

INSTALLATION, CARE AND MAINTENANCE



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 the monitoring equipment incorporated in the product is correctly connected;
- 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.

Official approval applies only providing:

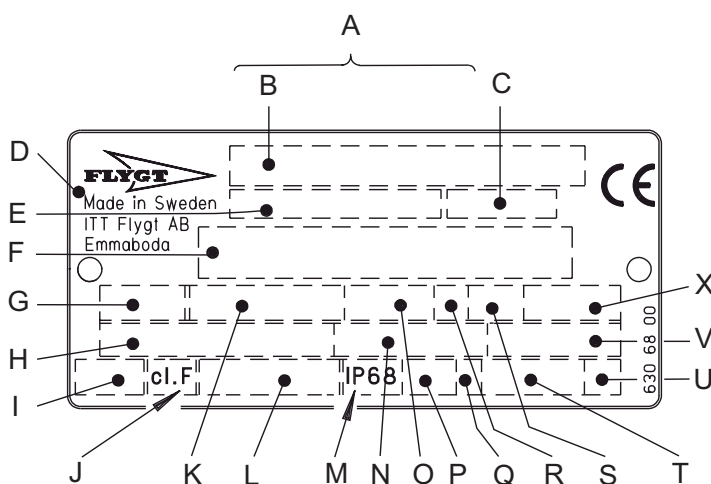
- that the product is used under conditions described in the care and maintenance instructions and in applications for which it is intended;
- that all service and repair work is done by a workshop authorized by Flygt;
- that genuine Flygt parts are used.

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

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



- A Serial number
- B Product code + Number
- C Curve code / Propeller code
- D Country of origin
- E Product number
- F Additional information
- G Phase; Type of current; Frequency
- H Rated voltage
- I Thermal protection
- J Thermal class
- K Rated shaft power
- L International standard
- M Degree of protection
- N Rated current
- O Rated speed
- P Max. submergence
- Q Direction of rotation: L=left, R=right
- R Duty class
- S Duty factor
- T Product weight
- U Locked rotor code letter
- V Power factor
- X Max. ambient temperature

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PRODUCT DESCRIPTION

Applications

The 2290.010 is intended to be used for pumping of water which may contain abrasive particles.

Liquid temperature: max. 40°C (103°F).

The pump is also available in POLY-LIFE version, U2290.010, with polyurethane coated wear parts.

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.

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.



WARNING!
Only Ex-approved pumps may be used in an explosive or flammable environment.

Design

The 2290.010 is a submersible, electric motor-driven pump.

Impellers

The pump is available with the following types of impellers:

radial-flow impeller of chromium-alloyed cast iron,
mixed-flow impeller of chromium-alloyed cast iron.

Shaft seals

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

Materials:

Inner seal: tungsten carbide—tungsten carbide.

Outer seal: tungsten carbide—tungsten carbide.

Shaft

Shaft material: stainless steel.

Bearings

The pump bearings are designed for the following time of operation:

13 000 hours.

The lower bearing consists of a two-row angular contact 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 60 Hz use only.

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

The motor can be run:

continuously or intermittently with maximum of 15 evenly spaced starts per hour.

The stator is insulated in accordance with IEC 85, class F, 155°C (310°F). The motor is designed to supply its rated output at ± 5% variation of the rated voltage without overheating the motor, ± 10% variation of the rated voltage, can be accepted provided that the motor does not run continuously at full load. The motor is designed to operate with a voltage imbalance of up to 2% between the phases (according to IEC 60 034-1).

Monitoring equipment

The stator incorporates three thermal protectors connected in series.

The thermal protectors:

open at 125°C (260°F)

close at 95°C (210°F).

See also “Electrical connections” and separate instructions for starters.

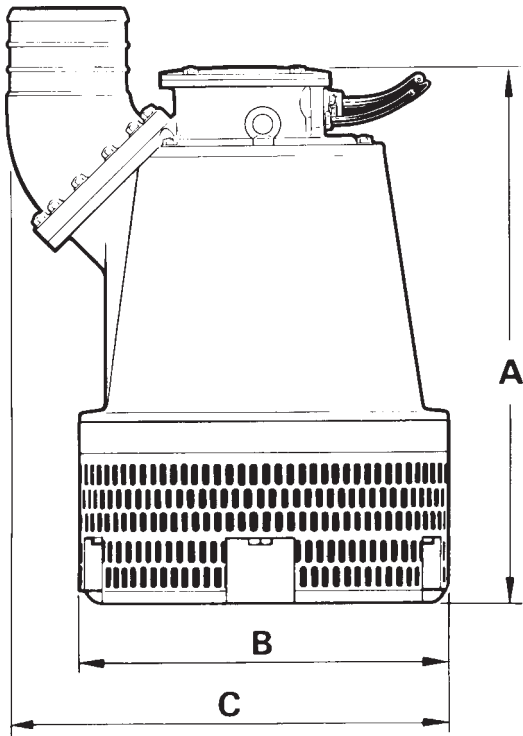


Note!
Make sure that the monitoring equipment incorporated in the product is correctly connected.

Cooling

The stator is cooled by the pumped liquid passing through the space between the stator casing and the outer casing.

Dimensions and weights



A = 1144 mm (45.0")
 B = 771 mm (30.4")
 C = 830–912 mm (32.7"–35.9")
 with hose connection
 847–935 mm (33.3"–36.8")
 with threaded pipe connection

Weight without motor cable: 540 kg (1190 lb).

Technical data

The pump curves show:

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

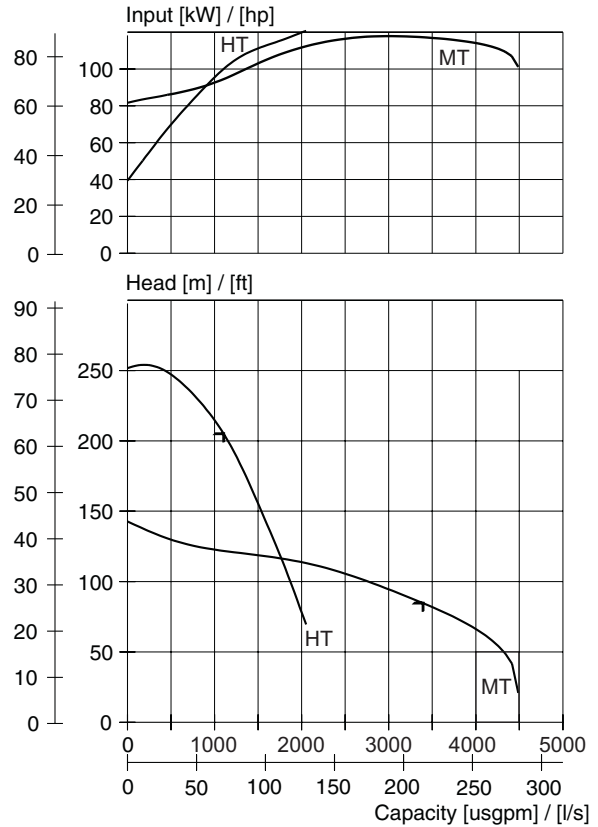
The following abbreviations are used:

MT = medium-head version

HT = high-head version

For further information, see "Parts list".

3 ~ 60 Hz, 1780 r/min



TRANSPORTATION AND STORAGE

The pump shall be transported and stored in a vertical position. Make sure that it cannot fall over.

Always lift the pump by its carrying handle or lifting eyes, **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. Do not ignore the risk of drowning.
4. Use a safety helmet, safety goggles and protective shoes.

Follow all other health and safety rules and local codes and ordinances.



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 equipment must be earthed. This applies to both pump equipment and any monitoring equipment. Failure to heed this warning may cause a lethal accident. Make sure that the earth lead is correctly connected by testing it.

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.

Install the motor cable and the control 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.

NOTE! For safety reasons, the earth lead should be approx. 100 mm (4.0") 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.

Check on the data plate which connection, star or delta, is valid for used main (line) voltage. Then mount, depending on main (line) voltage, the closing links on the terminal board for star or delta connection, see figure.

Connect the motor cable to the terminal board connections U1, V1, W1 and earth.

If star-delta start is used, both motor cables are connected as shown below. Closing links are not used with star-delta start.

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

Three thermal protectors are incorporated in the stator. The thermal protectors are normally closed.

The thermal protectors can be connected to maximum 250 V, breaking current maximum 6A at $\cos \varphi 0,6$. Flygt recommends that they are connected to 24 V over separate fuses in order to protect other control equipment.

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

Install the cover (16).

3 ~ 60 Hz, 1780 r/min

Voltage V connection	Power input kW	Rated current A	Starting current A
460 D	88	127	810
575 D	88	101	650
600 D	88	99	680



Note!

Make sure that the monitoring equipment incorporated in the product is correctly connected.

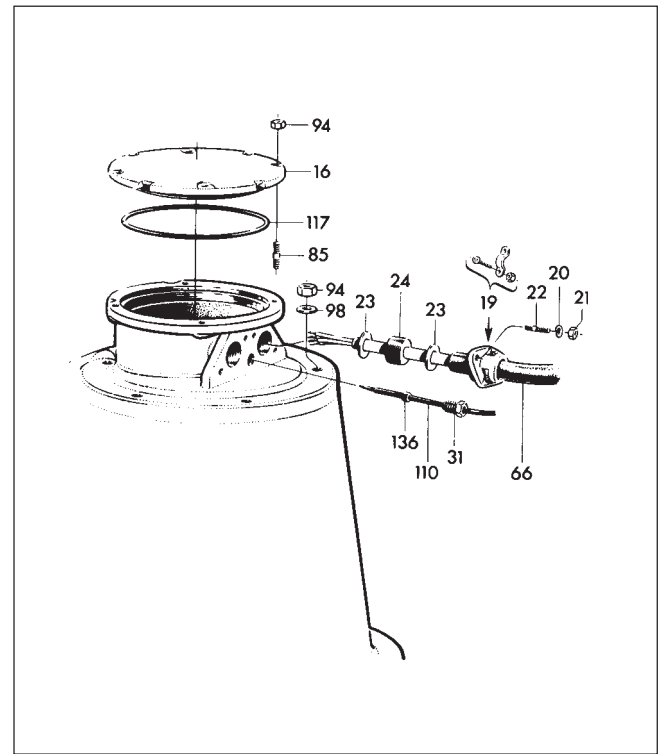
Tighten the nuts (21) and the gland nut (31) so that the cable entry unit bottoms out.

Connect the motor cable and the control cable to the starter equipment. Check the direction of rotation, see "Before starting". Transpose two phase leads if the impeller rotates in the wrong direction.

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 tables gives rated current and starting current. Fuse amperage and cable shall be selected in accordance with local rules and regulations. Note that with long cables, the voltage drop in the cable must be taken into consideration, since the motor's rated voltage is the voltage that is measured at the terminal board in the pump.

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.

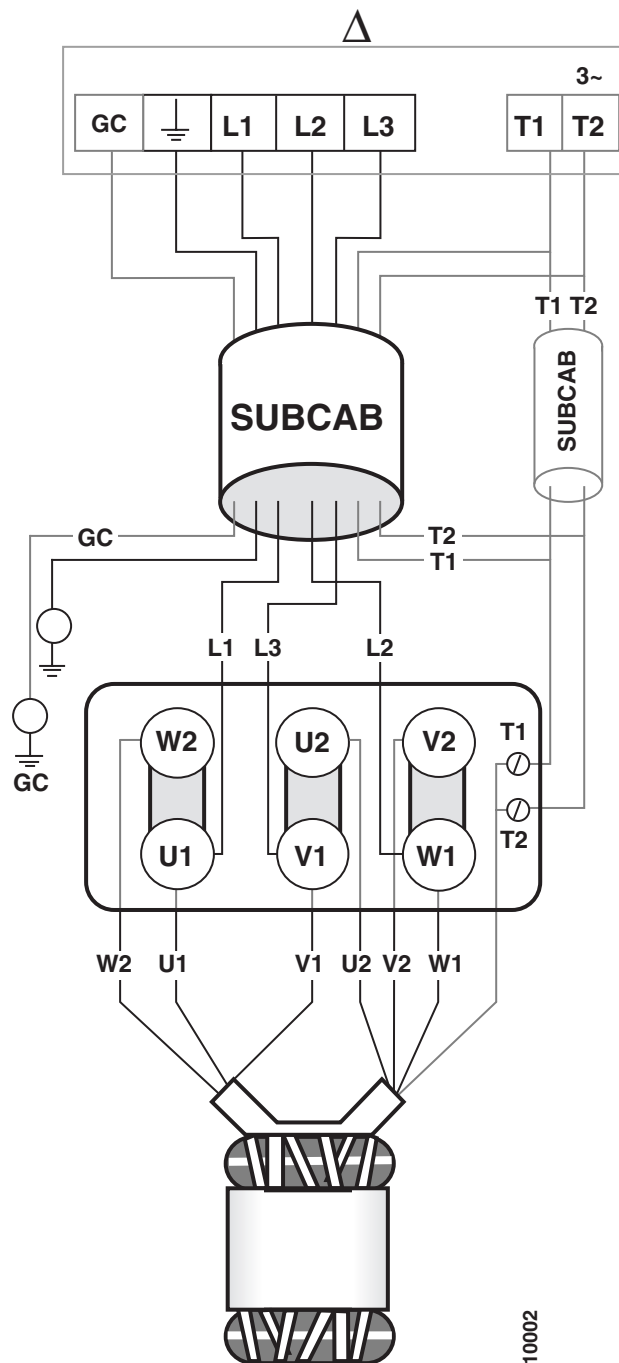


Stator connection

The stator leads are colour-marked as follows:

Stator
lead

- U1 = Red
- V1 = Brown
- W1 = Yellow
- V2 = Blue
- W2 = Black
- U2 = Green



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 each time the cable has been re-connected, as well as phase or total supply failure.

Place the pump on the ground. Push a pointed rod, piece of pipe or suchlike into one of the strainer apertures and tilt the pump slightly as shown in figure. Switch on the power momentarily. If the motor is correctly connected, the pump will jerk in the counter clockwise direction as shown in figure. If the pump jerks in the opposite direction, transpose two of the phases.

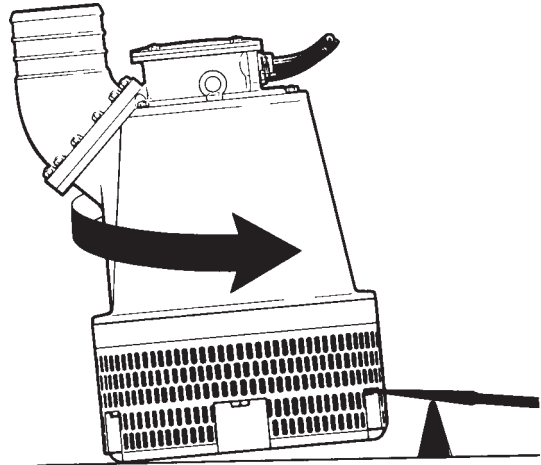
In carrying out this test, do not allow the pump to hang freely since the jerk may be so great, especially in the case of direct starting, as to be physically dangerous.

The above measures are described under "Inspection".



WARNING!
Watch out for the starting jerk,
which can be powerful.

Starting jerk



CARE AND MAINTENANCE

The figures in parentheses are item numbers and refer to the cutaway figures on pages 13 and 23.

Safety precautions



WARNING!
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.
- observe good personal hygiene.
- beware the risk of infection.
- follow local safety regulations.

Inspection

Regular inspection and preventive maintenance ensure more reliable operation.



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

Normally, the pump should be subjected to 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.

Recommended inspections:

Inspection of	Action
Visible parts on pump and installation	<p>Replace or fix worn and damaged parts.</p> <p>Make sure that all screws, bolts and nuts are tight.</p> <p>Check the condition of carrying handle/lifting eyes, chains and wire ropes.</p>
Pump casing and impeller	<p>Replace worn parts if they impair function.</p> <p>Wear on the impeller and the parts around it necessitates fine adjustment of the impeller or replacement of worn parts. See “Replacing the impeller” and “Replacing the diffuser”.</p>
Oil quantity	<div style="border: 1px solid black; padding: 5px;">  <p>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> <p>The oil housing contains 5.1 litres (5.1 US quarts). Always fill oil through the oil hole marked with an oil can. The oil casing is full when the oil reaches the filling hole. See “Changing the oil”.</p>
Condition of the oil	<p>A check of the condition of the oil can show whether there has been any leakage. Maximum permissible leakage is 0.05 ml/h. (0.0017 oz/h). Note! Air/oil mixture can be confused with water/oil mixture.</p> <p>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.</p> <p>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.</p> <p>If the oil contains too much water again, the fault may be:</p> <ul style="list-style-type: none"> — that an oil screw (67) is not sufficiently tight. — that the O-ring (103) or its sealing surface is damaged. — that an O-ring (118) or its sealing surface is damaged. — that the lower seal (8) is damaged. Contact a Flygt service shop.
Liquid in the stator casing	<div style="border: 1px solid black; padding: 5px;">  <p>WARNING. If there has been leakage, the stator casing may be under pressure. Hold a rag over the inspection screw to prevent splatter. See “Safety precautions” for additional information.</p> </div> <p>Remove the inspection screw (67) marked INSP and the O-ring (103). Tilt the pump so that any liquid in the stator casing can run out through the hole.</p> <p>If there is water in the stator casing, the cause may be:</p> <ul style="list-style-type: none"> — that the inspection screw (67) is not sufficiently tight. — that the O-ring (103) its sealing surface is damaged. — that an O-ring (119) is damaged. — that the cable entry is leaking. <p>If there is oil in the stator casing, the cause may be:</p> <ul style="list-style-type: none"> — that the inner seal (2) is damaged. Contact a Flygt service shop.

Inspection of	Action
Cable entry	<p>Make sure that the cable clamps are tight.</p> <p>If the cable entry leaks:</p> <ul style="list-style-type: none"> — check that the entry is tightened so it bottoms out. — cut a piece of the cable off so that the seal sleeve (24) closes around a new position on the cable. — replace the seal sleeve (24). — check that the seal sleeve (24) and the washers (23) 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>
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>
Pipes, valves and other peripheral equipment	<p>Repair faults and notify supervisor of any faults or defects.</p>
Insulation resistance in the stator	<p>Use insulation tester. With a 1000 V-DC megger the insulation between the phases and between any phase and earth (ground) should be > 1 MΩ.</p>

Changing the oil



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.

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

Unscrew the oil casing screw (67) marked with a symbol for oil drainage.

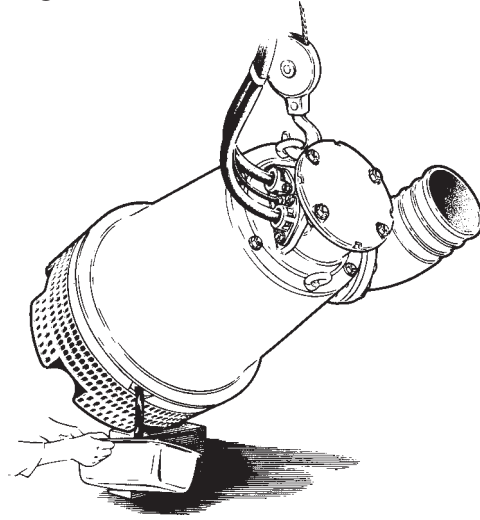
Turn the pump so that the oil hole faces downwards. It is easier to drain the oil if the other oil hole screw is also removed.

Fill with 5.1 litres (5.1 US quarts) of new oil. Always replace the O-rings under the oil casing screws. Place the screws back in. Tightening torque 10–20 Nm (7.5–15 ft lb).

A paraffin oil with viscosity close to ISO VG15 is recommended (e.g. Mobil Whiterex 309). The pump is delivered from factory with this type of oil.

In applications where poisonous properties are of less concern, a mineral oil with viscosity up to ISO VG32 can be used.

Draining the oil



Replacing the impeller

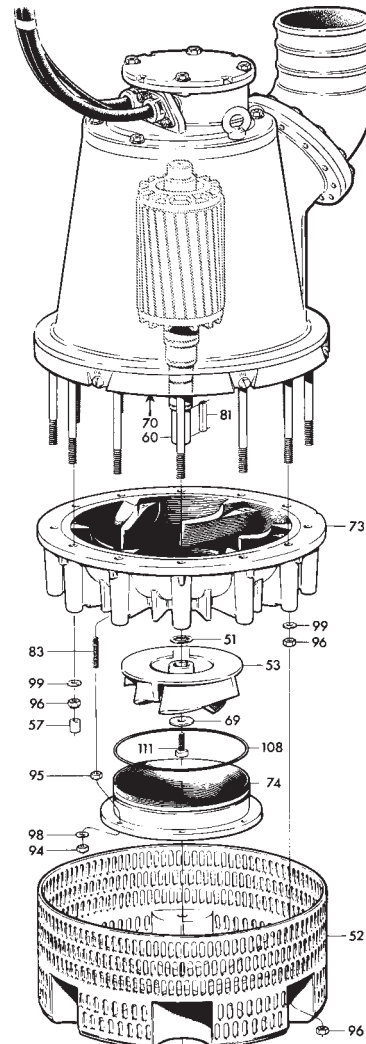
The POLY-LIFE version of this pump has a product code starting with U, (see the data plate on the pump). Make sure that spare parts with spare part numbers marked (U), in the spare parts list, are used.

When the new wear parts are fitted, a clearance must be provided between the impeller and the oil casing bottom and between the impeller and the lower diffuser. The clearance should be 0.2–0.3 mm.

Check after fitting that the impeller can rotate freely.

The polyurethane covering is extremely resistant to wear. If the impeller does not rotate completely freely, friction will generate a great deal of heat. The result can be that the wear parts are deformed or that the impeller gets stuck, resulting in damages to the pump.

Removing the impeller





WARNING!
Worn impellers often have very sharp edges.

Lay the pump on its side.

Remove nuts (96) and pull off the strainer (52).

Remove nuts (94)

Remove washers (98), lower diffuser (74) and O-ring (108).

Remove impeller screw (111).

Remove washer (69).

Pull off the impeller.

Use impeller puller, 84 13 60 or pry of carefully with two strong screwdrivers or bars.

Fitting the impeller

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

Clean and oil all sealing surfaces and O-rings.

Molybdenum disulphide (MoS_2) may not be used.

Check:

- that the key (81) is seated in the keyway on the shaft.
- that an appropriate number of adjusting washers (51) are on the shaft.

Grease end of shaft and impeller hub.

Place washer (69) on the impeller screw.

Press the impeller onto the shaft with the impeller screw.

Tighten the impeller screw.

Tightening torque 200 Nm (150 ft lb).

Check that the impeller can be rotated by hand.

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 (51).

Check that the impeller can easily be rotated by hand.

Screw the adjusting nuts (95) down toward the bottom of the studs (83).

Press the lower diffuser (74) against the impeller.

Screw the adjusting nuts (95) so that they lie flush against the lower diffuser.

Back off all adjusting nuts another half-turn (counter-clockwise).

Place washers (98) and nuts (94) on the studs.

Tighten the nuts (94) evenly all around.

The clearance between the impeller and the lower diffuser shall be as little as possible.

Check that the impeller can easily be rotated by hand. Install strainer (52).

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 should be kept to a minimum.



Replacing the diffuser

Removing the diffuser

Remove the impeller, see "Removing the impeller".
Remove sleeves (57), and unscrew the nuts (96).
Remove washers (99).
Remove diffuser (73).

Installing the diffuser

Screw the diffuser in place with the nuts (96).
Tightening torque 160–200 Nm (120–150 ft lb).
Do not forget to put back washers (99) and sleeves (57).
For further instructions, see "Fitting the impeller".



Replacing the upper diffuser

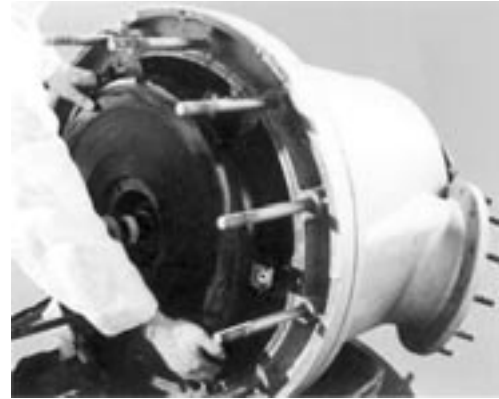
Removing the upper diffuser

Remove the lower diffuser, see "Removing the diffuser". Unscrew nuts (93) and remove washers (97). Pull off the wear protection (50) and upper diffuser (70). Remove O-ring (118).

Installing the upper diffuser

Reassemble in the reverse order to dismantling. Clean the O-ring (118) and its sealing surfaces carefully prior to installing the O-ring and the upper diffuser.

More extensive repairs require special tools and should be carried out by an authorized service technician.



ACCESSORIES AND TOOLS

Tandem operation

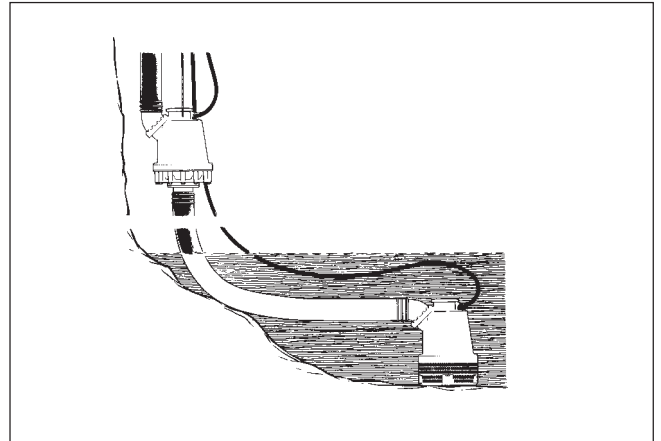
The delivery head can be increased by connecting two or three pumps in tandem.

Max. permissible operating pressure is 1 MPa (145 psi).

The vertical distances between the pumps should be approximately equal.

See special brochure that describes the procedure for tandem connection.

The following complete connection units are available for tandem connection:



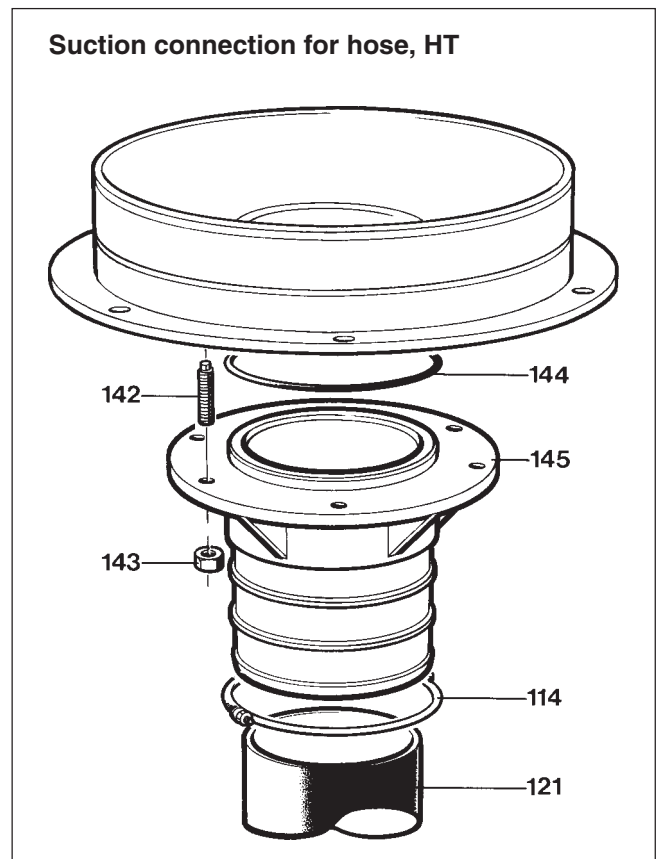
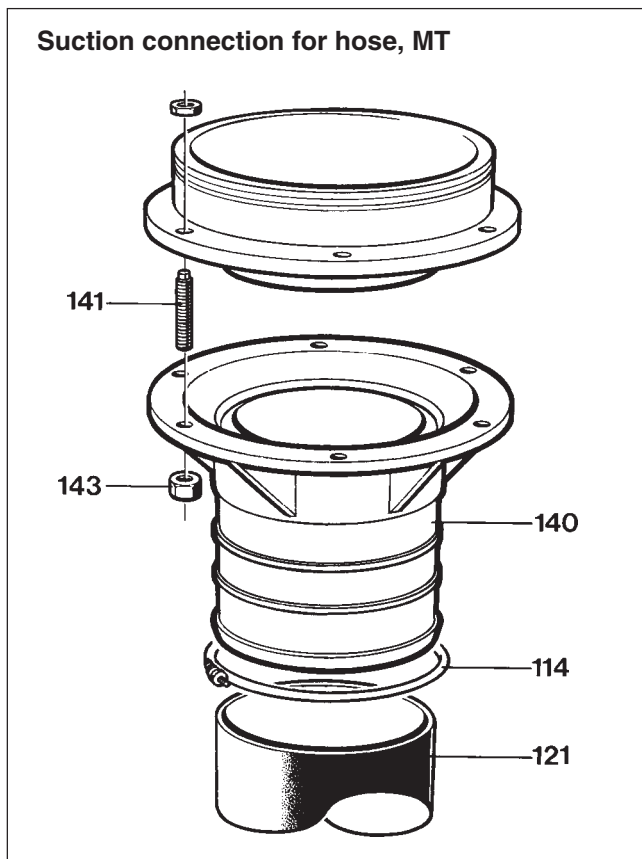
Description	Part No.	Intended for
Suction connection unit	282 89 01	Hose 6" HT
Suction connection unit	282 89 02	Hose 10" MT
Suction flange unit	284 43 01	Welding to a 6" pipe HT
Suction flange unit	284 43 02	Welding to a 10" pipe MT

MT version

Remove the strainer, the diffuser and the studs. Fit the new longer studs (141) and the adjusting nuts on the pump. Mount the diffuser and the connection (140), tighten the nuts (143). Adjust the diffuser, see "Adjusting the impeller".

HT version

Remove the strainer. Fit the connection (145) and the O-ring (144), on the diffuser with stud (142) and nut (143).

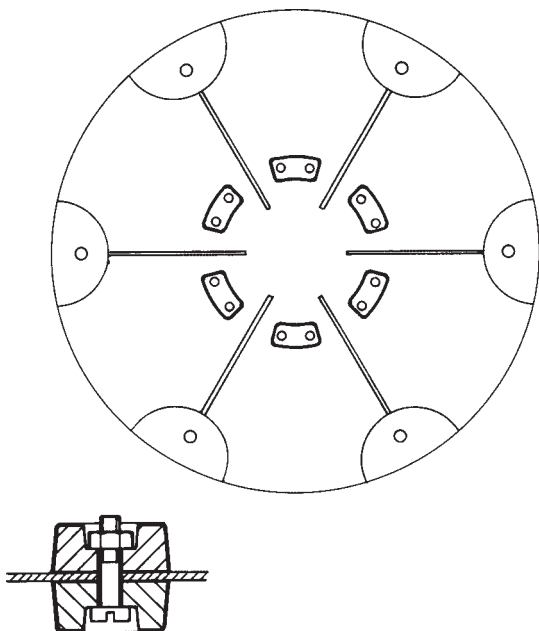


Zinc anode set

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

Installing zinc anodes

The anodes are installed as shown in the figure. Six anodes are fitted on the outside and six on the inside of the strainer bottom.



Important!

Brush or grind off paint, grease and dirt or any other coating that might interfere with the electrical contact between the anodes and the strainer.

Ordering No. 290 16 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:

Ordering No.	Description
84 13 92	Socket, 19 mm
84 13 96	Socket, 24 mm
84 14 06	Socket $\frac{9}{16}$ "
84 14 28	Adjustable wrench, 10" long
84 15 55	Extension bar
84 15 61	Swivel handle $\frac{1}{2}$ " □
84 15 64	Torque wrench 50–225 Nm
84 16 50	Screwdriver, width 8 mm
84 16 74	Screwdriver, width 14 mm
84 13 60	Impeller puller

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

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 isolated, except for those checks which cannot be performed without voltage.

Always make sure that there is no-one near the pump when it is connected.

Use the following checklist as an aid to fault tracing.

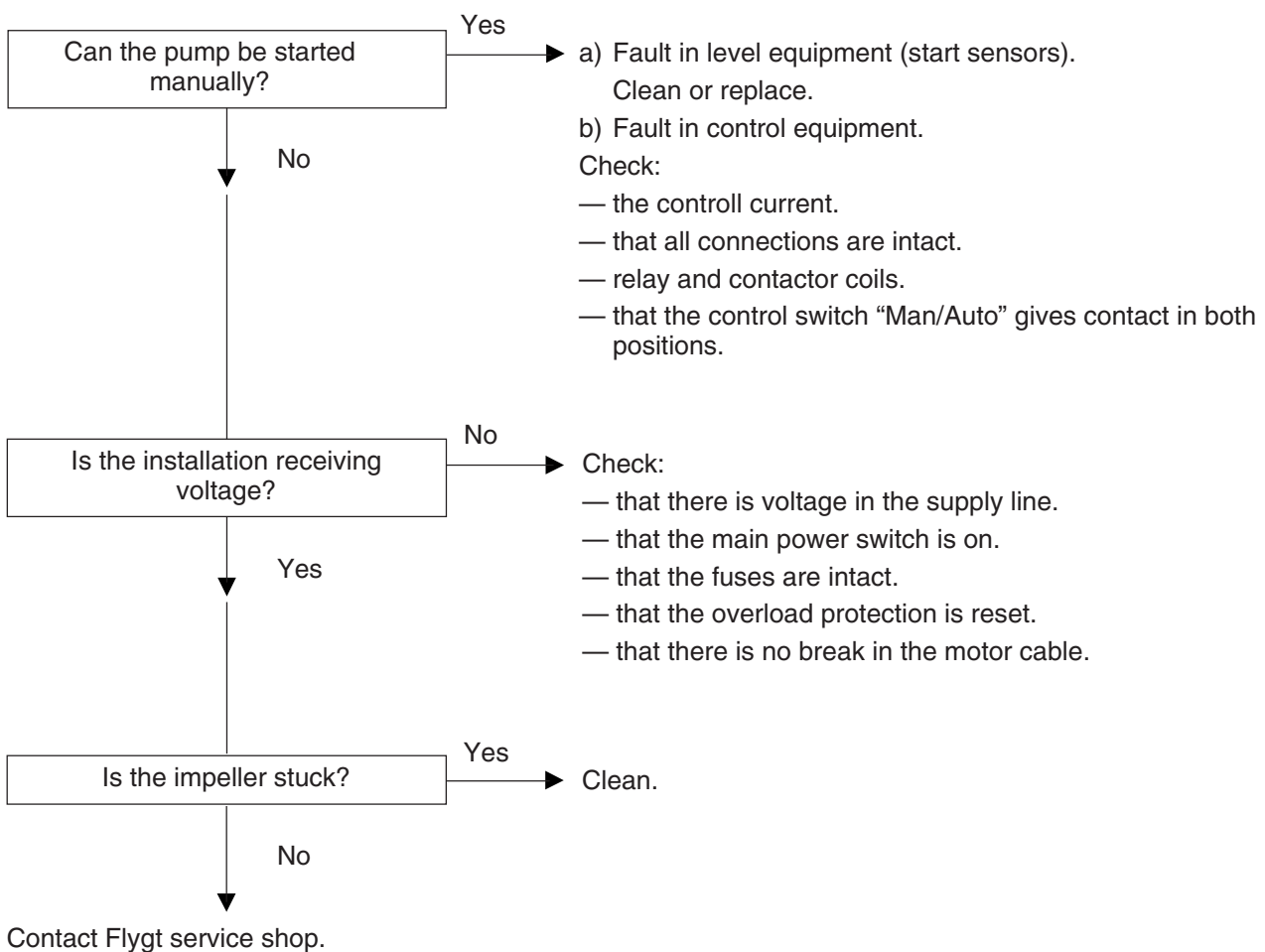
It is assumed that the pump and installation have formerly functioned satisfactorily.



Electrical work should be performed by an authorized electrician.

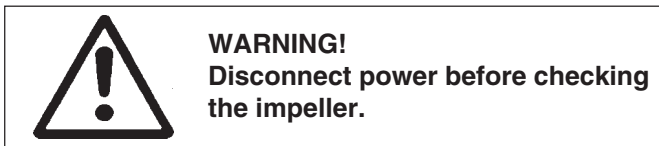
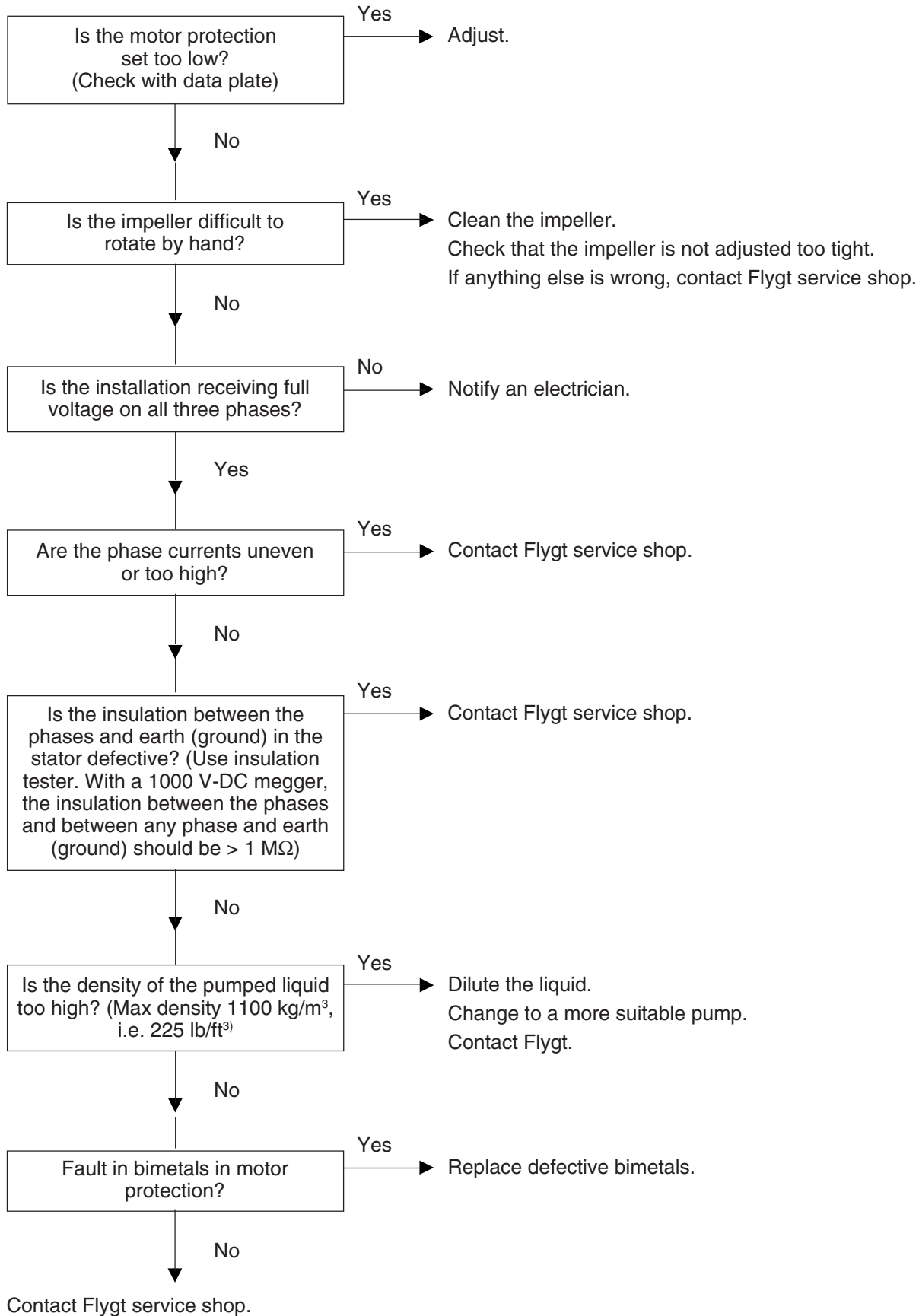
Follow local safety regulations and observe recommended safety precautions.

1. Pump fails to start

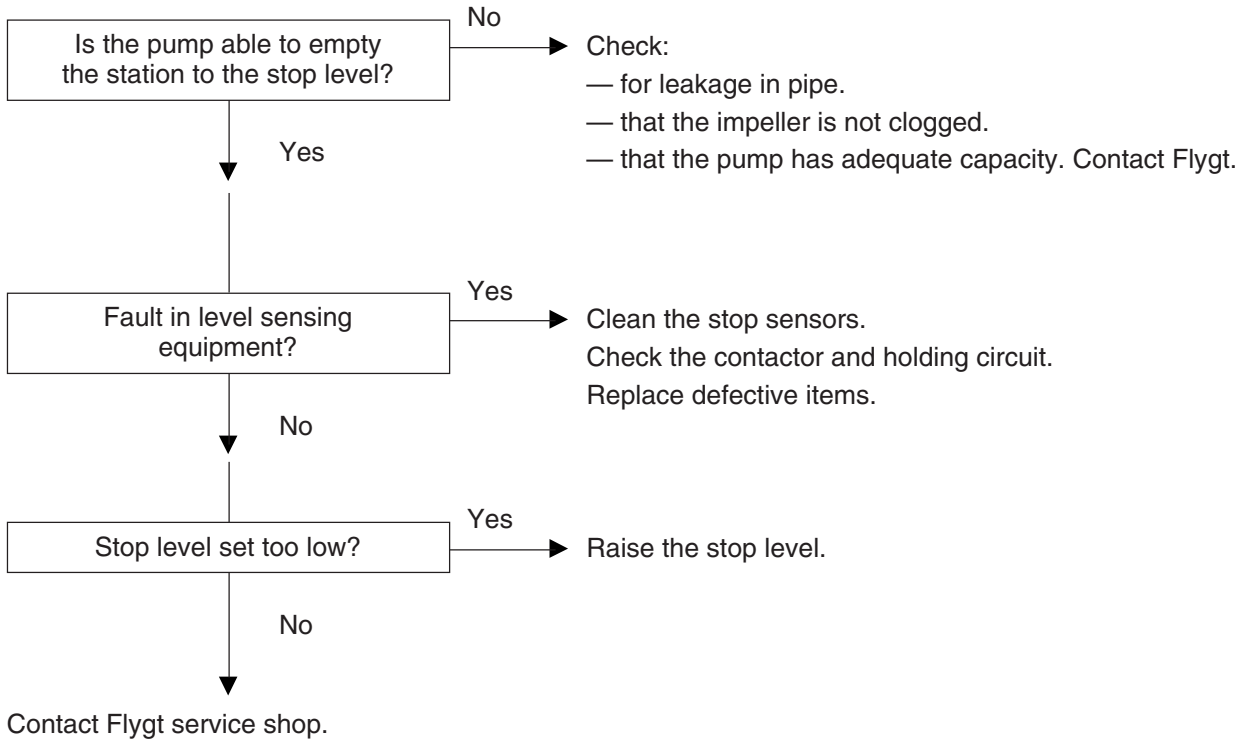


WARNING!
Disconnect power before checking the impeller.

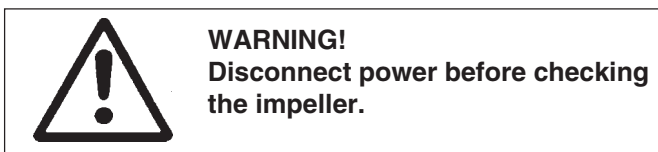
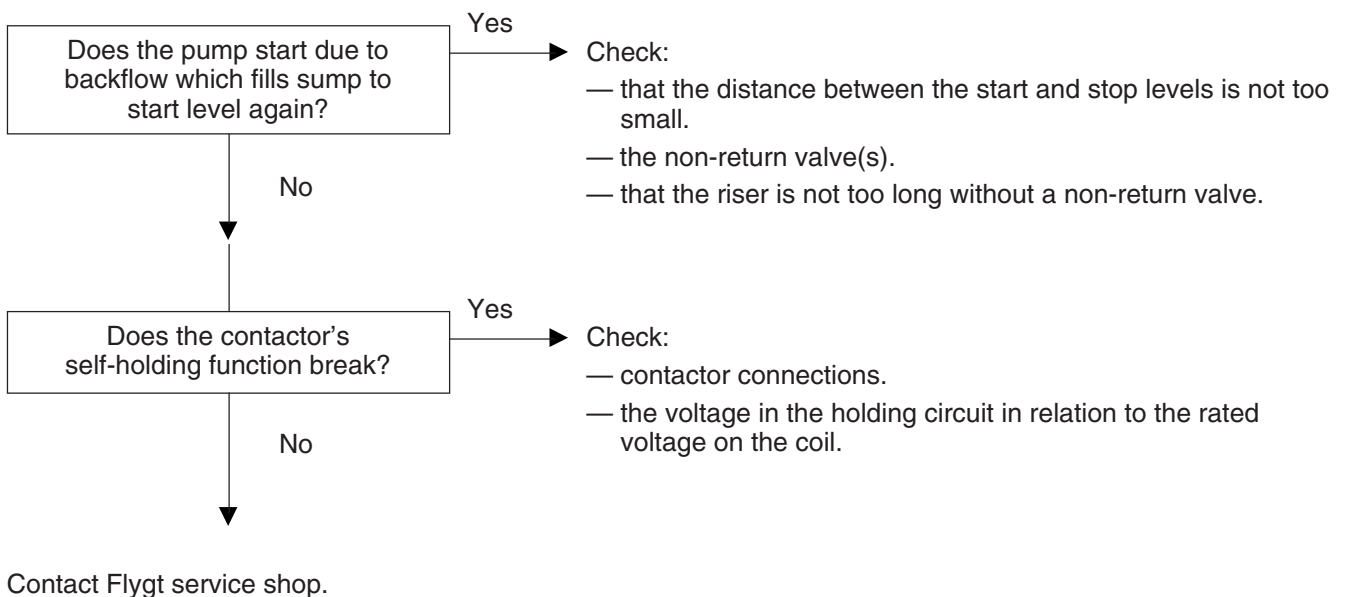
2. Pump starts but motor protection trips



3. The pump does not stop (valid for pumps with start and control equipment)



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



5. Pump runs but delivers too little or no water

Check:

- direction of rotation of the pump, see “Before starting”.
- the 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, diffuser disc, diffuser.

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.

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

