

INSTALLATION, CARE AND MAINTENANCE

EXPLOSION-PROOF
CERCHAR MS
MSHA Permissible



GUARANTEE

Flygt undertakes to remedy faults in products sold by Flygt provided:

- that the fault is due to defects in design, materials or workmanship;
- that the fault is reported to Flygt or Flygt's representative during the guarantee period;
- that the product is used only under conditions described in the care and maintenance instructions and in applications for which it is intended;
- that all service and repair work is done by a workshop authorized by Flygt;
- that genuine Flygt parts are used.

Hence, the guarantee does not cover faults caused by deficient maintenance, improper installation, incorrectly executed repair work or normal wear and tear.

Flygt assumes no liability for either bodily injuries, material damages or economic losses beyond what is stated above.

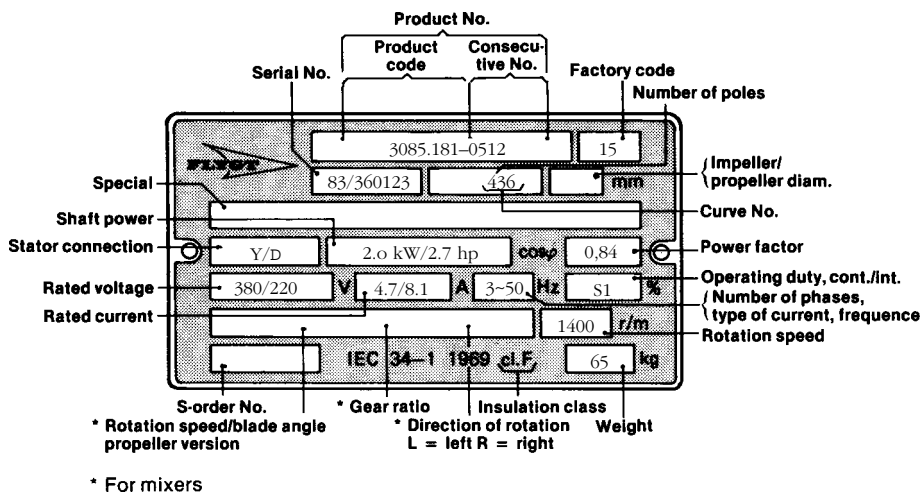
Official approval applies only providing:

- that the product is used under conditions described in the care and maintenance instructions and in applications for which it is intended;
- that all service and repair work is done by a workshop authorized by Flygt;
- that genuine Flygt parts are used.

Flygt guarantees that a spare parts stock will be kept for 10 years after the manufacture of this product has been discontinued.

The manufacturer reserves the right to alter performance, specification or design without notice.

DATA PLATE INTERPRETATION



CONTENTS

Product description _____	3	Electrical connections _____	6
Applications _____	3	Operation _____	11
Design _____	3	Care and maintenance _____	12
Technical data _____	4	Safety precautions _____	12
Caution statement for MSHA _____	4	Inspection _____	12
Dimensions and weights _____	5	Changing the oil _____	14
Transportation and storage _____	5	Replacing the impeller _____	14
Installation _____	6	Accessories and tools _____	16
Safety precautions _____	6	Fault tracing (troubleshooting) _____	18
Pump installation _____	6	Service log _____	22

PRODUCT DESCRIPTION

These care and maintenance instructions apply to an explosion-proof (permissible), submersible Flygt pump.

Applications

2151.080 is intended to be used for:

- pumping of water which may contain abrasive particles
- pumping of ground water.

The pump is designed for use in explosive environments in accordance with the following approvals:

CARCHAR MS	Centre d'Etudes et Recherches des Charbonnages de France, France
MSHA Permissible	Mine Safety and Health Administration, USA

Liquid temperature: max. 40°C (105°F).

Liquid density: max. 1100 kg/m³ (9.2 lb per US gal.).

The pumped liquid may contain particles up to a size which corresponds to the openings in the strainer (7x21 mm, 0.3"—0.8").

The pH of the pumped liquid: 5—8.

Depth of immersion: max. 20 m (65 ft).

For other applications, contact your nearest Flygt representative for information.

DESIGN

2051.080 is a submersible, electric motordriven pump.

Impellers

The pump has a radial-flow impeller of chromium-alloyed cast iron or stainless steel.

Shaft seals

The pump has two mechanical seals which provide the isolation necessary between the electric motor and the pumped liquid.

Seal surface material:

Inner seal, ceramic-carbon.

Outer seal, ceramic-tungsten carbide.

Shaft

The shaft is delivered with the rotor as an integral part.

Shaft material: stainless steel.

Bearings

The pump bearings are designed for at least 10 000 hours of operation.

The lower bearing consists of a single-row ball bearing.

The upper bearing consists of a single-row ball bearing.

Oil casing

The oil lubricates and cools the seals and acts as a buffer between the pump casing and the electric motor.

Pressure build-up within the oil casing is reduced by means of a built-in air volume.

Motor

Squirrel-cage 3-phase induction motor for 50 Hz or 60 Hz.

The motor is started by means of direct-on-line start.

The motor can be run continuously or intermittently with a maximum of 15 evenly spaced starts per hour.

Flygt motors are tested in accordance with IEC 34-1.

The stator is insulated to class F (155°C, 311°F). The motor is designed to supply its rated output at $\pm 5\%$ variation of the rated voltage. $\pm 10\%$ variation of the rated voltage, in respect of the temperature, can be accepted provided the motor does not run continuously under full load. The motor is designed to operate with a voltage imbalance of up to 2% between the phases. (according to IEC 34-1)

Monitoring equipment

In pumps with MSHA-approval the stator incorporates two thermal protectors connected in series.

The thermal protectors:

open at 125°C (260°F)

close at 95°C (200°F)

The monitoring equipment shall be of a design that makes automatic restart impossible.

See also "Electrical connections" and separate instructions for starters.

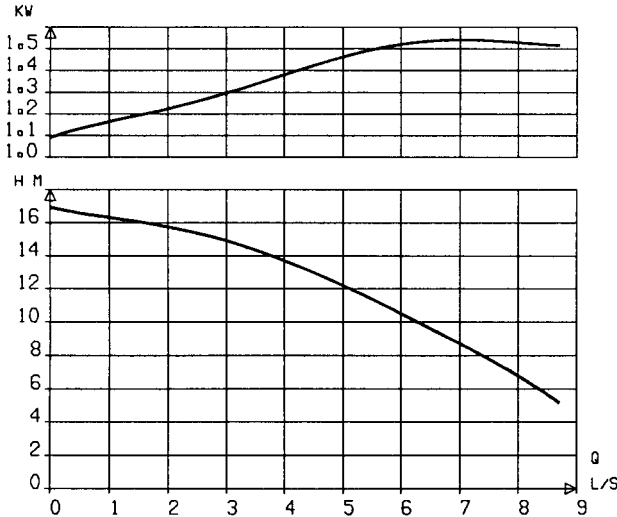
Technical data

For further information, see "Parts list".

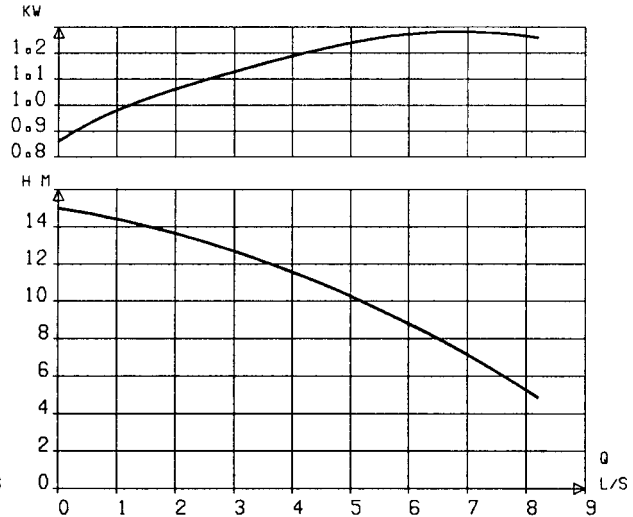
The pump curves show:

- input power at various operating points.
- flow rate versus total head.

50 Hz



60 Hz



CAUTION STATEMENT FOR MSHA

Federal Safety Regulations, as outlined in the applicable provisions of Title 30 of the Code of Federal Regulations, require that in order to maintain "permissibility" of this equipment the following conditions must be satisfied:

1. General Safety

Frequent inspections shall be made. All electrical parts, portable cable and wiring shall be kept in a safe condition. There shall be no openings into the casings of the electrical parts. The machine frame shall be effectively grounded. The power wires shall not be used for grounding. The operating voltage shall match the voltage rating of the motor.

2. Service and Repair

Inspections, service and repairs shall only be made when the portable cable is disconnected from the power supply. Work must be performed by trained personnel (preferably the manufacturer or his agent) to insure that the permissible pump is restored to its original state of safety in regard to all flame-arresting paths. Use replacement parts exactly as those furnished by the manufacturer. When cable entries are disturbed on pump or permissible

control, they shall be reassembled in the approved manner and with parts identical to the parts of the original certification.

3. Fastenings

All bolts, nuts, screws and threaded covers shall be properly tightened and secured.

4. Cables

A flame-resistant portable cable, bearing a MSHA assigned identification number, adequately protected by an automatic circuit-interrupting device shall be used. Special care shall be taken in handling the cable to guard against mechanical injury and wear.



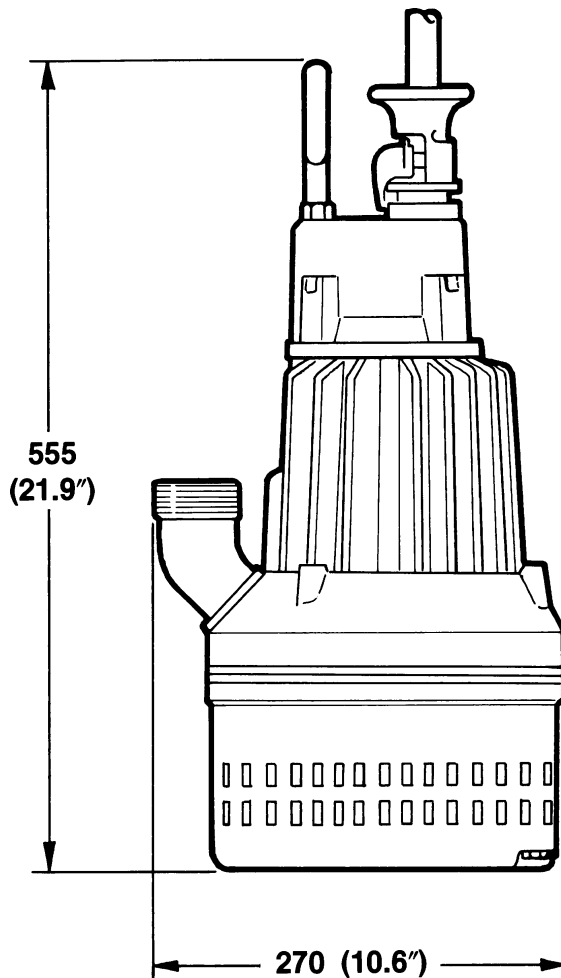
WARNING!

Failure to restore the permissible equipment to its original state of safety will void the MSHA APPROVAL. The creation of a safety hazard will subject the owner/operator of a mine to citations and penalties under the law.

Dimensions and weights


All dimensions are in mm (in).

Weight without motor cable: 18 kg (40 lb).



TRANSPORTATION AND STORAGE

The pump may be transported and stored in a vertical or horizontal position. Make sure that it cannot roll or fall over.

 **WARNING!**
Always lift the pump by its carrying handle, never by the motor cable or the hose.

The pump is frostproof as long as it is operating or is immersed in the liquid. If the pump is taken up when the temperature is below freezing, the impeller may freeze. The pump shall be operated for a short period after being taken up in order to expel all remaining water.

A frozen impeller can be thawed by allowing the pump

to stand immersed in the liquid for a short period before it is started. Never use an open flame to thaw the pump.

For longer periods of storage, the pump must be protected against moisture and heat. The impeller should be rotated by hand occasionally (for example every other month) to prevent the seals from sticking together. If the pump is stored for more than 6 months, this rotation is mandatory.

After a long period of storage, the pump should be inspected before it is put into operation. Pay special attention to the seals and the cable entry.

Follow the instructions under the heading "Before starting".

INSTALLATION

Safety precautions

In order to minimize the risk of accidents in connection with the service and installation work, the following rules should be followed:

1. Make sure the lifting equipment is in good condition.
2. Be aware of the risk of electrical accidents.
3. Use a safety helmet, safety goggles and protective shoes.
4. Do not ignore the risk of drowning.



WARNING!
At certain installations and operation points on the pump curve the noise level 70 dB, or for the actual pump specified noise level, can be exceeded.

Pump installation

Run the cables so that they do not have any sharp bends and are not pinched.

Connect the discharge connection and motor cable. See "Electrical connections".

Lower the pump into the sump.

Place the pump on a base which will prevent it from sinking into a soft sump bottom. Alternatively, the pump can be suspended by its handle just above the sump bottom.

For tandem connection of pumps, see "Accessories and tools".

Consult your nearest Flygt representative regarding:

- choice of peripheral equipment.
- other problems in connection with installation.

ELECTRICAL CONNECTIONS



WARNING!
All electrical work shall be carried out under the supervision of an authorized electrician. Local codes and regulations shall be complied with.

Check that the main (line) voltage and frequency agree with the specifications on the pump data plate.

The motor can be connected for different voltages as shown on the data plate.

Under no circumstances may starter equipment be installed in the explosion risk area.

Install the motor cable as illustrated in the figure.

To avoid leakage into the pump, check:

- that the cable entry seal sleeve and washers conform to the outside diameter of the cable, See the parts list
- that the outer jacket on the cable is not damaged. When refitting a cable which has been used before, **always** cut off a short piece of the cable so that the cable entry seal sleeve does not close around the cable at the same point again.

Mount and tighten the cable entry in the junction box cover, so that the seal sleeve is compressed and seals between the motor cable and the cover. Mount and tighten the clamp.

Connect the motor cable to the terminal board connections U1, V1, W1 and earth on the inside of the



NOTE!
For safety reasons, the earth lead should be approx. 70 mm (2.8") longer than the phase leads. If the motor cable is jerked loose by mistake, the earth lead should be the last lead to come loose from its terminal. This applies to both ends of the cable.

entrance cover. Check the direction of rotation, see "Before starting" (page 10). Transpose two phase leads if the impeller rotates in the wrong direction.

Connect the external protective earth.

Connect the control leads, of any, from the motor control circuit to T1 and T2.

Make sure that the pump is correctly earthed (grounded).

Install the entrance cover.

Remember that the starting surge with the direct-on line start can be up to six times higher than the rated current. Make sure that the fuses or circuit breakers are of the proper amperage.

The overload protection (motor protection breaker) shall be set to the motor's operating current, but no higher than the motor's rated current as given on the data plate.

50 Hz, 3~, 1.0 kW, 2850 r/min

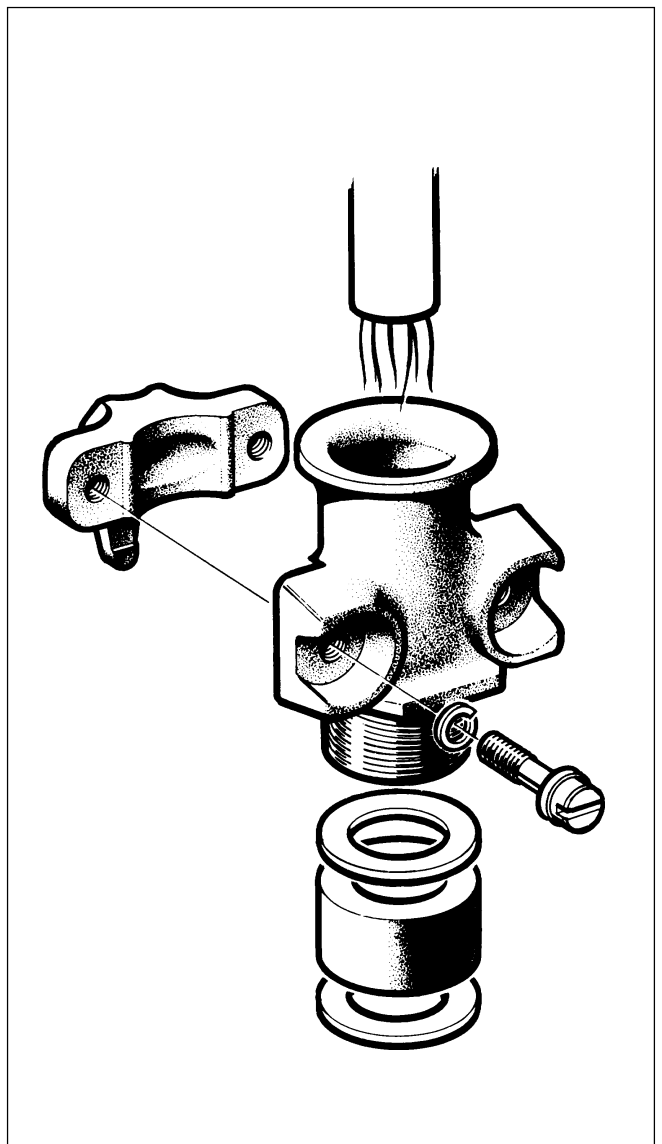
Voltage V	Rated Current A	Starting Current A
220	3.9	25
230	3.8	24
380	2.3	15
400	2.2	24
500	1.7	11
550	1.6	11

60 Hz, 1~, 1.2 kW (1.6 Hp) 3440 r/min

Voltage V	Rated Current A	Starting Current A
115	14.0	60
230	7.1	35

60 Hz, 3~, 1.2 kW (1.6 Hp) 3450 r/min

Voltage V	Rated Current A	Starting Current A
440	2.4	14
460	2.3	14
575	1.7	12

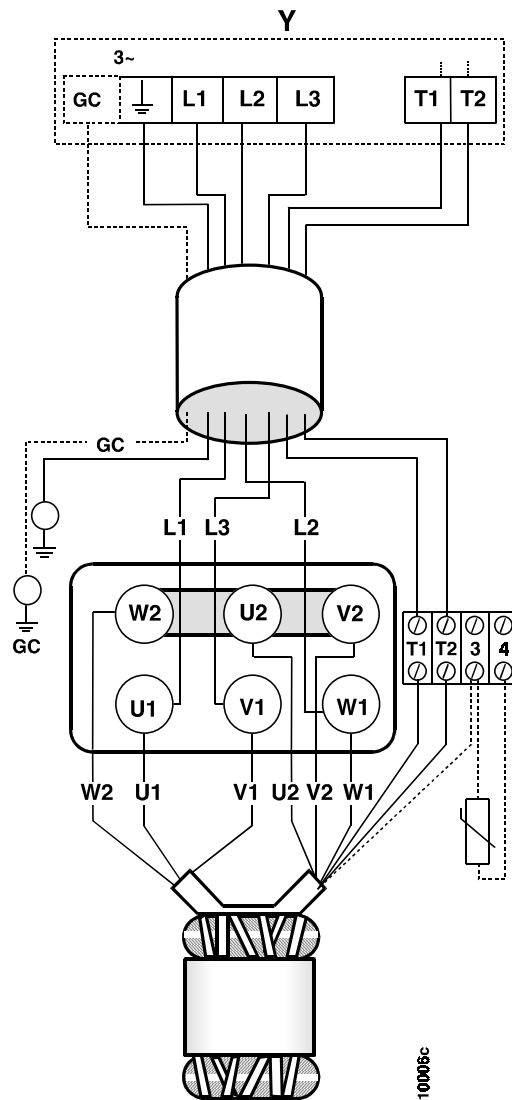


50/60 Hz, 3~ with terminal board

SUBCAB/SUBCAB AWG*:

Mains	Lead	Pump terminal board	Stator lead	Connection on terminal board
L1	Brown (Red*)	U1	U1, red	U1 (S1)
L2	Blue (White*)	W1	V1, brown	V1 (S2)
L3	Black (Black*)	V1	W1, yellow	W1 (S3)
Earth (PE)	Yellow/Green	PE	U2, green	U2 (S4)
Groundcheck	Yellow*	GC	V2, blue	V2 (S5)
T1	Black (Orange*)	T1	W2, black	W2 (S6)
T2	Black (Blue*)	T2		

Connect the control leads from the motor control circuit to T1 and T2.



50/60 Hz, 3~ with terminal board

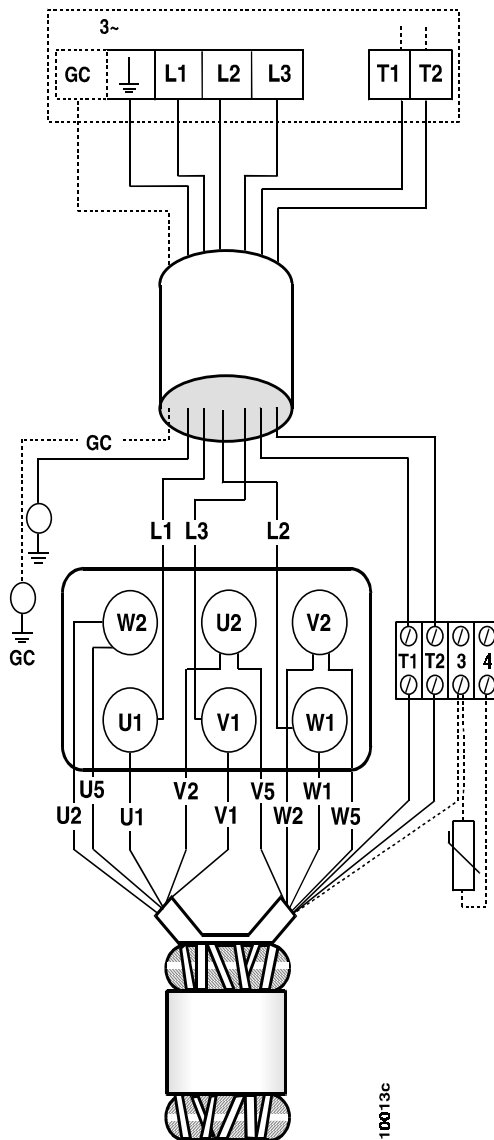
SUBCAB/SUBCAB AWG*:

Mains	Lead	Pump terminal board
L1	Brown (Red*)	U1
L2	Blue (White*)	W1
L3	Black (Black*)	V1
Earth (PE)	Yellow/Green	PE
Groundcheck	Yellow*	GC
T1	Black (Orange*)	T1
T2	Black (Blue*)	T2

The stator leads are connected to the terminal board as follows:

Stator lead	Connection on terminal board
U1, red	U1 (S1)
V1, brown	V1 (S2)
W1, yellow	W1 (S3)
U2, green	U2 (S4)
V2, blue	V2 (S5)
W2, black	W2 (S6)
U5, red	U5 (S7)
V5, brown	V5 (S8)
W5, yellow	W5 (S9)

Connect the control leads from the motor control circuit to T1 and T2.



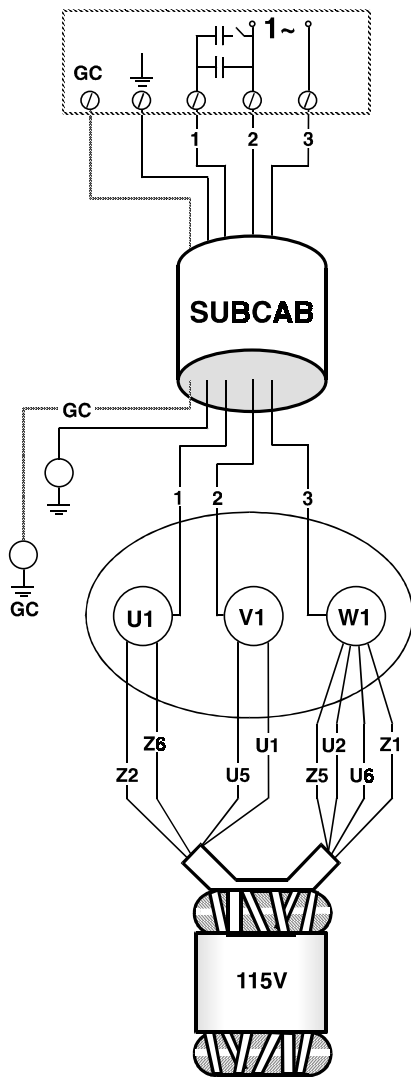
1 ~ operation

SUBCAB AWG

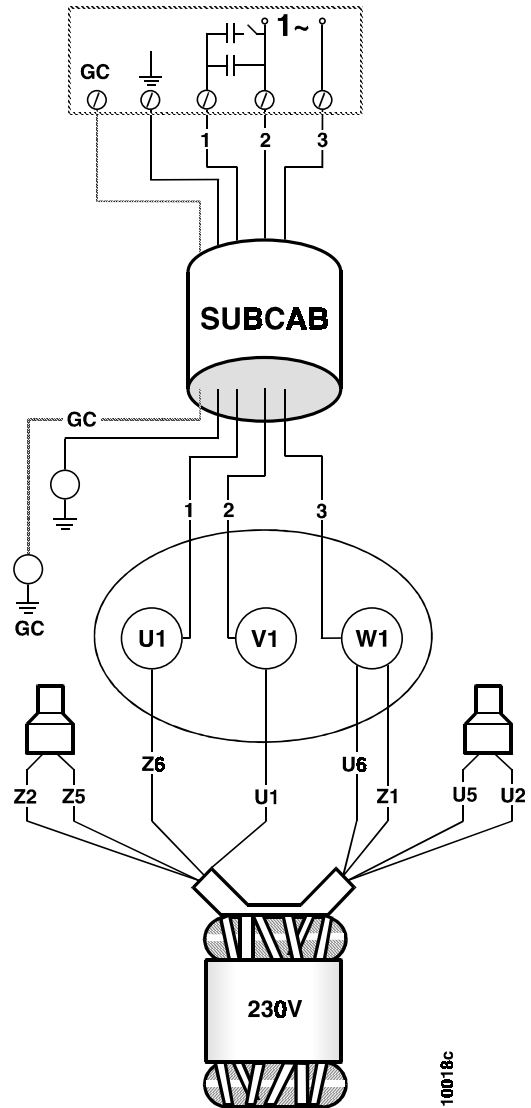
No.	Lead	Pump terminal board
1	Red	U1
2	Black	V1
3	White	W1
Earth (PE)	Yellow/Green	PE

The stator leads are connected to the terminal board as follows:

- U1 = red
- U2 = brown
- U5 = yellow
- U6 = green
- Z1 = blue
- Z2 = black
- Z5 = red
- Z6 = brown



10018c



10018c

OPERATION

Before starting

Check the oil level in the oil casing.

Remove the fuses or open the circuit breaker and check that the impeller can be rotated by hand.

Check that the monitoring equipment (if any) works.

Check the direction of rotation. See the figure. The impeller shall rotate clockwise, as viewed from above. When started, the pump will jerk in the opposite direction to the direction in which the impeller rotates. **Beware! The starting jerk on large pumps can be powerful.**

The above measures are described under "Inspection".

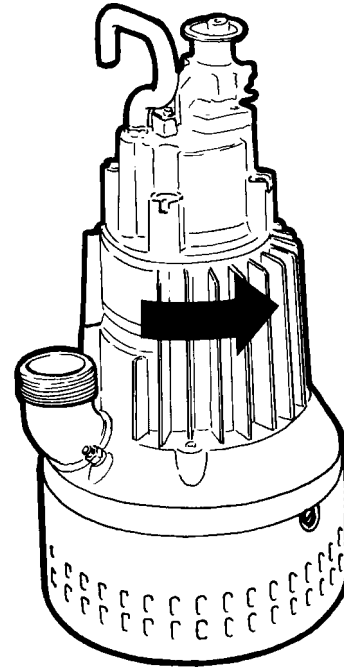
Cleaning

If the pump has been operating in very dirty water, allow it to run for a short period in clean water or flush clean water through the discharge connection. If clay, cement or other types of dirt are left in the pump, they may dry and clog the impeller and seal.

In order to avoid sedimentation when the pumped medium contains solid particles, the velocity of the medium in the discharge line should be:

Mixture	Min. velocity in discharge line
Water + sand	
Sand particles <0.1 mm (0.004")	1.5 m/s (4.9 ft/s)
Sand particles <0.6 mm (0.024")	2.5 m/s (8.2 ft/s)

Starting jerk



The pump can be provided with level regulation in order to prevent unnecessary wear on the hydraulic components.

CARE AND MAINTENANCE

The figures in parentheses are item numbers and refer to the exploded view on the last page.

Safety precautions

Before starting work on the pump, make sure that the pump is isolated from the power supply and cannot be energized.

NOTE! This applies to the control circuit as well.

The following points are important in connection with work on the pump:

- make sure that the pump has been thoroughly cleaned.
- follow local safety regulations.

Inspection

Regular inspection and preventive maintenance ensure more reliable operation.

The pump should be inspected at least every three months, more frequently under severe operating conditions.

Under normal operating conditions, the pump should have a major overhaul in a service shop once a year.

This requires special tools and should be done by an authorized service shop.

When the pump is new or when the seals have been replaced, inspection is recommended after one week of operation.



NOTE for Ex version

All work on the explosion-proof (permissible) motor section must be performed by authorized Flygt personnel.


Flygt renounces all responsibility for work done by untrained, unauthorized personnel.



WARNING!

Before starting work on the pump, make sure that the pump is isolated from the power supply and cannot be energized.

Recommended inspections:

Inspection of	Action
Visible parts on pump and installation	<p>Replace or fix worn and damaged parts. Make sure that all screws, bolts and nuts are tight. Check the condition of carrying handle, chains and wire ropes.</p>
Pump casing and impeller	<p>Replace worn parts if they impair function. Wear on the impeller and the parts around it necessitates fine adjustment of the impeller or replacement of worn parts. See "Replacing the impeller".</p>
Oil quantity	<div style="border: 1px solid black; padding: 5px;">  <p style="margin-left: 10px;">WARNING! If the seal leaks, the oil casing may be under pressure. Hold a rag over the oil casing screw in order to prevent splatter. See "Safety precautions" for additional information.</p> </div>
Condition of the oil	<p>Check that the oil reaches up to the oil hole when the pump is lying down with the oil hole up. Add oil as needed. See "Changing the oil".</p> <p>A check of the condition of the oil can show whether there has been an leakage. Maximum permissible leakage is 0.05 ml/h (0.0017 oz/h). (Note! Air/oil mixture can be confused with water/oil mixture). Insert a tube (or hose) into the oil hole. Cover the top end of the tube and take up a little oil from the bottom. Change the oil if it contains too much water, i.e., is heavily emulsified (cream-like), or if the water has settled out. See "Changing the oil". Check again one week after changing the oil. If the oil contains too much water again, the fault may be:</p> <ul style="list-style-type: none"> — that an oil screw (OIL) is not sufficiently tight. — that the O-ring of the oil screw or its sealing surface is damaged. — that the lower seal (48) is damaged. Contact a Flygt service shop.
Cable entry	<p>Make sure that the cable clamp is tight. If the cable entry leaks:</p> <ul style="list-style-type: none"> — check that the entry is sufficiently tightened. — cut a piece of the cable off so that the seal sleeve (28) closes around a new position on the cable. — replace the seal sleeve (28). — check that the seal sleeve (28) and the washers (18) conform to the outside diameter of the cables.
Cables	<p>Replace the cable if the outer jacket is damaged. Make sure that the cables do not have any sharp bends and are not pinched.</p>
Level sensors or other level equipment	<p>Check function. Clean, adjust, replace or repair damaged level sensing equipment. Follow the instructions for the level sensing equipment in question.</p>
Starter equipment	<p>If faulty, contact an electrician.</p>
Rotation direction of pump (requires voltage)	<p>Transpose two phase leads if the impeller does not rotate clockwise as viewed from above. Rotation in the wrong direction reduces the capacity of the pump and the motor may be overloaded. Check the direction of rotation every time the pump is reconnected.</p>

Changing the oil



WARNING!
If the seal leaks, the oil casing may be under pressure. Hold a rag over the oil plug to prevent splatter.

Lay the pump on its side on a bench or over two supports.

Unscrew the oil casing screw (OIL).

Turn the pump so that the oil hole faces downwards.

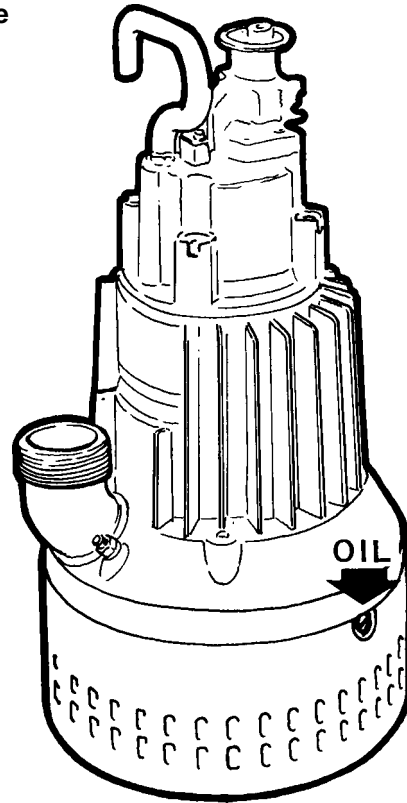
It is easier to drain the oil if the other oil hole screw is also removed.

Fill up with 0,5 litres (0.5 US quarts) of new oil. Use an ordinary SAE 10W-30 motor oil. Always replace the O-rings of the oil hole screws. Put the screws back and tighten them.



A paraffin oil approved by authorities (e.g. Mobil Whiterex 307–309) is recommended for raw or clean water pumping.

Oil hole



Replacing the impeller

Removing the impeller



WARNING!
Worn impellers often have very sharp edges.

Lay the pump on its side.

Remove nuts (10) and pull off the strainer (47).

Remove nuts (61).

Remove washers (14), lower diffuser (44) and springs (38).

Remove impeller screw (3).

Remove washer (14) under the impeller screw.

Pull off the impeller by tightening a (M12x45) screw into the impeller hub.

Do **not** pry off the impeller, since it can easily be damaged.

Remove the adjusting washers (33).

Installing the impeller

Make sure that the end of the shaft is clean and free of burrs. Polish off any flaws.

Check:

- that the key (1) is seated in the keyway on the shaft.
- that an appropriate number of adjusting washers (33) are on the shaft.

Grease end of shaft and impeller hub.

Place washer (14) on the impeller screw.

Press the impeller onto the shaft with the impeller screw.

Tighten the impeller screw.

Tightening torque 25 Nm (19 ft lb).

Check that the impeller is firmly seated.

Adjusting the impeller

The clearance between the impeller and the oil casing bottom should be minimal when the impeller is tightened. The clearance can be adjusted with the adjusting washers (33).

Check that the impeller can easily be rotated by hand.

Check that the springs (38) are seated on the studs (37).

Press the lower diffuser (44) against the impeller.

Place washers (14) and nuts (61) on the studs.

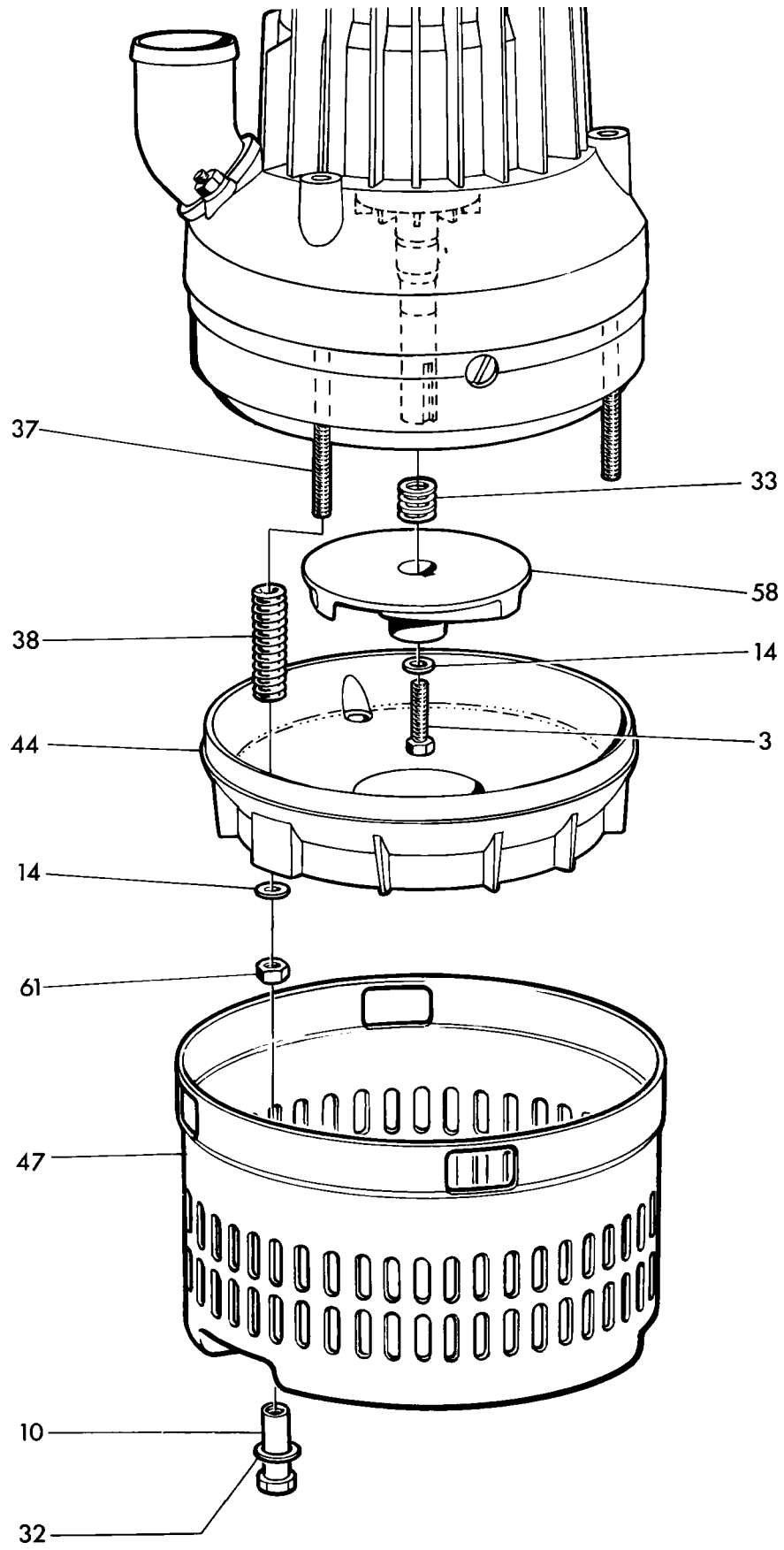
Tighten the nuts (61) evenly all around until the clearance between the impeller and the lower diffuser is as little as possible.

Check that the impeller can easily be rotated by hand.

Install: Strainer (47).

In order for the pump to perform at maximum capacity, the impeller must be adjusted regularly.

It is particularly important that the clearance between the lower diffuser and the impeller is kept to a minimum.



ACCESSORIES AND TOOLS

Tandem operation

The delivery head can be increased by connecting two or three pumps in tandem.

Max. permissible operating pressure is 0.4 MPa (57 psi).

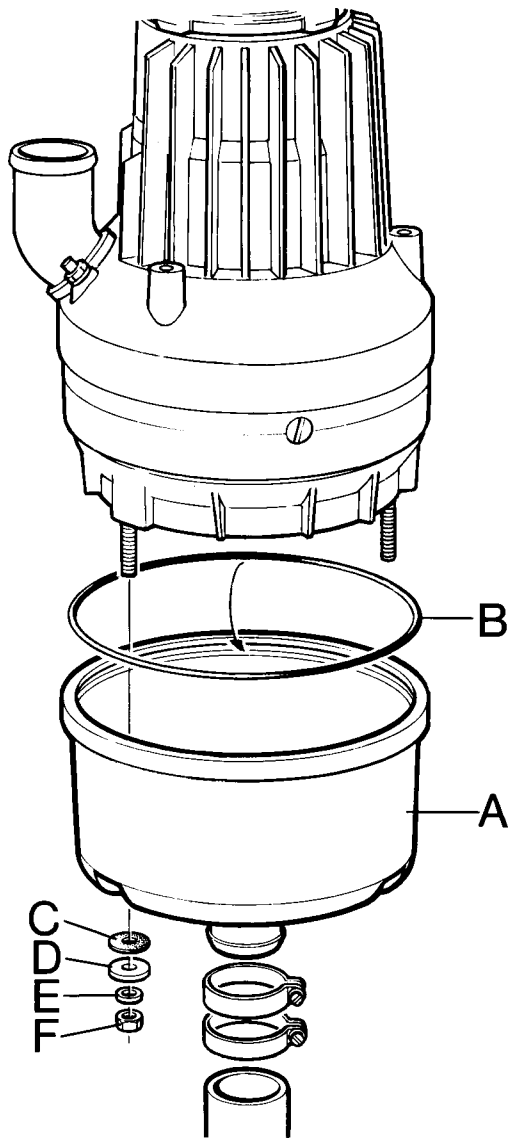
The vertical distances between the pumps should be approximately equal.

The connection unit for tandem operation replaces the strainer, see figure. Remove the strainer and fit the connection (A) in its place. Don't forget the O-ring (B). Fit gasket (C), washer (D), locking washer (E) and secure with nut (F).

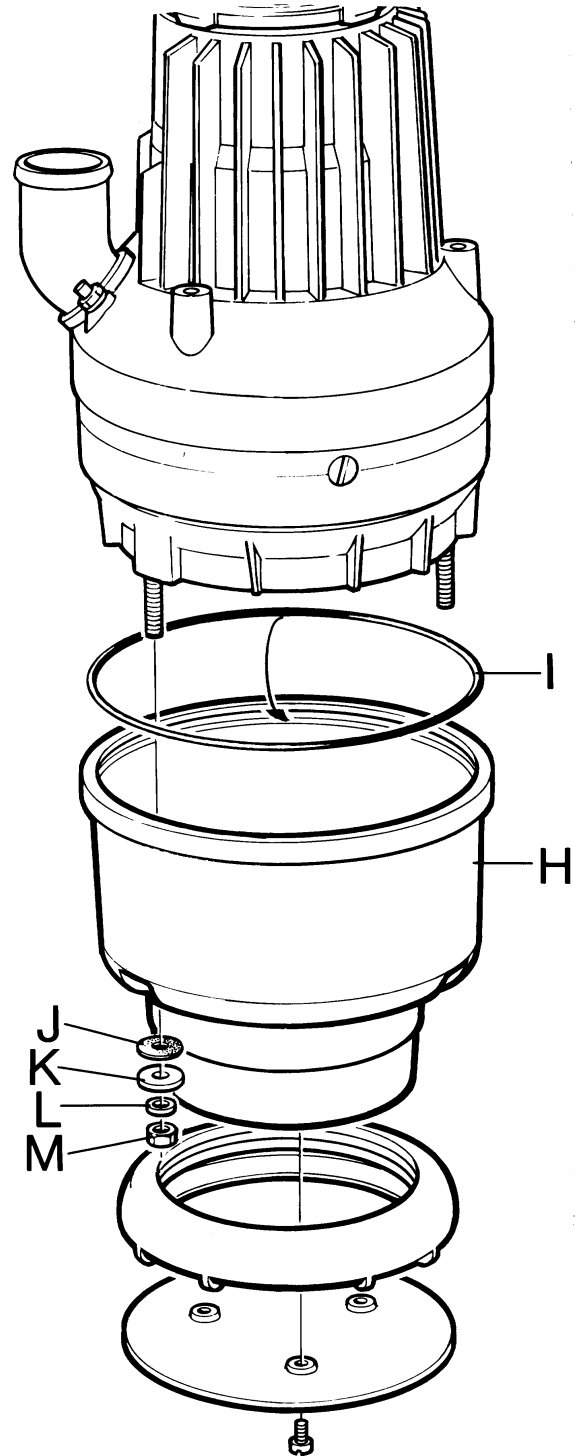
See special brochure that describes the procedure for tandem connection. The following complete connection units are available for tandem connection:

Order No.	Intended for
392 34 00	2" hose

Tandem operation



Low suction attachment



Low suction attachment

In order to get the pump to drain all the way down to the floor, the pump can be provided with a rubber collar.

The low suction attachment replaces the strainer, see figure. Remove the strainer and fit the low suction attachment (H) in its place. Don't forget the O-ring (I). Fit gasket (J), washer (K), locking washer (L) and secure with nut (M).

NOTE! In order for pumps with low suction attachments to start working, the pump casing must be primed (filled with water).

Order No. 392 35 00

Zinc anode set

In order to reduce corrosion on the pump, it can be fitted with zinc anodes.

Mount the zinc anodes as shown in the figure. The upper anodes (N) are mounted to a special mounting plate (O) which is fitted under the carrying handle.

The lower anodes (P) are mounted to the diffuser (R). First remove the strainer (S). The anodes are fitted by self-tapping screws in existing holes in the diffuser. Remount the strainer (S).

Order No. 405 12 00.

Level sensor

Flygt supplies level sensors suited for different liquid densities and with different cable lengths. See separate brochure.

Start and control equipment

Flygt has suitable start and control equipment for the pump. Contact Flygt for further information.

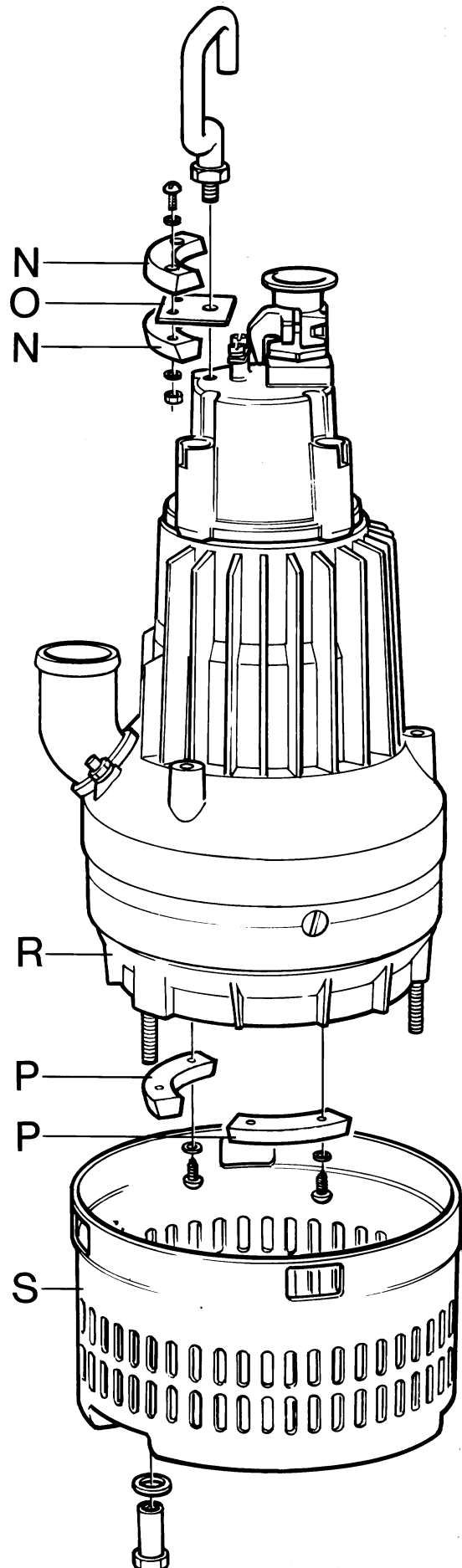
Tools

The following tools are required in order to perform the necessary care and maintenance of the pump:

Order No.	Description
84 11 39	Combination wrench, n = 13 mm
84 12 53	Socket-type screwdriver, n = 8 mm
84 13 87	Socket, n = 13 mm
84 13 90	Socket, n = 17 mm
84 14 31	Adjustable wrench, 18"
84 15 61	Swivel handle, 1/2" □
84 15 66	Torque wrench, 0—137 Nm
84 16 72	Screwdriver, width 8 mm
84 16 74	Screwdriver, width 14 mm
84 17 30	Allen keys set
	Screw M12x45 for pulling off the impeller

For further information on tools, see Flygt's Tool Catalogue.

Zinc anode set



FAULT TRACING (TROUBLESHOOTING)

A universal instrument (VOM), a test lamp (continuity tester) and a wiring diagram are required in order to carry out fault tracing on the electrical equipment.

Fault tracing shall be done with the power supply disconnected and locked off, except for those checks which cannot be performed without voltage.

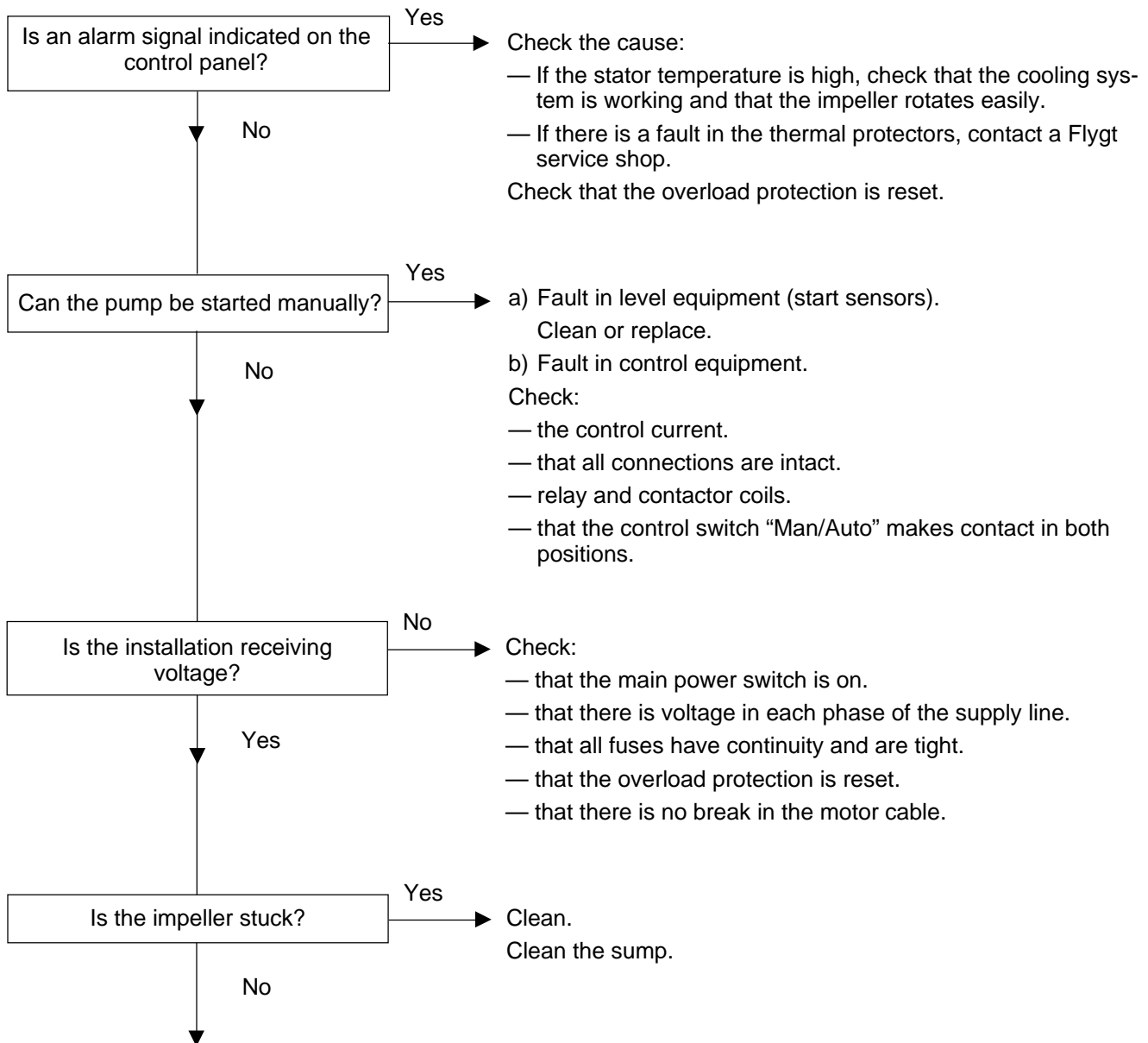
Always make sure that there is no one near the pump when the power supply is turned on.

Use the following checklist as an aid to fault tracing. It is assumed that the pump and installation have formerly functioned satisfactorily.

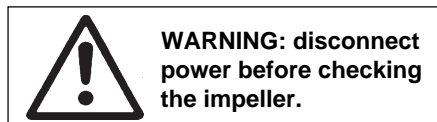
Electrical work shall be performed by an authorized electrician.

Follow local safety regulations and observe recommended safety precautions page 11.

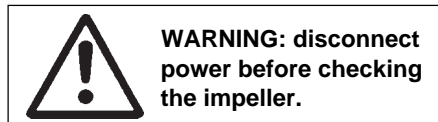
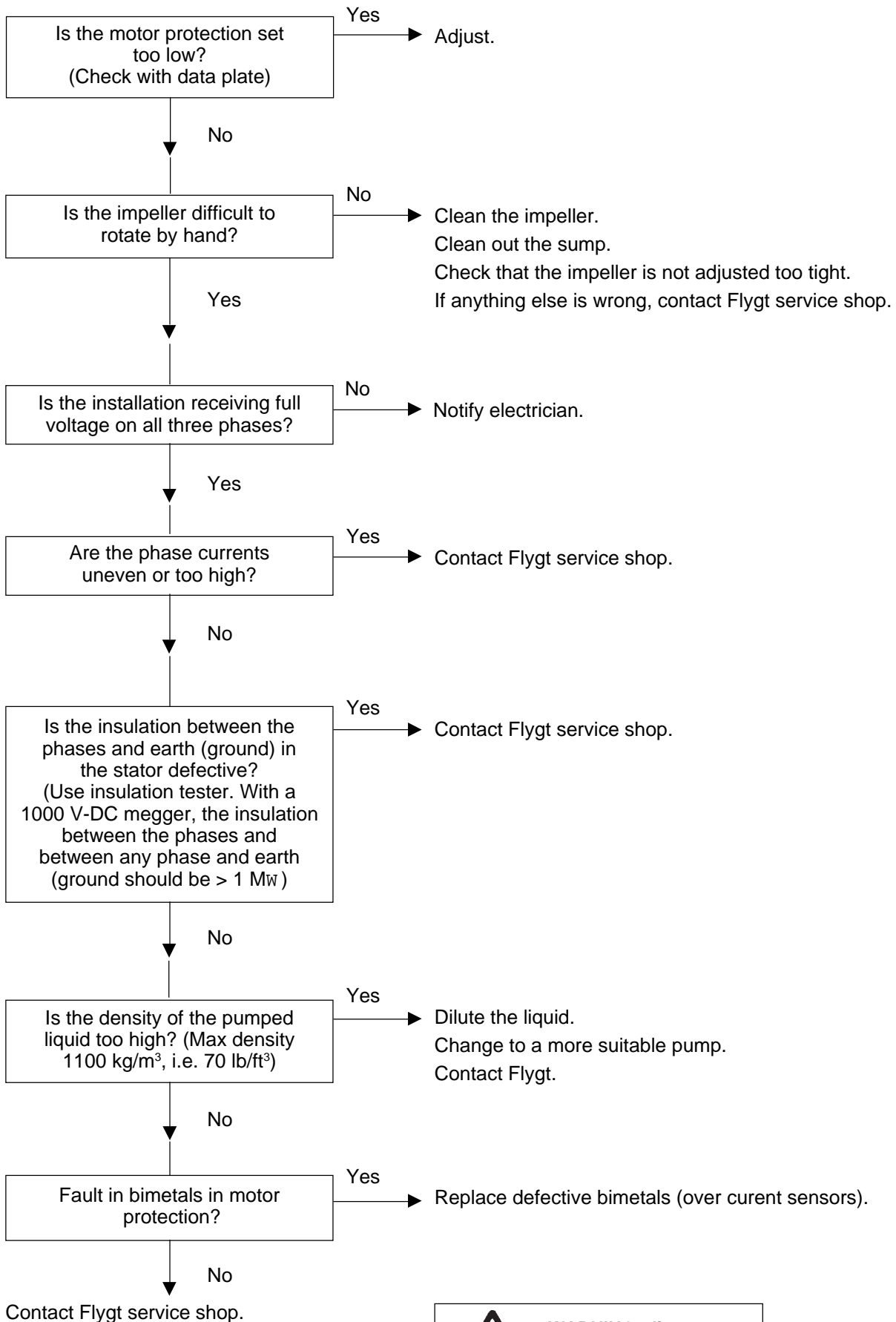
1. Pump fails to start



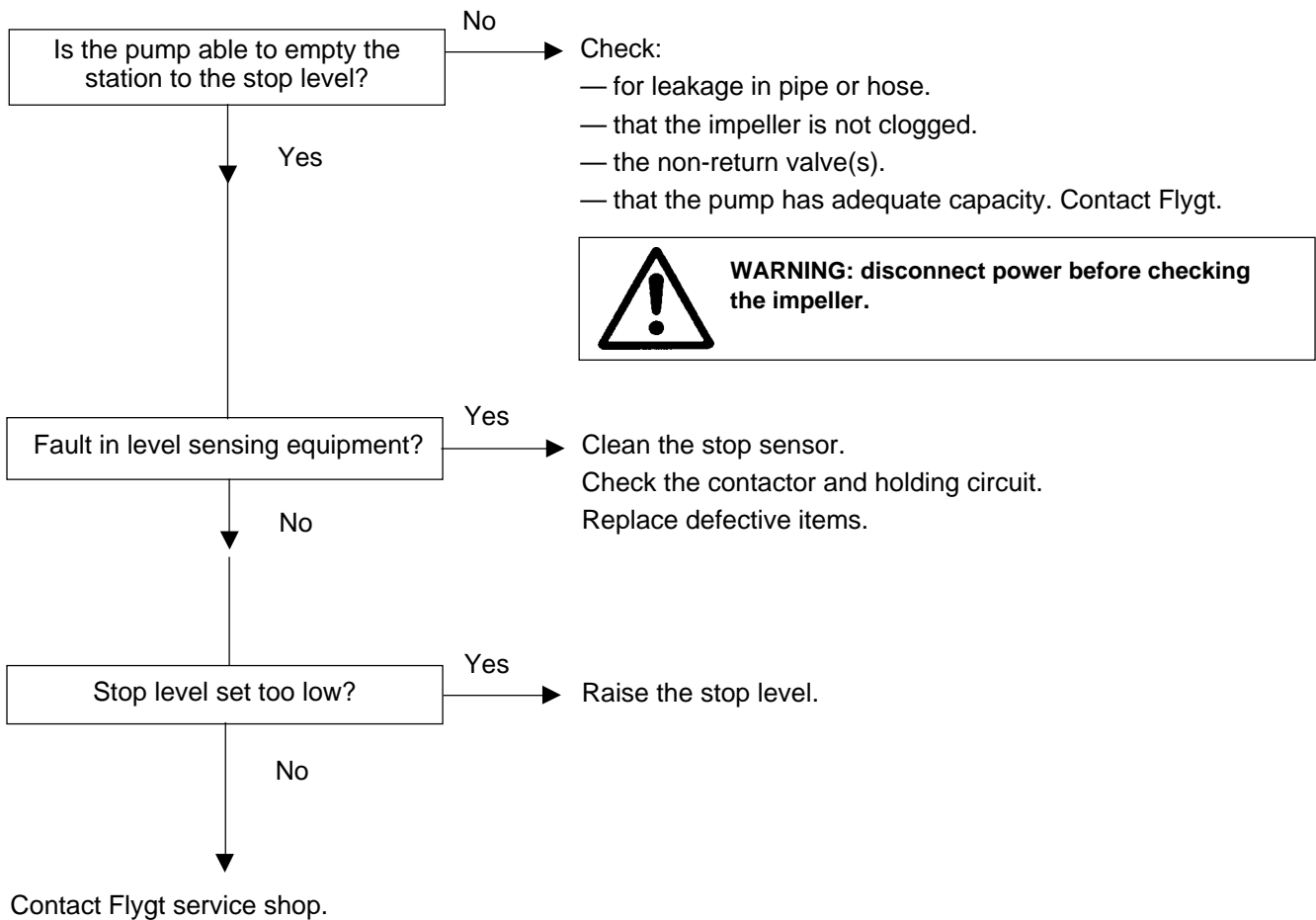
Contact Flygt service shop.



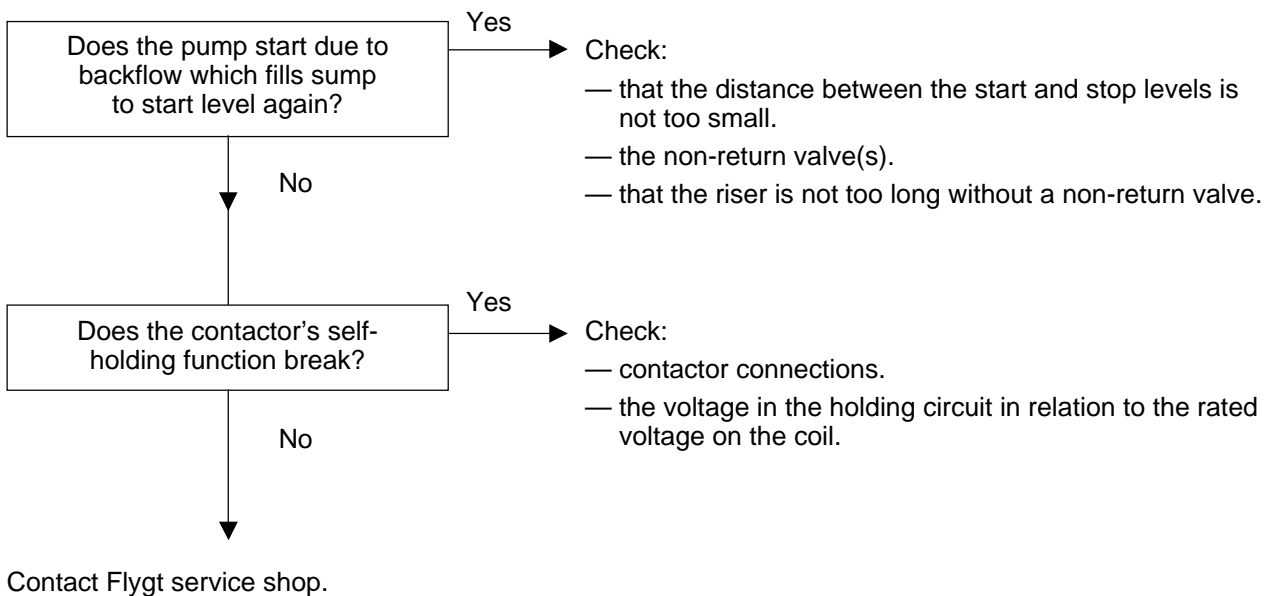
2. Pump starts but motor protection trips



3. The pump does not stop



4. The pump starts-stops-starts in rapid sequence



5. Pump runs but delivers too little or no water

Check:

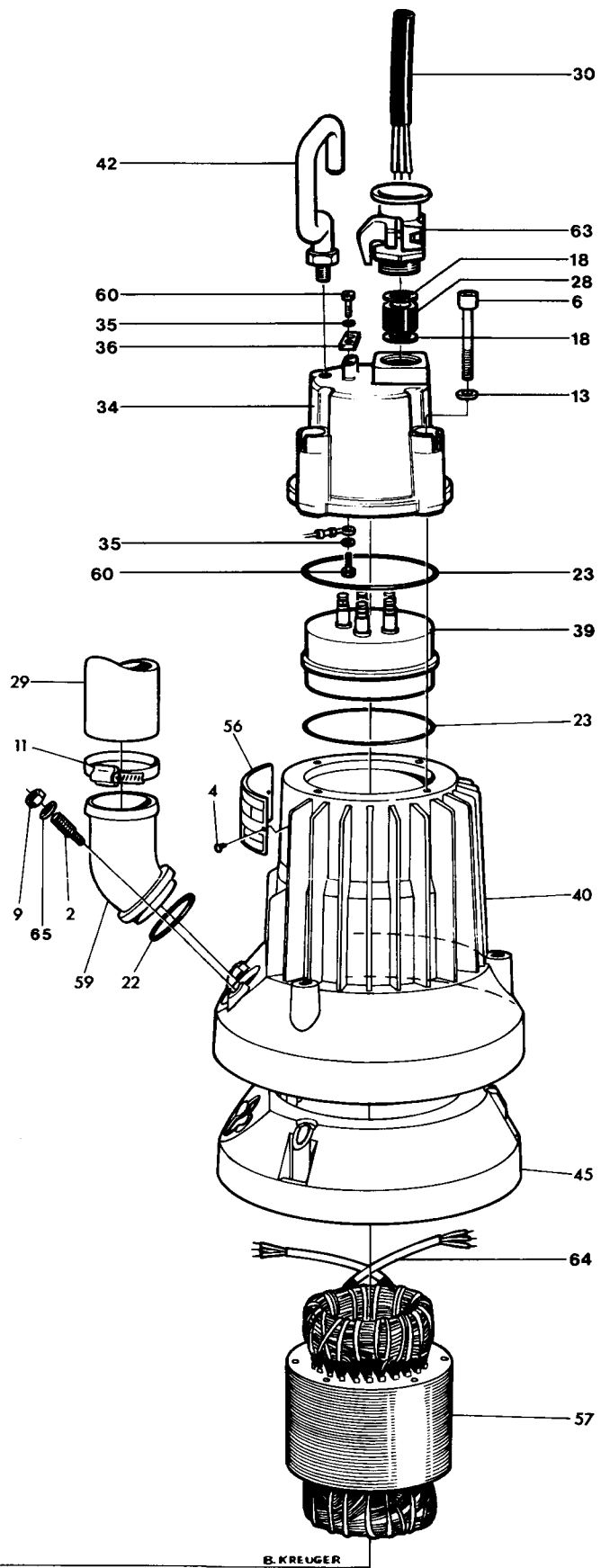
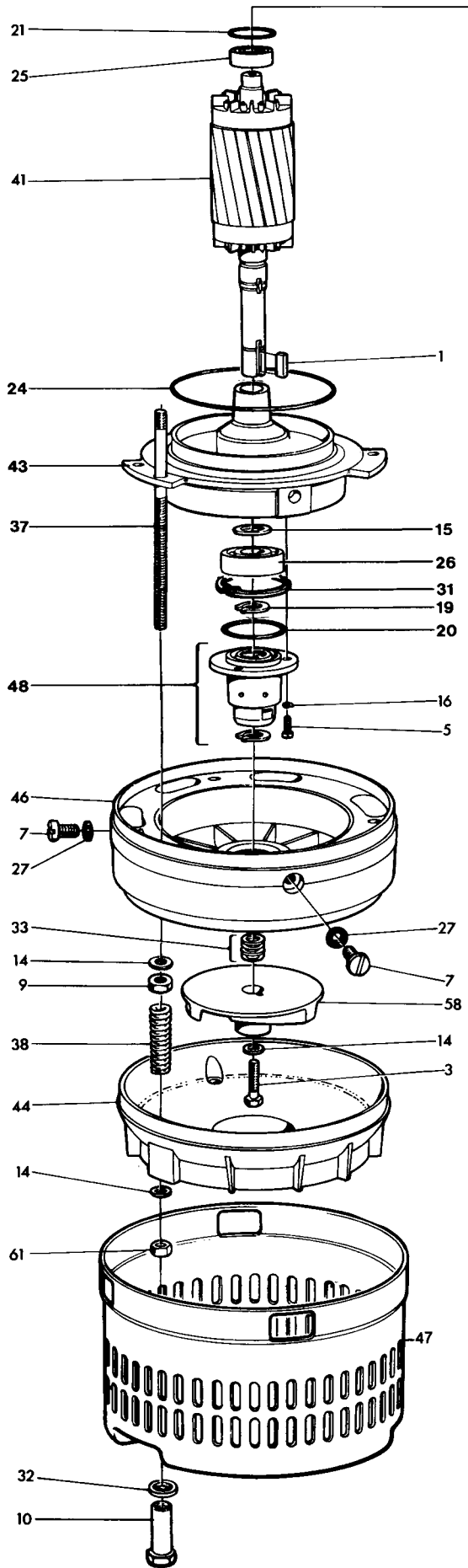
- direction of rotation of pump, see “Before starting”.
- that valves are open and intact.
- that pipes, impeller and strainer are not clogged.
- that the impeller rotates easily.
- that the suction lift has not been altered.
- for leakage in the pump installation.
- for wear on impeller, suction bottom.

See also under “Inspection”.

Do not override the motor protection repeatedly if it has tripped.

SERVICE LOG

Most recent service date	Pump No.	Hours of operation	Remarks	Sign.



B. KREUGER

