can be used. A good quality grease which can withstand high temperatures is preferred. If, on request, a motor was fitted with special bearings or grease filling, this is mentioned on the type plate and relubrication should be adapted to these data.

guarantee

Guarantee applications are dealt with in conformance with what is stated in the general buying & selling conditions of Rotor B.V. which are effective at the time of delivery.

maintenance and operation instructions

rotor nl® electric motors type 4AP, RN, XC, XF, XK, XV, 3AF

safety

These electric motors must be installed by qualified personnel. Connection to the mains and commissioning may only be carried out by a qualified installer in accordance with the locally applicable rules and regulations. The manufacturer cannot be held responsible for damages resulting from incompetent installation or use.

EG manufacturer's declaration

In accordance with the European directives

We, Rotor B.V., Mors 2, 7151 MX Eibergen, The Netherlands declare fully within our own responsibility that the product rotor nl® electric motors, series 4AP...,RN..., XC..., XF..., XK..., XV...,3AF..., and derived models this declaration relates to, complies with the relevant harmonised standards:

EN 60 034 - 1 EN 50 081 - 1
EN 60 034 - 5 EN 50 082 - 2
EN 60 034 - 6 EN 60 034 - 9
EN 60 204 - 1, article 16

according to the conditions in the European directives:

73/23/EEG: directive of the Council concerning the mutual adaptation of legal regulations of the Member Countries with regard to electric materials intended to be used within a certain voltage range, as modified by the directive of the Council (93/68/EEG);

89/336/EEG: directive of the Council concerning the mutual adaptation of the legislation with regard to electromagnetic compatibility, as modified by the directive of the Council (91/236/EEG), by the directive of the Council (92/31/EEG) and by the directive of the Council (93/68/EEG);

98/37/EG directive of the Council concerning the mutual adaptation of the legislation of the Member of Countries with machines.

We would like to point out to you that the product is intended to be built into a machine; based on the Machine directive the machine can only be put into operation when it meets all European requirements

Eibergen, The Netherlands, 1 January 1999

storage

Motors must be stored dry and free of vibrations. Openings of cable inlets and mounting holes in FT(B14) flanges must be temporarily covered. If the motors have been out of operation for a longer period of time, it is recommended to measure the insulation resistance before switching them on. If the measured insulation resistance is lower than 30 MΩ (measured at a voltage of 1,000 V) it is necessary to dry the motor winding first. If requested by the supplier, any guarantee forms must be filled in and returned before commissioning.

installation & set-up

The set-up and installation must be in conformance with the type of construction as given on the motor type plate and preferably as dry as possible. Ensure an unobstructed supply of sufficient cooling air.

For flange motors with FT (B14) flanges the maximum screw-in length of the mounting bolts is limited to 2.5 x bolt diameter (in order to prevent the winding from becoming damaged).

power take-off

The power of the motor can usually be taken off via a flexible coupling, V-belt or belt transmission. A precise alignment also increases the life of the bearings. If the electric motor is integrated with a tool, the manufacturer of the tool must ensure that the type of electric motor applied is tuned to the specific application. The transmission components mentioned must be fastened to the motor shaft using a draw bolt utilising the tapped hole in the shaft. The motors nowadays are balanced with half (H) key as declared on the typeplate and / a shaftend.

tightening moments

Special attention should be paid to the tightening moment of bolts and nuts. When mounting the motor the bolts must be tightened hand-tight using normal hand tools until the spring clip is flattened. In order to prevent the motor construction from becoming damaged, the bolts should never be tightened with the maximum force. Therefore a (large) torque wrench is not required. The same applies to the bolts and nuts of the terminal boards. A good electrical connection is required and in order to achieve this, the last nut should be tightened firmly while (if existing) the lower nut is arrested by a second wrench. After approx. 300 operating hours this connection and the mounting bolts of the motor etc. should be checked again and if necessary be retightened.

electrical connection

The motor connection must meet the local applicable regulations. A thermal safety device should reduce the risk of a motor overload. For connecting PTC thermistors (if present) a special thermistor relay must be used.

The motors can be used for both rotational directions. The rotational direction can be altered by exchanging any two mains connection wires. Extra silent motors usually are only suited for one direction of rotation (see rotation direction arrow on the motor).

Voltage frequency regulator

If the motor is connected to a voltage frequency regulator, generally no restrictions apply when the control range is between 30% and 120% of the nominal number of revolutions of the motor (at 50 Hz). The capacity (couple) reduction of the instrument should of course correspond to the characteristic of the combination of the voltage frequency regulator and the motor. Outside this control range, consultation with the manufacturer of the motor is essential.

bearing constructions

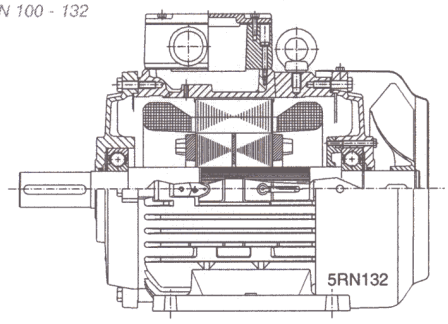
table 3

for standard rotor nl® squirrel cage induction motors

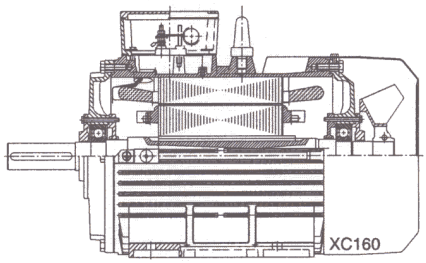
bearing type	grease (gram)	relubrication interval in hours in **open** bearings, *motorspeed in min⁻¹*							
		3.600	*3.000*	*1.800*	*1500*	*1200*	*1000*	*900*	*750*
6309/C3	13	5.800	7.100	10.300	11.600	13.300	14.800	15.800	17.500
6310/C3	15	5.000	6.700	10.000	11.200	12.900	14.400	15.300	17.000
6312/C3	20	3.600	5.600	9.200	10.500	12.200	13.700	14.600	16.200
6213/C3	20	2.950	4.900	8.900	10.200	12.000	13.400	14.300	16.000
6313/C3	22								
6314/C3	23	2.300	4.300	8.700	9.900	11.600	13.000	14.000	15.600
6215/C3	23	1.800	3.700	8.400	9.700	11.400	12.800	13.700	15.400
6315/C3	26								
6216/C3	30	1.250	3.100	8.100	9.450	11.100	12.500	13.500	15.100
6316/C3	33								
6217/C3	37	-	2.500	7.800	9.200	10.800	12.200	13.200	14.800
7217	37								
6317/C3	40								
6319/C3	45	-	1.200	7.400	8.800	10.500	11.900	12.900	14.500
6320/C3	50	-	1.000	7.100	8.500	10.200	11.700	12.600	14.200
6322/C3	60	-	-	6.600	8.000	9.800	11.300	12.300	13.900
NU213/C3	22	1.400	2.400	5.800	7.600	9.600	10.700	11.400	12.800
NU215/C3	23	900	1.850	5.600	7.500	9.100	10.300	11.000	12.300
NU315/C3	26								
NU216/C3	30	600	1.550	5.200	7.100	8.900	10.100	10.800	12.100
NU316/C3	33								
NU217/C3	37	-	1.250	5.100	6.900	8.600	9.700	10.600	11.800
NU317/C3	40								
NU319/C3	45	-	600	4.800	6.600	8.400	9.500	10.300	11.600
NU320/C3	50	-	-	4.000	5.700	8.200	9.400	10.100	11.400
NU322/C3	60	-	-	3.400	5.200	7.700	9.100	9.800	11.100

Relubrication intervals based on the data of bearing and grease manufacturers determined in accordance with the latest known method.
The relubrication intervals must be halved in motor set-ups with a vertical shaft.
When the grease temperatures are higher than the grease reference temperatures the relubrication must be halved for each 15°C increase.

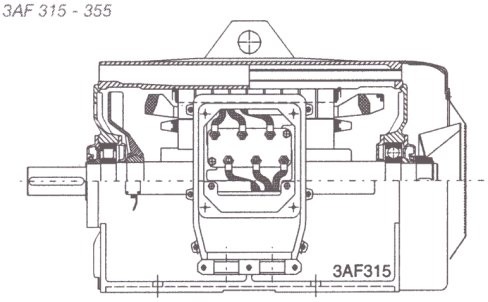
5RN 100 - 132



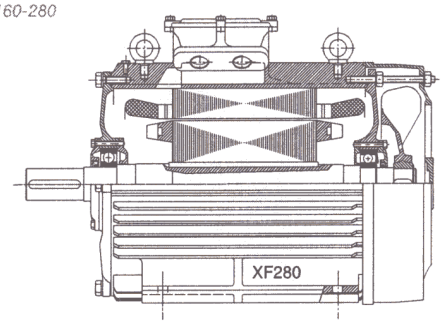
XC 160 - 225



3AF 315 - 355



XF 160-280



bearing types and relubrication intervals

for standard rotor nl® squirrel cage induction motors

table 1

type	poles	bearing
4AP56	all	6200-2Z/C3
4AP/5RN63	all	6201-2Z/C3
4AP/5RN71	all	6202-2Z/C3
4AP/5RN80	all	6204-2Z/C3
4AP/5RN90	all	6205-2Z/C3
4AP/5RN100	all	6206-2Z/C3
4AP/5RN112	all	6306-2Z/C3
4AP/5RN132	all	6308-2Z/C3
X.C/5RN160	all	6309-2Z/C3
X.F160	all	6309/C3
X.C180	all	6310-2Z/C3
X.F180	all	6310/C3
X.C200	2,42	6312/C3
X.C200	remain	6312-2Z/C3
X.F200	all	6312/C3

type	poles	bearing D.E.	bearing N.D.E.
X.C225	6, 8	6313-2Z/C3	6313-2Z/C3
X.C225	remain	6313/C3	6313/C3
X.F225	alle	6315/C3	6313/C3
4RN225	2	6213/C3	6213/C3
4RN225	4, 6, 8	6313/C3	6313/C3
X.F250	all	6315/C3	6313/C3
4RN250	2	6215/C3	6215/C3
4RN250	4, 6, 8	6315/C3	6315/C3
X.F280	all	6316/C3	6315/C3
4RN280	2	6216/C3	6216/C3
4RN280	4, 6, 8	6317/C3	6317/C3
3AF.315	2	NU316M/C3	6316M/C3
3AF.315	2-B35/V1	6316M/C3	6316M/C3
3AF.315	4, 6, 8	NU320/C3	6320/C3
3AF.315	4,6,8-B35/V1	6320/C3	6320/C3
4RN315S/M	2	6217/C3	6217/C3
4RN315S/M	4, 6, 8	6319/C3	6319/C3
4RN315L	2 horizontal	6217/C3	6217/C3
4RN315L	2 vertical	6217/C3	7217
4RN315L	4, 6, 8	6319/C3	6319/C3
3AF.355	4, 6, 8-B3	NU322/C3	6322/C3
3AF.355	4,6,8-B35/V1	6322/C3	6322/C3

D.E. = driven end
N.D.E. = not driven end
2Z (SKF) code, twosided (metal) closed bearing.
C3 code for the (radial) bearing clearance class.

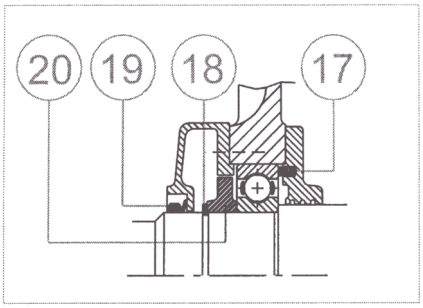
table 2

bearing type	grease life in hours in closed bearings provided with grease of a high temperature range (T_{ref} 85°C) at a bearing temperature of 70°C, ***motorspeed min^{-1}***							
	3.600	*3.000*	*1.800*	*1.500*	*1.200*	*1.000*	*900*	*750*
6200 2Z/C3	40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000
6201 2Z/C3	40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000
6202 2Z/C3	40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000
6204 2Z/C3	30.000	34.000	40.000	40.000	40.000	40.000	40.000	40.000
6205 2Z/C3	28.000	32.000	40.000	40.000	40.000	40.000	40.000	40.000
6206 2Z/C3	24.000	30.000	40.000	40.000	40.000	40.000	40.000	40.000
6306 2Z/C3	22.000	28.000	40.000	40.000	40.000	40.000	40.000	40.000
6308 2Z/C3	16.000	22.000	34.000	38.000	40.000	40.000	40.000	40.000
6309 2Z/C3	13.000	18.000	30.000	32.000	38.000	40.000	40.000	40.000
6310 2Z/C3	11.000	16.000	28.000	30.000	36.000	40.000	40.000	40.000
6312 2Z/C3	9.000	12.000	24.000	26.000	32.000	36.000	38.000	40.000
6313 2Z/C3	7.200	10.000	20.000	24.000	30.000	34.000	36.000	40.000
6314 2Z/C3	6.000	9.000	18.000	23.000	28.000	32.000	34.000	38.000

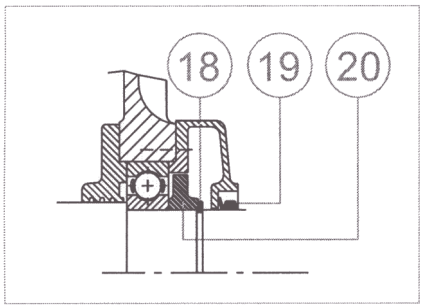
*The grease life is the time in which **99%** of the bearings is still lubricated sufficiently. At **90%** this time is 2x as long.*
The grease life must be halved in case of a standard (MT) grease filling with a reference temperature of 70°C.
The grease life must be halved in motor set-ups with a vertical shaft.

motorconstruction

motortype 4RN 225 - 315



D.E. (Driven End)



N.D.E. (Non Driven End)

description

1. bearing D.E.
2. outer bearing cover D.E.*
3. inner bearing cover D.E.
4. motor endshield or flange D.E.
5. terminal box
6. terminal box cover
7. stator stack
8. tapped hole for earthing bolt
9. rotor stack
10. stator frame
11. inner bearing cover N.D.E.
12. motor endshield N.D.E.
13. fan
14. fancover
15. outer bearing cover N.D.E.*
16. bearing N.D.E.
17. waved washer / spiralspring
18. circlip
19. V-ring
20. slingerdisc*

** not for frames 225 / 250*

design

- cast iron frame, endshield and flanges
- cast iron terminal box
  4 x 90° turnable
- ball bearings (SKF or equivalent), and fixed on N.D.E. side.
  D.E.-side with waved washer or spiral-spring for restricted axial pre-tension
- automatic grease relief optional

mountings

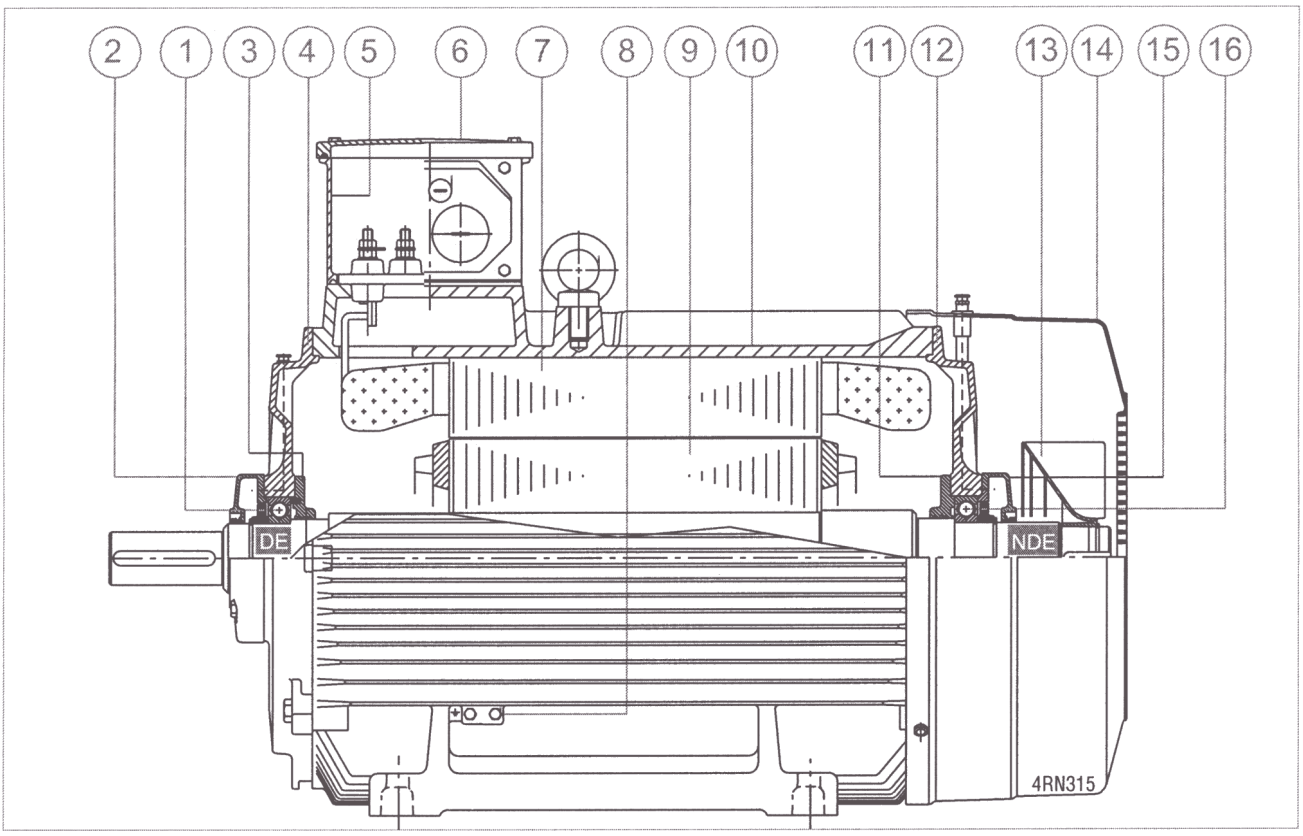
- foot mounted motor IM 1001 (IM B3)
- flange mounted motor IM 3001 (IM B5)
- foot / flange mounted motor IM 2001 (IM B35)
- flange mounted motor IM 3011 (IM V1) + canopy
- 2nd shaftend IM...2
- all frame mountings according IEC 34-7 code I (I)

cooling

- T.E.F.C. - IC 411 (IEC 34-6) with external cooling by fan

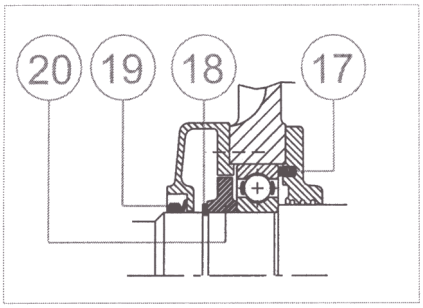
dimensions

- according IEC 72-1
  DIN 42673 / DIN 42677

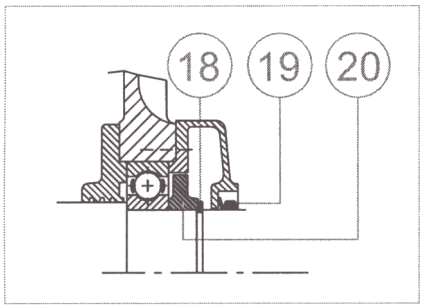


motorconstruction

motortype 4RN 225 - 315



D.E. (Driven End)



N.D.E. (Non Driven End)

description

1. bearing D.E.
2. outer bearing cover D.E.*
3. inner bearing cover D.E.
4. motor endshield or flange D.E.
5. terminal box
6. terminal box cover
7. stator stack
8. tapped hole for earthing bolt
9. rotor stack
10. stator frame
11. inner bearing cover N.D.E.
12. motor endshield N.D.E.
13. fan
14. fancover
15. outer bearing cover N.D.E.*
16. bearing N.D.E.
17. waved washer / spiralspring
18. circlip
19. V-ring
20. slingerdisc*

** not for frames 225 / 250*

design

- cast iron frame, endshield and flanges
- cast iron terminal box
  4 x 90° turnable
- ball bearings (SKF or equivalent), and fixed on N.D.E. side.
  D.E.-side with waved washer or spiral-spring for restricted axial pre-tension
- automatic grease relief optional

mountings

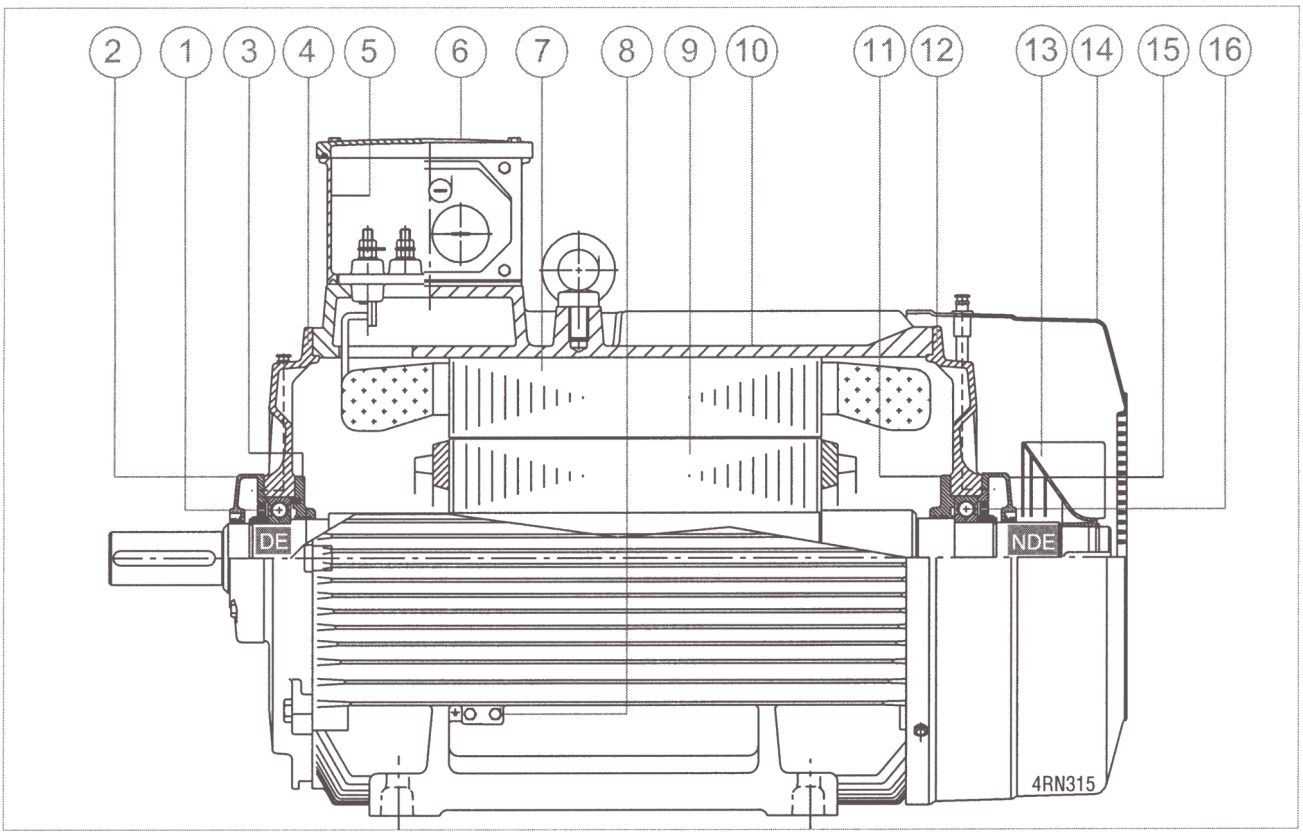
- foot mounted motor IM 1001 (IM B3)
- flange mounted motor IM 3001 (IM B5)
- foot / flange mounted motor IM 2001 (IM B35)
- flange mounted motor IM 3011 (IM V1) + canopy
- 2nd shaftend IM...2
- all frame mountings according IEC 34-7 code I (I)

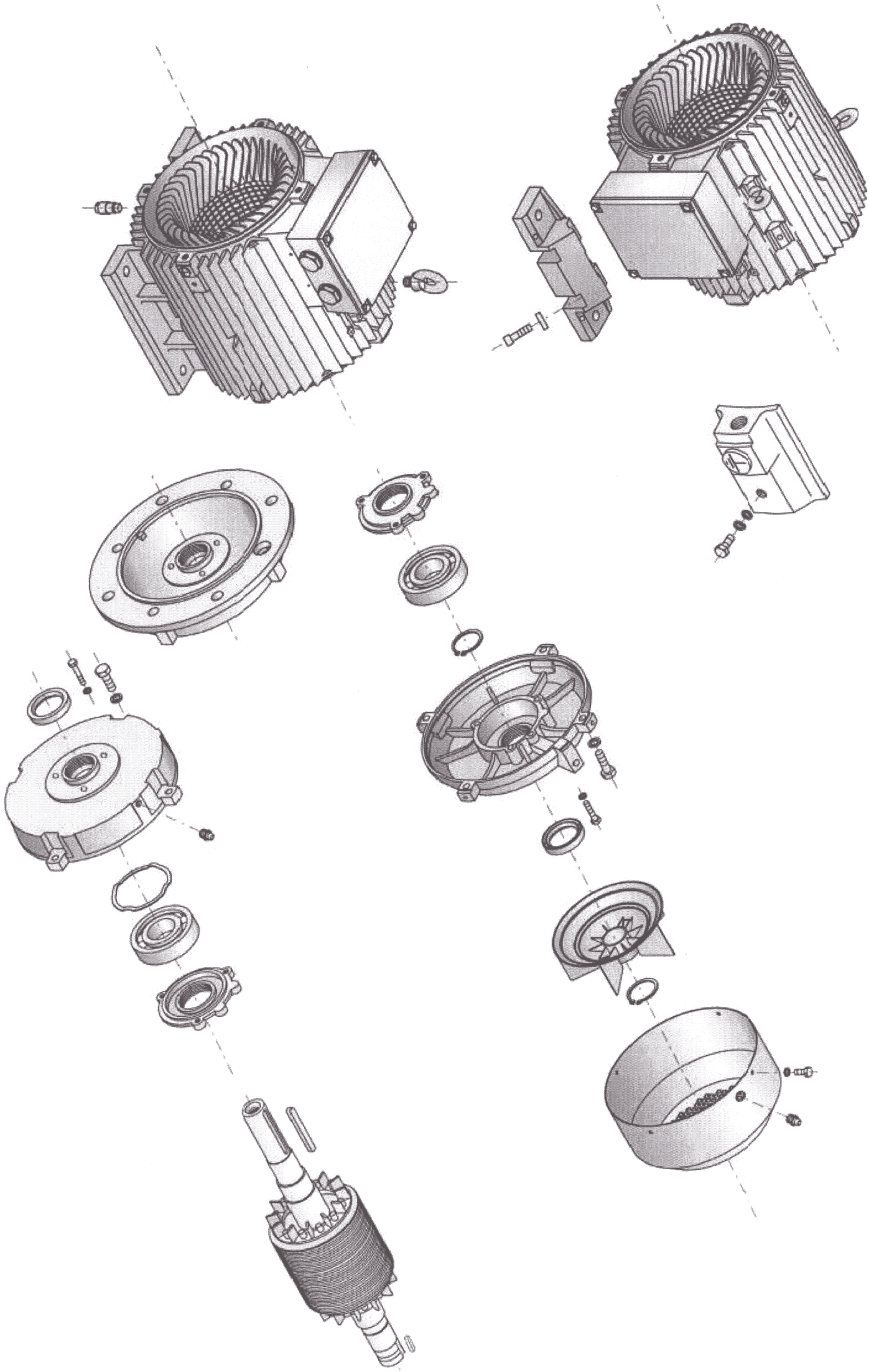
cooling

- T.E.F.C. - IC 411 (IEC 34-6) with external cooling by fan

dimensions

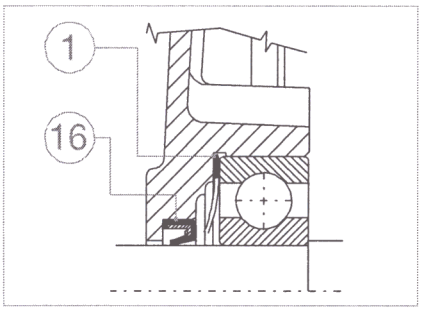
- according IEC 72-1
  DIN 42673 / DIN 42677



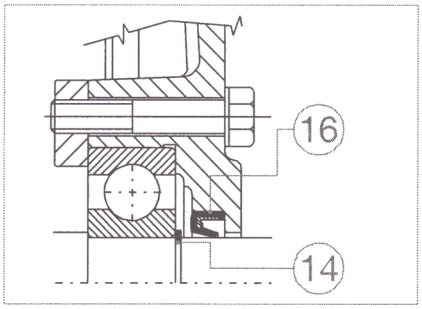


motorconstruction

motortype 4AP 56 to 100



D.E. (Driven End)



N.D.E. (Non Driven End)

description

1. waved washer
2. bearing D.E.
3. motor endshield D.E.
4. terminal box
5. terminal box cover
6. stator frame
7. rotor stack
8. stator stack
9. inner bearing cover N.D.E.
10. motor endshield N.D.E.
11. fan
12. bearing N.D.E.
13. fanhood
14. circlip
15. tapped hole for earthing bolt
16. oil seal (IP55 and IP56)
17. gamma seal type RB (IPW55 - IP56)

cooling

- T.E.F.C. - IC 411 (IEC 34-6) with external cooling by a fan (standard)

construction

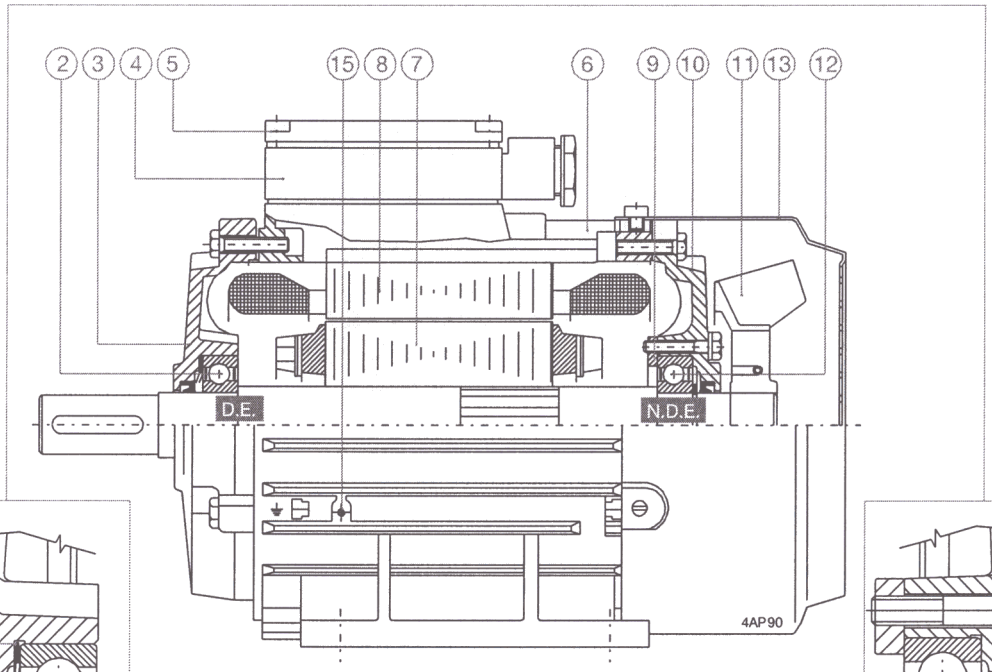
- cast iron end shields and flanges
- frame size 56 to 90: aluminium housing
- frame size 100: cast iron (standard) or aluminium housing
- all frame sizes aluminium terminal box (turnable 4 x 90°)
- SKF ball bearings or equivalent, type 2Z fixed on N.D.E.-side. D.E.-side with waved washer for reduced axial preloading.

mounting

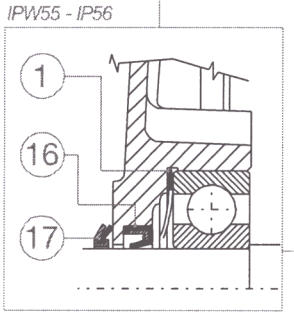
- foot mounted motor IM 1001 (IM B3)
- flange mounted motor IM 3001 (IM B5) - IM 3601 (IM B14)
- foot/flange mounted motor IM 2001 (IM B35) - IM 2101 (IM B34)
- flange mounted motor IM 3011 (IM V1) + cover
- all frame mountings according IEC 34-7 code II(I)

dimensions

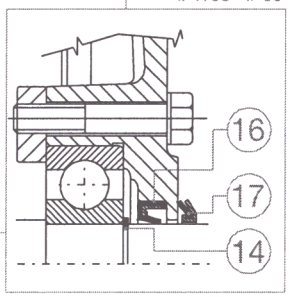
- according IEC 72-1 DIN 42673 / DIN 42677

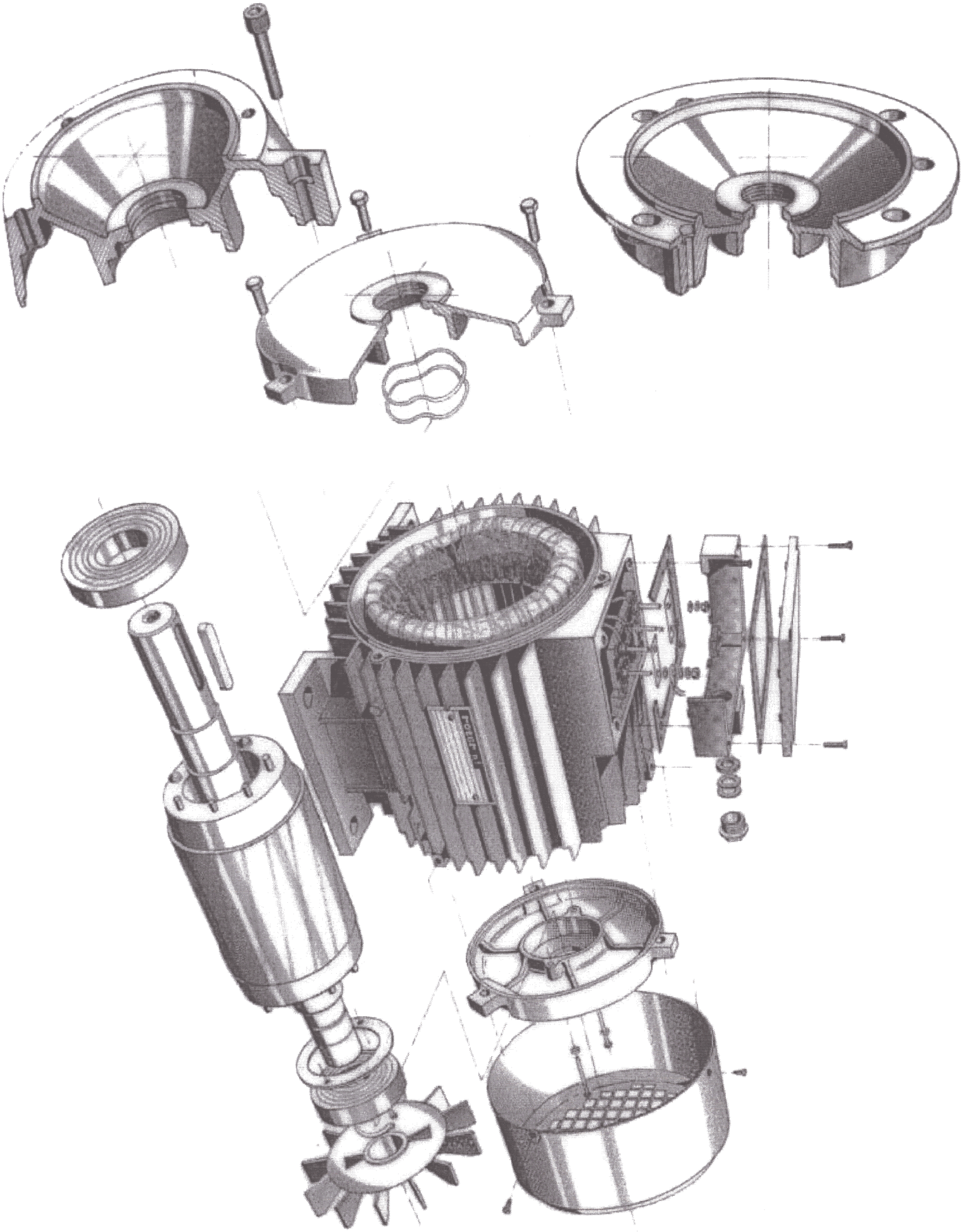


IPW55 - IP56



IPW55 - IP56





4 Hydraulic system flushing

Flushing is a cleaning method to remove particles from the hydraulic system of the power pack and the hydraulic lines to its consumers.

Flushing is only necessary:

1. After completing the installation of the hydraulic system (before the first operational use!).
2. When suspecting severe contamination of the system
3. After taking an oil sample with faulty results
4. When failure of a component has been detected, like the hydraulic motor or hydraulic pump.

4.1 Pre-requisites

Only use clean hydraulic lines and components when assembling a hydraulic system. Blank off component openings and lines after cleaning and before installation.

Before starting a flushing procedure make sure the hydraulic oil in the hydraulic oil tank and the system is clean.

To expel a large percentage of contaminants and degraded fluid:

1. Drain the oil from the tank and the system as thoroughly as possible
2. Replace the oil filter (see 4.8)
3. Clean the hydraulic lines and tank mechanically
4. Fill the tank to the minimum level required and allow the oil to circulate at normal operating temperature
5. Drain the oil and replace the filter for the second time
6. Refill the hydraulic tank.

When the system has been emptied completely, make sure to bleed air from the hydraulic pump at the case drain connection (L). Fill the hydraulic oil tank with enough oil to compensate for the hydraulic oil used for bleeding the hydraulic pump.

4.2 Duration of flushing procedure

The duration of the flushing procedure depends on the size of the system.

You may use the following as guideline:

- Main lines, first cycle: approx. 6 hours
- Consumer lines (each): approx. 2 hours
- Main lines, second cycle: approx. 4 hours.

4.3 Normal periodic inspection intervals and maintenance

Replace the hydraulic filter element:

- When the indicator points to the red area
- After 1000 operating hours or
- At least every 6 months.

Replace the hydraulic oil:

- After the first 300 – 500 hours
- When contaminated
- After 4000 operating hours.

4.4 Preparation

Replace the filter element in the hydraulic oil filter (if not already done).

Make a by-pass connection between the pressure and the return connecting points of the hydraulic lines that need to be flushed.

An (adjustable) orifice must be installed between the pressure and return line to allow pressure build-up of the hydraulic pump.

Make sure the hydraulic oil tank is sufficiently full (± ¾ full 245 litre).

Adjust the pressure relief valve on the hydraulics control panel to minimum pressure (rotating counter clockwise).

Make sure all hydraulic connections in the system are connected securely and are not leaking.

4.5 Flushing procedure

Note:

Use the normal procedures for starting and stopping the power pack as described in the instruction manual!

4.5.1 Start procedure

1. Start the power pack and allow it to operate for about 30 minutes to remove as much air from the system as possible
2. Check the hydraulic lines for leakage
3. Slowly increase the pressure to 70 bar and allow it to stabilize
4. Stop the power pack
5. Adjust the pressure relief valve to minimum pressure
6. Inspect the oil in the oil tank for contamination (take an oil sample)
7. Correct the hydraulic oil level if necessary.

4.5.2 Main lines (first cycle)

Caution!

During the main lines flushing procedure monitor the hydraulic oil level in the tank, the temperature of the hydraulic oil and the differential pressure indicator on the hydraulic filter. Check the hydraulic lines for leakage.

1. Start the power pack
2. Slowly increase the pressure to 70 bar and allow it to stabilize
3. Open the adjustable orifice between the main pressure line and the main return line
4. Check the hydraulic lines for leakage
5. Maintain a pressure of 70 bar
6. Flush the main lines for approx. 6 hours
7. Stop the power pack
8. Adjust the pressure relief valve to minimum pressure
9. Close the adjustable orifice between the main pressure line and the main return line
10. Inspect the hydraulic filter for contamination and replace if necessary
11. Inspect the oil in the oil tank for contamination (take an oil sample)
12. Correct the hydraulic oil level if necessary.

4.5.3 Consumer lines (each, one by one)

Repeat the following steps for each consumer connection.

Caution!

During the consumer lines flushing procedure monitor the hydraulic oil level in the tank, the temperature of the hydraulic oil and the differential pressure indicator on the hydraulic filter. Check the hydraulic lines for leakage.

1. Start the power pack
2. Slowly increase the pressure to 70 bar and allow it to stabilize
3. Open the adjustable orifice between one consumer pressure line and the return line
4. Check the hydraulic lines for leakage
5. Maintain a pressure of 70 bar
6. Flush the consumer lines for approx. 2 hours
7. Stop the power pack
8. Adjust the pressure relief valve to minimum pressure
9. Close the adjustable orifice between the flushing consumer pressure line and the return line
10. Inspect the hydraulic filter for contamination and replace if necessary
11. Inspect the oil in the oil tank for contamination (take an oil sample)
12. Correct the hydraulic oil level if necessary.

4.5.4 Main lines (second cycle)

Carry out the following steps after flushing all consumer lines.

Caution!

During the main lines flushing procedure monitor the hydraulic oil level in the tank, the temperature of the hydraulic oil and the differential pressure indicator on the hydraulic filter. Check the hydraulic lines for leakage.

1. Start the power pack
2. Slowly increase the pressure to 70 bar and allow it to stabilize
3. Open the adjustable orifice between the main pressure line and the main return line
4. Check the hydraulic lines for leakage
5. Maintain a pressure of 70 bar
6. Flush the main lines for approx. 4 hours
7. Stop the power pack
8. Adjust the pressure relief valve to minimum pressure
9. Close the adjustable orifice between the main pressure line and the main return line.

4.5.5 Finishing

1. Replace the hydraulic filter (see 4.8)
2. Inspect the oil in the oil tank for contamination (take an oil sample)
3. Correct the hydraulic oil level if necessary
4. Operate the power pack and check the hydraulic filter for leakage
5. Make a report of the flushing results.

4.6 Power flushing procedure

If the oil sample in the finishing procedure (see 4.5.5) is an unsatisfactory a power flushing procedure needs to be carried out.

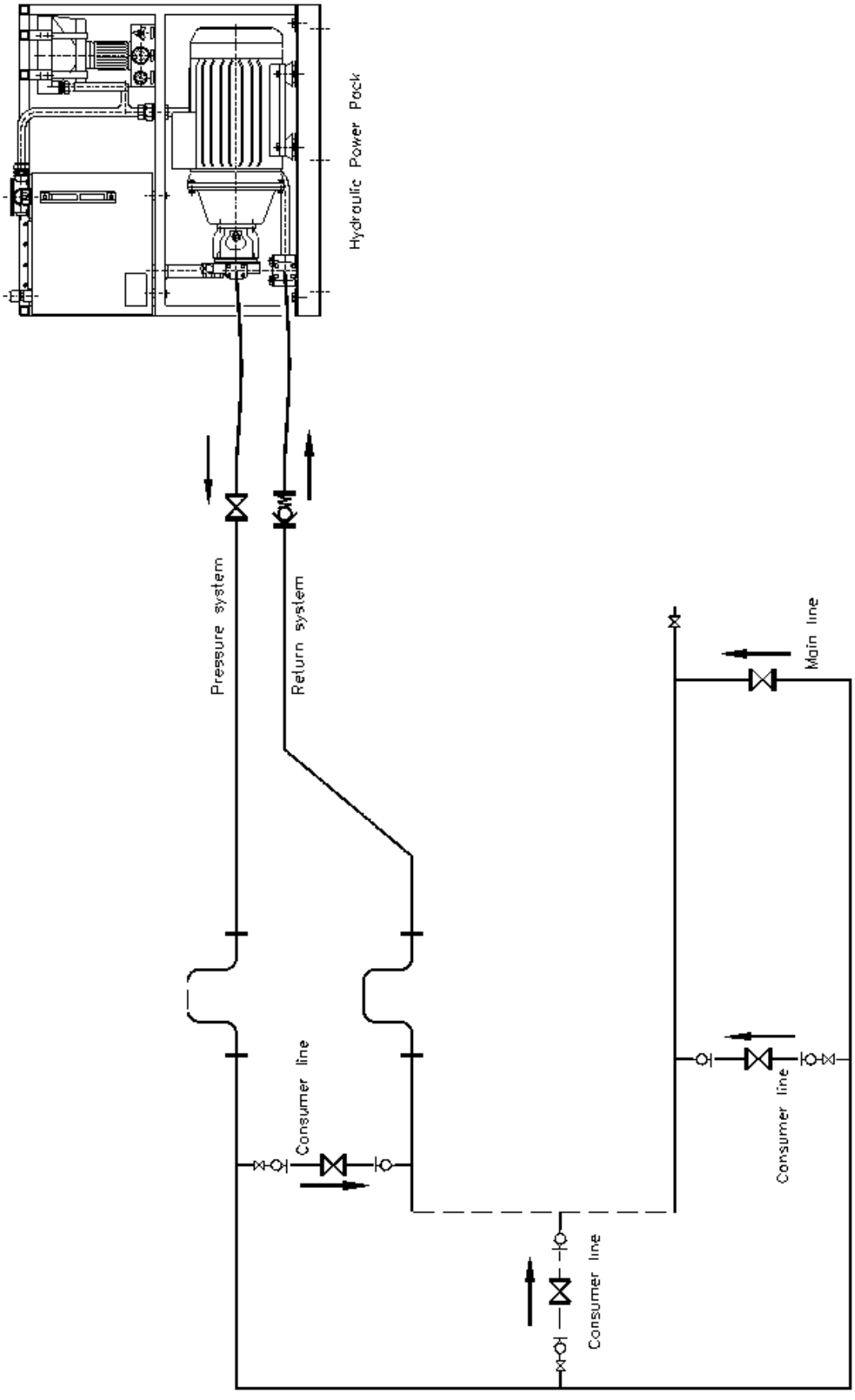
Power flushing involves the use of a purpose-built rig (*not supplied by Marflex*) to circulate a low viscosity fluid at high velocities to create turbulent flow conditions.

A flushing rig is typically equipped with a pump that has a flow rate up to several times of that of the system's normal flow, directional valves, accumulators, fluid heater and cooler and of course, a bank of filters.

Directional valves enable the flushing direction to be changed, the accumulators enable pulsating flow conditions and the heater and cooler enable the fluid temperature to be increased or decreased. All of these can assist in the dislodgment of contaminants.

Analysis of the flushing fluid must be performed regularly during the flushing operation to determine the cleanliness of the system.

4.7 Example of a ships hydraulic system



4.8 Removal / installation of the hydraulic oil filter element

Type: Finn-Filter FK 1099

Replace filter element:

- When the indicator points to the red area
- After 1000 operating hours or
- At least every 6 months.

4.8.1 Hydraulic oil filter element removal

Danger!

Make sure the hydraulic system is completely de-pressurized before opening the hydraulic filter!

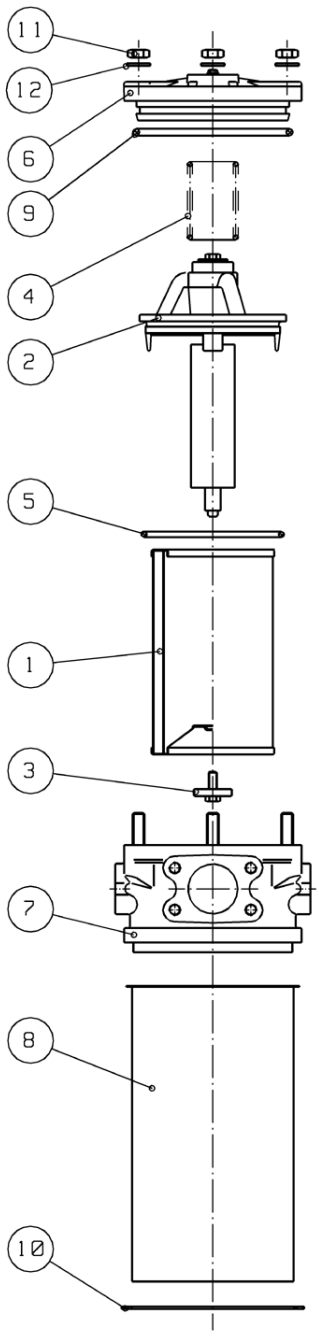
Warning!

Dispose of the used filter element properly!

1. Remove the three nuts (11) and washers (12) from the filter end cap (6)
2. Remove the filter end cap and the spring (4) from the filter housing (7)
3. Lift the filter element (1) with filter holder assembly (2) out of the filter housing
4. Remove the element from the holder assembly by removing the bolt with support plate (3) from the filter bottom
5. Inspect the filter element for contamination.

4.8.2 Hydraulic oil filter element installation

1. Check the condition of the O-ring on the filter end cap (9) and the O-ring on the filter holder assembly (5). Replace if necessary
2. Clean all parts of the hydraulic oil filter and inspect for damage. Replace if necessary
3. Apply some oil on the seals and the threads before installation
4. Install the filter element (1) on the filter holder assembly (2) and secure with the bolt with support plate (3)
5. Place the filter holder assembly with the filter element in the filter housing (7)
6. Install the spring (4) with the filter end cap (6) on the filter housing and secure with the nuts (11) and washers (12)
7. Operate the power pack and check the hydraulic oil filter for leakage.



Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

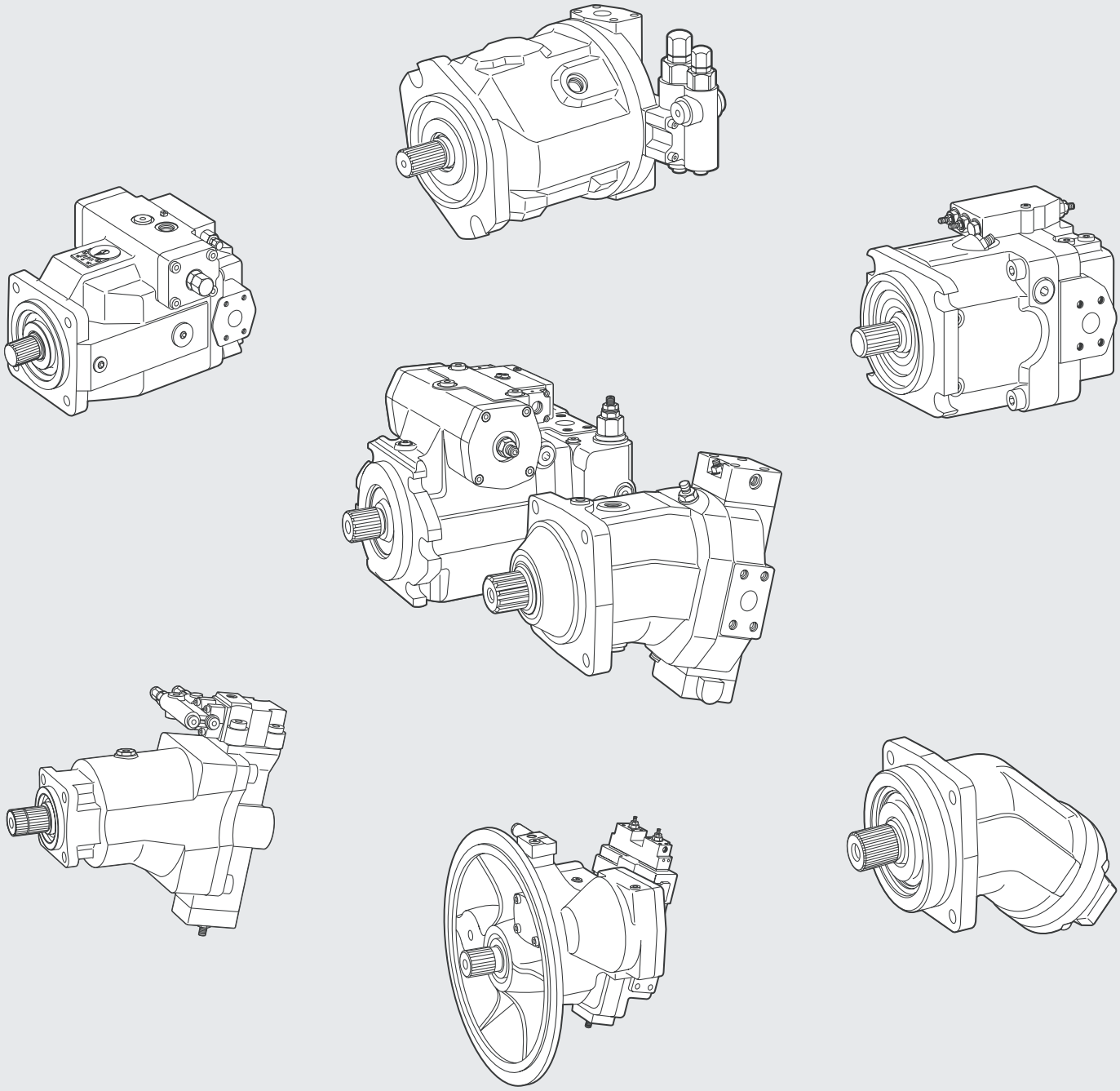
Rexroth
Bosch Group

General Operating Instructions for Axial Piston Units

RE 90 300-B/02.06
Replaces 05.05

B

General Operating Instructions



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This website also provides information about contact persons in other countries.

Manufacturer details are available on the axial piston unit name plate.

Contents

Avoiding hazards

DANGER!

To ensure reliable operation and to avoid damage when performing an installation, commissioning or repair work, study these operating instructions carefully and thoroughly!

Bosch Rexroth AG can not be held liable for any personal injuries or machine damage arising from non-adherence to these operating instructions. In case of damage induced by disregard of these operating instructions, any warranty provided by Bosch Rexroth AG will be rendered null and void and liability placed with the operator.

1 About these instructions

1.1 Structure and requirements

Documents

Operating instructions for Rexroth axial piston units consist of three part documents:

- General operating instructions for axial piston units

  These general operating instructions for axial piston units will assist you during installation, commissioning and operation of Rexroth axial piston units. These include axial piston pumps and motors for use in open or closed hydraulic circuits.

  Unless stated differently, the information in these operating instructions applies to all Rexroth axial piston units. Information, which only applies to specific pumps or motors or hydraulic concepts, is marked in the text accordingly.

- Product-specific operating instructions

  The product-specific operating instructions for the individual Rexroth axial piston units contain additional, specific information on installation, commissioning and operation. Not every Rexroth axial piston unit is supplied with its own product-specific operating instructions.

  Always observe both the details in the product-specific operating instructions and the details in the general operating instructions RE 90 300-B.

- Technical data sheet

  The technical data sheets for the individual Rexroth axial piston units contain the complete technical data.

Please contact Rexroth to request the missing parts of the documentation, if you are not in possession of the whole set of documents. Safe operation of Rexroth axial piston units can only be guaranteed if you observe the details in all the part documents.

General operating instructions

These general operating instructions will assist you during installation, commissioning and operation of Rexroth axial piston units. You will require the individual chapters of these instructions for the different phases of working with the axial piston unit:

- "2 Safety" on page 7 explains how the instructions in this document are to be understood and contains several basic safety instructions on handling axial piston units.
- "3 Product description" on page 11 provides you with information on the identification of axial piston units as well as its proper and intended use.
- "4 Installation" on page15 provides you with information on the installation, and on the disassembly and storage of axial piston units.
- "5 Commissioning" on page 25 explains what you have to observe during the commissioning of the axial piston unit and machine or the system.
- The overview in "6 Troubleshooting" on page 31 assists you in searching and tracing faults on the axial piston unit and the general machine or system.

- "7 Servicing" on page 35 provides you with information on maintenance, inspection and repairs to the axial piston unit.
- The Annex starting on page 37 contains project-planning notes for selection of the hydraulic fluid, and design of the tank, filter and heat exchanger as well as the correct piping of the hydraulic system.

Area of validity for these instructions

These operating instructions are valid for Rexroth axial piston units for operation with permissible hydraulic fluids. Information on permissible hydraulic fluids is available in the technical data sheet.

These operating instructions are for the:

- machine or system manufacturer,
- operating company,
- operator.

Each particular installation drawing, technical data sheet and order confirmation of the Bosch Rexroth AG is also binding for the machine or system manufacturer.

Important documents

Before starting with the tasks described in this instruction manual, make sure that the following documents are already available:

- **Product-specific operating instructions**
  The product-specific operating instructions contain special information valid for each particular axial piston unit. Please ask Rexroth if there is a product-specific instruction manual for your axial piston unit.
- **Order confirmation**
  The order confirmation contains the preset technical data. The axial piston unit may only be operated using the values and conditions specified in the order confirmation.
- **Installation drawing**
  The installation drawing for the axial piston unit contains the outer dimensions, all connections and the hydraulic plan for the axial piston unit.
- **Technical data sheet**
  The technical data sheet contains among other things the permissible technical data for the axial piston unit.
- **General connection plan of the machine or system**
  The hydraulic and electrical connection plan of the machine or system contain the information of the hydraulic or electrical connections. You need this data to work with the axial piston unit as part of the machine or system. You will get the documentation from the machine or system manufacturer.

The following Rexroth publications give further information about installation and operation of the axial piston unit:

- **RE 90 220: Mineral-oil based hydraulic fluids**
  Describes the requirements on a mineral-oil based hydraulic fluid for the operation of a Rexroth axial piston unit and assists you in selecting a hydraulic fluid for your system.
- **RE 90 221: Environmentally acceptable hydraulic fluids HEES, HEPG, HETG for axial piston units**
  Describes the requirements on an environmentally acceptable hydraulic fluid for the operation of a Rexroth axial piston unit and assists you in selecting a hydraulic fluid for your system.
- **RE 90 223: Axial piston unit for the operation with HF hydraulic fluids**
  Contains additional information on the use of Rexroth axial piston units with HF hydraulic fluids.
- **RE 90 300-03-B: Information on using hydraulic drives at low temperatures**
  Contains additional information on the use of Rexroth axial piston units at low temperatures.

1.2 Staff requirements

General requirements, qualification

Axial piston units may only be installed and operated by qualified personnel.

Qualified personnel is someone who is able to evaluate his tasks, to recognize dangers, and to take necessary measures to provide risks of accidents on the basis of his professional education, his knowledge and experience as well as the knowledge of relevant regulations.

Persons who are currently being instructed, trainees, or supervised persons under 18 may not work on Rexroth hydraulic products.

This does not apply for adolescents with a minimum age of 16, if

- the work with Rexroth hydraulic products is necessary for reaching the training goal,
- the protection of the adolescent is guaranteed by an experienced supervisior and if they use only work equipment, tools and protection means which exclude injuries.

Persons, who are alcoholized, or under the influence of drugs or medicaments, which affect the reactivity may generally not operate or maintain Rexroth hydraulic products.

Requirements on maintenance staff

Maintenance measures can be necessary to obtain the operability of the axial piston unit. Details are available in chapter "7 Servicing" (page 35).

Maintenance measures include inspection, service and maintenance of hydraulic and electrical components. For these different activities different levels of minimum qualifications of the staff are required.

To perform **inspections** on the outermost parts of the axial piston unit the staff has to fulfill the following requirements:

- he/she has to be instructed in the task.

To perform **service** tasks on hydraulic parts of the axial piston unit personnel must fulfill the following requirements:

- he/she has to introduced in the task,
- he/she has have specific hydraulic knowledge,
- he/she has be able of reading and fully understanding hydraulic plans,
- he/she has fully understand the relations regarding the installed security devices and,
- he/she has fully understand the function and configuration of the hydraulic components.

Repair work on axial piston units may only be made by repair shops who are authorized by Rexroth. Rexroth offers a complete range of services for the repair of Rexroth axial piston units.

For electric work generally applies the following:

- Work on electric equipment may only be done by an authorized and trained electrician or by instructed persons under the direction and supervision of an authorized trained electrician according to the electro-technical regulations.

1.3 Hazard markings and pictograms

This instruction differentiate between categories of hazards as per ISO Guide 37:

⚠ DANGER!	This hazard marking warns of high risk, lethal dangers and severe injuries.
⚠ WARNING	This hazard marking warns of medium risk, injuries and severe property damage.
⚠	This hazard marking warns of low risk and property damage.
Note	This marking refers to information, which helps to better understand the machine processes, or which refers to special or important circumstances.
Tip	This marking refers to information which helps to work more efficient.

2 Safety

Read this chapter carefully before starting to work with the axial piston unit.

Rexroth axial piston units are to be installed as components in machines or systems. The safety regulations in this instruction relate to axial piston units only. Please note additionally the manufacturer's safety regulations for the machine or system.

2.1 Basic safety instructions

Please observe strictly the following safety instructions as well as the safety instructions of the machine or system manufacturer, to avoid any injuries and health damages as well as material damage and environmental pollution.

⚠ DANGER! **Danger of life**

Working on operational machines or systems forms a danger to life or physical condition.

The works described in this document may only be performed on disconnected **machines or systems**. Before starting to work please ensure that:

- the engine cannot be switched on.
- all power transmitting components and connections (electric, pneumatic, hydraulic) are switched off according to the manufacturers instructions and cannot be switched on again. If possible, remove the main fuse on the machine or system.
- the machine or system is completely hydraulically relieved (depressurized). Please follow the instructions of the machine or system manufacturer.

⚠ WARNING **Risk of injury**

To avoid any injuries, please observe the following recommendations regarding **safety wear**:

- While working on the machine or system always wear safety shoes with steel caps.
- While working with dangerous substances (for example hydraulic fluids) always wear safety gloves, safety glasses and suitable working clothes.

⚠ DANGER! **Risk of toxication and injury**

Contact with hydraulic fluids may damage your health (e.g. eye injuries, skin and tissue damage, toxication at inhalation).

- Please check the lines for wear or damage before each inital operation.
- Please wear thereby protective gloves, safety glasses and suitable working clothes.
- If however hydraulic fluid contacts the eyes or penetrates your skin please consult a doctor immediately.
- When dealing with hydraulic fluids absolutely observe the safety instructions of the hydraulic fluid manufacturer.

⚠ WARNING

Risk of burns!

The axial piston unit heats up during operation. Also the solenoids on the axial piston unit heat up during operation. Touching the axial piston unit or solenoids could result in severe burn injuries.

- Always allow the axial piston unit to cool down before touching it.
- Protect yourself by wearing heat-resistant gloves and protective clothing.

⚠ DANGER!

Risk of toxication and injury

While searching for leakages escaping hydraulic fluid can penetrate the skin and cause severe poisoning and injuries.

- Only search for leakages when the machine is switched off and depressurized.

⚠ WARNING

Risk of injury and damage

Incorrectly connected components can cause severe malfunctions.

- Ensure that pipes are connected according to the connection plan.
- Perform component-oriented functional tests.

⚠ DANGER!

Fire hazard

Hydraulic pressure fluid is flammable.

- Please obstruct a naked flame and ignition sources from the axial piston unit.

⚠ WARNING

Hearing damage

The noise emission of axial piston units depends on speed, operating pressure and installation conditions. You can count on the fact that the sound pressure level rises above 70 dBA on normal operating conditions. This may cause hearing damage.

- Always wear hearing protection while working next to the operating axial piston.

⚠ WARNING

Environmental pollution

Hydraulic fluids are water-endangering fluids. Leaking hydraulic fluid can cause toxication of the groundwater and ground contamination.

- Place a collector vessel under the axial piston unit.
- Remedy the leakage immediately.
- National laws and regulations must be observed at all times. In Germany hydraulic machines or systems are classified as "systems for handling water-polluting substances for the purpose of the Federal Water Act (WHG)". In this context please note especially §1 and §19 of the WHG (§19g, 19i, 19l).
- Further information is available in the Rexroth publications "Mineral-oil based hydraulic fluids", RE 90 220. "Environmentally acceptable, rapid biologically degradable hydraulic fluids HEPG, HEES for axial piston units", RE 90 221 and "Axial piston units for operation with HF hydraulic fluids, RE 90 223.

2.2 Due diligence of the operating company and the operator

The operating company and the operator has to ensure that

- the axial piston unit is only used conventionally (see "3.5 Conventional use" on page 13).
- the axial piston unit is stored, operated and repaired according to the operating and environmental conditions defined in the technical data, and especially that the limits given in the technical data will not be exceeded.
- the axial piston unit after being repaired may only be operated if in proper and fully functional condition.
- required personal protective equipment is available to the staff and that it will be worn.
- while working on the axial piston unit the engine has been securely switched off and the system has to be depressurized.
- the operating instructions (general and product-specific) are always available in a legible and complete status at the location of the axial piston unit.
- only qualified and authorized staff will be deployed for the maintenance of the axial piston unit.

Note

For storing, installation, commissioning or operation of the axial piston unit at low temperatures (lower than –25 °C) the instructions in the Rexroth publication "Instructions on using hydrostatic drives at low temperatures", RE 90 300-03-B must be observed.

Note

In addition to the instruction manual please observe generally valid, statutory and other binding regulations of the national legislation for accident prevention and environmental protection.

2.3 Responsibility of the machine or system manufacturer

Rexroth axial piston units are components for the purpose of the Machine Directive 98/37/EG (sub units), which are used for the installation in a machine or a system. Rexroth axial piston units are no ready-to-use machines for the purpose of the EU Machine Directive.

Bosch Rexroth AG indicates that the scope of supply is exclusively intended for the installation in a machine or system or to be connected with other components to a whole new machine or system.

This instruction serves as a basis for the general system instructions to be issued by the machine or system manufacturer.

Commissioning is prohibited until it is secured that the machine or system, in which these products are installed, comply with the regulation of the EU Directives and all other guidelines regarding the machine or system.

In addition to the machine guidelines, additional guidelines such as, e.g. pressure vessel directive and explosion protection directive, are also valid. The interaction of the hydraulic product with the machine or system, in which the hydraulic product is installed, can cause various dangers. For this reason make sure that the hydraulic product is unreservedly applicable for its intended use at its installation point.

The interfaces to the general machine and the operating conditions are of major significance. We recommend that the result of the danger analysis (risk assessment) for the general machine has also to be involved in the planning for the hydraulic product.

Note

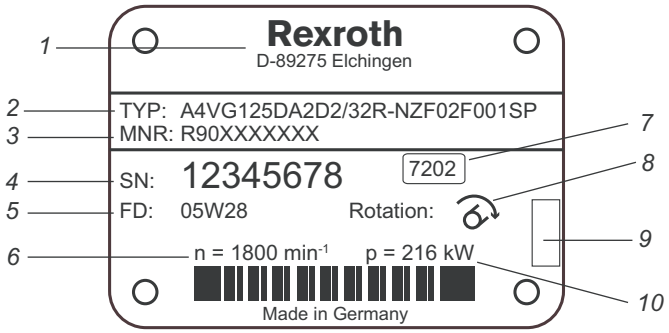
For storing, installation, commissioning or operation of the axial piston unit at low temperatures (lower than –25 °C) the instructions in the Rexroth publication "Instructions on using hydrostatic drives at low temperatures", RE 90 300-03-B must be observed.

3 Product description

This chapter explains how to identify an axial piston unit using the name plate. In addition you will get information how to use the axial piston unit properly.

3.1 Identification of the axial piston unit

The axial piston unit can be identified with the name plate. The following example shows the name plate of a variable pump A4VG:



The name plate contains the following information:

1 Manufacturer

2 Ordering code

3 Material number of axial piston unit

4 Serial number

5 Production date

6 Speed [1])

7 Internal plant designation

8 Direction of rotation (looking on to shaft, here: clockwise)

9 Designated area for test stamp

10 Power [1])

[1]): Positions 6 and 10 vary depending on the product.

3.2 Functional description

The product spectrum of Rexroth axial piston units covers the following categories:

- Type of function: pump or motor
- Type of circuit: open or closed hydraulic circuit
- Design: bent axis or swashplate
- Displacement: fixed or variable

The pressure range of Rexroth axial piston unit is available in the technical data sheet.

Axial piston **pumps** are designed and built for the generation, the control and the regulation of a hydraulic flow and are product-specific in the open or closed circuit. Thereby they are powered by an "engine".

Note

In these operating instructions the term "engine" is used as a generic term for diesel, petrol, gas and electric engines.

Axial piston **units** are designed and built to convert the hydraulic flow into rotation and torque.

Axial piston units are used to build hydrostatic transmissions for the insertion in static or mobile operation. Such transmissions are suitable for the transmission of outputs for moving, turning, lifting and for all kinds of motion involving large forces.

A detailed functional description is available in the product-specific operating instructions for your axial piston unit.

3.3 Scope of supply

The following components are part of scope of supply of axial piston units:

- Axial piston unit with transport protection
- Protective caps
- Flange covers
- Label with commissioning information

3.4 Technical data

Details on technical data of your axial piston unit are available in the technical data sheet.

The set technical data of your axial piston unit are available in the order confirmation.

3.5 Conventional use

Observe the following while operating the axial piston unit:

- The axial piston unit may only be stored in a dry and dust-free atmosphere, which is free of corrosives and vapors.

  The factory corrosion protection is sufficient when stored under the specified conditions, unless condensate or leakage water penetrates the axial piston unit.

- The axial piston unit may only be operated using the following hydraulic fluids:
  - Mineral oils according to the "Mineral-oil based hydraulic fluids" data sheet (RE 90 220)
  - Environmentally acceptable hydraulic fluids according to the "Environmentally acceptable hydraulic fluids HEES, HEPG, HETG for axial piston units" data sheet (RE 90 221)
  - Fire resistant HF hydraulic fluids according to the "Axial piston units for operation with HF hydraulic fluids" data sheet (RE 90 223)

  You can get information about using the product combined with other hydraulic fluids on request.

  When using non mineral-oil based hydraulic fluids observe the restrictions in the "Environmentally acceptable hydraulic fluids HEES, HEPG, HETG for axial piston units" (RE 90 221) and "Axial piston units for operation with HF hydraulic fluids" (RE 90 223).

- The axial piston unit may only be operated under the specified operating conditions.

  The axial piston unit may only be operated when technically in perfect working order and further it may only be stored, operated and repaired according to the technical data, operating and environmental conditions mentioned in the order confirmation. Particularly the limits specified in the technical data may not be exceeded.

  For storing, installation, commissioning or operation of the axial piston unit at low temperatures (lower than –25 °C) the instructions in the Rexroth publication "Instructions on using hydrostatic drives at low temperatures", RE 90 300-03-B must be observed.

- The axial piston unit may only be operated with the specified output data.

  The operation with other connection, application or output data, than those specified in the general and product-specific operating instructions and the technical data sheet, is only permitted with a written agreement of Bosch Rexroth AG. Additionally, the technical details specified in the respective order confirmation of Bosch Rexroth AG apply related to a system. The order confirmation is available for the machine or system manufacturer and is binding.

- The axial piston unit may only be used for the specified purpose.

  The axial piston unit may not be used for other purposes than the specified one, unless Bosch Rexroth AG agreed the other purpose in written form. The operating instructions of the machine or system manufacturer and if necessary any technical data must be strictly observed.

- The axial piston unit may not be used in explosive environments.

  Ignition sources are not allowed in immediate vicinity of the axial piston unit, because hydraulic fluid escaping may be flammable or even explosive.

- General use and predictable fault usage has to be considered (Device and Product Safety Act GPSG, Product Liability Act PHG).

Note

Any deviations from the intended usage or specifications contained in these instructions, technical modifications and conversions of the axial piston unit, and the operation of individual parts or the installation of individual parts into other products will affect the safety and exclude any warranty.

4 Installation

This chapter describes the essential, generally valid steps for the installation of Rexroth axial piston units. Read this chapter if you:

- wish to install an axial piston unit into a static or mobile hydraulic system or
- wish to disassemble or dispose an axial piston unit.

Also observe the details of the installation in the product-specific operating instructions of your axial piston unit.

Note

Observe the underlying safety instructions on page 7 of these operating instructions for all work performed for installation of the axial piston unit.

The following warning is corresponding to all variable pumps influencing with an external signal the volume flow resp. the flow direction (e.g. with HD or EP control unit):

⚠ CAUTION

The spring centering in the pilot control unit is not a safety device

Through contamination in the control unit – e.g. in hydraulic fluid, wear particles, or particles out of a system –the valve spool can get stuck in an undefined position. In this case, the pump flow does not follow the command inputs of the machine operator anymore .

- Make sure that a proper emergency shut down function can bring the driven machine movements to a safe position immediately (e.g. stop).
- Adhere to the specified cleanliness level 20/18/15 (< 90 °C) or 19/17/14 (> 90 °C) to ISO 4406.

You will find all information about the selection of the hydraulic fluid and the design of the tank, the filter and the heat exchanger as well as for correct piping of the hydraulic system in the Annex as from page 37.

Structure of chapter

This chapter is structured as follows:

- "4.1 General installation instructions" on page 16 contains information that must be observed before and after the installation.
- Information on unpacking the axial piston unit is available on page 17.
- As from "4.3 Preparing axial piston unit for assembly" on page 17 you will be informed about the steps for the installation.
  The following sections describe the necessary steps.
  - Unpacking of the axial piston unit.
  - Assembly of the axial piston unit at the scheduled installation location.
  - Connection of the hydraulic lines.
  - Connection of an electrical controller (optional).
- "4.8 Disassembling the axial piston unit" on page 23 and the following sections contain information about disassembling, storing or disposing the axial piston unit.

4.1 General installation instructions

The installation location and position for an axial piston unit essentially determine the process of installation and commissioning (as when filling the axial piston unit).

Information about permitted installation locations and positions is available in the product-specific operating instructions or in the technical data sheet.

Note

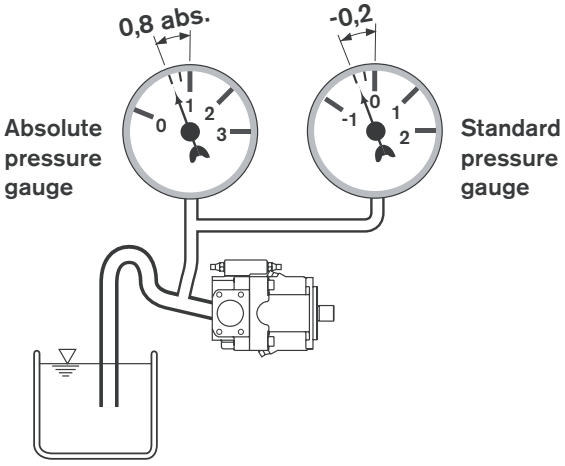
Please count on an influence of the control device while operating with variable axial piston units which are assemblied in certain installation locations. Because of gravity, dead weight and housing internal pressure minor curve displacements and actuating time changes may occur.

Valid for all installation positions:

- The housing of the axial piston unit must be filled and air bled with hydraulic fluid at commissioning and during operation.
- To achieve favorable noise values, decouple all connecting lines (suction, pressure and leakage fluid connections) from the tank using flexible elements.

Suction pressure for pumps

Generally in all installation positions and locations a **minimum suction pressure** at connection "S" is prescribed for all pumps : Minimum suction pressure ≥ 0.8 bar abs (additional values see technical data sheet).



⚠ CAUTION

Risk of damage for to axial piston unit

The axial piston unit must always be filled with hydraulic fluid.

- During commissioning make sure that the axial piston unit is supplied with sufficient hydraulic fluid.
- Ensure that the entire hydraulic system is tight.
- In the case of unusual noise or vibration development switch off the machine or system immediately and check whether the axial piston unit has been filled with hydraulic fluid.

Cleanliness

Cleanliness must be observed:

- Absolute cleanliness is required. The axial piston unit must be installed in a clean condition. Contamination of the hydraulic fluid may severely impair the service life of the axial piston unit.
- Do not use any cotton waste or fibrous cloths for cleaning. Use suitable fluid cleaning agents to remove lubricants and other major contamination. Cleaning agent must not penetrate the hydraulic system.

4.2 Unpacking instructions

While unpacking the axial piston unit please observe the following instructions:

⚠ CAUTION

Risk of parts falling down

If the packaging is not opened correctly parts may fall out and damage the parts or result in injury.

- Place the packaging on a flat and sustainable underground.
- Open the packaging from the top only.

Note

The axial piston unit will be delivered in a corrosion protection film. The film can be disposed of with other polyethylene materials.

When disposing of the packaging always observe the national laws.

4.3 Preparing axial piston unit for assembly

To prepare the axial piston unit for assembly:

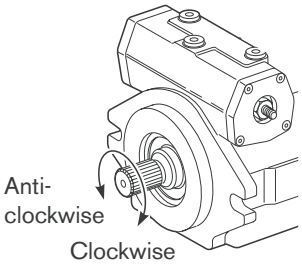
1 Remove the packaging material and dispose it according to the valid regulations.

2 Check the scope of supply regarding transportation damages.

3 Compare the material number and designation (ordering code) with the details in the order confirmation.

If the material number for the axial piston unit does not correspond with the one in the order confirmation. Please contact the Rexroth-Service for clarification.

4 Check the rotational direction of the axial piston unit (on the name plate) and make sure that this corresponds to the directional rotation of the engine or power take-off drive.



Note

Please note that the direction of rotation as specified on the name plate determines the direction of rotation of the axial piston unit with regard to the drive shaft. The engine direction of rotation is described in the engine manufacturer's operating instructions.

4.4 Transporting the axial piston unit to the installation location

Depending on size and local conditions axial piston units can be transported – e.g. using a fork lift truck or hoisting gear.

The drive shaft **can** be used to transport the axial piston unit as long as only outward axial forces occur. Thus you can hook the axial piston unit onto the drive shaft.

Therefore turn an eyebolt into the drive shaft. Make sure that each eyebolt can bear the total weight of the axial piston unit plus approx. 20 %.

⚠ CAUTION

Risk of damage

Prompt or impulsive forces on the drive shaft can damage the axial piston unit.

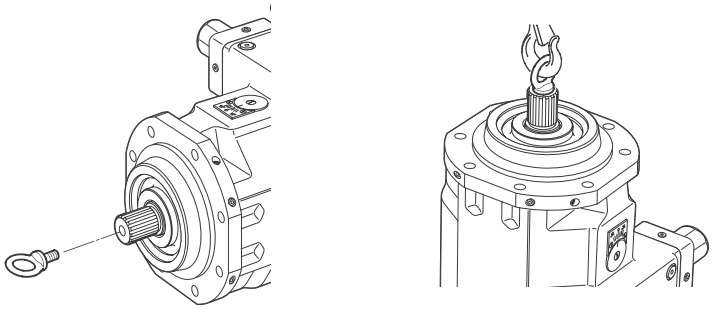
While transporting make sure that the axial piston unit's drive shaft is not subjected to prompt or impulsive forces. That means precisely:

- Do not hit the coupling or drive shaft of the axial piston unit.
- Do not set/place the axial piston unit on the drive shaft.
- Details about the permissible axial and radial loading are available in the technical data sheet.

To transport the axial piston unit to the installation location:

1 Turn the eyebolt into the drive shaft as shown. The size of the thread is stated in the installation drawing.

You can hoist the axial piston unit as shown using the eyebolt screwed into the drive shaft without any risk of damaging it.



4.5 Assembling the axial piston unit

How to assemble the axial piston unit depends on the connecting elements to the drive or the output side. The following descriptions explain the installation of the axial piston unit:

- via coupling
- via a gearbox
- via a cardan shaft

Tool required

You will require the following tool:

The installation drawing contains the dimensions for all connections on the axial piston unit. Please observe also the instructions of the manufacturers for the other hydraulic components when selecting the required tool.

General information

During assembly (and disassembly) of the axial piston unit observe the following general instructions:

- The axial piston unit has to be fixed so that the expected forces and torques can be transferred without any danger.
- The permissible axial and radial loading of the drive shaft, the permissible torsional vibrations, optimum direction of load force, as well as the limit speeds are available in the respective technical data sheet.
- When driving a pump or the output of a motor with the aid of a **cardan shaft** vibrations may occur, which may result in temporary leaks on the shaft seal ring of the axial piston unit depending on the frequency and temperature.
- After a short running time **toothed belts** lose a major portion of their pre-tension and thus cause fluctuations in speed or torsional vibrations.

  Torsional vibrations may result in leakages on the shaft sealing ring of the driven axial piston unit. Particularly at risk are diesel drives with a small number of cylinders and low flywheel mass.

  Rexroth recommends to avoid this type of toothed belt drive or to equip it with an automatic tensioning device.
- **V-belt drives** without automatic tensioning device are also critical in terms of speed fluctuations or torsional vibrations. These can also lead to leakages on the shaft sealing ring.

  An automatic tensioning device can lessen the speed fluctuations and vibrations and thus avoid consequential damage.

  Rexroth recommends the use of V-belt drives only with an automatic tensioning device.
- In both types of **belt drive** the permissible radial loading on the shaft must be observed. If necessary, the belt pulley can be separately mounted.
- The drive and output elements are to be assembled by pulling it onto the drive shaft with the aid of the threaded hole in the drive shaft end.

⚠ CAUTION

Risk of damage

Prompt or impulsive forces on the drive shaft can damage the axial piston unit.

During installation make sure that the axial piston unit's drive shaft is not subjected to prompt or impulsive forces. That means precisely:

- Do not hit the coupler or drive shaft of the axial piston unit.
- Do not set/place the axial piston unit on the drive shaft.
- Details about the permissible axial and radial loading are available in the technical data sheet.

Coupling

To assemble the axial piston unit with a coupling:

1. Assemble the specified coupling half to the drive or output shaft of the axial piston unit according to the coupling manufacturer's specifications.

   The shaft of the axial piston unit is equipped with a threaded hole. The size of thread is stated in the installation drawing. This threaded hole can be used for assembling the coupling.
2. Make sure that the installation location is clean and free from contaminants.
3. Brace the coupling hub onto the drive shaft or ensure a permanent lubrication of the drive shaft. This avoids any formation of frictional corrosion and thus the attendant wear.
4. Transport the axial piston unit to the installation location and assemble the coupling onto the drive or output according to the coupling manufacturer's specifications.

   Please note that the axial piston unit should not be tightened until the coupling has been correctly assemblied.

5 Fix the axial piston unit at the installation location. If necessary, details on the tools required and tightening torques for the fixing screws can be procured from the machine or system manufacturer.

a) For **installation of the bell housing** check the axial play of the coupling through the bell window according to the manufacturer's specifications.

b) For **installation of the flange** align the axial piston unit carrier to the drive or output.

Note

Please note the following:

- Frictional corrosion on the coupling parts is to be avoided either by clamping the coupling hub onto the drive shaft or through constant lubrication.
- When using flexible couplings and after completing the installation check the drive has to be free of resonance.

Installation on a gearbox

Drive shaft connections are to be protected against frictional corrosion (constant lubrication).

The concealed installation means that it is not longer possible to inspect whether the axial piston unit's centering diameter actually centers the axial piston unit (observe tolerances), or whether axial or acts on the drive shaft of the axial piston unit (installation length). The control must therefore take place during the assembly procedure.

Completing the assembly

To complete the assembly:

1 Remove any assemblied eyebolts.

2 Remove transport protection.

The axial piston unit is delivered with protective caps and plastic plugs. They have to be removed before the connection. Which actual transport protection has to be removed at your axial piston unit can be read in the product-specific operating instructions.

Generally the caps and plugs can be removed by hand. If necessary a gripper can also be used.

The protective caps of the adjustment screws may not be removed.

Note

Sealing rings and surfaces may be damaged if the transport protection is not removed correctly.

Please note the following:

- Do not damage the sealing surfaces!
- All ports must have pipes or hoses connected according to the hydraulic connection plan or the ports must be sealed with screw plugs.
- The operating and function connections are designed exclusively for connecting hydraulic lines (see under "4.6 Connecting lines").

3 For axial piston pumps with drive-through:

If a drive through element is used (auxiliary pump, PTO), remove the flange cover and assemble the auxiliary pump as shown in the pump manufacturer's instructions.

4.6 Connecting lines

The machine or system manufacturer is responsible to dimension the lines. The axial piston unit must be connected in line with the hydraulic connection plan of the machine or system manufacturer to the remaining hydraulic system.

Observe the following safety instructions.

⚠ CAUTION

Risk of damage

Hydraulic lines and hoses that are installed under tension, generate additional mechanical forces during operation and thus reduce the service life of the axial piston unit and the overall system.

- Install all lines and hoses free of tension.

⚠ CAUTION

Risk of damage

Generally a minimum permissible suction pressure at port "S" is prescribed for axial piston pumps in all installation locations. If the pressure at port "S" drops under the specified values, damage may occur, which may lead to destruction of the pump.

- Make sure that the required suction pressure is reached by using corresponding piping (suction cross-section, pipe diameter, tank position) and appropriate viscosity .

Note

The operating and function connections are designed exclusively for connecting hydraulic lines.

⚠ WARNING

Risk of wear and malfunctions

The cleanliness of the hydraulic fluid determines the cleanliness and the service life of the hydraulic system. Contamination of the hydraulic fluid leads to wear and malfunctions.
In particular, solid contaminants in the hydraulic lines such as welding beads and metal shavings may damage the axial piston unit.

- Absolute cleanliness is required. The axial piston unit must be installed in a clean condition. Contaminants in the hydraulic fluid could considerably impact the function and service life of the axial piston unit.
- Pay particular attention during installation to ensure that ports, hydraulic lines and attachment parts (e.g. measuring device) are clean. Thoroughly clean these items before opening ports. Make certain than no contaminants enter the system when closing the ports.
- Use suitable liquid cleaning agents to remove lubricants and other difficult-to-remove contaminants.Cleaning agent must not penetrate the hydraulic system.
- Do not use any cotton waste or fibrous cloths for cleaning.
- Do not use hemp or mastic as sealant.

Notes on routing lines

Observe the following instructions when routing the suction, pressure and leakage fluid lines. Observe also the project planning instructions in the Annex (see page 37).

The **suction line** (pipe or hose) must be as short and straight as possible.

The line cross section is to be measured so that the minimum permitted pressure at the suction port is not dropped below and the maximum permitted pressure is not exceeded. Observe the air tightness of the junctions and the pressure strength of the hose compared with the external air pressure.

Sufficient burst resistance of the pipes, hoses and connecting elements must be observed for **pressure lines**.

Route **leakage fluid lines** so that the housing is constantly filled with hydraulic fluid and to ensure that no air gets through the shaft sealing ring even for extended down times. The housing internal pressure may not exceed the limits listed for the axial piston unit in the technical data sheet under any operating conditions. The junction of the leakage fluid line must always be mounted under the minimum fluid level in the tank.

Procedure

To connect the axial piston unit to the hydraulic system:

1 Remove the transport protection (if not already removed).

2 Clean the lines.

3 Connect the lines according to the hydraulic connection plan.

All ports must be connected either to pipes or hoses according to the installation drawing and machine or system connection plan or the ports plugged using suitable locking screws.

The following **tightening torques** apply:

- **Internal threads of the axial piston unit**: The maximum permissible tightening torques $M_{G\ max}$ are the maximum values of the internal threads and must not be exceeded. Values see in product-specific operating instructions.
- **Fittings**: Observe the manufacturer's instruction regarding tightening torques of the used fittings.
- **Fixing screws**: For fixing screws according to DIN 13/ISO 68, we recommend checking the tightening torque in individual cases as per VDI 2230
- **Locking screws**: For the locking screws supplied with the axial piston unit, the required tightening torques of locking screws M_V apply. Values see in product-specific operating instructions.

4 Make sure:

- that the union nuts are correctly tightened on the screwed connections and flanges (Observe tightening torques!). Mark all checked screwed connections using, e.g. a permanent marker.
- that pipe and hose lines and any combination of connecting pieces, couplings or connecting points with hoses or pipes are checked by an expert to ensure that they are safe to operate.

4.7 Connecting electric controller

The machine or system manufacturer is responsible for dimensioning the electrical control.

For electrically controlled axial piston units, the electric controller must be connected according to the electric connection plan of the machine or system manufacturer.

Note

To prevent malfunctions or incorrect direction of rotation or flow, make certain that all connections are correct.

4.8 Disassembling the axial piston unit

⚠ DANGER!

Danger to life

Working on an axial piston unit with switched on the engine forms a danger to life and physical condition.

- Switch off the machine or system and unload it (depressurize), before disassembling the axial piston unit. The procedure on how to shut down and relieve the machine is available in the specifications of the machine or system manufacturer. The switched-off machine must be secured against being switched on again.

To disassemble the axial piston unit proceed as follows:

1 Switch the machine or system off.

2 Relieve the hydraulic system according to the machine and system manufacturer's specifications. Make sure that the hydraulic system is depressurized.

3 Allow the axial piston unit to cool down. Check whether the axial piston unit has cooled down far enough so that it can be dismantled without any problems.

4 Place a fluid collector under the axial piston unit, to collect any fluid that may escape.

5 Disconnect the axial piston unit using a suitable tool from the pipelines, so that any escaping fluid drops can be collected in the provided collector.

6 Empty the axial piston unit.

7 Seal all openings.

8 If necessary, prepare the axial piston unit for storage as described on the following pages.

4.9 Preparing axial piston unit for storage

The axial piston unit is provided ex-factory with a corrosion protection packaging (corrosion protection film).

The active substance which leaks from the corrosion protection film into the interior drops onto the metal surface and forms a separating layer between the material and electrolyte (water).

Note

When storing Rexroth axial piston units, do not remove the corrosion protection film before no independent corrosion protection is provided.

If the film is damaged or opened the active substance enters the immediate environment; the corrosion protection capability has then been destroyed. For this reason seal any openings in the film immediately.

The film is solely approved for corrosion protection of the axial piston unit.

If the axial piston unit is to be stored for an extended period or removed from the machine or system and not built in again straight away, it must be conserved against corrosion for the duration of storage.

The storage areas must be free from corrosive material and vapor. The professional storage of the axial piston unit must be inspected occasionally.

The following instructions only refer to units which are operated with a mineral-oil based hydraulic fluid. Other hydraulic fluids require conservation methods that are specifically designed for them. In such a case contact Rexroth.

When storing axial piston units the following instructions must be adhered considering the external and internal corrosion protective measures. The axial piston unit may not be stored under conditions that are less favorable than those stated in the table.

Prepare the axial piston unit for storage according to the following specifications:

Storage conditions	Storage period	
	Up to 12 months	12 to 24 months
	Protective method	
Solid, dry, constantly temperate room	Discharge the axial piston unit and seal all connections airproof. Pack the axial piston unit airproof in a corrosion protection film. (Standard protection method)	Discharge the axial piston unit and fill with approx. 10 to 20 ml of the corrosion protection VCI 329. Seal all connections airproof. Pack the axial piston unit airproof in a corrosion protection film.
Dry room, maximum temperature difference <10 °C	Discharge the axial piston unit and fill with approx. 10 to 20 ml of the corrosion protection VCI 329. Seal all connections airproof. Pack the axial piston unit airproof in corrosion protection film and additionally in a wooden crate.	

Note

The corrosion protection VCI 329 is only compatible with mineral oil.

4.10 Disposing the axial piston unit

Note the following points in case of disposal:

- Drain all hydraulic fluid from the axial piston unit
- Professional disposal of fluid residue according to the manufacturer's specifications and valid laws at the operator
- Professional disassembly and separation according to cast parts, steel, nonferrous metals, electronic waste, seals and delivery for recycling at a specialist company

The qualified disposal of the axial piston unit has to be carried out in accordance with national valid laws.

5 Commissioning

This chapter explains how to startup the axial piston unit. Follow the instructions in this chapter if:

- you are starting operation of the axial piston unit for the first time,
- you are going to operate the axial piston unit again after having had it repaired,
- you are going to operate the axial piston unit after a standstill with an empty suction line, or
- you are going to operate the axial piston unit again following an extended idle period (> 6 months).

Note: The axial piston unit is a component within the meaning of Machine Directive 98/37/EG, which is used for installation in a machine or system. Commissioning is **prohibited** unti it is determined that the machine or system, in which this product is installed, complies with the regulations of the EU directives and all other relevant guidelines.

Observe the following safety instructions for commissioning:

⚠ DANGER!

Danger to life

Working in the danger zone of a machine or system represents a danger for life and physical condition.

- Eliminate all potential sources of dangers on the machine or system.
- Nobody may stand in the machine's or system's danger zone.
- The emergency stop button for the machine or system must be within reach.
- Always follow the instructions of the machine or system manufacturer for commissioning.

⚠ CAUTION

Risk of damage

Contamination of the hydraulic fluid leads to wear and malfunctions. In particular solid contaminants in the hydraulic lines such as, e.g. welding beads and metal shavings may damage the axial piston unit.

- Pay attention to utmost cleanliness when performing commissioning.

⚠ CAUTION

Risk of damage

An commissioning or a restart without or with insufficient hydraulic fluid filling in the housing area will lead to damage or immediately destroy the power unit.

- Make sure that during commissioning or restarting of a machine or system the entire housing area of the axial piston unit and the suction and working lines are filled with hydraulic fluid and remain filled throughout the operation.

Note

When performing commissioning of the axial piston unit, observe

- the basic safety instructions on page 7 of these operating instructions,
- the details for commissioning in the product-specific operating instructions for your axial piston unit,
- the VDI-guidelines for commissioning and maintenance of hydraulic systems VDI-3027 as well as the CETOP proposals.

5.1 Preparations

Before commissioning of the axial piston unit, you should take all necessary precautions and have all required equipment ready.

Pressure fluid required

You will require an authorized hydraulic fluid:

The machine or system manufacturer can provide you with precise details on the hydraulic fluid. Details on minimum requirements on mineral-oil based hydraulic fluids, environmentally compatible hydraulic fluids or HF hydraulic fluids for the axial piston unit are available in the Rexroth publications RE 90 220, RE 90 221 or RE 90 223.

5.2 Filling of the axial piston unit

Before you can operate the axial piston unit, it must be completely filled with hydraulic fluid. Therefore we recommend the use of a charging unit.

To ensure the functional reliability of the axial piston unit, the cleanliness level 20/18/15 according to ISO 4406 at least is necessary for the hydraulic fluid. At very high hydraulic fluid temperatures (+90 °C to maximum +115 °C) the cleanliness level 19/17/14 according to ISO 4406 is at least necessary. If these classes cannot be adhered please contact Rexroth. Regarding permissible temperatures, see technical data sheet.

When filling the axial piston unity observe the following safety instructions:

⚠ DANGER!

Risk of toxication and injury

Contact with hydraulic fluids may damage your health (e.g. eye injuries, skin and tissue damage, toxications when inhaling).

- Check the lines for signs of wear or damage before each commissioning.
- Wear protective gloves, safety glasses and suitable working clothes.
- If however hydraulic fluid does enter the eyes or penetrates your skin consult a doctor immediately.
- When dealing with hydraulic fluids always observe the safety instructions issued by the hydraulic fluid manufacturer.

⚠ DANGER!

Fire hazard

Hydraulic pressure fluid is flammable.

- Do not subject the axial piston unit to naked flame and ignition sources.

⚠ CAUTION

Risk of damage

The axial piston unit must be filled with hydraulic fluid during operation and at standstill.

- During initial start-up make sure that the axial piston unit is supplied with sufficient hydraulic fluid. In the event of unusual noise or vibration development switch off the machine or system immediately and check whether the axial piston unit is filled with hydraulic fluid.

Note

When filling the hydraulic system note the following:

- the axial piston unit may not be operated when it is being filled,
- the lines must also be filled,
- information on the optimum filling position of your axial piston unit is available in the product-specific operating instructions.

Procedure

Proceed as follows when filling the axial piston unit with hydraulic fluid:

1 Fill and air bleed the axial piston unit via the appropriate ports (see product-specific operating instructions).

⚠ CAUTION

Risk of damage to the axial piston unit

An air pocket in the area near the bearings will damage the axial piston unit.

- With the "shaft upwards" installation position, it is especially important that the housing of the axial piston unit is completely filled with hydraulic fluid during commissioning and during operation.
- With installation above the tank, the case interior may drain via the leakage fluid line after longer standstill periods (air enters the via shaft seal ring) or via the service line (gap leakage). The bearings are thus insufficiently lubricated when the pump is restarted. Therefore, check the hydraulic fluid level in the case interior regularly; if necessary, recommission.
- The suction line must be filled with hydraulic fluid.

2 Operate the pump at a lower speed (starter speed at combustion engines resp. tip-operation at electric motors) until the pump system is completely filled.

3 Air bleed via the appropriate port (see product-specific operating instructions).

4 Make certain that all ports are either connected with pipes or plugged according to the general connection plan.

5.3 Testing the direction of rotation of the engine

Make sure that direction of rotation of the axial piston unit matches the details on the name plate (see also "4.3 Preparing axial piston unit for assembly" on page 17). To do so rotate the engine briefly at lowest rotational speed (jog).

5.4 Testing hydraulic fluid supply

The axial piston unit must always have a sufficient supply of hydraulic fluid. For this reason, it is not essential that the hydraulic fluid supply is given at initial start-up.

If you test the hydraulic fluid supply, perform a constant check on the noise development and check leakage fluid level in the tank. If the axial piston unit gets louder (cavitation) or the leakage fluid is discharged with bubbles, it will indicate that the axial piston unit is not being supplied with sufficient hydraulic fluid. Instructions on troubleshooting are available on page 31.

To test the hydraulic fluid supply:

1 Allow the engine to run at the lowest rotational speed.
The axial piston unit must be operated without load.
Pay attention to leakage and noise.

2 Check the axial piston unit's leakage fluid line here.
The leakage fluid should not contain any bubbles.

3 Check the suction pressure at port "S" of the axial piston pump.
The permissible values are available in the technical data sheet.

5.5 Performing functional test

Once you have tested the hydraulic fluid supply, you must perform a functional test on the system. The functional test should be performed according to the details of the machine or system manufacturer. Pay attention to noise development and leakage fluid. Please note that brief changes in noise development are perfectly normal.

The axial piston unit is checked for functional capability before delivery according to the technical details. During commissioning it must be ensured that the axial piston unit was installed into the system on schedule.

⚠ DANGER!

Danger in case of incorrectly connected machine or system

Any change of the connections will lead to contrary functions (e.g. lift instead of lower) and thus represents a corresponding danger to persons and equipment.

- When connecting hydraulic cylinders, pumps, motors and valves check the specified hydraulic piping.

⚠ DANGER!

Hot surfaces

The axial piston unit heats up during operation. The solenoids in the pump also heat up during operation. Touching the axial piston unit or the solenoids may lead to severe burn injuries.

- Allow the axial piston unit to cool down and protect yourself against burn injuries by wearing heat-resistant gloves and protective clothing.

5.6 Performing flushing cycle

Rexroth recommends a flushing cycle for the general machine or system. This serves to remove any contaminants from the machine or system.

The flushing cycle can, e.g. by using an additional flushing unit.

Note

The axial piston unit must be operated without load during the flushing cycle.

Note

To ensure that the hydraulic fluid has the correct cleanliness level note the following instructions:

- The finer the filtration the better the cleanliness class of hydraulic fluid reached, the longer the life of the axial piston machine.
- To ensure the functional reliability of the axial piston unit, the cleanliness level 20/18/15 according to ISO 4406 at least is necessary for the hydraulic fluid.
- At very high hydraulic fluid temperatures (+90 °C to maximum +115 °C) the cleanliness level 19/17/14 according to ISO 4406 at least is necessary.
- If these classes cannot be adhered please contact Rexroth.

6 Troubleshooting

The following table may assist you diagnosing a fault. The table does not claim to be complete.

The typical features and faults form the columns in the table and the potentially affected parts on the axial piston unit and machine or the system form the rows. The individual table cells describe the cause and remedy for each respective fault (column) on each part (row).

Specific instructions on troubleshooting your axial piston unit are available in the product-specific operating instructions.

Practically, problems that are not considered here may also occur.

Component	Irregular noise	No or insufficient flow
Output elements	Mechanical parts faulty on output side (coupling seat, misalignment etc.)	Speed transfer or travel transfer faulty
Hydraulic cylinder/ hydraulic motor	Insufficient rotation or speed, overhauling processes (hydraulic motors is driven by a machine to a pump), braking noise, faulty inner seal, damage on the power unit	Internal losses, leaking boots, dirt-specific wear
Flow control valves	Air inclusions, differential pressure too small, vibrations	Control cover clogged up, throttle-type check valve adjusted
Pressure valves/ post-suction valves (secondary)	Vibration or rattling indicates air inclusions or faulty damping, wrong pressure setting, insufficient post suction, opening pressure of post-suction valves too high, cavitation on oil motor	Adjustment too low, valve seat damaged, jammed through contamination
Directional-control valves	Actuation faulty, configuration fault (nominal width), throttling points	Wrong or inaccurate slide position, negative overlap, control pressure too low - fails to interconnect
Pressure valves (primary)	Vibration or rattling indicates air inclusions or faulty damping, wrong pressure setting	Adjustment too low, valve seat damaged, jammed through contamination
Hydraulic accumulator	Accumulator bubble faulty, nitrogen filling penetrates hydraulic circuit, faulty seals, inflow or discharge rates too high Accumulator in connection with throttle losses could provoke vibration-capable systems	Nitrogen filling pressure too low
Return lines	Line does not end below the oil, turbulence towards suction side, no separation, mechanical vibrations, insufficient fastening	–
Filter	Insufficient fastening, mechanic vibrations	For high-pressure filters: The insert is contaminated, bypass valve is jammed
Cooler	Air-oil cooler-valve noise, mechanic vibrations	–
Pressure lines	Inapropriate fastening, impact sound, pipe cross section too small	Screw connection leaky, cross section too small, increase of the throttling point pressure
Engine	Wrong rotating direction, rotation speed too high, bearing play, bearing damage	Rotation speed too low
Coupling	Coupling seat faulty, misalignment, flexible elements defective	Rotation speed transfer faulty
Variable pump	Rotation speed too high, air intake, cavitation, mechanic damage	Power comparison of the engine pump (do outputs match each other?), pump fails to swivel out, inner leakage, dirt-specific wear (stroke limitation on a too small swivel angle)
Overflow-oil line	Insufficient fastening	–
Suction conditions	Insufficient suction cross-section, suction height too high, diversions, cross-section constrictions, suction line leakage, air bubbles, tank stop valve not open, resistance at filter	Suction behavior interrupted, insufficient suction cross section, suction height too high, diversions, cross section constrictions, suction line leaky
Container hydraulic fluid	Oil level too low, oil foaming, water in oil, cold operating material, viscosity too high, ineffective tank ventilation	Oil level too low, ineffective tank ventilation

Component	No or insufficient pressure	Pressure / flow fluctuation
Output elements	Torque transfer faulty	Output elements defective
Hydraulic cylinder/ hydraulic motor	Inner or external leakage, dirt-specific wear, power unit damage	No or insufficient ventilation, faulty boots, stick-slip effect, alternating load directions, hydraulic motor absorption quantity too small or too large
Flow control valves	–	Air inclusions, differential pressure too small, flow control valve contaminated, check valve faulty
Pressure valves/ post-suction valves (secondary)	Adjustment too low, valve seat damaged, spring rupture, foreign matter in valve seat	Alternating back pressure, pressure valve set too small, valve seat damage
Directional-control valves	Wrong position, mechanically jammed, reset spring fracture, leakage dummy plugs separated	Flow forces influence the slider activity and opening paths, positioning fault, unstable position, control pressure fluctuations
Pressure valves (primary)	Adjustment too low, valve seat damaged, spring rupture, foreign matter in valve seat	Alternating back pressure, pressure valve set too small, valve seat damage
Hydraulic accumulator	Nitrogen filling pressure too low or too high: Stored output insufficient	Vibration-capable system between hydraulic accumulator, pressure and flow-control valves and pumps
Return lines	–	–
Filter	For high-pressure filters: The insert is contaminated, bypass valve is jammed	–
Cooler	–	–
Pressure lines	Line breakage, screw connections not tight, display or testers faulty	Incorrectly ventilated, display or tester faulty, wrong display
Engine	Wrong rotating direction, drive output too low, electric motor incorrectly connected.	Engine irregularity too large, for diesel motors idling speed too low, frequency fluctuations for electric motors
Coupling	Torque transfer faulty	–
Variable pump	Power comparison of engine pump (do outputs match?), pump fails to swivel out, inner leakage, dirt-specific wear power-unit damage (stroke limitation on a too small swivel angle),	Air suction, inner leakage, dirt-specific wear, power-unit damage, controller unstable. For motor compression or for temporary overload interrupted control behavior as consequence of dirt jamming. Motor compression through excess output consumption on power take-off, controller fluctuates
Overflow-oil line	–	–
Suction conditions	Suction behavior interrupted, insufficient suction cross section, suction height too high, diversions, cross section constrictions, suction line leakage, air inclusions	Suction behavior interrupted, insufficient suction cross section, suction height too high, diversions, cross section constrictions, suction line leakage, air inclusions
Container hydraulic fluid	Oil level too low, viscosity hydraulic fluid too low, thus causing high leakages, gap leakages	Air bubbles, turbulence from return to suction, wrong tank design, no sealing between return and suction chamber

Component	Pressure fluid temperature too high
Output elements	–
Hydraulic cylinder/ hydraulic motor	Inner Leakage, gap leakages, wear damages, hydraulic motor and cylinder configuration too small
Flow control valves	Wear, gap leakages
Pressure valves/post-suction valves (secondary)	Setting too high: Increase in gap leakages in all components, increased leakage oil attack. Load rhythm by machine too high. Setting too low: Output drop, thermal attack, cone valve jams when opened
Directional-control valves	Wrong position, throttle losses, measurement too short, cross section too small, wear
Pressure valves (primary)	Setting too high: Increase in gap leakages in all components, increased leakage oil attack. Load rhythm by machine too high. Setting too low: Output drop, thermal attack, cone valve jams when opened
Hydraulic accumulator	–
Return lines	Cross section too narrow
Filter	Bypass valve opening pressure too high
Cooler	Measurement too small, cooling effect too low, room or ambient temperature too high, external ventilation or water supply interrupted, surface contaminated, bypass valve open
Pressure lines	Cross section too narrow, throttling through insufficient bending radii
Engine	Rotation speed too high
Coupling	–
Variable pump	Inner leakage, wear-related damage
Overflow-oil line	High temperature as consequence of greater leakage indicates expected breakdown in a component
Suction conditions	–
Container hydraulic fluid	Wrong viscosity, oil filling too low, tank too small. In event of major local heating lubricity, pressure load and aging resistance of pressure fluid is impaired. Component wear, gap leakages, heating

7 Servicing

Regular cleaning is necessary to maintain the axial piston unit. Visible coarse dirt must be removed. In particular, sensitive and important components such as solenoids, valves and displays must be kept clean.

CAUTION

Risk of damage

When cleaning, sealings may be destroyed and water may penetrate into the air bores.

- Do not point the high-pressure cleaner at sensitive components such as, e.g. shaft sealing ring, electrical connections and electrical components.
- Do not use any corrosive substances for cleaning.

7.1 Maintenance

Usually axial piston units are maintenance-free units. However the service life of axial piston units depends also on the quality of the hydraulic fluid. For this reason Rexroth recommends that the hydraulic fluid has to be changed at least once a year or every 2000 operating hours or that it has to be analyzed by a laboratory.

The service life of the hydraulic fluid is depends essentially on the machine or system. Thus, the machine or system manufacturer is responsible for defining the maintenance periods.

Changes in the leakage flow indicate wear in the axial piston unit. For this reason Rexroth recommends that the leakage fluid quantity has to be measured and documented at regular intervals. This will enable unscheduled wear in the axial piston unit to be detected at an early stage and thus enable the cause to be rectified quickly.

7.2 Inspection

To enable the axial piston unit to run for a long time and reliably, Rexroth recommends a regular inspection of the hydraulic system and that the following operating conditions have to be documented:

- Operating temperature at a comparable charge state (weekly)
- Hydraulic fluid status (daily)
- Hydraulic fluid quality (after 2000 operating hours)

The axial piston unit itself should be checked regularly for:

- Leakages (daily)
  Early recognition of losses in hydraulic fluid can help to find faults on the machine or system and to clear them. For this reason Rexroth recommends that the axial piston unit and machine or system has always to be kept in a clean condition.
- Unusual noise development (daily)
  Unusual noise development may have various reasons. The "6 Troubleshooting" chapter on page 31 will help you in searching for possible fault causes.
- Loosened fixing elements (monthly)
  All fixing elements have to be checked when the system is switched off, depressurized and cooled down.

Systematic documentation of the operating conditions (such as, e.g. increasing operating temperatures) will enable you to detect increased wear at an early stage and to implement the necessary countermeasures.

⚠ WARNING **Risk of damage**

The axial piston unit may only be operated with the technical data as listed in the order confirmation.

- If the axial piston unit deviates from the permissible operating parameters, shutdown the system and implement measures for adjustment.

7.3 Repair

Repairs of the axial piston unit may only be performed by authorized, skilled and instructed staff. Rexroth offers a comprehensive range of services for the repair of Rexroth axial piston units.

Only original Rexroth service parts may be used for repairs of Rexroth axial piston units.

Tested parts and pre-assembled original Rexroth modules enable successful repairs with the minimal expenditure of time.

The list of service parts for axial piston units are order specific. When ordering service parts please quote the material and serial number of the axial piston unit as well as the material numbers of the service parts.

Repair contact

Please address all requests on repair work to the Service department at the axial piston unit's manufacturing plant. Details on the manufacturing plant are available on the axial piston unit's rating label.

Bosch Rexroth AG
Hydraulics
Product Segment Axial Piston Units
Elchingen plant
Glockeraustrasse 2
89275 Elchingen, Germany

Telephone +49 (0) 73 08 82-0
Fax +49 (0) 73 08 72 74

service.elchingen@boschrexroth.de

Bosch Rexroth AG
Hydraulics
Product Segment Axial Piston Unit
Horb plant
An den Kelterwiesen 14
72160 Horb am Neckar, Germany

Telephone +49 (0)74 51 - 92 0
Fax +49 (0)74 51 - 82 21

service.horb@boschrexroth.de

Information on contacts in the various countries is available at the following Internet address.

www.boschrexroth.com/addresses

Appendix A: Project planning information

This annex contains instructions of additional components that are required to complete the hydraulics system. Select these components together with the respective manufacturers. Only some conventional instructions are listed below. Rexroth is not responsible of correctness and completeness in individual cases.

Project planning instructions are available for the following topics:

- Selection of hydraulic fluid
- Tank design
- Filter design
- Cooler
- Hose lines and piping

Selection of hydraulic fluid

The hydraulic fluid in the hydraulic circuit must be chosen very carefully already at project planning the drive to ensure failure-free and efficient operation. Often not all hydraulic fluid requirements can be fulfilled constantly. Therefore, a concrete consideration, which should be performed together with the hydraulic fluid supplier, is advisable.

Please note also the specifications in the "Mineral-oil based hydraulic fluids" (RE 90 220), "Environmentally-compatible hydraulic fluids HEES, HEPG, HETG for axial piston units" (RE 90 221) and "Axial piston units for operation with HF hydraulic fluids" (RE 90 223).

The viscosity or viscosity temperature characteristics are of primary importance, whereas the density and pour point must be noted, too.

Mineral-oil based fluid grades are suitable for the usage with axial piston pumps and motors. Their suitability is also dependent on the following factors:

- Wear properties
- Viscosity temperature characteristics
- Oxidation and corrosion protection
- Material compatibility
- Air separation properties (LAV)
- Water separation properties (WAV)

Wear properties and viscosity

Details on wear properties and the viscosity of hydraulic fluids are available in the "Mineral-oil based hydraulic fluids" (RE 90 220), "Environmentally-compatible hydraulic fluids HEES, HEPG, HETG for axial piston units" (RE 90 221) and "Axial piston units for operation with HF hydraulic fluids" (RE 90 223).

Tank design

Due to the heat balance the tank has to be large enough.

The following applies for an initial estimate of the tank volume V (in l):

- for mobile installations:
  V = 0.25...0.4 • Q + 1,25 • EZ, whereas
  – Q is the numerical value of the maximum pump suction volume (in l/min) and
  – EZ is the sum of the filling volumes of all cylinders (in l).
- for stationary installations:
  V = 3...5 • Q

You should also consider an air space of 10 to 15 % of the hydraulic fluid volume.

Note

Attach a sign at an easily visible point on the tank, which identifies the tank as a hydraulic fluid tank. The specification, volume and hydraulic fluid change intervals should also be specified. Add a reference to the filter change intervals and the designation of the interchangeable filter cartridges.

Make sure that the tank filling process can only be performed using a permanently fixed filter. Usually, new hydraulic fluid from new barrels is contaminated.

Ground clearance

Make sure that the ground clearance is at least 15 cm, to ensure that a good heat dissipation is given.

Drainage options

Due to temperature fluctuations condensation water will be formed in the tank. It has to be possible to collect this water and contamination at the lowest point of the tank. Therefore, incline the base and provide a drainage option at the lowest point.

Stabilizer plates

Provide stabilization plates, which serve to avoid turbulent flows in the tank and which promote dirt depositing and air separation.

Air filters

Make sure that the planned air filters have at least the same filter purity as the installation filters.

Hydraulic fluid level control

Make sure that a hydraulic fluid level control is assemblied at an easily visible position. Hydraulic fluid, which escapes through a leaking component, is always contaminated and may not be returned to the tank. Perform a corresponding augmentation in good time so that the lowest hydraulic fluid level is never reached.

Suction line

Suction lines should be routed so that they are in a position of approx. 5 cm over the base of the tank or in case of a lateral exit be this far away from the base of the tank.

The entry diameter should be enlarged by an inclined gate and an alignment to the oil-stabilized side should be made.

A suction line that ends too close to the surface may enable air to be aspirated. Therefore note that there is also a temporary removal of hydraulic fluid by cylinders as well as a possible inclined position of the machine when determining the lowest hydraulic fluid level.

The negative pressure may not drop below 0.8 bar (abs.) (see also the respective data sheet).

Leakage fluid line

Route the junction of the leakage fluid in the tank below the minimum hydraulic fluid level. Pay attention to a sufficient cross-section while integrating several leakage fluid lines into a collecting pipe.

Filter design

The purity of the hydraulic fluid and the service life of the hydraulic system are directly associated. Constant filtering of the hydraulic fluid and additional measures (e.g. flushing circuit during commissioning or after assembly work on the system) are therefore particularly important.

The filter manufacturer has to account for the filter function and the compliance with the required cleanliness level.

Required cleanliness level		
Temperature range	< 90 °C	90 °C to 115 °C
DIN ISO 4406	20/18/15	19/17/14

Accessibility

Make sure that the filters can be accessed ideally to ease the maintenance work.

Equip the filter where possible with a contamination display and a pressure-resistant filter element.

Cooler

Usually, air-oil or water-oil cooling is sufficient in the leakage fluid lines. The cooling load conforms with the load and speed of the hydraulic components. Thereby, load rhythm and the radiating surface are very important. Check the temperature balance by measuring the temperature during commissioning.

Arrange the air-oil heat exchanger so that they are not in the area of the hot exhaust air of the main engine or the working machine.

Provide a cooler bypass for the protection of the oil cooler during cold starts. This can be realized by installing a check valve or a therm-bypass-valve.

Please attend especially to a regular dedusting of the fins of air-oil heat exchangers.

Hose lines and piping

Hose lines are used in hydraulics systems to connect tie-in points that move relative to each other. Hose lines also serve to dampen the transmission of structure-borne sound.

We would like to point out that the installation or unit manufacturer is responsible for ensuring that the design and installation of hose lines and piping is conducted conform to standards. In particular, the installation or unit manufacturer must ensure that the hose lines and fittings are designed to match the maximum dynamic pressures of the pumps and motors, which are specified in the order confirmation, evident from dynamic measurements or which may occur at the operator.

In this context we would like to refer to the EN norms for hoses and hose lines according to DIN EN 853–857 and their installation according to the safety regulations of the BIA in ZH 1/74.

Furthermore, the following information apply for the connections:

- To achieve favorable noise values decouple all connecting lines (suction, pressure, leakage fluid connections) from the tank using flexible elements.
- Route any leakage fluid back to the tank so that as little leakage fluid pressure (= case pressure) as possible is generated.

Index

S

T

U

W

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5 Maintenance of portable pump, MSP-80

Danger!

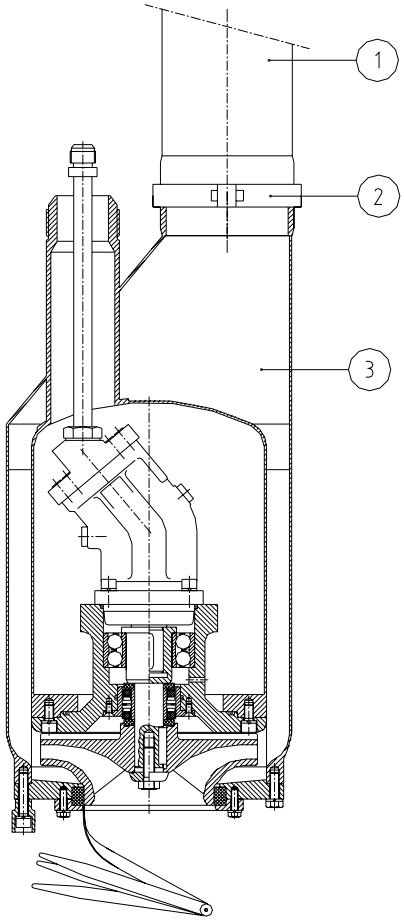
Make sure that the portable pump is diconnected and depressurised!

5.1 Inspection/overhaul of portable pump

See assembly drawing for detailed information

5.1.1 Connection pipe removal

1. Disconnect the clamp (2) and the Teflon O-ring (2)
2. Remove the connection pipe (1) from the pump (3)
3. Check the space between the wear ring and the impeller with a feeler gauge.



Note:

If the space between the wear ring and the impeller is greater than 1 mm the wear ring has to be replaced.

Note:

Always replace the lock washers, gaskets and O-rings.

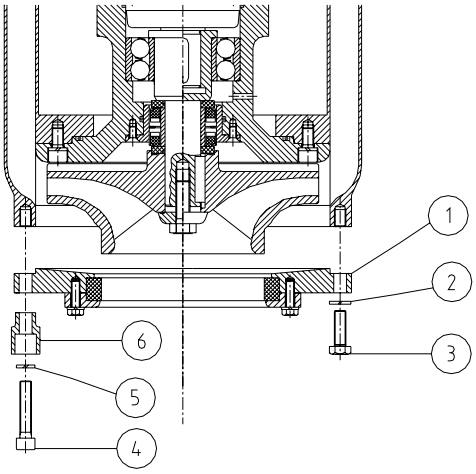
5.1.2 Suction cover removal

1. Clean the pumphead before disassembling.

Tip.

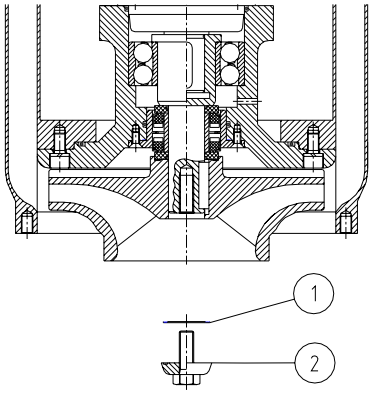
Before sending the pumphead to a workshop, label it with information about the last pumped product!

2. Place the pump on its side, on a proper flat working surface, preferably a workbench in a workshop.
3. Remove the socket head screws (4) and lock washers (5) to remove the distance feet (6).
4. Unscrew the bolts (3) and the washers (4).
5. Remove the suction cover (1).



5.1.3 Impeller removal

1. Remove the impeller bolt (2) by rotating it counter clockwise.
2. Replace the O-ring (1) of the impeller bolt.

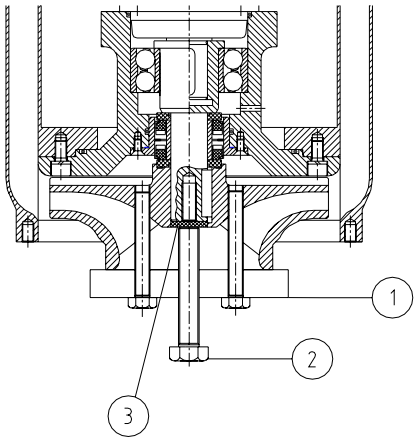


Caution!

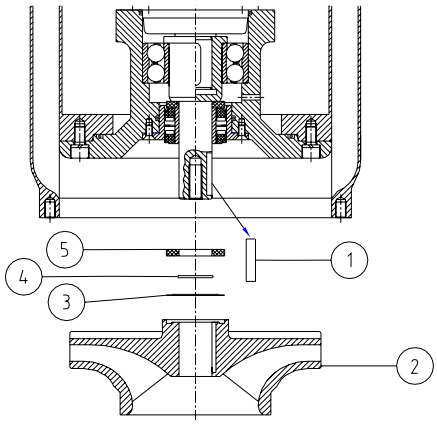
Take care not to damage the pump shaft when using the impeller extractor

Use a protective ring between the shaft and the impeller extractor bolt.

3. Install the impeller extractor (1) over the impeller.
4. Use the protective ring (3) to protect the thread.
5. Carefully pull the impeller from the pump shaft by rotating the bolt (2) clockwise.

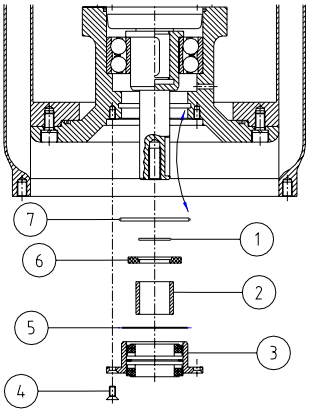


6. Remove the impeller (2) from the shaft
7. Remove the gasket (3) and the O-ring (4) from the shaft.
8. The rotary part (5) of the mechanical seal will now be visible and can be removed.
9. Remove the impeller key(1)



5.1.4 Mechanical seal removal

1. Remove the countersunk screws (4)
2. Remove the seal support ring (3)
3. Remove the gasket (5)
4. Remove the distance sleeve (2)
5. Remove the other rotary part (6) of the mechanical seal
6. Remove the O-ring (1) from the rotary part (6)
7. Remove the O-ring from the motor support



5.1.5 Mechanical seal inspection

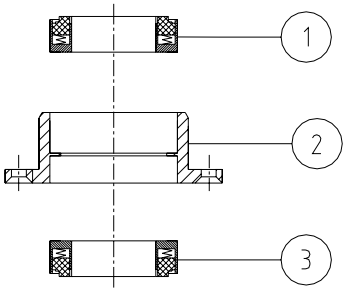
Tip.

Inspect the surfaces of the mechanical seal for smoothness.
Smoothen or replace if necessary.

Tip.

If necessary use a drive to remove the stationary parts of the mechanical seal. Make sure not to damage the seal support ring (2)

1. Pull out the stationary parts (1 & 3) carefully
2. Clean the seal support ring (2) and degrease it
3. Heat the seal support ring to a temperature of 80°C above ambient temperature, using the induction heater.

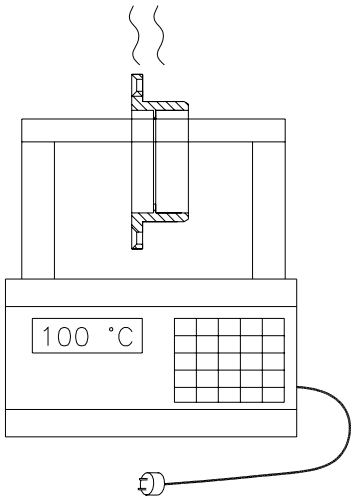


Caution!

It is not allowed to heat the seal support ring using a burner, torch, etc.!

Caution!

Never heat a bearing to a temperature above 125 °C (255 °F)!



Tip.

Loctite 542 is used as a locking and sealing fluid between the seal support ring and the stationary parts of the mechanical seal.

4. Apply some Loctite 542 to the new stationary parts of the mechanical seals.

Caution!

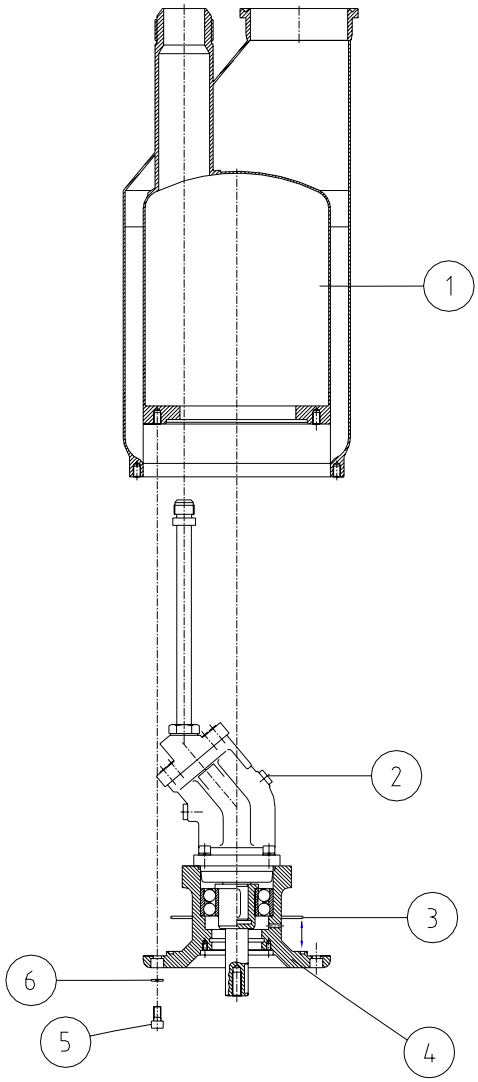
Installation of the mechanical seal must be done by hand, do not use a hammer!

Always use fire proof gloves!!

5. Install the new stationary parts of the mechanical seals, make sure the parts are placed correctly.
6. The assembly must harden for a period of approx. 4 hours

5.1.6 Hydraulic motor removal

1. Remove the bolts (5) and lock washers (6)
2. Withdraw the hydraulic motor (2) and the motor support (4) from the pump casing (1)
3. Remove the O-ring (3) from the groove in the motor support (4)



Tip.

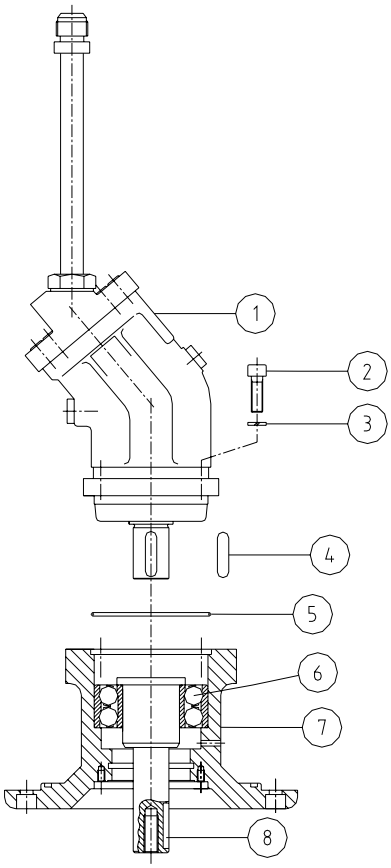
Clean the interior of the pump casing (1) thoroughly.

Tip.

Remove the hydraulic oil from the hydraulic motor using the oil drain connection!

5.1.7 Hydraulic motor inspection

1. Unscrew the socket head screws (2) and remove the lock washers (3)
2. Disconnect the hydraulic motor (1) from the motor support (7)
3. Inspect the keys (4) and the O-ring (5)
4. Rotate the pump shaft (8) to check if the ball bearing (6) runs smoothly, replace the ball bearing if necessary



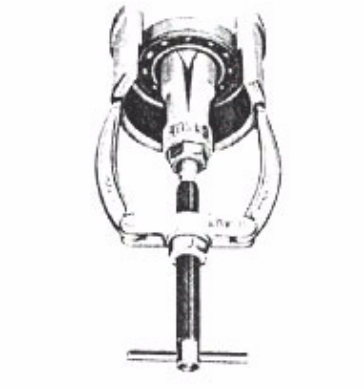
Tip.

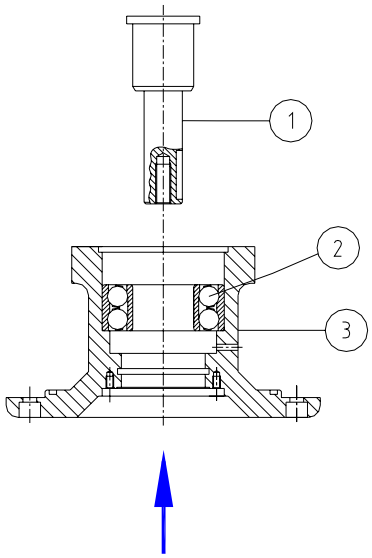
For inspection or replacement of the hydraulic motor and/or seals, it is recommended to send it to Marflex.

5.1.8 Ball bearing replacement

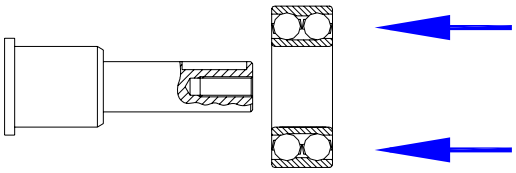
1. Carefully remove the pump shaft (1) from the motor support (3)
2. Remove the ball bearing (2) using an internal bearing extractor

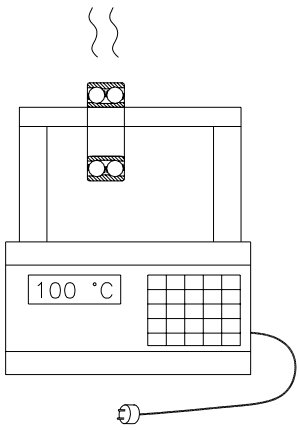
Internal bearing extractor





3. Heat the new bearing using the induction heater
4. Slide the ball bearing onto the pump shaft

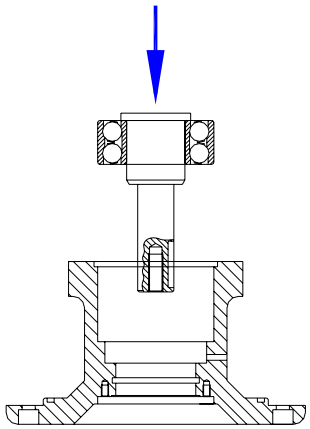




Tip.

Let the assembled pump shaft and ball bearing cool down before further assembly!!

5. Heat the motor support (3) using the induction heater
6. Slide the assembled pump shaft and ball bearing into the motor support

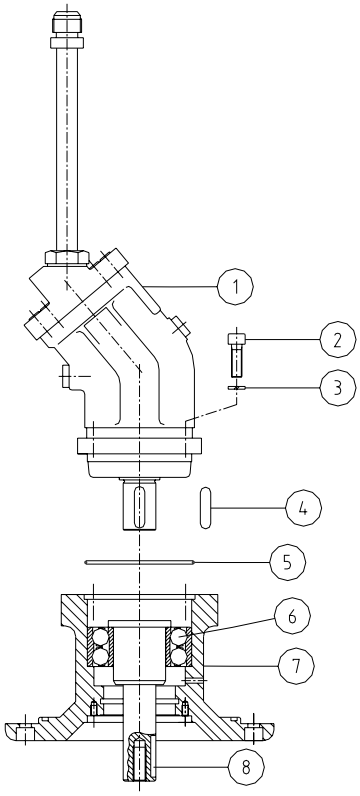


5.1.9 Hydraulic motor installation.

Caution!

Always use new O-rings, bonded seals, shaft seals and lock washers.

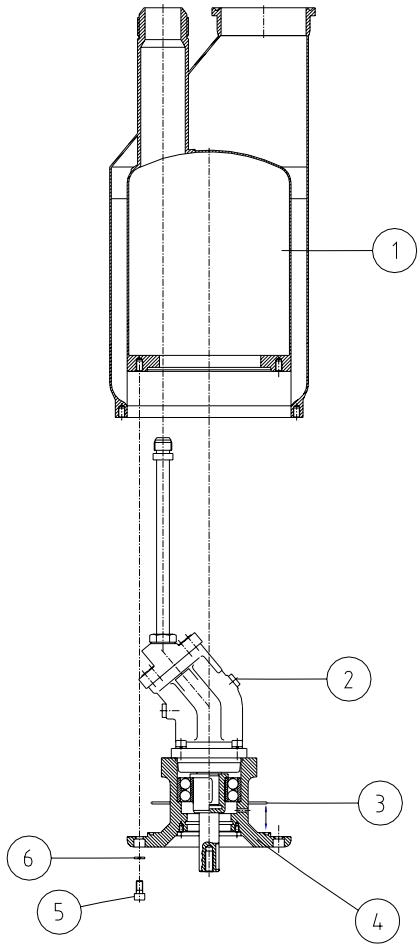
1. Clean the seal support (7) thoroughly.
2. Place the slightly greased O-ring (5) into the motor support (7)
3. Place the key (4) into the shaft of the hydraulic motor
4. Place the seal support (7) onto the hydraulic motor (1).
5. Fasten the seal support with the bolts (2) and lock washers (3).



Tip.

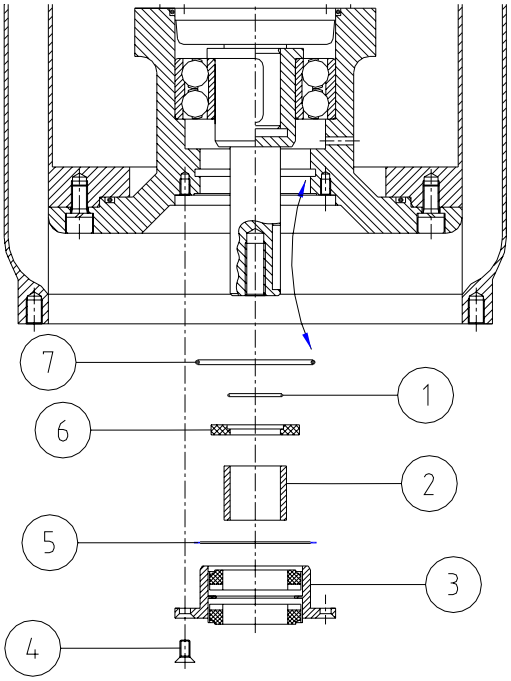
Fill the hydraulic motor with hydraulic oil using the oil drain connection!

6. Place the slightly greased O-ring (3) into the groove of the motor support
7. Slide the hydraulic motor into the pump (1)
8. Fasten the hydraulic motor with the bolts (5) and lock washers (6).



5.1.10 Mechanical seal installation

1. Place the slightly greased O-ring (7) into the groove of the motor support
2. Place the slightly greased O-ring (1) into rotary part of the mechanical seal (6)
3. Place the rotary part of the mechanical seal (6) onto the pump shaft
4. Place the distance sleeve (2) onto the pump shaft
5. Place the gasket (5) onto the seal support ring (3)
6. Place the seal support ring (3) onto the pump shaft
7. Use the countersunk screw (4) to fasten the seal support ring (3)



5.1.11 Impeller inspection

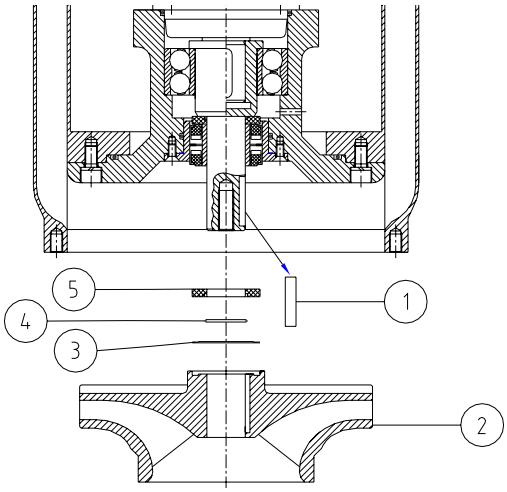
Inspect the impeller for damage and replace if necessary.

The impeller is a long life component. Replacement is only necessary if damaged or when there is a significant decrease in capacity (loss of performance).

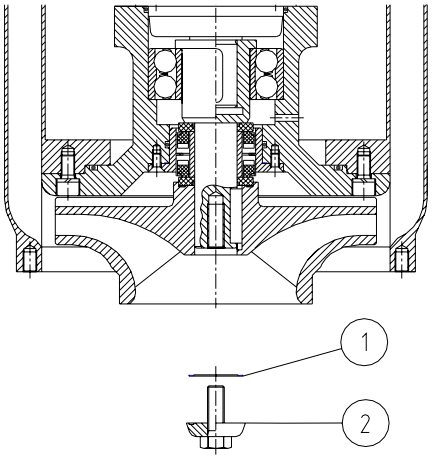
Contact the Marflex engineering department for advice on repair when no spare part is available.

5.1.12 Impeller installation

1. Clean the pump shaft and the key slots in the pump shaft thoroughly.
2. Place the key (1) into the pump shaft
3. Place the gasket (3) onto the impeller (2)
4. Place the slightly greased O-ring (4) in the groove of the rotary part of the mechanical seal (5)
5. Place the rotary part of the mechanical seal (5) onto the impeller
6. Align the keyways in the impeller (5) with the keys in the key slots on the pump shaft and slide the impeller carefully over the pump shaft

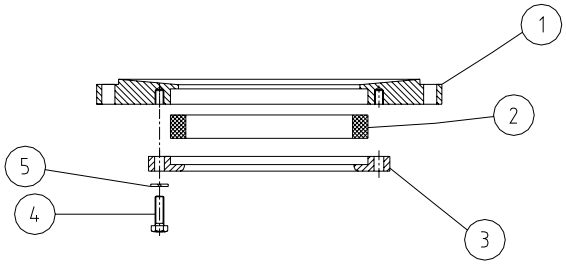


7. Place the slightly greased O-ring (1) in the groove of the impeller nut (2)
8. Tighten the impeller nut, rotating it clock-wise, to the prescribed torque value (see the table of tightening torque's) using a suitable torque wrench.
9. Manually check that the impeller can rotate smoothly.



5.1.13 Suction cover wear ring inspection / replacement

1. Remove the socket head screws (4) and lock washers (5) from the suction cover (1).
2. Remove the wear ring support (3)
3. Remove the wear ring (2) from the suction cover.



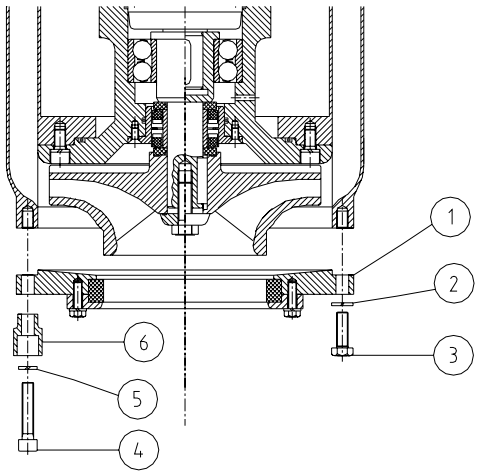
Tip.

If necessary cool the PTFE wear ring down before installation to ease installation. Use a fridge, coolbox, ice, etc..

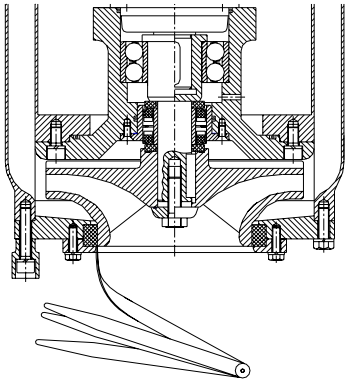
4. Install the new wear ring in the suction cover (1) by pressing the cooled wear ring in place.
5. Reinstall the wear ring support (3) and secure it with the socket head screws (4) and lock washers (5)

5.1.14 Suction cover installation

1. Place the pump, on its side, on a proper flat working surface.
2. Place the assembled suction cover (1) over the impeller.
3. Install the suction cover with the bolts (3) and lock washers (2).
4. Install the distance feet (6) using the socket head screws (4) and lock washers (5)
5. Make sure the impeller is rotating freely and not locked as a result of a to small clearance with the (new) wearring.



6. Check the clearance between the wear ring in the suction cover and impeller. This clearance can be measured with a feeler gauge and the clearance must be the same over the entire circumference.



6 Maintenance tripod and winch

Warning!

Keep hands and clothes away from the wire rope and the rotating parts of the winch when operated during maintenance!

Warning!

Beware of broken wires in the wire rope of the winch when carrying out maintenance. Broken wires are extremely sharp! Wear proper working gloves!

6.1 Maintenance tripod

Tripod with manual operated winch and hose reel

The tripod components and material are basically maintenance free.

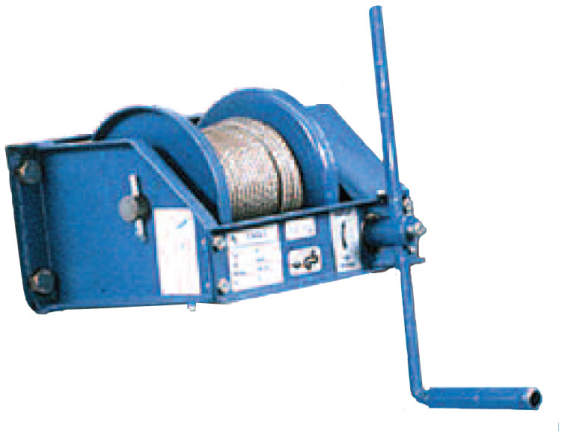
Clean the tripod after every operational use.

6.2 Maintenance winch

6.2.1 Manual operated wich

Clean the wire rope after every operation.

If necessary apply a light film of grease on the worm wheel of the winch.
Make sure to use grease without resin or acid.

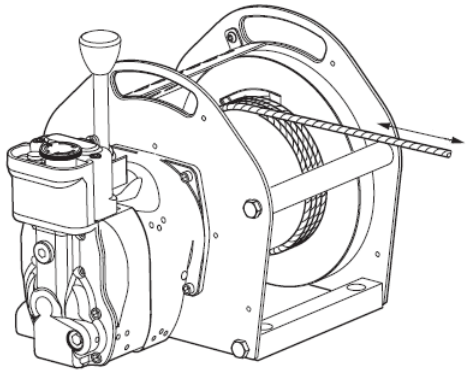


6.2.2 Air operated winch

Clean the wire rope after every operation.

Replenish the lubricant in the air line lubricator.

For maintenance items on the air operated winch see the applicable supplier's maintenance manual.



6.2.3 Electrical operated winch

Clean the wire rope after every operation.

For maintenance items on the electrical operated winch see the applicable supplier's maintenance manual.

6 Specifications

1 Deepwell pump specification

Data sheet deepwell pump and electric motor

Pump data

Pump type:	MDPD-100		Cargo Pump		
Quantity:	12		Material impeller:	AISI 316L-1,4404	
Capacity:	200	m3/hr.*	Material pump:	AISI 316L-1,4404	
Head:	110	mlc.*	Material decktrunk:	AISI 316L-1,4404	
Specific gravity:	1	kg/ltr.	Pump length:	8310	mm.**
Viscosity:	1	cSt.	Decktrunk height:	270	mm.
Temperature:	20	˚C.	Drive:	Electric	
Design speed:	3338	rpm.	Stripping deepwell:	☑ DN25-PN16	
Maximum speed:	3600	rpm.	Stripping draining:	☐	
Consumed power:	73	kW.	Super stripping:	☐	
Torque:	209	Nm.	Toolbox:	MDP-GLX	
Impeller type:	CPK 80-250		Sealing arrangement:	Lipseal	
Pump head type:	MDP-G1_3		Ambient temperature:	-20˚C. — 45˚C.	
Impeller diameter:	260	mm.			
Discharge connection:	DN150-PN16				
Suction connection:	Ring with rectangular wearring				
Extra options:	None				

** According ISO 9906 Grade 2*

*** Distance between top of the decktrunk flange and bottom of the well*

Data sheet deepwell pump and electric motor

Electric motor data

Manufacturer:	F&G				
Type:	280S-2		Main cable bushing:	2 X M63	
Frequency:	60	Hz.	Stillstand heating:	1 X M20	
Number of poles:	2		PTC cable bushing:	1 X M20	
High output:	☑		Accesoires cable:	X	
Output:	105	kW.	Insulation Class:	F	
Rated current :	172,5	A.	Protection Class:	IP 56	
Voltage:	440	V.	Explosion Class:	EEx de IIC T4	
Speed:	3565	rpm.	Stillstand heating:	240	W.
Efficiency:	92	%.	Duty type:	S1	
Power factor:	0,87		Electric connection:	Star-Delta	
Weight:	700	kg.	Mounting arrangement:	V1	

Marflex MDPD−100
Expected QH− & Power curve

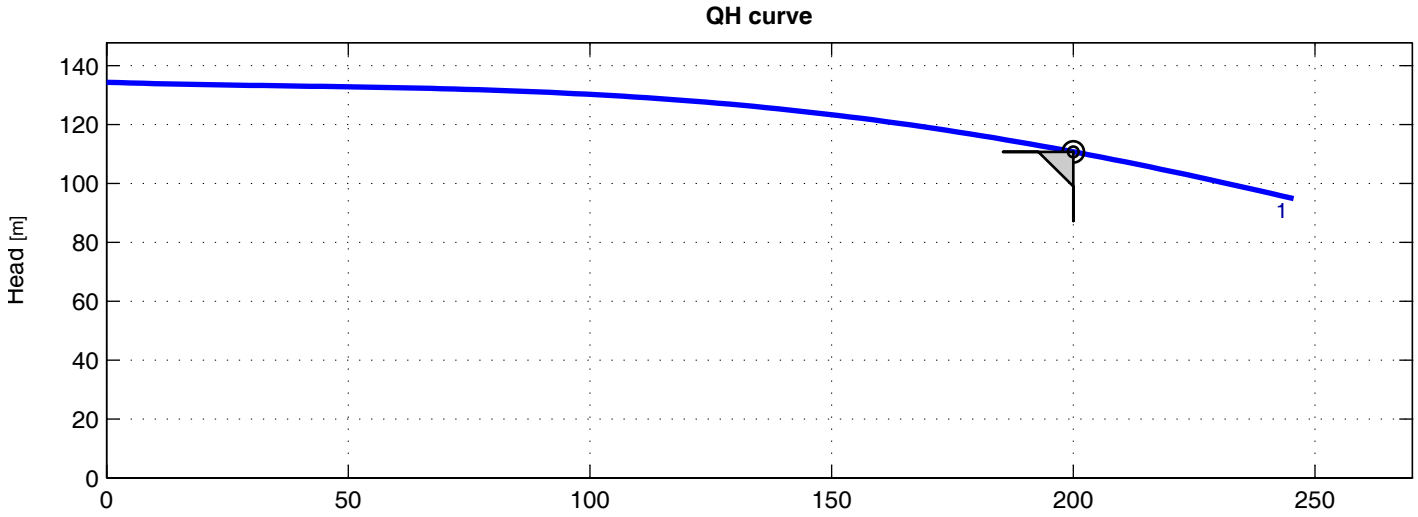
Louis Pasteurstraat 12
3261 LZ Oud−Beijerland
The Netherlands
Tel: +31−186−890200
Fax: +31−186−890299

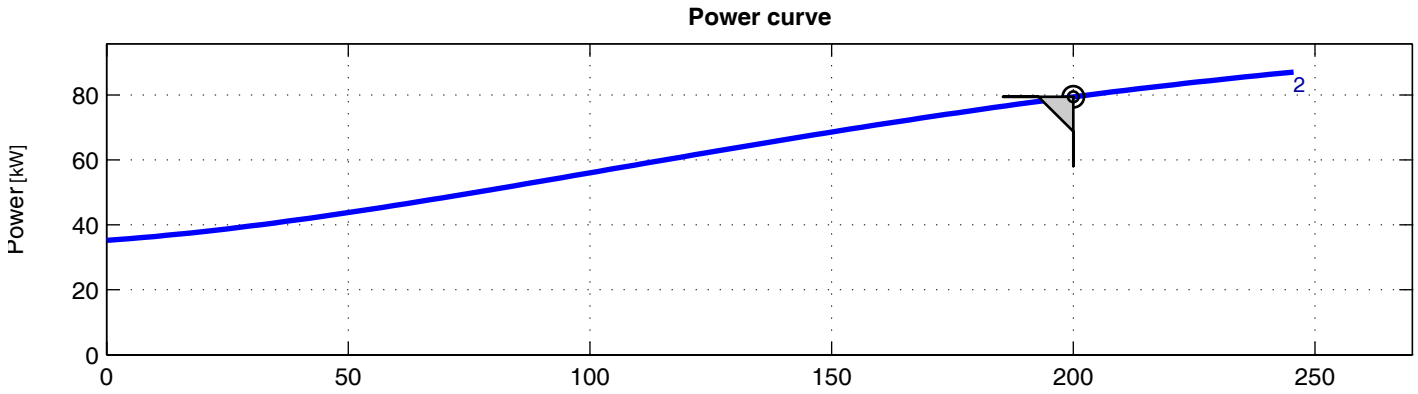
Customer: Yilyak / NB # 077
Order no.: 18070069
Date: 28−06−2007

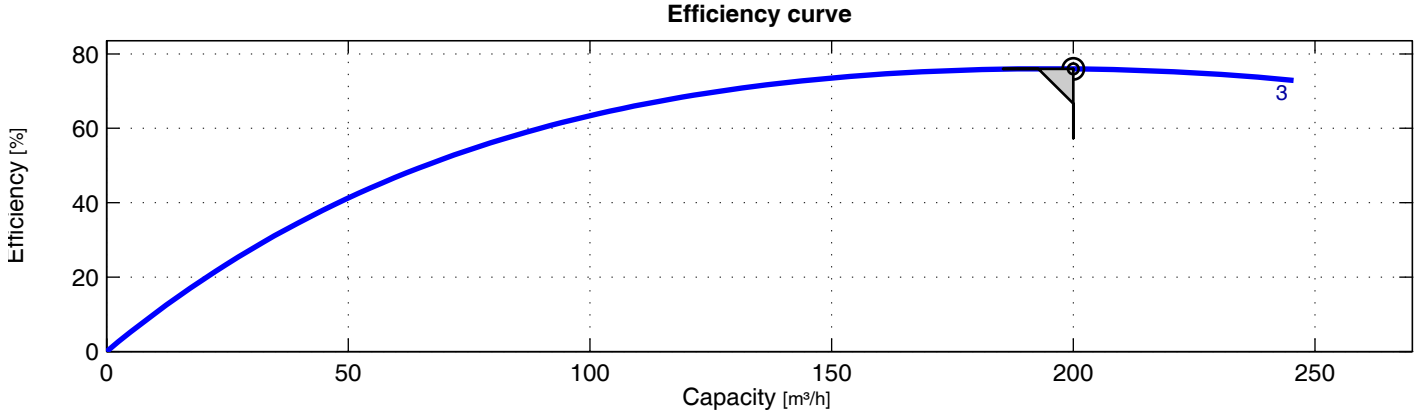
Pump type: MDP−G1_3
Speed: 3400 [rpm]
Diameter: 260 [mm]
Spec. gravity: 1 [−]
Viscosity: 1 [cSt]

Specifications:
Capacity: 200 [m³/h]
Head: 110.7 [m]
Power: 79.4 [kW]

1. QH, 1[cSt]
2. Power, sg 1, 1[cSt]
3. Eff, 1[cSt]







Data sheet deepwell pump and electric motor

Pump data

Pump type:	MDPD-80		Cargo Pump		
Quantity:	2		Material impeller:	AISI 316L-1,4404	
Capacity:	100	m3/hr.*	Material pump:	AISI 316L-1,4404	
Head:	110	mlc.*	Material decktrunk:	AISI 316L-1,4404	
Specific gravity:	1,8	kg/ltr.	Pump length:	3094	mm.**
Viscosity:	1	cSt.	Decktrunk height:	270	mm.
Temperature:	20	˚C.	Drive:	Electric	
Design speed:	3312	rpm.	Stripping deepwell:	☑ DN25-PN16	
Maximum speed:	3600	rpm.	Stripping draining:	☐	
Consumed power:	60	kW.	Super stripping:	☐	
Torque:	173	Nm.	Toolbox:	MDP-BLX	
Impeller type:	CPK 65-250		Sealing arrangement:	Lipseal	
Pump head type:	MDP-B1_2		Ambient temperature:	-20˚C. —	45˚C.
Impeller diameter:	250	mm.			
Discharge connection:	DN100-PN16				
Suction connection:	Ring with rectangular wearring				
Extra options:	None				

** According ISO 9906 Grade 2*

*** Distance between top of the decktrunk flange and bottom of the well*

Data sheet deepwell pump and electric motor

Electric motor data

Manufacturer:	F&G				
Type:	250M-2		Main cable bushing:	1 X M63	
Frequency:	60	Hz.	Stillstand heating:	1 X M20	
Number of poles:	2		PTC cable bushing:	1 X M20	
High output:	☑		Accesoires cable:	X	
Output:	81	kW.	Insulation Class:	F	
Rated current :	146,4	A.	Protection Class:	IP 56	
Voltage:	440	V.	Explosion Class:	EEx de IIC T4	
Speed:	3565	rpm.	Stillstand heating:	120	W.
Efficiency:	91	%.	Duty type:	S1	
Power factor:	0,8		Electric connection:	Star-Delta	
Weight:	545	kg.	Mounting arrangement:	V1	

Marflex MDPD–80
Expected QH– & Power curve

Louis Pasteurstraat 12
3261 LZ Oud–Beijerland
The Netherlands
Tel: +31–186–890200
Fax: +31–186–890299

Customer: Yilyak / NB # 077
Order no.: 18070069
Date: 28–06–2007

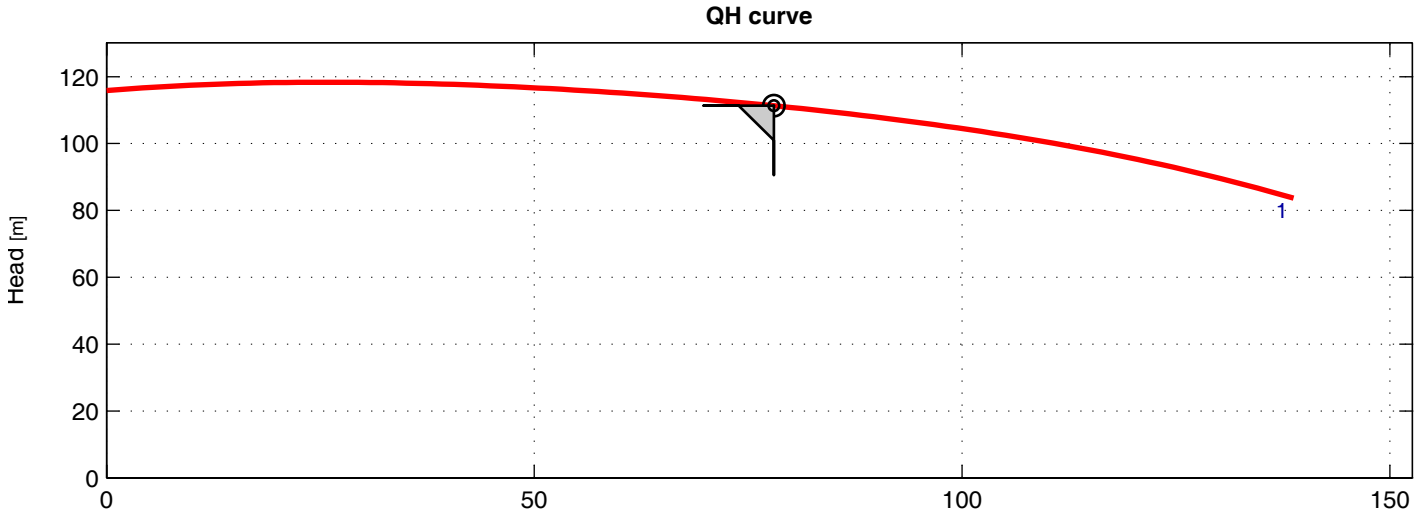
Pump type: MDP–B1_2
Speed: 3300 [rpm]
Diameter: 250 [mm]
Spec. gravity: 1.8 [–]
Viscosity: 1 [cSt]

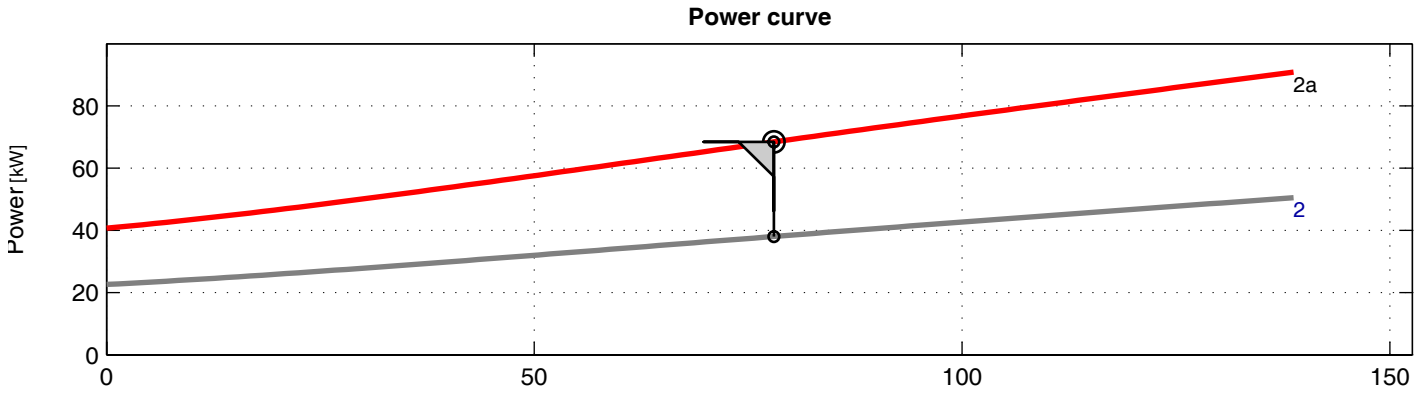
Specifications:
Capacity: 78 [m³/h]
Head: 111.3 [m]
Power: 68.4 (38.0*) [kW]
*) values for water 1cSt/sg1.0

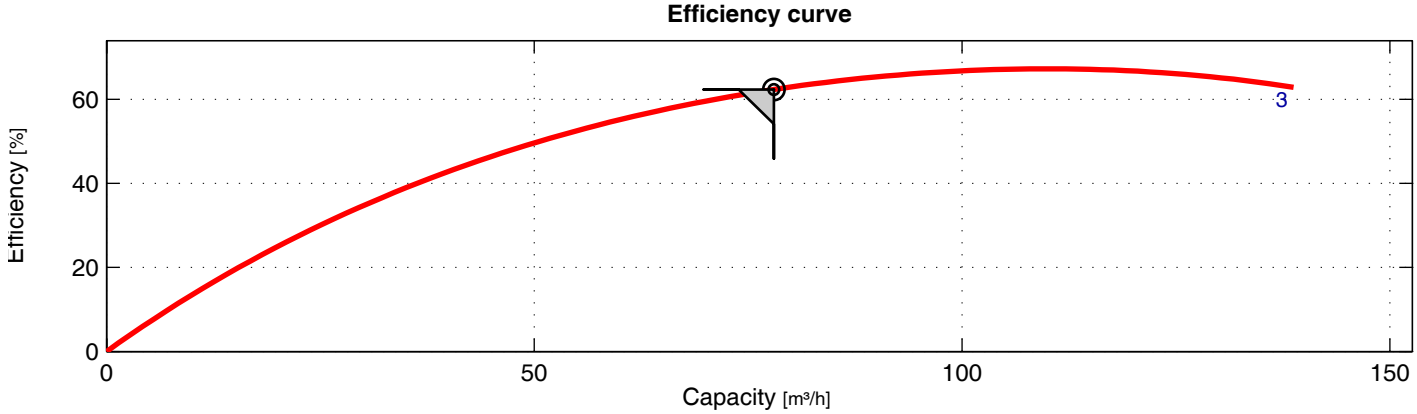
1. QH, 1[cSt]

2. Power, sg 1, 1[cSt]
2a. Power, sg 1.8, 1[cSt]

3. Eff, 1[cSt]







2 Power pack specification

Data sheet power pack

Power pack data

Power pack type:	EHP 45				
Quantity:	1		Nr of connections:	1	
Length:	1300	mm.	Pressure connection:	1" SAE, 6000 psi	
Height:	1250	mm.	Return connection:	1 1/2" SAE, 3000 psi	
Width:	600	mm.	Ambient temperature:	40	˚C.
Weight:	500	kg.			

Hydraulic pump data

Manufacturer:	Rexroth				
Hydraulic pump:	A10VSO 45		Maximum pressure:	280	bar.
Speed:	1760	rpm.	Operating pressure:	280	bar.
Flow:	72	ltr/min.			

Electro motor data

Manufacturer:	Rotor				
Motor type:	200L-4		PTC:	140	˚C.
Frequency:	60	Hz.	Tropicalized:	☑	
Output:	34	kW.	Insulation Class:	F	
Voltage:	440	V.	Protection Class:	IP 56	
Rated current:	57	A.	Explosion Class:	None	
Power factor:	0,87		Efficiency:	91,6	%.
Speed:	1760	rpm.	Stillstand heating:	220/240 V - 80 W	

Oil cooler data

Manufacturer:	Bugge				
Oil cooler:	003-100		Required output:	0,18	kW.
Speed:	1630	rpm.	PTC:	140	˚C.
Air Flow:	0,37	m3/s.	Tropicalized:	☑	
Cooling capacity:	8,4	kW.	Insulation Class:	F	
Explosion Class:	None		Protection Class:	IP 56	
			Cooler heating:	220 V - 16 W	

3 Portable pump specification

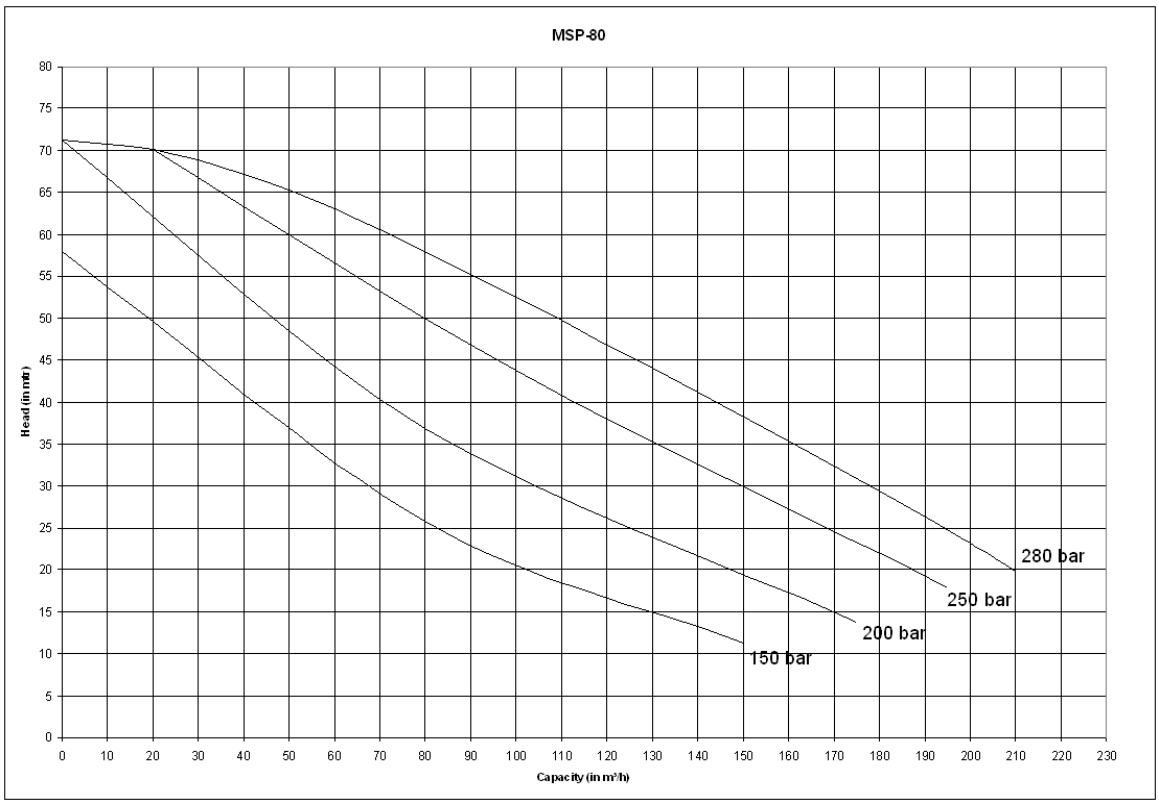
Data sheet portable pumps

Pump data

Pump type:	MSP-80c				
Quantity:	1		Motor type:	Ax plunger, mech seal	
Design:	Single stage centr		System pressure:	280	bar.
Capacity:	70	m3/hr.*	Maximum pressure:	320	bar.
Operating Head:	65	mlc.*	Return pressure:	10	bar.
Maximum Head:	85	mlc.*	Material pres hose:	Synthetic rubber	
Viscosity:	1	cst.	Material ret hose:	Synthetic rubber	
Specific gravity:	1	kg/ltr.	Pres hose connection:	Tema 5020	
Maximum speed:	4800	rpm.	Ret hose connection:	Tema 7520	
Maximum flow:	75	ltr/min.	Length hydr hoses:	18	m.
Material impeller:	AISI 316L		Discharge connection:	Sandvik FCL 4” flange	
Material pump:	AISI 316L		Max outer diameter:	250	mm.
Flow control:	☐		Heigth pumpcasing:	570	mm.
Start/stop valve:	☑		Weight:	45	kg.

** According ISO 9906 Grade 2*

Performance diagram MSP-80c



4 Tripod specification

Data sheet Tripod

Tripod data

Type:	Tripod		
Quantity:	1	Drive:	Manual

5 Standard practices and torque values

5.1 Standard torque values

Note:

Make sure to use the correct torque using the applicable table values based on material and quality class!

5.1.1 Tightening torque's for nuts and bolts, Stainless Steel.

A frictional power loss of 0.2 is maintained (greased screw thread).

Caution!

Apply some grease to the screw thread of the bolts.
Use grease based on chlorine-paraffin or another comparable product, capable to protect the screw thread against seizing.

Caution!

Use torque wrenches only! Do NOT hammer the bolts, nuts and wrenches
Apply the torque slow and evenly.

Caution!

Make sure the torque wrench is perpendicular to the bolt and NOT at an angle.

The values below serve as a guideline only, no liability should be assumed!

Table 1: Quality class of fasteners: stainless steel A4-80. (AISI 316)

Bolts/Nuts	Tightening torque	Bolts/Nuts	Tightening torque
M 5	6,9 Nm	M 12	100 Nm
M 6	11,8 Nm	M 16	245 Nm
M 8	28,7 Nm	M 20	494 Nm
M 10	58 Nm	M 24	852 Nm

5.1.2 Tightening torque's for nuts and bolts, Steel

A frictional power loss of 0.14 is maintained. (greasy screw thread)

Caution!

Apply some grease to the screw thread of the bolts.
Use grease based on chlorine-paraffin or an other comparable product, capable to protect the screw thread against seizing.

Caution!

Use torque wrenches only! Do NOT hammer the bolts, nuts and wrenches
Apply the torque with an even and slow speed.

Caution!

Make sure the torque wrench is perpendicular to the bolt and NOT at an angle.

The values below serve as a guideline only, no liability should be assumed!

Table 2: Quality class of fasteners: steel 8.8.

Bolts/Nuts	Tightening torque	Bolts/Nuts	Tightening torque
M 5	6,1 Nm	M 12	87 Nm
M 6	10,4 Nm	M 16	215 Nm
M 8	25 Nm	M 20	430 Nm
M 10	51 Nm	M 24	740 Nm

Table 3: Quality class of fasteners: steel 10.9.

Bolts/Nuts	Tightening torque	Bolts/Nuts	Tightening torque
M 5	8,9 Nm	M 12	130 Nm
M 6	15,5 Nm	M 16	310 Nm
M 8	37 Nm	M 20	620 Nm
M 10	75 Nm	M 24	1060 Nm

Table 4: Quality class of fasteners: steel 12.9.

Bolts/Nuts	Tightening torque	Bolts/Nuts	Tightening torque
M 5	10,4 Nm	M 12	150 Nm
M 6	18,0 Nm	M 16	370 Nm
M 8	43 Nm	M 20	720 Nm
M 10	87 Nm	M 24	1240 Nm

5.2 Advised lubricant types for pipe stack

Danger!

Be aware of a lubricant's flash point (> 200 °C)

Caution!

In arctic environments be aware of the solidification temperature of the lubricant. (< –30 °C)

Caution!

Use only new, clean oil of a well-known brand!

5.2.1 Operating conditions

Table 5: Recommended oil under different conditions

Condition:	Temperature range:	Advised oil type:
Normal	Temperature inside the tank 20°C - 95°C. Ambient temperature 10°C - 45°C	ISO VG 32 (SAE 10W40)
Arctic	Temperature inside the tank 5°C - 95°C. Ambient temperature -25°C - 35°C.	ISO VG 32 (SAE 10W40)
Tropical	Temperature inside the tank 20°C - 95°C Ambient temperature 15°C - 50°C	ISO VG 46 (SAE 15W40)

5.2.2 Brands and oil types (examples)

Table 6: Manufacturer / Oil type

Manufacturer	VG 32	VG 32	VG 46	VG 46
AGIP	--	OSO 32	ARNICA 645	OSO 46
ARAL	ARAL	VITAM GF/DE 32	VITAM HF 46	VITAM GF/DE 46
AVIA	AVILUB HVI 32	AVILUB RSL 32	AVILUB HVI 46	AVILUB RSL 46
BP	ENERGOL SHF 32	ENERGOL HLP(D) 32	ENERGOL SHF 46	ENERGOL HLP(D) 46
CASTROL	HYSPIN AWH 32	HYSPIN AWS 32	HYSPIN AWH 46	HYSPIN AWS 46
CHEVRON	EP.HYDR.OIL 32 HV	EP.HYDR.OIL 32	--	EP.HYDR.OIL 46
DEFROL	HVP 32	HLP 22	HVP 46	HLP 46
ESSO	UNIVIS J 32	NUTO H 32	UNIVIS N56	NUTO H 46
FINA	HYDRAN HV 32	HYDRAN 32	HYDRAN HV 46	HYDRAN 46

Table 6: Manufacturer / Oil type (Continued)

Manufacturer	VG 32	VG 32	VG 46	VG 46
FUCHS	RENOLIN MR 520	RENOLIN M(B)10	RENOLIN MR 1030	RENOLIN MR(B) 15
OPTIMOL	HYDO MV 5035	HYDO 5035	HYDO MV 5045	HYDO 5045
MOBIL	DTE 13	DTE 24	DTE 15	DTE 25
OMV	HLP M 32	HLP 32	HLP M 46	HLP 46
SHELL	TELLUS T 32	TELLUS 32	TELLUS T 46	TELLUS 46
TEXACO	RANDO HD AZ 32	RANDO HD A 32	--	RANDO HD B 46
VALVOLINE	--	ETC 25	--	ETC 30
VEEDOL	--	--	--	ANDARIN 46
HD-MOTOROIL	--	SAE 10 W	SAE 10 W 30	--
TOTAL	--	--	EQUIVIS ZS46	--

5.3 Advised lubricant types for powerpacks

Technical data (source: Rexroth - Bosch)

Technical Data

Hydraulic Fluid

We request that before starting a project, detailed information about the choice of hydraulic fluids and application conditions are taken from our catalogue sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic oils) and RE 90223 (HF hydraulic fluids).

The A11VO variable displacement pump is not suitable for operation with HFA, HFB and HFC. When operating with HFD or environmentally acceptable hydraulic fluids, restrictions in the technical data should be noted – please contact us (the hydraulic fluid used should be stated in clear text in the order).

Operating viscosity range

We recommend that the operating viscosity (at operating temperature), for both the efficiency and life of the unit, be chosen within the optimum range of:

ν_{opt} = opt. operating viscosity 16…36 mm^2/s

referred to tank temperature (open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

ν_{min} = 5 mm^2/s

short term, at a max. permissible leakage oil temperature t_{max} = 115°C

ν_{max} = 1600 mm^2/s short term, on cold start (t_{min} = -40°C)

Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

At temperatures of –25°C to –40°C special measures may be required. Please contact us for further information.

Notes on the selection of hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

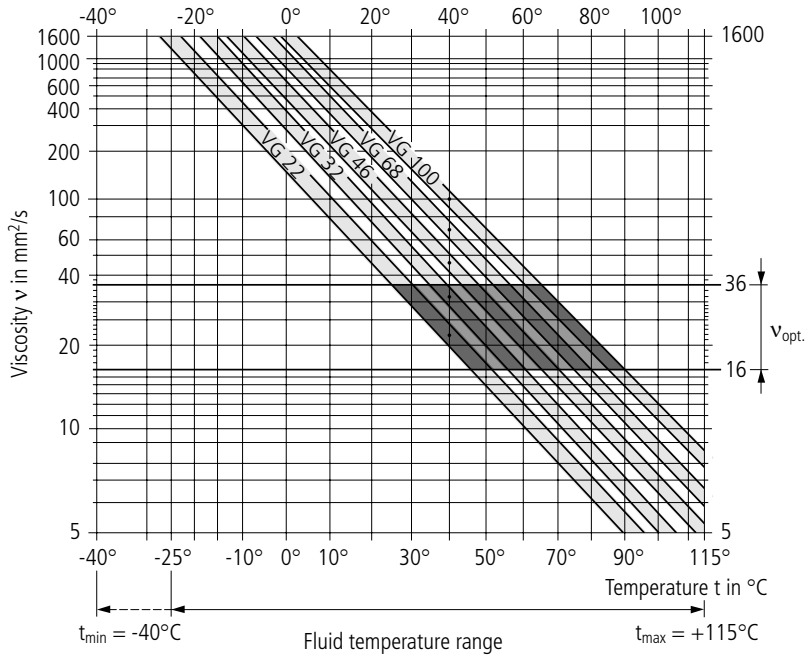
The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selection diagram). We recommend that the higher viscosity grade is selected in each case.

Example: At an ambient temperature of X°C, the operating temperature in the tank is 60°C. In the optimum viscosity range ν_{opt} (shaded area), this corresponds to viscosity grades VG 46 or VG 68. VG 68 should be selected.

Important: The leakage oil temperature is influenced by pressure and speed and is typically higher than the tank temperature. However, maximum temperature at any point in the system must be less than 115°C.

Please consult Brueninghaus Hydromatik if the above conditions cannot be kept at extreme operating parameters or because of high ambient temperature.

Selection diagram



5.4 Measuring / maintaining (hydraulic) lubricant cleanliness

Lubricant cleanliness is an important aspect to be considered when using (hydraulic) systems and components.
It is usual to request that the system is flushed to achieve a specific degree of cleanliness, e.g. NAS 6.

Measuring hydraulic cleanliness is not straight forward, consequently various standards exist on this subject.

5.4.1 Cleanliness standards

There are two cleanliness standards most commonly used:

- ISO 4406
- NAS 1638.

ISO 4406, is perhaps the most widely used International standard for representing the contamination level of industrial fluid power systems. Under ISO 4406 cleanliness is classified by a two number code, e.g. 16/13, based on the number of particles greater than 5 µm and 15 µm respectively in a known volume of fluid.
However some manufacturers have expanded the code to three numbers by the addition of a code number representing the number of particles greater than 2 µm, e.g. 18/16/13. Using Table 7: below, we can see a cleanliness rating of 18/16/13 based on the number of particles greater than 2 µm, 5 µm and 15 µm respectively in a known volume of fluid.
This would mean that there were:
1300 - 2500 particles greater than 2 micron in size
320 - 640 particles greater than 5 micron in size, and
40 - 80 particles greater than 15 microns in size.

The **NAS 1638** cleanliness standard was originally developed for aerospace components in the US but is still widely used for industrial and aerospace fluid power applications.
It is used widely in the UK North Sea industries. NAS 1638 is comprised of fluid cleanliness classes, each class defined in terms of maximum allowed particle counts for designated particle size ranges. See Table 8: below.

To determine how ISO 4406 and NAS 1638 compare to each other see Table 9:.

Table 7: ISO 4406

Range Number	No of Particles per ml	
	More Than	Up to and including
24	80 000	160 000
23	40 000	80 000
22	20 000	40 000
21	10 000	20 000
20	5 000	10 000
19	2 500	5 000
18	1 300	2 500
17	640	1 300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64

Table 8: NAS 1638

Class	Maximum Number of Particles / 100 ml				
	5 - 15	5 - 25	25 - 50	50 - 100	>100
00	125	22	4	1	0
0	250	44	8	2	0
1	500	89	16	3	1
2	1000	178	32	6	1
3	2000	356	63	11	2
4	4000	712	126	22	4
5	8000	1425	253	45	8
6	16000	2850	506	90	16
7	32000	5700	1012	180	32
8	64000	11400	2025	360	64
9	128000	22800	4050	720	128
10	256000	45600	8100	1440	256
11	512000	91200	16200	2880	512
12	102400	182400	32400	5760	1024

Table 9: Comparison standards

ISO Code	NAS Class
23/21/18	12
22/20/18	--
22/20/17	11
22/20/16	--
21/19/16	10
20/18/15	9
19/17/14	8
18/16/13	7
17/15/12	6
16/14/12	--
16/14/11	5
15/13/10	4
14/12/9	3
13/11/8	2
12/10/8	--
12/10/7	1
12/10/6	--

5.4.2 Minimum recommended cleanliness / filtration level

Table 10: Typical fluid cleanliness levels for different types of (hydraulic) systems

Type of (hydraulic) system	Minimum recommended cleanliness level			Minimum recomended filtration level in microns
	ISO 4406	NAS 1638	SAE 749	
Silt sensitive	13/10	4	1	2
Servo	14/11	5	2	3-5
High pressure (250–400 bar)	15/12	6	3	5-10
Normal pressure (150-250 bar)	16/13	7	4	10-12
Medium pressure (50 -150 bar)	18/15	9	6	12-15
Low pressure (< 50 bar)	19/16	10	-	15-25
Large clearance	21/18	12	-	25-40

5.4.3 Testing fluid cleanliness

There are two ways of testing fluid cleanliness.

The first involves sending a fluid sample to a laboratory for analysis. The lab results contain detailed information on the condition of the fluid. The information normally included in a fluid condition report, along with typical targets or alarm limits, are shown in Table 11:.

Table 11: Example fluid condition report

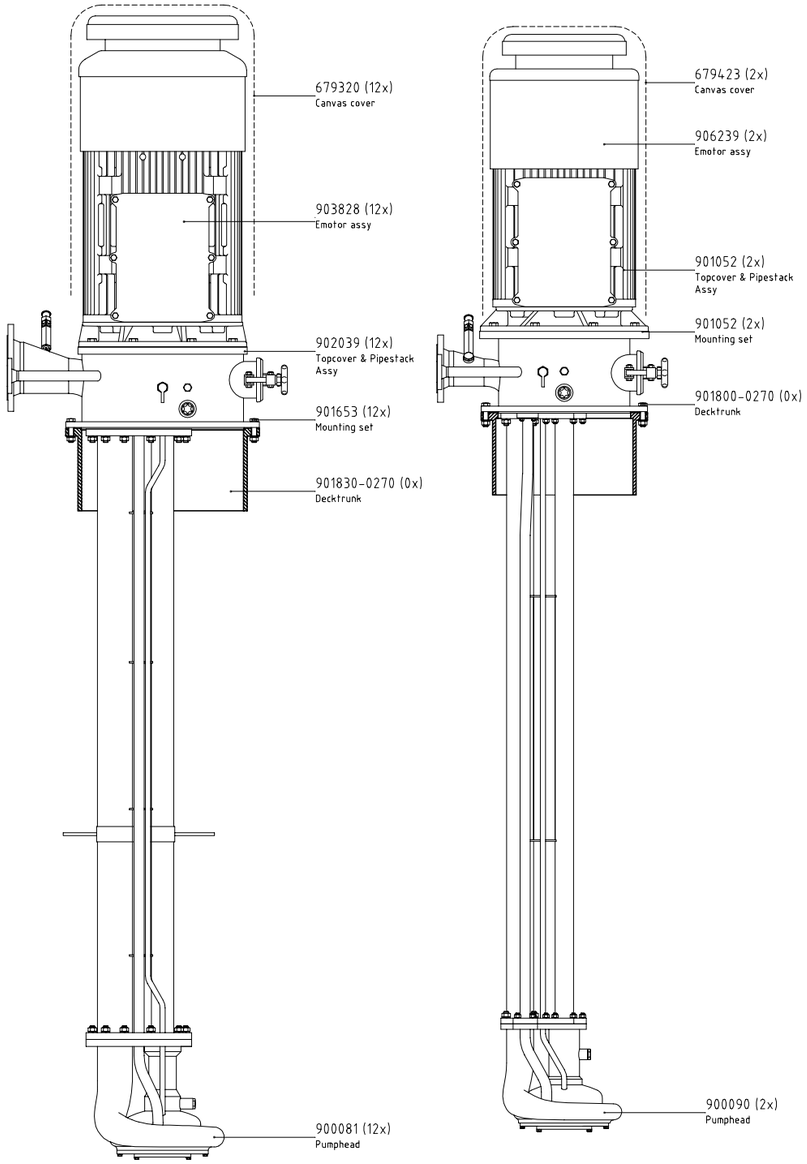
Condition catagory	Recommended targets or alarm limits
Fluid cleanliness level	Within targeted range chosen for the system or recommended by the manufacturer (ISO 4406)
Wear debris level	(Al) 5 ppm, (Cr) 9 ppm, (Cu) 12 ppm, (Fe) 26 ppm, (Si) 15 ppm
Viscosity	± 10 % of new fluid
Water content	< 100 ppm
Total Acid Number (TAN)	+ 25% of new fluid
Additive level	- 10% of new fluid

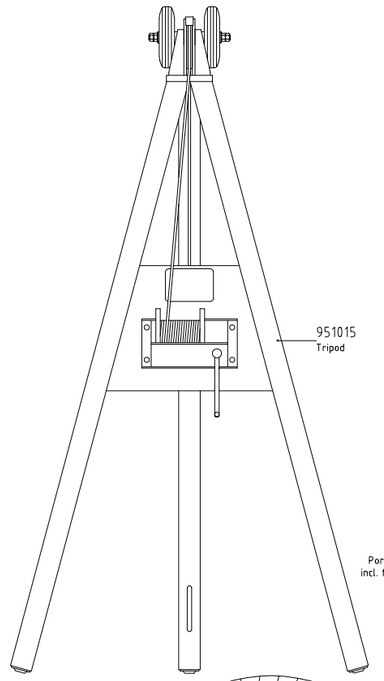
The second way to test a fluid's cleanliness level is to use a portable, electronic instrument designed for this purpose. This method is convenient and results are almost instant, however it shouldn't be considered a total substitute for lab analysis because the results do not include wear debris levels, viscosity, water content and other useful data.

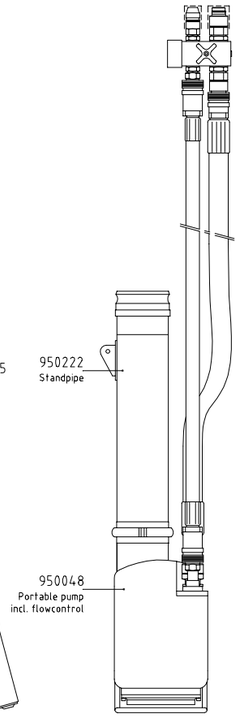
But when the two methods are used in combination, the frequency of lab analysis can be reduced.

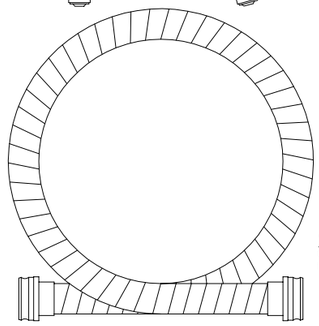
7 Drawings and part lists

1 Scope of supply drawing(s)

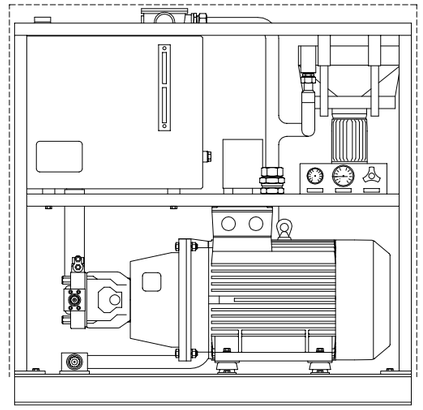


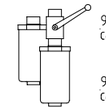


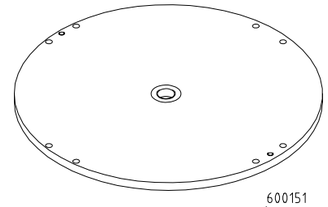


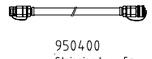


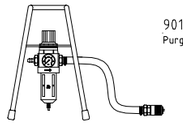
950617
Power Pack

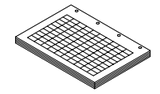


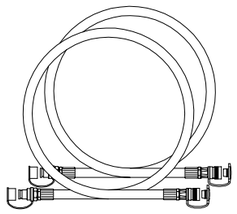




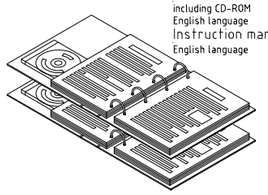


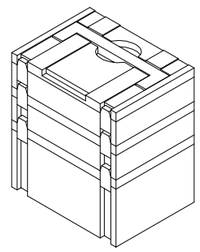


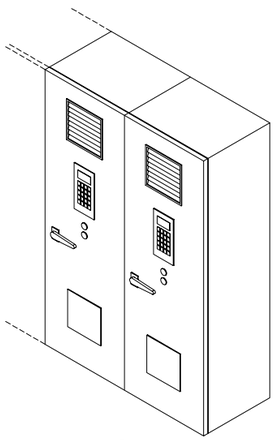




Installation manual (3x)
including CD-ROM
English language
Instruction manual (3x)
including CD-ROM
English language
Instruction manual FC (3x)
English language







3				
2				
1	RvdM 05-09-07			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:10	mm	A1

TITLE / DESCRIPTION

Scope of supply

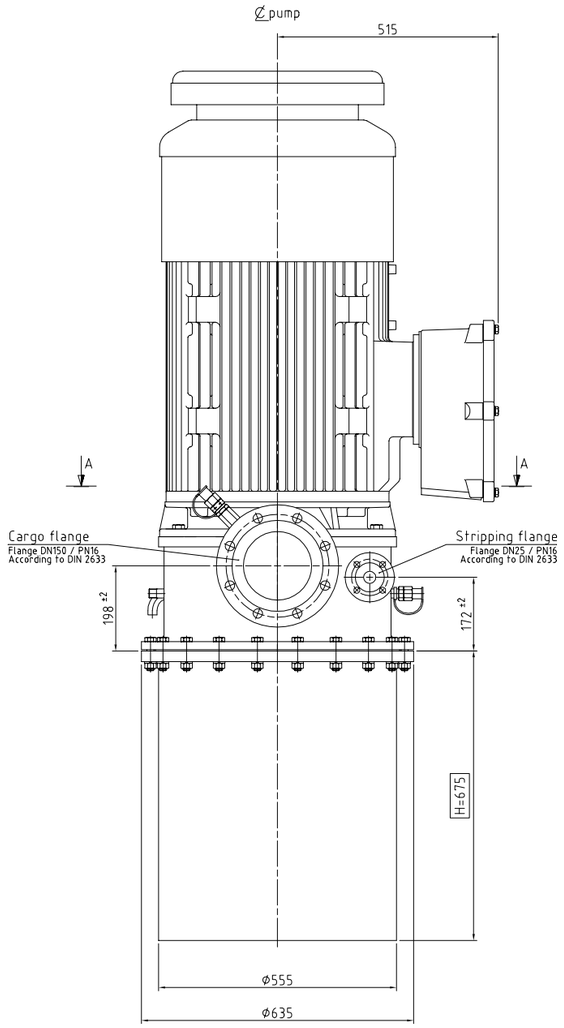
MarFlex b.v.
Louis Pasteurstraat 12
3281LZ Oud-Beijerland
The Netherlands
Tel : 0186-890200
Fax: 0186-890299

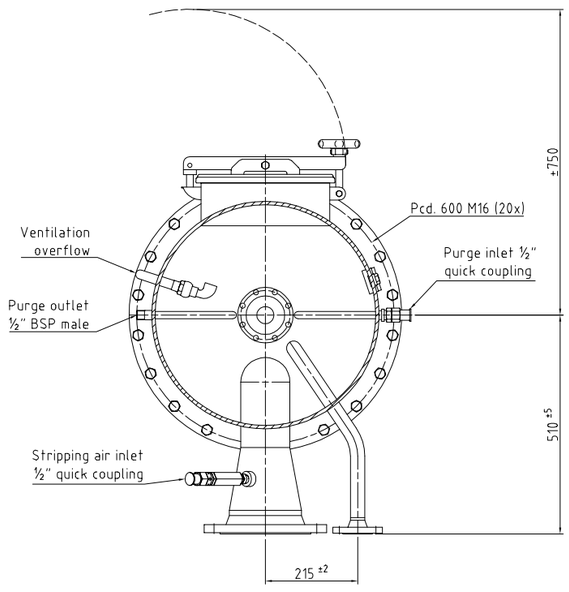
PROJECT/ALT. No.: Yilyak Yakit/NB077
SHEET: 1
DOCUMENT No. / ITEM No.: 18070069-00
OF: 1

2 Cargo pump(s) drawings

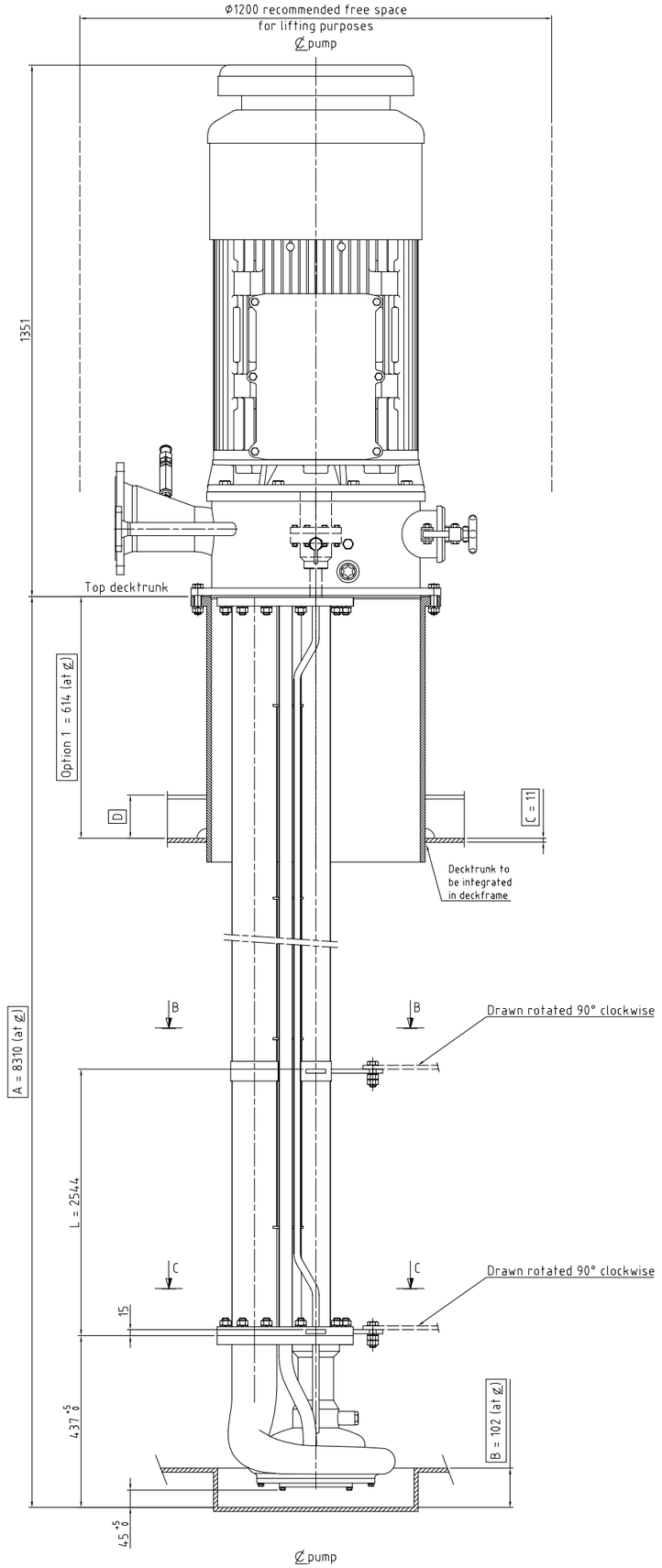
Includes:

- Installation drawing(s)
- Dummy drawing(s) (if applicable)
- Component drawings

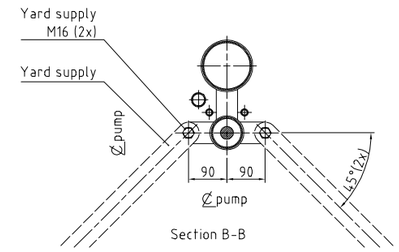




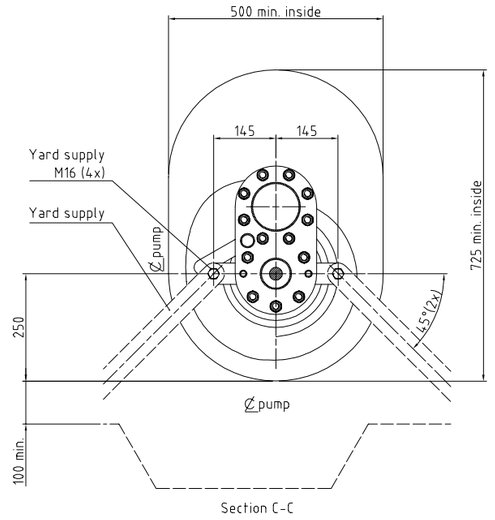
Section A-A
E-motor omitted for clearity



℄pump



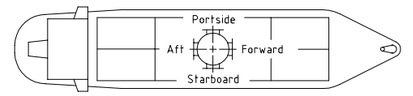
Section B-B



Section C-C

Electric motor can be positioned on the topcover with increments of 45°.
Pump assembly can be positioned on the decktrunk with increments of 90°.
The suction well can be placed with increments of 180° depending on the pumphead direction.

Weigths					
E-motor	573	kg	Decktrunk	56	kg
Pumphead	75	kg	Pipestack	23	kg/m
Topcover	170	kg	Stackflange	16	kg
Lubrication oil (SAE 32/46)					
Topcover	7	ltr	Pipestack	2,4	ltr/m



Variable dimensions (provided by the yard)					
Dimension A	8310	mm	Dimension D		mm
Dimension B	102	mm	Dimension H	675	mm
Dimension C	11	mm	Dimension L	2544	mm
Deck reinforcement (provided by the yard)					
Option 1 (above deck)	614	mm	Option 2 (below deck)		mm
Direction of discharge (provided by the yard)					
Portside			Forward	6x	
Starboard			Aft	6x	
Quantity and diameters of electric cable (provided by the yard)					
Power supply	x	mm	Screened	Yes / No	
PTC / Standstill heating	x	mm	Screened	Yes / No	

All dimensions indicated with max. or min. are recommended measurements.

ISSUE	MADE BY / DATE	CHECKED	APPROVAL	E.C. DESCRIPTION
3				
2	EH 27-11-07			Added variable dimensions, changed position of pipe stack support
1	AvO 19-06-07			

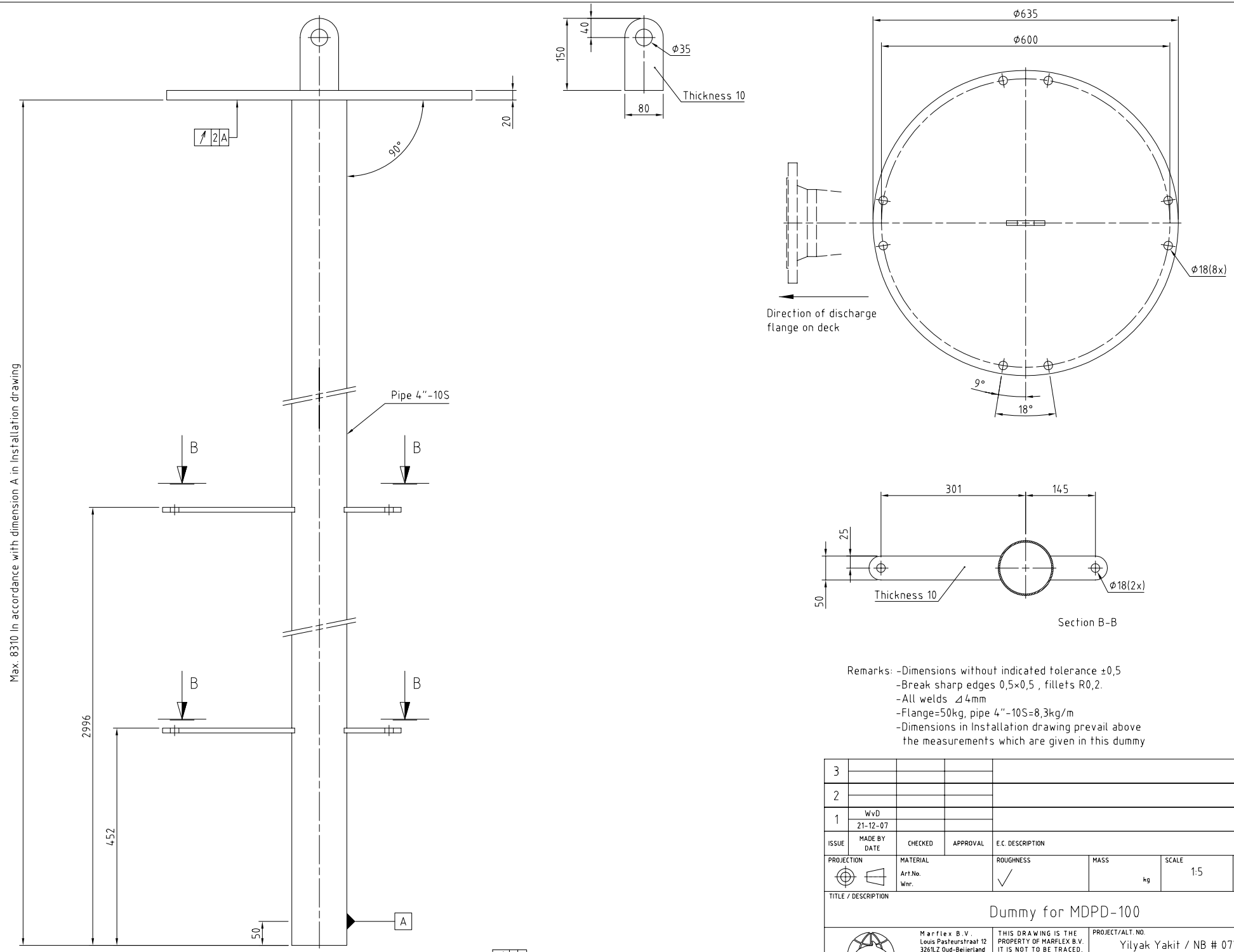
PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:5	mm	A0

TITLE / DESCRIPTION

Installation drawing MDPD-100 cargo pump

Marflex B.V.
Louis Pasteurstraat 12
8243.Z Oud-Beijerland
The Netherlands
Tel. +31 186-890200
Fax +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
Yilyak Yakit/NB 077	1
DOCUMENT NO. / ITEM NO.	OF
18070069-01	1



Remarks: -Dimensions without indicated tolerance ±0,5
-Break sharp edges 0,5×0,5 , fillets R0,2.
-All welds ⊿4mm
-Flange=50kg, pipe 4"-10S=8,3kg/m
-Dimensions in Installation drawing prevail above the measurements which are given in this dummy

2 A = Circulair run-out max. 2mm from point A on pipe

3				
2				
1	WvD 21-12-07			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.	✓	kg	1:5	mm	A2

TITLE / DESCRIPTION

Dummy for MDPD-100

Marflex B.V.
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3261LZ Oud-Beijerland
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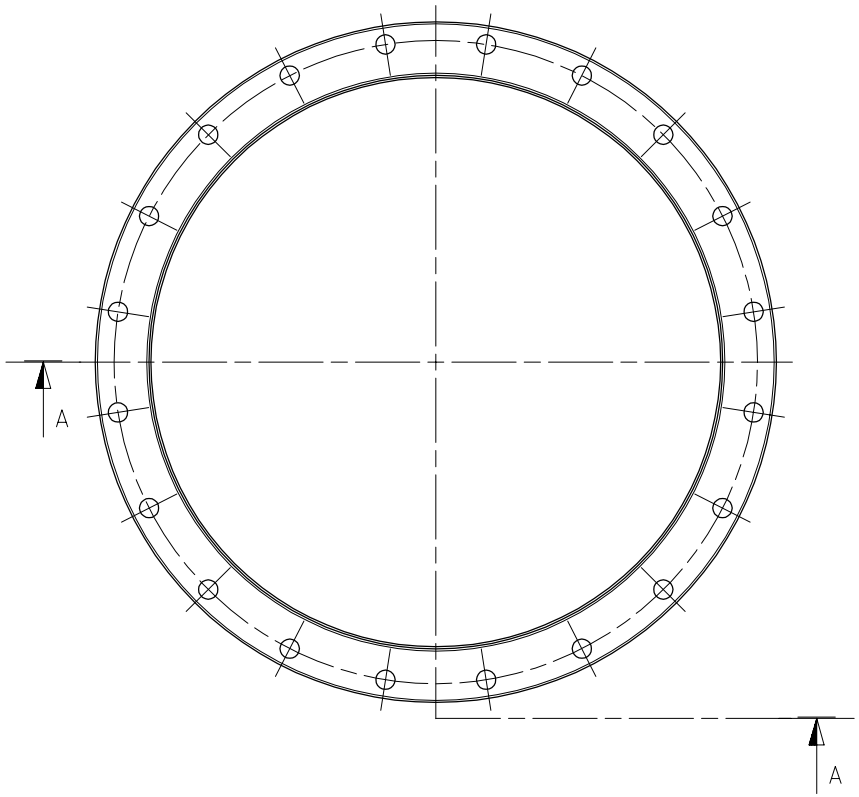
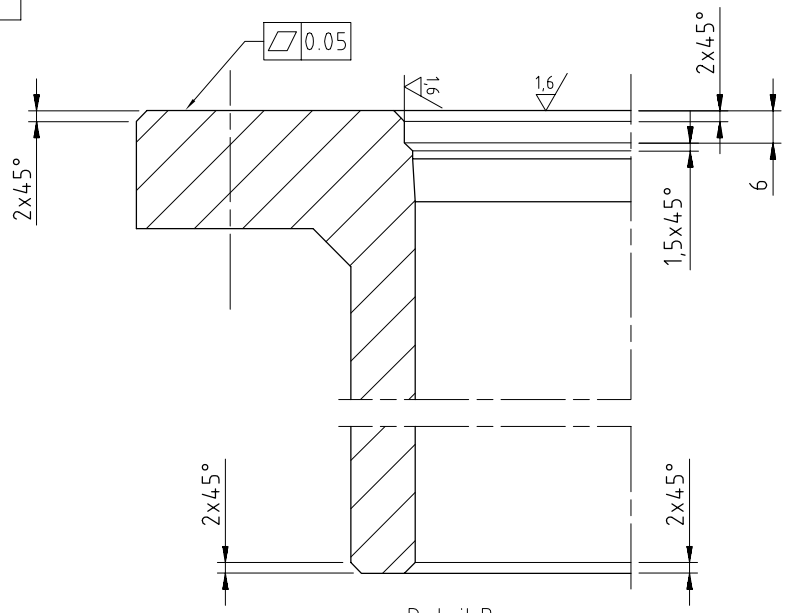
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

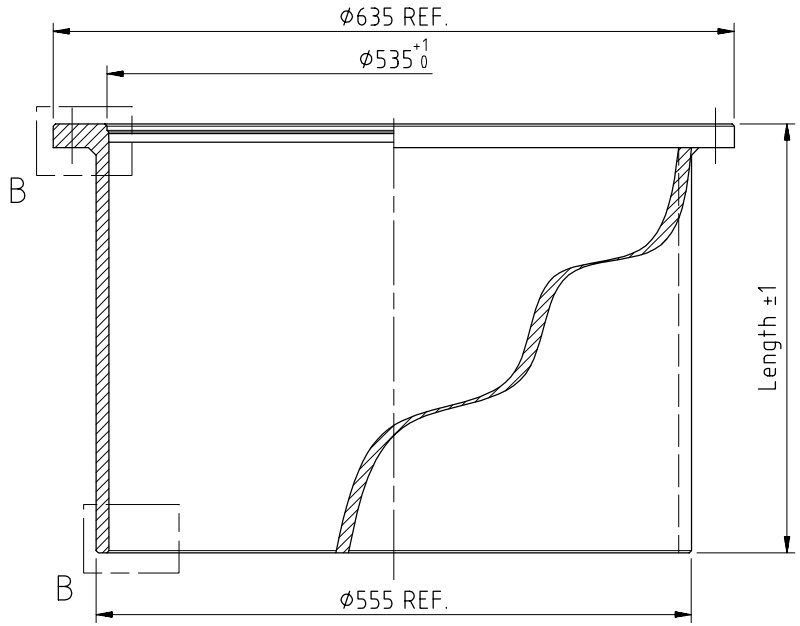
PROJECT/ALT. NO.	SHEET
Yilyak Yakit / NB # 077	1
DOCUMENT NO. / ITEM NO.	OF
18070069-03	1



Project number	18070069
Article number	901830-0270
Length	270
Qty	0



Detail B
Scale 1:1



Section A-A

Surface Treatment:
-Pre treatment to be shotblast cleaning to ISO-SA2½.
-Sigmaweld MC painting to dry film thickness(d.f.t.) of 18µm.

Remarks: -Dimensions without indicated tolerance ±0,2.
-Break sharp edges 0,5x0,5 , fillets R0,2.

8	AvO 04-05-05	Keemink 27-05-05	Keemink 27-05-05	Removed length dedicated art.nrs.
7	EH 11-03-05			Added article numbers 901830-0640, 901830-0720, 603229 and 603230.
6	EH 14-12-04	AdH 23-12-04	AdH 23-12-04	Added length dedicated art.nrs.
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. 603032 Wnr. 1.0037	1,6	kg	1:5 1:1		A3

TITLE / DESCRIPTION

DECKTRUNK-0635-D18x20-1.0037-0

Marflex B.V.
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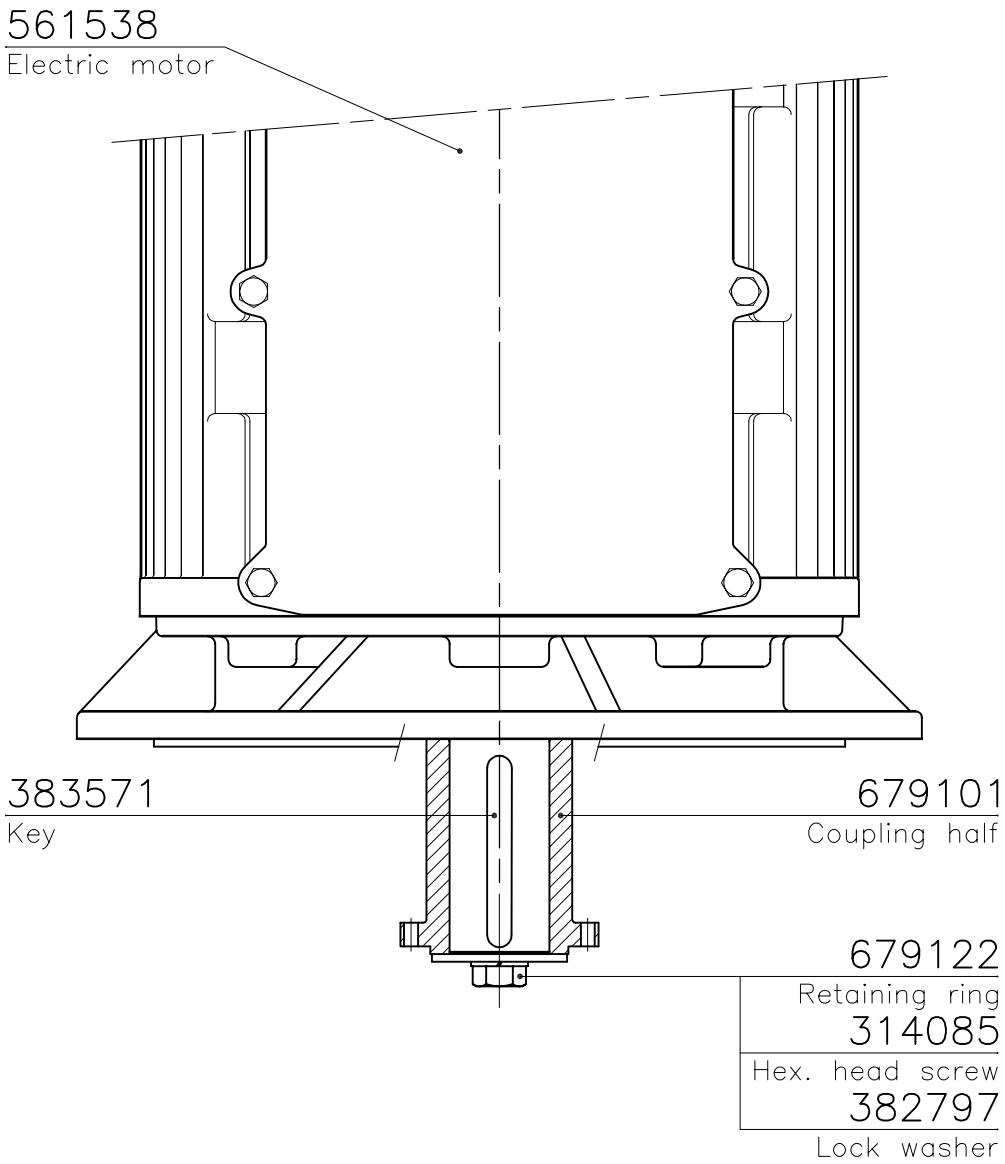
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.

SHEET 1

DOCUMENT NO. / ITEM NO. 901830

OF 1



3				
2				
1	KS			
	12-10-06			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

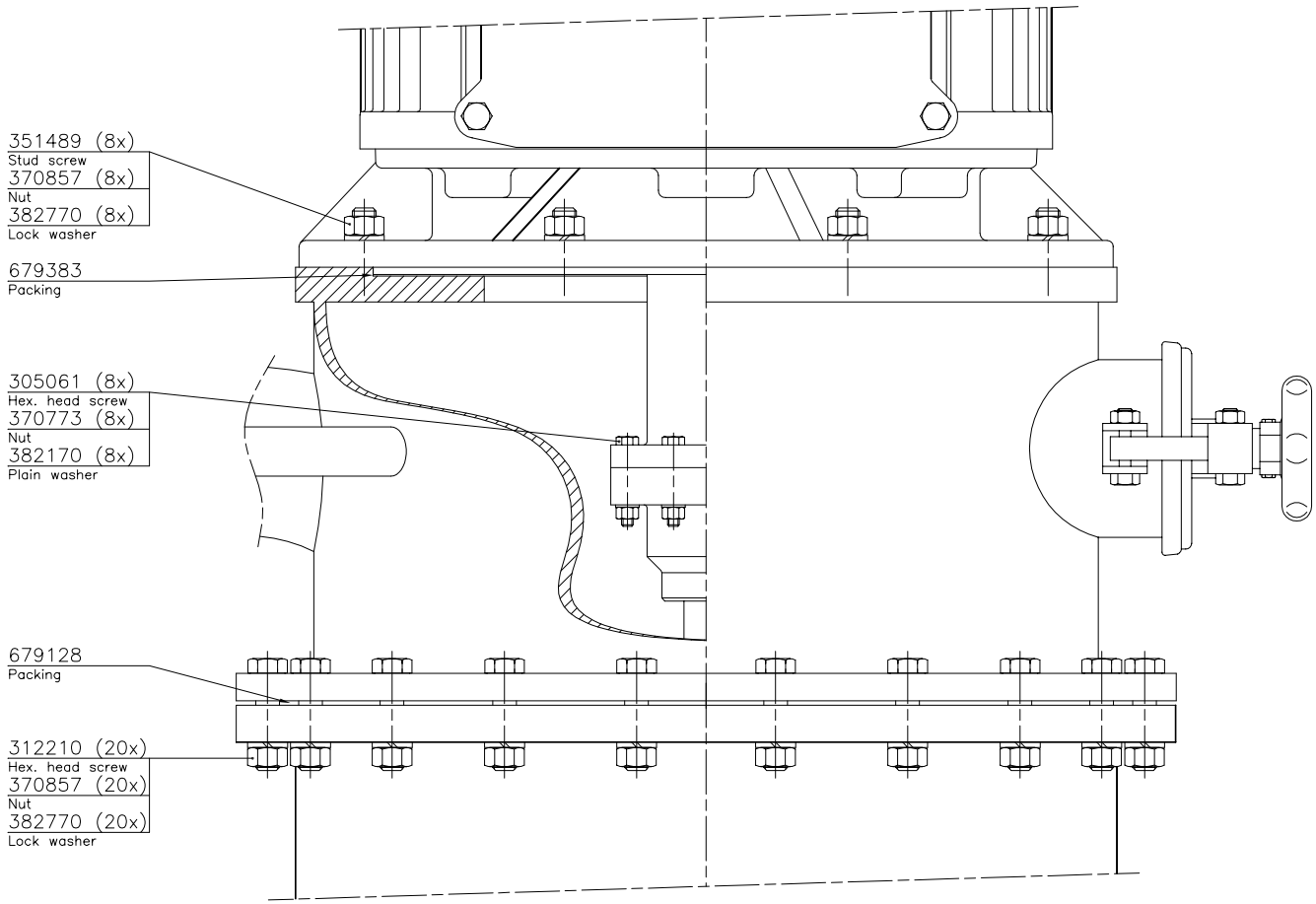
PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:5	mm	A4

TITLE / DESCRIPTION

EMASSY30-62M052-105H-46Z41DE-0

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
Motor Size 280	1
DOCUMENT NO. / ITEM NO.	OF
903828	1



3a	HAK	AvO	AvO	Item 370773 was 371603
	19-06-07	21-06-07	21-06-07	
3	NM	AdH	AdH	Changed drawing title
	13-07-04	19-07-04	19-07-04	
2	AvO	AdH	AdH	Changed drawing lay-out. Changed art.no. 371603 was 370773,
	09-06-04	10-06-04	10-06-04	382170 was 382644 and 305061 was 307167.
1	MvD	Keemink		
	19-03-97	21-03-97		
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:2,5	mm	A2

TITLE / DESCRIPTION

MOUNTINGSETED-G4M08-S162-161-0

Marflex B.V.
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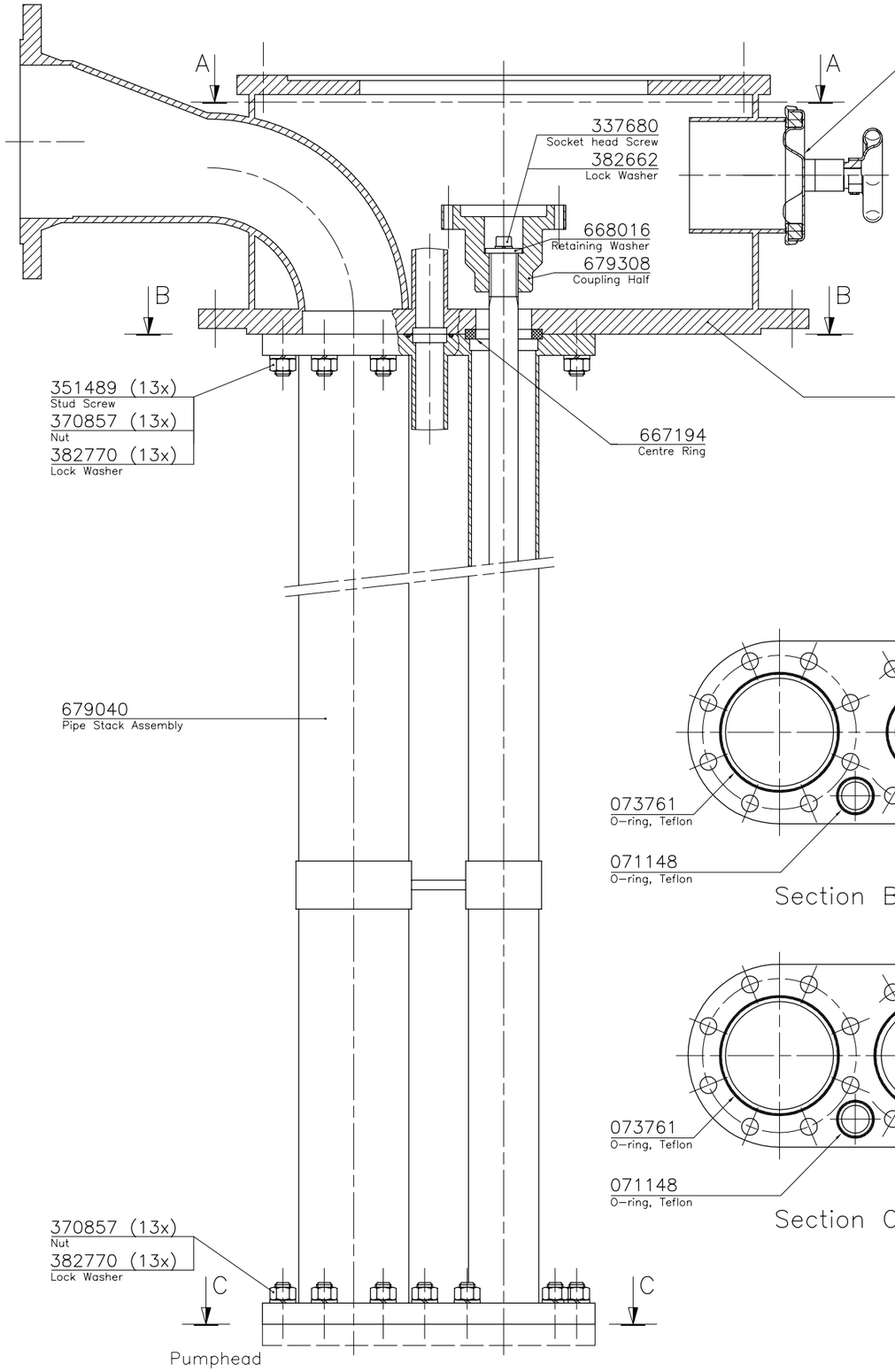
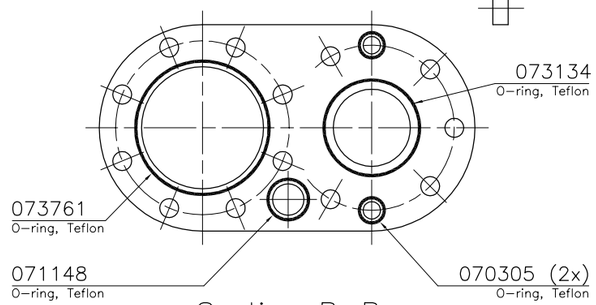
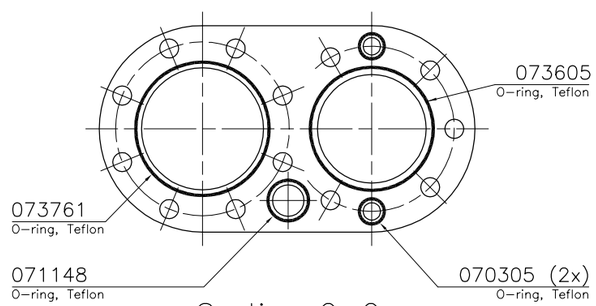
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
	1
DOCUMENT NO. / ITEM NO.	OF
901653	1

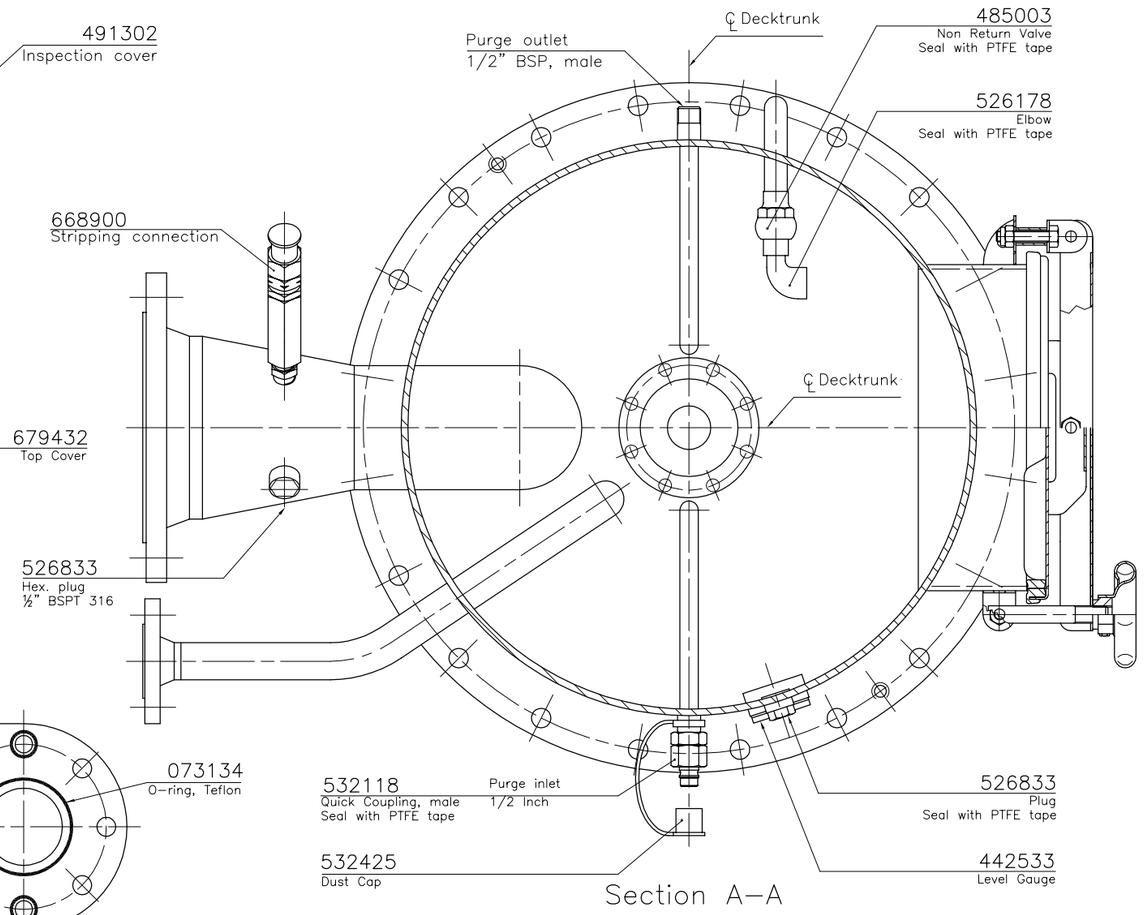




Section B–B



Section C–C



Section A–A

3				
2				
1	AvO 21-06-07	EH 21-06-07	EH 21-06-07	
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:4	mm	A2

TITLE / DESCRIPTION

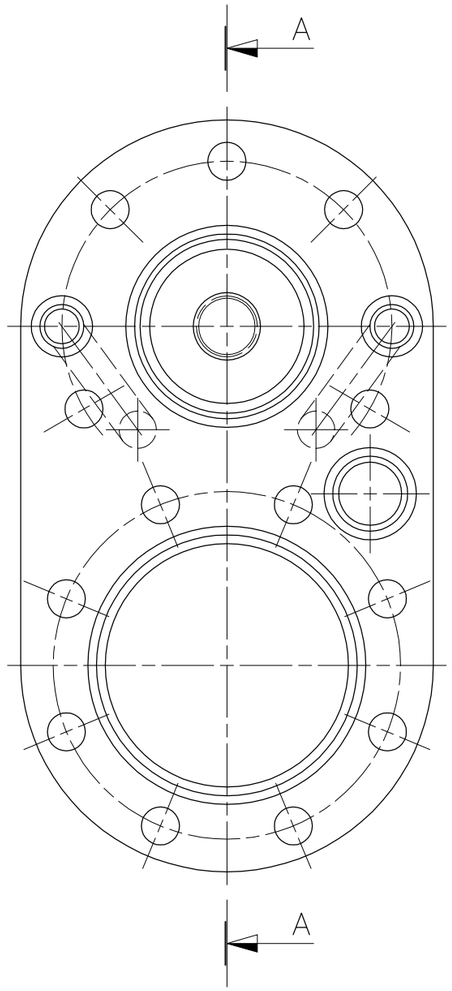
CTP-GS-D06B-E051-EL000000-04

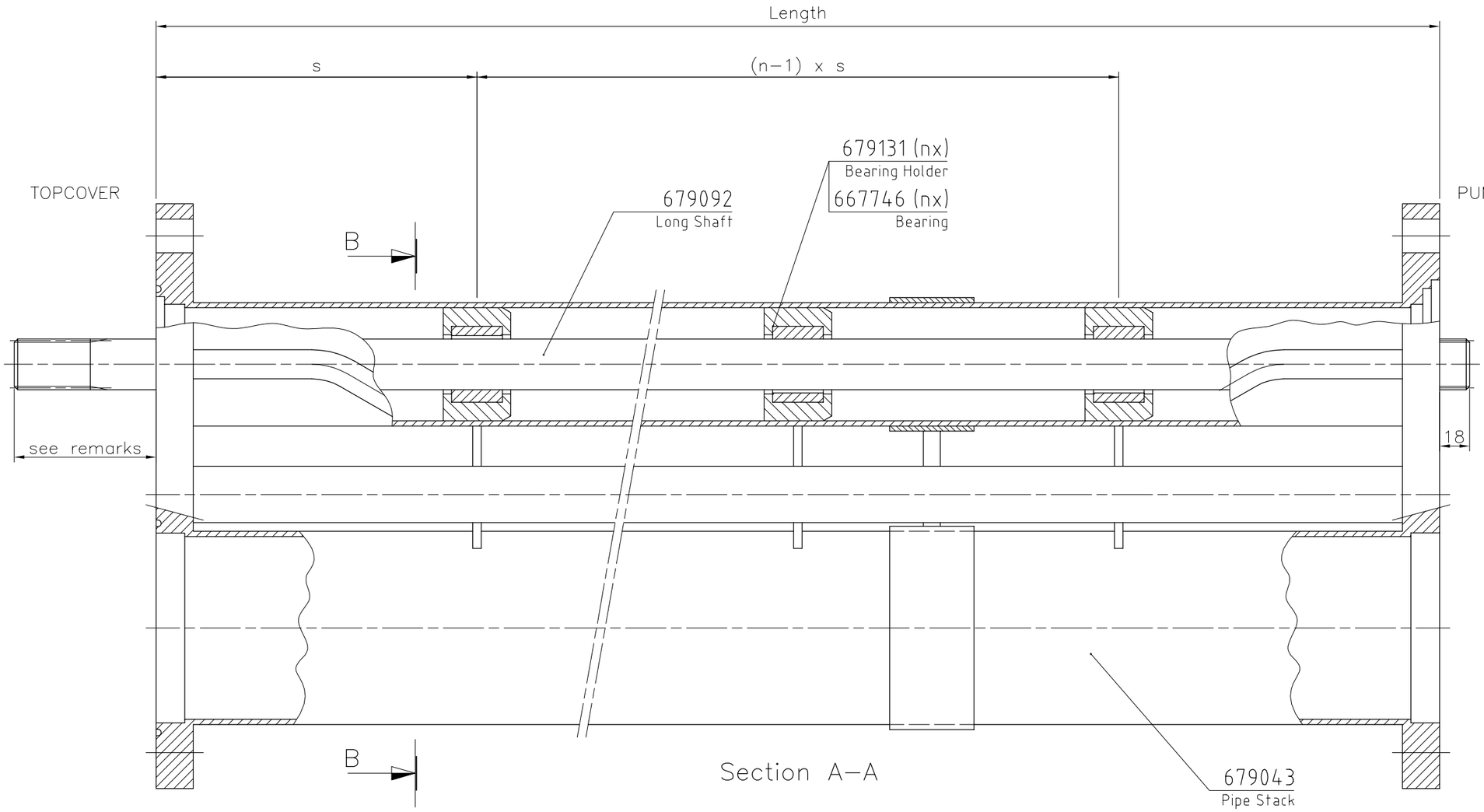
Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.

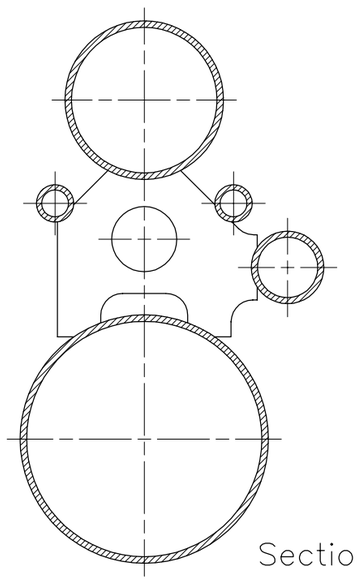
DOCUMENT NO. / ITEM NO. 902039

SHEET 1 OF 1





Section A–A



Projectnumber	
Length	
Qty	
s≤800	
n	

Remarks: –Dimension 112,5 if length e–motor shaft is 110
–Dimension 82,5 if length e–motor shaft is 140

3				
2	EH 20-04-05	AvO 02-05-05	AvO 02-05-05	Added remarks and dimension 18
1	AdH 29-09-04			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr. 1.4404		kg	1:2	mm	A2

TITLE / DESCRIPTION

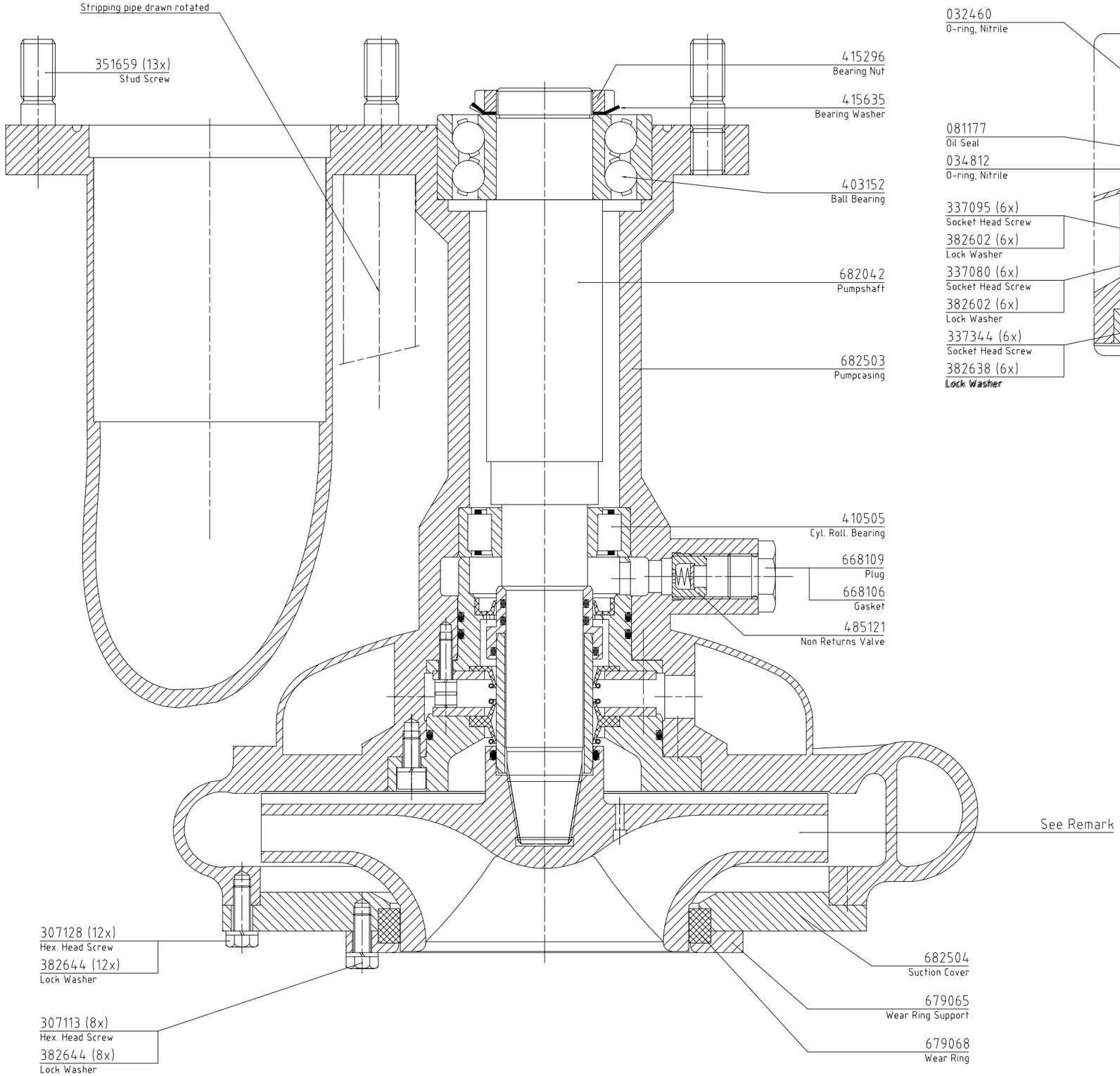
PIPESTACK ASSEMBLY MDP-G/S XL

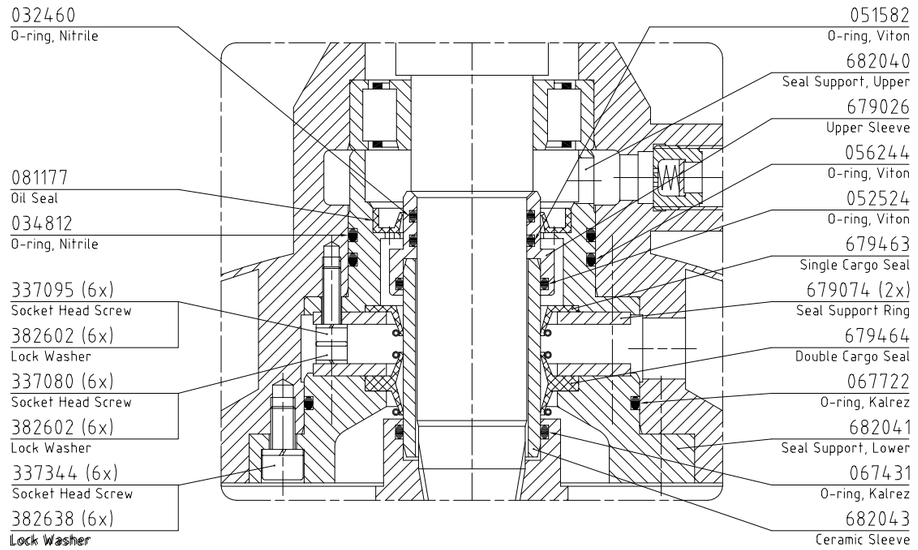
Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel. : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.

DOCUMENT NO. / ITEM NO. 679040

SHEET 1 OF 1





Impeller diameter	G1L3X Art.No	G1L31X Art.No
ø260	679254	679555
ø255	679443	679556
ø250	679397	679557
ø245	679444	679558
ø240	679445	679559
ø235	679446	679560
ø230	679374	679561
ø225	679377	679562
ø220	679396	679563
ø215	679447	679564
ø210	679378	679565
ø205	-	679566
ø200	679379	679567

ISSUE	MADE BY / DATE	CHECKED	APPROVAL	E.C. DESCRIPTION
5	AdH 30-10-03	Keemink 30-10-03	Keemink 30-10-03	Added G1L31X art.nrs. impeller
4	AdH 13-06-03	Keemink 13-06-03	Keemink 13-06-03	Added stripping pipe & notation for stripping pipe.
3	AvO 11-11-02	P.d.J 21-11-02		Changed Art.nr. 351659 was 351489

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr. 1.4404		kg	1:1	mm	A1

TITLE / DESCRIPTION

CPH-G1L30X/S-N0-04

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Tel +31 186-890200
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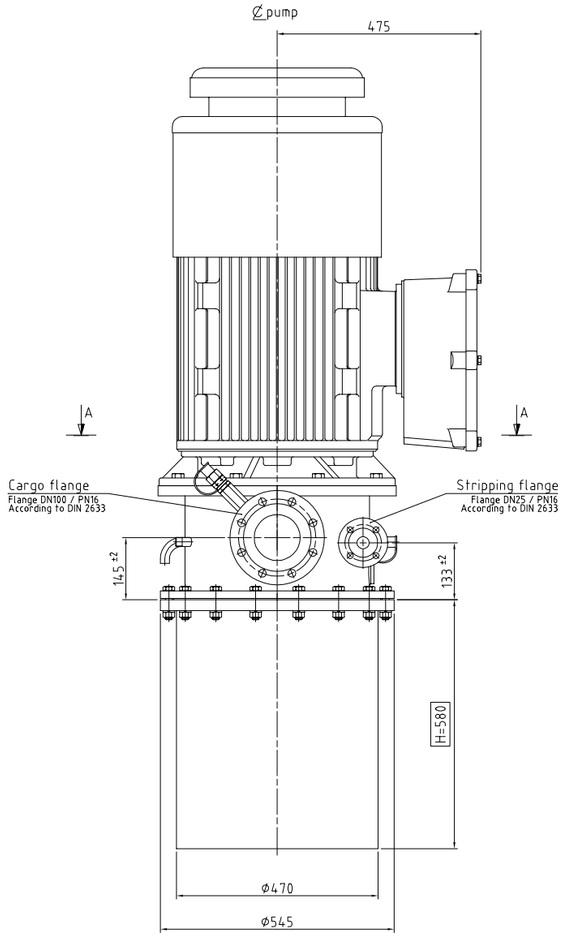
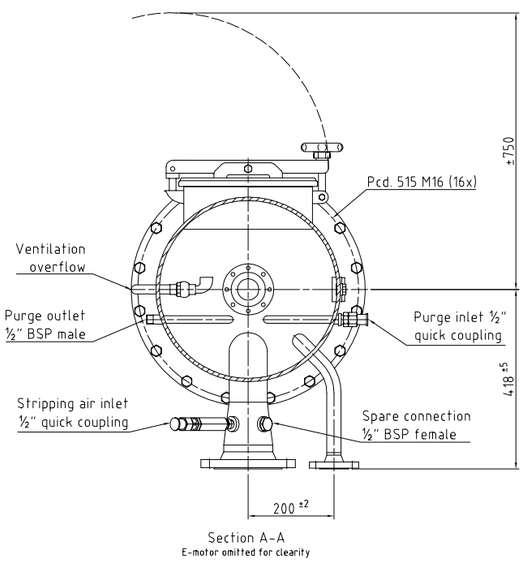
www.marflex.com

PROJECT/ALT. NO.

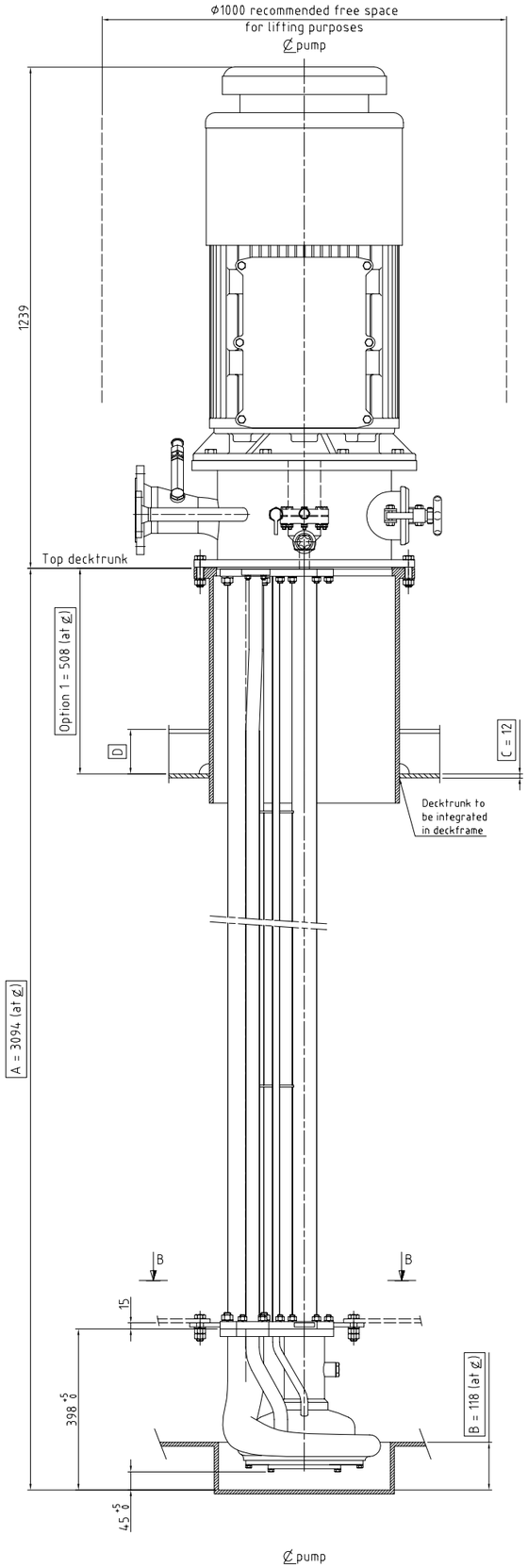
DOCUMENT NO. / ITEM NO. 900081

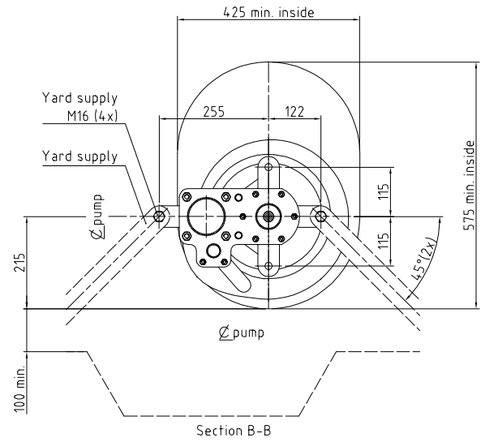
SHEET 1 OF 1





Section A-A
E-motor omitted for clearity

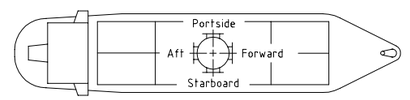




Section B-B

Electric motor can be positioned on the topcover with increments of 45°.
Pump assembly can be positioned on the decktrunk with increments of 90°.
The suction well can be placed with increments of 180° depending on the pumphead direction.

Weigths					
E-motor	573	kg	Decktrunk	33	kg
Pumphead	45	kg	Pipestack	19	kg/m
Topcover	130	kg	Stackflange	9	kg
Lubrication oil (SAE 32/46)					
Topcover	5	ltr	Pipestack	2	ltr/m



Variable dimensions (provided by the yard)					
Dimension A	3094	mm	Dimension D		mm
Dimension B	118	mm	Dimension H	580	mm
Dimension C	12	mm			
Deck reinforcement (provided by the yard)					
Option 1 (above deck)	508	mm	Option 2 (below deck)		mm
Direction of discharge (provided by the yard)					
Portside			Forward		
Starboard			Aft		
Quantity and diameters of electric cable (provided by the yard)					
Power supply	x	mm	Screened		Yes / No
PTC / Standstill heating	x	mm	Screened		Yes / No

All dimensions indicated with max. or min. are recommended measurements.

ISSUE	DATE	MADE BY	CHECKED	APPROVAL	E.C. DESCRIPTION
3					
2	28-11-07	EH			Added variable dimensions and extra pipe stack supports.
1	19-06-07	AvD			

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:5	mm	A0

TITLE / DESCRIPTION

Installation drawing MDPD-80 slop pump

Marflex B.V.
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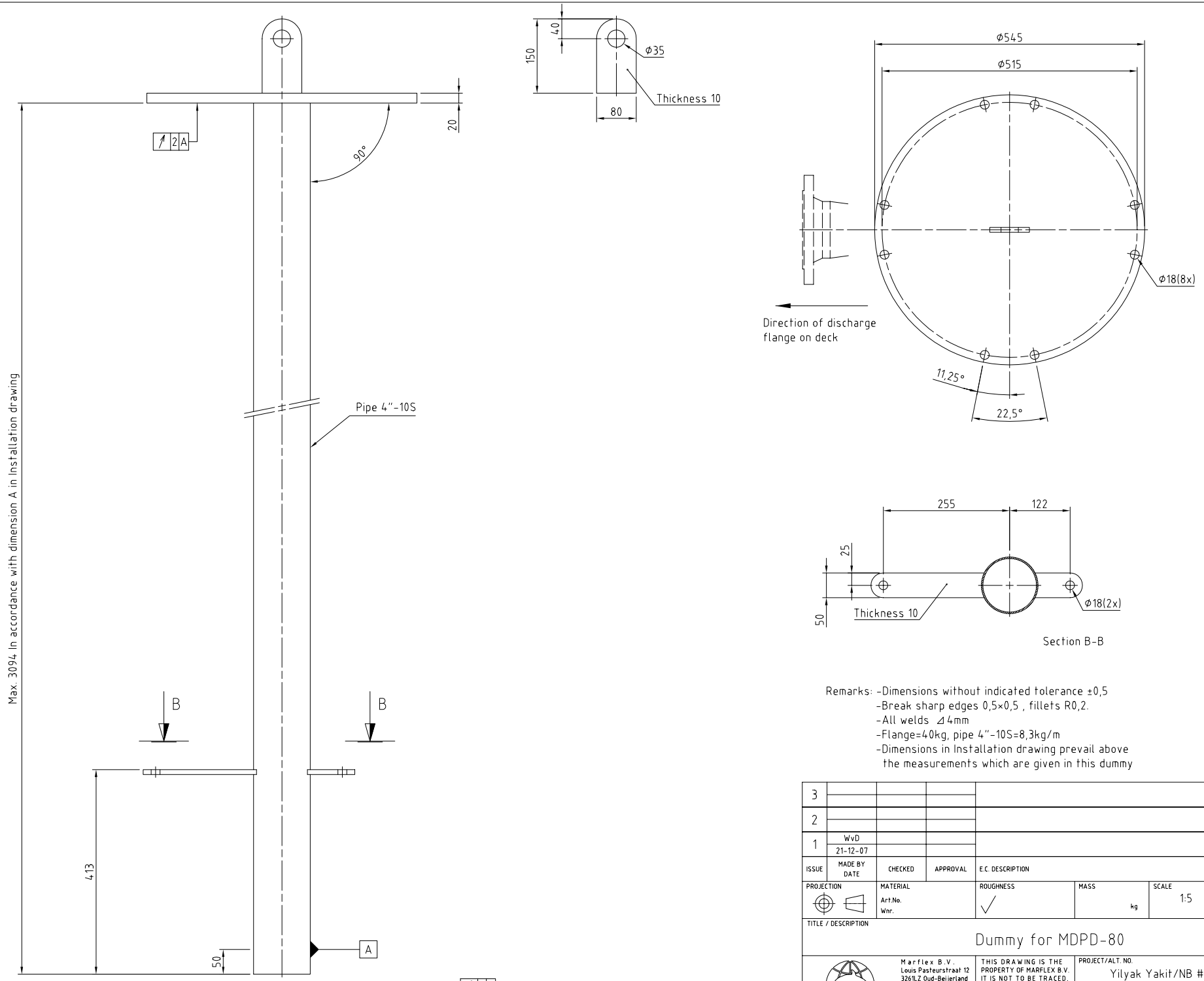
Tel. +31 186-890200
Fax. +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
Yilyak Yakit/NB 077	1
DOCUMENT NO. / ITEM NO.	OF
18070069-02	1



/ 2 A = Circulair run-out max. 2mm from point A on pipe

Remarks: -Dimensions without indicated tolerance ±0,5
-Break sharp edges 0,5×0,5 , fillets R0,2.
-All welds ⊿4mm
-Flange=40kg, pipe 4"-10S=8,3kg/m
-Dimensions in Installation drawing prevail above the measurements which are given in this dummy

3								
2								
1	WvD 21-12-07							
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION				
PROJECTION	MATERIAL Art.No. Wnr.			ROUGHNESS ✓	MASS kg	SCALE 1:5	UNIT mm	SIZE A2

TITLE / DESCRIPTION

Dummy for MDPD-80

Marflex B.V.
Louis Pasteurstraat 12
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The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
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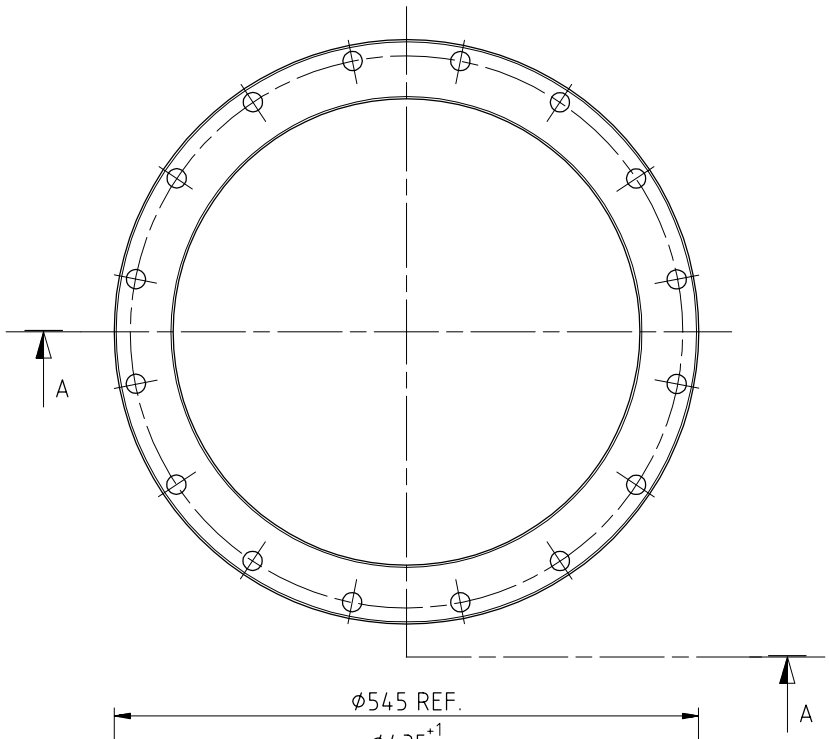
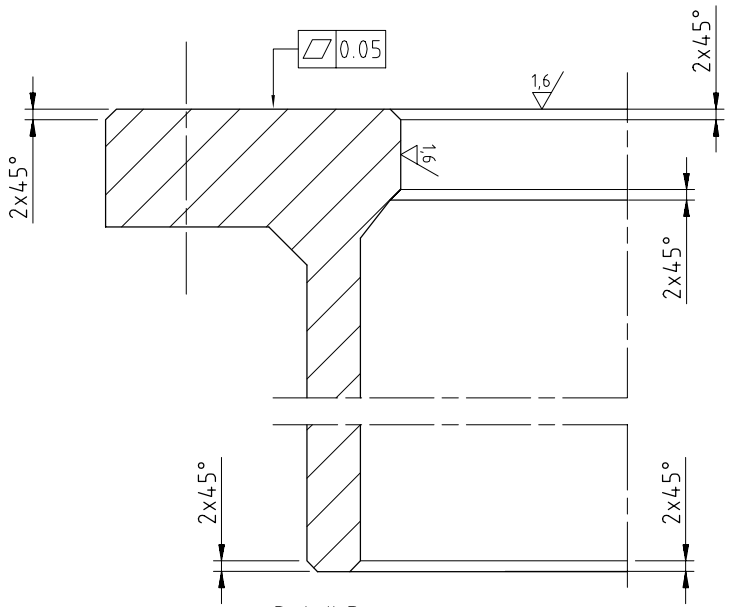
PROJECT/ALT. NO. Yilyak Yakit/NB # 077

DOCUMENT NO. / ITEM NO. 18070069-04

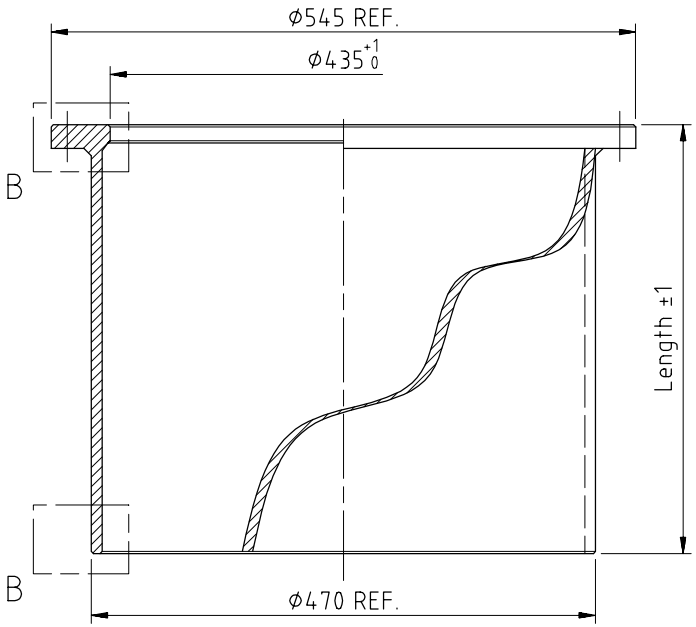
SHEET 1 OF 1



Project number	18070069
Article number	901800-0270
Length	270
Qty	0



Detail B
Scale 1:1



Section A-A

Surface Treatment:
-Pre treatment to be shotblast cleaning to ISO-SA2½.
-Sigmaweld MC painting to dry film thickness(d.f.t.) of 18µm.

Remarks: -Dimensions without indicated tolerance ±0,2.
-Break sharp edges 0,5x0,5 , fillets R0,2.

8	AvO	Keemink	Keemink	Removed length dedicated art.no's.
	09-05-05	26-05-05	26-05-05	
7	E.H			Added article numbers 901800-0720 and 668084
	04-04-05			
6	E.H	AdH	AdH	Added length dedicated art.nrs.
	14-12-04	23-12-04	23-12-04	
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

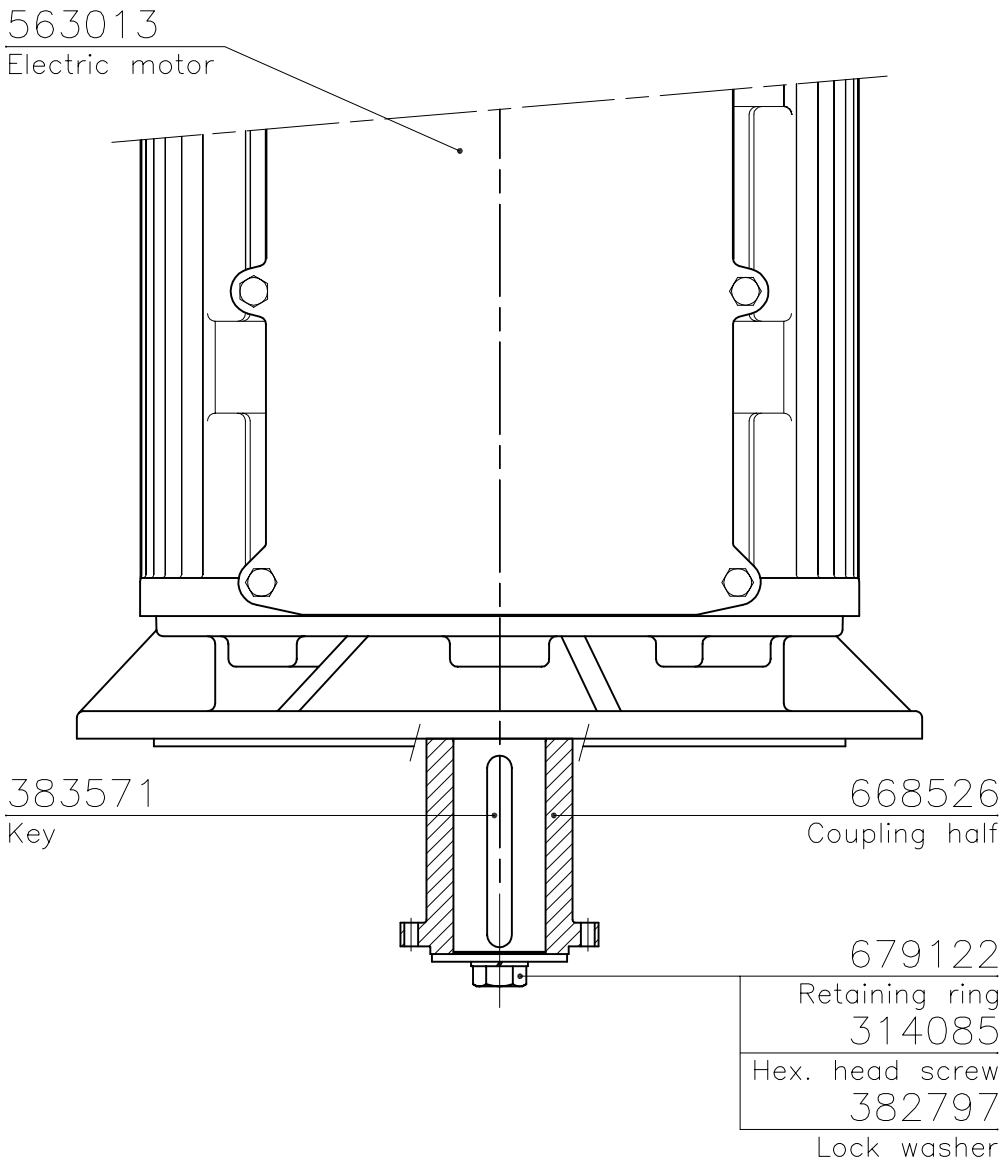
PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. 668895 Wnr. 1.0037	1,6	kg	1:5 1:1		A3

TITLE / DESCRIPTION

DECKTRUNK-0545-D18x16-1.0037

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET 1
DOCUMENT NO. / ITEM NO. 901800	OF 1



3				
2				
1	AvO 21-06-07	EH 21-06-07	EH 21-06-07	
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

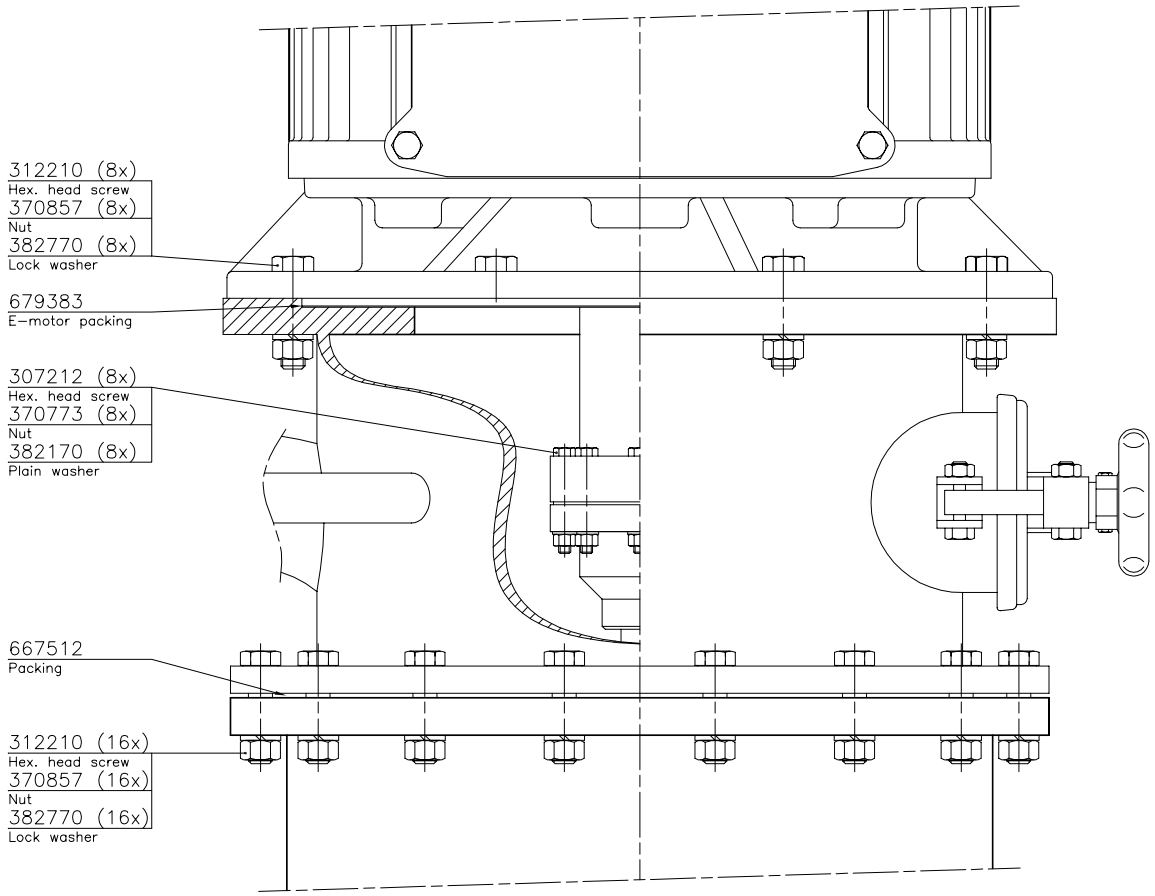
PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:5	mm	A4

TITLE / DESCRIPTION

EMASSY25-52M042-081H-46Z41DE-0

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
Motor Size 250	1
DOCUMENT NO. / ITEM NO.	OF
906239	1



3a	HAK	AvO	AvO	Item 370773 was 371603
	19-06-07	21-06-07	21-06-07	
3	NM	AdH	AdH	Changed drawing title
	13-07-04	16-07-04	16-07-04	
2	AvO	AdH	AdH	Changed drawing lay-out. Changed art.no. 371603 was 370773 and
	07-06-04	09-06-04	09-06-04	382170 was 382644.
1	PdJ	MvD		
	17-06-97	18-06-97		
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:2,5	mm	A2

TITLE / DESCRIPTION

MOUNTINGSETED-B4M08-H162-161-0

Marflex B.V.
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3261LZ Oud-Beijerland
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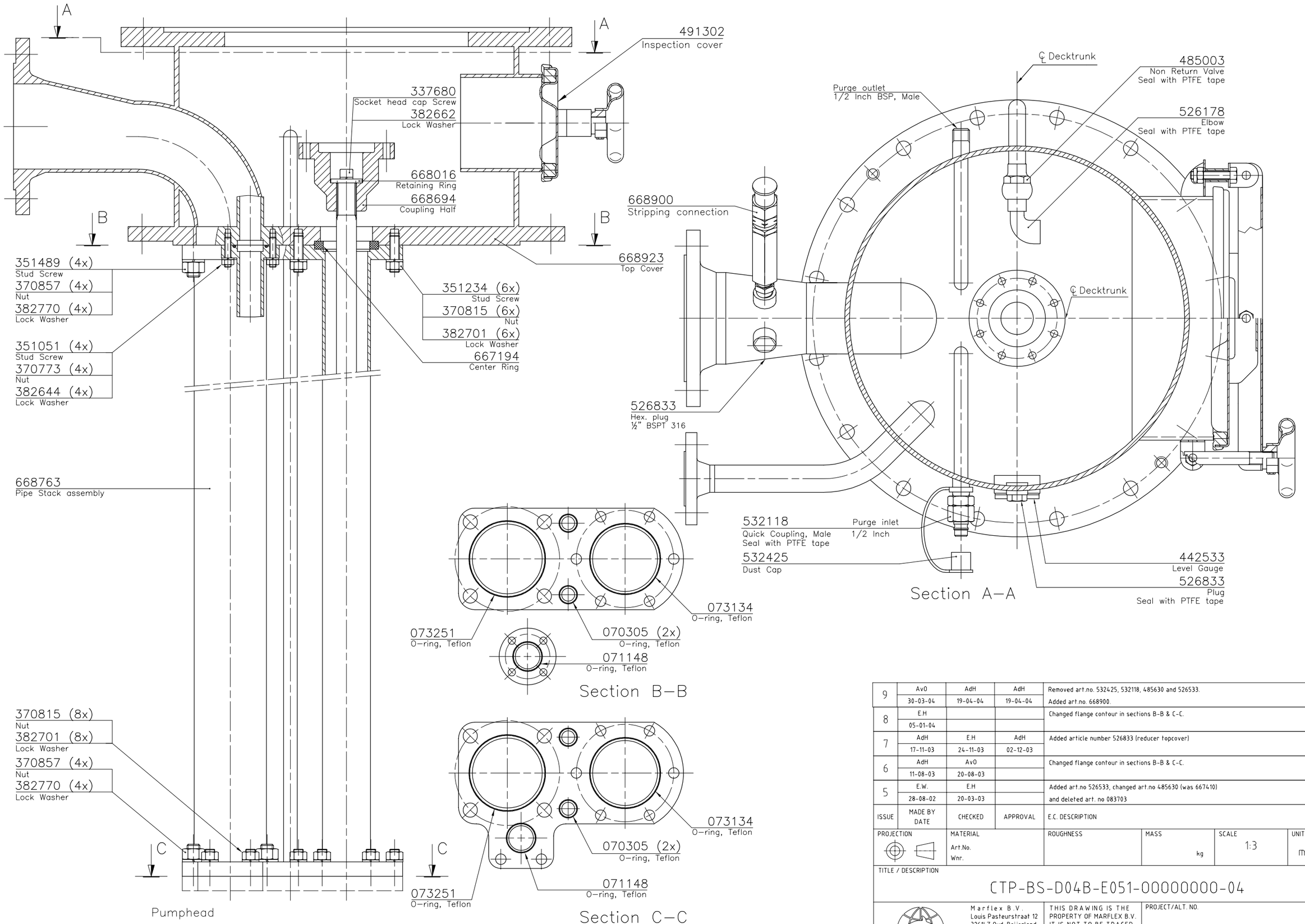
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
	1
DOCUMENT NO. / ITEM NO.	OF
901629	1



9	AvO 30-03-04	AdH 19-04-04	AdH 19-04-04	Removed art.no. 532425, 532118, 485630 and 526533. Added art.no. 668900.
8	E.H 05-01-04			Changed flange contour in sections B-B & C-C.
7	AdH 17-11-03	E.H 24-11-03	AdH 02-12-03	Added article number 526833 (reducer topcover)
6	AdH 11-08-03	AvO 20-08-03		Changed flange contour in sections B-B & C-C.
5	E.W. 28-08-02	E.H 20-03-03		Added art.no 526533, changed art.no 485630 (was 667410) and deleted art. no 083703
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

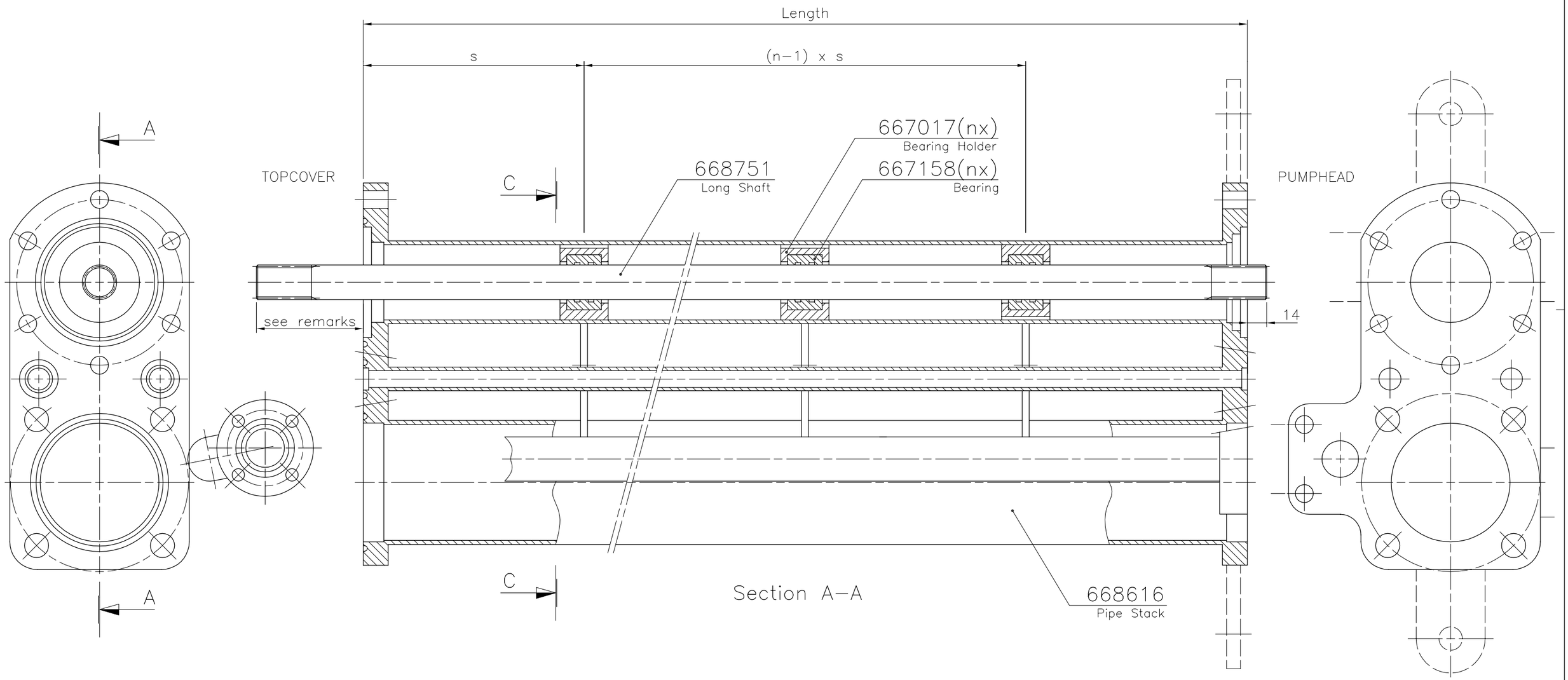
PROJECTION	MATERIAL Art.No. Wnr.	ROUGHNESS	MASS kg	SCALE 1:3	UNIT mm	SIZE A2

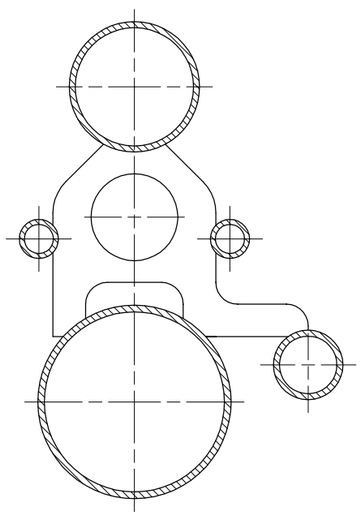
TITLE / DESCRIPTION

CTP-BS-D04B-E051-00000000-04

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET 1
DOCUMENT NO. / ITEM NO. 901052	OF 1





Section C−C

5	EH	AvO	AvO	Added dimensions 82,5 (585,5 ext.) and 14
	18-04-05	02-05-05	02-05-05	
4	EH	AdH	AdH	Changed flanges contour
	05-11-04	12-11-04	12-11-04	
3	AdH	AvO		Changed flange contour,changed supports into dotted lines.
	11-08-03	20-08-03		
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr. 1.4404		kg	1:2	mm	A2

TITLE / DESCRIPTION

PIPESTACK ASSEMBLY MDP-B/S

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.

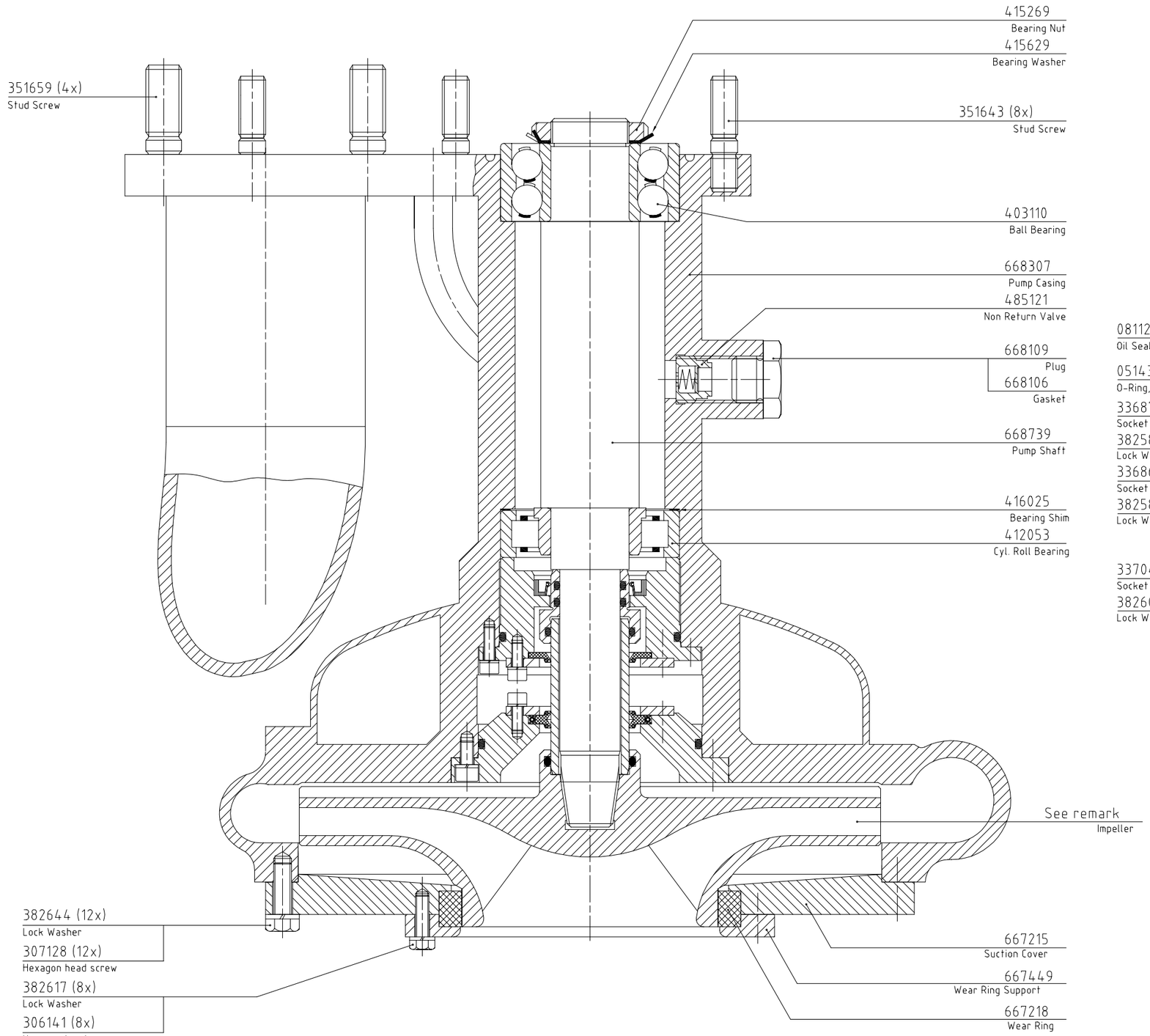
SHEET 1

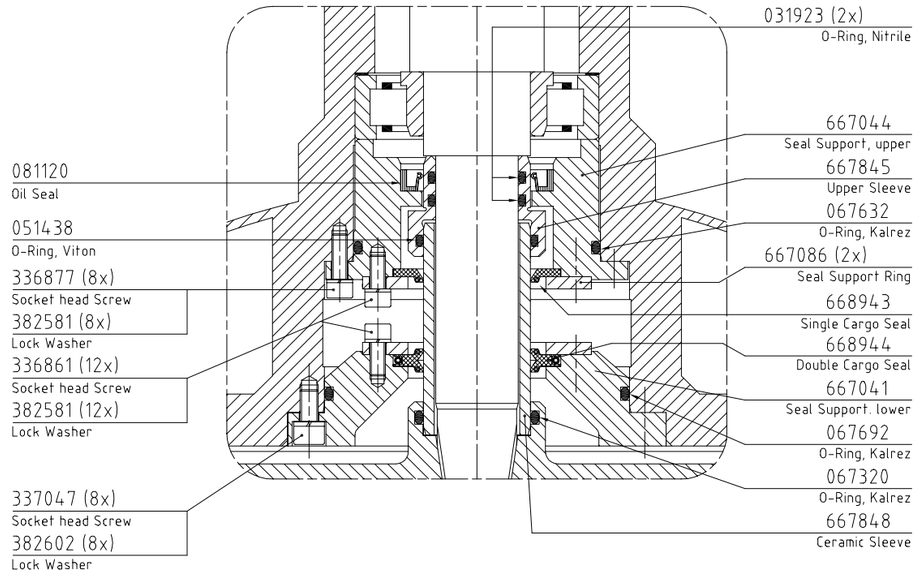
DOCUMENT NO. / ITEM NO. 668763

OF 1

Projectnumber	
Length	
Qty	
s≤600	
n	

Remarks:
−Dimension 82,5
−Dimension 585,5 in case of extended pipe stack





Remark

Impeller diameter	Art.No
ø260	668633
ø255	668636
ø250	668639
ø245	668642
ø240	668850
ø235	668853
ø230	668682
ø225	668683
ø220	668975
ø215	668974
ø210	668886
ø205	668684

3	KS	AvO	AvO	Added art.no's: 668636 and 668633
	23-01-06	23-01-06	23-01-06	
2	AvO	E.H	AdH	Removed art.no. 384030
	12-03-04	15-03-04	18-03-04	
1	E.H.	J.H.	Keemink	
	31-03-03	17-04-03	17-04-03	
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr. 1.4404		kg	1:1	mm	A1

TITLE / DESCRIPTION

CPH-B1L20X/S-N0-04

Marflex B.V.
Louis Pasteurstraat 12
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The Netherlands
Tel +31 186-890200
Fax +31 186-890299
www.marflex.com

PROJECT/ALT. NO.

SHEET 1

DOCUMENT NO. / ITEM NO. 900090

OF 1

3 Part lists

3.1 Advised spare parts (MDPD)

*MDPD-80, pump head type MDP-B**

	SPARE PARTS										
	MDPD-80	Pump head type	MDP								
		0701-001 update 24-05-07	BL1X (900043-045)			BL2X (900050-055-057-279			BL2W (900271-272)		
		Number of pumps	1-6	7-12	13-24	1-6	7-12	13-24	1-6	7-12	13-24
		Part number set	900400	900401	900402	900409	900410	900411	900496	900497	900498
	Part number	Description	Qty								
Pipestack	070305	O-RING TEFLON	4	4	8	4	4	8	4	4	8
Pipestack	071148	O-RING TEFLON	2	2	4	2	2	4	2	2	4
Pipestack	073134	O-RING TEFLON	2	2	4	2	2	4	2	2	4
Pipestack	073251	O-RING TEFLON	2	2	4	2	2	4	2	2	4
Pumphead	031923	O-RING NITRILE	2	2	4	2	2	4	2	2	4
Pumphead	051438	O-RING VITON	1	1	2	1	1	2	1	1	2
Pumphead	067320	O-RING KALREZ	1	1	2	1	1	2	1	1	2
Pumphead	067321	O-RING KALREZ							1	1	2
Pumphead	067632	O-RING KALREZ	1	1	2	1	1	2	1	1	2
Pumphead	067692	O-RING KALREZ	1	1	2	1	1	2	1	1	2
Pumphead	081120	OIL SEAL VITON	1	1	2	1	1	2	1	1	2
Pumphead	382581	LOCK WASHER	20	20	40	20	20	40	20	20	40
Pumphead	382602	LOCK WASHER	8	8	16	8	8	16	8	8	16
Pumphead	382644	LOCK WASHER	20	20	40	12	12	24	12	12	24
Pumphead	382617	LOCK WASHER				8	8	16	8	8	16
Pumphead	389004	RETAINING WASHER	10	10	20				10	10	20
Pumphead	403110	BALL BEARING	1	1	2	1	1	2	1	1	2
Pumphead	412053	CYLINDRICAL ROLLER BEARING	1	1	2	1	1	2	1	1	2
Pumphead	667053	WEAR RING	1	1	2						
Pumphead	667218	WEAR RING				1	1	2	1	1	2
Pumphead	668106	GASKET	3	3	6	3	3	6	3	3	6
Pumphead	668943	SINGLE CARGO SEAL	1	1	2	1	1	2	1	1	2
Pumphead	668944	DOUBLE CARGO SEAL	1	1	2	1	1	2	1	1	2
Pumphead	668739	PUMP SHAFT		1	1		1	1			
Pumphead	668926	PUMP SHAFT								1	1
Pumphead	667848	CERAMIC SLEEVE		1	1		1	1		1	1
Pumphead	383563	WOODRUFF KEY								1	1

Advised spare parts (MDPD)

*MDPD-100, pump head type MDP-G**

	SPARE PARTS															
	MDPD-100	Pump head type	MDP													
		0701-002 update 24-05-07	G1			G1 (1.4462)			G1L2	GL2 (900128)		GL3 (900110)			GL4	
		Number of pumps	1-6	7-12	13-24	1-6	7-12	13-24	1-6	1-6	7-12	1-6	7-12	13-24	1-6	7-12
		Part number set	900430	900431	900432	900433	900434	900435	900540	900436	900437	900445	900446	900447	900454	900455
	Part number	Description	Qty													
Pipestack	070305	O-RING TEFLON	2	4	4	2	4	4	4	4	4	4	4	8	4	4
	071148	O-RING TEFLON	2	4	4	2	4	4	2	2	2	4	4	8	2	2
	073134	O-RING TEFLON	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	073605	O-RING TEFLON	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	073761	O-RING TEFLON	2	4	4	2	4	4	2	2	2	2	2	4	2	2
Pumphead	032460	O-RING NITRILE	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	034812	O-RING NITRILE	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	051582	O-RING VITON	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	052524	O-RING VITON	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	056244	O-RING VITON	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	067431	O-RING KALREZ	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	067722	O-RING KALREZ	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	081177	OIL SEAL VITON	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	382602	LOCK WASHER	12	24	24	12	24	24		12	12	12	12	24	12	12
	360353	LOCK WASHER							12							
	382638	LOCK WASHER	6	12	12					14	14	6	6	12	6	6
	365061	LOCK WASHER				6	12	12								
	360354	LOCK WASHER							6							
	382644	LOCK WASHER	20	40	40							8	8	16		
	365051	LOCK WASHER				20	40	40								
	360304	LOCK WASHER							20							
	389004	RETAINING WASHER								10	10	10	10	20	10	10
	403152	BALL BEARING	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	410505	CYLINDRICAL ROLLER BEARING	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	668106	GASKET	3	6	6	3	6	6	3	3	3	3	3	6	3	3
	679068	WEAR RING	1	2	2	1	2	2	1			1	1	2		
	667218	WEAR RING								1	1					
	630373	WEAR RING													1	1
	679463	SINGLE CARGO SEAL	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	679464	DOUBLE CARGO SEAL	1	2	2	1	2	2	1	1	1	1	1	2	1	1
	682042	PUMP SHAFT		1	1		1	1								
	679089	PUMP SHAFT									1		1	1		1
	682043	CERAMIC SLEEVE		1	1		1	1								
	603015	CERAMIC SLEEVE									1		1	1		1

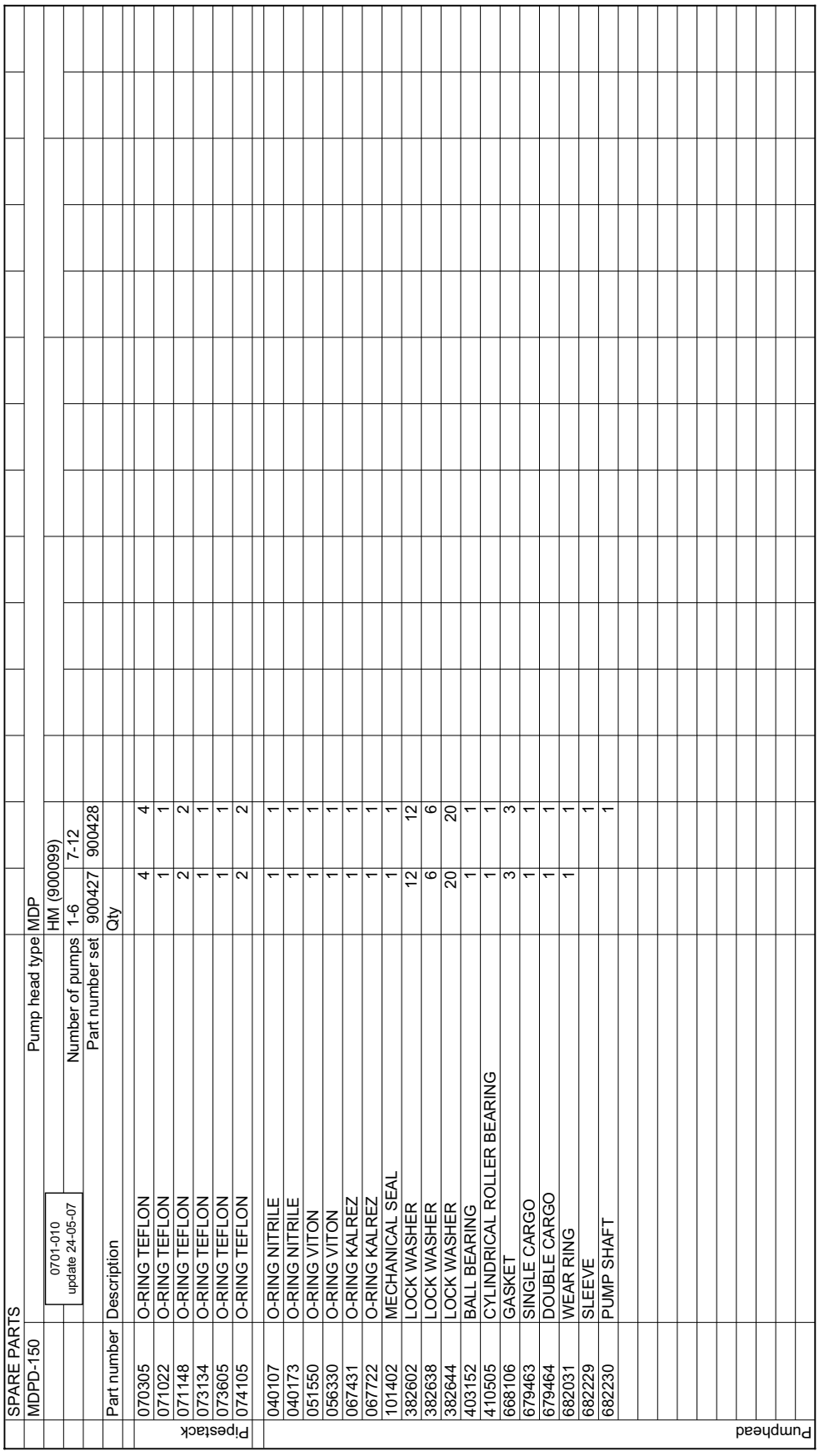
MDPD-100, pump head type MDP-G (mechanical seal)*

	SPARE PARTS			
	MDPD-100	Pump head type	MDP	
		0701-009 update 25-05-07	GM3 (900098)	
		Number of pumps	1-6	7-12
		Part number set	900417	900418
	Part number	Description	Qty	
Pipestack	070305	O-RING TEFLON	4	4
Pipestack	071148	O-RING TEFLON	2	2
Pipestack	073134	O-RING TEFLON	1	1
Pipestack	073605	O-RING TEFLON	1	1
Pipestack	073761	O-RING TEFLON	2	2
Pumphead	040107	O-RING NITRILE	1	1
Pumphead	040173	O-RING NITRILE	1	1
Pumphead	051550	O-RING VITON	1	1
Pumphead	056330	O-RING VITON	1	1
Pumphead	067431	O-RING KALREZ	1	1
Pumphead	067722	O-RING KALREZ	1	1
Pumphead	101402	MECHANICAL SEAL	1	1
Pumphead	382602	LOCK WASHER	12	12
Pumphead	382638	LOCK WASHER	6	6
Pumphead	382644	LOCK WASHER	8	8
Pumphead	389004	RETAINING WASHER	10	10
Pumphead	403152	BALL BEARING	1	1
Pumphead	410505	CYLINDRICAL ROLLER BEARING	1	1
Pumphead	668106	GASKET	3	3
Pumphead	679068	WEAR RING	1	1
Pumphead	679463	SINGLE CARGO SEAL	1	1
Pumphead	679464	DOUBLE CARGO SEAL	1	1
Pumphead	682229	SLEEVE		1
Pumphead	682230	PUMPSHAFT		1

*MDPD-150, pump head type MDP-H**

	SPARE PARTS								
	MDPD-150		Pump head type	MDP					
		0701-003 update 24-05-07		H (900076-089)			H1L5 (900074)		
			Number of pumps	1-6	7-12	13-24	1-6	7-12	13-24
			Part number set	900456	900457	900458	900550	900551	900552
	Part number	Description		Qty					
Pipestack	070305	O-RING TEFLON		4	4	8	4	4	
Pipestack	071022	O-RING TEFLON		1	1	2	1	1	
Pipestack	071148	O-RING TEFLON		2	2	4	3	3	
Pipestack	073134	O-RING TEFLON		1	1	2	1	1	
Pipestack	073605	O-RING TEFLON		1	1	2	1	1	
Pipestack	074105	O-RING TEFLON		2	2	4	2	2	
Pumphead	032460	O-RING NITRILE		1	1	2	1	1	
Pumphead	034812	O-RING NITRILE		1	1	2	1	1	
Pumphead	051582	O-RING VITON		1	1	2	1	1	
Pumphead	052524	O-RING VITON		1	1	2	1	1	
Pumphead	056244	O-RING VITON		1	1	2	1	1	
Pumphead	067431	O-RING KALREZ		1	1	2	1	1	
Pumphead	067722	O-RING KALREZ		1	1	2	1	1	
Pumphead	081177	OIL SEAL VITON		1	1	2	1	1	
Pumphead	382602	LOCK WASHER		12	12	24	12	12	
Pumphead	382638	LOCK WASHER		6	6	12	6	6	
Pumphead	382644	LOCK WASHER		20	20	40			
Pumphead	382662	LOCK WASHER					8	8	
Pumphead	382701	LOCK WASHER					16	16	
Pumphead	403152	BALL BEARING		1	1	2	1	1	
Pumphead	410505	CYLINDRICAL ROLLER BEARING		1	1	2	1	1	
Pumphead	668106	GASKET		3	3	6			
Pumphead	679463	SINGLE CARGO SEAL		1	1	2	1	1	
Pumphead	679464	DOUBLE CARGO SEAL		1	1	2	1	1	
Pumphead	682031	WEAR RING		1	1	2			
Pumphead	630078	WEAR RING					1	1	
Pumphead	682042	PUMP SHAFT			1	1			
Pumphead	682178	PUMP SHAFT						1	
Pumphead	682043	CERAMIC SLEEVE			1	1			
Pumphead	603015	CERAMIC SLEEVE						1	

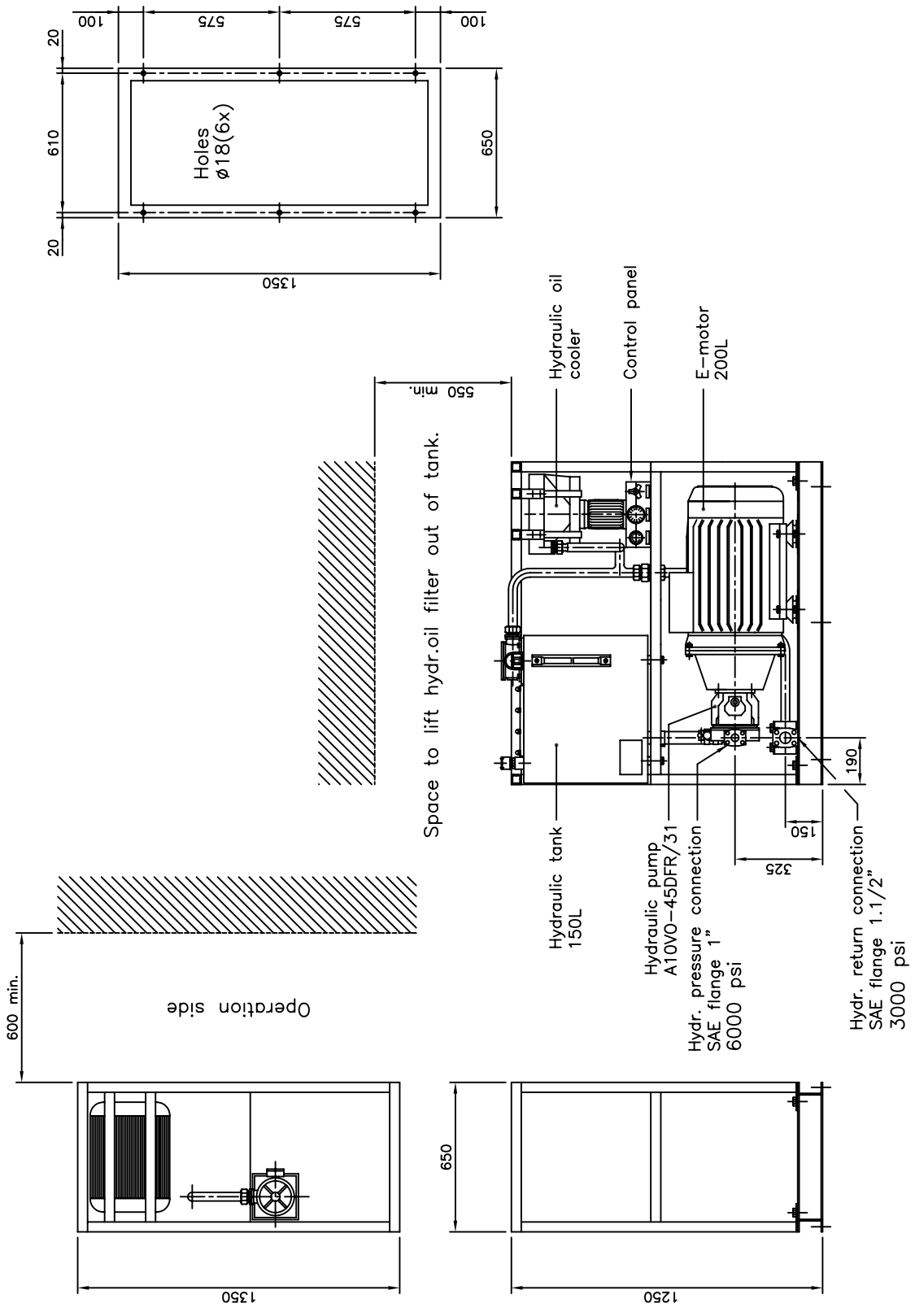
MDPD-150, pump head type MDP-H (mechanical seal)*



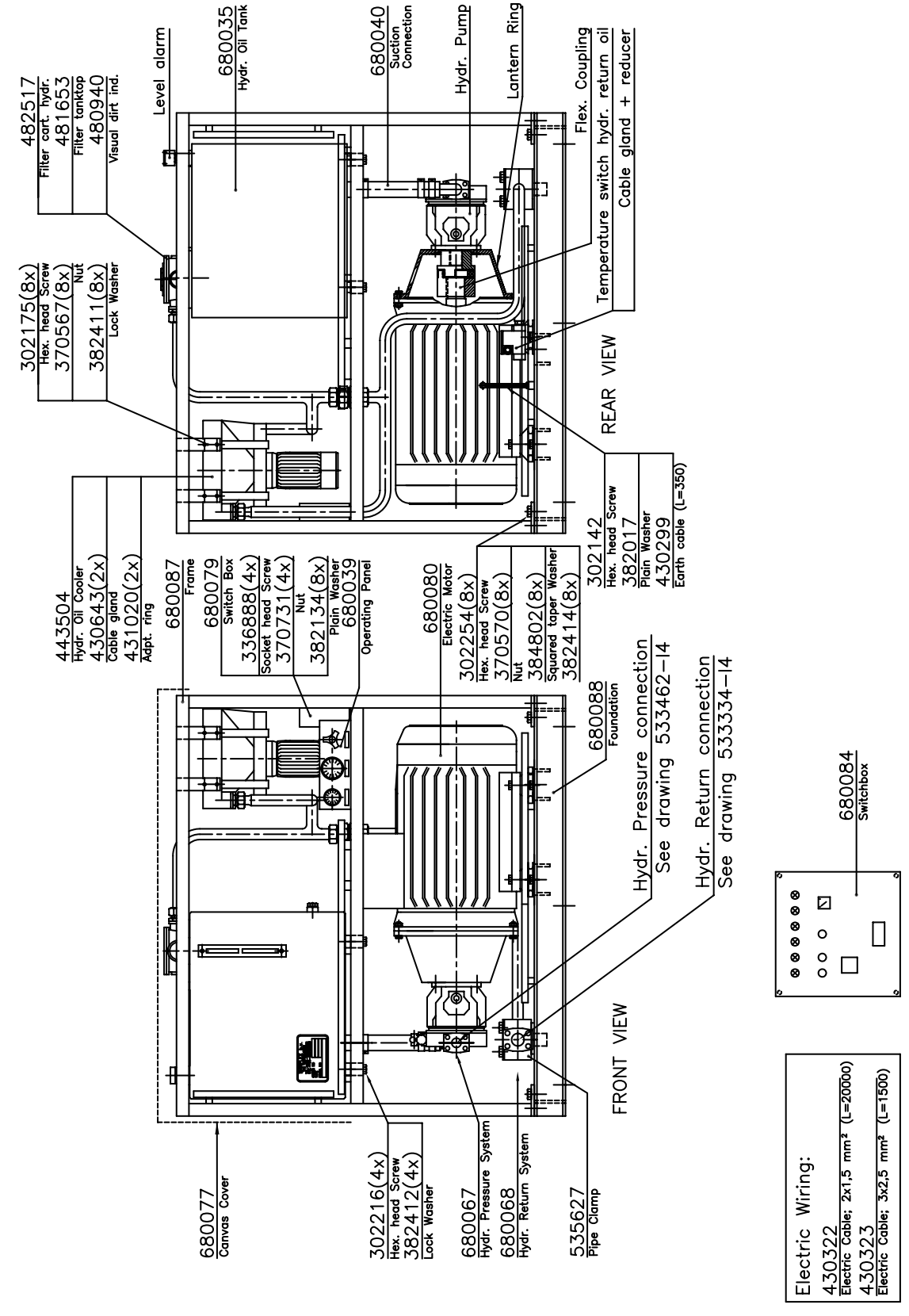
4 Power pack EHP 45-200 drawings and part lists

4.1 Drawings

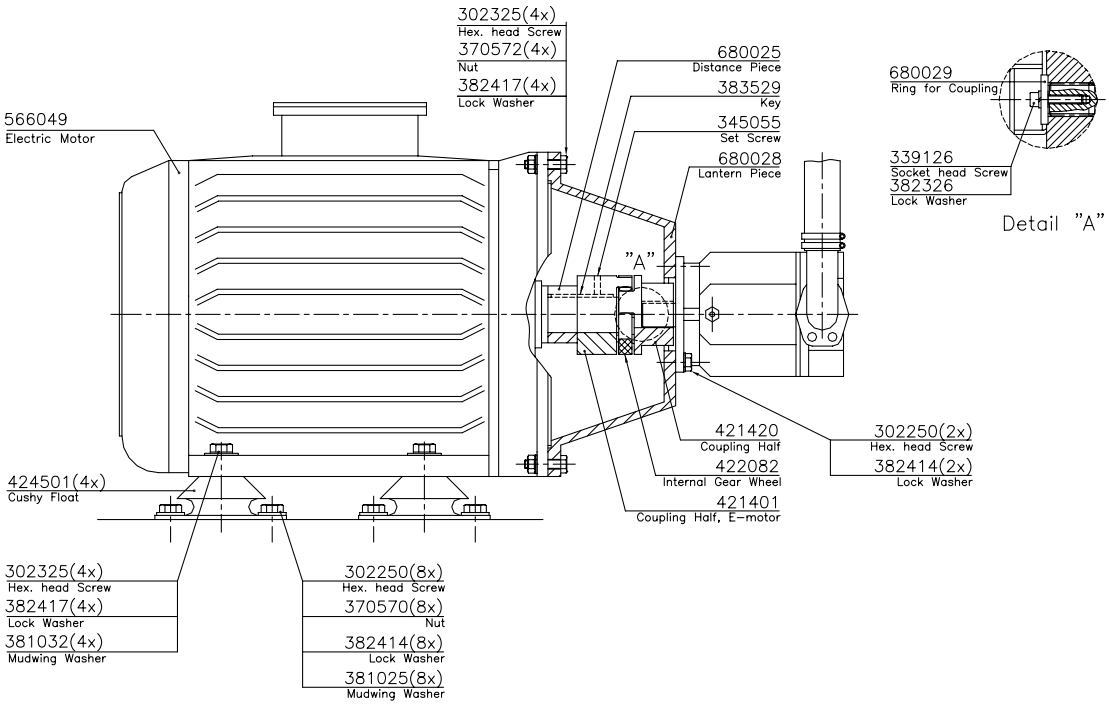
Dimensional drawing, 950617-01 rev 2



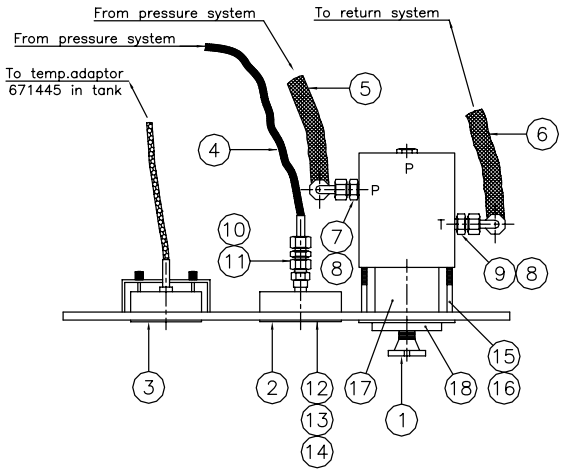
EHP-45/200L-4 60Hz SAE, 950617 rev 9



Electric motor assy, 680080 rev 4

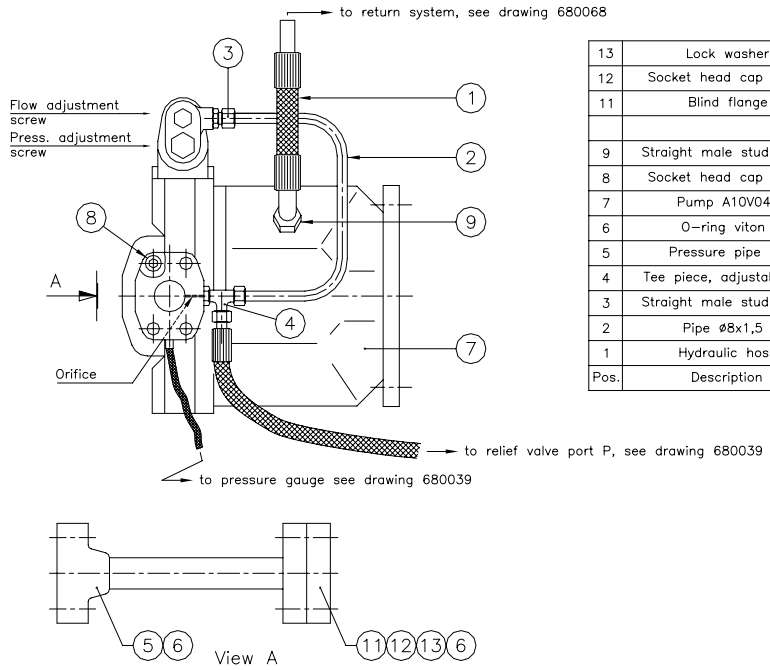


Hydraulic components dashboard, 680039 rev 2



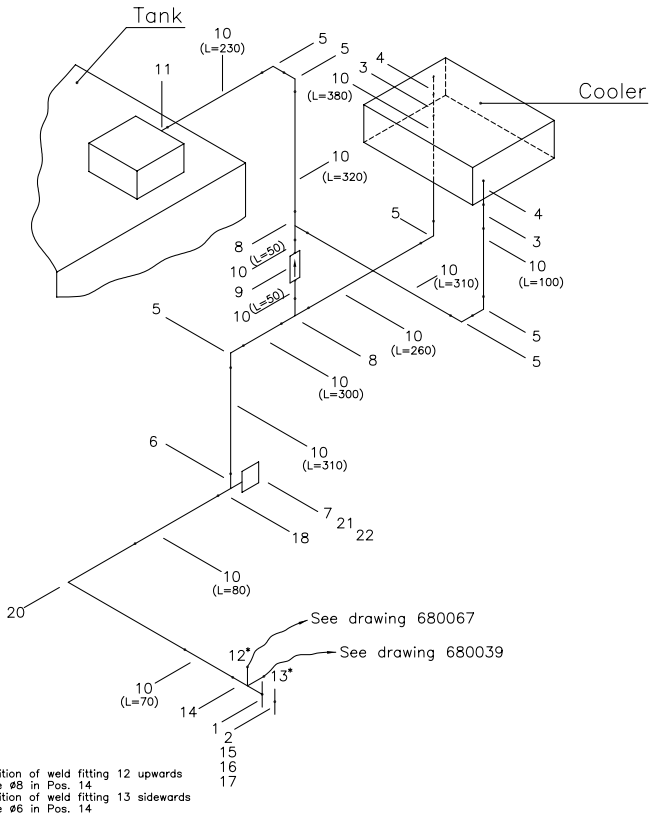
Pos.	Description	Art.nr.	Qty.
18	Cover plate relief valve	681019	1
17	Pipe ø40x2,5 L=38	671244	1
16	Lock washer 6,2mm	382149	2
15	S.h.capscr. M6x40	337143	2
14	Lock washer 4,2mm	382578	3
13	Hexagon nut M4	370710	3
12	S.h.capscr. M4x16	336540	3
11	Pressure gauge connector	536809	1
10	Straight fitting	536016	1
9	Hex. nipple 8L 1/4"	537665	1
8	Dowty 1/4"	083031	2
7	Hex. nipple 8S 1/4"	537700	1
6	Return hose ZZ07003755	507607	1
5	Press hose ZZ07006634	506633	1
4	Measuring hose	537836	1
3	Temp. indicator	445560	1
2	Pressure gauge	444165	1
1	Relief valve	486117	1

Pressure system, 680067 rev 6



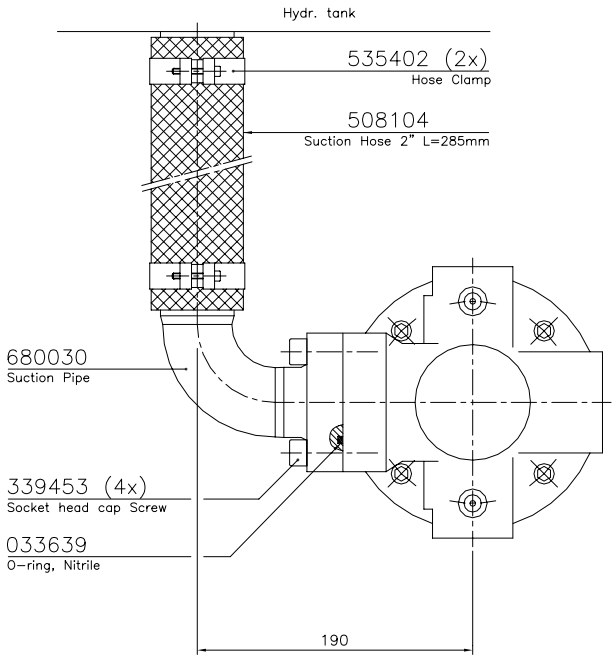
Pos.	Description	Art.nr.	Qty.
13	Lock washer	382458	4
12	Socket head cap screw	333601	4
11	Blind flange	533442	1
9	Straight male stud fitting	536334	1
8	Socket head cap screw	339320	4
7	Pump A10V045	558930	1
6	O-ring viton	051381	2
5	Pressure pipe	680081	1
4	Tee piece, adjustable	537351	1
3	Straight male stud fitting	536351	1
2	Pipe ø8x1,5	800780	1
1	Hydraulic hose	504004	1

Return system, 680068 rev 9

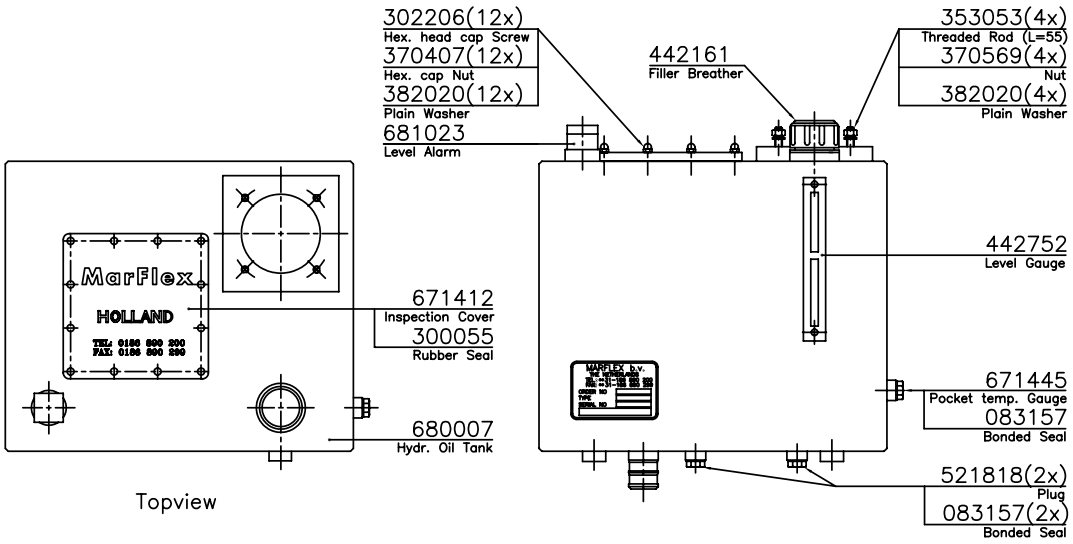


Pos.	Description	Art.nr.	Qty.
22	Bonded seal ½"	083157	1
21	Cable gland M20	430643	1
20	Elbow 45° 42x3	806930	1
18	Elbow 90°	680078	1
17	Lock washer	382414	4
16	Socket head cap screw	333105	4
15	O-ring	052704	1
14	Reducer 1.1/2"x1.1/4"	806493	1
13	Weld fitting 08L	536501	1
12	Weld fitting 12L	536503	1
11	Straight male stud fitting	536239	1
10	Pipe 42x3 L=2600 (tot)	800927	1
9	Non return valve	485435	1
8	T-Piece	806339	2
7	Temp. switch	446101	1
6	Socket temp. switch	600100	1
5	Elbow 90° 42.4x2.6	806074	6
4	Straight male stud fitting	536236	2
3	Reducing pipe 28-42	680031	2
2	Blind flange SAE 1 1/2"	533434	1
1	SAE welding flange 1.1/2"	533334	1

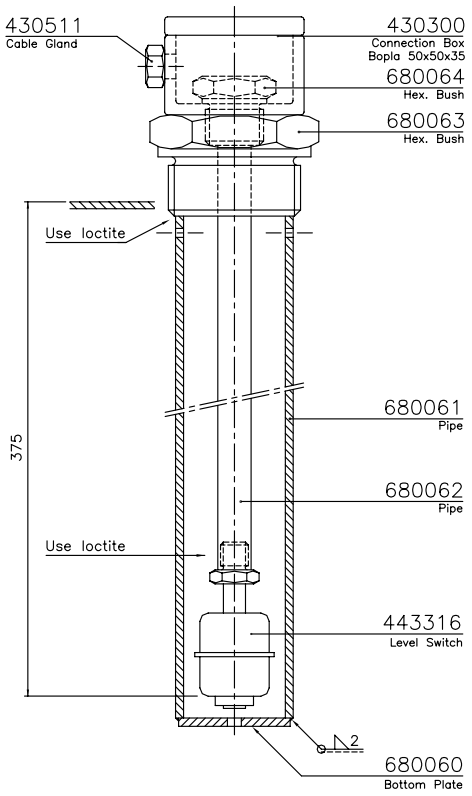
Suction connection, 680040 rev 4



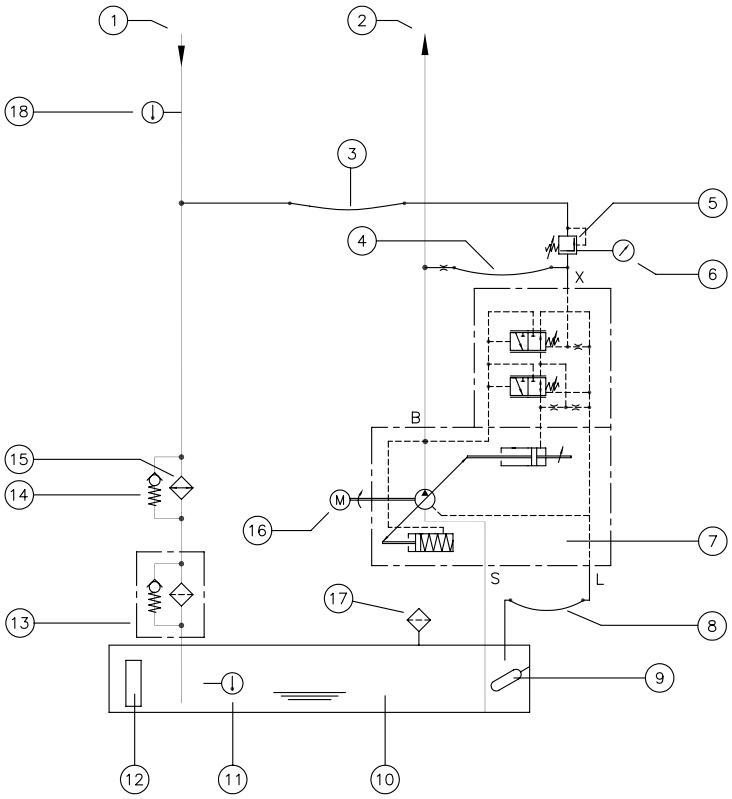
Hydraulic oil tank assembly, 680035 rev 4



Level alarm hydraulic oil tank, 681023 rev 6

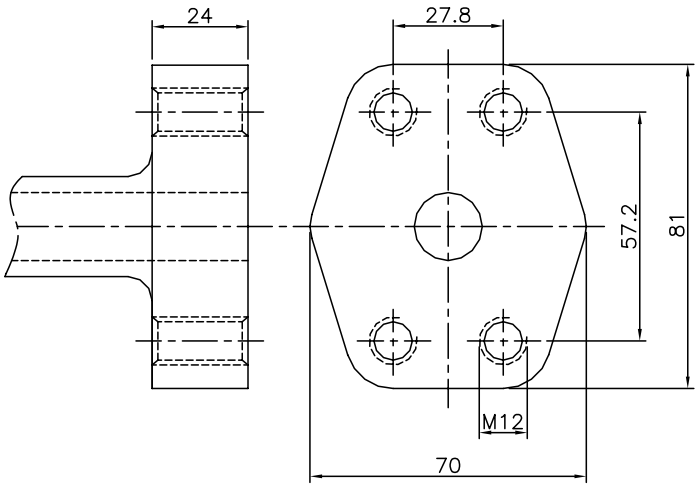


Hydraulic diagram, 950617-02 rev 1

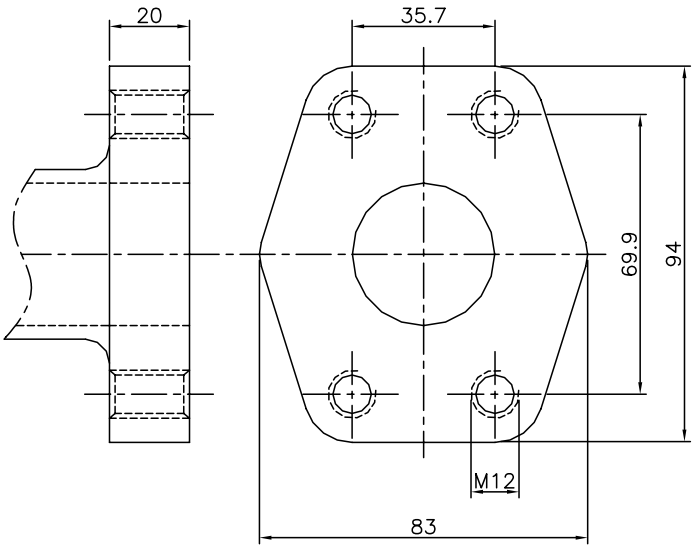


Item	Description
18	Temperature switch
17	Filler breather filter, pressurised 0,3 bar
16	Electromotor 200L–4
15	Oil cooler
14	Non return valve
13	Oil filter
12	Level gauge
11	Temp. indicator (control panel)
10	Hydraulic oil tank
9	Level alarm/switch
8	Oil leakage hose, hydraulic pump
7	Hydraulic pump A10VO–45 DFR/31
6	Manometer (control panel)
5	Relief valve (control panel)
4	Hydraulic hose
3	Oil leakage hose, relief valve
2	Pressure connection
1	Return connection

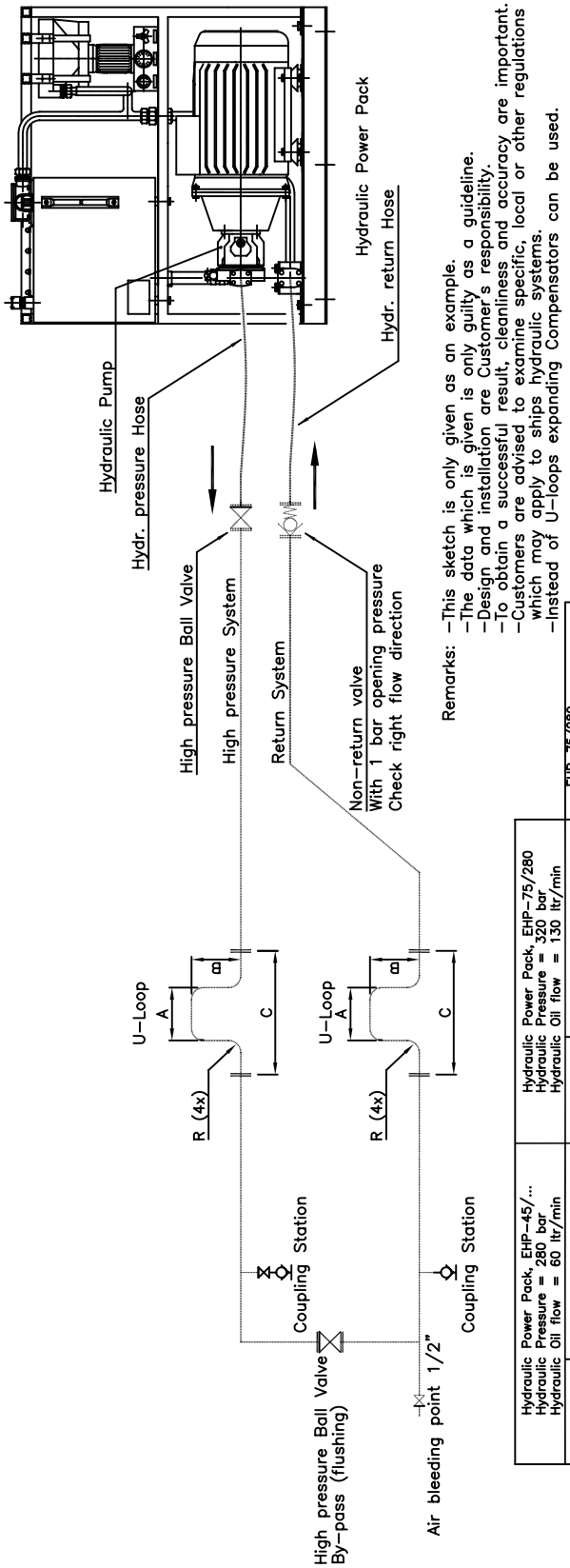
Pressure SAE flange 1" 6000 PSI (420 bar), 533462 rev 2



Return SAE flange 1.1/2" 3000 PSI (210 bar), 533334 rev 2



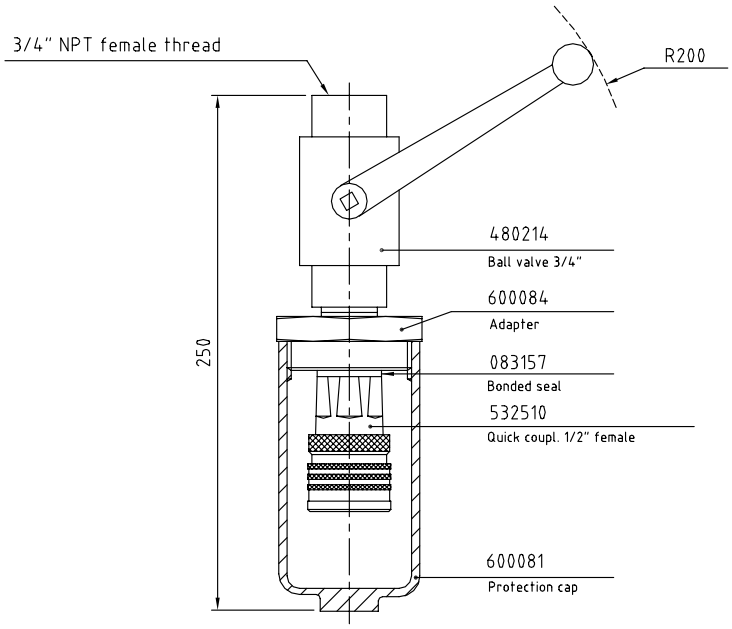
Drawing of hydraulic system (example), 950616-05



Remarks: -This sketch is only given as an example.
-The data which is given is only guilty as a guideline.
-Design and installation are Customer's responsibility.
-To obtain a successful result, cleanliness and accuracy are important.
-Customers are advised to examine specific, local or other regulations which may apply to ships hydraulic systems.
-Instead of U-loops expanding Compensators can be used.

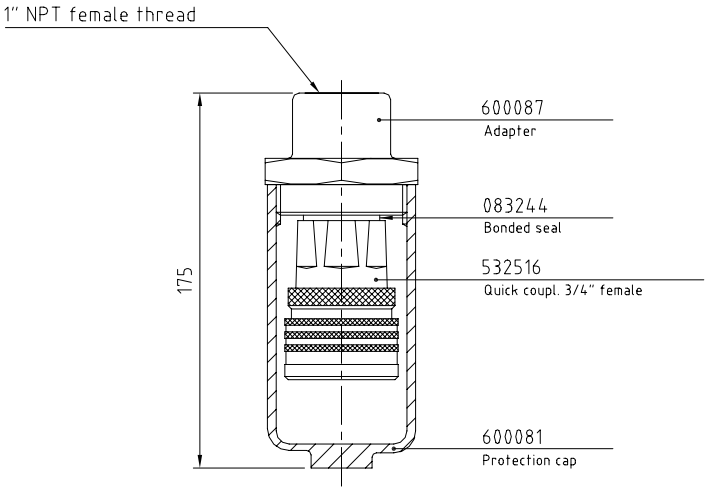
Hydraulic Power Pack, EHP-45/... Hydraulic Pressure = 280 bar Hydraulic Oil flow = 60 ltr/min		Hydraulic Power Pack, EHP-75/280 Hydraulic Pressure = 320 bar Hydraulic Oil flow = 130 ltr/min		EHP-75/280 For lenghts on deck more than 20 mtr.
Sizes of high pressure hose. Classification	Lenght = 750 mm Size = 1 inch DIN20023 4SP	Sizes of high pressure hose. Classification	Lenght = 1000 mm Size = 1 inch DIN20023 4SH	
Sizes of high pressure line. Classification	Diameter = 30 mm Wall thickness = 4 mm DIN 2391C/DIN 2445 St.52.4	Sizes of high pressure line. Classification	Diameter = 30 mm Wall thickness = 4 mm DIN 2391C/DIN 2445 St.52.4	Diameter = 38 mm Wall thickness = 5 mm DIN 2391C/DIN 2445 St.52.4
Sizes of SAE flanges.	SAE 1 inch 6000 psi with 30 mm pipe connection	Sizes of SAE flanges.	SAE 1 inch 6000 psi with 30 mm pipe connection	SAE 1 1/2 inch 6000 psi with 38 mm pipe connection
Sizes of high Pressure valve	SAE 1 inch 6000 psi Ball Valve	Sizes of high Pressure valve	SAE 1 inch 6000 psi Ball Valve	SAE 1 1/2 inch 6000 psi Ball Valve
Sizes of return hose. Classification	Lenght = 750 mm Size = 1 1/2 inch DIN20022-1ST	Sizes of return hose. Classification	Lenght = 1000 mm Size = 2 inch DIN20022-1ST	
Sizes of return line. Classification	Diameter = 42 mm Wall thickness = 4 mm DIN 2391C/DIN 2445 St.37.4	Sizes of return line. Classification	Diameter = 60 mm Wall thickness = 4 mm DIN 2391C/DIN 2445 St.37.4	
Sizes of SAE flanges.	SAE 1 1/2 inch 3000 psi with 42 mm pipe connection	Sizes of SAE flanges.	SAE 2 inch 3000 psi with 60 mm pipe connection	
Sizes of non-return valve	SAE 1 1/2 inch 3000 psi	Sizes of non-return valve	SAE 2 inch 3000 psi	
U=Loop, Pressure Line Carbon Steel every 30 mtr. Stainless Steel every 20 mtr.		U=Loop, Pressure Line Carbon Steel every 30 mtr. Stainless Steel every 20 mtr.		
A=700 B=700 C=1500 R=165		A=700 B=700 C=1500 R=165		
U=Loop, Return Line		U=Loop, Return Line		
A=700 B=700 C=1500 R=165		A=700 B=700 C=1500 R=165		

Coupling station, pressure side, 950340 rev 3



Working pressure = 300 bar (coupled)
Working pressure = 250 bar

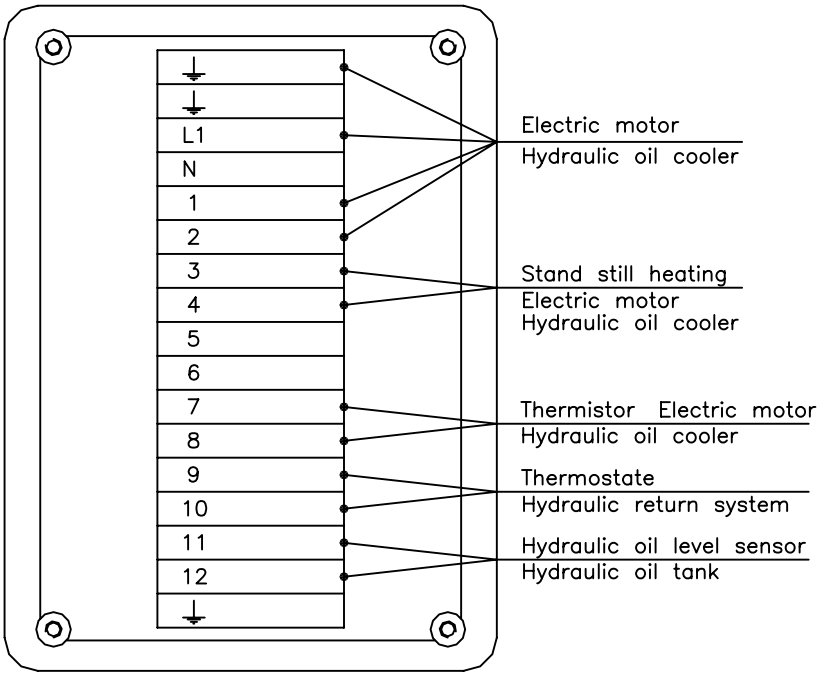
Coupling station, return side, 950341 rev 3



Working pressure = 280 bar (coupled)
Working pressure = 210 bar

4.2 Wiring diagram and control box

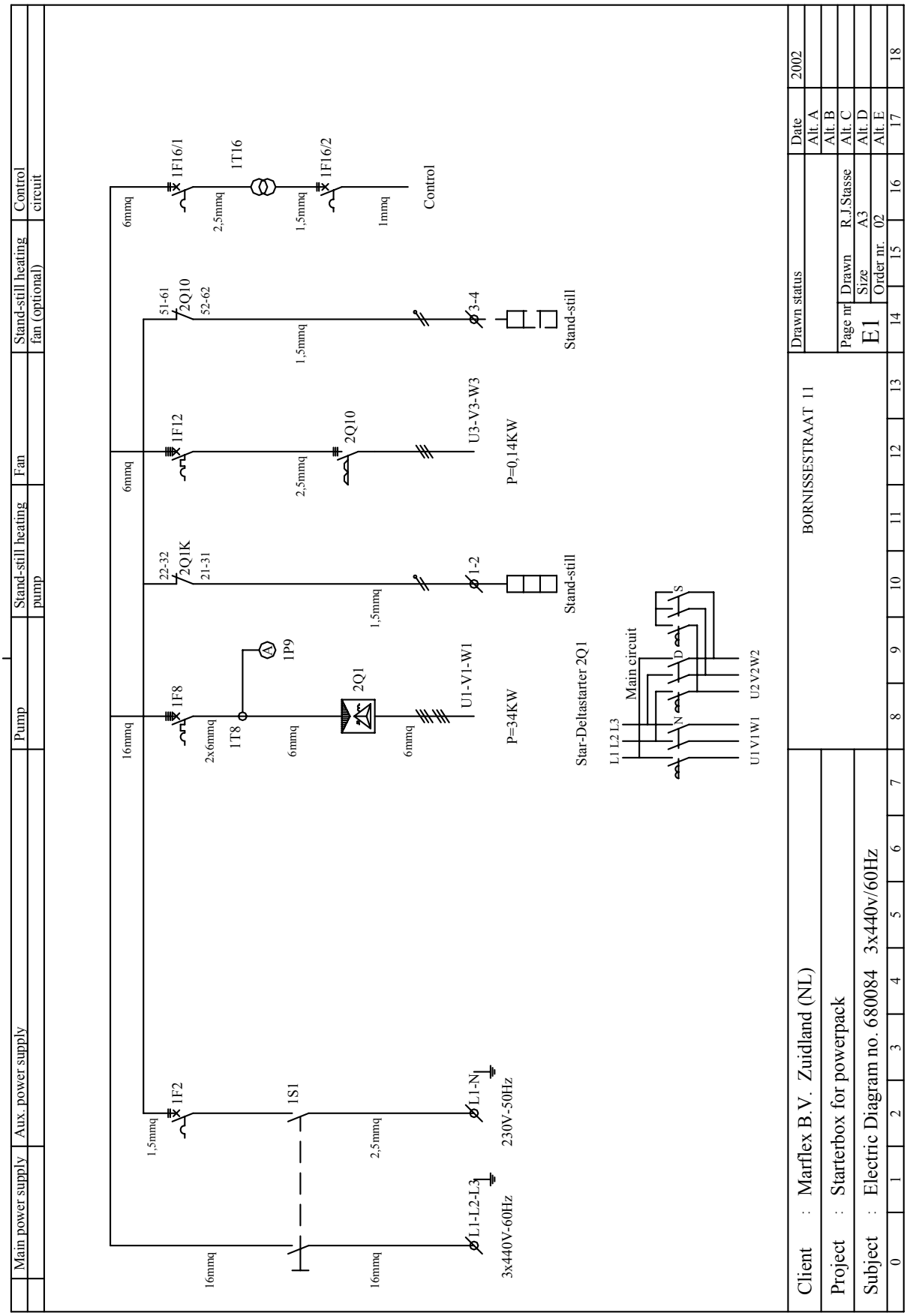
Connection box, 680079 rev 1

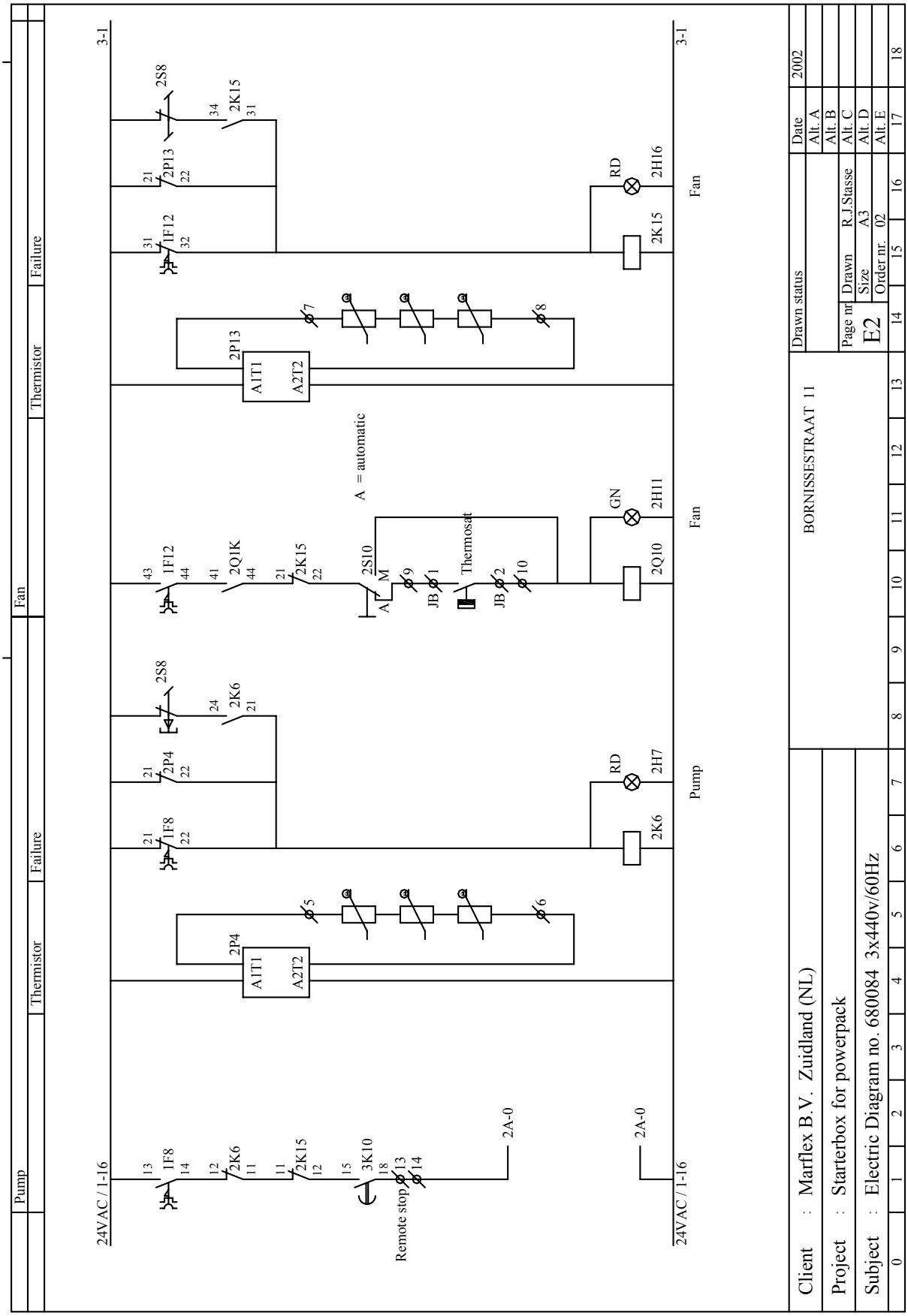


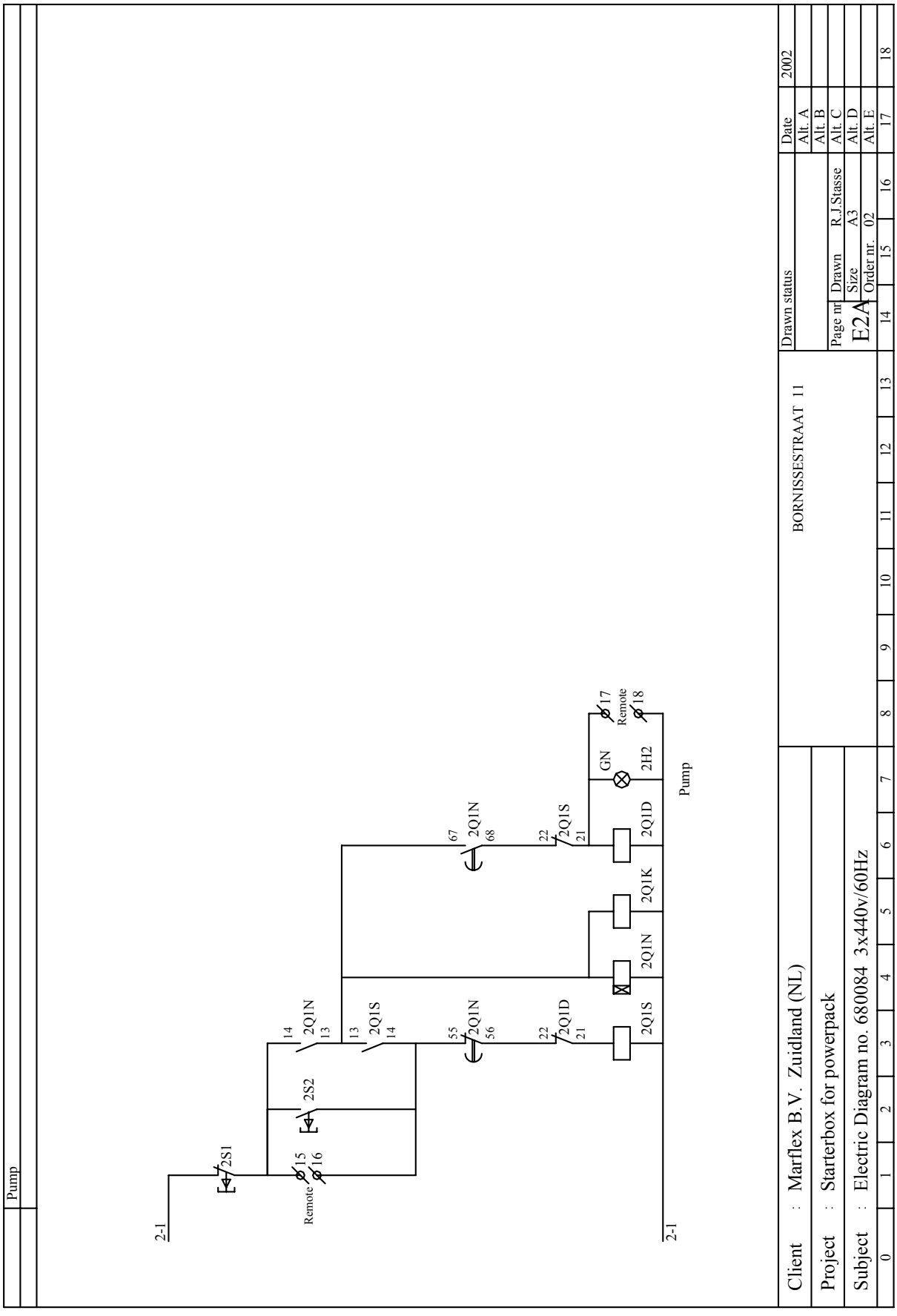
4.2.1 Wiring diagram

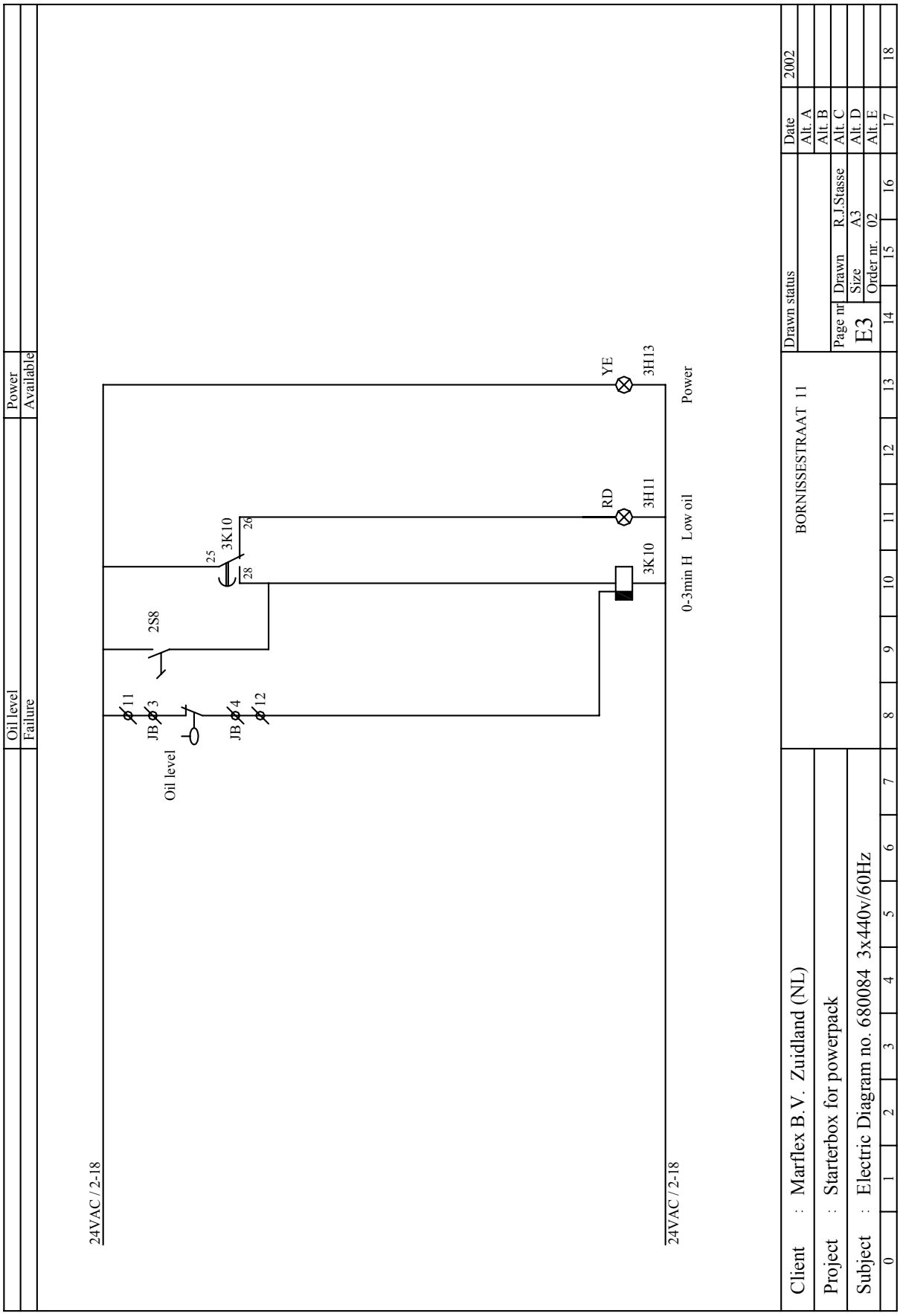
Part number: 680084

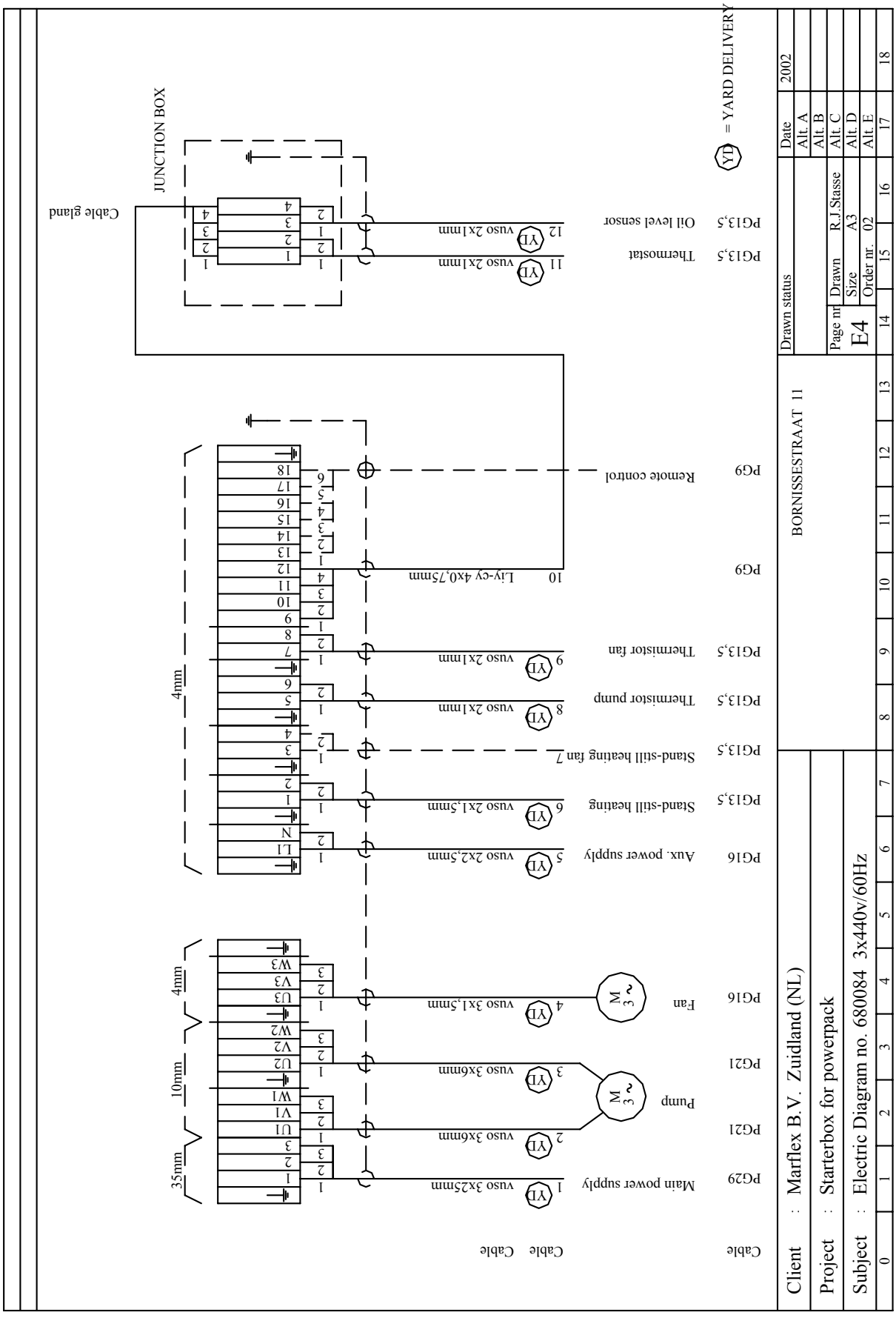
- 35 kW
- 3 x 440 V
- 50 Hz.

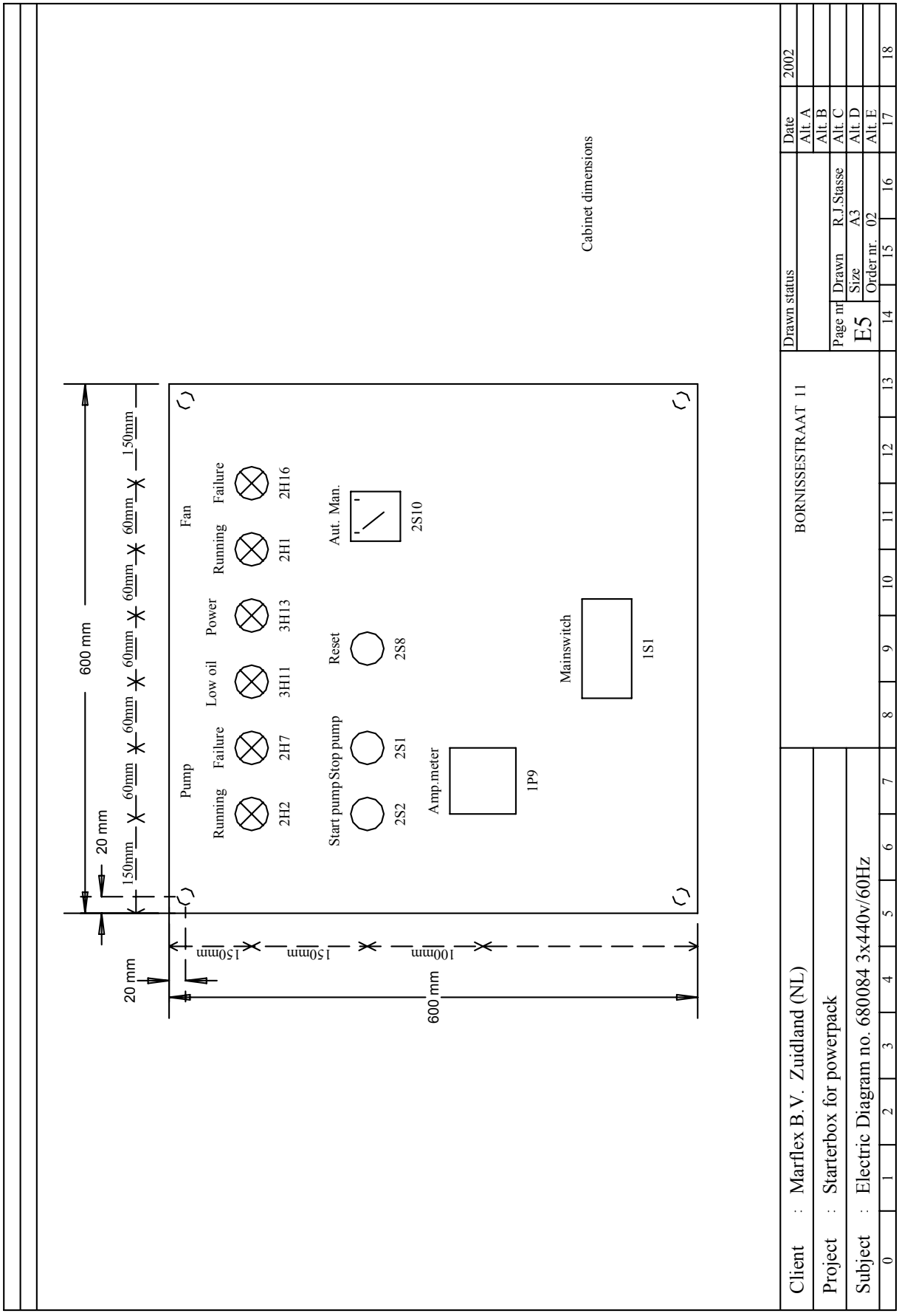



Pump
Fan
Thermistor
Failure
Client : Marflex B.V. Zuidland (NL)
Project : Starterbox for powerpack
Subject : Electric Diagram no. 680084 3x440v/60Hz
BORNISSESTRAAT 11
Drawn status
Date 2002
Alt. A
Alt. B
Alt. C
Alt. D
Alt. E
Page nr E2
Drawn R.J.Stasse
Size A3
Order nr. 02
24VAC / 1-16
3-1
2A-0
Remote stop
A = automatic
Thermosat
Fan
Pump
RD
GN




Oil level
Failure
Power
Available
24VAC / 2-18
11
JB
3
Oil level
4
JB
12
2S8
25
3K10
26
28
YE
3H13
RD
3H11
3K10
0-3min H
Low oil
Power
24VAC / 2-18
Client : Marflex B.V. Zuidland (NL)
Project : Starterbox for powerpack
Subject : Electric Diagram no. 680084 3x440v/60Hz
BORNISSESTRAAT 11
Drawn status
Date
2002
Alt. A
Alt. B
Alt. C
Alt. D
Alt. E
Page nr
E3
Drawn R.J.Stasse
Size A3
Order nr. 02
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18




Cabinet dimensions
600 mm
20 mm
150mm
60mm
150mm
100mm
Pump
Running
Failure
2H2
2H7
Start pump
Stop pump
2S2
2S1
Amp meter
1P9
Low oil
3H11
Reset
2S8
Power
3H13
Fan
Running
2H1
Aut. Man.
2S10
Failure
2H16
Mainswitch
1S1
BORNISSESTRAAT 11
Drawn status
Date
2002
Alt. A
Alt. B
Alt. C
Alt. D
Alt. E
Page nr
E5
Drawn
R.J.Stasse
Size
A3
Order nr.
02
Client : Marflex B.V. Zuidland (NL)
Project : Starterbox for powerpack
Subject : Electric Diagram no. 680084 3x440v/60Hz

Page	Code	Qty	Description	Fabricate	Type
1	-	1	cabinet	rittal	AE 1060
1	1F12	1	aux. contact	Telem.	GVAN11
1	1F12	1	motorprotectionswitch	Telem.	GV2 ME04
1	1F16/2	1	circuitbreaker	Merlin Gerin	C60N C4 2pol 4A 24266 TU 271254
1	1F16/1	1	circuitbreaker	Merlin Gerin	C60N C10 2pol 10A 24268 TU 273177
1	1F2	1	circuitbreaker	Merlin Gerin	C60N C10 2pol 10A 24268 TU 273177
1	1F8	1	aux. contact	Telem.	GV3A01 + GV3ME63
1	1P9	1	amperemeter	Faget	EIV72 0-75/150A 75/5
1	1S1	1	mainswitch	K&N	KG64B-T303-VE24 K1 +2x H010 + A11-VE SI M280D/B24S
1	1T16	1	transformer	Trafa	460/400/24V-160VA 213497
1	1T8	1	stroomtrafo + voet	Faget	RM60N E2A 75/5 + 411887
2	2H2/2H11	2	signallamp green	Telem.	ZB4-BV03+ZB4-BV6
2	2H7/2H16/3H11	3	signallamp red	Telem.	ZB4-BV04+ZB4-BV6
2	2K6/2K15	2	aux.relais / socket	Telem.	RXN41G11B7 + RXZ7G
2	2P3/2P12	2	ptc relais	Allen Bradley	Cat 817-M
1	2Q10	1	contactor	Telem.	LC1D09B7 + LADN02
1	2Q1D	1	contactor	Telem.	LC1D40B7
1	2Q1K	1	Aux.relais/socket	Telem.	RXN41G11B7 + RXZ7G
1	2Q1N	1	contactor/timer	Telem.	LC1D40B7 + LAD-S2
1	2Q1S	1	contactor	Telem.	LC1D25B7
2	2S1/1	1	pushbutton stop	Telem.	ZB4-BA4+ZB4-BZ102
2	2S1/2	1	pushbutton start	Telem.	ZB4-BA3+ZB4-BZ101
2	2S10	1	selector switch	Telem.	ZB4-BJ2+ZB4 -BZ101+ZB4-BE102 + ZB2-BY2179
2	2S8	1	drukknop reset	Telem.	ZB4-BA2+ 2x ZB4-BE102+ZB4-BZ102
2	3H13	1	signallamp blau	Telem.	ZB4-BV06+ZB4-BV6
3	3K10	1	timer	Telem.	LAD-S2

Client	:	Marflex B.V. Zuidland (NL)
Project	:	Starterbox for powerpack
Subject	:	Electric Diagram no. 680084 3x440v/60Hz

ELECTRO MODERN B.V. and GENERAL SHIPSTORES
BORNISSESTRAAT 11
3044 AC ROTTERDAM
TEL. 010-4623977
FAX. 010-4152063
E-MAIL emod@electromodem.nl

4.3 Part list

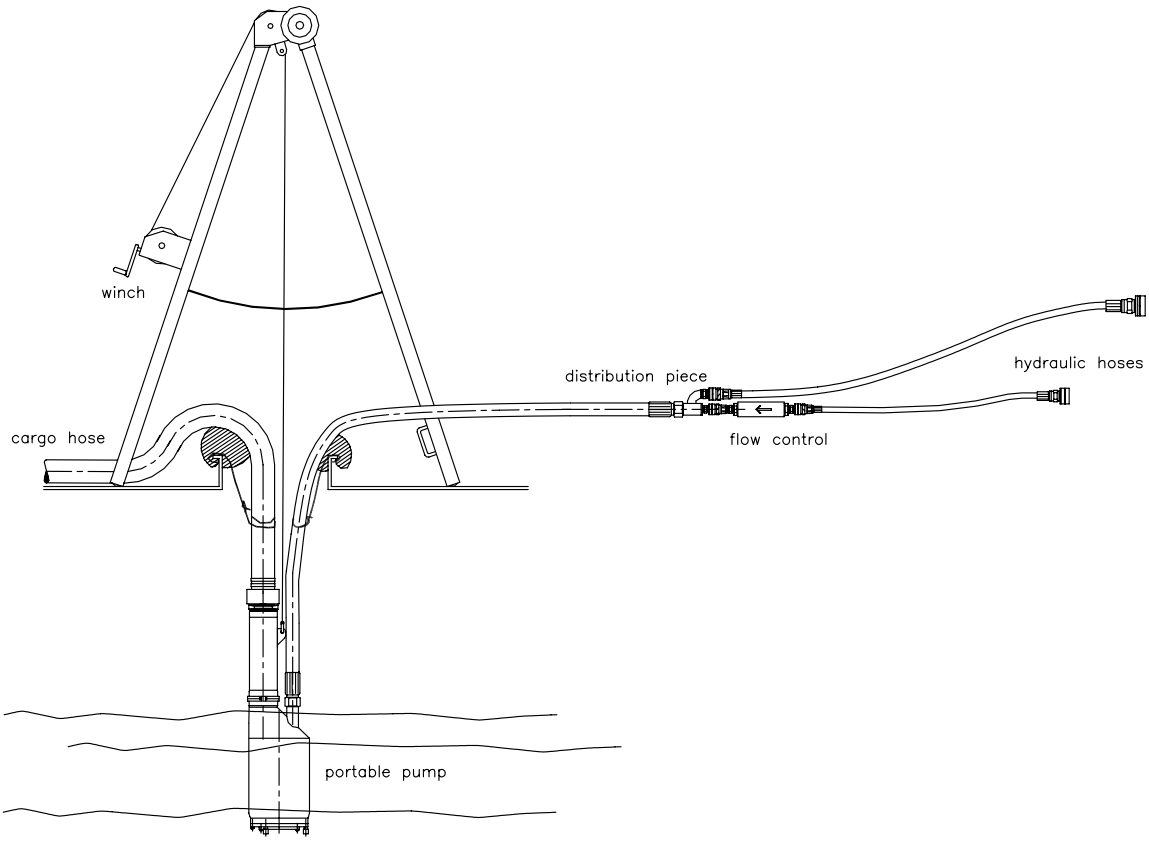
4.3.1 Advised spare parts

Partnumber	Description	Qty
482517	Filter cartridge	1

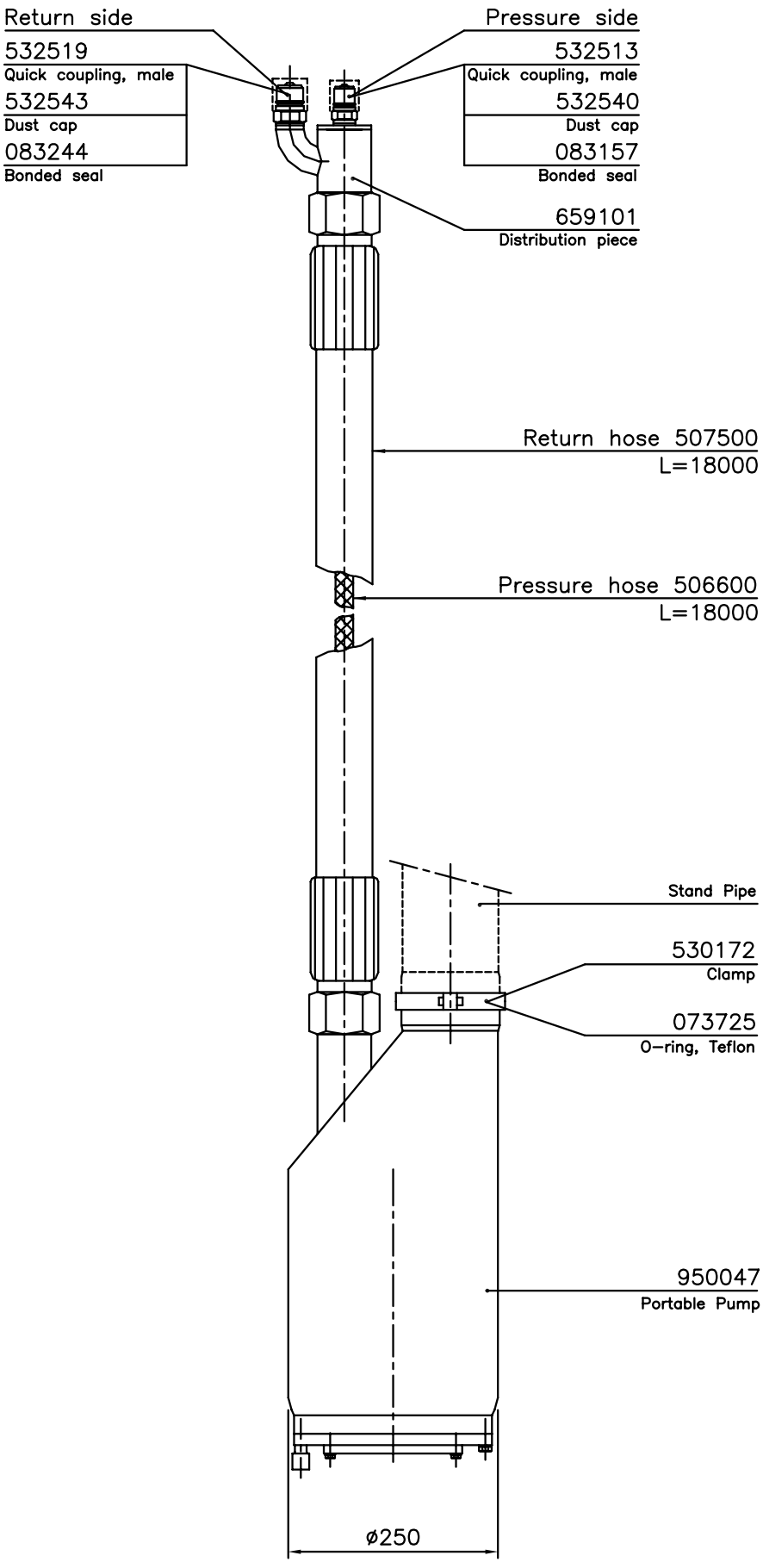
5 Portable pump MSP-80 drawings and part lists

5.1 Drawings

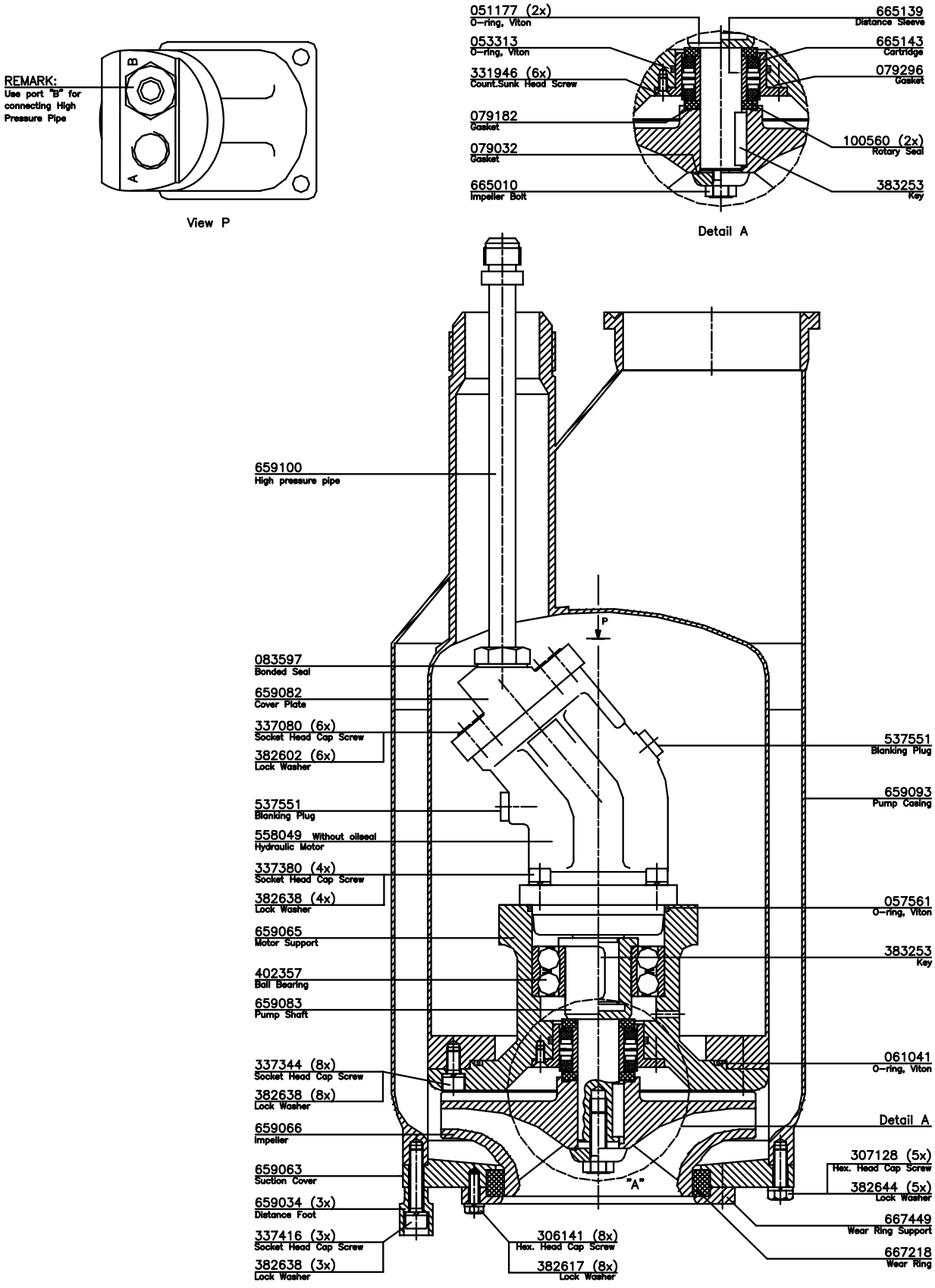
Set-up portable pump (typical)



MSP-80 assy, 950048 rev 1



MSP-80 unit, 950047 rev 6



5.2 Part list

5.2.1 Advised spare parts MSP-80 assy

Partnumber	Description	Qty
073725	O-ring, Teflon©	1
532540	Dustcap	1
532543	Dustcap	1

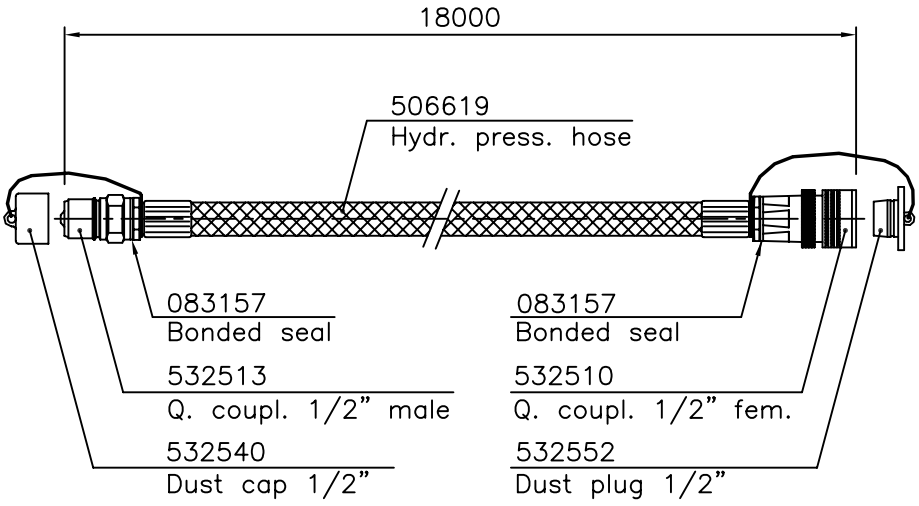
5.2.2 Advised spare parts MSP-80 unit

Partnumber	Description	Qty
051177	O-ring, Viton©	2
053313	O-ring, Viton©	1
057561	O-ring, Viton©	1
061041	O-ring, Viton©	1
079032	Gasket, Teflon©	1
079182	Gasket, Teflon©	1
079296	Gasket, Teflon©	1
083597	Bonded seal	1
100560	Rotating part mechanical seal	1
100563	Stationary part mechanical seal	1
382602	Lock washer	6
382617	Lock washer	8
382638	Lock washer	7
382644	Lock washer	13
402357	Bearing	1
667218	Wear ring	1

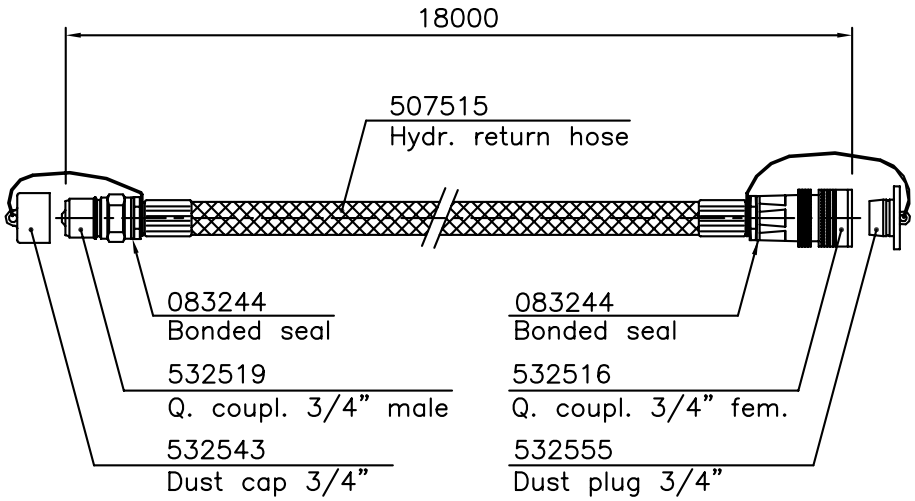
5.3 Optional

5.3.1 Hydraulic extension hoses

Hydraulic pressure hose 5/8" TEMA, 950415 rev 2

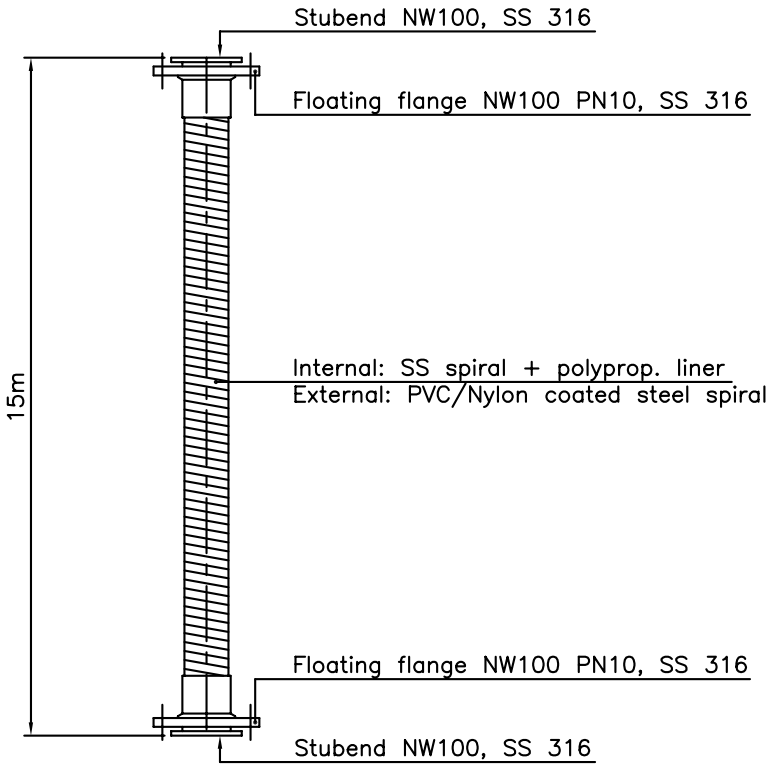


Hydraulic return hose 3/4" TEMA, 950469 rev 3



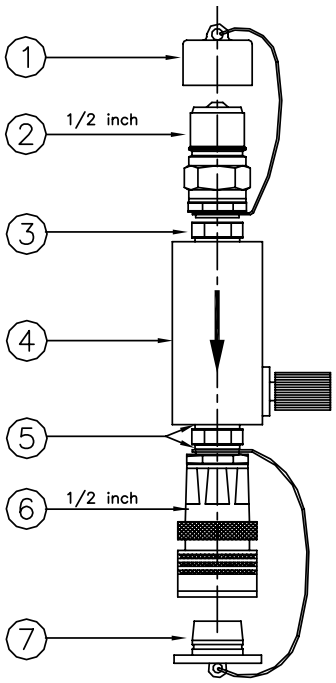
5.3.2 Cargo hose

Cargo hose 4", 950860 rev 2



5.3.3 Flow control

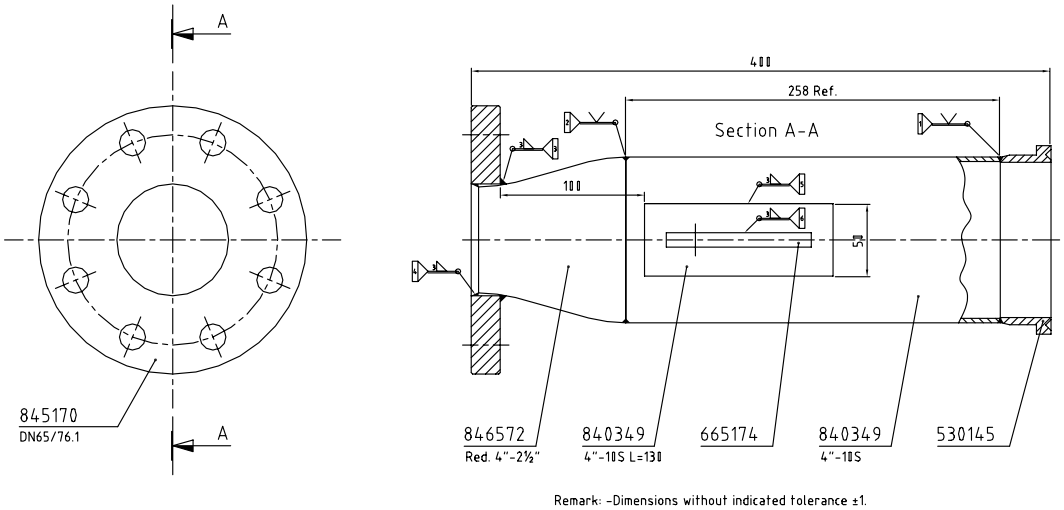
Flow control assy 1/2" TEMA, 950351 rev 2



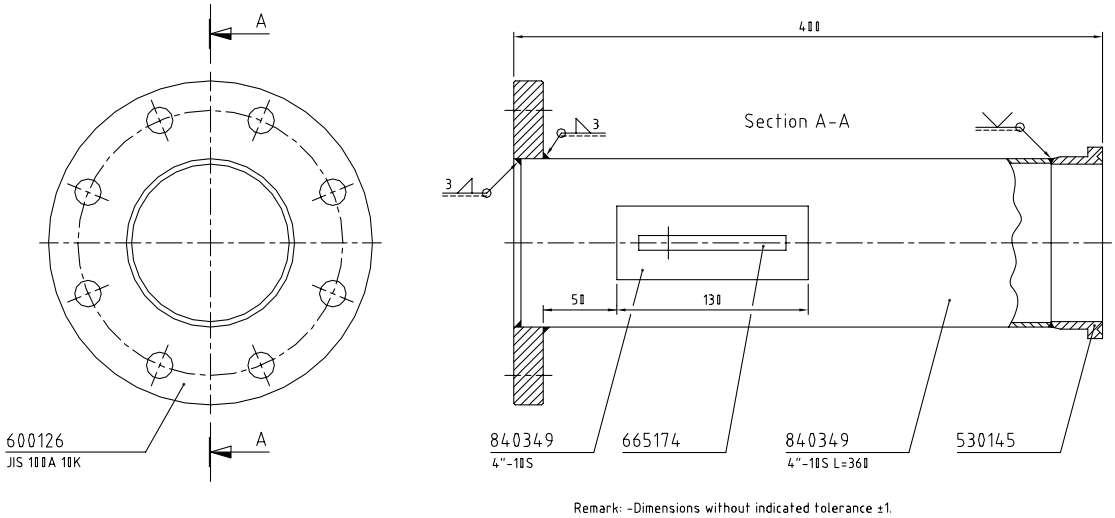
Item:	Art.No:	Description:	Qty:
7	532552	Dust plug	1
6	532510	Quick coupling female	1
5	083157	Bonded seal	4
4	484023	Flow control	1
3	521658	Hexagon nipple	2
2	532513	Quick coupling male	1
1	532540	Dust cap	1

5.3.4 Connection pipe

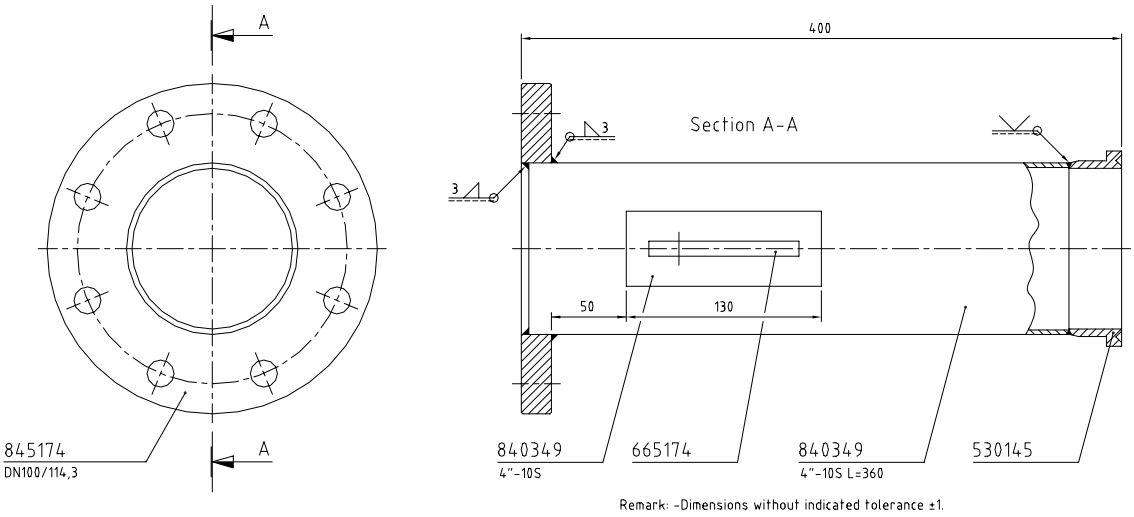
Connection pipe MSP-80 DN65, 950224 rev 1



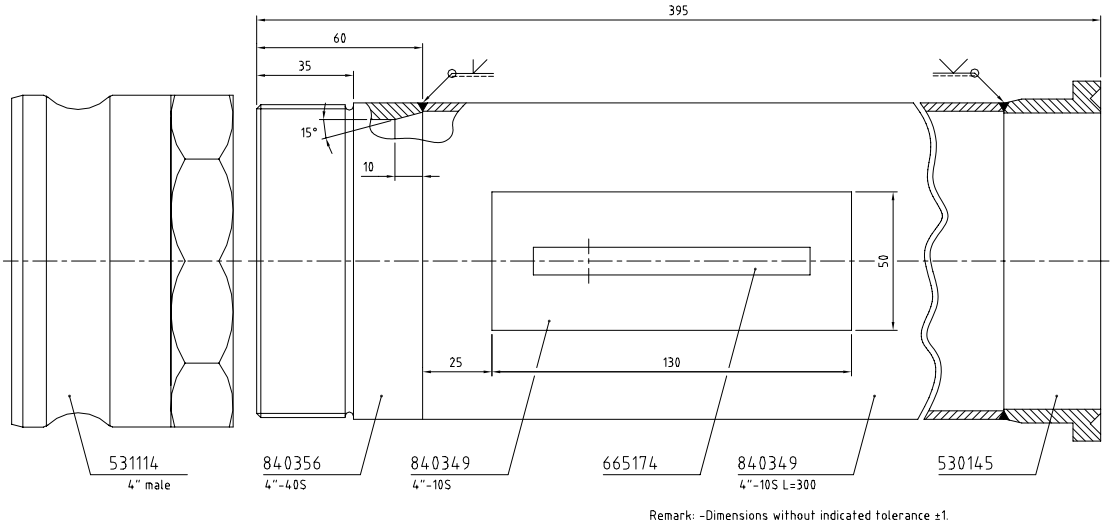
Connection pipe MSP-80 JIS100A 10K, 950221rev 1



Connection pipe MSP-80 DN-100, 950222 rev 3



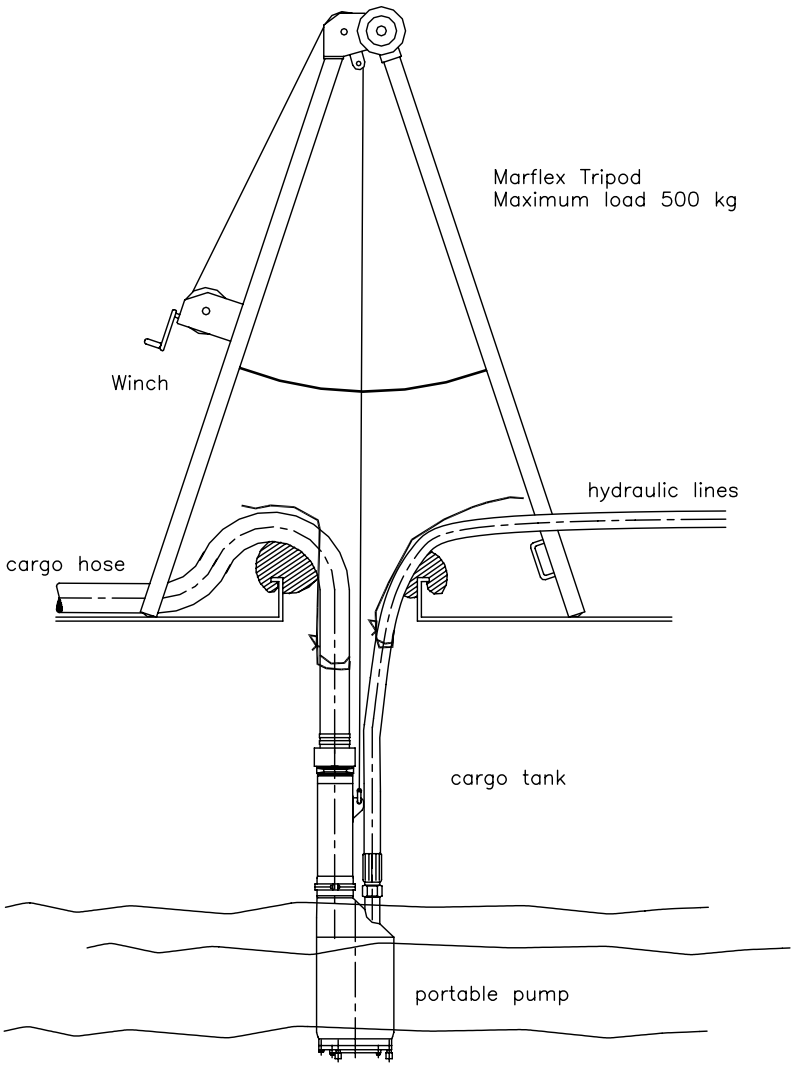
Connection pipe MSP-80 4" Camlock, 950220 rev 1



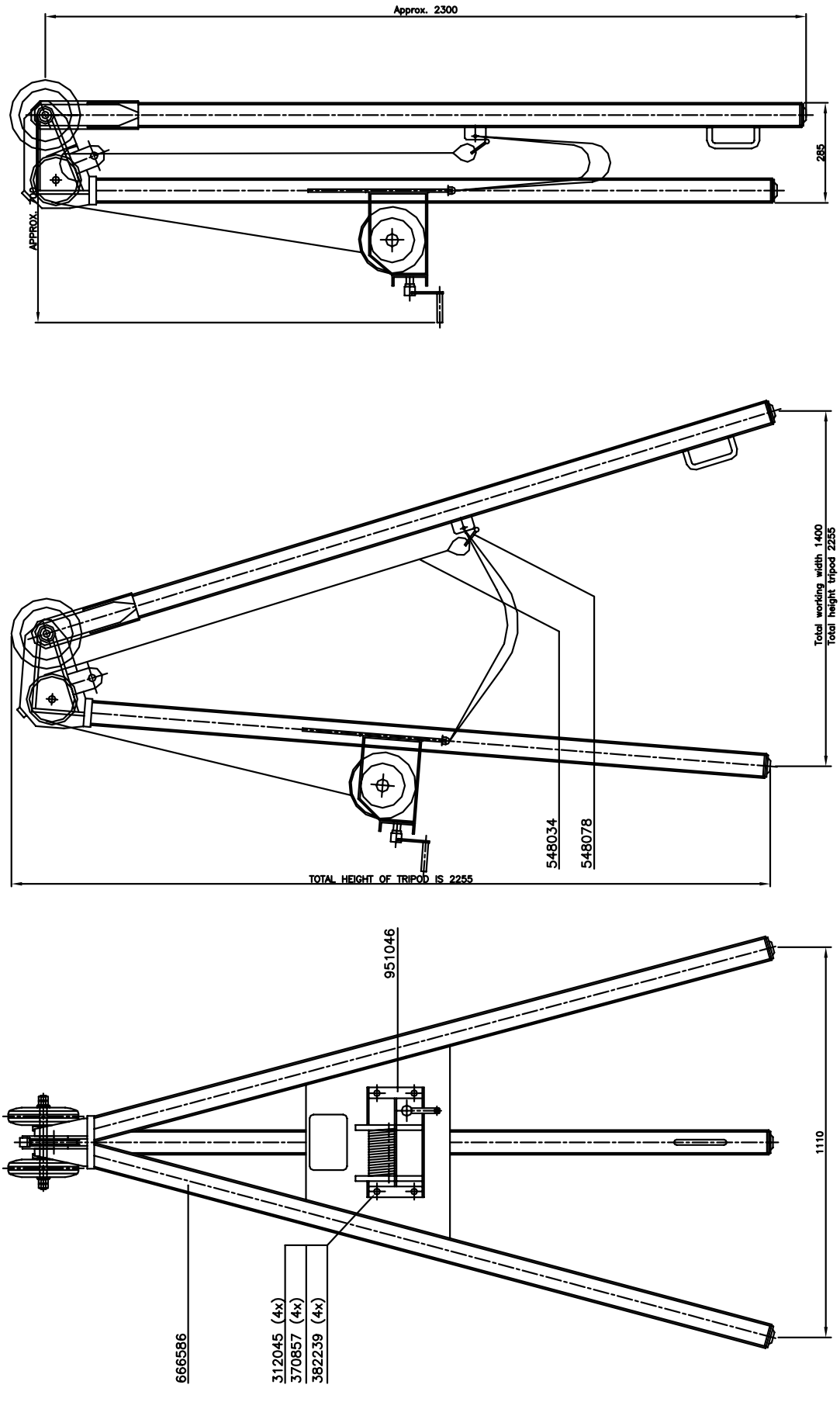
6 Tripod (manually operated)

6.1 Drawings and parts

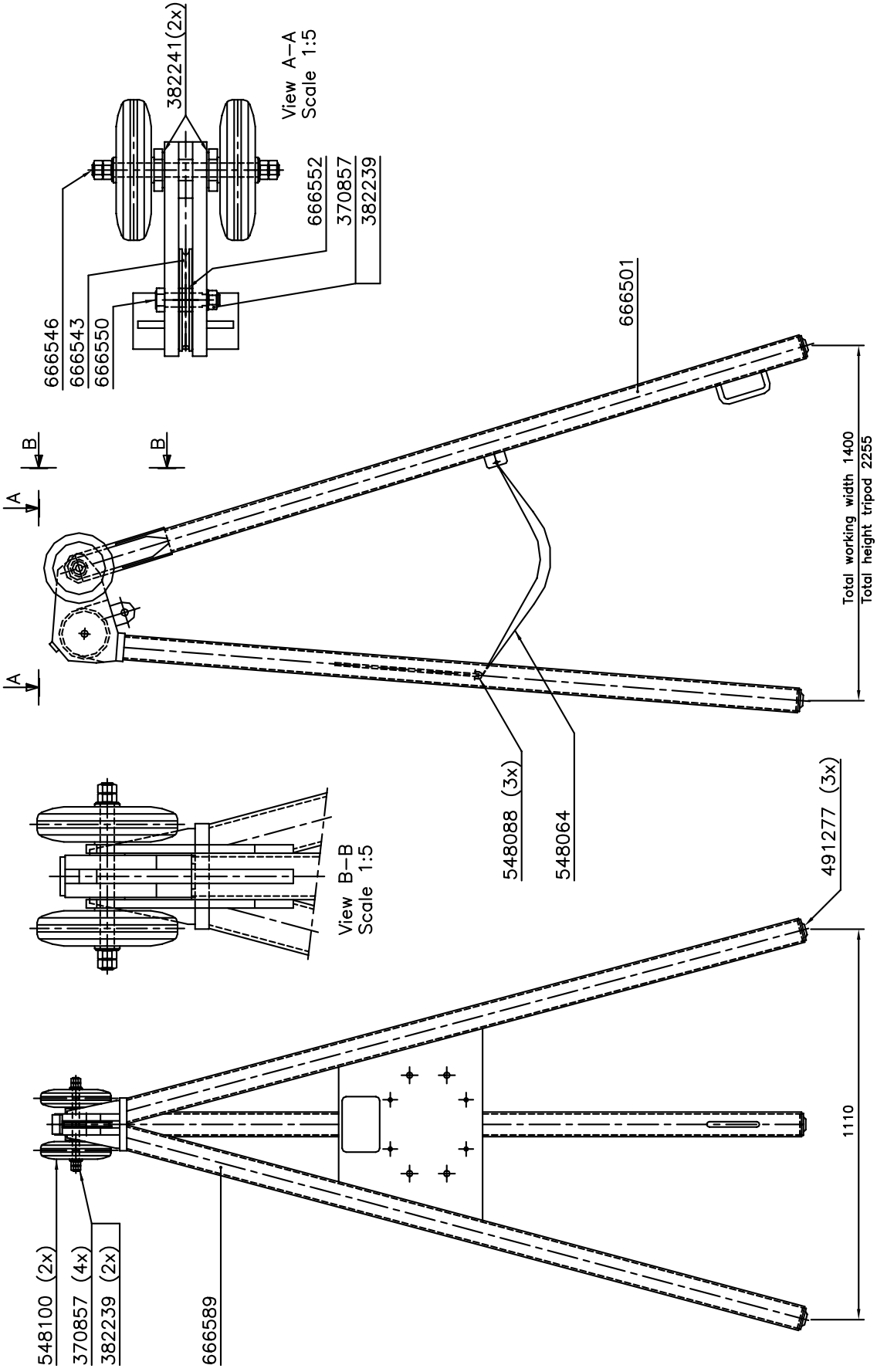
Set-up tripod (typical)



Tripod hoist, manual winch, 951015 rev 8



Tripod, sub assembly type-B, 666586 rev 1



8 Installation procedures

1 Installation of cargo pump and deck trunk

Caution!

Verify the pump well is installed in a position that complies to the installation drawing **before** *the deck trunk and the cargo pump are installed!*
The orientation of the pump well in the tank and the related position of the pump head are essential for proper installation and removal of the pump head in case of maintenance!

Note:

This chapter gives a general description of the installation of a Marflex deepwell cargo pump.
The images shown can differ from your actual situation.
Refer to the applicable installation- and component drawings for the actual details and dimensions.

Note:

Carefully read this manual before installing the Marflex pump.
Determine the correct type of pump and have the applicable installation drawings and tools prepared up front.

1.1 Installation conditions

1.1.1 Recommended free space around a deepwell pump

For proper installation, commissioning, inspection and maintenance on the main deck free working space is recommended, both in vertical and in horizontal direction.

Vertical:

- To lower and install the assembled pipe stack (with top cover & pump head) onto the deck trunk, the area above the deck trunk must be free of any pipe lines, catwalks or cable ways.
  The recommended dimensions of free space for lifting purposes can be found on the installation drawing.

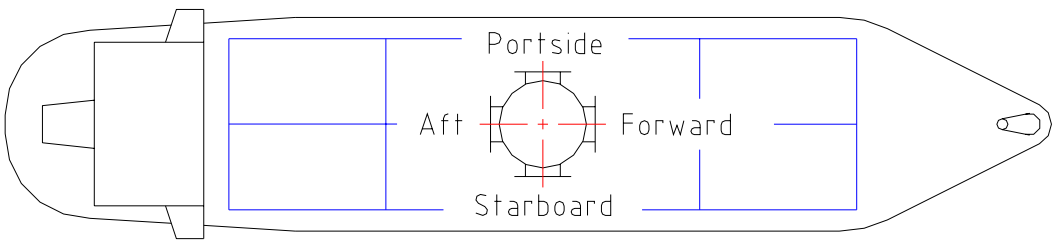
Horizontal:

- To open the inspection hatch on the pump's top cover, a minimal (radial) clearance must be maintained.
  The recommended radial clearance can be found on the installation drawing.

1.1.2 Direction of discharge

Make sure to check the direction of the discharge flanges on the pump, the pump can be positioned in 4 ways.
The actual direction of discharge is related to the position of the installed pump well in the tank and can be found on the installation drawing.

Overview of discharge directions



1.1.3 Free space under deepwell pump head

For inspection and/or maintenance the pump head can be removed from underneath the pipe stack while leaving the pipe stack in position.

This requires a free space underneath the pump head. The minimal required dimension can be found on the installation drawing.

1.1.4 Hoisting

Note:

To properly access the deepwell pump for inspection or repair do not construct pipelines, catwalks or cable ways etc. above the deepwell pump

Above the deepwell pump a free height is needed to hoist the assembled deepwell pump, in and out of the cargo tank.

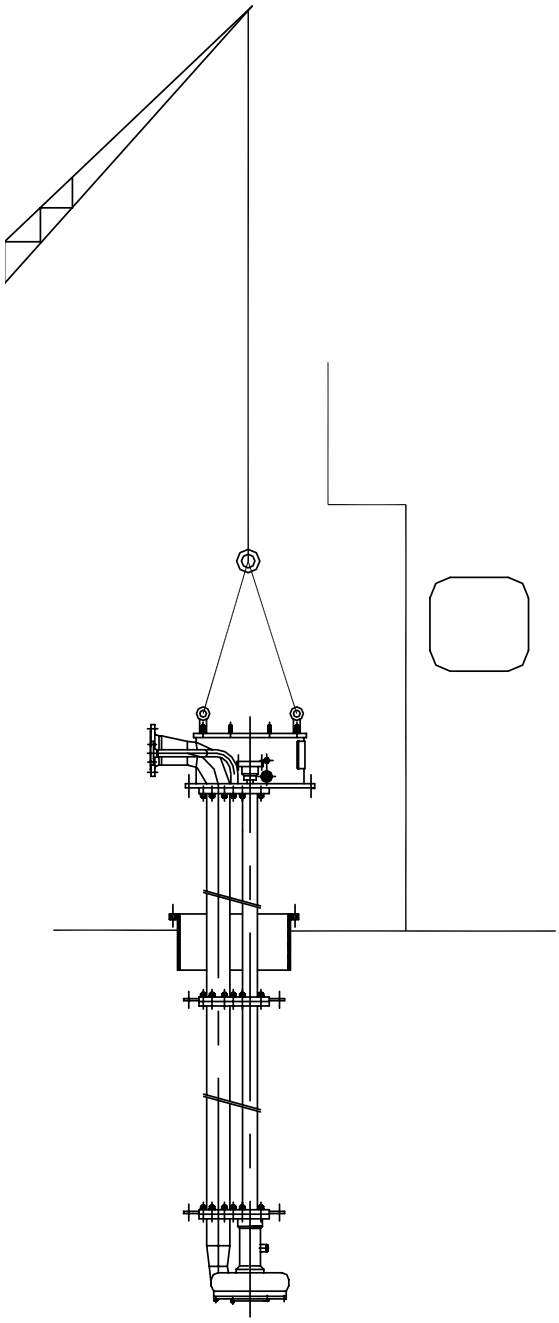
The electric motor must be installed on the pump's top cover after the top cover and pipe stack are installed on the deck trunk due to it's weight.

Top cover, pipe stack & pump head are normally assembled at the Marflex factory.

For hoisting purposes the pump assembly is equipped with transport supports & soft slings.

Transport supports are bolted on top cover & pump head side; soft slings are fitted to the pipe stack.

Long pipe stacks can be transported in sections and are assembled as close as possible to the installation location.



1.2 Deck trunk installation

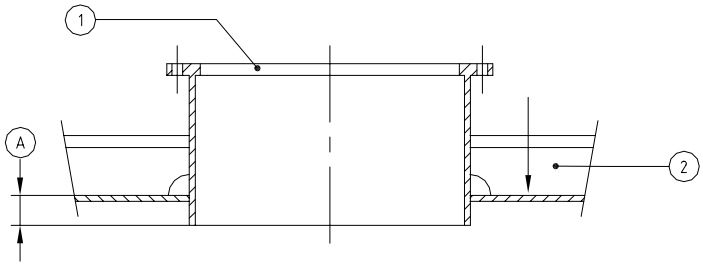
1.2.1 Parts welded to the deck structure

The deck trunk (supplied by Marflex or locally manufactured) is welded to the ships structure.

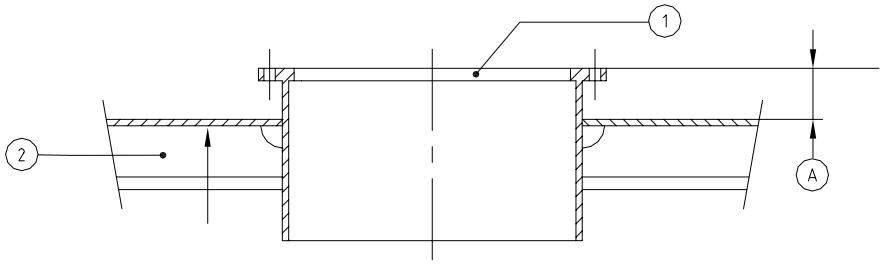
To eliminate vibrations and reduce noise the deck trunk is preferably welded between the deck stiffeners. If the ship lacks stiffeners these must be manufactured locally and welded to the deck to integrate the deck trunk with the ship's structure.

Stiffeners should be manufactured with care to prevent shrinkage and deformation.

With stiffeners (2) situated **on** deck, the minimum length "A" of the deck trunk (1), below deck, must comply with the dimensions given in the installation drawing.



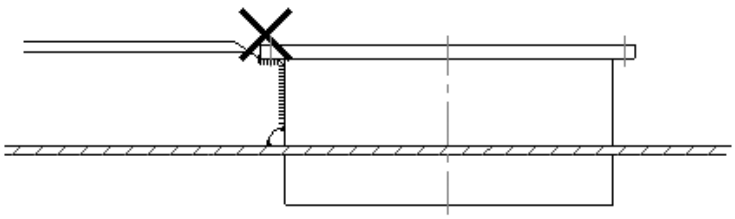
With stiffeners (2) situated **below** deck, the minimum length "A", of the deck trunk (1), above deck, must comply with the dimensions in the installation drawing.



The height of the manufactured stiffening profiles must be sufficient to support the pump including electric motor and to absorb vibrations and noise.

Caution!

It is NOT allowed to weld anything to the deck trunk flange!



The deck trunk is the main structural interface between the ship's structure and the pump.
If installed correctly the deck trunk ensures a smooth, vibration & noise free running of the deep-well pump.

1.2.2 Installation and alignment using a dummy

In order to ensure the correct alignment of the deck trunk, a so-called dummy is a helpful tool. This tool has the following characteristics and advantages:

- The dimension between the bottom of the tank well to the upper edge of the deck trunk flange (dimension “A” on the Marflex installation drawings) can be measured with an accurately fabricated dummy.
- The dimension between the topside deck to the upper edge of the deck trunk flange will be accurate.
- The bolt holes in the deck trunk flange can be accurately positioned with reference to the ship’s centre line.
- The centre of the pump head can be placed at it’s design point in the tank well.
- The support plates needed for the pump head support can be welded in the tank simultaneously .
  This is also the case for support plates if the deepwell pump is equipped with a multiple pipe stack.
- After welding the deck trunk to the support plates the yard can completely finish processing the cargo tank (pickling, passivation, blasting or coating).

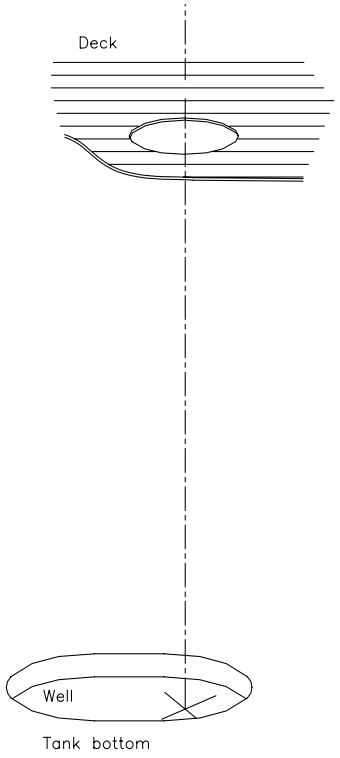
Optionally the dummy can be equipped with a cargo discharge flange and a stripping flange in order to pre-fabricate the connections on the main deck. This will reduce welding activities after the deepwell pump’s installation.

Tip.

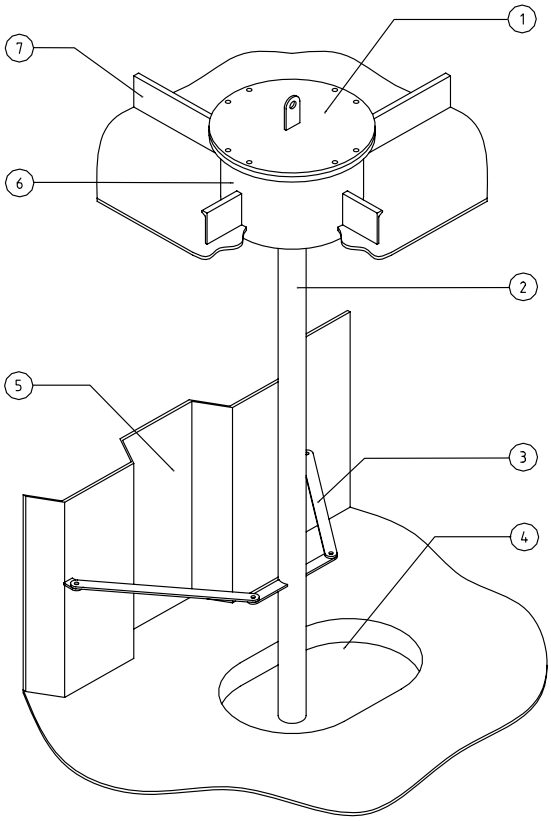
It is NOT recommended to include the discharge and stripping flange in the dummy.
It is better to make the connecting pipe work to suit the deepwell pump after installation of the deepwell pump. This prevents mismatch of the connections resulting in material stress when connecting the flanges.

Installation and alignment deck trunk

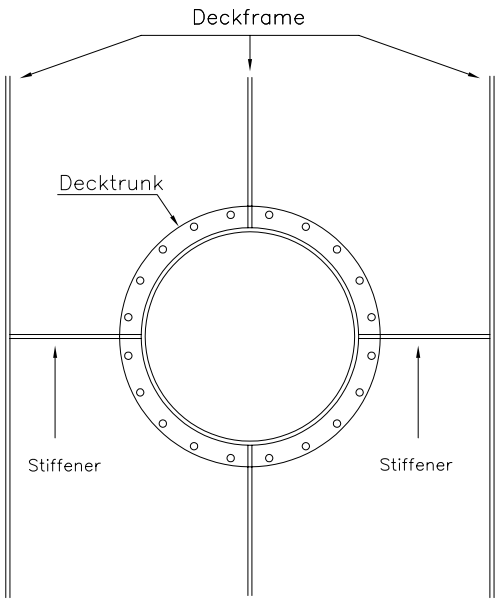
1. Determine and mark the centre of the pump on deck
   (Use the installation drawing to determine position and measurements)
2. Cut the appropriate hole in the deck
3. Determine and mark the centre of the pump in the well (4) inside the tank

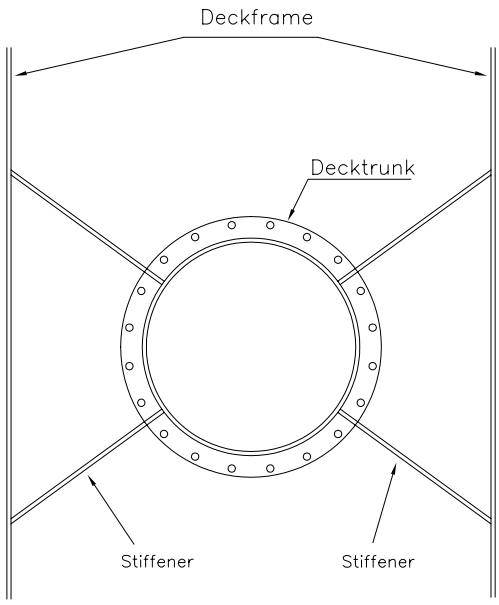


4. Install the deck trunk (6) on the dummy flange (1) and hoist the assembled dummy through the hole in the deck plating of the cargo tank
5. Align the bolt holes in reference to the ships centre line
   (Use the installation drawing for position and dimensions)
6. Check the centre of the dummy (2) in the tank well (4)
   (Misalignment of more then 5mm is not acceptable)
7. Repeat this check and adjust the assembly until the misalignment is less then 5mm
8. Tack weld the dummy pipe into the bottom of the tank well to ensure the centre of the pump.
9. Check the vertical alignment of the dummy (should be less then 1 mm per meter height)
10. Tack weld the deck trunk to the deck plating of the cargo tank. (Do not remove the dummy after welding)
11. Manufacture the deck stiffeners (Refer to the installation drawing for details)
12. Tack weld the deck stiffeners
13. Re-check the dummy alignment
14. Finish welding the deck trunk into position, prevent deformation and/or shrinkage
15. Allow the installation to cool down and re-check the alignment
16. Remove the dummy assembly
17. Verify that the installation is positioned according to the installation drawing
18. Cover the installed deck trunk until the cargo pump is completely installed to prevent damage or deformation.



Examples stiffener position





1.2.3 Installation and alignment using a laser instrument

Warning!

Laser light can be blinding! Use with care!

Caution!

The laser instrument is a delicate tool. Handle with care to prevent damage!

Note:

The laser can only be used to install the deck trunk!

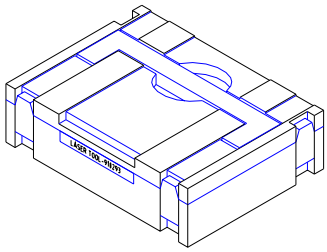
Note:

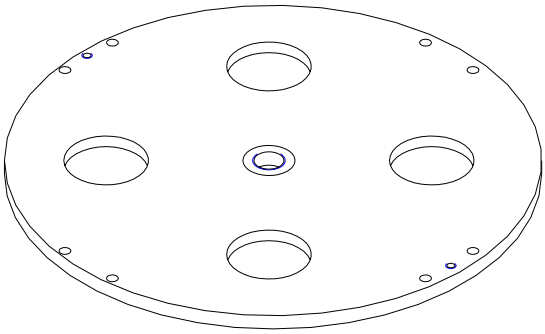
A complete laser alignment instrument with adapting flange, bolts and nuts can be obtained from Marflex (on loan).
For information contact the Marflex sales department.

The laser alignment instrument consists of the following:

- An aluminium box
- A laser instrument
- An adapting flange
- 4 adjusting bolts
- 4 nuts.

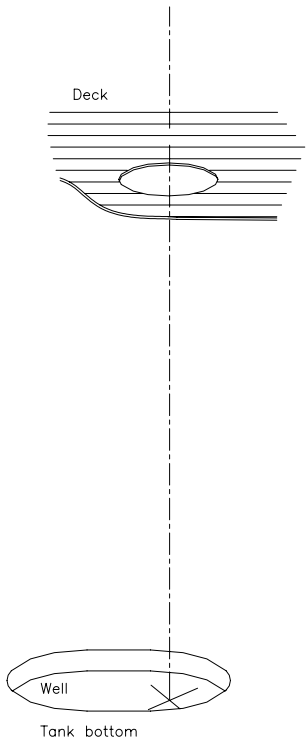
Laser tool box with adapting flange



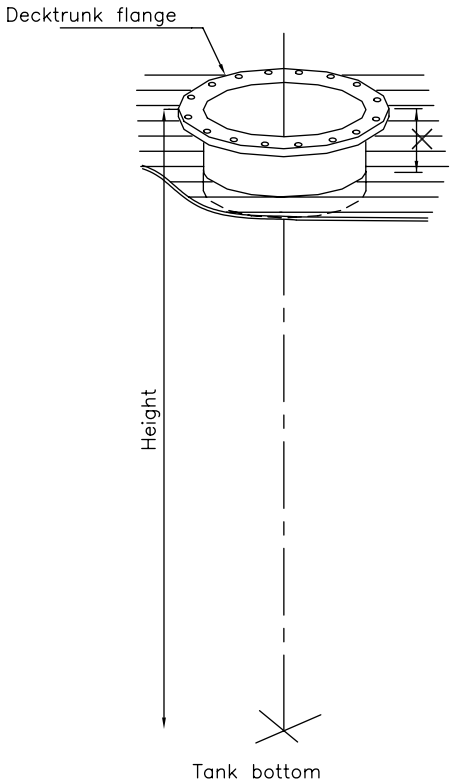


Installation and alignment of deck trunk

1. Determine and mark the centre of the pump on deck
   (Use the installation drawing to determine position and measurements)
2. Cut the appropriate hole in the deck
3. Determine and mark the centre of the pump in the tank



4. Place the deck trunk in the hole and support it with wooden blocks e.g..
5. Measure and adjust the height of the deck trunk flange to the tank bottom
   (Use the installation drawing to determine position and measurements)
6. Align the bolt holes of the deck trunk with the ship's centre line



7. Install the adapting flange on the deck trunk using the adjustable bolts
8. Screw the laser tool entirely to the adapting flange
9. Switch on the laser (blinking led)
10. Adjust the deck trunk and make sure the laser light bundle is pointing to the pump centre marking inside the tank
11. Fix the deck trunk in position using tack welds
12. Produce and tack weld the stiffeners in position (if applicable)
13. Check height and alignment again and adjust if necessary
14. Remove the laser from the adapting flange
15. Finish welding the deck trunk and the stiffeners, prevent deformation and shrinkage
16. Allow the installation to cool down
17. Screw the laser tool, again, entirely in the adapting flange
18. Check height and alignment again and adjust if necessary
19. Remove the laser from the adapting flange
20. Remove the adapting flange from the deck trunk.

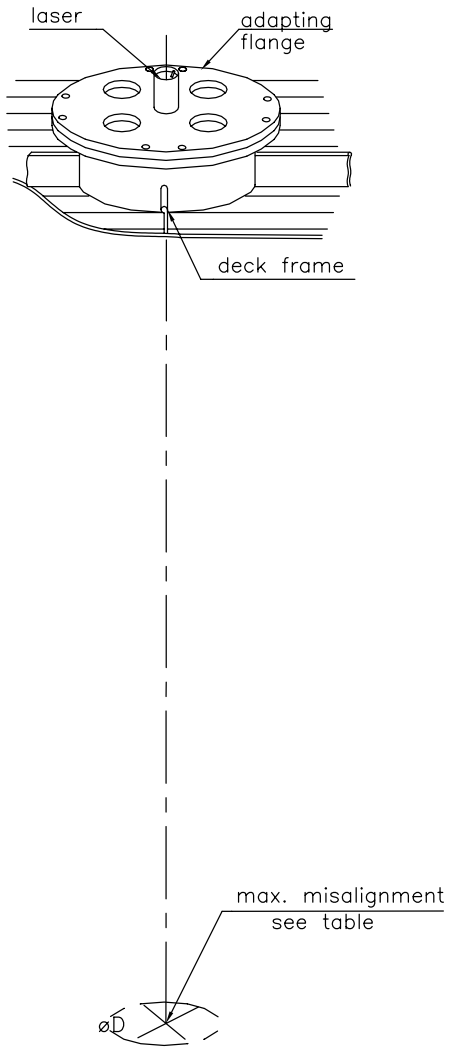


Table 1: Mis-alignment

Maximum allowed misalignment 2 mm / m	
Length pipe stack (m)	Misalignment øD (mm)
3	6
6	12
12	24
18	36
24	48

1.2.4 Installation and alignment using an original cargo pump

Caution!

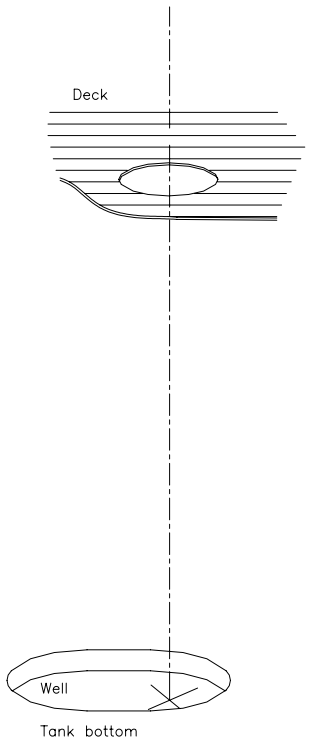
The below described procedure is not recommended when work such as coating or blasting still needs to be performed in the tank.

Caution!

To prevent damage and warranty loss take extreme care when using the described procedure. Take care not to put any stress on the pump assembly, especially the pipe stack.

Installation and alignment of deck trunk

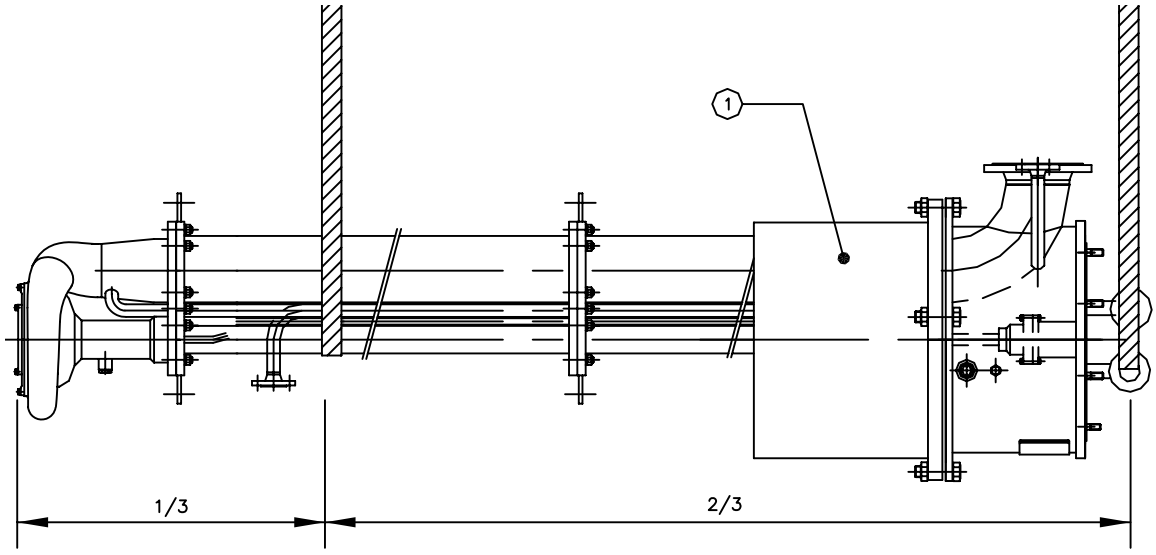
1. Determine and mark the centre of the pump on deck
   (Use the installation drawing to determine position and measurements)
2. Cut the appropriate hole in the deck
3. Determine and mark the centre of the pump in the tank
4. Assemble the pump according to 1.3 (if applicable)



Note:

For hoisting procedures see 1.4.2

5. Install the deck trunk (1) on the top cover with the appropriate bolts, washers and nuts.



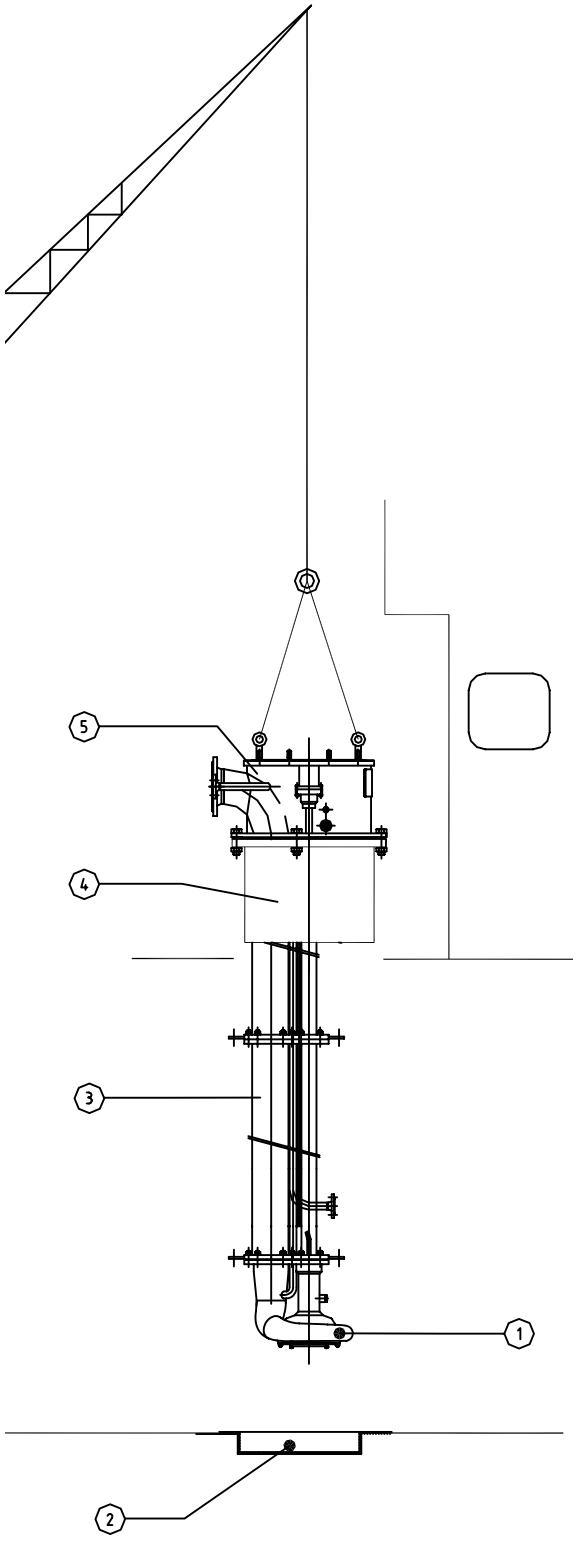
Caution!

Extra care must be taken when lowering the pump assembly through the deck hole into the tank!

Note:

The distance between the pump head and the bottom of the tank well is essential for maintenance purposes.

6. Fabricate a wooden plate with the correct dimensions to use as dummy for the clearance between pump head and tank well (for the correct thickness use the data on the installation drawing)
7. Place the wooden cover plate in the tank well (2)
8. Make sure the mark of the centre of the pump is visible
9. Lower the pump assembly (3) through the deck hole into the tank
10. Lower the pump assembly onto the wooden plate and align the pump head (1) with the centre marking in the tank well
11. Align the top cover (discharge flange) (5) with the ship's centre line
12. Manufacture the stiffeners (if applicable) and place them in position
13. Tack weld the deck trunk (4) and the stiffeners in position
14. Disconnect the pump assembly from the deck trunk and hoist the assembly out of the tank
15. Place a cover plate on the deck trunk flange
16. Finish welding the deck trunk and stiffeners, prevent deformation and shrinkage
17. Allow the installation to cool down
18. Re-install the pump assembly
19. Check the distance and alignment of the pump head
20. Verify the installation position and dimensions comply with the installation drawing
21. Remove the pump assembly
22. Cover the installed deck trunk until the cargo pump is completely installed to prevent damage or deformation.



1.3 Cargo pump assembly (if applicable)

When possible the Marflex pumps are shipped as a complete assembly.

In case of a length > 12 meter the pumps are divided into two or more sections. Before installation of the pump these parts must be assembled on location.

Warning!

Carry out the assembly on a stable floor!

Caution!

Make sure the pump is protected against rain, wind and dust particles during assembly. Using a tent e.g. is advised.
Grinding particles and mild steel can cause serious damage to the stainless steel pump!

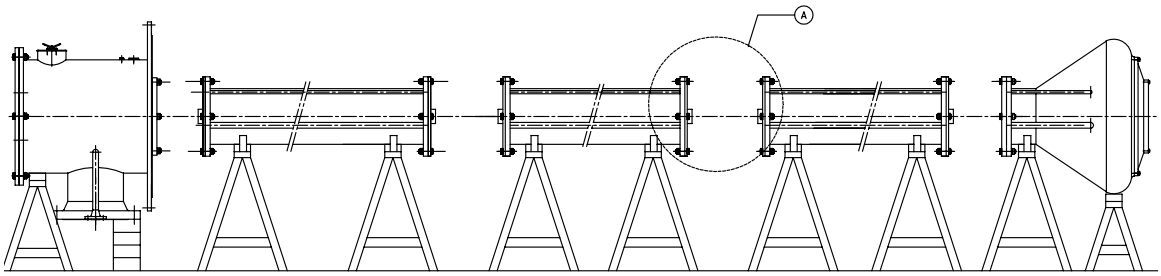
Caution!

Use supports capable of carrying the pump assembly weight and of equal height.
Use supports of correct height to carry the top cover and the pump head.
Protect the pump assembly against scratches and damage using wood and/or carpets between supports and pump parts.

Note:

Because of the length of some pumps it is recommended that the assembly of the complete pump is carried out as close to the final installation location as possible.

Example assembly setup (MDPC)



1.3.1 Preparation

The delivered parts are marked with part numbers. These part numbers correspond with the numbers on the applicable drawings.

Some parts, like long shafts and pipe stack parts, can have the same part number but different lengths. These parts have an item number corresponding with the applicable section of the pump.

Collect the parts and group as section to prepare for assembly.

For installation of the pump head see section “General maintenance”.

1.3.2 Assembly (MDPC type)

In general the assembly of the pump is done starting from the bottom (pump head) to the top (top cover).

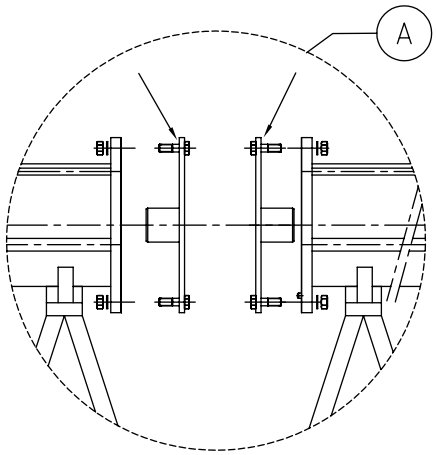
Caution!

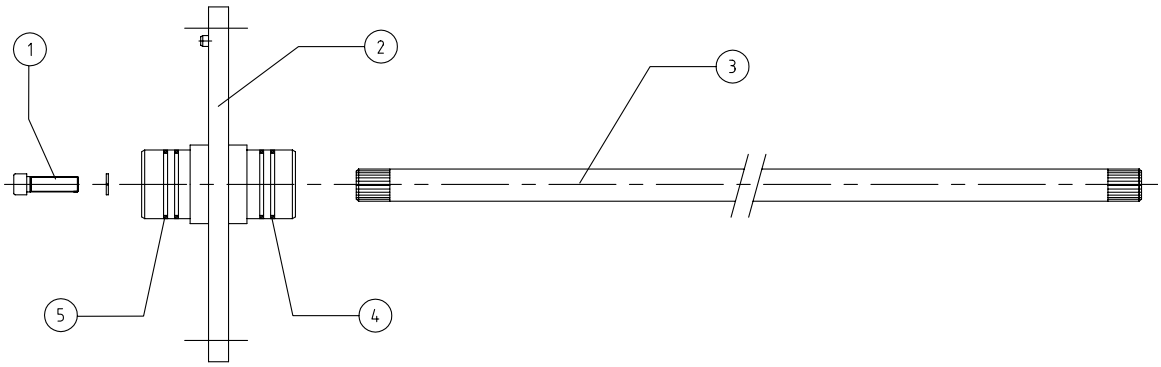
The intermediate flanges do not all have the same shape! Make sure to use the correct one!

Caution!

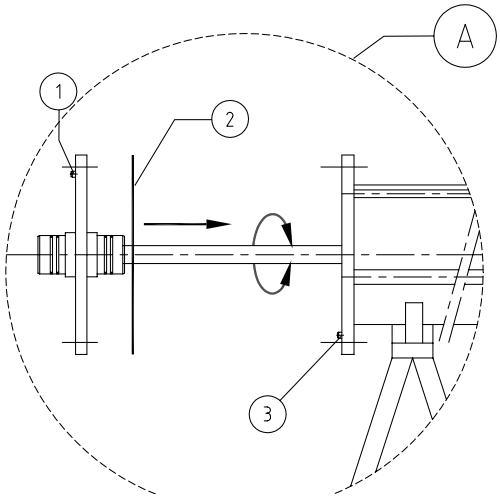
Make sure to align the splines of shafts e.d. properly to allow smoothly installation!
Do NOT hammer on the spline connections!

1. Remove the cover plates, enclosing and centering the long shaft, from the flanges (detail A)
2. Clean the flanges, pipes and seal grooves
3. Apply a light coating of high quality grease to the flanges
4. Clean the applicable intermediate flange (2) and apply some grease
5. Install new O-rings (4 and 5) on both sides of the intermediate flange
6. Slide the intermediate flange carefully over the spline of the long shaft (3)
7. Check for correct engagement of the splines
8. Install the socket head screw (1) and torque tighten to the correct value (see section “Standard practices and torque values”)

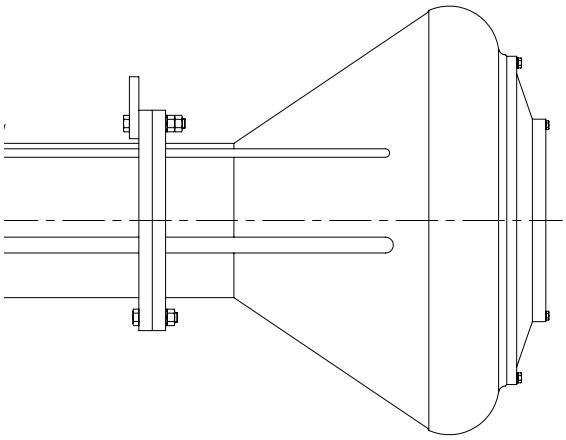




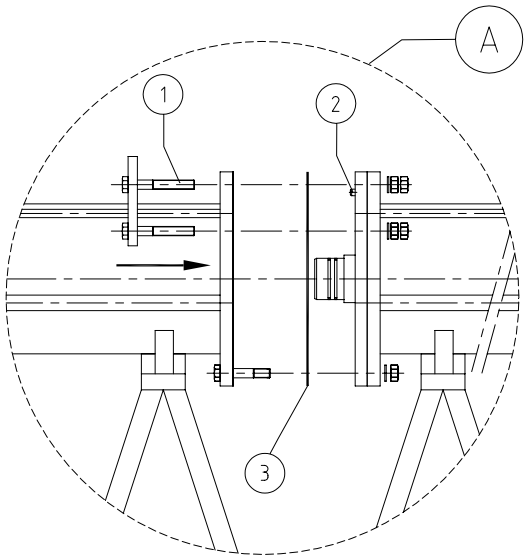
9. Apply a light coating of grease on the long shaft
10. Install new O-rings (2) in the grooves on one side of the intermediate flange and the pipe connections
11. Carefully slide the long shaft into the pipe stack section through the bearings
12. Align the dowel pins for proper engagement and check the position of the pipe connections
13. Check for proper engagement of the splines in the next intermediate flange or in the pump head



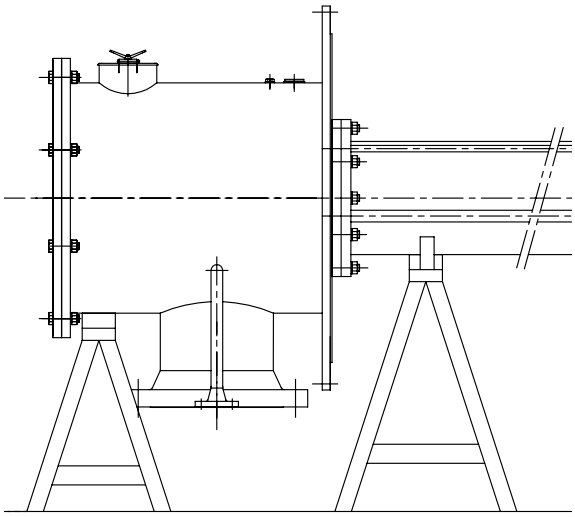
14. For installation of the pump head see section “General maintenance”.



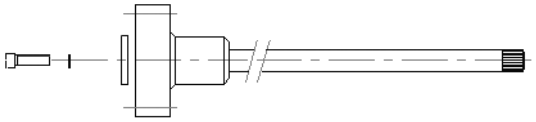
15. Install new O-rings (3) in the grooves on the opposite side of the intermediate flange and the pipe connections
16. Move the opposite pipe stack close to the intermediate flange
17. Align with the dowel pin (2)
18. Carefully move the opposite pipe stack in position
19. With the long shaft installed in the opposite pipe stack rotate the long shaft manually to allow proper spline engagement
20. Install the bolts (1), washers and nuts (and mounting plates if applicable)
21. Torque tighten to the correct value (see section “Standard practices and torque values”)
22. Repeat previous steps for each pipe stack element

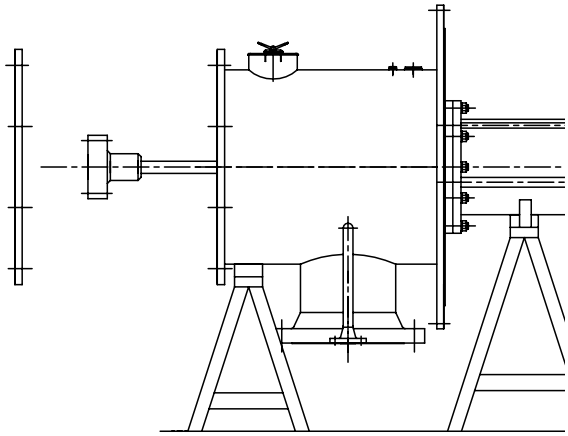


23. Install new O-rings in the grooves on the upper part of the pipe stack and the pipe connections
24. Move the top cover to the upper part of the pipe stack
25. Install the bolts, washers and nuts
26. Torque tighten to the correct value (see section “Standard practices and torque values”)



27. Place the lower coupling halve of the electric motor connection over the splines of the top long shaft
28. Install the retaining ring in the coupling halve
29. Secure the retaining ring with the bolt and lock washer
30. Torque tighten to the correct value (see section “Standard practices and torque values”)
31. Remove the cover plate from the top cover
32. Apply a light coating of grease on the long shaft
33. Slide the assembled top long shaft through the top cover and the upper part of the pipe stack
34. Rotate the long shaft manually to allow proper engagement of the splines in the next intermediate flange
35. Reinstall the cover plate on the top cover
36. Protect all flanges and openings after the pump assembly.





1.3.3 Assembly (MDPD type)

In general the assembly of the pump is done starting from the bottom (pump head) to the top (top cover).

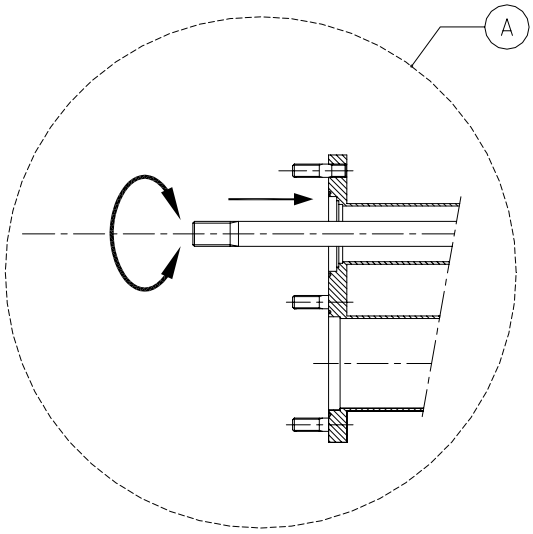
Caution!

The intermediate flanges do not all have the same shape! Make sure to use the correct one!

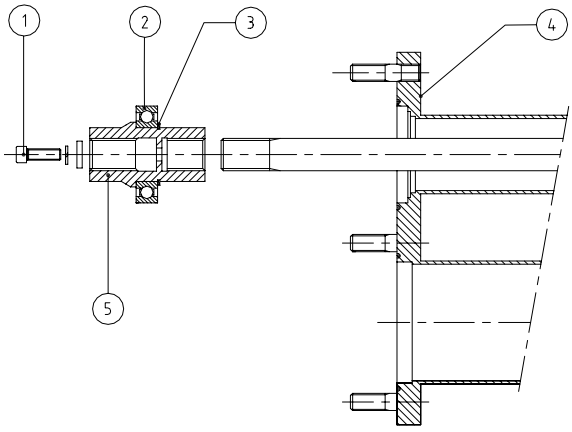
Caution!

Make sure to align the splines of shafts e.d. properly to allow smoothly installation!
Do NOT hammer on the spline connections!

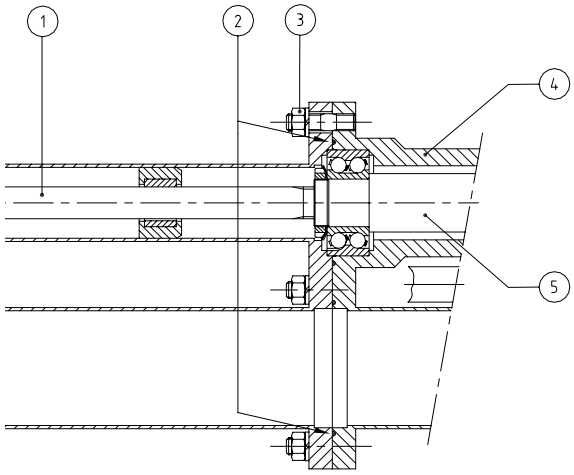
1. Remove the cover plates from the pipe stack flanges
2. Clean the flanges and the applicable long shaft
3. Apply a light coating of grease on the long shaft
4. Slide the long shaft into the pipe stack, through the bearings (detail A)

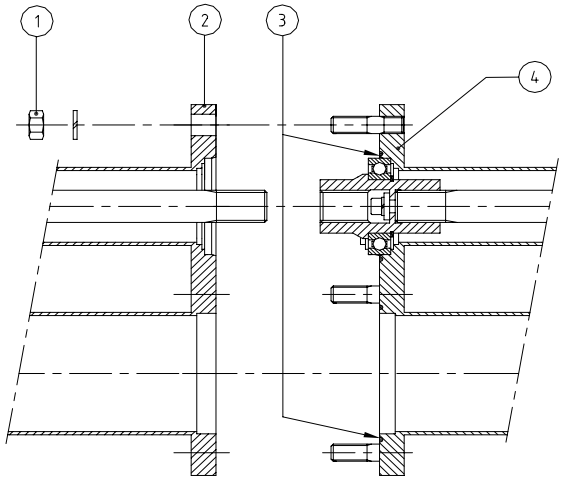


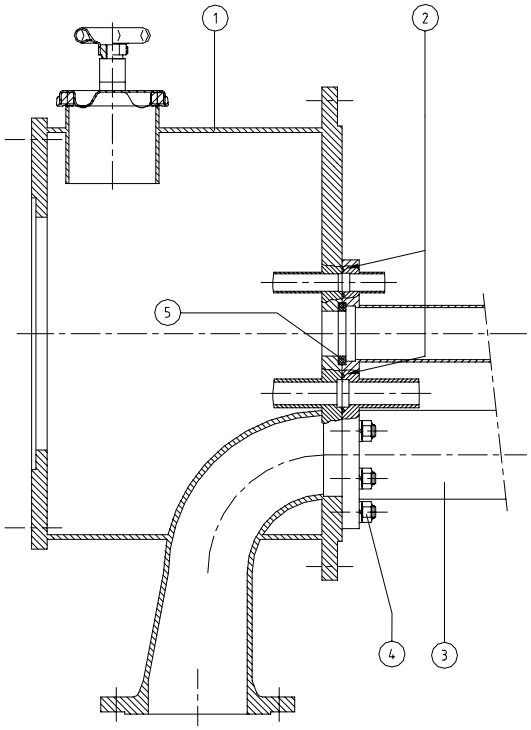
5. Heat the bearing (2) up to a temperature of ± 80 °C above ambient with a bearing heater
6. Slide the heated bearing on the intermediate coupling (5) and secure with the circlip (3)
7. Align the intermediate coupling with the splines of the long shaft in the pipe stack (4)
8. Install the intermediate coupling on the long shaft and secure with the socket head screw (1) and (lock) washers
9. Torque tighten to the correct value (see section “Standard practices and torque values”)



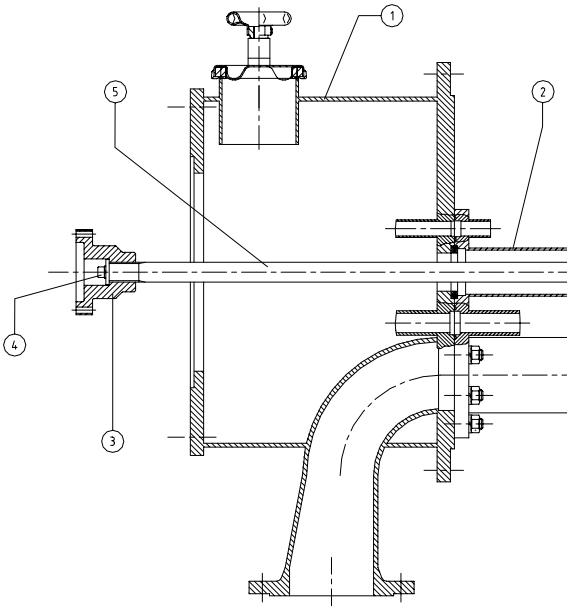
10. Move the pipe stack towards the pump head (4)
11. Clean the flanges, pipes and seal grooves
12. Apply a light coating of high quality grease to the flanges
13. Install the O-rings (2) in the grooves of the pump head
14. Align the long shaft (1) in the pipe stack with the splines in the drive shaft (5) in the pump head
15. Fit the pipe stack, with care, onto the pump head
16. Install the nuts (3) with (lock) washers
17. Torque tighten to the correct value (see section “Standard practices and torque values”)
18. Check the shafts for smooth rotation
19. Move the next pipe stack (2) towards the previous one (4)
20. Clean the flanges, pipes and seal grooves
21. Apply a light coating of high quality grease to the flanges
22. Install the O-rings (3) in the grooves of the pipe stack
23. Align the long shaft of the next pipe stack with the splines in the intermediate coupling of the previous pipe stack
24. Fit the pipe stacks carefully together
25. Install the nuts (1) with (lock) washers
26. Torque tighten to the correct value (see section “Standard practices and torque values”)
27. Check the shafts for smooth rotation
28. Repeat previous steps for each pipe stack element
29. Move the top cover (1) towards the upper pipe stack (3)
30. Clean the flanges, pipes and seal grooves of the upper pipe stack and the top cover
31. Install the O-rings (2) in the grooves of the pipe stack
32. Install the centre ring (5) in the race of the pipe stack
33. Fit the top cover, with care, onto the upper pipe stack
34. Install the nuts (4) with (lock) washers
35. Torque tighten to the correct value (see section “Standard practices and torque values”)







36. Place the lower coupling halve of the electric motor connection (3) over the splines of the top long shaft (5)
37. Install the retaining ring in the coupling halve
38. Secure the retaining ring with the bolt and lock washer (3)
39. Torque tighten to the correct value (see section “Standard practices and torque values”)
40. Remove the cover plate from the top cover (1)
41. Apply a light coating of high quality grease on the long shaft
42. Slide the assembled top long shaft through the top cover and the upper part of the pipe stack (2)
43. Rotate the long shaft manually to allow proper engagement of the splines in the next intermediate coupling
44. Reinstall the cover plate on the top cover
45. Protect all flanges and openings after the pump assembly.



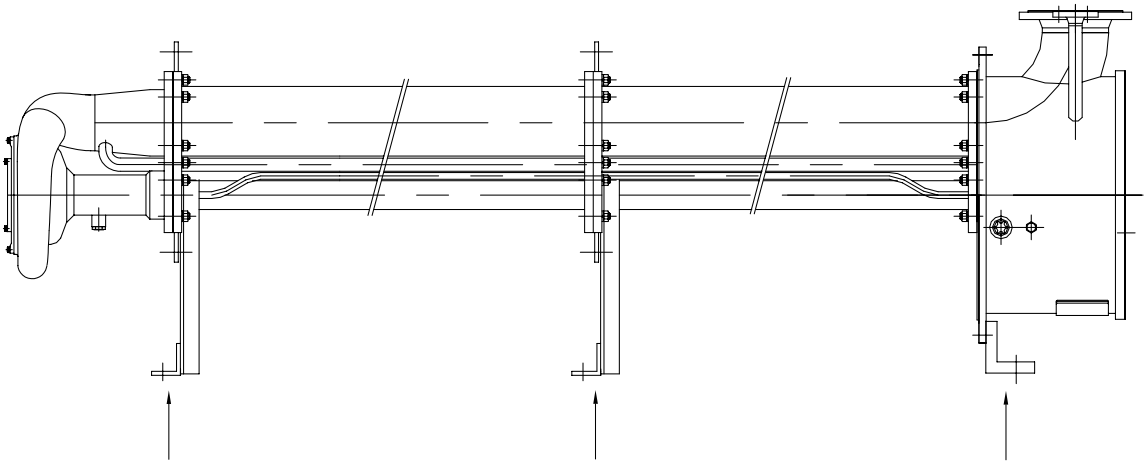
1.4 Cargo pump transport and hoisting

1.4.1 Transport

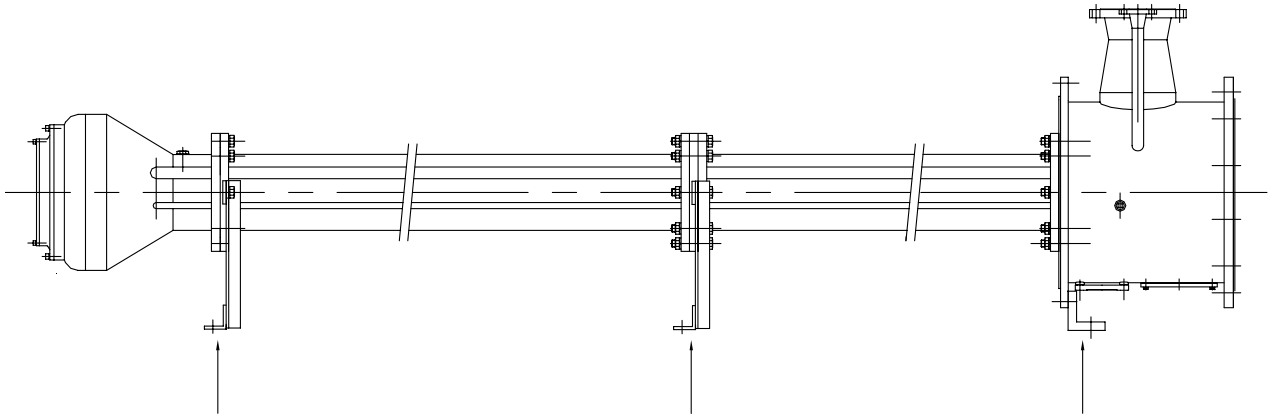
Due to the weight of the electric motor the pump and the electric motor are transported separately.

The pump assembly is carried by special transport supports mounted at the flanges.
These supports are provided with bolt holes allowing the pump assembly to be secured on the transport vehicle.

MDPD



MDPC



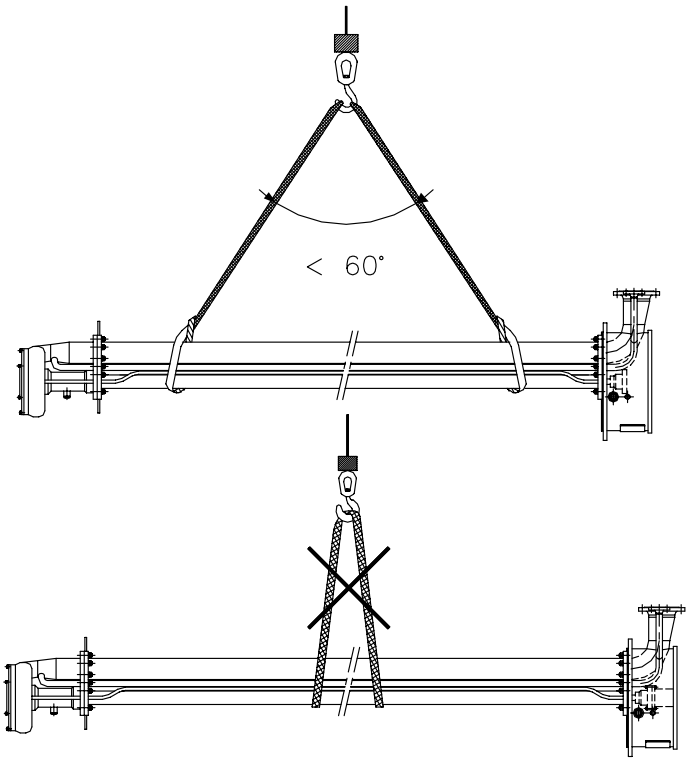
Caution!

Make sure the pipes (purging / stripping) at the pipe stack are not damaged during transport when using a crane!

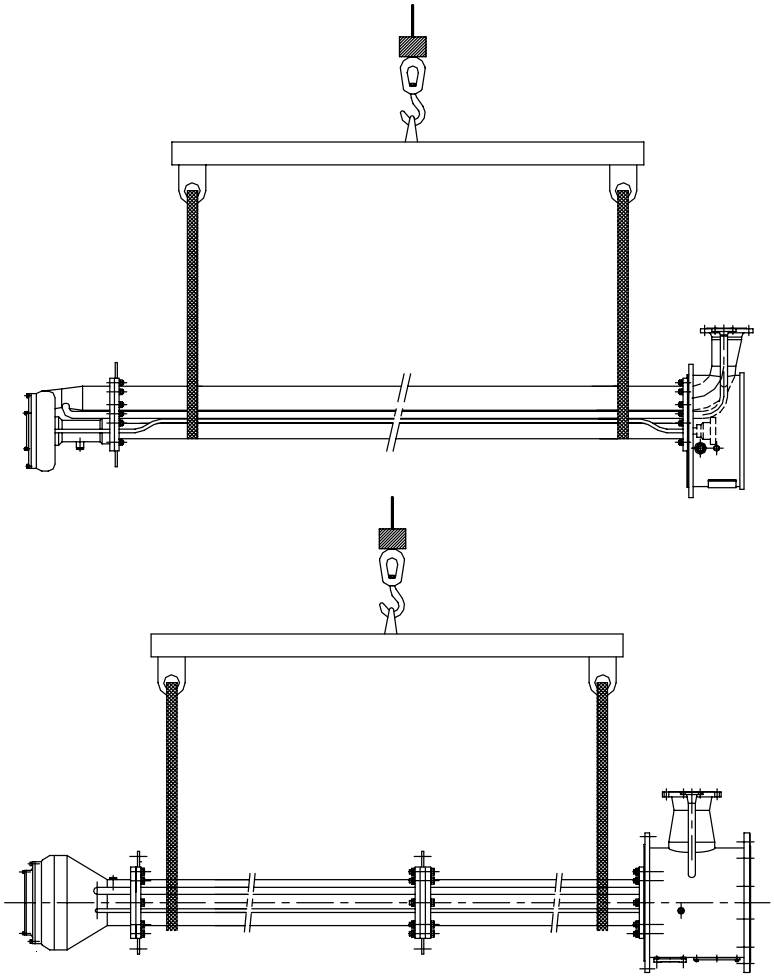
Caution!

During transport with a crane use proper, approved, hoisting material!
For pump assemblies longer then 5 meter the use of an equaliser is required!

Pump length < 5 meter



Pump length > 5 meter



1.4.2 Hoisting

Caution!

Use only approved hoisting equipment!

Caution!

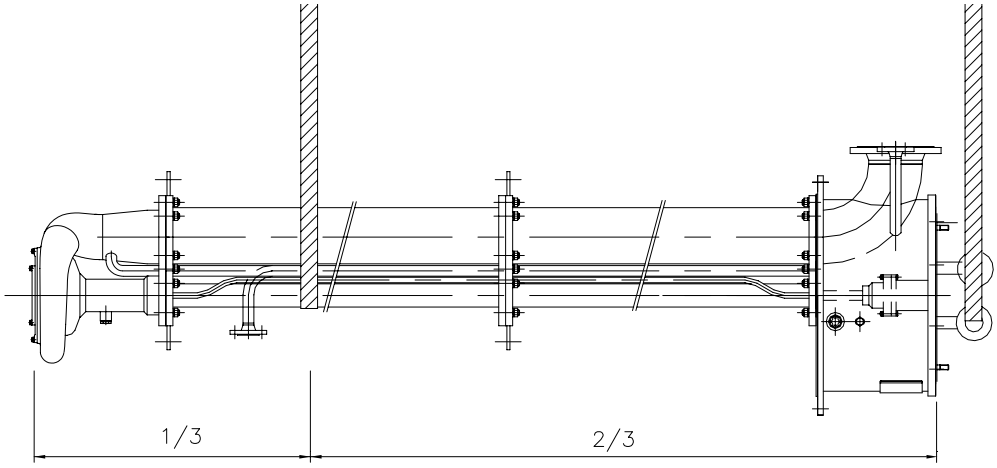
Make sure the slings do not slide from their position during hoisting!

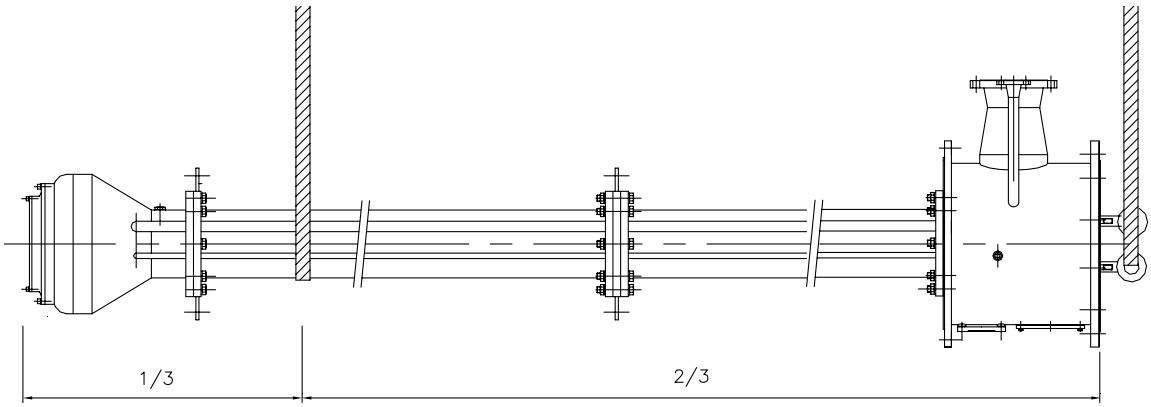
Caution!

Make sure the pipes (purging / stripping) at the pipe stack are not damaged during hoisting!

In **horizontal** position, with a length more then 5 mtr, the pump is always hoisted using two slings and an equalizer.

To hoist a pump of **7 to 12 mtr** from horizontal to **vertical** position a second crane is always required to avoid unacceptable distortion of the pipe stack.





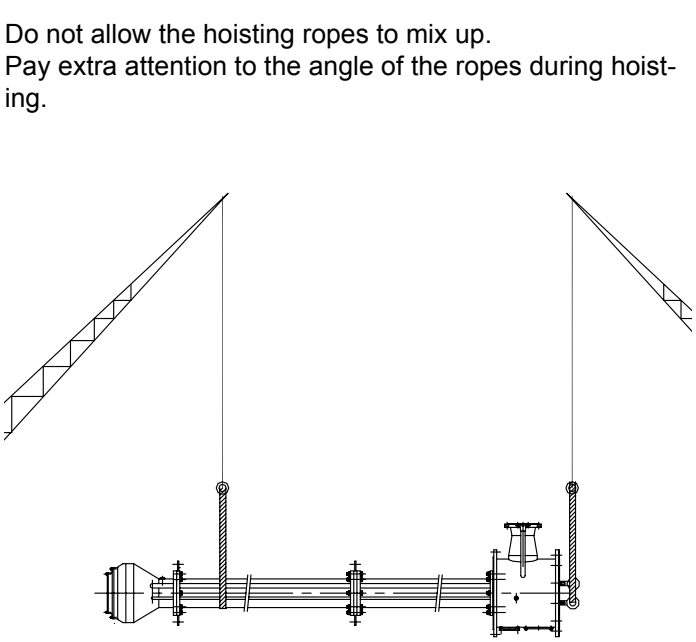
If the total weight of the pump assembly (top cover, pipe stack and pump head) is **below** 1400 kg use 4 eye nuts / bolts at the flange of the top cover.

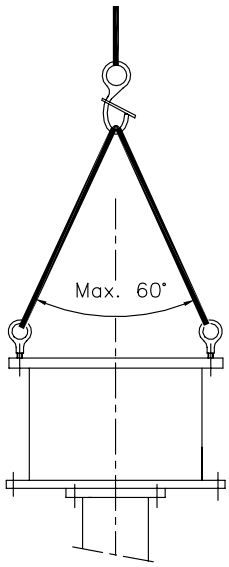
If the total weight of the pump assembly (top cover, pipe stack and pump head) **exceeds** 1400 kg use a special hoisting flange mounted at the flange of the top cover. See the pump installation drawing for applicable weights.

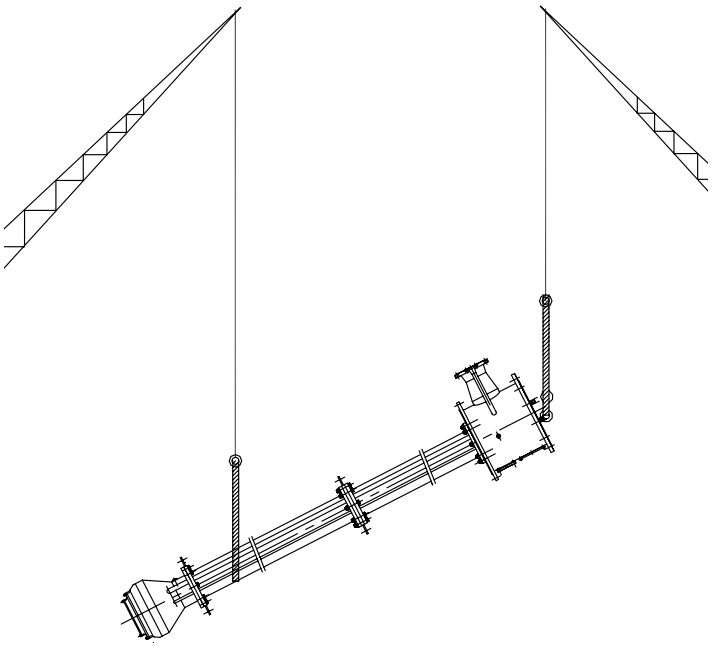
Tip.

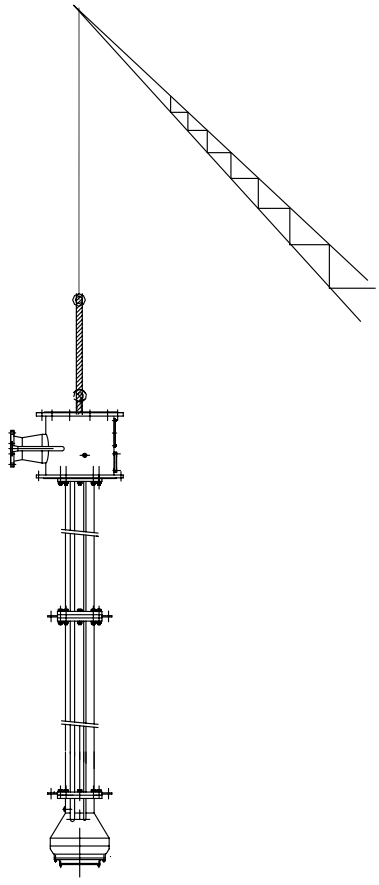
Make sure the correct seals / packings are installed on the deck trunk **before** *lowering the pump assembly through the deck trunk!*

Do not allow the hoisting ropes to mix up.
Pay extra attention to the angle of the ropes during hoisting.









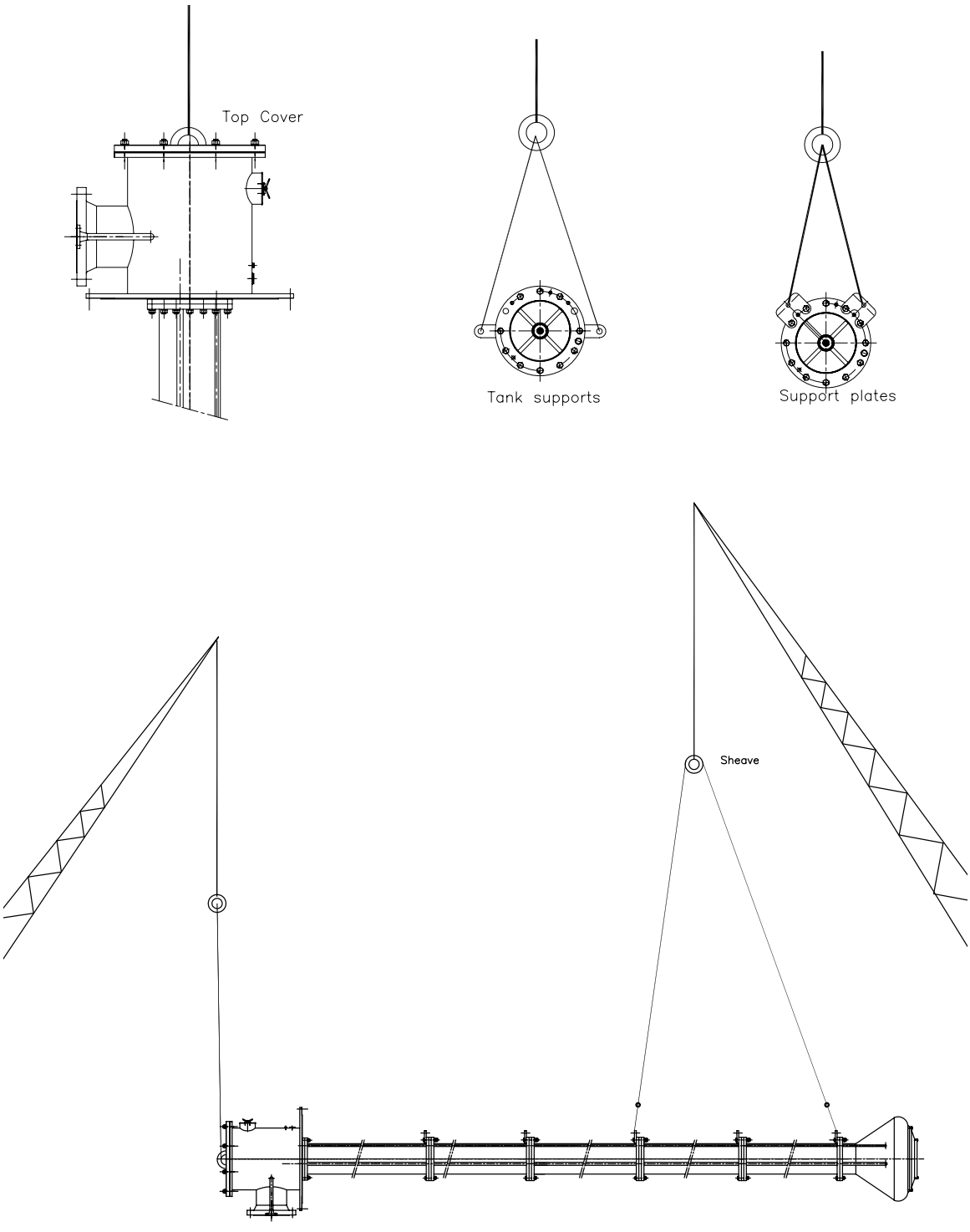
To hoist a pump longer than **12 mtr** to **vertical** position a second crane is always required to avoid unacceptable distortion of the pipe stack.

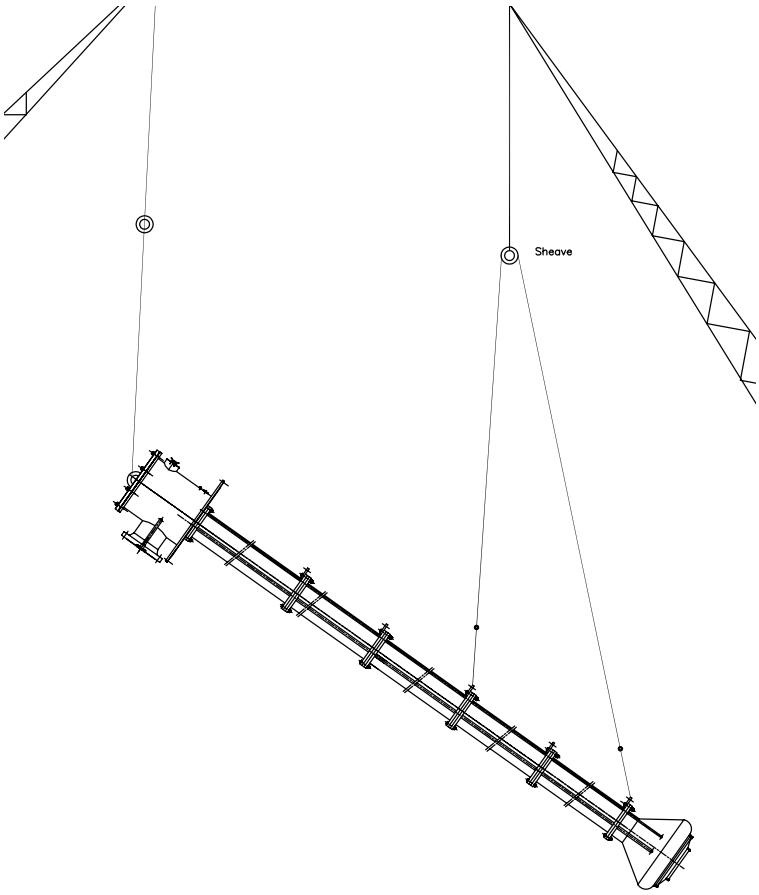
One crane, capable of carrying the total weight, connected directly to a hoisting flange installed on the electric motor mounting flange on the top cover.

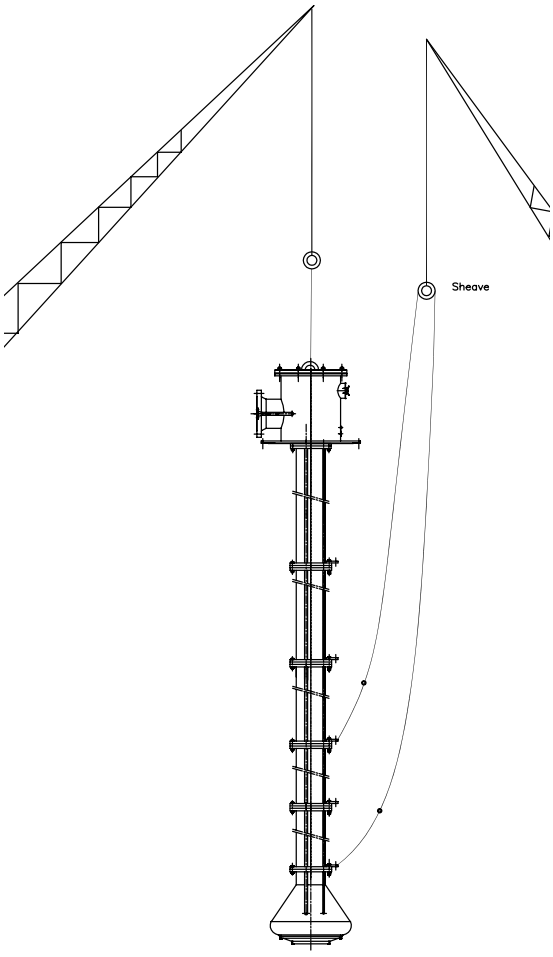
The other crane must be equipped with a sheave capable of carrying the total weight of the pump.

Connect hoisting ropes and shackles only to the pump hoisting points.

Example hoisting points

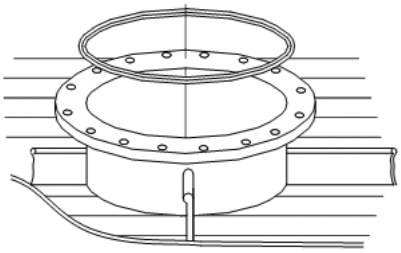



Sheave


Sheave

1.5 Cargo pump installation

1. Clean the deck trunk flange
2. Position the packing on the deck trunk flange
3. Prepare for pump installation



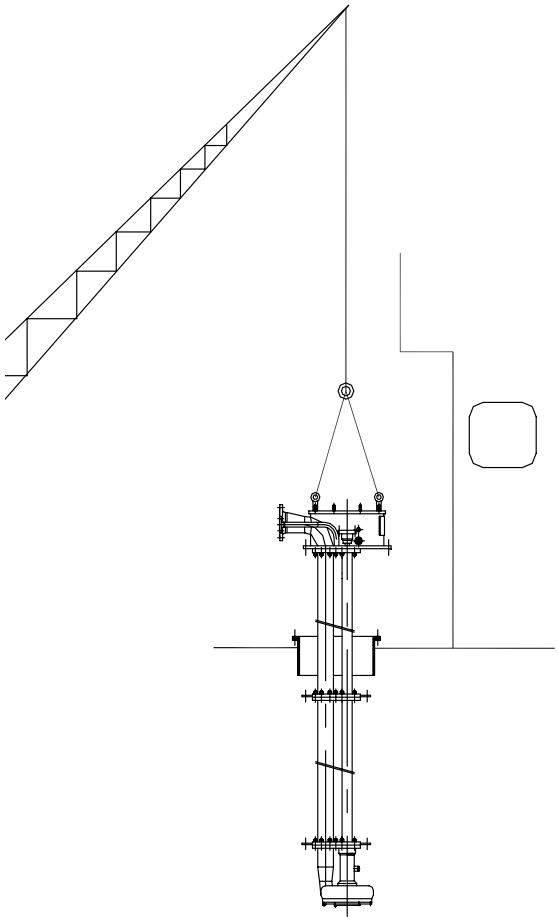
Warning!

When lowering the pump into the tank do NOT correct the position of the packing between the top cover flange and the deck trunk flange by hand!

Caution!

Prevent damage to the packing! Handle with care!

4. Place the pump in position above the deck trunk
5. Use conical pins in the top cover flange to align the bolt holes
6. Monitor the flange of the deck trunk and the flanges for discharge / purging / stripping during installation
7. Monitor the pump head inside the tank during installation
8. Lower the pump through the deck trunk into the tank
9. Make sure the flanges for discharge / purging / stripping point into the correct direction
10. Place the top cover flange on the deck trunk flange without rotating the packing
11. Install the attachment bolts, washers and nuts
12. Torque tighten, in sequence, to the correct value (see section “Standard practices and torque values”)
13. Remove the hoisting equipment



Caution!

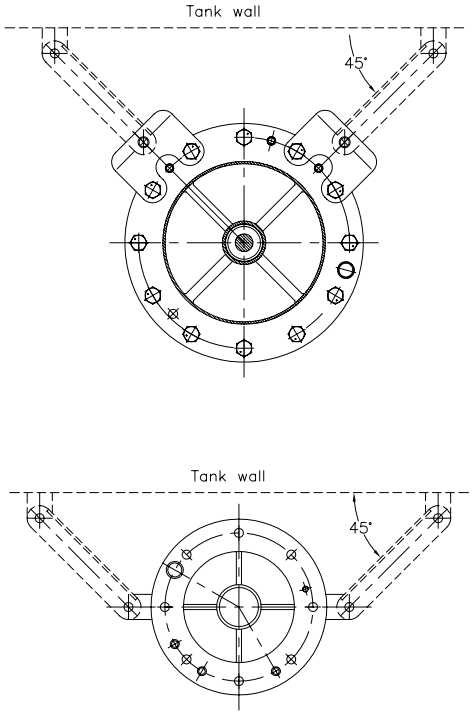
Cover all openings on the top cover to prevent contamination by foreign objects, dirt or water! Contamination of the pump is cause for complete overhaul.

Caution!

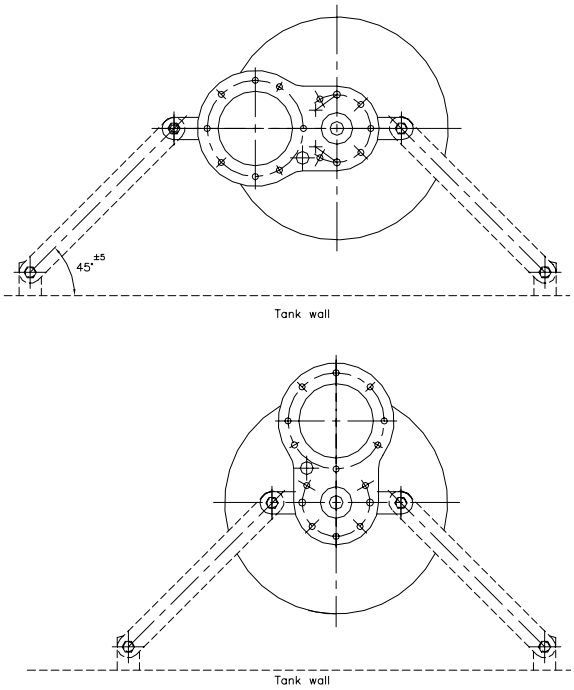
Observe the following limitations when manufacturing distance brackets for installation between pump and tank wall:
length distance bracket: max. 500 mm » advised bracket profile: flat bar 50 x 10
length distance bracket: max. 1200 mm » advised bracket profile: angled bar 50 x 50 x 5
length distance bracket: max. 1700 mm » advised bracket profile: angled bar 100 x 100 x 10
length distance bracket: over 1700 mm » Marflex approval for construction mandatory.
Install the distance brackets in a horizontal position (90° perpendicular to the pump shaft).

14. Manufacture the distance brackets for installation between pump and tank wall
15. Install the distance brackets to the pipe stack and the tank wall
16. Make sure the brackets are installed “tension free”

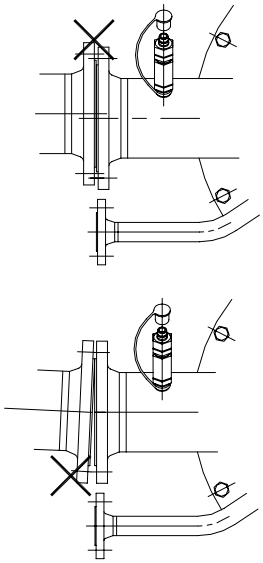
Example distance brackets MDPC



Example distance brackets MDPD



17. Manufacture the discharge / purging / stripping pipes
18. Install the discharge / purging / stripping pipes and valves
19. Connect the pipes (valves) to the flanges of the pipe stack
20. Make sure the pipes are installed “tension free”



Warning!

Installation location and position of the purges lines must prevent contact with mists of cargo exiting the purge outlet!

Caution!

It is NOT allowed to install a valve or any other restriction in the purging outlet line!

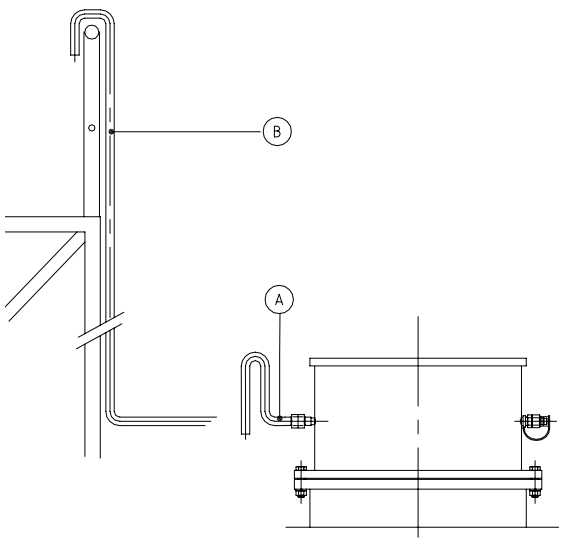
Tip.

Make sure the purge line installation is removable for cleaning and inspection.

Note:

The purge line outlet can be close to the pump (river tanker (A)) or, due to heavy sea, with a line routed to the catwalk or an other protected area (sea tanker (B)) allowing collection of purge content with a sample bottle e.g
Optionally a purge container or a header tank can be installed to collect the purge content.
Collection of purge content is necessary to determine the condition of the seals and monitor leakage.

21. Manufacture the purge line(s) (Ø 15 - 22 mm.)
22. Connect the purge line(s) to the purge outlet on the top cover.



1.5.1 Tank well protection screen installation (optional)

To prevent contamination or collection of debris inside the well of the pump Marflex suggests the installation of a screen.

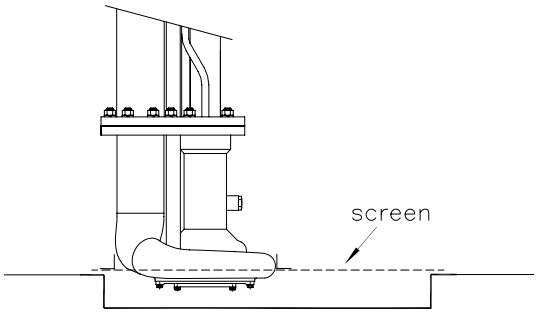
The installation of a screen also prevents damage of the pump vanes by loose objects thus protecting the performance of the pump system.

The screen covers the well entirely and fits closely arround the pump head.

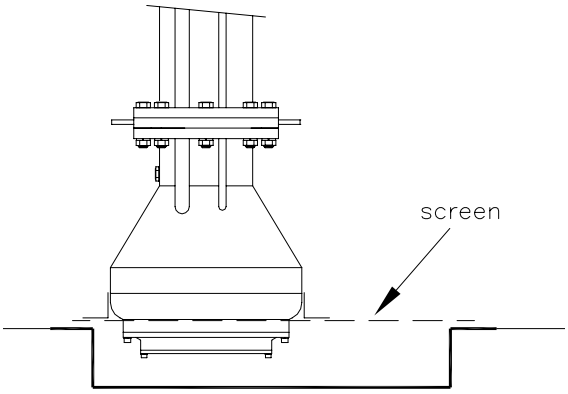
Note:

When manufacturing a protection screen make sure the grid of the screen is fine enough to restrain loose objects and wide enough not to obstruct the product flow.

Example installation MDPD



Example installation MDPC



1.6 Transport, hoisting and installation electric motor

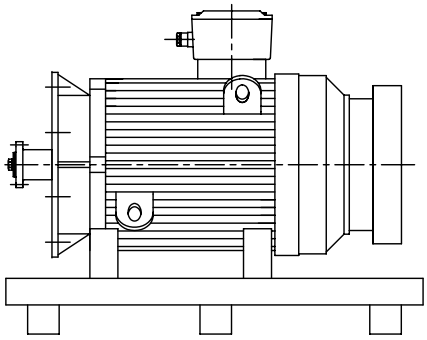
1.6.1 Transport

Caution!

Handle the electric motor with care!
The electric motor is easily damaged!

The electric motor is transported on a special transport cradle.

Inspect the electric motor, fan cowl and shaft coupling half for damage before installation. Repair or replace when necessary.



1.6.2 Hoisting

Warning!

Be aware of the weight of the electric motor! See section "Specification" for details.

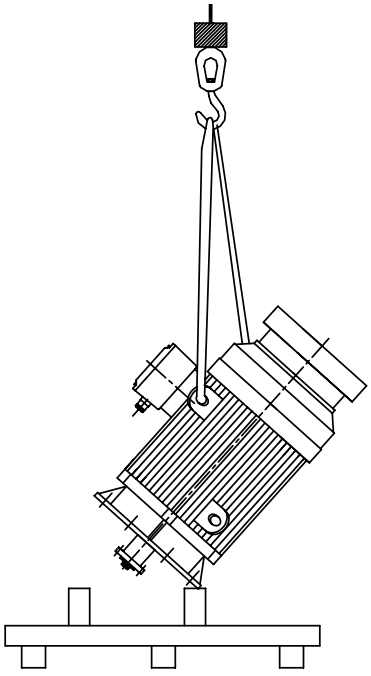
Caution!

Use only approved hoisting equipment!

Caution!

Avoid the electric motor and especially the shaft coupling from touching the ground during hoisting!

1. Install hoisting eye bolts (if applicable)
2. With fixed hoisting points select the best useable hoisting points
3. Attach the hoisting ropes at the hoisting points
4. Protect the fan cowl against damage
5. Carefully lift the electric motor from the transport cradle
6. Place the electric motor upright on the transport cradle
7. Inspect the electric motor, fan cowl and shaft coupling half for damage before installation. Repair or replace when necessary.



1.6.3 Installation

Warning!

Be aware of the weight of the electric motor! See section "Specification" for details.

Warning!

Connection of power supply cables e.d. is only allowed by a qualified engineer.

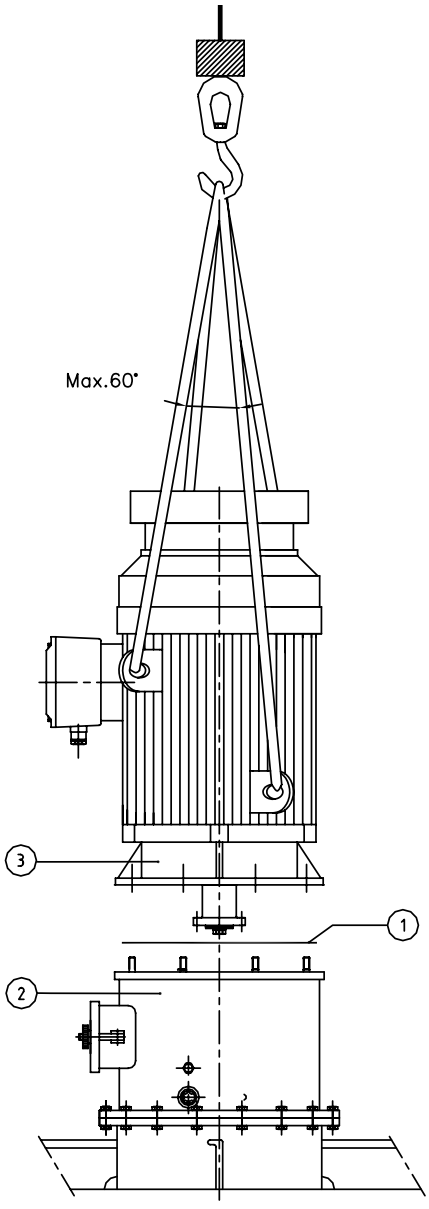
Caution!

Use only approved hoisting equipment!

Caution!

Cable entry to the terminal box is only allowed using cable glands!

1. Attach hoisting equipment at four hoisting points
2. Hoist the electric motor and move above the top cover
3. Spray a light coating of silicones on the mounting flange of the electric motor (3) to prevent oxidation
4. Place the O-ring (1) in position on the mounting flange of the top cover (2)
5. Rotate the electric motor in such a position to allow proper connection of the power supply cables
6. Lower the electric motor in position on the top cover
7. Check for proper seating of the electric motor mounting flange on the mounting flange of the top cover
8. Release the tension on the hoisting equipment
9. Install the attachment nuts and washers
10. Torque tighten, in sequence, to the correct value (see section "Standard practices and torque values")
11. Remove the hoisting equipment
12. Connect the power supply cables
13. Connect the cables for PTC and/or heating (if applicable).



1.7 Shaft coupling connection

Caution!

Determine the direction of rotation of the electric motor before connecting the shaft coupling halves!

Caution!

Make sure all tools and other material are removed after connecting the coupling halves before closing the inspection hatch!

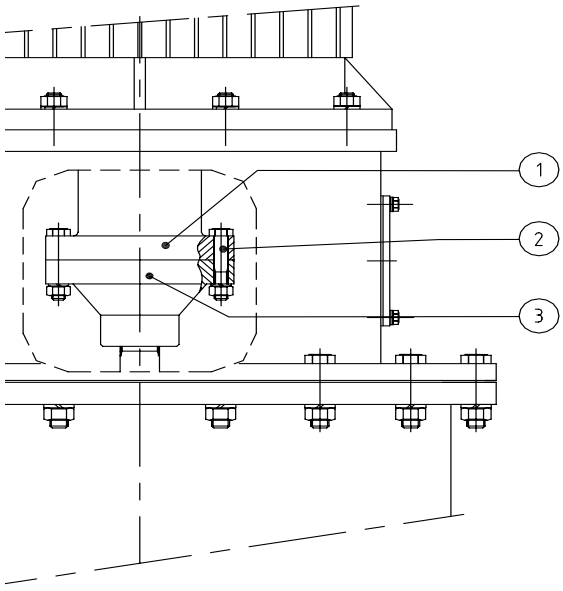
Note:

The rotation of the pump is clockwise (viewed from the top) and marked with an arrow on the mounting flange of the top cover.

Note:

Some coupling connections are equipped with a spacer between the coupling halves to ease the removal and installation of the pump head inside the tank.

1. Open the inspection hatch on the top cover
2. Determine the direction of rotation of the electric motor by switching on the power supply
3. Correct the cable connection to change the direction of rotation if necessary
4. Switch off and secure the power supply
5. Cover the opening around the long shaft in the pipe stack to prevent tools e.g. from falling into the pipe stack
6. Lift the lower coupling half (3) and fit with the upper coupling half (1) correctly
7. Install the attachment bolts with nuts and washers (2)
8. Torque tighten, in sequence, to the correct value (see section “Standard practices and torque values”)
9. Remove all tools, other materials and the cover from the opening around the long shaft
10. Inspect the area inside the top cover for foreign objects
11. Close the inspection hatch on the top cover
12. Fill the pump with lubricant (see section “Maintenance”).



1.8 Test run

Caution!

It is NOT allowed to operate the pump in the wrong rotational direction!

Caution!

Prevent dry operation of the pump!

Caution!

It is NOT allowed the operate the pump with the electric motor cover installed!

Caution!

Make sure the tank(s) and connecting pipes are clean and properly connected to allow a safe and proper test run!

1.8.1 Preparation

1. Fill the system tank(s) with sufficient water to allow proper testing (± 1 hour)
2. Carry out a purging procedure (see section “Maintenance”)

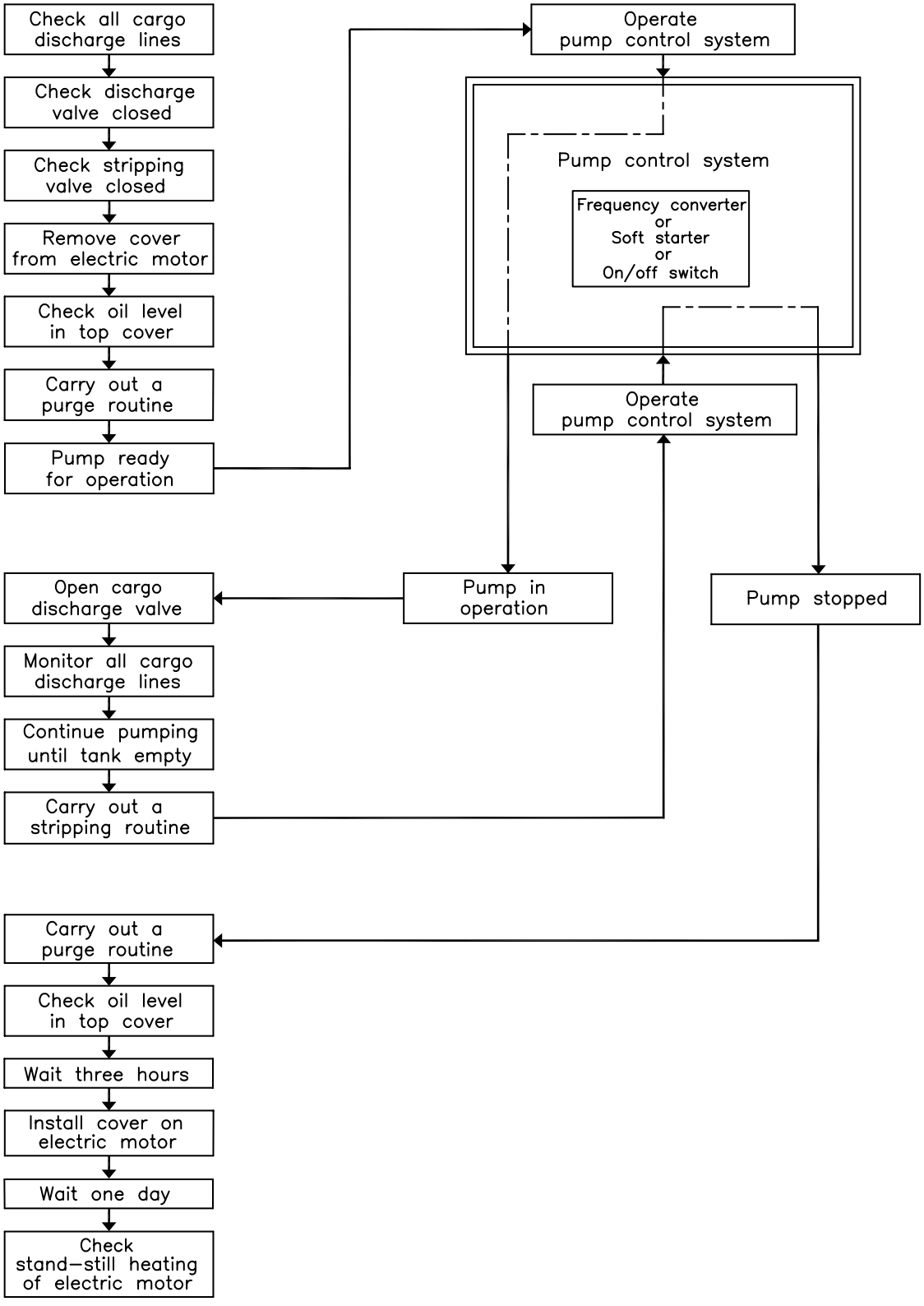
1.8.2 Pump operational test

1. Check connections and valves in the pump system for proper installation
2. Make sure the discharge valve is closed
3. Switch on the electric motor
4. Check the electric motor for operation
5. Check the pressure indicator for pressure increase (if applicable)
6. Open the discharge valve
7. Allow pump to operate for ± 1 hour
8. During operation check lines, connections and valves for leakage or discrepancies
9. During operation check the electric motor for vibration or excessive heating
10. During operation check the pump assembly for vibration or excessive heating
11. Close the discharge valve
12. Switch off the electric motor

1.8.3 Finals

1. Carry out a purging procedure to check the shaft seals and remove any lubricant or product residues (see section “Maintenance”)
2. Check the standstill heating of the electric motor (regularly) for operation while the pump is switched off.

1.8.4 Operation procedure (schematic)



1.9 Troubleshooting

Table 2: Deepwell pump failure

Indication	Probable cause	Corrective action
Pump fails to operate.	Failure electrical power supply. Start-stop control failure (frequency converter or soft starter or on/off switch) Wiring not connected properly. Wiring broken.	Check and repair electrical system and wiring
Pump operates but fails to pump.	Closed discharge valves. Solidified residues in the pump or discharge lines. A cloth or other object blocks the suction side of pump head.	Open de relevant discharge valves. Inspect, remove blockage and clean the relevant items.
Pump operates but has low performance.	Pump speed is too low. Discharge valves not opened completely. Solidified residues in the pump or discharge lines. A cloth or other object blocks the suction side of pump head. Something is stuck in the vanes of impeller. Wear rings in pump head worn.	Check electrical system. Open relevant discharge valves. Inspect, remove blockage and clean the relevant items. Check the pump head, dismantle and repair if required.
Pump demands too much power during operation. Electric motor stopped by thermal protection.	The cargo discharge valve is opened while starting the pump. Start-stop control failure. (frequency converter or soft starter or on/off switch)	Start pump only with discharge valve in closed position. Check and repair electrical system and wiring.
Pump (electric motor) rotates during loading of cargo tank.	Discharge valves are not in the correct position during loading. (The cargo flows via the discharge pipe system, through the pump head and also the impeller, back into the cargo tank rotating the impeller and the electric motor in a wrong direction and an unacceptable high rotation.) Tank loading via the pump.	Stop immediately tank loading to protect the pump (electric motor) against too high rotation, in the wrong direction. Open or close the relevant valves to stop cargo flow through the pump. Tank loading via the pump is NOT allowed.
Excess wear of seals and/or wear ring in pump head.	Products possibly containing solid ingredients, sediment, sand or rust or due to some unclean products.	Filter out the pollution present in some products.

Table 2: Deepwell pump failure (Continued)

Indication	Probable cause	Corrective action
Pump is vibrating extremely during discharging.	Rotating parts out of balance. Impurities stuck in the impeller. Pump supports (distance profiles) to the tank wall are not properly installed. A defective bearing in pump head or electric motor.	Check the pump head, dismantle and repair if required.. Install the pump supports properly. Check and repair relevant items.
Sight glass in top cover indicates low oil level.	Plug and gasket on oil-filling nipple in pumphead leaking. Leaking oil seal in pump head. Leaking O-rings in partition of deepwell pump..	Check the pump head, dismantle and repair if required.

Table 3: Purging failure

Indication	Probable cause	Corrective action
Product (water) and/or lubricant collected after purging.	The shaft seals leak product (water) or lubricant.	Within limits no action required, check section “Maintenance”for the prescribed limits. Outside prescribed limits. Replace the shaft seals.
Product (water) and/or lubricant flows out of the purge pipe during normal pumping operation.	The shaft seals leak product (water) or lubricant. Broken ceramic sleeve in pumphead. Cracks in pipe stack pipes.	Check and repair relevant items.
During purging no air or nitrogen flows through the purge pipes or cofferdam.	No air or nitrogen pressure. Purge pipes blocked by solidified product or solidified mixture of products in the cofferdam and purge pipes.	Check air or nitrogen pressure. Remove the pumphead from the pipe stack, remove the blockage in the purge pipes with a flexible rod or by warming up the purge pipes with steam and blow through with pressed air or use ultra high-pressure water. Replace the purge pipes if blockage can not be removed.
Frequent purging prevents purging failures!		

Table 4: Stripping failure

Indication	Probable cause	Corrective action
Cargo stripping insufficient.	Pump speed too low when stripping. Leaking / closed cargo discharge valve. Stripping valve not opened completely. Not enough air or nitrogen pressure. Back pressure in stripping pipe too high.	Check relevant items and take appropriate actions.

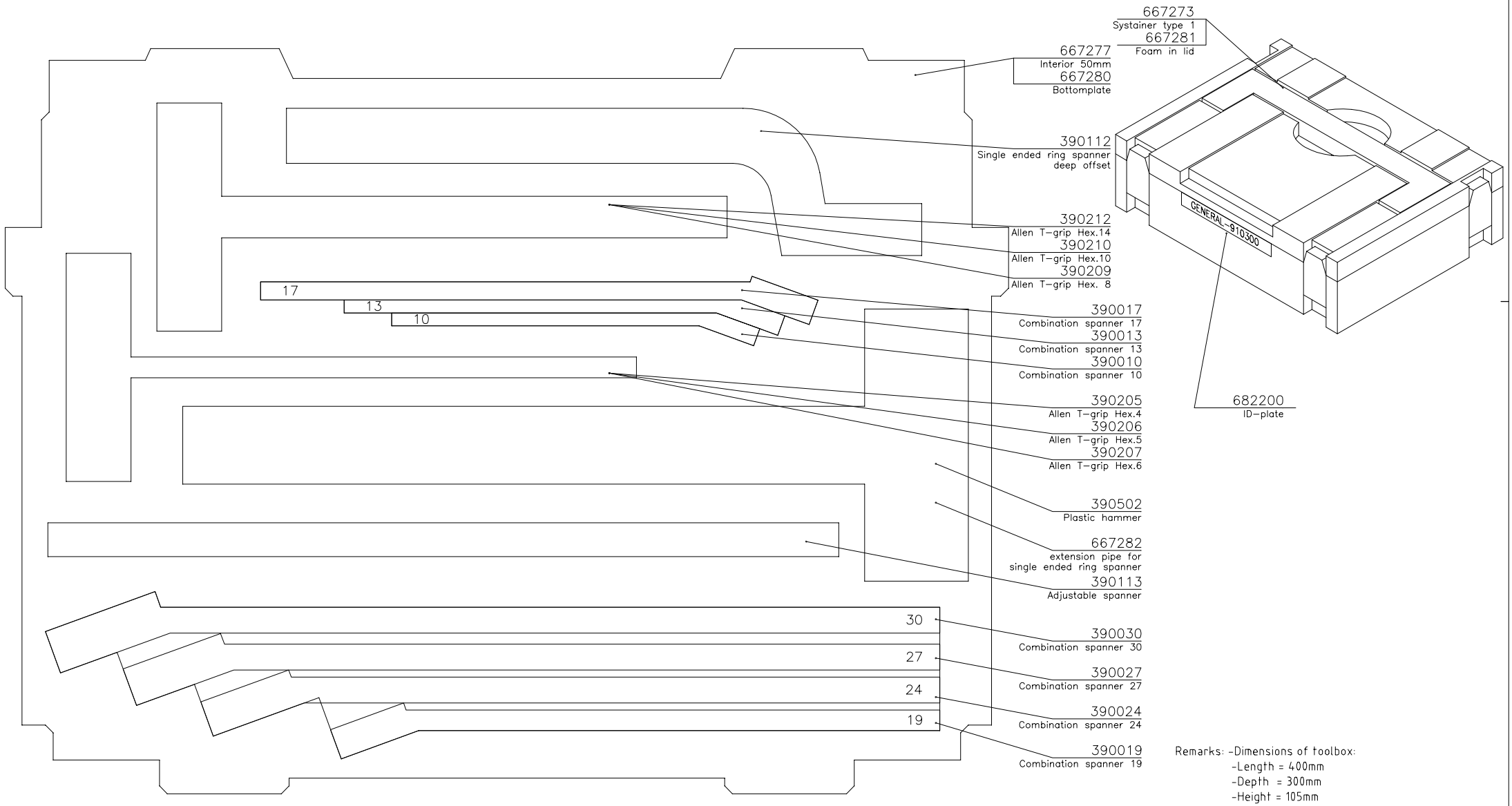
Table 5: Electric motor failure

Indication	Probable cause	Corrective action
Electric motor fails to start.	Blown fuses. Overload protection activated. Incorrect power supply. Incorrect line connections. Open circuit in winding or control switch. Rotor defective. Electric motor overloaded.	Replace fuses with proper type and rating. Check and reset overload protection in starter. Check power supply complies with motor rating plate and load factor. Check connections. Check fuses, electric motor and replace relevant items. Check electric motor and replace relevant items. Reduce load.
Electric motor produces abnormal noise.	Mechanical cause: Damaged bearing(s). Mechanical friction. Damaged cooling fan .	Disconnect the electric motor from the long shaft of the pump and check operation of the electric motor stand alone. Check and repair relevant items.
	Electrical cause: The noise stops after switching off the electrical power supply. Normal voltage and 3 phase balanced. Abnormal voltage. Phase imbalance.	Check the power supply at the motor terminals. Check terminal block connection and tighten the connectors. Check power supply lines Check winding resistance.
Anti condensation heating in electric motor not working.	Power supply failure. Wiring connections are not installed correctly. Wiring broken.	Check / repair the power supply. Correct and tighten the wiring connections. Check / repair electrical system including wiring connections.

Table 5: Electric motor failure (Continued)

Indication	Probable cause	Corrective action
Abnormal temperature increase of electric motor.	Ventilation for cooling is restricted or blocked. Damaged cooling fan . Faulty power supply. Wiring connections in terminal box are not installed correctly. Overload. Partial short-circuit. Phase imbalance.	Check and correct any blockage or restriction. Repair replace damaged fan. Check / repair the power supply. Correct and tighten the wiring connections. Check / repair the power supply. Determine and correct fault. Check the winding resistance
Electric motor to low speed.	Voltage too low at motor terminals.	Correct voltage or transformer terminals or reduce load. Check connections. Check conductors for proper size.
Electric motor operates and then stops.	Power failure.	Check power supply. Check for loose connections to line, to fuses and to power control.
Wrong rotational direction.	Phase sequence incorrect.	Correct connections at electric motor or at switchboard.
Electric motor stalls.	One phase failure. Wrong application. Overload Low voltage. Open circuit.	Check lines for open phase. Chance type or size. Consult manufacturer. Reduce load. Check power supply complies with motor rating plate and load factor. Check connections. Check fuses, check overload relay, stator and push buttons.

9 Toolboxes



Remarks: -Dimensions of toolbox:
-Length = 400mm
-Depth = 300mm
-Height = 105mm

3	EH	AvO	AvO	Added dimensions of toolbox
	26-04-05	28-04-05	28-04-05	
2	AdH	E.H	AdH	Added art.nr.682200
	15-07-04	23-11-04	23-11-04	Changed contour of 667277
1	AdH			
	24-05-04			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:1 1:2	mm	A2

TITLE / DESCRIPTION

TOOL BOX GENERAL PUMP TOOLS

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
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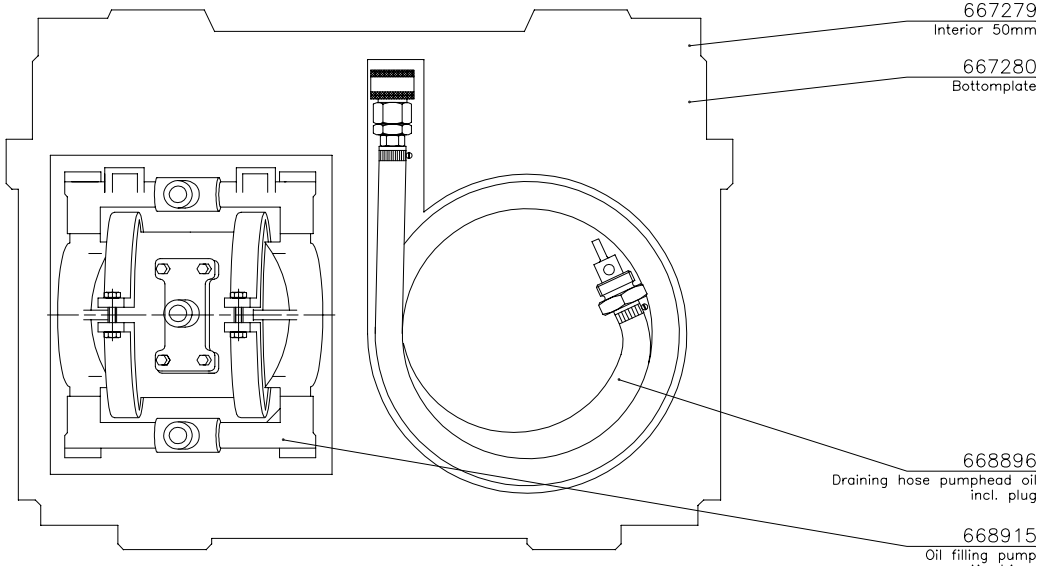
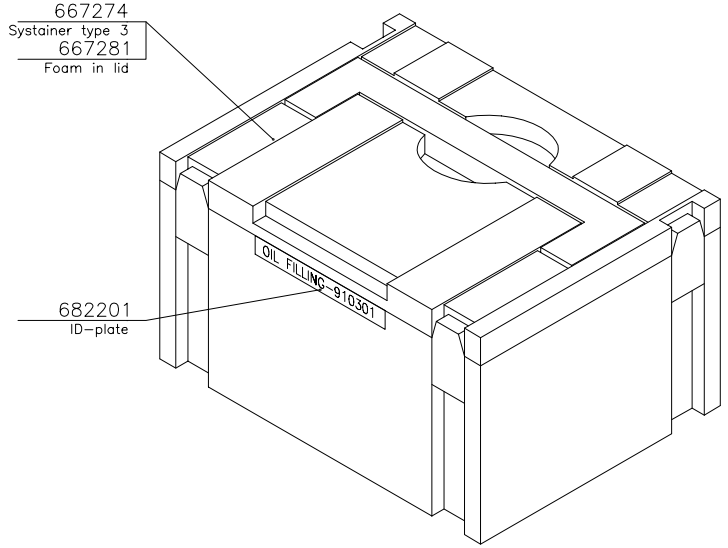
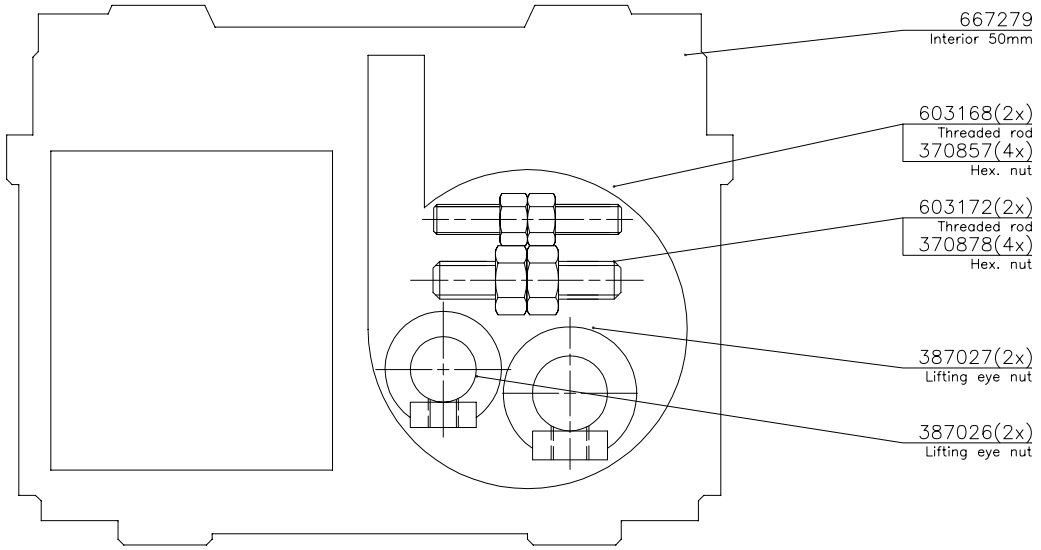
910300	1



Bottom Layer





Top Layer

Remarks: -Dimensions of toolbox:
-Length = 400mm
-Depth = 300mm
-Height = 210

mm

3	EH	AvO	AvO	Added dimensions of toolbox
	26-04-05	28-04-05	28-04-05	
2	AdH	E.H	AdH	Added art.nr.682201
	15-07-04	23-11-04	23-11-04	Changed contour of 667279
1	AdH			
	24-05-04			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:1 1:2	mm	A2

TITLE / DESCRIPTION

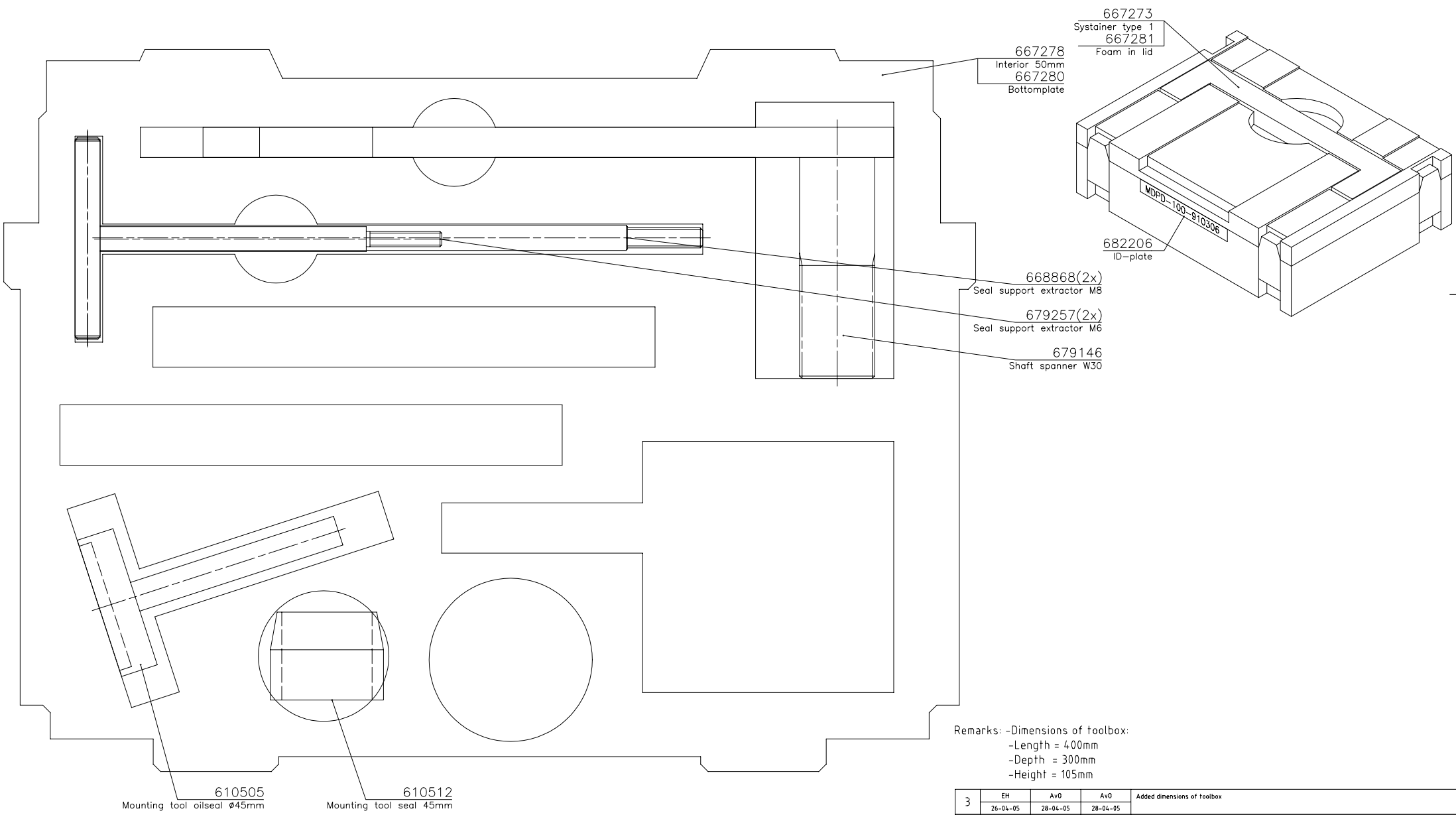
TOOL BOX OIL FILLING

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.

SHEET 1 OF 1

DOCUMENT NO. / ITEM NO. 910301



Remarks: -Dimensions of toolbox:
-Length = 400mm
-Depth = 300mm
-Height = 105mm

3	EH 26-04-05	AvO 28-04-05	AvO 28-04-05	Added dimensions of toolbox
2	AdH 15-07-04	E.H 23-11-04	AdH 23-11-04	Added art.nr.682206 Changed contour of 667278
1	AdH 24-05-04			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:1 1:2	mm	A2

TITLE / DESCRIPTION

TOOL BOX MDP-GLX

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
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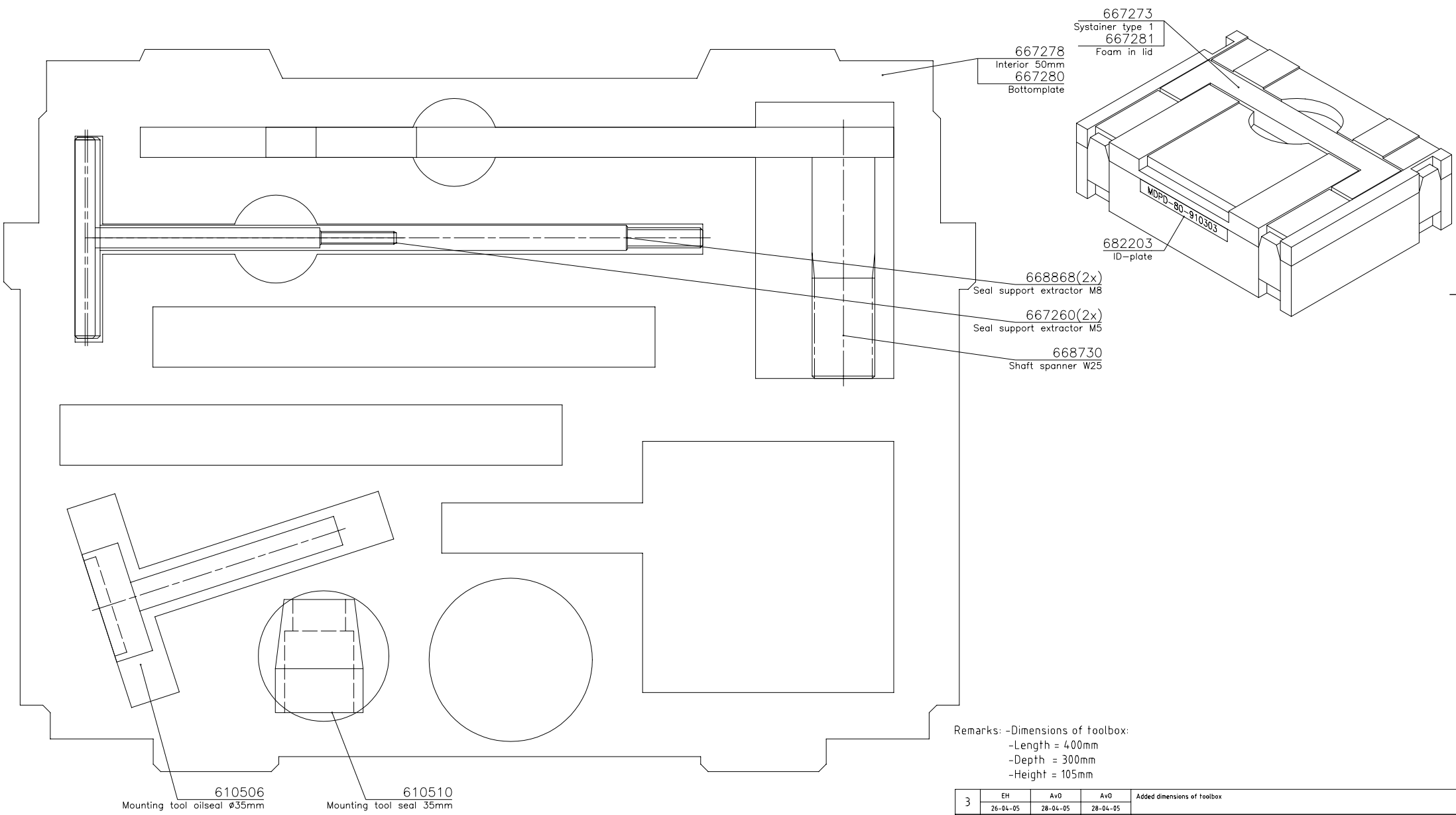

Remarks: -Dimensions of toolbox:
-Length = 400mm
-Depth = 300mm
-Height = 105mm

3	EH 26-04-05	AvO 28-04-05	AvO 28-04-05	Added dimensions of toolbox
2	AdH 15-07-04	E.H 23-11-04	AdH 23-11-04	Added art.nr.682203 Changed contour of 667278
1	AdH 24-05-04			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:1 1:2	mm	A2

TITLE / DESCRIPTION

TOOL BOX MDP-BLX

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
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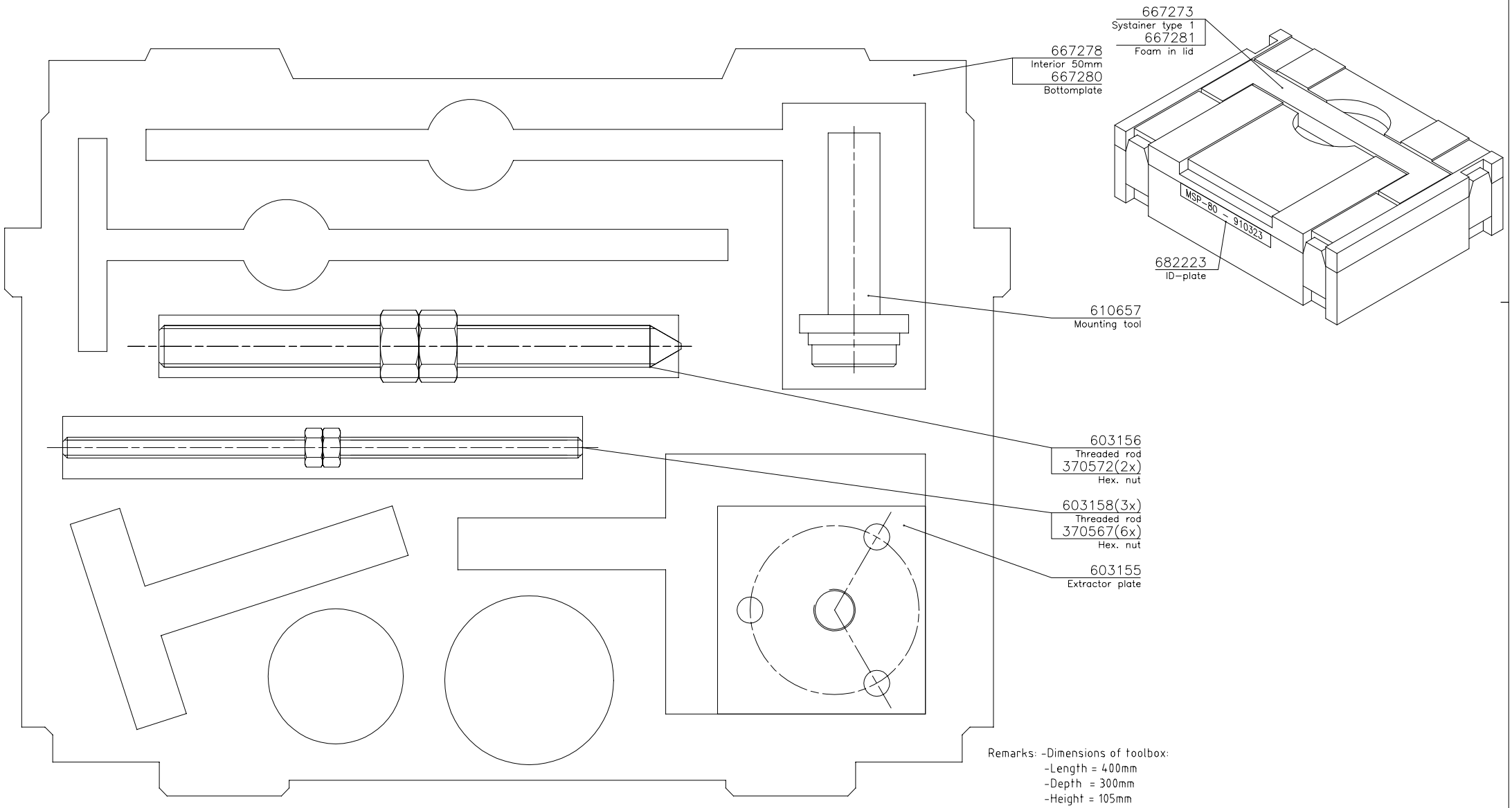
910303	1



Remarks: -Dimensions of toolbox:
-Length = 400mm
-Depth = 300mm
-Height = 105mm

4	AvO	EH	AvO	Added art.no. 610657.
	23-09-05	30-11-05	01-12-05	
3	EH	AvO	AvO	Added dimensions of toolbox
	26-04-05	28-04-05	28-04-05	
2	AdH	E.H	AdH	Added art.nr.682223
	15-07-04	23-11-04	23-11-04	Changed contour of 667278
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr.		kg	1:1 1:2	mm	A2

TITLE / DESCRIPTION

TOOL BOX MSP-80

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
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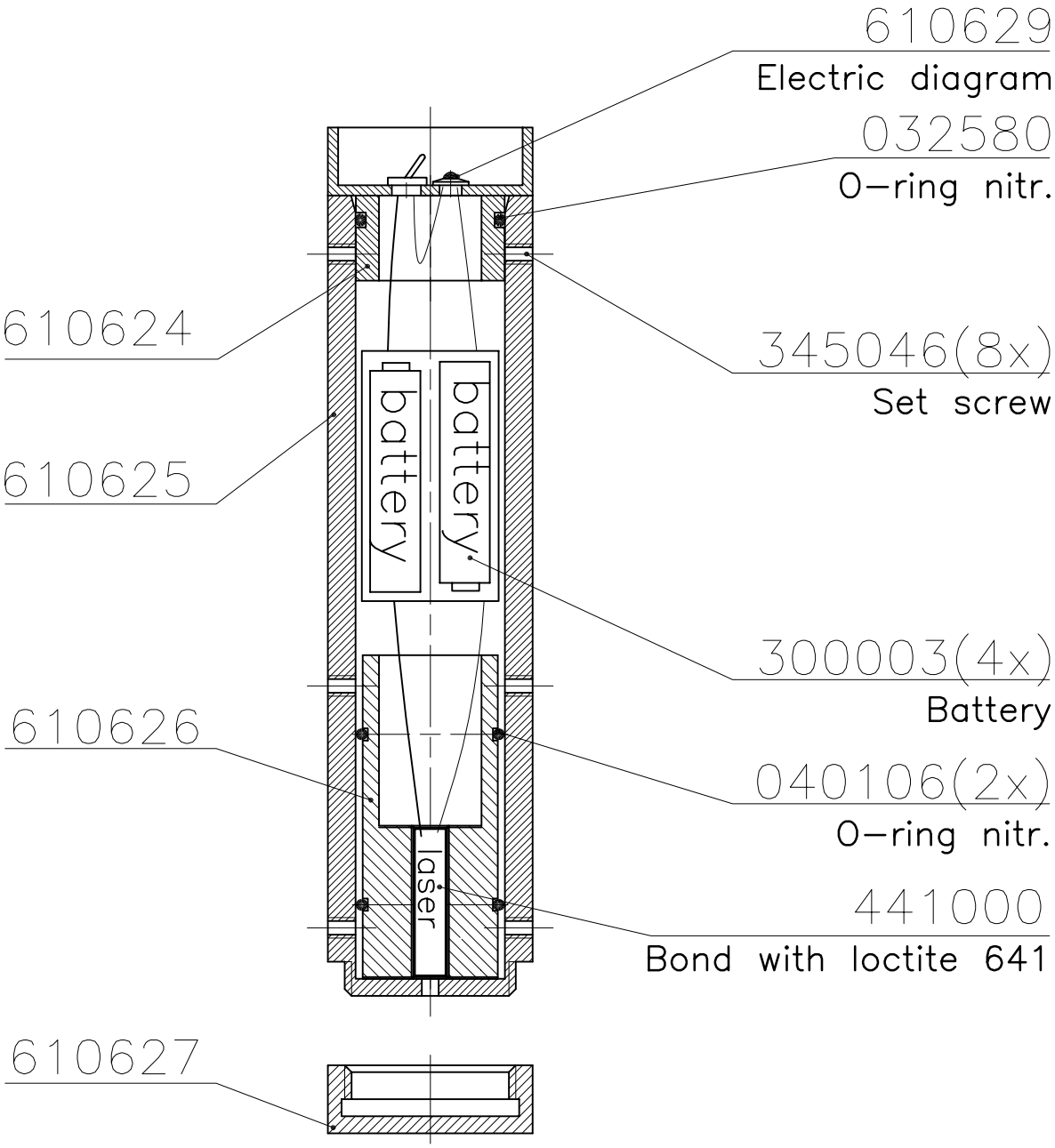
910323	1



ISSUE	MADE BY / DATE	CHECKED	APPROVAL	E.C. DESCRIPTION
3	AdH 07-02-05			Added art.nr. for battery 300003
2	E.H 02-12-04	AdH 02-12-04	AdH 02-12-04	Added art.nr. for laser, 441000
1	E.W. 28-11-02			

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. Wnr. Aluminium		kg	1:2	mm	A4

TITLE / DESCRIPTION

LASER TOOL ASSY BATTERY TYPE

Marflex B.V.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : +31 186-890200
Fax : +31 186-890299
www.marflex.com

PROJECT/ALT. NO.	SHEET
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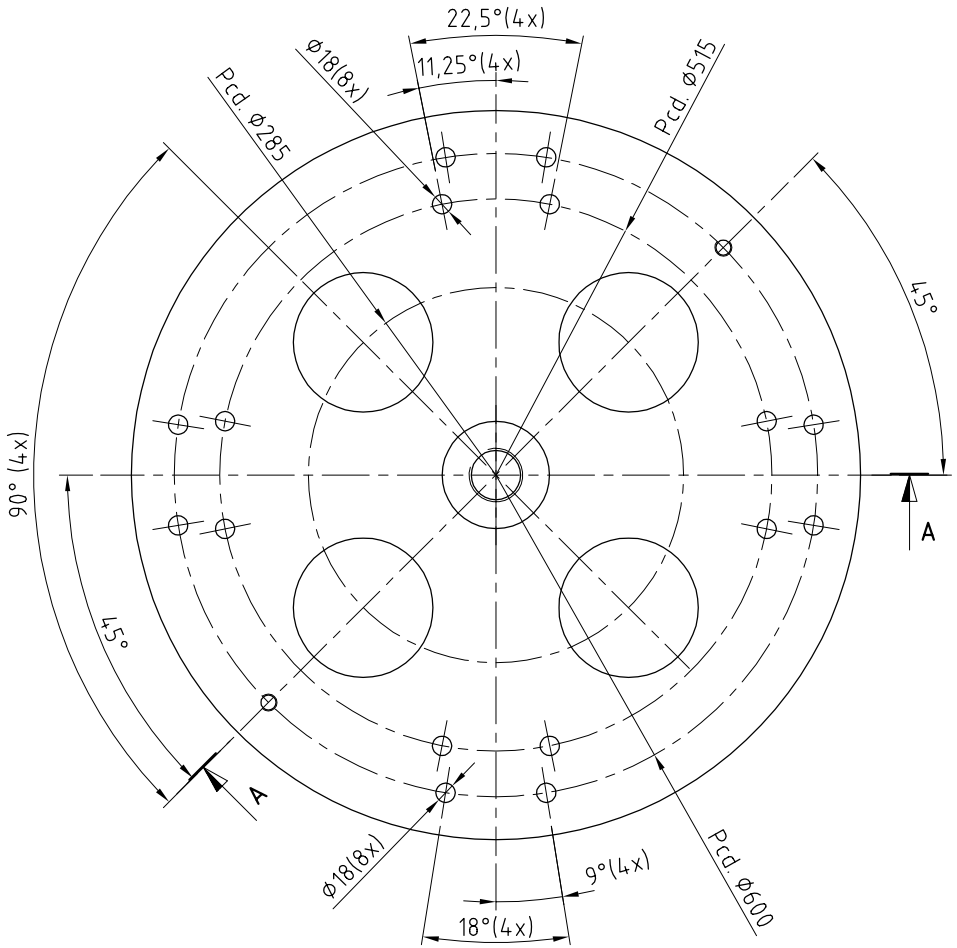
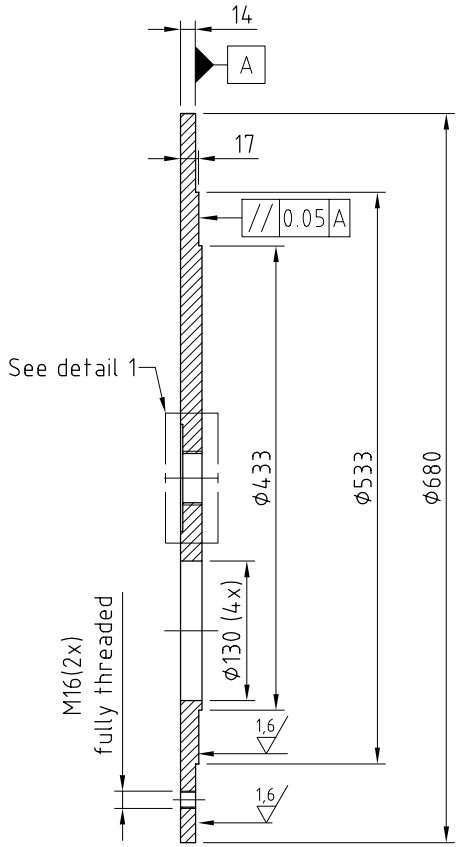
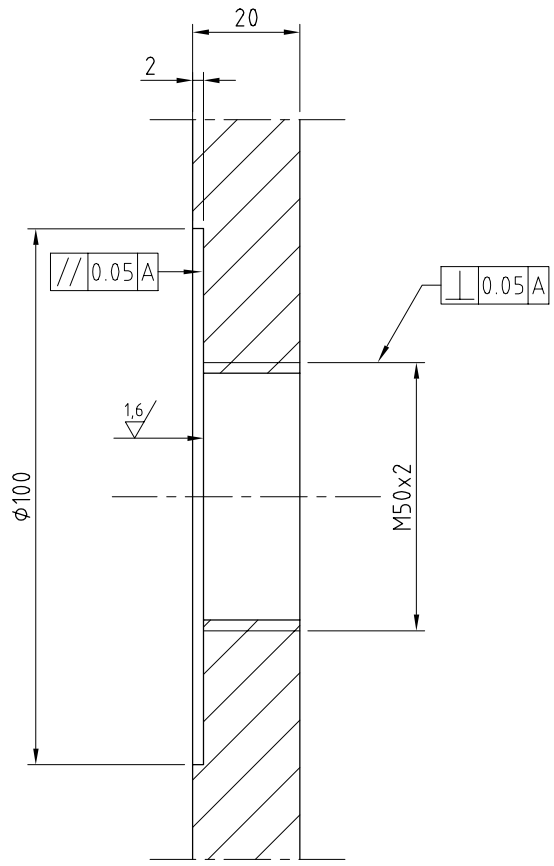
951099	1





Section A-A



Detail 1
Scale 1:1

Remarks: -Dimensions without indicated tolerance ±0,2.
-Break sharp edges 0,5x0,5 , fillets R0,2.

3				
2	AdH 07-02-05	AvO 09-02-05	AvO 09-02-05	Added 2x M16 fully threaded at Pcd. 600 & Material specifications.
1	P.d.J 05-12-00			
ISSUE	MADE BY DATE	CHECKED	APPROVAL	E.C. DESCRIPTION

PROJECTION	MATERIAL	ROUGHNESS	MASS	SCALE	UNIT	SIZE
	Art.No. 600160 Wnr. 3.3547	1,6	7 kg	1:5	mm	A3

TITLE / DESCRIPTION

Flange for Lasertool Decktrunk D=545 & D=635

MarFlex b.v.
Louis Pasteurstraat 12
3261LZ Oud-Beijerland
The Netherlands
Tel : 0186-890200
Fax: 0186-890299

PROJECT/ALT. No.: MDP-B/G+MBPD150/200

SHEET: 1

DOCUMENT No. / ITEM No.: 600151

OF: 1