Submersible motor pumps

Series	**KRT**
Size	**DN 40...DN 100**
	1 1/2”... 4”
Motor sizes	**0 2, 2 2 (2pol.)** **1 4, 2 4 (4pol.)** **3 4 (4pol.)**
Material types	**G**

Works–No.: **see The operating manual**

The operating manual contains important information and hazard/danger warnings. It is imperative to read the instructions set out in the manual prior to installation, making electrical connections and commissioning. Additional operating instructions relating to the components of this plant will also have to be observed.

In principle if any work has to be carried out to the plant all electrical supplies (inclusive of the control cable) should be disconnected at the mains supply switch. The plant has to be safeguarded against accidental starting.

These operating instructions contain important notes for the individual material versions of the below sizes:

Impeller type	Pump Size	Material version
		Cast iron
		G
F, S	40 – 160	S, F
F	65 – 200	F
F, E	80 – 200	F, E
F	100 – 200	F

Contents

1 General

This KSB pump has been developed in accordance with the latest technology, it was manufactured with great care and is subject to constant quality control.
The operating manual is designed to introduce the pump to you, make operation easier and to make full use of all its applications. The operating manual contains important information to ensure safe, correct and economic operation. It is imperative to observe the contents of the operating manual to ensure reliability and long operating life of the pump and to avoid dangerous practices.
The operating manual does not take into account any local regulations which have to be complied with by the operator or by any hired installation staff.
This pump must never be operated outside the limits laid down in the technical documentation with regard to pumped media, rate of flow, speed, density, pressure and temperature, including motor rating or contrary to any other instructions stipulated in the operating manual or contract documentation.
The nameplate states series/size, the most important operating data and the Works No. / Serial No., which must always be stated when making inquiries, subsequent orders and especially when ordering spare / replacement parts.
Should any additional information or instructions be required, or if there is any damage to the equipment, then please contact your nearest KSB service.

2 Safety

This operating manual contains basic instructions, which must be observed during installation, operation and servicing. Therefore it is imperative that this manual is read prior to assembly by the fitter and relevant skilled staff / and operators, and it must always be kept within the locality of the machine/plant.
Do not only observe the general safety notes under this section, but as well any other notes regarding safety included in the manual.

2.1 Identification of symbols used within the operating manual

The symbols contained within this manual calling attention to situations where non-observance could endanger lives, are especially identified such as:

Calling attention to electric current with

Safety instructions relating to situations where non-observance could damage the machine and its functions are identified with the word:

Caution

Any instructions which are actually printed on the machine such as:
- arrow indicating the direction of rotation,
- identification for fluid connections.

must be observed without fail and be kept clean and legible.

2.2 Personnel skills and training

Operators, as well as service, inspection and assembly personnel must have the appropriate skills to carry out such work. Area of responsibility, allocation and supervision of the personnel must be controlled by the operator. Should the personnel not have the required knowledge, training must be arranged. If required, the operator can arrange such training to be carried out by KSB. The operator must also ensure that the instruction manual is fully understood by the personnel.

2.3 Dangerous practices non-observance of safety instructions

Non-compliance with the safety instructions can endanger people's lives, the environment and the pumps.
In detail, non-compliance could, for example, cause the following:
- Failure of pump / plant to operate.
- Failure of servicing and maintenance methods.
- Endangering people by contact with electrical, mechanical and chemical matters.
- Contamination of the environment by leakage of dangerous substances.

2.4 Safe working methods

The operator must observe all safety instructions outlined in this manual, the existing national safety precautions to prevent accidents, and also any inter-company working, operating and safety regulations.

2.5 Safety instructions for operators

- If hot or cold machine parts are considered a danger, then these parts must be protected where contact is possible.
- Safety equipment to prevent contact with hot or cold movable parts must not be removed while the machine is in operation.
- Leakages (for example at shaft seals) of dangerous media (e.g. explosive, poisonous, hot liquids) must be disposed of in such a manner as to avoid any danger to personnel and environment.
- Danger caused by electric supply must be eliminated (in this respect, see details of any regulations enforced by individual countries of the VDE and / or local power supply stations).

2.6 Safety instructions during maintenance, inspection and installation

The operator bears the responsibility to ensure that all service, inspection and maintenance work is carried out by authorized and fully trained personnel, who have read and are familiar with the operating instructions.
Basically, all work to the pump should only be carried out when the machine is not operating. The operating instructions relating to the method of switching off the equipment must be adhered to without fail.
Pumps pumping dangerous media must be decontaminated.
Once maintenance work is completed, all safety equipment must be reinstated again and checked to ensure they function correctly.
Read and follow the point listed in the paragraph 6.1 prior to installation.

2.7 Unauthorized modifications to the pump and fitting of spare parts

Modifications to the pump can only be carried out after authorization has been obtained from the manufacturer. Original spare parts and ancillary equipment supplied by the manufacturer provide safety. Installation of any other parts voids the warranty for any pump failure which occurs as a result of installing non-manufacturer's parts.

2.8 Unauthorized modes of operation

Operating safety of the equipment is only guaranteed if all operating instructions as outlined in paragraph 1 - General - are observed. The limits given in the data sheet must under no circumstances be exceeded.

2.9 Explosion protection

Special conditions apply to the operation of explosion-proof pumps. The explosion-proof status of the pump set is only assured if the pump set is used in accordance with its designated use. The limits stated in the data sheet and on the name plate must not be exceeded under any circumstances. Correct monitoring of the motor temperature is imperative to ensure explosion protection. Electrical connection plans and function diagrams are given in the Annex. Never operate an explosion-proof pump without monitoring the stator temperature. Modifications or alteration of the pump may affect explosion protection and are only permitted after consultation with the manufacturer. Only original spare parts and accessories authorized by the manufacturer must be used for explosion-proof pumps.

3 Transport and interim storage

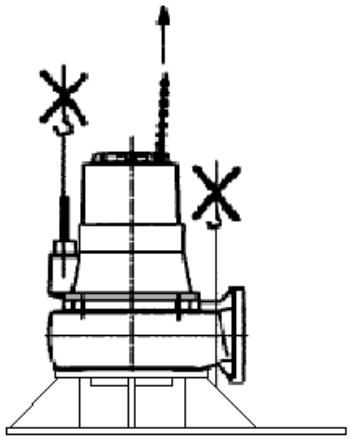
⚠ **The chain or lifting cable which is supplied must only be used for lifting the appropriate pump unit. General use for lifting heavy loads is not permitted**.

Do not lift the pump by the motor power cable. Do not lift pump over people.

⚠ **The pump must be handled carefully during transport. The chain or lifting cable must be attached securely at the pump and crane end. Personnel can be injured and the pump unit damaged should the pump slip out of the chain / guide rope**.

3.1 Transport

The motor housing / cover of the pump has been prepared for attaching the chain supplied with the unit. For lifting the unit during unpacking only this prepared fixing should be used for attaching the lifting chain.



3.2 Storage and Conservation

The procedure has been outlined in paragraph 6.3 "shut down ".

4 Description of pump

4.1 General description

KSB submersible pumps are close-coupled units which are non-self-priming. The impellers in these pumps can vary, depending on the impeller type required by the customers to suit a particular application. Usually, the pumps are operated fully submerged. For short periods, they may run dry until the minimum filling level is reached.

4.2 Identification data

Identification can be found on the nameplate, which is fitted to the motor.

KRT F 100-200 / 2 4 X G - S

Series

Impeller type (E, F, S)

E = single-vane impeller
F = free-flow impeller
S = with cutter

Hydraulic size

Motor size

Number of poles

2-pole
4-pole

Motor version (U, X)

U = standard version
X = explosionproof XP/I/1/CD/T3

Material combination

G = Pump complete in cast iron

Installation type

S = stationary wet-well installation without cooling jacket
P = transportable wet-well installation without cooling jacket

4.3 Construction

4.3.1 Driver

KSB submersible pump sets are supplied with single-phase motor (size: 0 2) and three-phase asynchronous motors (sizes: 2 2, 1 4, 2 4 and 3 4) complete with connecting cable.
Starting method standard: direct.

4.3.1.1 Motors in explosion proof design

In accordance with NEC 500, listed by Factory Mutual <FM>:
Class I, Division 1, Groups C & D, T3.

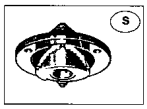
4.3.2 Shaft seal

The shaft seal consists of two mechanical seals, which are independent of the direction of rotation at pump and motor end. The oil chamber which is fitted between the two mechanical seals ensures cooling and lubrication.

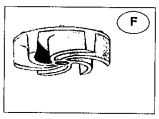
4.3.3 Bearing assembly

All sizes are fitted with grease-lubricated, maintenance-free rolling element bearings.

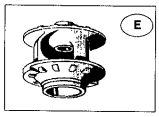
4.3.4 Impeller types



Cutter (S) for feces, domestic sewage and sewage containing long fibrous admixtures.



Free–flow impeller (F–impeller) for pumping liquids containing larger solid particles and fibers liable to twist and bunch and also gas and air inclusions.



Single–vane impeller (E–impeller) for pumping liquids containing larger solid particles and fibers liable to twist and bunch, and also for the damage–free transport of solids.

4.3.5 Installation types

Installation type P: transportable installation
Installation type S: stationary wet-well installation
The installation type supplied can be identified from the type designation (see 4.2).
For detailed installation description, see item 5.6.

4.3.6 Dimensions

For unit dimensions, mating dimensions and weights please refer to the **Appendix "Dimension table"**.

4.4 Ancillary equipment

Recommended equipment is described in **appendix "Electrical connection diagrams"**.

Any information relating to other ancillary equipment will be given by our Sales Office.

5 Assembly / Installation

5.1 Safety regulations

It is not permitted for any person to enter the tank during operation of the pump unless special safety precautions have been taken in accordance with current safety regulations.

5.2 Checking procedure prior to installation

Construction lay-out must be in accordance with measurements set out on the table of dimensions.

The construction of the concrete foundations should be sufficiently strong (min. 3000 psi / min. B 25 DIN 1045) to ensure a secure and functionally correct installation in compliance with DIN 1045 or equivalent standard. Concrete foundations must have set before installation of the unit. Its surface must be level and even.

5.3 Installation

Examine the unit carefully prior to commencement of installation regarding any damage incurred to the unit and cabling during transport. Before installation of the pump all items listed in paragraph 6.1 have to be checked in sequence. A separate nameplate stating pump and motor data is supplied within the scope of supply. This nameplate must be fixed in a clearly visible position outside the tank (for example control panel, piping, mounting bracket).

5.3.1 Checking of operating data

A check must be carried out to ensure that the details stated on the nameplate correspond to the order and pump data (for example operating voltage, frequency and pumped media temperature etc.).

5.3.2 Oil level control

The oil chambers of our submersible pumps were filled with environmentally safe non-toxic paraffin oil at the factory.

The oil level must be checked prior to initial operation of the unit.

Procedure see item 6.1.1.

5.3.3 Checking of the direction of rotation

Before starting with the installation, make sure that the direction of rotation is the correct one, acc. to para 5.5.5.

5.4 Connection of the pipeline

(Appendix "General arrangement of installation sets" Fig 1).

The discharge pipe shall be connected taking into account the permissible flange loads as given in the **table "Permissible flange loads"**.

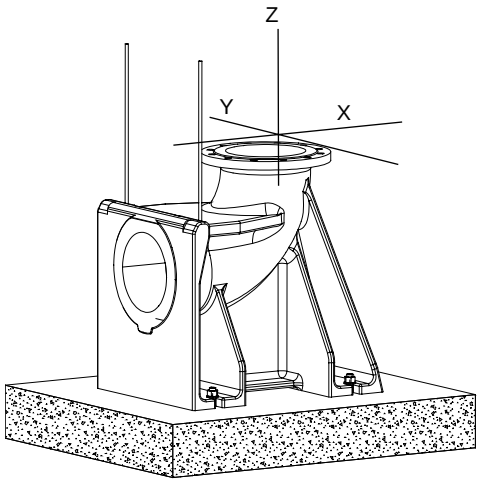


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Table "Permissible flange loads"

Forces [N]					Moments [Nm]			
DN	F_y	F_z	F_x	$\sum F$	M_y	M_z	M_x	$\sum M$
40/50	1,350	1,650	1,500	2,600	1,000	1,150	1,400	2,050
65	1,700	2,070	1,870	3,270	1,070	1,220	1,500	2,200
80	2,050	2,500	2,250	3,950	1,150	1,300	1,600	2,350
100	2,700	3,350	3,000	5,250	1,250	1,450	1,750	2,600

Forces [lb]					Moments [lb–ft]			
DN	F_y	F_z	F_x	$\sum F$	M_y	M_z	M_x	$\sum M$
40/50	305	370	340	585	735	845	1,030	1,510
65	380	465	420	735	790	900	1,105	1,625
80	460	560	505	890	845	955	1,180	1,730
100	605	750	675	1,180	920	1,070	1,290	1,915

Caution **Under no circumstances must the pump be used as an anchoring point for the pipeline.**

Any expansion of the pipes caused by high temperatures must be adjusted by taking appropriate corrective measures, to ensure that the pump does not come under undue stress due to pipeline forces and torques.

Excessive pipeline forces can cause leakages of pumped media for example.

Toxic and hot media can endanger life.
When emptying objects on a lower level, a non–return valve must be fitted into the discharge pipe to avoid backflow from the channel, which could be led via the backflow level (road level) upwards and only then into the sewage channel.

Caution **Screwed pipeline joints where plastic parts were used, must not be damaged by careless handling of tools during the installation of pump and pipeline**.

Fitting of a non–return valve is also essential for longer rising pipes to avoid excessive backflow when the pump is turned off. Ensure that ventilation is taken into account when installing a non–return valve.

5.5 Electrical connection

General

The electrical connection must be carried out by a trained electrician and in compliance with local regulations.

The voltage must comply with the voltage indicated on the nameplate.

Electrical installation must be in accordance with the Appendix **"Electrical connection diagrams"** for the appropriate motor sizes. The pump is delivered with cable.

Caution **Do not remove the protective cover, which is situated at the cable end until immediately before installation**.

The individual wires of the cable ends bear marking tapes (e.g. U1/(T1). V1/(T2), W1/(T3), U2/(T4), V2/(T5), W2/(T6), 21, 22, or 10, 11, ...).

If cables have to be shortened, take note of the wire index number or color imprints. In such a case, remove the yellow marking tapes and reaffix them afterwards.

5.5.1 Monitoring equipment

The unit has been supplied with monitoring equipment to prevent damage. Installation, description and functioning of the monitoring equipment to prevent damage can be taken from **appendix "Electrical connection diagrams"**.

Caution **Temperature monitoring protects the motor in the event of insufficient cooling. Safe and reliable operation and explosion protection can only be ensured if the temperature monitoring equipment is operational.**

5.5.2 Installing the electric cabling

Caution **After installing the unit, it is advised to position and support the motor cable so not to have it sucked into the pump during operation**.

For correct installation of the electric cabling within the pump sump (**appendix "General pump outline" Fig. 4**) we recommend using kellum grips, which can be supplied for additional cost (paragraph 4.4). Slack installation of cables could cause damage to the electric cabling when the pump is operating.

Fitting of cable protection sheath:

If a protection sheath is included in the scope of supply for the electric cabling, it has to be fitted according to the instructions given in the supplementary operating manual **"Assembly of protection sheath"**.

5.5.3 Overcurrent relay

The motor must be protected against overloading by a thermally compensated overcurrent relay to comply with NEC and regulations which are in accordance with local requirements. This must be adjusted to the nominal motor current (FLA) indicated on the nameplate.

5.5.4 Level control switch

Pumping stations with automatic pump operation should be fitted with a level control switch. The cut-off point should be set to the lowest shut-off point for automatic operation as indicated on the **"Dimension tables".**

5.5.5 Checking of the direction of rotation

Once the electrical connections are complete, the following should be checked.

Caution **The pump cannot reach its duty point if the direction of rotation is incorrect.**

Non-observance can lead to damaging the pump set.

Never put hands or any objects into the pump when the pump can be accidentally started. Prior to carrying out rotation check, make sure no foreign objects are in the pump casing.

Caution **The running time should be as short as possible approx. 1 minute. The direction of rotation of explosion-proof pumps must always be checked outside the potentially explosive atmosphere.**

Correct direction of rotation:

If the right phase sequence of the circuit is known, the correct direction of rotation will occur automatically, providing the instructions in 5.5 have been carried out correctly (rotating of the motor to the left).

The direction of rotation is checked by bumping the pump and observing of the impeller.

When looking at the pump mouth, the impeller must move to the left (with some pumps, the direction of rotation is marked by an arrow).

(See **appendix "General pump outline" Fig. 5)**.

If the direction of rotation is incorrect, interchange 2 of the 3 phases in the disconnect switch or motor control.

5.5.6 Connection of a potential equalizer

For potential equalization use the external connection terminal at the cable entry.

(**Appendix "General pump outline" Fig. 5)**.

5.6 Assembly kit installation

The following assembly kits are available for assembly / installation of the KRT pump unit.

- 5.6.1 Stationary wet–well installation,
- 5.6.2 Transportable installation.

5.6.1 Stationary installation with guide cable

5.6.1.1 Description

(Appendix "General outline installation set" Fig. 1).

Stationary installation provides the facility to insert and lift out the pump unit at any time regardless of liquid level within the sump by means of a double guide cable.

Guided securely by two parallel, previously tightened stainless steel cables the pump slides into the well or tank and attaches itself to the discharge elbow which has been fitted to the bottom.

The weight of the pump acts to seal the connection between pump and discharge elbow. A profile gasket between the pump and discharge elbow achieves a zero leakage, pressure-proof elastic connection.

5.6.1.2 Scope of supply for stationary wet–well installation

Please refer to the **Appendix "Wet–well installation with guide cables"**.

5.6.1.3 Installation of pump with claw connection

Use **appendix "Wet–well installation"** with guidance.

1. Prior to lowering the pump fit claw part # 732 to the discharge flange of the pump housing.
   Screws have to be tightened in accordance with the instructions. This is described under item 7.5.1 in the table "**Bolt tightening torque"**.

2. Fit profile gasket # 410 into the groove of the claw / pump casing flange.

5.6.1.4 Installation of the mounting bracket / discharge elbow / guide cable

Construction of the base foundations should be sufficiently strong (min. 3,000 psi) to ensure a functionally correct fixing of guide cable equipment and discharge elbow.

Refer to the drawing as illustrated in **appendix "Wet-well installation"** for all installation tasks outlined below.

1. Secure mounting bracket part # 894 using anchor bolt part # 90-3.37 (supplied by others) at the sump opening rim. Borehole diameter and depth for the anchor bolt to be taken from **appendix "Dimension tables"**.
   All means of fixation are part of the scope of supply.
   For the bolt of the mounting bracket refer to **appendix "Dimension tables**.

2. Fit threaded bolt part # 904 / nuts part # 920.36 with thrust insert part # 553 and with clamp part # 572 to the mounting bracket part # 894. Do not unscrew hexagonal nut part # 920.36 too much, just enough to allow sufficient play for tightening the cable subsequently. Ensure that the thrust insert part # 553 are fitted correctly to the clamp part # 572.
3. The discharge elbow should be positioned and secured to the base of the sump so that the tightened cable will run vertically later on.

   Should construction / pipework etc. require the cable to run off the vertical, then a maximum angle of 5° should be adhered to, thus ensuring safe fitting function.Securing of the discharge elbow is carried out by using steel anchor bolts part # 90-3.38 or foundation bolts part # 900.38 regardless of pump size or material combination. Refer to **appendix "Dimension tables"** and **appendix "Wet-well installation"** for details relating to appropriate fitting instructions and hole dimensions.
4. Insert and fit the cable part # 59-24. First push the thrust insert part # 553 up. Thread one end of the wire through the hole in the, clamp making sure it goes through the correct hole, see annex "Wet-well installation with guide cable".

   Run the cable round the discharge elbow part # 72-1 then back up to the clamp. Pass the other end through the second hole in the clamp and make the cable taut by hand. Clamp the cable firmly in position using the thrust insert part # 553 and tensioning nut part # 920.36.
5. Tighten the cable by means of the tensioning nut part # 920.36 on the mounting bracket. Then lock with the second nut part # 920.36 with a torque as outlined in the table below. For instructions concerning installation of Guide Cable Spacer, refer to **appendix "Guide Cable Spacer".**
6. The loose end of the cable at the clamp part # 572 can either be twisted into a ring or the end can be cut off. After length adjustment, seal off ends to avoid fraying.
7. Place hook part # 59-18 into the mounting bracket part # 894 to enable the lifting chain part # 885 or rope part # 59-24.02 to be attached at a later stage.

Table Bolt tightening torque: Steel anchor bolt

Size (Ø) [in/mm]	**Torque** [lbf–ft/Nm]
0.39 / 10	7.5 / 10
0.71 / 18	60 / 80

Table **Bolt tightening torque "Foundation bolt"**

Size (Ø) [in/mm]	**Torque** [lbf–ft/Nm]
0.47 / 12	20 / 25
0.63 / 16	50 / 65
0.79 / 20	95 / 125

Table **"Guide cable - tension"**

Size	**M_A** [lbf–ft/Nm]	**P** [lb/N]
DN 40... DN 100	7 / 9	900 / 4,000

M_A = tightening torque

$_P$ = wire tension

5.6.1.5 Fitting of chain or lifting rope stationary wet-well installation

Installation of this equipment should be carried out in accordance with the "General pump outline", Fig. 1a by inserting the chain / lifting rope into the opposite the outlet branch. Further details can be found in **"Wet-well installation"**.
This type of assembly permits the fitting of the pump to the discharge elbow.

5.6.1.6 Installation of the pump

(Appendix "General outline installation set" Fig. 1).
The pump is lowered into the sump by guiding it from above over the clamp part # 572. It is then attached to the guide cable or rails and slowly lowered into the sump. Once the pump is lowered, it will attach itself to the discharge elbow part # 72-1 and is then securely fixed to the outlet pipe ready for use. Finally, attach the chain or rope to the hook part # 59-18 on the mounting bracket.

5.6.1.7 Connection of the pipeline

(Appendix "General outline installation set", Fig. 1).
For procedure, see para. 5.4.

5.6.2 Transportable installation

5.6.2.1 Description

Pumps for transportable installation are supplied with a pump stand. The outlet flange can be used for fitting either rigid or flexible piping.
Examples for typical installation possibilities can be taken from **appendix "General outline-installation set " Fig. 2**.
Ancillary equipment can be requested and purchased from our sales offices.

5.6.2.2 Components / extent of supply for transportable installation

Please refer to drawing in **appendix "Wet-well installation-transportable" for assembly**.

5.6.2.3 Assembly kit installation

Please refer to drawing in **appendix "Wet-well installation - transportable"** for assembly.
The base plate or the pump stand must be fitted prior to installing the pump. All screws must be tightened according to instructions. Refer to **table "Bolt tightening torque"** paragraph **7.5.1** for instructions.

5.6.2.4 Assembly chain or lifting rope transportable installation

Fitting of chain / lifting rope should be installed out as outlined in **appendix "Wet-well installation-transportable**.
Always use the lifting point which is closes to the pump discharge on top of the motor, see **appendix "General pump outline" Fig. 1b**.

5.6.2.5 Installation of pump

Transportable installation permits to operate the pumps in different locations.
For example, they can be used for:
- draining mines,
- the emergency draining of canals,
- pumping water out of rivers etc.

For such applications the pump must be installed in a vertical position with the motor on the top and fitted to a firm base.

6 Start up / shut down

Caution **It is important to follow these requirements. Any damage incurred as a result of non-compliance is not covered by the warranty**.

Caution **Do not pump any media which is unsuitable for the material outlined in the technical documentation**.

6.1 Initial start up of pump

Prior to starting the pump it has to be ascertained that the following points have been checked and executed:
- Operating data (see 5.3.1), oil level (see 6.1.1) and direction of rotation (see 5.5.5).
- Check that the installation of the electrical supply was carried out correctly in accordance with **appendix "Electrical connection diagrams"**.

Caution **Temperature monitoring in the motor winding protects the motor in case of insufficient cooling conditions. Reliable operation and explosion protection can only be warranteed if the circuits for temperature monitoring function properly**.

- Ensure that the pump has been installed correctly to comply with installation kit paragraph 5.6.
- Should the pump have been out of service for a long period, then the steps outlined in paragraph 6.4 must be carried out.

6.1.1 Oil level check

Procedure according to **appendix "General pump outline"**.
Fig. 2. Remove screwed plug part # 903.03 with joint ring part # 411.03. The minimum oil level must not fall short of measure "M". If it is lower, fill the oil chamber via feed opening until overflow. Regarding oil quality and quantity, see point 7.2.4 (Oil change). Tighten screwed plug with joint ring again.

6.1.2 Start-up

The pump must be started up against a closed discharge side check valve and open shut-off valve. If the discharge pipe is not fitted with a check valve, the pump must be started up with the shut-off valve slightly open and slowly opening further.

Caution Pump start-up against a closed shut-off element will result in increased wear.

Suitable valves must be installed to ensure that any high points in the discharge piping are properly vented.

When the pump is started up via frequency inverter, short start ramps must be ensured (approx. 3-5 s) for the motor to reach the rotational speed corresponding to the mains frequency. Speed controlled operation shall only start after approx. 2-5 minutes.

Caution **Pump start-up with long start ramps and low frequency may cause clogging**.

6.2 Limitation of the operating range

6.2.1 Minimum liquid level

The pump is ready for operation when the liquid level reached the top of the motor.

This minimum liquid level also applies to pumping stations with automatic pump operation.

(Appendix "General pump outline" Fig. 6).

Built-in temperature controls within the winding will protect the motor from overheating. If the motor overheats (for example during long operation with a completely exposed motor), the built-in temperature controls will switch off the motor and turn it on again automatically after cooling down.

The control system must provide a protection against dry running by stopping the pump automatically at lowest switch-off water level (cut-off contact, see 5.5.4).

Caution **Dry running leads to increased wear (and tear) and should be avoided. Never allow an explosion-proof pump to run dry!**

6.2.2 Temperature of pumped media and surroundings

The maximum temperature is indicated on the nameplate.

KRT... version U [1)] X	104 °F / 40 °C

[1)] Can be operated up to 178 °F / 80 °C for a limited period (3-5 min. until the thermal protection equipment is activated).

Caution **Do not operate the equipment at temperatures higher than those indicated above, unless KSB has given written consent. Damage caused due to non-observance of this warning will not be covered by the warranty. Explosion-proof pumps must never - not even for short periods - be operated at fluid or ambient temperatures exceeding the data given on the name plate.**

6.2.3 Density of pumped media

Power input of the pump increases directly with the density of the pumped medium. To avoid overloading of the motor this density must comply with the data stated in the order.

6.2.4 Abrasive media

When pumping media containing abrasive particles, increased wear of hydraulic and mechanical seals must be expected. The maintenance intervals must be halved compared to those usually recommended (as outlined in paragraph 7.2). In addition, it is recommended to limit the flow velocity the pipe in relation to the rising main to > 4.9 ft/s <16 ft/s/ > 1.5 m/sec < 5 m/sec in order to achieve the maximum operating periods possible.

6.2.5 Starting frequency

To prevent high temperature increases in the motor and excessive loads on the motor, seal elements and bearings, the switching frequency shall not exceed 30 starts per hour and maximum 5,000 starts.

6.2.6 Operating voltage

The maximum admissible deviation of the operating voltage amounts to ±10% of the rated voltage. The maximum admissible voltage difference between the single phases amounts to +/-1%.

6.2.7 Frequency converter operation

The output frequency is limited at 60 Hz.

For the possible speed range the following criteria have to be observed:

- Q_{min} and Q_{max} according to characteristic curve,
- minimum speed capable to carry solids,
- minimum flow velocity to fully open a non-return valve,
- natural frequency ranges of pipe systems.

Caution **Never operate an explosion-proof pump outside this range!**

6.3 Shut down / storage / preservation

If operation is not required until some time after delivery, we recommend the following steps for storage of the pump:

6.3.1 Storage of new pumps

- Spray the inside of the pump housing with oil, paying special attention to the area around the impeller wear ring. Spray oil through inlet and outlet flanges. It is then recommended to cover the flanges with plastic caps or similar.
- Store the pump in an upright position in a dry place. Support all electrical cables at cable entry points to avoid permanent distortion.
- Electric connecting cables are capped securely for protection purposes prior to delivery. This protection must not be removed.

6.3.2 Measures for prolonged shut down periods

1. **The pump remains installed ready for operation when required**.
   In order to maintain pump availability, the pump should be switched on for brief periods (approx. 10 sec) once every month.
2. **The pump is dismantled and stored**
   Prior to storage the pump should be checked and maintained in accordance with paragraph 7.1 and 7.2. Subsequently, the preservation outlined in paragraph 6.3.1 must be carried out.

6.4 Re-starting pump after storage

Prior to re-starting the pump, all checks and maintenance steps outlined in **paragraphs 7.1** and **7.2** have to be carried out.

Always disconnect all electricity supplies prior to working at the pump. Safeguard the pump from being started accidentally. Otherwise, there will be danger to life.

In addition, free-running of the impeller should be checked. This can be done by putting one hand into the pump casing and manually turning the impeller.

When restarting the pump the items outlined in **paragraph** 6.1 and **6.2** have to be observed.

Immediately after completion of the maintenance work, all safety and protection equipment has to be installed expertly and must be set working. Correct temperature monitoring is imperative to ensure explosion protection. Never operate an explosion-proof pump without monitoring the stator temperature.

7 Service and maintenance

7.1 General instructions

The operator must ensure that all maintenance, inspection and repair work is carried out by qualified, authorized staff who are familiar with the equipment and who have read the operating instructions.
By compiling a maintenance plan it is possible to cut maintenance expenses and avoid extensive down-time, thus achieving trouble-free and reliable operation of the pump.

Always disconnect all electricity supplies prior to working on the pump. Safeguard the pump from being started accidentally. Otherwise, there will be danger to life.

If the pumped media are harmful, the pump must be decontaminated. Special care should be taken to prevent an endangering of personnel and environment when draining leakage liquid / oil. All official regulations must be adhered to.

Special regulations apply to repair work on explosions–proof pumps. Modifications or alteration of the pump may affect explosion protection and are only permitted after consultation with the manufacturer. Only original spare parts and accessories authorized by the manufacturer must be used for explosion–proof pumps.

7.2 Service / Inspection

The following points must be observed to ensure reliable operation:

This work must only be carried out by experienced personnel!

	Maintenance work	**Maintenance Interval**
7.2.1	Insulation resistance test	Every 4,000 opeating hours; at least once a year
7.2.2	Checking the electric cables	
7.2.3	Visual inspection of lifting chain / rope	
7.2.4	Check of monitoring equipment	Every 10,000 opeating hours; at least every three years
7.2.5	Oil change	
	General overhaul	Every five years

The pump / motor shaft is supplied with grease-lubricated for life ball bearings. They need no maintenance tasks.

7.2.1 Checking of the insulation resistance check

The insulation resistance of the motor winding has to be checked every 4,000 hours but at least once a year during general maintenance.
Measurements should be taken at the motor cable ends (disconnected at the control panel or station J-box). The measurement should be taken by using a megger.

- Measuring voltage: max 1,000 VDC voltage.

The measurements to be taken are:

a. Winding against ground
   - All winding leads connected together, and measured to ground lead (green-yellow).

b. Winding temperature sensor against ground
   - All winding ends be connected to ground lead (green-yellow core).
     All cable ends of the winding temperature sensors (21/22 or 10/11) must be connected to one another. Otherwise the sensors will be damaged; measure to ground lead (green-yellow).

The insulation resistance of the motor winding with cable ends tied together must not be less than 1 MΩ. If measurements are less, then cable and motor must be checked separately. During the measurement procedure the supply cable must be disconnected from the motor.
If the insulation resistance for the electric supply cable is less than 1 MΩ, this indicates a damaged cable and needs replacement.
Low reading of the insulation resistance values of the motor indicates that there is a fault in the winding. If this is the case, contact KSB.

7.2.2 Checking of the electric cable

- Visual inspection of the electric cable.
  Whenever the pump is inspected, the electrical supply cables should also be checked with regard to damage such as cracks or bubbles, due to either mechanical or chemical causes. If such damage is detected, then all electric cables must be replaced.

- Checking the protective grounding conductors. Measurement of the resistance between green-yellow cores and any exposed metal surface on pump should be < 1Ω.

  Never switch on a pump with a defective ground conductor!

If the given values are exceeded, disconnect the electric cable at the motor and check again directly at the motor. If values are exceeded here also, the motor must be repaired; contact KSB.

7.2.3 Visual inspection of lifting chain / lifting rope

Maintenance checks to the pump should also include the lifting chain / lifting rope inclusive of fitting to the pump with regard to possible damage–caused either mechanically or chemically. Damaged parts must be replaced by manufacturer's original spare parts.
This also refers to the correct fixing of the lifting chain / liftig rope to the pump.

7.2.4 Checking of sensors

The sensors shall be checked every 10,000 operating hours or at least every three years during general maintenance work.
The tests described below measure the resistance at the conductor ends of the control cable. The actual function of the sensors is not tested.

Caution Never use voltages higher than 30V to check the sensors!

a. Bimetal switch
Measure the resistance between terminals 21 and 22. The resistance must be lower than 1Ω.

b. Thermistors (PTC)
Measure the resistance between terminals 10 and 11. The resistance measured must be between 200 Ω. and 1,000 Ω.

If the tolerances given are exceeded disconnect the control cable at the pump and check again directly at the terminals inside the motor. If tolerances are still exceeded, the winding will have to be replaced.

c. Leakage sensors in the motor
Measure the resistance between terminal 9 and the earth conductor (PE).
The resistance measured must be higher than 60 kΩ. Lower resistance values would suggest water ingress into the motor. In this case the motor must be opened and overhauled.

7.2.5 Oil change

The oil chamber of our submersible pump has been filled with environmentally friendly, non-toxic paraffin oil of medical quality on the pump end.

After every 10,000 hours of use, or three years, whichever comes first, the oil must be changed.

⚠ **Pumped liquid might enter the oil chamber when it is warm after operation, which can cause a pressure rise within the chamber. It is, therefore, advisable to cover the filling plug part # 903.03 (with a cloth) during the opening process to avoid hot liquid (squirting out) escaping**.

Procedure:

(Appendix "General pump outline").

Erect the pump as shown in Fig. **7** and put a suitable container under the plug. Unscrew screwed plug part # 903.03 with joint ring part # 411.03 and drain the oil.

The oil is light in color and transparent in appearance. Slight discolouring, caused by running in of new mechanical seal or small leakage of dirt via the pumped media will have no adverse effect. Severe contamination of the oil by the pump media, however, indicates damaged mechanical seals. In this case, replace the mechanical seal.

Screw in screwed plug part # 903.03 with joint ring part # 411.03.

Refilling:

Erect the pump as demonstrated in Fig. 2 and fill the oil chamber with oil until overflow (see also paragraph 6.1.1). Replace the plug part # 903.03 and fit a new o-ring part # 411.03.

Oil quantity:

The quantity see table 7.2.5.1 **"Lubricating instructions"**.

Recommended quality of oil:

Paraffinoil, free-flowing, Merkur Pharma 40, made by DEA, Duoprime 90 made by LYONDELL or equivalent, non-toxic. This quality is harmless and as such complies with the regulations applicable to food.

Alternative:

All non–alloyed and alloyed motor oils of classes SAE 10W can be used for lubrication of the mechanical seals. With regard to disposal all general Government regulations must be observed.

Caution **Regional regulations have to be observed to the extent that the oil does not contaminate the pumped media (for example drinking water) and that safe disposal is guaranteed. Otherwise, it is not permitted to fill the pump with oil, but paraffin oil must be used for this purpose**.

7.2.5.1 Table "Lubricating instructions"

Characteristic	Sizes		F,S 40-160	F 65-200	F,E 80-200 F 100-200
	Motor sizes within this group	2 - pole 4 - pole	02 22	14	14, 24, 34
Quantity of oil for filling ltr./quarts			0.4 / 0.42	0.5 / 0.53	0.6 / 0.63
Grease up quantity	Motor side cm3 Pump side cm3		Service life – grease filling		

For recommended quality of oil, see paragraph 7.2.5.

7.3 Drainage / Disposal

Caution **If the pump has been used to pump hazardous media, care must be taken, when draining the leakage liquid / oil filling, so that personnel and environment are not endangered. All government regulations have to be observed**.

7.4 Dismantling

7.4.1 Basic guidelines and instructions

All repair and maintenance work to the pump must only be carried out by trained straff, and original replacement parts must be used. **The safety precautions as outlined in paragraph 7.1 and 7.4.4 have to be observed**.

Dismantling and re-assembly may only be carried out in line with the appropriate sectional drawing. The sectional drawing and other instructions are detailed in the appendix. The dismantling sequence should be carried out as outlined in the sectional drawing.

If there are any problems, please contact our service department for advice.

7.4.2 Preparing for dismantling

Prior to dismantling the oil chamber is to be emptied.

7.4.3 Dismantling the pump section

Dismantling the pump section is carried out as illustrated in the drawing (**appendix "General arrangement drawing"**). Special tools are not required. **The only exceptions relate to the impeller dismantling / assembly process for the pump size KRT S 40-160**.

7.4.3.1 Special points relating to the dismantling of the impeller KRT S 40-160

The impeller is enclosed and an auxiliary device is required for dismantling. All other procedures are outlined in appendix "Assembly instruction - cutter."

7.4.3.2 Dismantling of mechanical seal

Exact instructions relating to fitting positions of the mechanical seals, either motor side or pump side, are outlined in **appendix "Mechanical seal arrangement with parts list"**.

7.4.4 Dismantling the motor component

Please ensure, when dismantling the motor and the electric cable, that core identifications are clearly marked for future reference during re–assembly.

Special points for explosion proof motors.

All other work affecting the flameproofness, such as new windings and mechanical repairs at the motor section, require a subsequent acceptance test by an approved engineer or have to be carried out at the premises of the manufacturer or factory certified repair center.

7.5 Re–assembly

7.5.1 General instructions

Assembly of the pump must be carried out in accordance with the current mechanical engineering regulations. All parts which were dismantled must be cleaned and tested with regard to wear. Damaged or worn parts must be replaced by using **manufacturer's original spare parts**. Ensure that all sealing surfaces are clean and the O-rings or flat seals fit perfectly. We recommend the use of O-rings/seals at all times. O-rings made from continuous strips which were glued together must not be used.

Assembly of the pump takes place in reverse order of dismantling. The drawing combined with the individual parts index should be used as a guide. All screws must be tightened during assembly as outlined in the instructions. General instructions in this respect are outlined in the **Table below "bolt tightening torque" and special points are stated in the installation instructions**. Assure bolts are lubricated prior to tightening.

Table: **Bolt tightening torque**

Thread	**Torque** [lbf–ft / Nm] A 276 Type 316 Ti (A4-70) / A 276 S 31803 (1.4462)		
M 5	3	/	4
M 6	5	/	7
M 8	13	/	17
M 10	26	/	35
M 12	44	/	60
M 16	110	/	150
M 20	215	/	290

7.5.2 Special points relating to components for re–assembly

7.5.2.1 Mechanical seal

In principle, we recommend to use new manufacturer's spare parts for mechanical seals. In this respect it should be noted:

To achieve perfect performance, it is important to ensure that all parts are immaculately clean and that greatest care is taken during the fitting of the mechanical seal. Protectors of the moving surfaces must not be removed until immediately before fitting the part. The surface of the shaft must be perfectly clean and undamaged.

In principle to assist with the fitting of the bellows mechanical seal, the inside of the bellows should be wetted with soapy water (do not use oil).

Fitting of the bellows mechanical seal at the motor end.

To avoid damage to the rubber bellows by a keyway or shaft recess, the shaft stub should be covered with a thin sheet of foil (approx. 5...15 mils thick). Push the rotating unit over foil cover and place into fitting position. Then remove the foil.

7.5.2.2 Impeller assembly

See section 7.4.3.

7.5.2.3 Checking seals

After assembly the mechanical seal part oil chamber should be tested for leaks.

Procedure:
(Appendix "General pump outline" Fig. 8).
The oil fill / drain hole is used to test for leaks. Securely screw the testing device into the hole.

Test media: Compressed air,

Test pressure: max. 7.25 psi / 0.5 bar,

Test duration: 2 min.

Make sure that the pressure does not decrease during the test. Afterwards, fill the oil chamber (compare para. 7.2.4).

7.5.2.4 Motor

Ensure prior to re-assembly of **explosion proof motors** that all the special points outlined in paragraph 7.4.4 were observed. All motors must be tested electrically in line with paragraph 6.1, 6.2 and 7.2.

7.6 Spare parts

Always provide the following data when ordering spare parts:

Pump type: e.g. KRTF100-200/24XG-S

Works–No. / Serial–No (e.g. 5M07–777222/3, or 888999)

Motor–No. (e.g.015234 or blank)

This data can be taken from the nameplate.

8 Trouble–shooting

	Unit not pumping
	Pump delivers insufficiently
	Current / power consumption too high
	Head too low
	Pump operation is uneven and noisy

Cause	**Remedy:** Prior to carrying out work to the pressure containing parts - release pressure from the pump! Disconnect power supply to the pump.
Pump delivers against excessively high discharge pressure	Open discharge valve further until duty point is reached
Valve in discharge pipe not fully open	Open gate valve completely
Pump not running within operating limits	Check operating data of the pump
Pump and / or pipeline are not completely vented or primed	Vent - by lifting the pump off the duckfoot bend and lowering it back again.
Pump inlet blocked by deposits	Clean inlet, pump parts and non return valve
Inlet pipe or impeller blocked - rotor running sluggishly	Remove deposits from within the pump and / or pipelines
Dirt / fibres in impeller chambers	Check impeller ensuring that it rotates slightly - if necessary clean hydraulic
Wear of internal pump parts	Replace worn parts
Damaged column pipe (pipe and seal)	Replace defective column pipe Renew seals
Unacceptable air or gas content within the pumped media	Contact your nearest authorised KSB agent
Oscillations caused by plant	Contact your nearest authorised KSB agent
Wrong direction of rotation	Switch two phases of the circuit cabling
Insufficient operating voltage	Check electric supply Check cable connections
Motor not running due to no voltage supply	Check electrical installation Inform electrical company
Motor running on two phases only	Replace defective fuses Check electric cable connections
Motor winding or electric cable defective	Replace by new original KSB cabling or contact your nearest authorized KSB agent
Radial bearing in the motor defective	Contact your nearest authorised KSB agent
With star delta connection - Motor only running in star position	Check star delta connection
Water level dropping excessively during operation	Check supply and capacity of system - (sump depth) check level control
Temperature monitor for winding control has ceased to operate due to excessively high winding temperature	The motor will switch on automatically after cooling down
Thermistor release unit without automatic restart facility for temperature limit (flameproof) has been released due to exceeding the permissible winding temperature	Check the pump.
Moisture protection relay has been released due to moisture within the motor	Check the pump.

Caution If working inside the pump is necessary whilst the pump is under warranty, then contact your nearest authorized KSB agent prior to commencement of work.

Non–observance will negate any warranty claims.

9 Appendix

General pump outline

Motors: 0 2...2 2
1 4...3 4

DN 40...DN 100

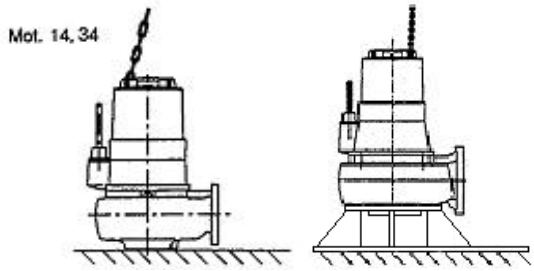


Fig. 1a Fig. 1b

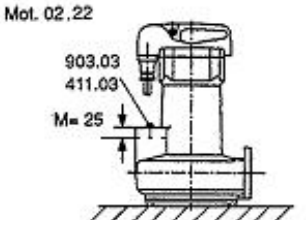


Fig. 2

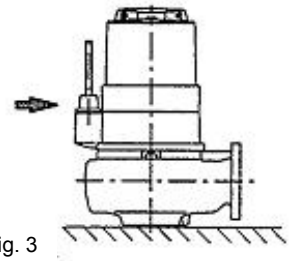
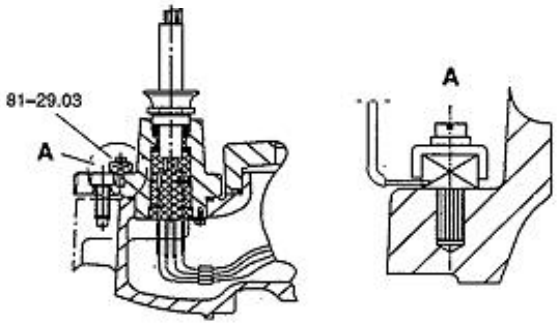
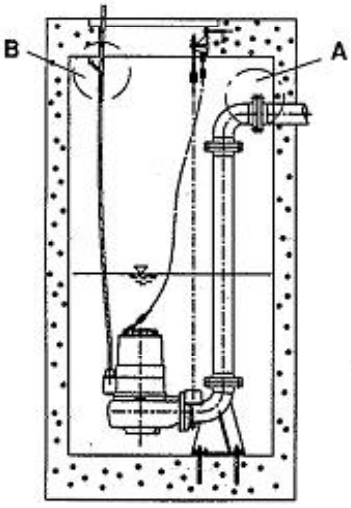
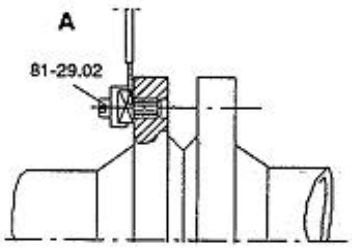


Fig. 3







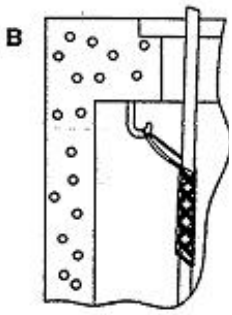
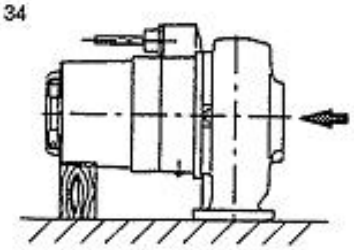


Fig. 4

Mot. 14, 34



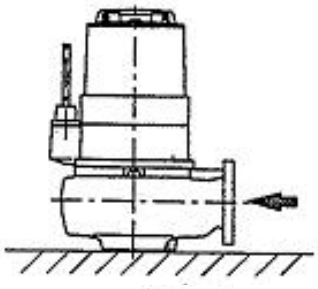
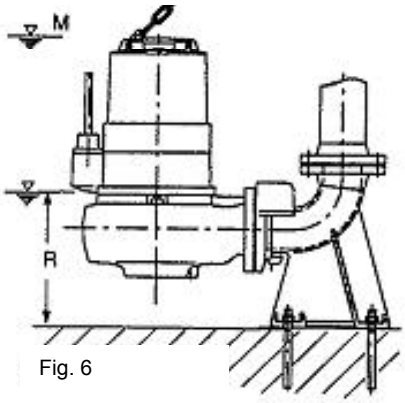


Fig. 5



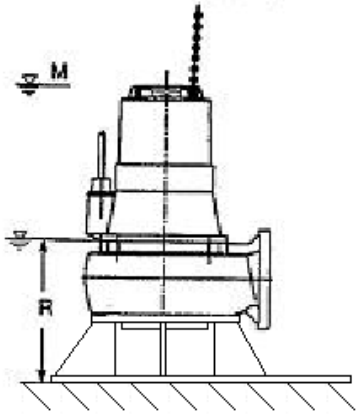


Fig. 6

Mot. 02, 22

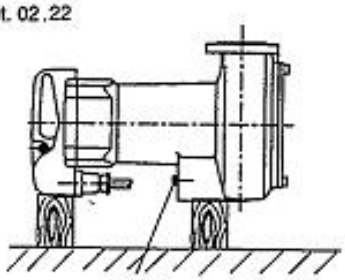


Fig. 7 903.03
411.03

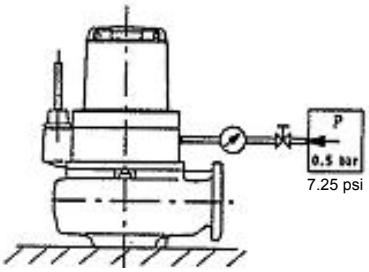
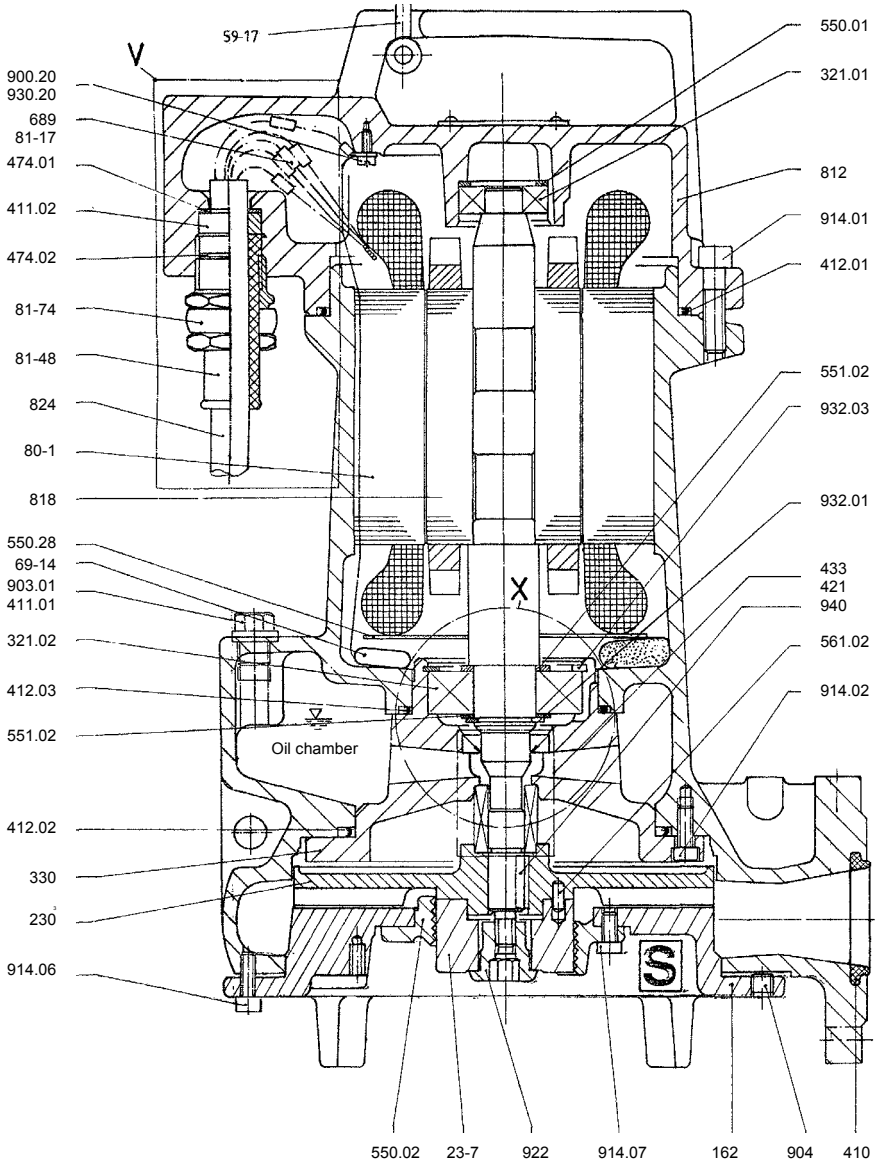


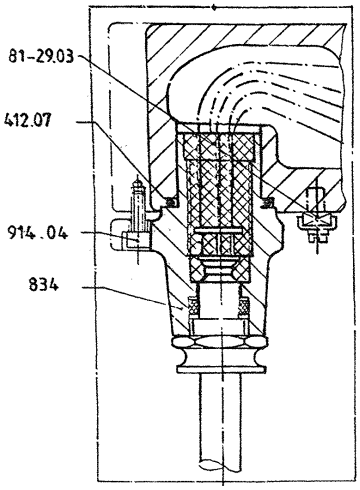
Fig. 8

General arrangement drawing

Motors: 0 2...2 2 40-160



DETAIL "V" ONLY FOR FM APPROVED DESIGN (MOTOR 2 2)



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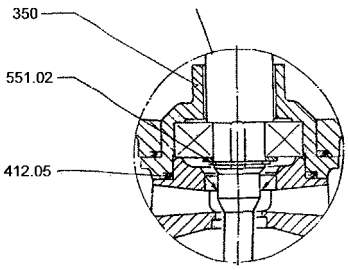
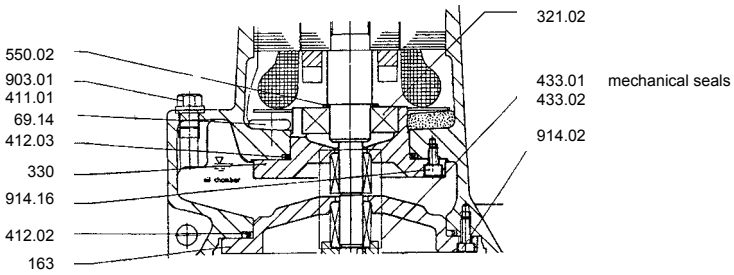
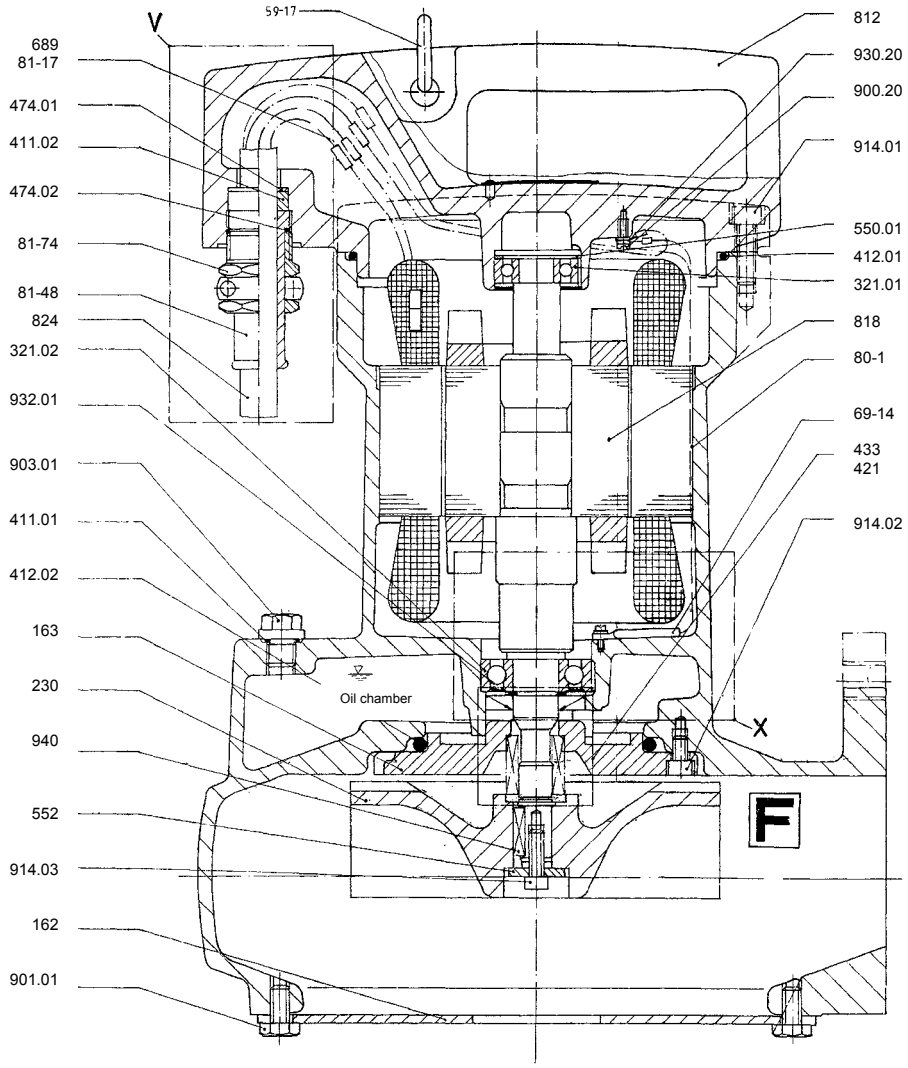


DETAIL "X" NON EXPLOSION PROOF DESIGN (MOTOR 0 2)



General arrangement drawing

Motors: 1 4 65-200



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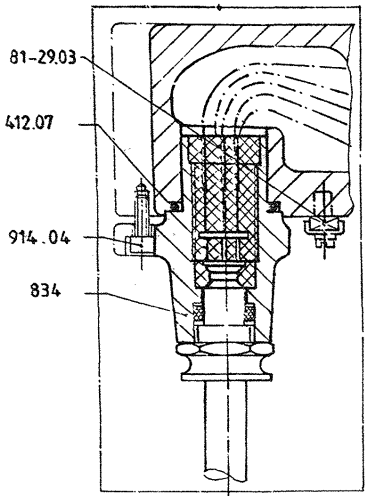

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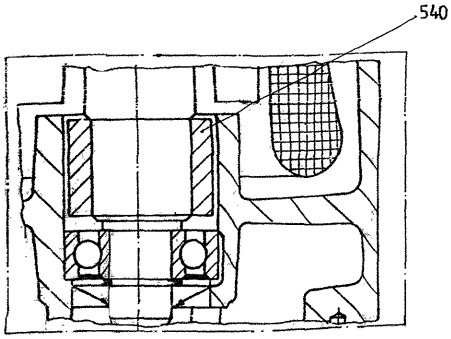
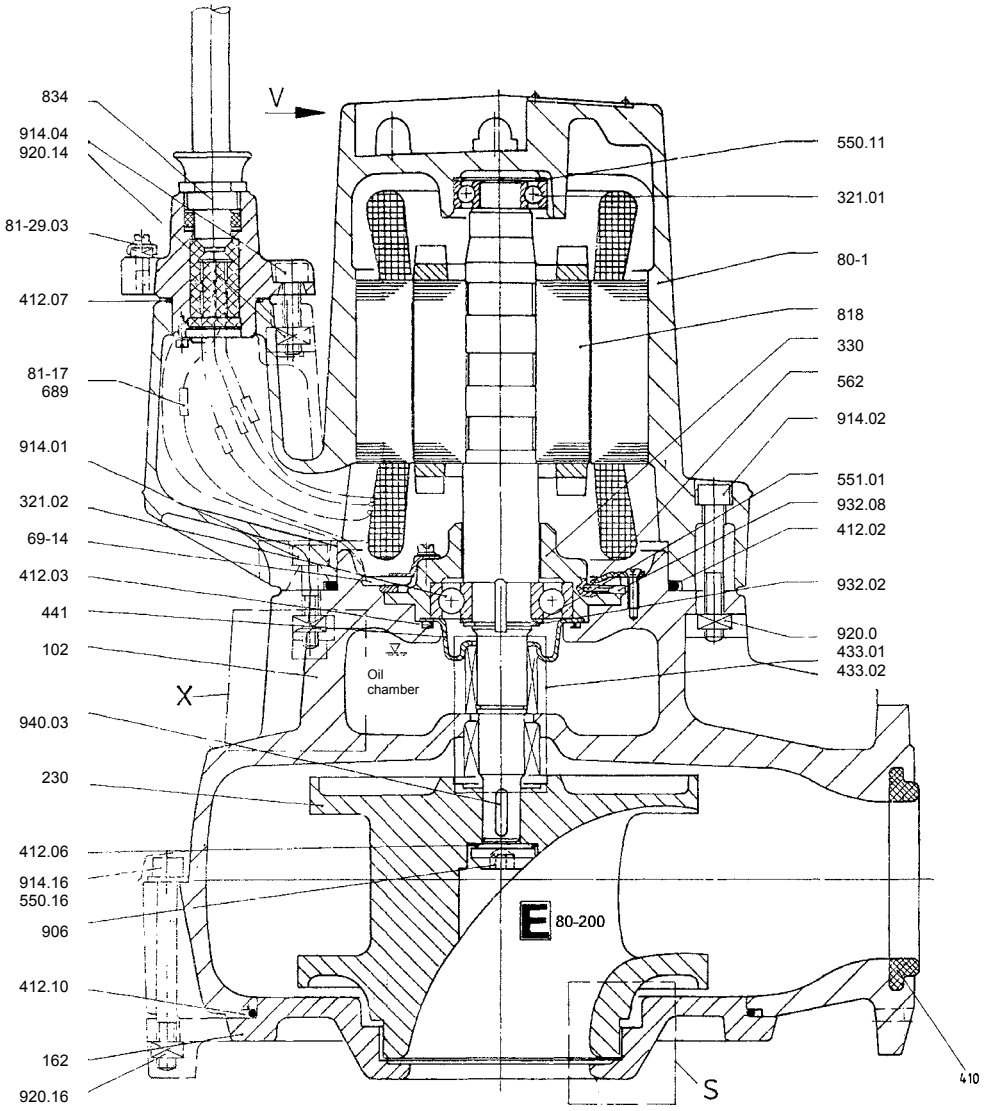


Moisture sensor not avaible for FM APPROVED design

General arrangement drawing

Motors: 1 4...3 4 80-200
2 4...3 4 100-200



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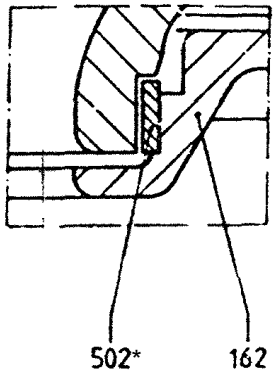

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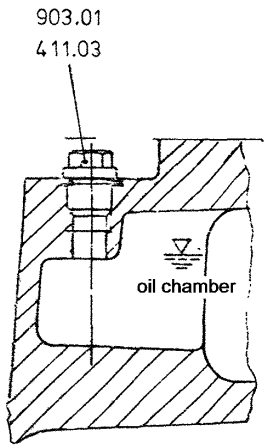

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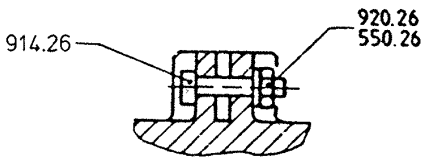
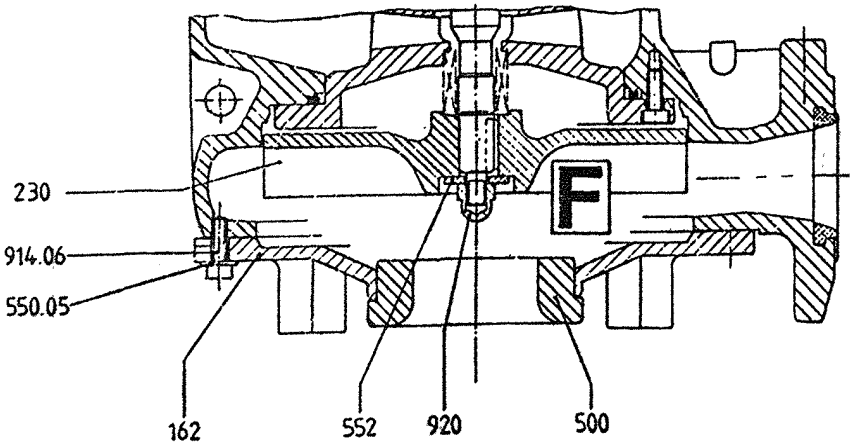
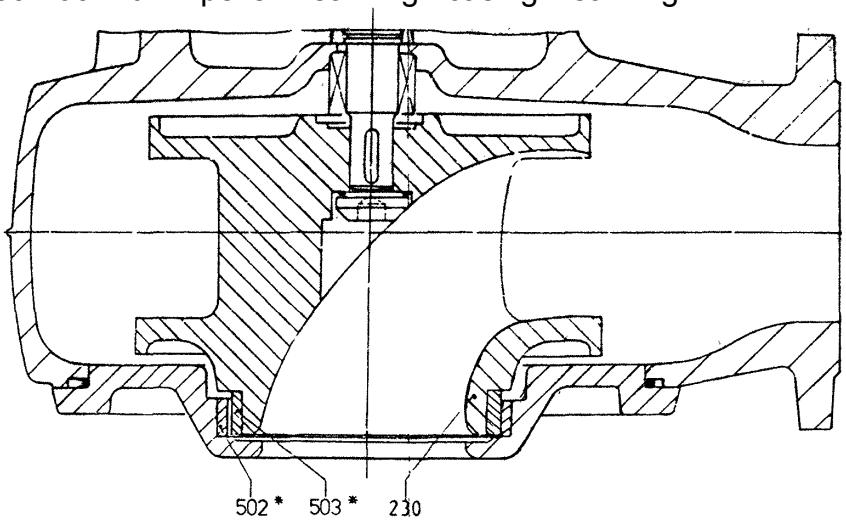


General arrangement drawing

Alternative design F 40-160



Alternative design E 80-200 with impeller wear ring / casing wear ring



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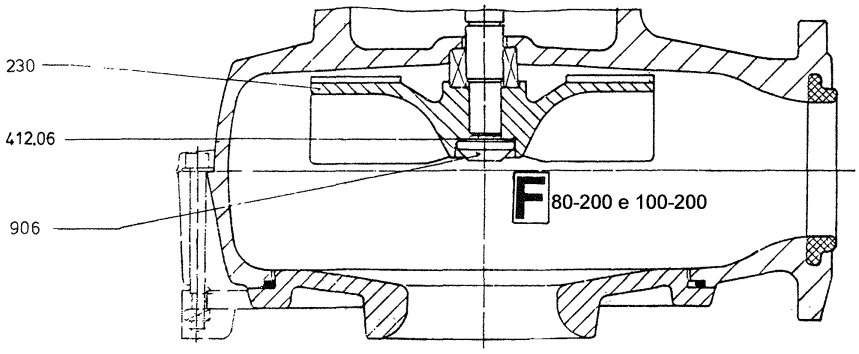
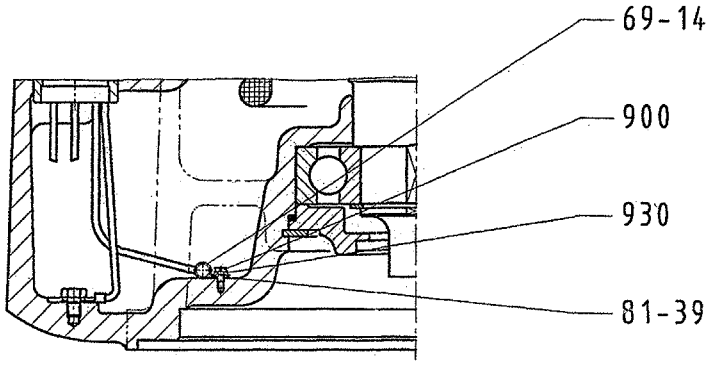
Alternative design F 80/100-200



General arrangement drawing

Detail Leakage detection



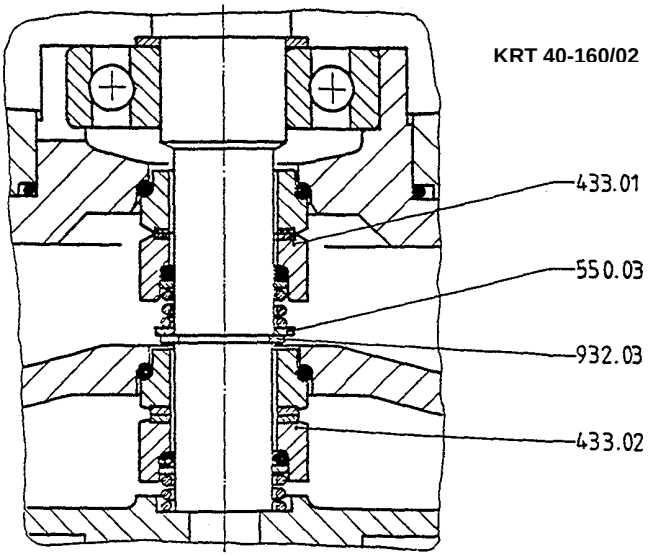
Part No.	Part description
23-7	Impeller body
59-17	Schackle
80-1	Submersible motor
80-3	Bushing
81-17	Butt joint
81-29	Clamp
81-48	Insulation funnel
69-14	Moisture protection of motor
81-74	Pressure screw
102	Volute casing
162	Suction cover
163	Discharge cover
230	Impeller
321	Radial ball bearing
330	Bearing bracket
350	Bearing housing
410	Profile joint
411	Gasket
412	O-ring
421	Rotary shaft seal
441	Seal casing
433	Mechanical seal
474	Thrust ring
500	Ring
502	Casing wear ring

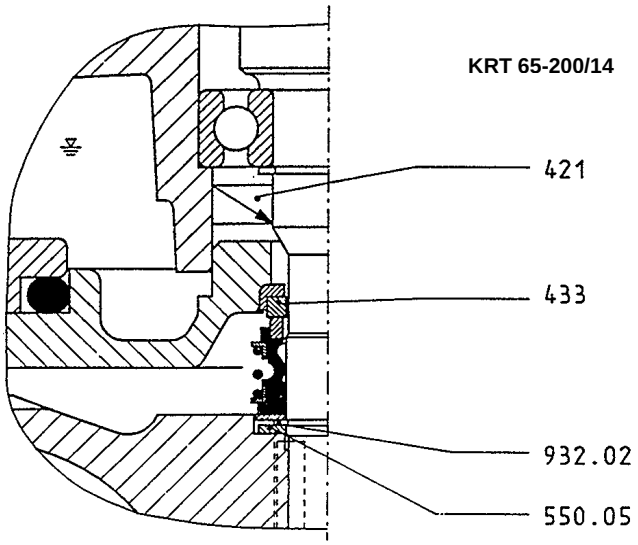
Part No.	Part description
503	Impeller wear ring
524	Shaft protecting sleeve
540	Bush
550	Disc
551	Spacer disc
552	Locking disc
561	Grooved pin
562	Cylindrical pin
689	Isolation
812	Motor casing
818	Rotor
824	Cable
834	Cable duct
900	Screw
901	Hexagon head bolt
903	Screwed plug
904	Screwed pin
906	Impeller screw
914	Socket head cap screw
920	Nut
922	Impeller nut
930	Safety device
931	Safety sheet
932	Circlip
940	Key

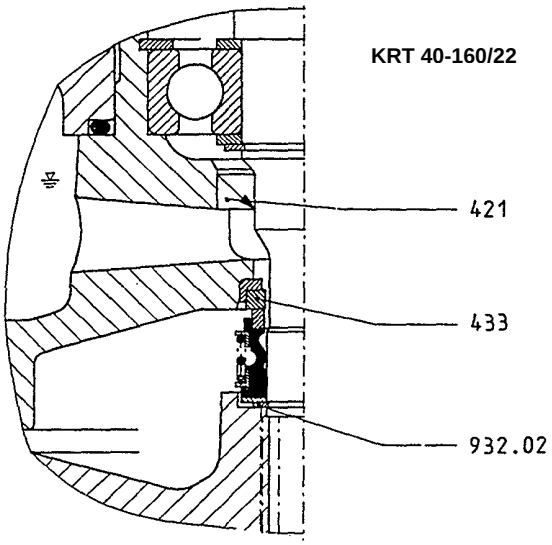
Installation plan – mechanical seal

Motors: 0 2...2 2
1 4

40-160
65-200





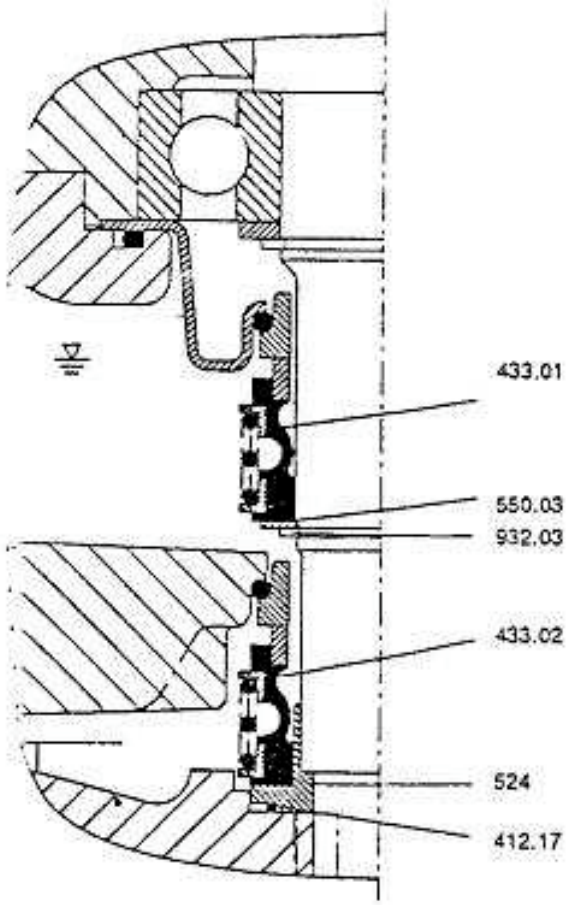


Part No.	Part description
421	Rotary shaft seal
433	Mechanical seal
433.01	Mechanical seal
433.02	Mechanical seal
550	Disc
932	Circlip

Installation plan – mechanical seal

Motors: 1 4...3 4

80-200
100-200



Part No.	Part description
412	O-Ring
433.01	Mechanical seal
433.02	Mechanical seal
524	Shaft protecting sleeve
550	Disc
932	Circlip

General outline installation set

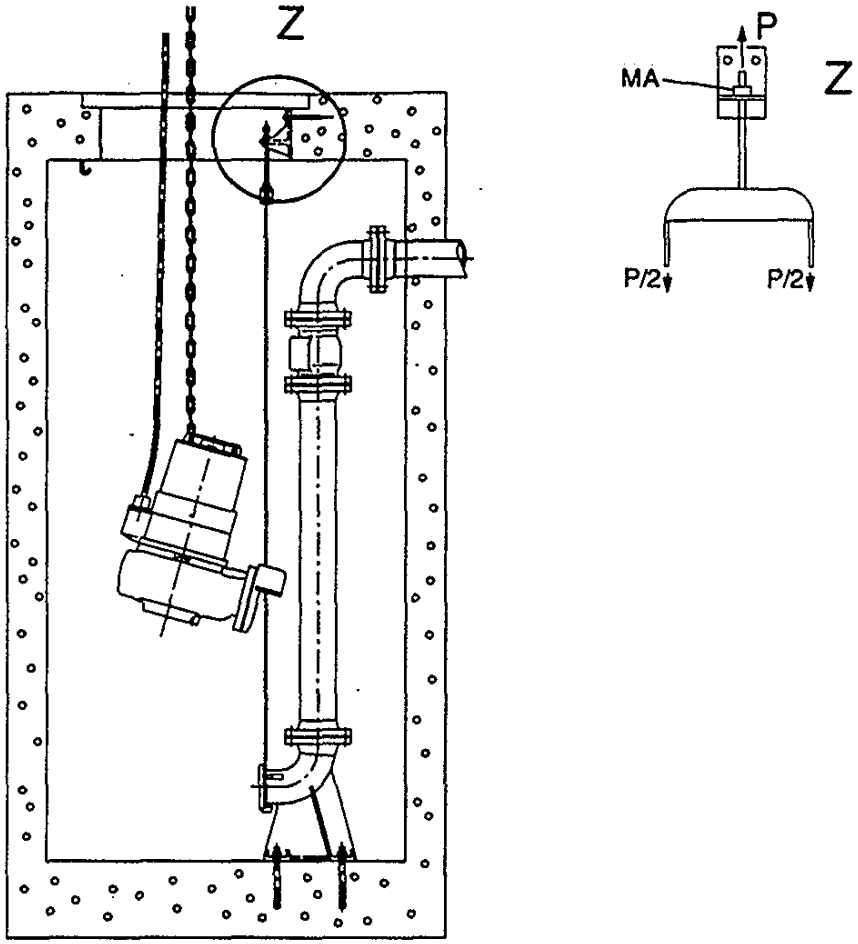


Fig. 1

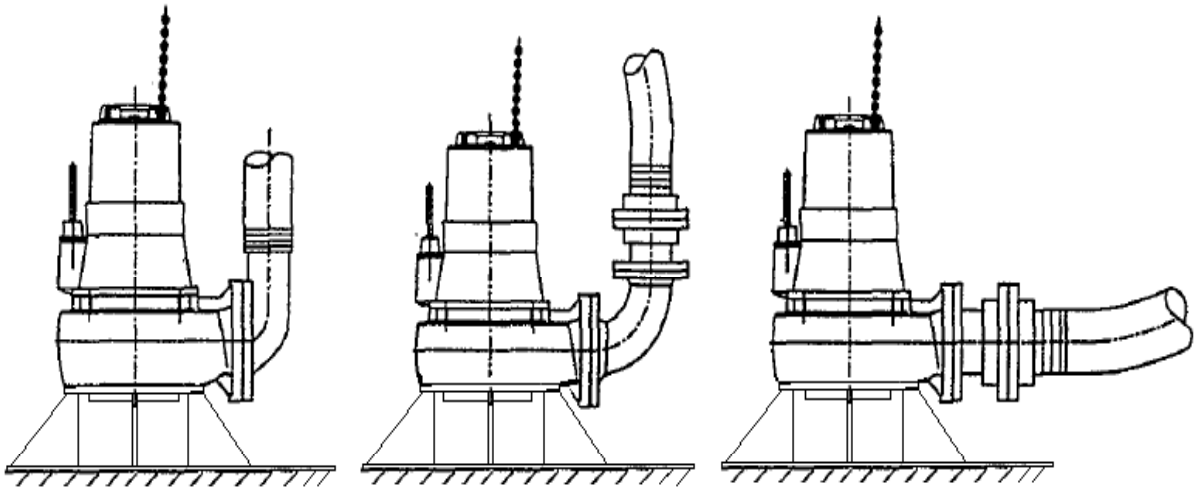
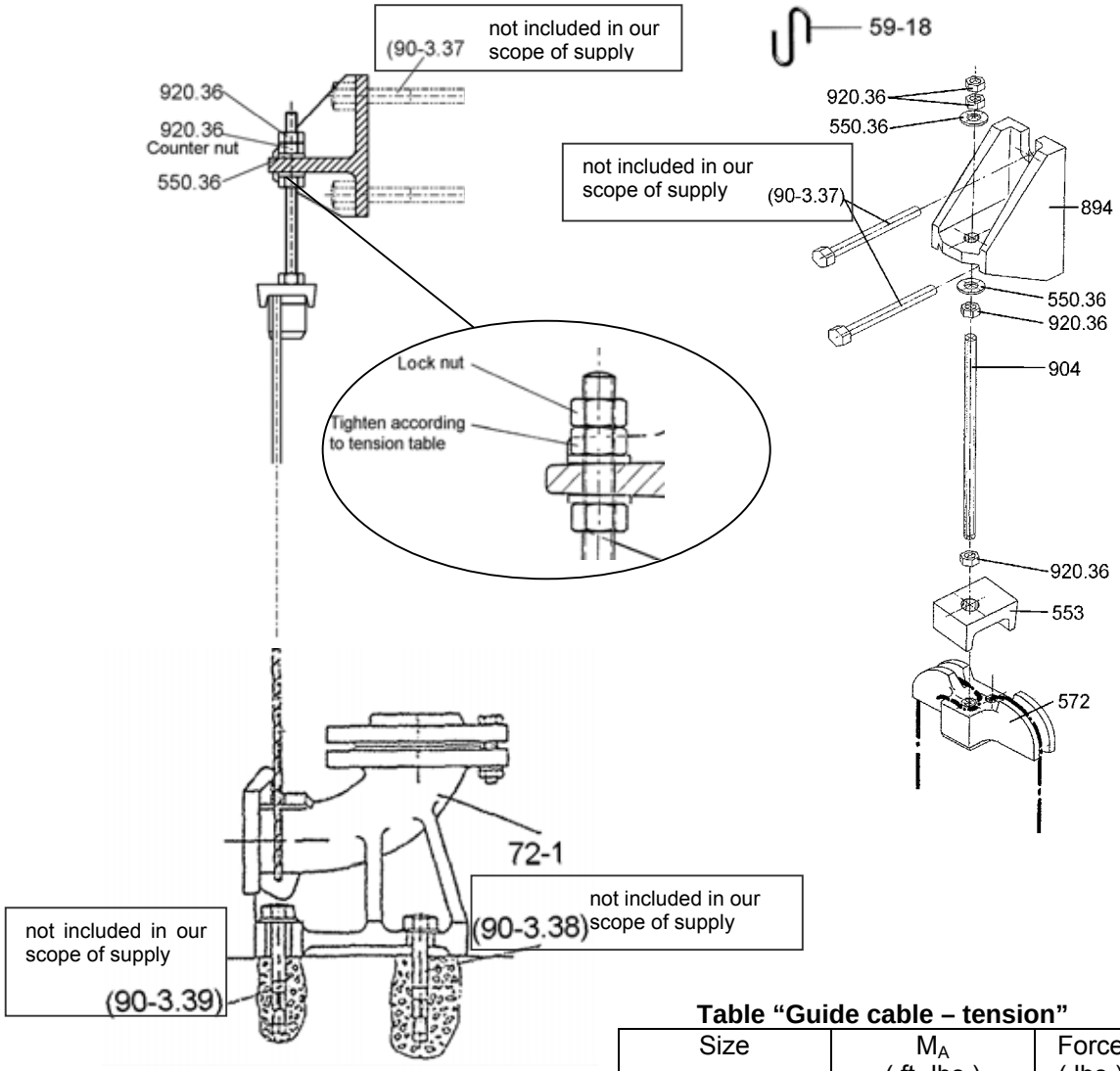


Fig. 2

Wet–well installation with guide cable

Motors: 0 2...2 2 40-160



IDENT No. PART LIST 3349A7683

IDENT No.	ZN200	DENOMINATION	QT
3348A7412	894	BRACKET	1
3348A7411	572	CLAMP	1
011457137	904	TIE ROD	1
3348A7413	553	THRUST INSERT	1
011250365	920.36	NUTS	4
011866101	970	PLATE	1
011305334	550.36	WASHERS	2
008956803	59-18	S-HOOK	1

Table “Guide cable – tension”

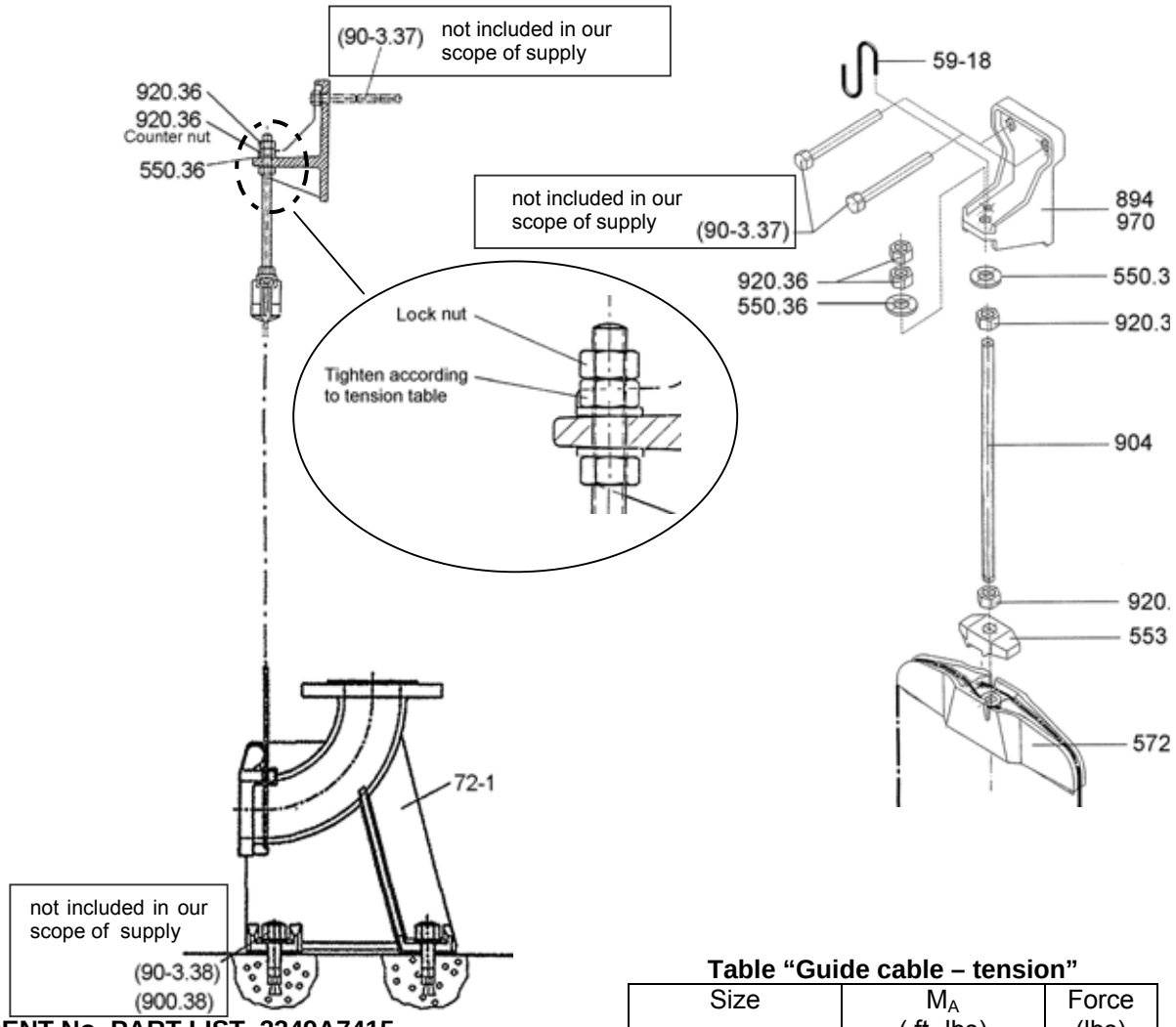
Size	M_A (ft.-lbs)	Force (lbs)
40-160	5	675

M_A = Tightening torque
Force = Cable tension

The guide cable needs to be properly tensioned. Tensioning is achieved by tightening the hexagonal nut (part # 920.36) situated on top of the mounting bracket. Use the torque of MA outlined in the table “Guide cable tension” to achieve sufficient cable tension. The second hexagonal nut is used subsequently to secure it. The loose end of the cable at the clamp (572) can be either twisted into a ring or the end can be cut off using an acetylene torch. This should fuse or weld the ends of the cables to avoid fraying.

Wet–well installation with guide cable

Motors: 0 2...2 2 65-200
1 4...3 4 80/100-200



IDENT No. PART LIST 3349A7415

IDENT No.	ZN200	DENOMINATION	QT
3348A7185	894	BRACKET	1
3348A7183	572	CLAMP	1
011456944	904	TIE ROD	1
3348A7181	553	THRUST INSERT	1
011222904	920.36	NUTS	4
011866102	970	PLATE	1
011303053	550.36	WASHER	2
008956803	59-18	S-HOOK	1

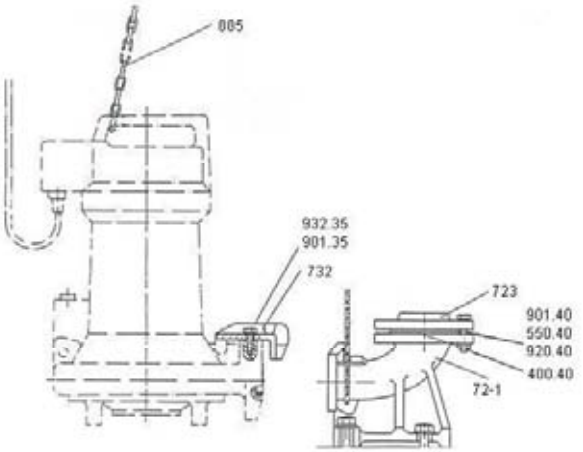
Table "Guide cable – tension"

Size	M_A (ft.-lbs)	Force (lbs)
65-200	7	900
80-200 100-200	10	1350

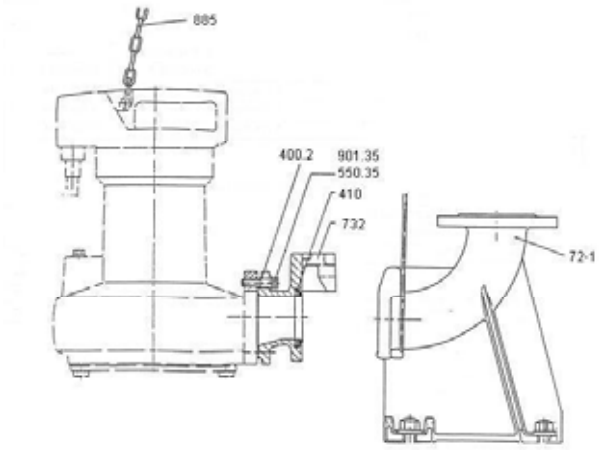
M_A = Tightening torque
Force = Cable tension

The guide cable needs to be properly tensioned. Tensioning is achieved by tightening the hexagonal nut (part #920.36) situated on top of the mounting bracket. Use the torque of MA outlined in the table "Guide cable tension" to achieve sufficient cable tension. The second hexagonal nut is used subsequently to secure it. The loose end of the cable at the clamp (572) can be either twisted into a ring or the end can be cut off using an acetylene torch. This should fuse or weld the ends of the cables to avoid fraying.

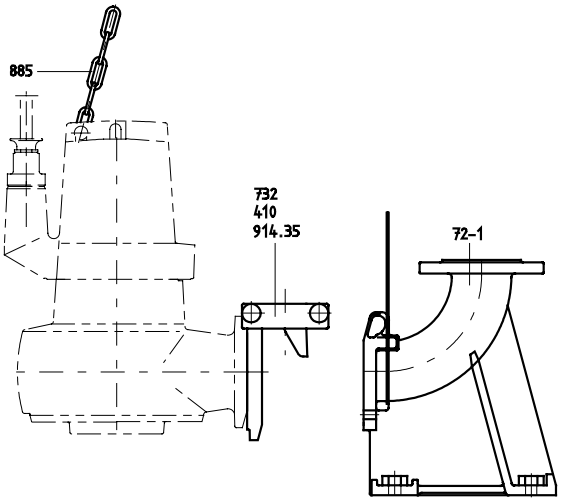
KRT 40-160



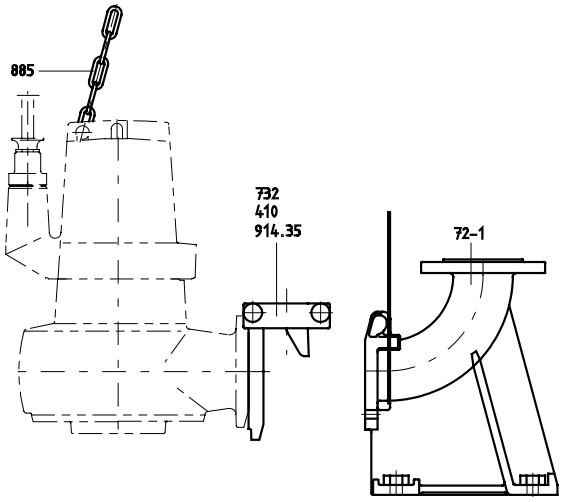
KRT 65-200



KRT 80-200



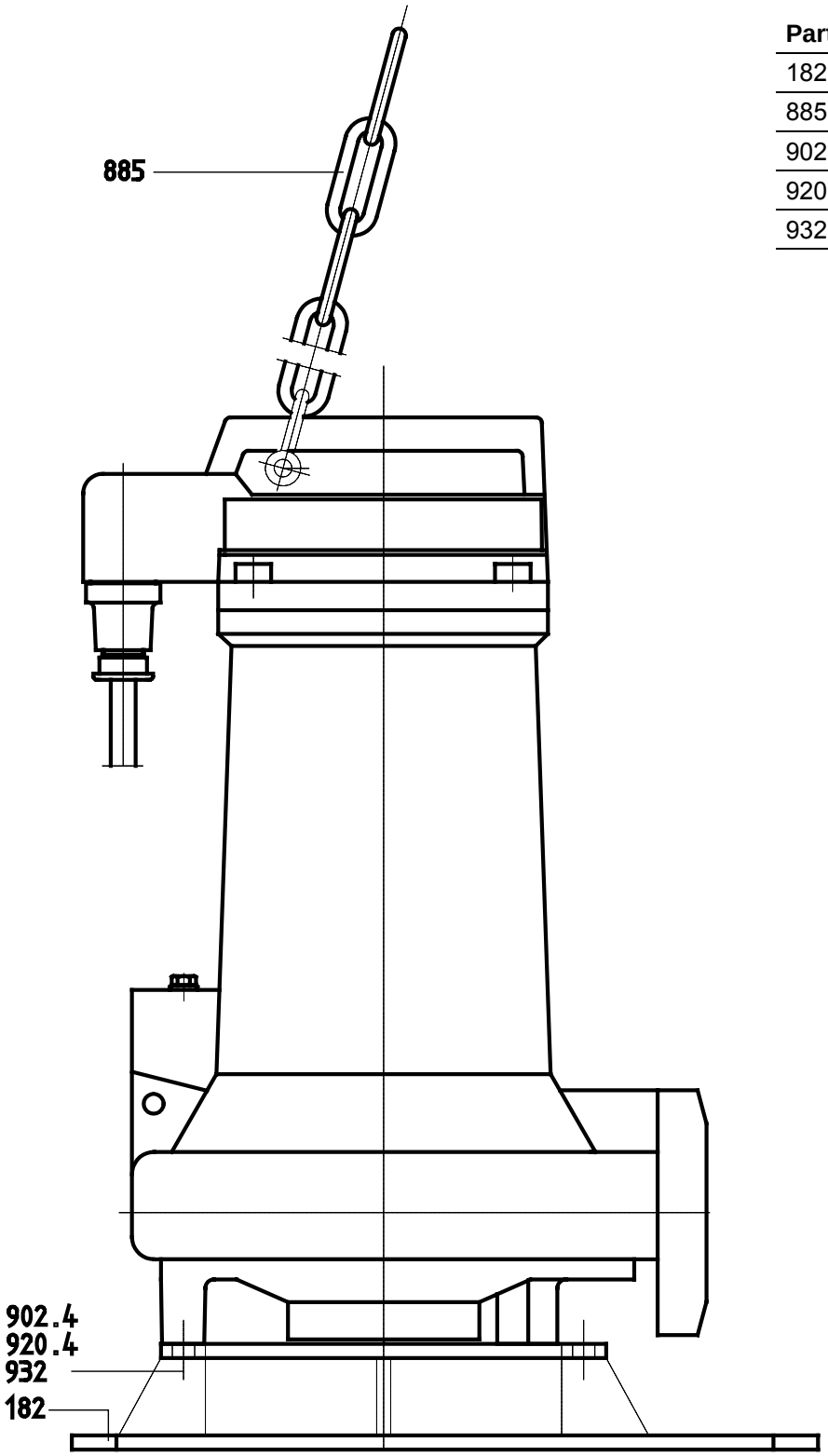
KRT 100-200



Part No.	Part description
72-1	Flanged bend
400	Flat gasket
410	Profile joint
550	Disc
572	Clamp
723	Flange
732	Holder
885	Chain
901	Hexagon head bolt
902	Stud
914	Socket head capscrew
920	Nut
931	Lockwasher
932	Circlip

Wet–well installation transportable

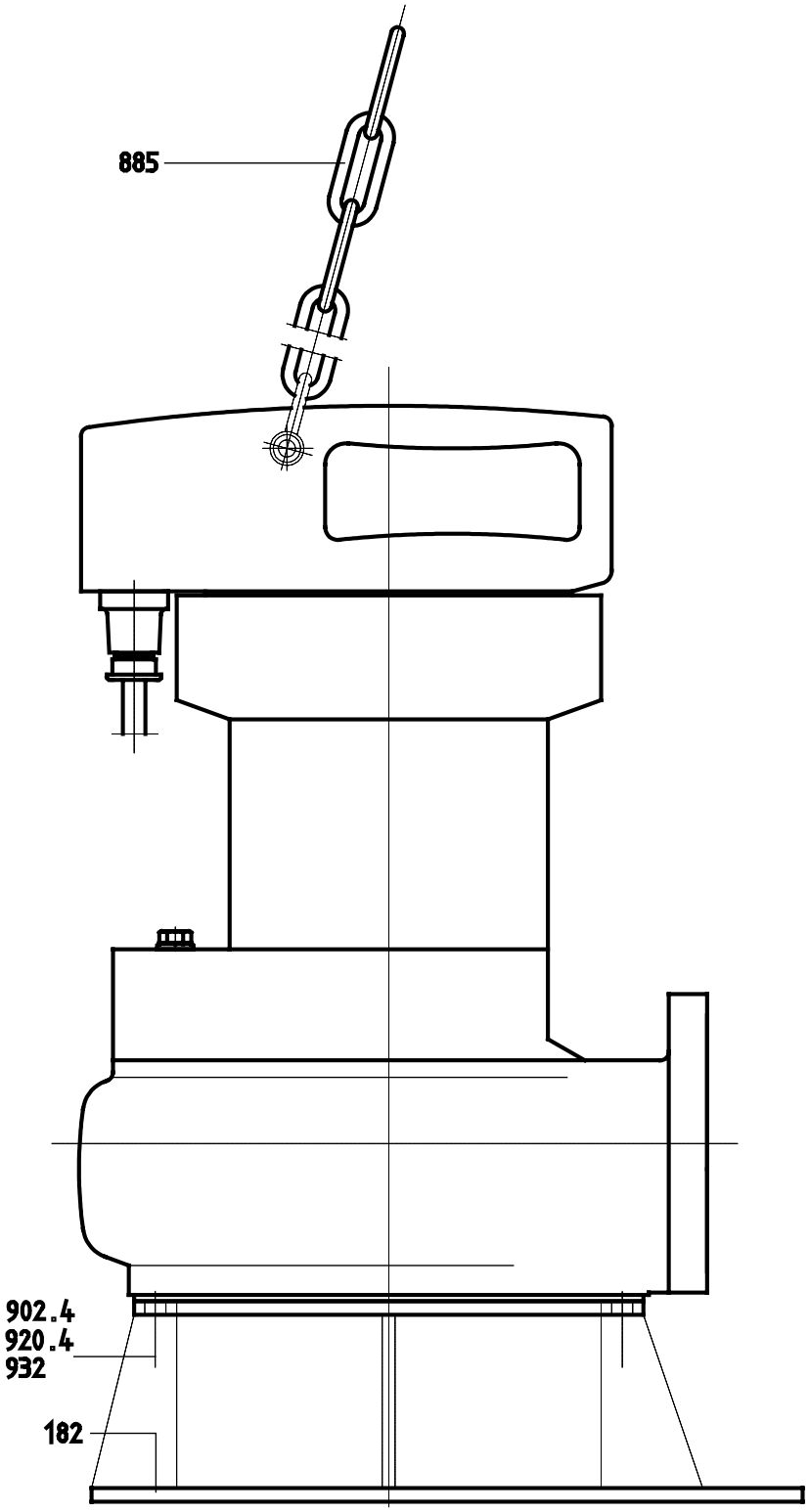
Motors: 0 2...2 2 40-160



Part No.	Part description
182	Portable stand
885	Chain
902	Stud
920	Nut
932	Circlip

Wet–well installation transportable

Motors: 1 4 65-200

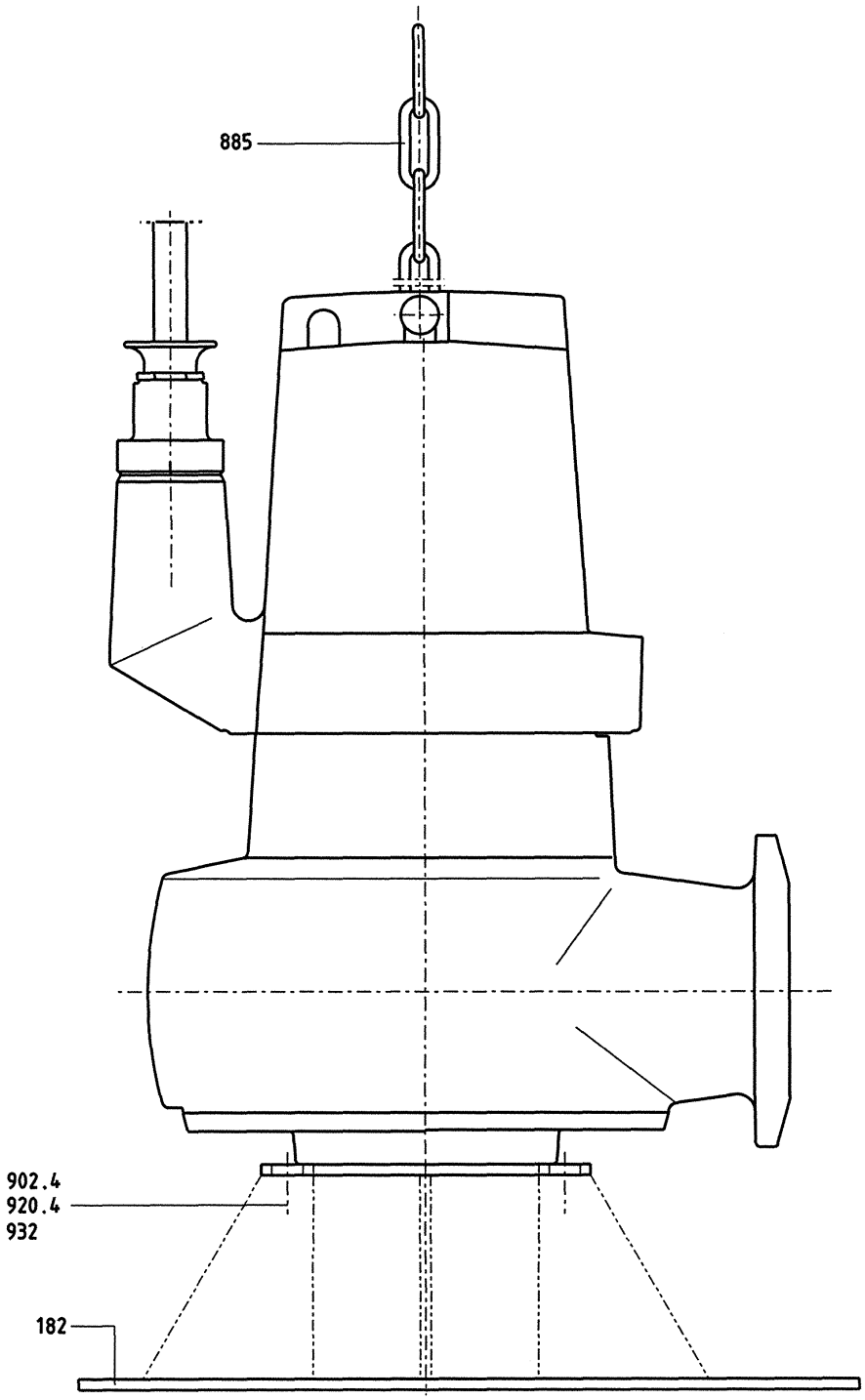


Part No.	Part description
182	Portable stand
885	Chain
902	Stud
920	Nut
932	Circlip

Wet–well installation transportable

Motors: 1 4...3 4

80-200
100-200



Part No.	Part description
182	Portable stand
885	Chain
902	Stud
920	Nut
932	Circlip

Electrical connection diagram

Motors: 0 2 U 230 V

Motor running with start and run capacitors:
Start capacitors: 90 microFarad (230 Volts)
Run capacitors: 65 microFarad (230 Volts)

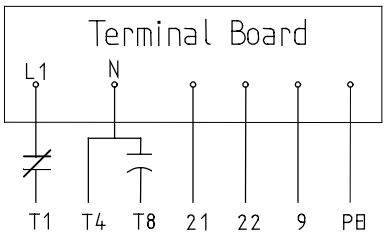
Description - Thermal motor monitoring

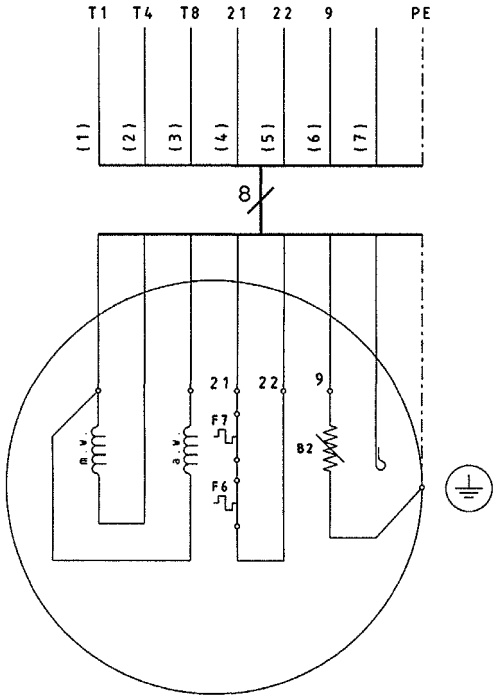
The winding is protected by a temperature monitoring circuit:

F6, F7 = 2 bimetallic switches in the motor winding,
Identification tape 21, 22,
max. operating voltage of switch: 250 V,
max. current: 2 A.

It is necessary to use this circuit to protect the winding.
Using of bimetallic switches:
The conductors have to be directly connected to the control circuit of the motor contactor.
It must switch of the pump when the maximum winding temperature is reached and automatically on again after the motor have cooled down.

⚠ **Temperature monitoring in the winding protects the motor in case of insufficient cooling. Reliable operation and explosion-proof protection can only be guaranteed if the circuits for temperature monitoring function properly.**





Description – moisture device monitoring

The winding is protected by a Moisture sensor (electrode):

B2: = Moisture sensor (electrode),
Installed in the motor chamber,
Identification tape 9

Cable Identification

7x...mm²	**Identification tape.**	**Cable identification numbers or colours**
A07RN-F:	T1	(1)
	T4	(2)
	T8	(3)
	21	(4)
	22	(5)
	9	(6)

Electrical connection diagram

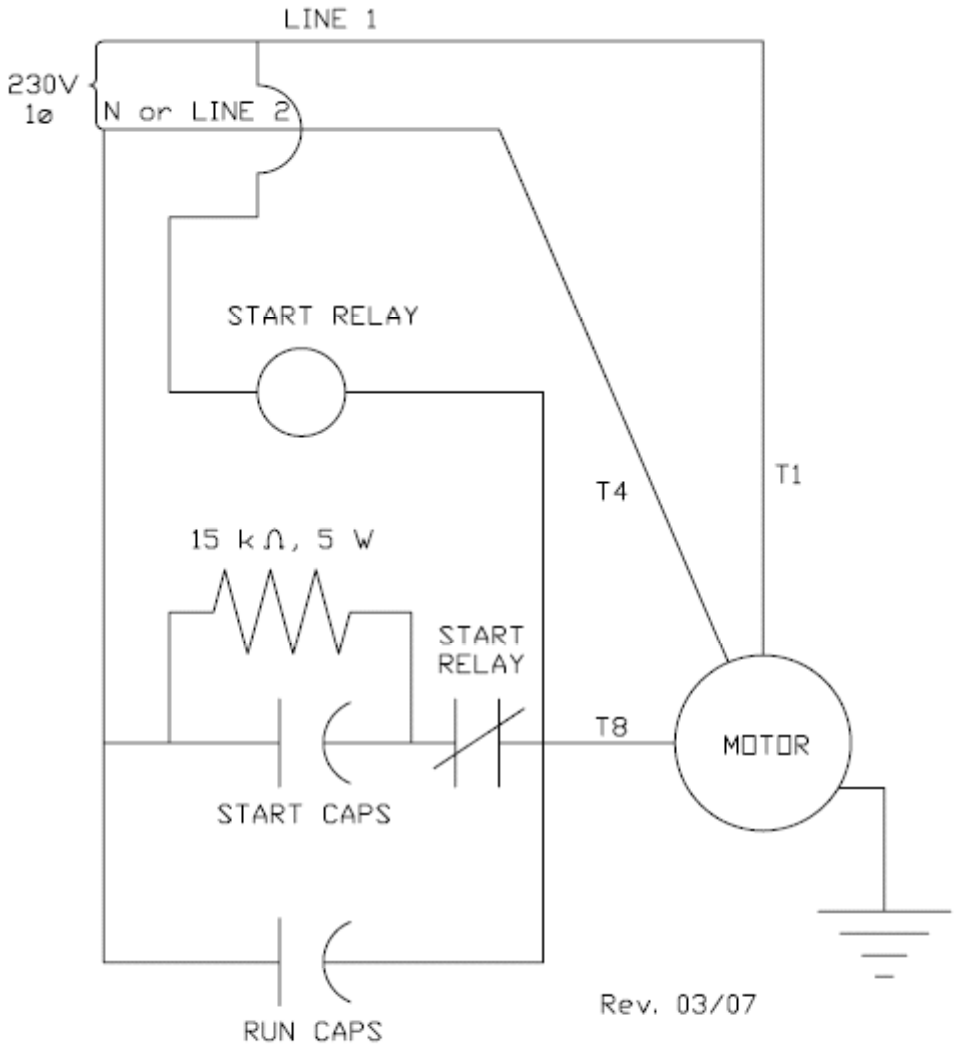
Motors: 0 2 U 230 V

single phase with start and run capacitor

Motor Running with Start & Run Capacitor

Start Capacitor: 90 microFarad

Run Capacitor: 65 microFarad for 230V



Electrical connection diagram

Motors: 2 2 U, 1 4 U 230 V
2 2 U, 1 4 U 460 V

Description - Thermal motor monitoring

The winding is protected by a temperature monitoring circuit:

F6 = 1 bimetallic switches in the motor winding,
Identification tape 21, 22
max. operating voltage of switch: 250 V,
max. current: 2 A.

It is necessary to use this circuit to protect the winding.
Using of bimetallic switches:
The conductors have to be directly connected to the control circuit of the motor contactor.
It must switch of the pump when the maximum winding temperature is reached and automatically on again after the motor have cooled down.

⚠ **Temperature monitoring in the winding protects the motor in case of insufficient cooling. Reliable operation and explosion-proof protection can only be guaranteed if the circuits for temperature monitoring function properly.**

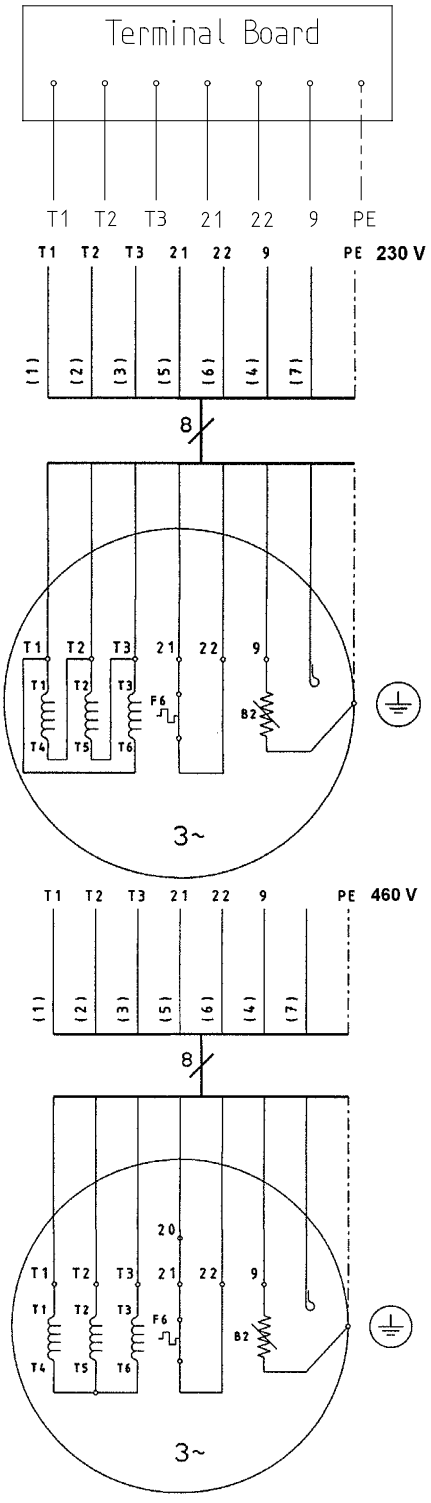
Description – moisture device monitoring

The winding is protected by a Moisture sensor (electrode):

B2: = Moisture sensor (electrode),
Installed in the motor chamber,
Identification tape 9

Cable Identification

8x...mm²	**Identification tape.**	**Cable identification numbers or colours**
NSSHOU-J or	T1	(1)
A07RN-F:	T2	(2)
	T3	(3)
	21	(5)
	22	(6)
	9	(4)



Electrical connection diagram

Motors: 2 2 X, 1 4 X1 230 V
2 2 X, 1 4 X1 460 V

Description - Thermal motor monitoring

The winding is protected by two independent temperature monitoring circuits:

F4, F5 = 2 bimetallic switches in the motor winding,
Identification tape 20, 21,
max. operating voltage of switch: 250 V,
max. current: 2 A.

F6, F7 = 2 bimetallic switches in the motor winding,
Identification tape 21, 22,
max. operating voltage of switch: 250 V,
max. current: 2 A.

It is necessary to use one of both circuits to protect the winding.
Using of bimetallic switches:
The conductors have to be directly connected to the control circuit of the motor contactor.
It must switch of the pump when the maximum winding temperature is reached and automatically on again after the motor have cooled down.

⚠ **Temperature monitoring in the winding protects the motor in case of insufficient cooling. Reliable operation and explosion-proof protection can only be guaranteed if the circuits for temperature monitoring function properly.**

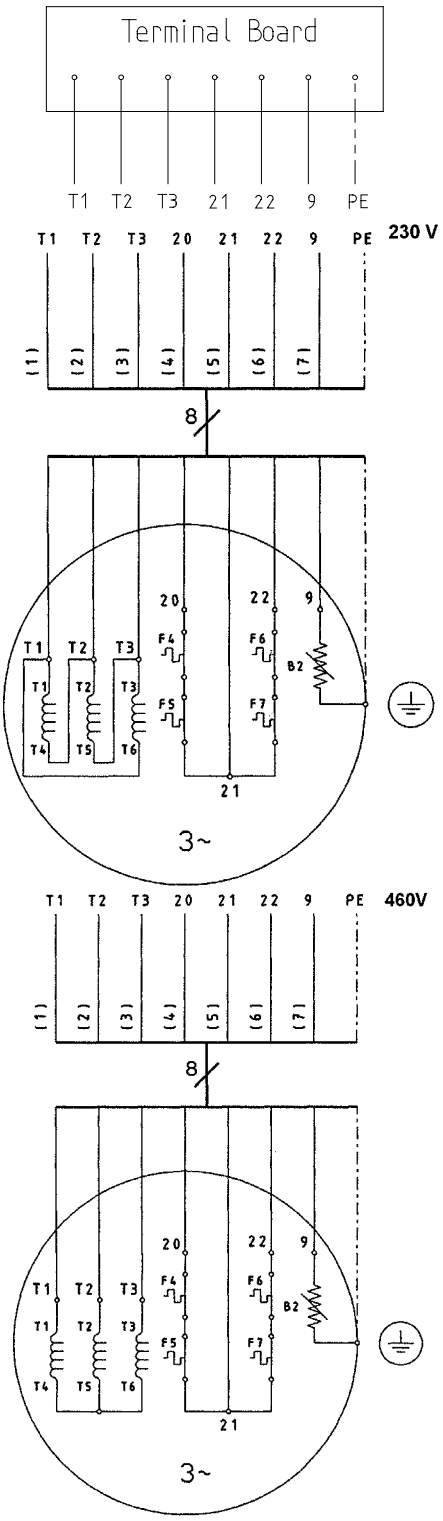
Description – moisture device monitoring

The winding is protected by a Moisture sensor (electrode):

B2: = Moisture sensor (electrode),
Installed in the motor chamber,
Identification tape 9

Cable Identification

8x...mm²	Identification tape	Cable identification numbers or colours
NSSHOU-J or	T1	(1)
A07RN-F:	T2	(2)
	T3	(3)
	20	(4)
	21	(5)
	22	(6)
	9	(7)



Electrical connection diagram

Motors: 1 4 X2, 2 4 X, 3 4 X 230 V
1 4 X2, 2 4 X, 3 4 X 460 V

Description - Thermal motor monitoring
The winding is protected by two independent temperature monitoring circuits:
F4, F5 = 2 bimetallic switches in the motor winding,
Identification tape 21, 22,
max. operating voltage of switch: 250 V,
max. current: 2 A.
R1, R2, R3 = 3 PTC thermistors in the motor winding,
Identification tape 10, 11,
max. operating voltage on terminals,
$U_{max.}$ = 30 V d.c.
resistance between terminals 10 / 11,
- at ambient temperature 100–750 Ω,
- at shut down temperature > 4000 Ω.

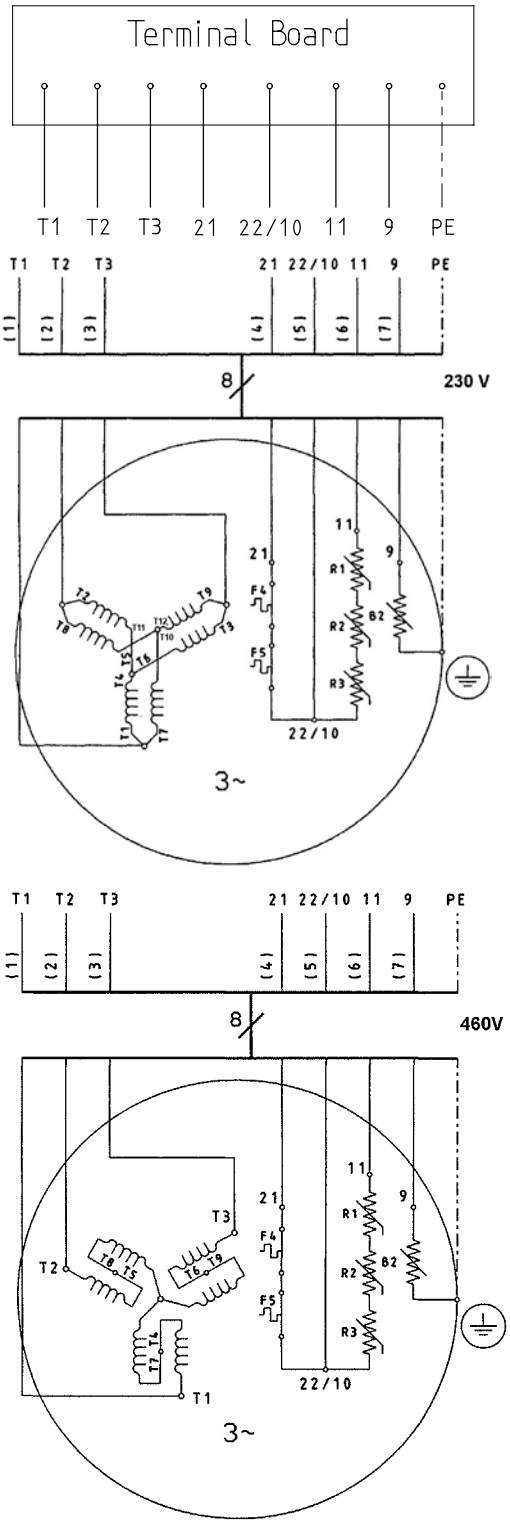
It is necessary to use one of both circuits to protect the winding.
Using of bimetallic switches:
The conductors have to be directly connected to the control circuit of the motor contactor.
It must switch of the pump when the maximum winding temperature is reached and automatically on again after the motor have cooled down.
Optional use of thermistors (PTC):
A thermistor control unit with manual / auto reset may be installed in the control circuit of the motor.
It must switch off the pump when the maximum winding temperature is reached.
In this case no additional equipment is necessary.

⚠ **Temperature monitoring in the winding protects the motor in case of insufficient cooling. Reliable operation and explosion-proof protection can only be guaranteed if the circuits for temperature monitoring function properly.**

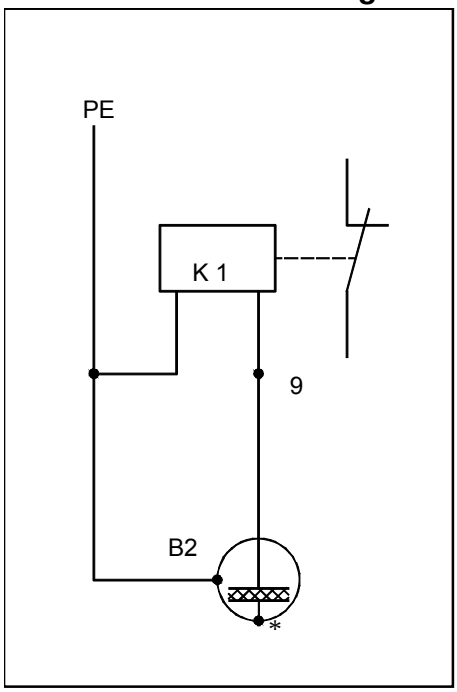
Description – moisture device monitoring
The winding is protected by a Moisture sensor (electrode):
B2: = Moisture sensor (electrode),
Installed in the motor chamber,
Identification tape 9

Cable Identification

8x...mm²	Identification tape	Cable identification numbers or colours
NSSHOU-J:	T1	(1)
	T2	(2)
	T3	(3)
	21	(4)
	22	(5)
	10	(5)
	11	(6)
	9	(7)



Function Chart – Leakage detection



Leakage inside the motor
To protect against motor damage due to liquid entry into the motor an electrode is fitted inside the motor housing close to the junction box. Tripping of the electrode relay must result in the pump being shut off. The electrode relay (K1) must meet the following requirements: Sensor circuit 10 to 30V~, tripping current 0.5 to 3 mA.

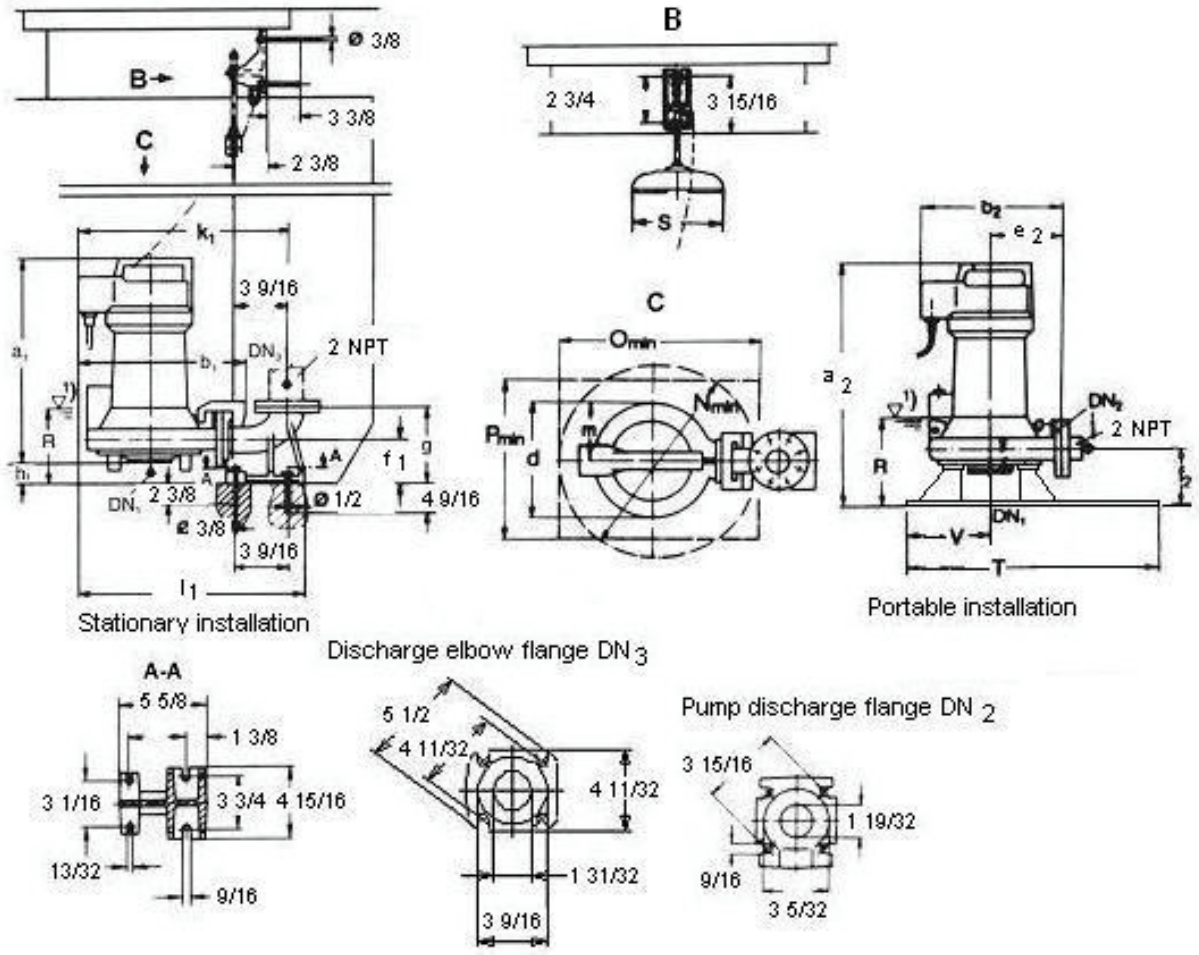
Check of the leakage sensor
Measure the resistance between terminal 9 and the earth conductor (PE).
The resistance measured must be higher than 60 kΩ. Lower resistance values would suggest water ingress into the motor. In this case the motor must be opened and overhauled.

B2 = Leakage sensor inside the motor
Core identification: 9,

K1 = Electrode relay.

Dimension table

KRT 40-160



KRT... U,X	DN_1	DN_2	DN_3	MOTOR PUMP DIMENSIONS												
				a_1	a_2	b_1	b_2	d	e_2	f_1	f_2	g	h_1	k_1	l	m
F 40-160/22	2 3/16	2 NPT	2NPT	16 3/8	18	12 7/8	11	8 15/16	5 11/16	3 7/16	4	5 7/8	1 9/16	15 5/8	17 1/8	4 9/16
S 40-160/22	-												2 3/16			
S 40-160/02	-															

Dimensions in inches

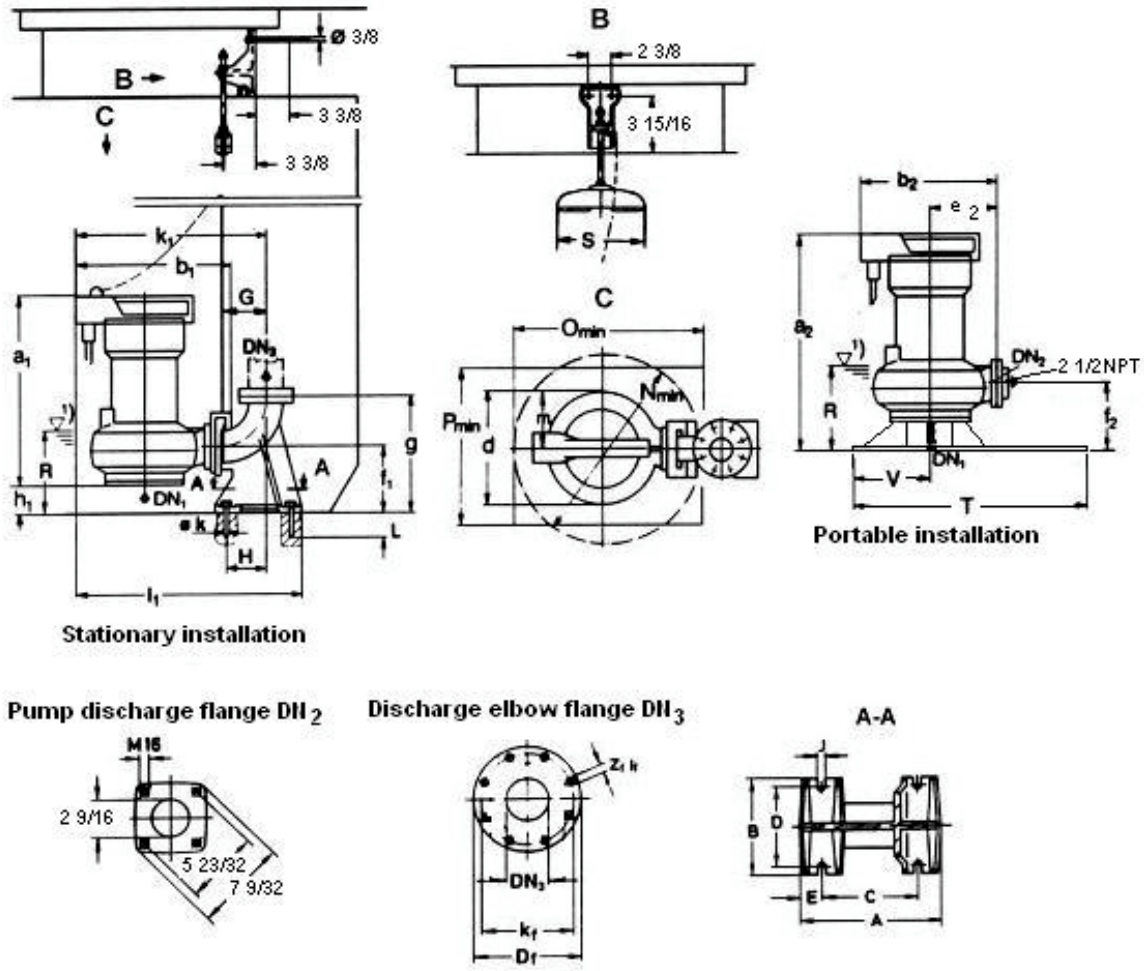
KRT... U,X	INSTALLATION PUMP DIMENSIONS							Motor pump weight (lbs) G (material)
	N	O	P	R	S	T	V	
F 40-160/22	14 31/32	14 31/32	11 13/16	4 11/32	3 1/8	13 3/16	5 17/32	88
F 40-160/22								91
S 40-160/02								91

Dimensions in inches

1) Lowest shut-off point for automatic operation

Dimension table

KRT 65-200



DISCHARGE ELBOW FOUNTATION DIMENSIONS										
DN_3	A	B	C	D	E	G	H	J	ØK	L
3	9 27/32	7 7/8	7 3/32	5 59/32	1 3/8	5 5/16	4 15/16	9/16	1/2	4 17/32

Dimensions in inches

DISCHARGE ELBOW FLANGE DN_3					
DN_3	kf	Df	zf	Ø lf	STANDARD
3	6	7 17/32	4	23/32	ANSI B16.1 125#FF

Dimensions in inches

KRT... U,X	DN1	DN2	MOTOR PUMP DIMENSIONS												
			a_1	a_2	b_1	b_2	d	e_2	f_1	f_2	g	h_1	k_1	l	m
F 65-200/14	2 3/16	2 9/16	17 1/8	20 9/32	16 5/32	11 5/8	11 7/16	5 29/32	6 1/8	6 1/2	12 7/32	2 25/32	20 1/2	24 1/32	5 29/32

Dimensions in inches

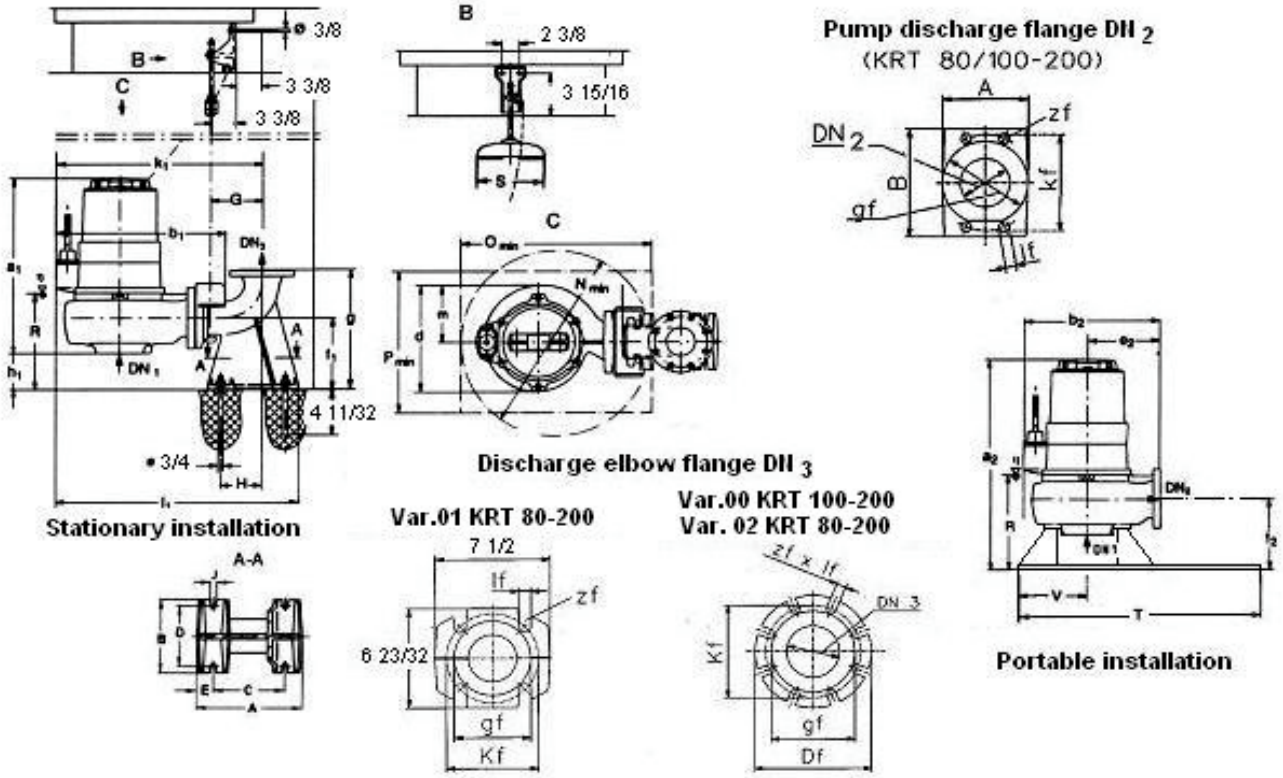
F KRT... U,X	INSTALLATION PUMP DIMENSIONS							Motor pump weight (lbs) G (material
	N	O	P	R	S	T	V	
65-200/14	20 3/32	20 3/32	15 3/4	8 9/32	6 1/2	13 3/16	5 17/32	88

Dimensions in inches

1) Lowest shut-off point for automatic operation

Dimension table

KRT 80-200



DISCHARGE ELBOW FOUNDATION								
Pump size	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**J**
80-200	**11 13/16**	**7 7/8**	**8 11/16**	**5 29/32**	**1 19/32**	**6 1/32**	**5 17/32**	**25/32**

Dimensions in inches

DISCHARGE ELBOW FLANGE DN_3									
Pump size	**Var**	**DN2**	**DN3**	**gf**	**kf**	**Df**	**zf**	**Ølf**	**Standard**
80-200	**02**	**3**	**4**	**5**	**7 3/32**	**8 11/16**	**8**	**23/32**	**ANSI B16.1 125#RF**
80-200	**01**	**3**	**3**	**5**	**6**	**8 3/8**	**4**	**13/16**	**ANSI B16.1 125#RF**

Dimensions in inches

KRT... U,X	DN_1	DN_2	MOTOR PUMP DIMENSIONS												
			a_1	a_2	b_1	b2	d	e2	f1	f2	g	h1	k1	l	m
F/E 80-200/14	3	3	19 5/16	24 5/8	18 23/32	15 9/16	12 5/8	8 9/32	7 7/8	9 1/4	14 31/32	3 15/16	23 1/32	27 25/32	6 1/2
F/E 80-200/24			19 29/32	25 7/32											
F/E 80-200/34															

Dimensions in inches

KRT... U,X	INSTALLATION PUMP DIMENSIONS							Motor pump weight (lbs) G (material)
	N	O	P	R	S	T	V	
F/E 80-200/14	21 21/32	21 21/32	15 3/4	12 13/16	6 1/2	17 23/32	7 7/8	185
F/E 80-200/24								199
F/E 80-200/34								210

Dimensions in inches

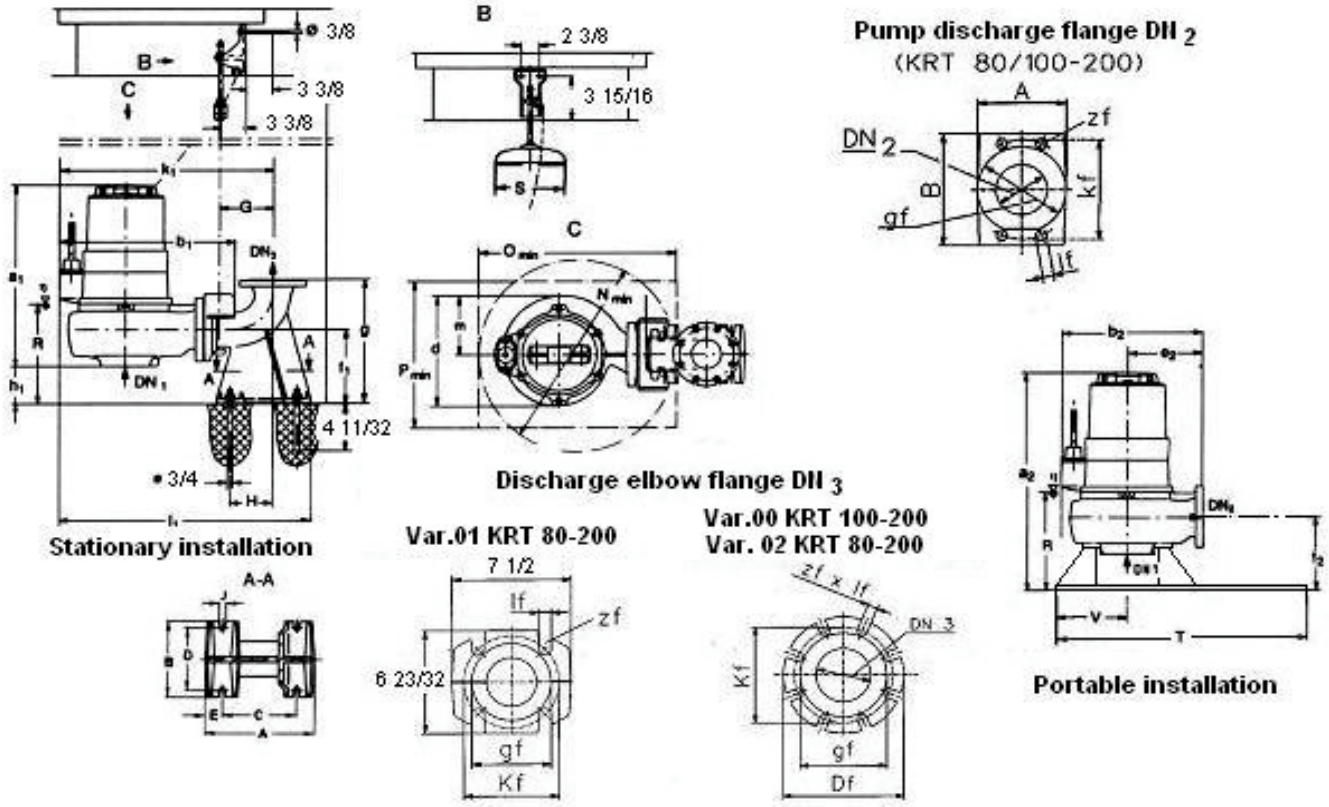
DISCHARGE PUMP FLANGE DN_2						
DN_2	A	B	g_f	k_f	$Øl_f$	z_f
3	5 7/16	7 7/32	5 7/16	6 5/16	11/16	4
4	6 7/32	8 9/32	6 7/32	7 3/32	23/32	4

Dimensions in inches

1) Lowest shut-off point for automatic operation

Dimension table

KRT 100-200



DISCHARGE ELBOW FOUNDATION								
Pump size	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**J**
100-200	**12 7/32**	**7 7/8**	**8 11/16**	**5 29/32**	**1 25/32**	**6 1/2**	**5 17/32**	**25/32**

Dimensions in inches

DISCHARGE ELBOW FLANGE DN_3									
Pump size	**Var**	**DN2**	**DN3**	**gf**	**kf**	**Df**	**zf**	**Ølf**	**Standard**
100-200	**00**	**4**	**4**	**6 3/16**	**7 3/32**	**8 11/16**	**8**	**23/32**	**ANSI B16.1 125#RF**

Dimensions in inches

KRT... U,X	DN_1	DN_2	MOTOR PUMP DIMENSIONS												
			a_1	a_2	b_1	b2	d	e2	f1	f2	g	h1	k1	l	m
F 100-200/24	4 11/32	4	20 11/16	25 31/32	18 23/32	15 9/16	12 5/8	8 9/32	9 15/32	9 27/32	16 15/16	4 15/16	23 7/32	28 3/8	6 1/2
F 100-200/34															

Dimensions in inches

KRT... U,X	INSTALLATION PUMP DIMENSIONS							Motor pump weight (lbs) G (material)
	N	O	P	R	S	T	V	
F 100-200/24	21	21	15 3/4	12	6 1/2	17	7 7/8	197
F 100-200/34	21/32	21/32		13/16		23/32		205

Dimensions in inches

DISCHARGE PUMP FLANGE DN_2						
DN_2	A	B	g_f	k_f	$Ø l_f$	z_f
3	5 7/16	7 7/32	5 7/16	6 5/16	11/16	4
4	6 7/32	8 9/32	6 7/32	7 3/32	23/32	4

Dimensions in inches

1) Lowest shut-off point for automatic operation

Assembly instruction - Cutter

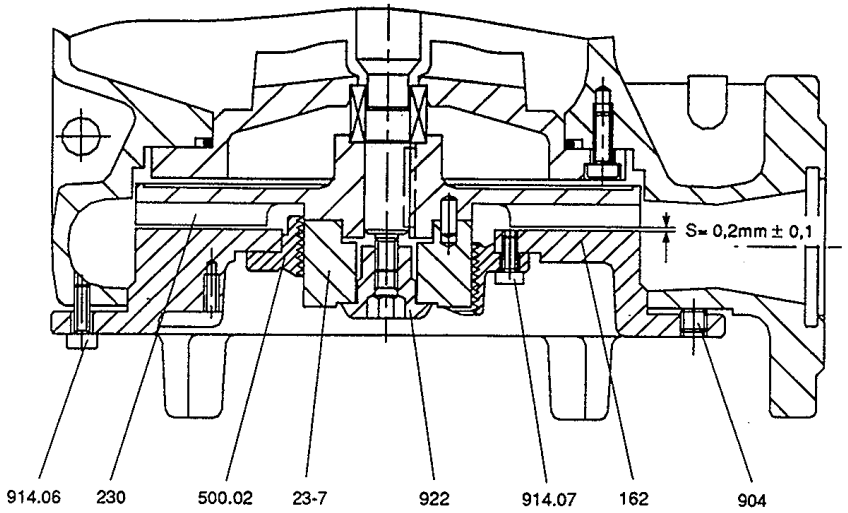


Fig. 1

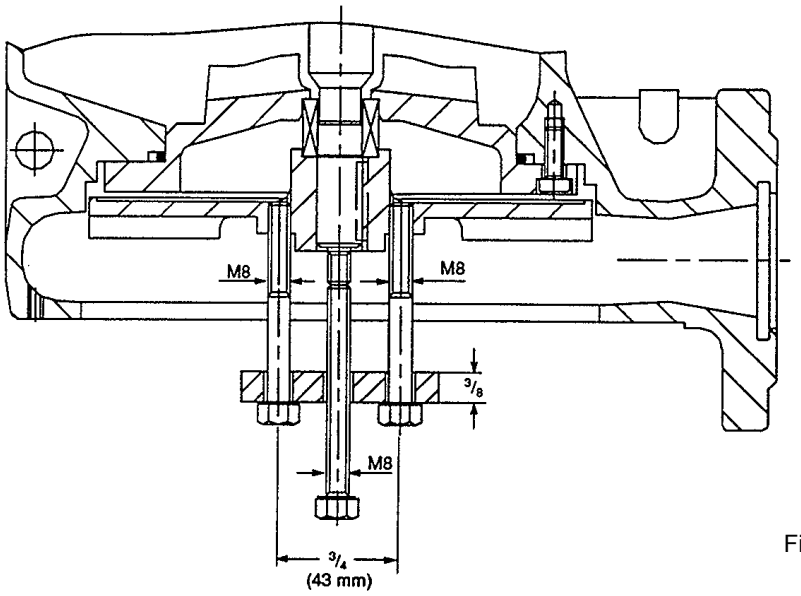


Fig. 2

Dismantling

1. Lock impeller by sticking a screwdriver through the discharge nozzle. Undo impeller nut part # 922 by means of an SW 6 Allen key.
2. Remove screws part # 914.07 and lift out ring part # 500.02 by means of a screwdriver.
3. Detach the impeller body part # 23-7 from the impeller part # 230 by hammering it gently. Remove the impeller body.
4. Undo screws part # 914.06 and lift suction cover part # 162 off the pump.
5. Use pull-off device, see fig. 2, to pull impeller part # 230 off the shaft.

Assembly

Assembly is carried out in reverse sequence. Use threaded pins 904 to adjust the impeller clearance to S = 0,2 mm ± 0,1, see fig. 1.

Installation of Cable Guide Spacers – 3/16‘‘ diameter cable

Installation of Spacers

Installation depth > 10 ft.

Guide cable diameter 3/16‘‘

General remarks

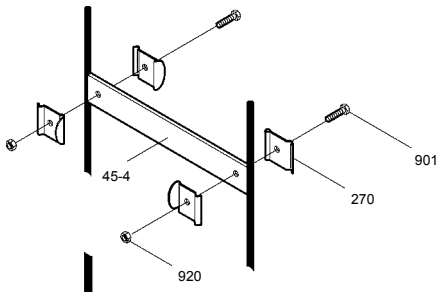
The spacers and required hardware are delivered separately. The spreader is to be mounted horizontally, between the guide cables.

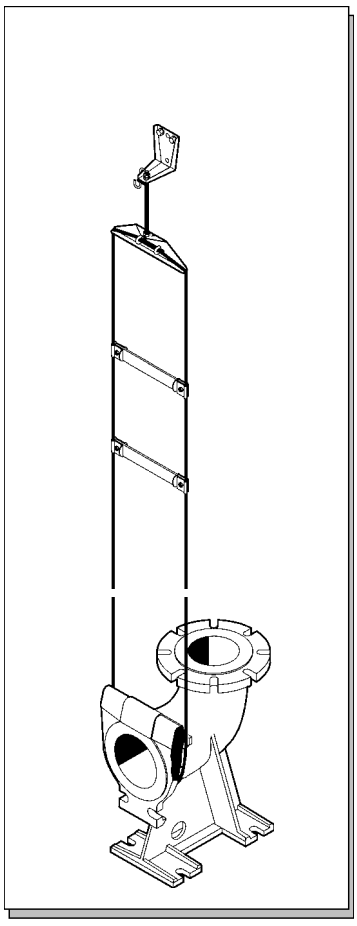
Installation

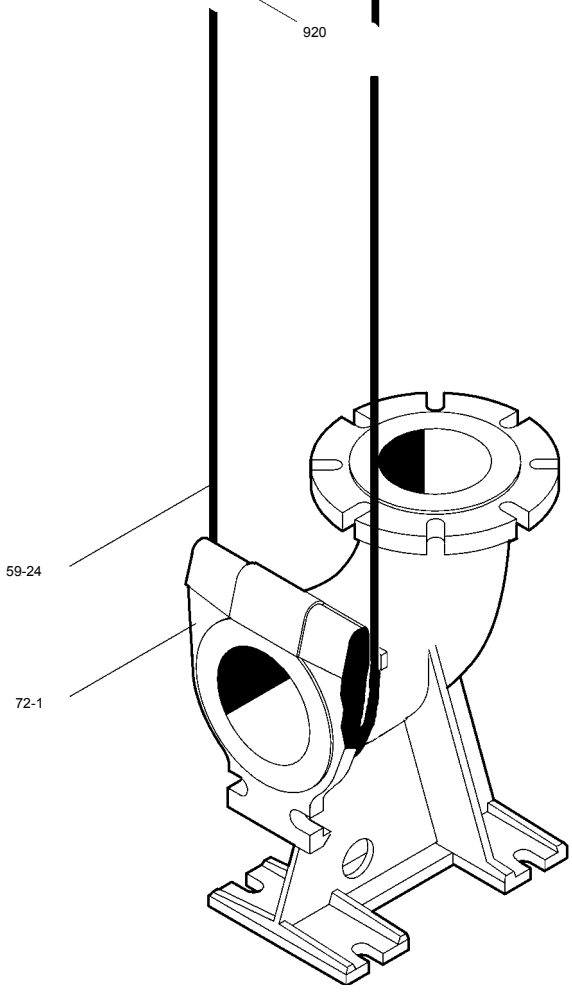
After installing the guide cable:

1. Install the spacer (part # 45–4) in equal vertical distances, every 8 ft, ±15‘‘, between the two guide cables (part # 59–24).
2. Level the spacers in a horizontal position and fasten to the guide cable with the mounting plates (part # 270) and the mounting fasteners (parts # 901 & 920).

Part #	Name
45–4	Spacer
59–24	Guide cable
72–1	Discharge elbow
270	Amounting plate
901	Hex head machine screw
920	Hex nut







Installation of Cable Guide Spreaders

For guide cables at pump depth greater than 15‘ Cable diameter 3/16‘‘

Number of spacers required, at depth greater than					
< 30Ft.	37 – 44 Ft.	45 – 59 Ft.	60 – 74 Ft.	75 – 89 Ft.	90 – 100 Ft.
0	1	2	3	4	5
0	1	2	3	4	5
0	1	2	3	4	5
0	1	2	3	4	5
0	1	2	3	4	5

. . . and should something have to be replaced,

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- **Amacan**
- **Omega**
- **KRT Drainer**
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Fax:	(+55) 11 4596-8580	**Tel:**	(+55) 11 4596-8500
From:			

In order to ensure the smooth processing of your spare parts inquiry, we request that you let us have the following data:

1. Works No. / Item No. enter here

- The works No. is given on the name plate of your pump
  e.g. **2-M01-753328**
  or
  9970428626 000100 2

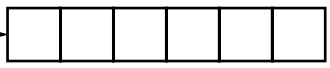
Sample

in addition:

Pump type
e.g. **KRT–F 100–250/7 4 UG–249**

2. Required part with part No.

enter here

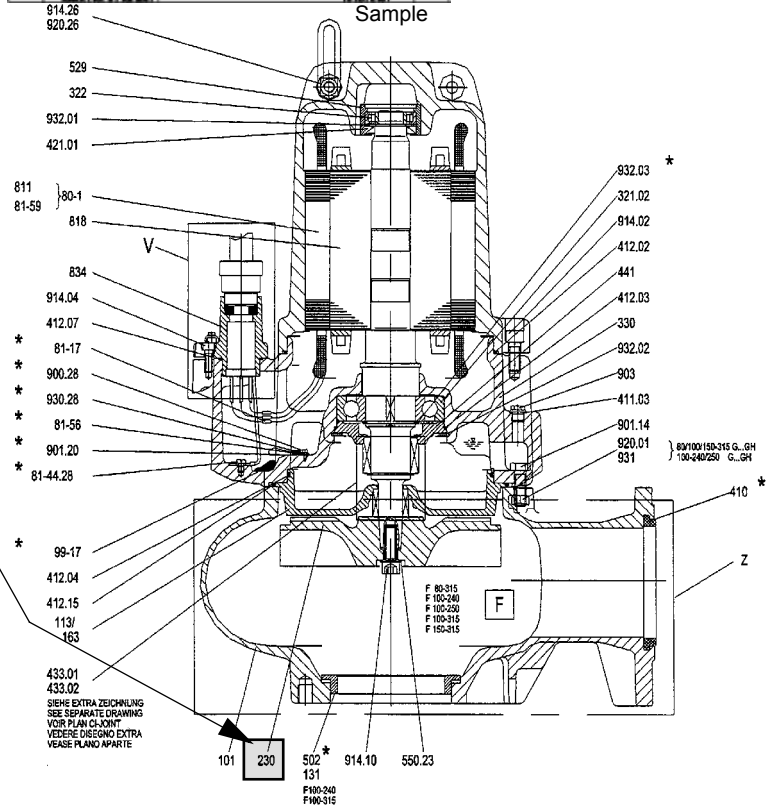


- The description of the parts is given in the operating instructions
  e.g. **Impeller, Part no. 230**

in addition:

for multi-vane impeller:
impeller diameter in mm

for terminal gland:
cable length in mm



28.04.2008

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