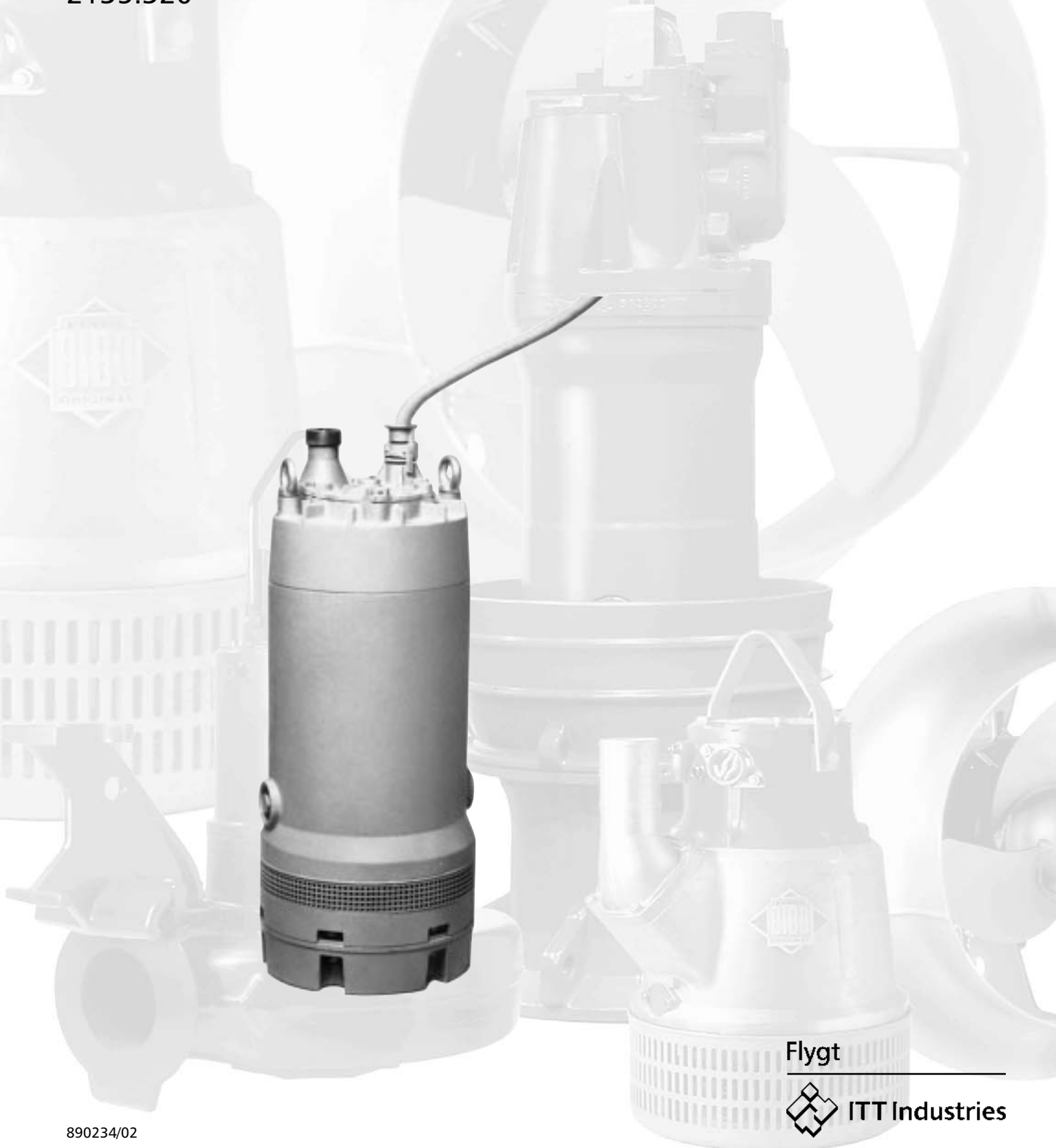




Installation, care and maintenance

2135.320



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 is correctly connected;
- that all service and repair work is done by a workshop authorized by Flygt;
- that genuine Flygt parts are used.

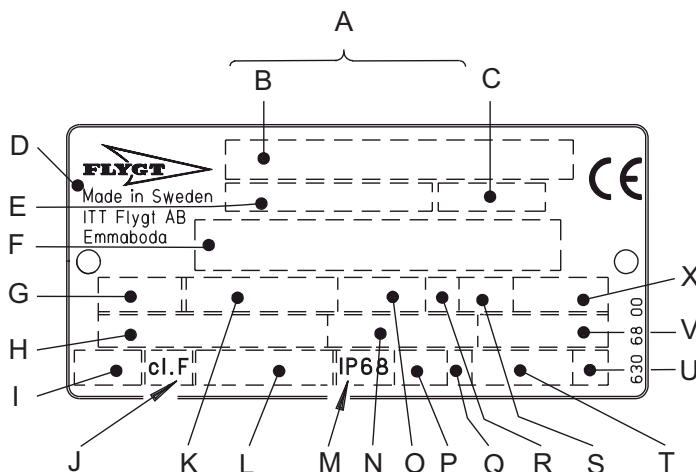
Hence, the guarantee does not cover faults caused by deficient maintenance, improper installation, incorrectly executed repair work or normal wear and tear.

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 PLATES 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

2135.320 is intended to be used for pumping of water which may contain abrasive particles.

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.

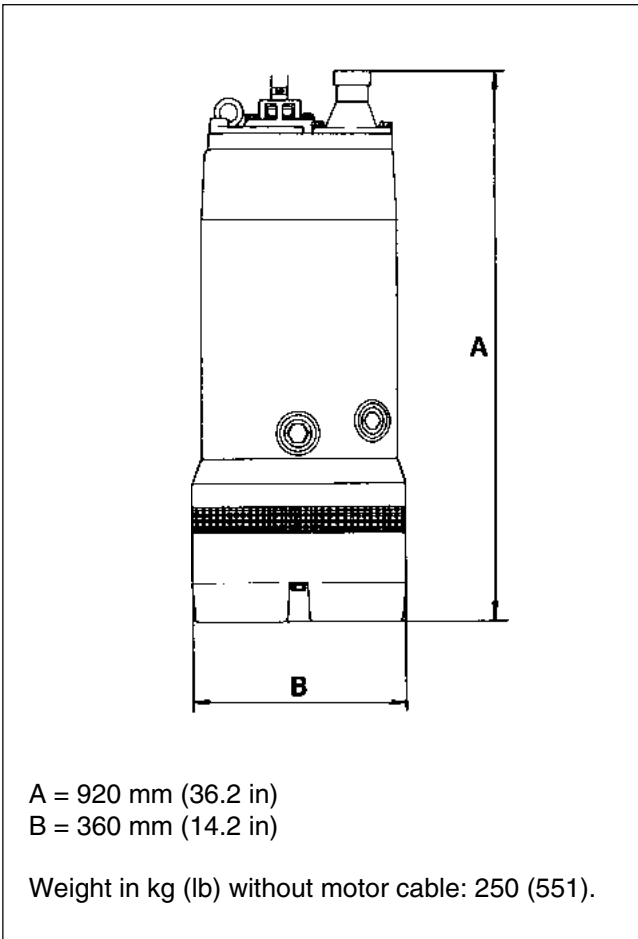
The pH of the pumped liquid: 5—8.

Depth of immersion: max 20 m (66 ft).

The pump shall not be used in explosive or flammable environments or with flammable liquids.

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

Dimensions and weight



Motor data

**Rated output: 13.5 kW,
 3 ~ 50 Hz, 2920 r/min**

| Voltage V | Rated Current A | Starting Current A |
|--------------|--------------------|-----------------------|
| 220 | 44 | 335 |
| 380 | 25 | 194 |
| 400 | 24 | 179 |
| 415 | 23 | 187 |
| 440 | 22 | 200 |
| 500 | 19 | 145 |
| 550 | 18 | 137 |
| 1000 | 9.7 | 71 |
| 1100 | 8.8 | 78 |

**Rated output: 16.5 kW,
 3 ~ 60 Hz, 3525 r/min**

| Voltage V | Rated Current A |
|--------------|--------------------|
| 230 | — |
| 460 | 26 |
| 575 | 21 |
| 600 | 20 |

Design

2135 is a submersible, electric motordriven pump.

Impellers

The pump is equipped with two radialflow impellers.

Shaft seals

The pump has two mechanical seals.

Materials:

Inner seal: tungsten carbide — carbon.

Outer seal: tungsten carbide — tungsten carbide.

Shaft

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

Shaft material: stainless or carbon steel.

Bearings

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

The lower bearing consists of a doublerow angular contact ball bearing.

The upper bearing consists of a singlerow 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.

The motor is started by means of:

star-delta or direct on line start.

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

The stator is insulated in accordance with class F (155°C, 310° F). The motor is designed to supply its rated output at $\pm 5\%$ variation of the rated voltage. Without overheating the motor, $\pm 10\%$ 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.

Monitoring equipment

The stator incorporates three thermal switches connected in series.

The thermal switches:

open at 125°C (260°F).

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

See also "Electrical connections" and separate instructions for starter equipment.



NOTE!

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

Cooling

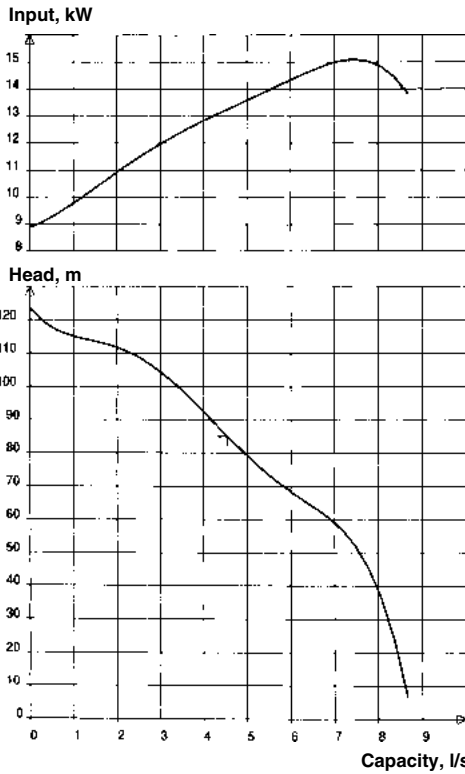
The stator is cooled by the pumped liquid passing through the space between the stator casing and the outer casing.

Technical data

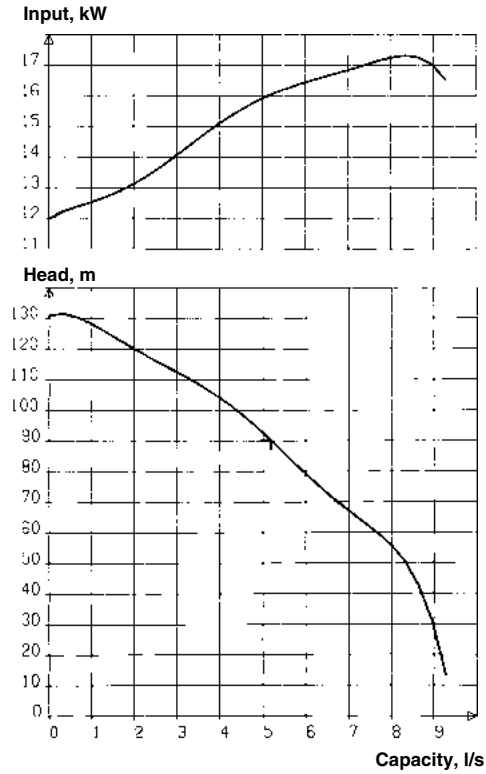
The pump curves show:

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

50 Hz



60 Hz



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 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. Use a safety helmet, safety goggles and protective shoes.
4. A first-aid kit must be handy.

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

Handling equipment

Lifting equipment will facilitate handling of the pump.
WARNING! Keep out from under suspended loads.

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.

Consult your nearest Flygt representative regarding:

- sizing of sump, pumping station and access frame.
- choice of peripheral equipment.
- other problems in connection with installation.

ELECTRICAL CONNECTIONS

All electrical work shall be carried out under the supervision of an authorized electrician.

Local codes and regulations shall be complied with.



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 mains 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 the starter equipment be installed in the pump pit.

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 (3.94") 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, Y or Δ , is valid for the voltage supply. Then, depending on voltage, arrange the connection on the terminal board in accordance with Y or Δ .

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 in the figure. Links are not used with star-delta start.

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

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

Install the cover (97).

Tighten the screws (1) 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".

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.

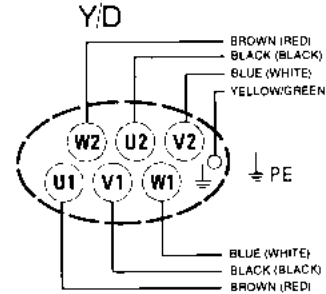
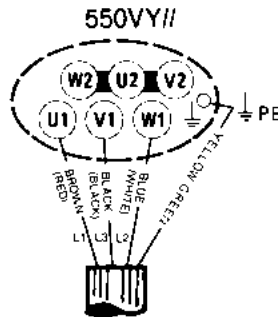
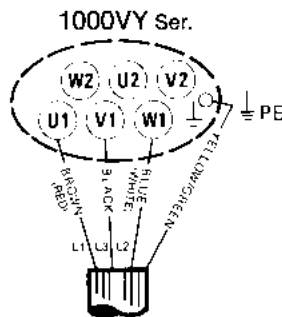
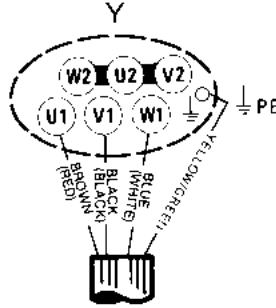
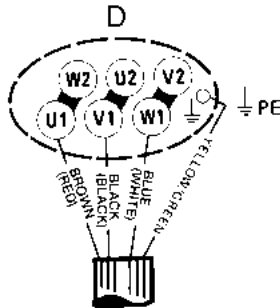
The table (see “Product Description”) gives rated current and starting current. Fuse amperage and cable shall be selected in accordance with local rules and regulations. Note that with long cables, the voltage drop in the cable must be taken into consideration, since the motor’s rated voltage is the 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.



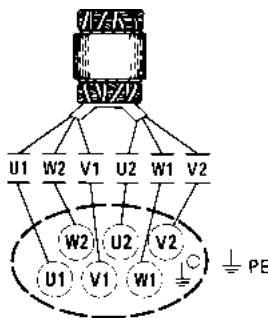
NOTE!
Make sure that the monitoring equipment incorporated in the product is correctly connected.

Motor cable connection



Stator connection

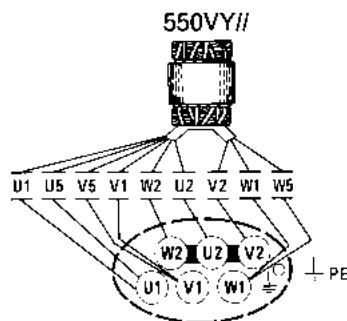
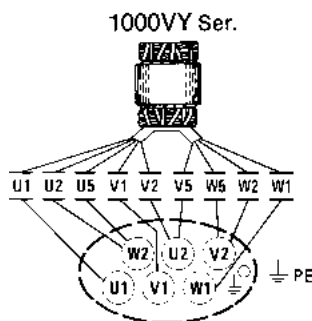
6 stator leads



The stator leads are colour-marked as follows:

- U1 (S1) = Red
- V1 (S2) = Brown
- W1 (S3) = Yellow
- U2 (S4) = Green
- V2 (S5) = Blue
- W2 (S6) = Black
- U5 (S7) = Red
- V5 (S8) = Brown
- W5 (S9) = Yellow
- U6 (S10) = Green
- V6 (S11) = Blue
- W6 (S12) = Black

9 stator leads



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.

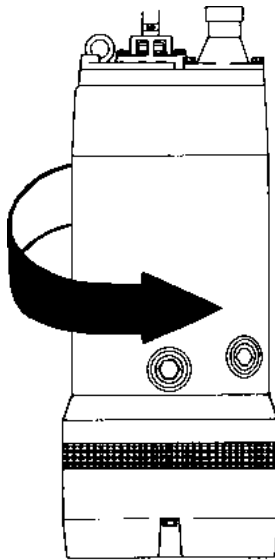
Check the direction of rotation. See the figure. The impeller shall rotate clockwise, as viewed from above. When started, the pump will jerk in the opposite direction to the direction in which the impeller rotates.



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

The above measures are described under "Inspection".

Starting jerk



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

| Mixture | Min. velocity in discharge line |
|---------------------------------------|------------------------------------|
| 1. Water + coarse gravel | 4 m/s (13.2 ft/s) |
| 2. Water + gravel | 3.5 m/s (11.5 ft/s) |
| 3. Water + sand | |
| Sand particles < 0.1 mm (0.004 in) | 1.5 m/s (5.0 ft/s) |
| Sand particles < 0.6 mm (0.024 in) | 2.5 m/s (8.2 ft/s) |

Choose dimension of the discharge line to give the pumped liquid at least this velocity.

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

Cleaning

If the pump has been running in very dirty water, let it run for a while in clean water, or flush it through the discharge connection. If clay, cement or other similar dirt is left in the pump it may clog the impeller and seal preventing the pump from working.

During the longer period out of operation, the pump must be test run every other month to prevent the mechanical seals from sticking together.

CARE AND MAINTENANCE

The figures in parentheses are item numbers and refer to the Exploded view.

Safety precautions



NOTE!
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.
- 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 twice a year, 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.

Service contract

Flygt or its agent offers service agreements in accordance with a preventive maintenance plan. For further information, please contact your Flygt representative.


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 lifting eyes, chains and wire ropes.</p> |
| Pump casing and impeller | <p>Replace worn parts if they impair function. Wear on the outlet flange on the pump casing usually causes corresponding wear on the discharge connection. 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 | <p>Oil casing</p> <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 plug in order to prevent splatter. See "Safety precautions" for additional information. Check that the oil reaches up to the oil hole.</p> </div> |
| Condition of the oil | <p>A check of the condition of the oil can show whether there has been an increased leakage. 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 oil housing contains separated water. 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 (90) is not sufficiently tight. — that the O-ring (33) of an oil screw or its sealing surface is damaged. — that an O-ring (41) or its sealing surface is damaged. — that the lower mechanical seal (67) is damaged. Contact a Flygt service shop. |

| Inspection of | Action |
|---|---|
| Liquid in the stator casing |  <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> |
| Cable entry | <p>Make sure that the cable clamps are tight. If the cable entry leaks:</p> <ul style="list-style-type: none"> — check that the entry is firmly tightened into its bottom-most position. — cut a piece of the cable off so that the seal sleeve (51) closes around a new position on the cable. — replace the seal sleeve (51). — check that the seal sleeve (51) and the washers (20) 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> <p>NOTE! The level sensor contains a mercury switch. Damaged sensors should therefore be disposed of in a proper manner.</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, during non-load every time the pump is reconnected.</p> |
| Pipes, valves and other peripheral equipment | <p>Repair faults and notify supervision 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 M Ω.</p> |

Changing the oil

Oil casing



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 (90).

Turn the pump so that the oil hole faces downwards.

Fill up with 2.5 litres (2.6 US quarts) of new oil. 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.



Always replace the O-rings of the oil hole screws. Put the screws back and tighten them.

Removing the impeller



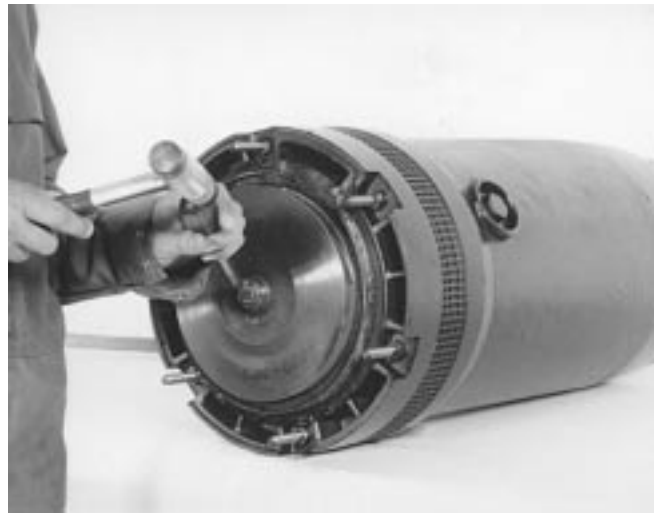
WARNING!
Worn impellers often have
very sharp edges.



Lay the pump on its side.
Remove nuts (13) and washers (22).



Pry of the lower diffuser with a pair of screwdrivers.



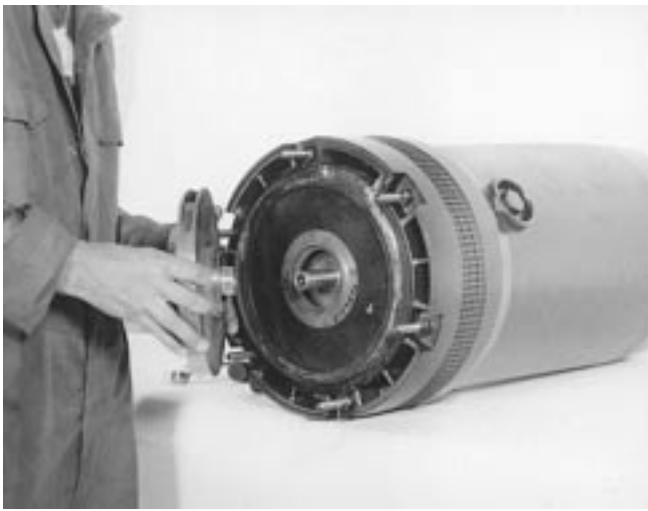
Knock back the folded washer (26).



Remove the impeller bolt (2).



Pull of the impeller nr 1 with a puller.



Pull of impeller nr 2.



Remove the nuts (13) from the stud (89).



Pull of the diffuser disc (113) with a puller.



Pull of the upper diffuser (112) with puller.

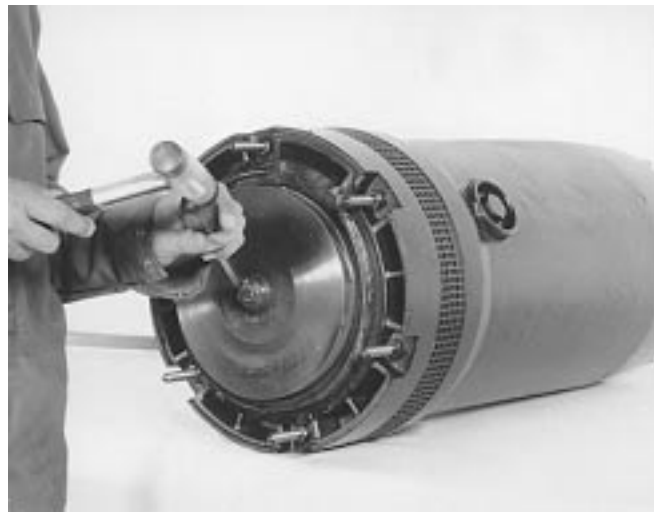


After the four screws (5) have been removed the washer (106) can be knocked out.



Installing the impeller

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



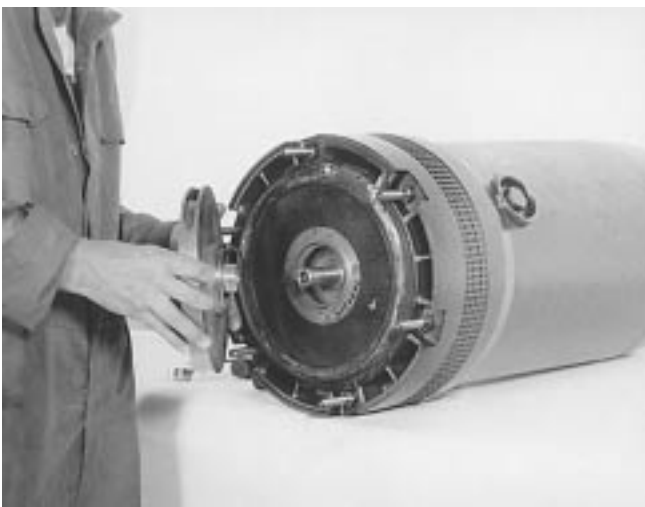
Fold back the washer (26) after tightening the impeller screw (2).

Check that the impeller can be rotated by hand.



Install the diffuser disc (113), knock carefully with a rubber club.

Fit impeller nr 2 and the upper diffuser. Don't forget to put on washers (22) before the nuts.



Continue with impeller nr 1.

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.

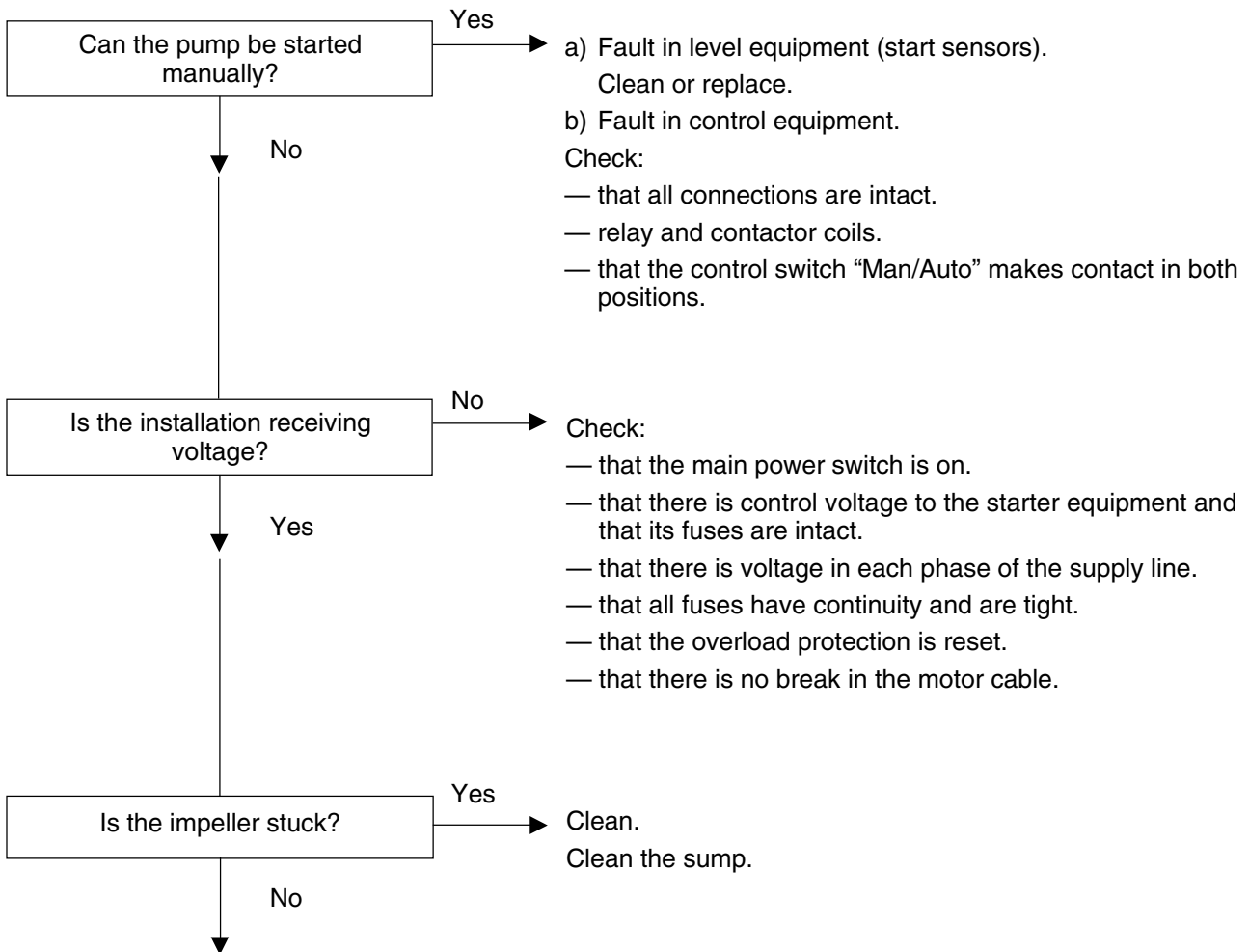
Use the following checklist as an aid to fault tracing. It is assumed that the pump and installation have formerly functioned satisfactorily.



Electrical work should be performed by an authorized Flygt service electrician.

Follow local safety regulations and observe recommended safety precautions.

1. Pump fails to start

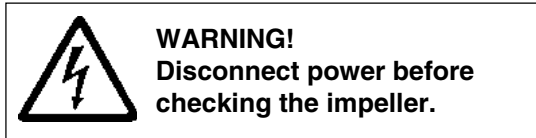
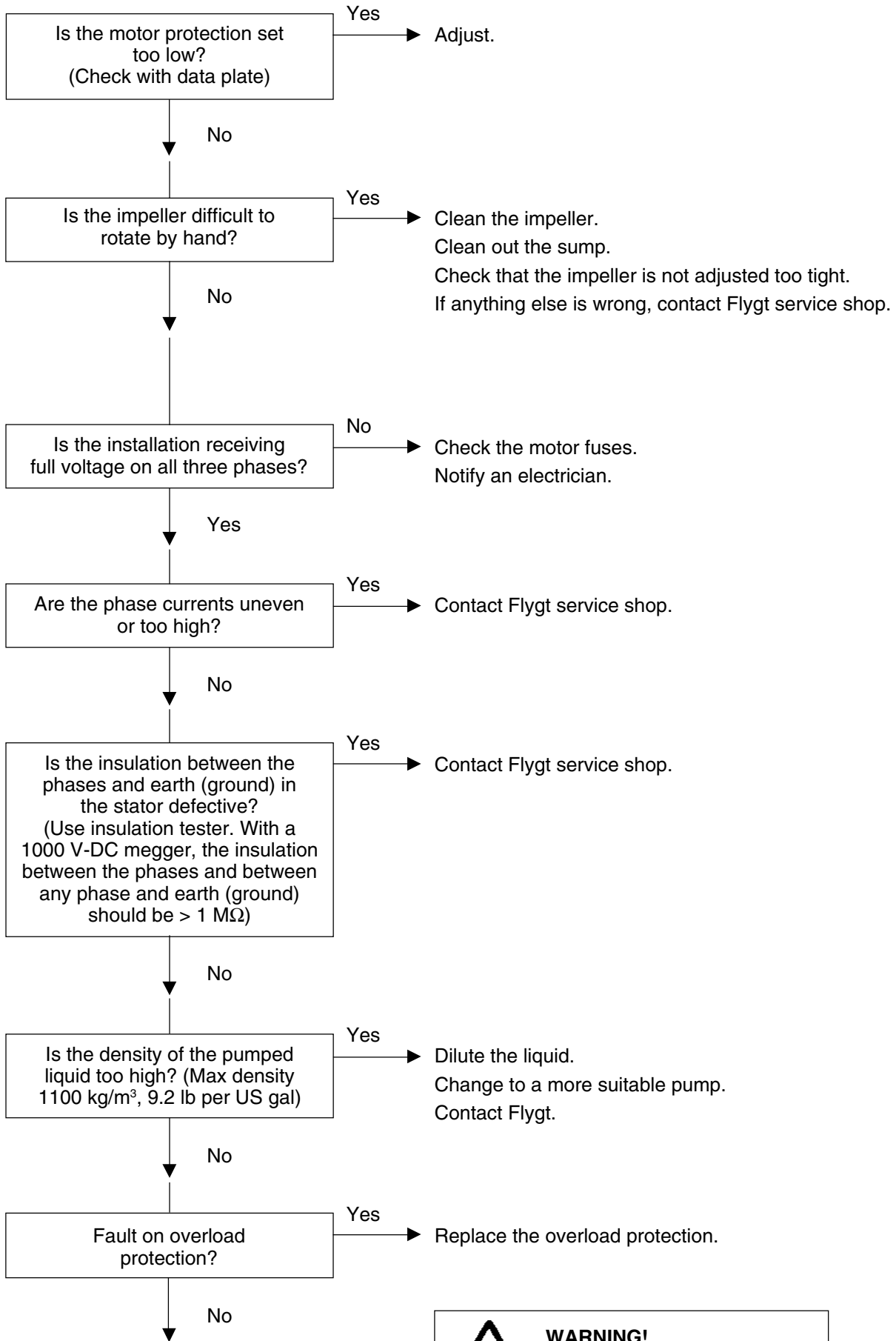


Contact Flygt service shop.

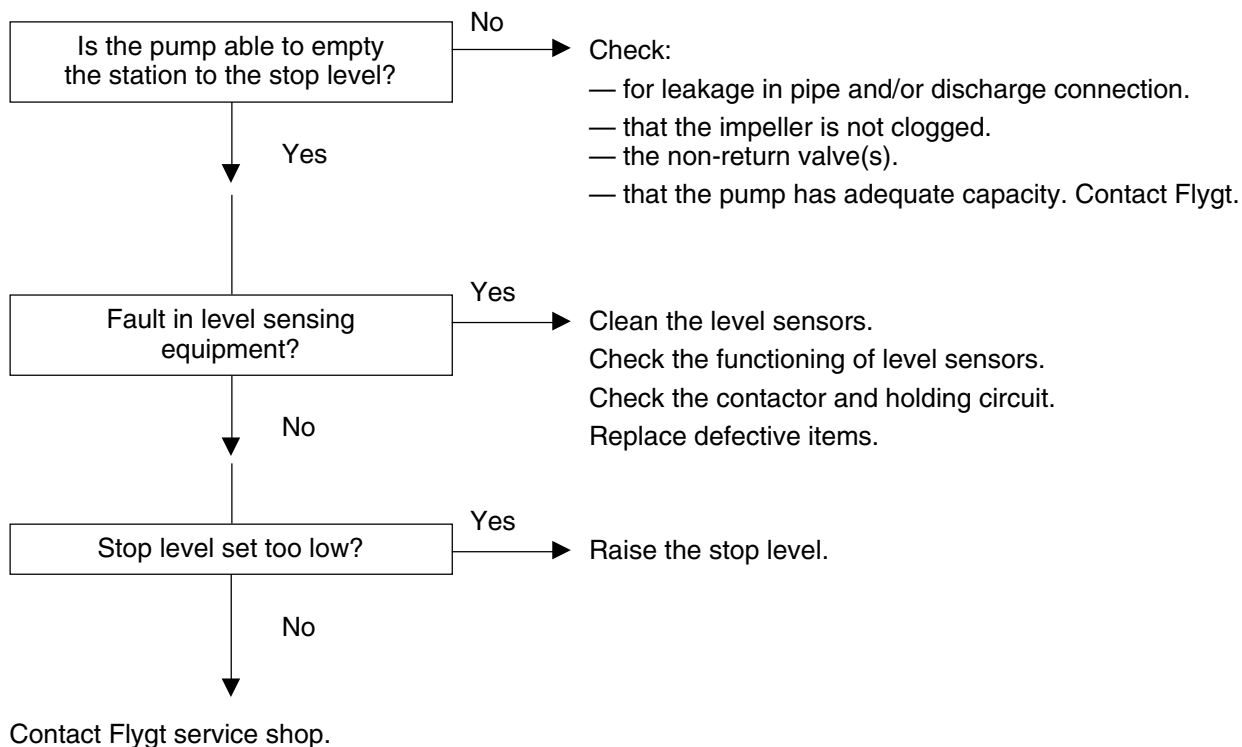


WARNING!
Disconnect power before checking the impeller.

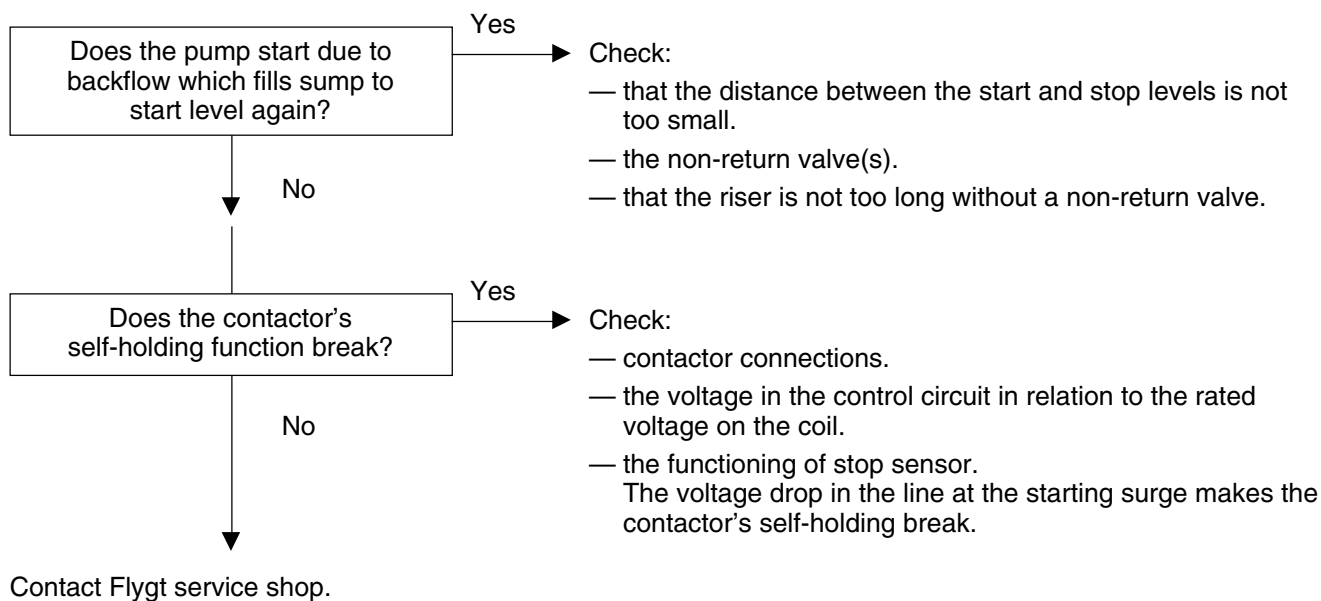
2. Pump starts but motor protection trips



3. The pump does not stop



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



WARNING!
Disconnect power before
checking the impeller.

5. Pump runs but delivers too little or no water

Check:

- direction of rotation of the 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 wear ring, impeller, pump casing/flange, suction bottom, diffuser disc, diffuser.

See also under “Inspection”.

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

ACCESSORIES AND TOOLS

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

Besides ordinary standard tools, the following tools are required in order to perform the necessary care and maintenance of the pump:

| Order No. | Description |
|-----------|-------------------|
| 84 13 60 | Puller (Impeller) |
| 84 13 63 | Puller (Bearings) |
| 84 15 14 | Hook wrench |
| 398 22 00 | Shaft-seal tool |

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

SERVICE LOG

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



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