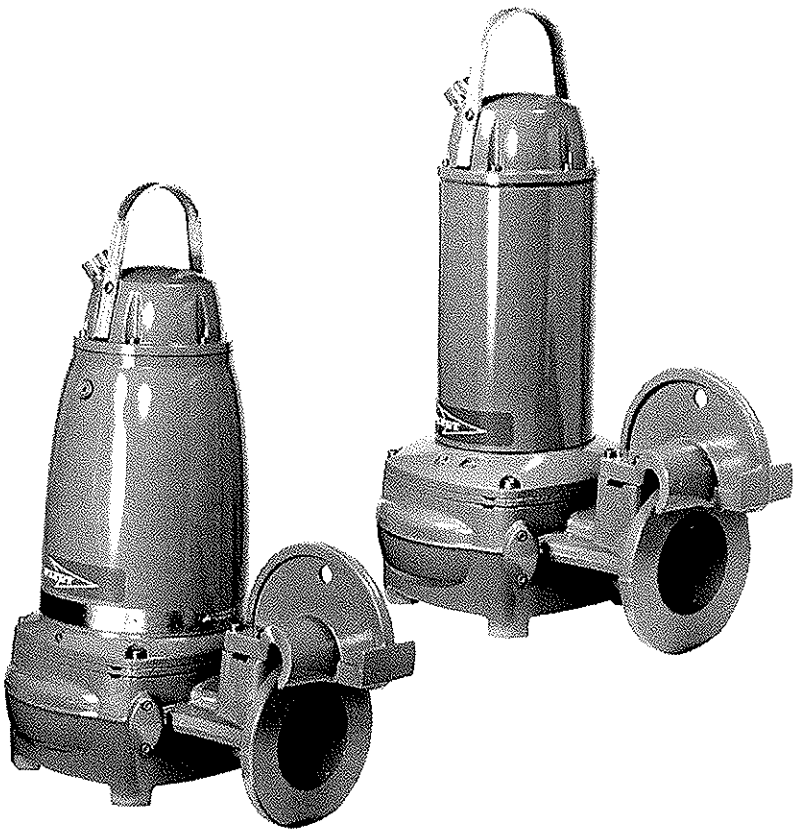
FLYGT

Installation, Care and Maintenance

3202



894445/16

Flygt

ITT Industries

CONTENTS

Safety 2
Guarantee 3
Data plate interpretation 4
Product description 5
Introduction 5
Application 5
Motor data 6
Design of the pump 8
Transportation and storage 10
Installation 10
Handling equipment 10
Safety precautions 11
Installation alternatives 11
Electrical connections 13
Connection of stator and motor leads 14
Sensor connections 22
Operation 24
Before starting 24
Care and Maintenance 25
Service/Inspection 25
Changing the coolant 27
Removing the impeller 28
Installing and setting clearance 29
Removing the impeller - dry installation 30
Installing and setting clearance 30
Fault tracing 32

SAFETY

This manual contains basic information on the installation, operating and maintenance and should be followed carefully. It is essential that these instructions are carefully read before installation or commissioning by both the installation crew as well as those responsible for operation or maintenance. The operating instructions should always be readily available at the location of the unit.

Identification of safety and warning symbols



General Danger:

Non-observance given to safety instructions in this manual, which could cause danger to life have been specifically highlighted with this general danger symbol.



High Voltage:

The presence of a dangerous voltage is identified with this safety symbol.

WARNING! Non-observance to this warning could damage the unit or affect its function

Qualifications of personnel

An authorized (certified) electrician and mechanic shall carry out all work.

Safety regulations for the owner/operator

All government regulations, local health and safety codes shall be complied with.

All dangers due to electricity must be avoided (for details consult the regulations of your local electricity supply company).

Unilateral modification and spare parts manufacturing

Modifications or changes to the unit/installation should only be carried out after consulting with Flygt.

Original spare parts and accessories authorized by the manufacturer are essential for compliance. The use of other parts can invalidate any claims for warranty or compensation.

Dismantling and re-assembly

If the pump has been used to pump hazardous media, care must be taken that, when draining the leakage, personnel and environment are not endangered.

All waste and emissions such as used coolant must be appropriately disposed of. Coolant spills must be cleaned up and emissions to the environment must be reported.

The pumping station must be kept tidy and in good order at all times.

All government regulations shall be observed.

SAFETY

NOTES FOR EX-PRODUCTS

- **Only Ex-approved pumps may be used in an explosive or flammable environment.**
- **Do not open the pump when an explosive gas atmosphere may be present.**
- **Before starting work on the pump, make sure that the pump and the control panel are isolated from the power supply and can not be energized. This applies to the control circuit as well.**
- **All mechanical work on the explosion-proof motor section must be performed by personnel authorized by Flygt.**
- **Electrical connection on the explosion-proof motor must be made by authorized personnel.**
- **Thermal contacts must be connected to protection circuit intended for that purpose according to the approval of the product.**
- **The pump may be used only in accordance with the approved motor data stated on the data plates.**
- **Intrinsically safe circuits are normally required (Ex i) for the automatic level control system by level regulator if mounted in zone 0.**
- **This equipment must be installed in conformity to prescriptions in international or national rules (IEC/EN 60079-14).**
- **The maintenance operation must be made in conformity to the international or national standards (IEC/EN 60079-17).**
- **The yield stress of fastener elements in the product must be in conformity with the value specified in the table for "Material of fastener" on the approval drawing or the parts specified in the part list for the product.**
- **According to the ATEX directive the Ex-pump must never run dry. Permitted minimum water level, see dimensional drawing for the pump. Dry running at service and inspection is only permitted outside the Ex area.**
- **The user must know about the risks due the electric current and the chemical and physical characteristics of the gas and/or vapours present in hazardous areas.**
- **Flygt disclaims all responsibility for work done by untrained, unauthorized personnel.**

GUARANTEE

ITT 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 faults are reported to Flygt or Flygt's repre sentative during the guarantee period;

— that the product is used only under condition described in the Installation, Care and Maintenance manual and in applications for which it is intended;

— that the monitoring equipment incorporated in the product is correctly **connected** and **in use**; — that all service and repair work is done by a work shop authorized by Flygt;

— that genuine Flygt parts are used.

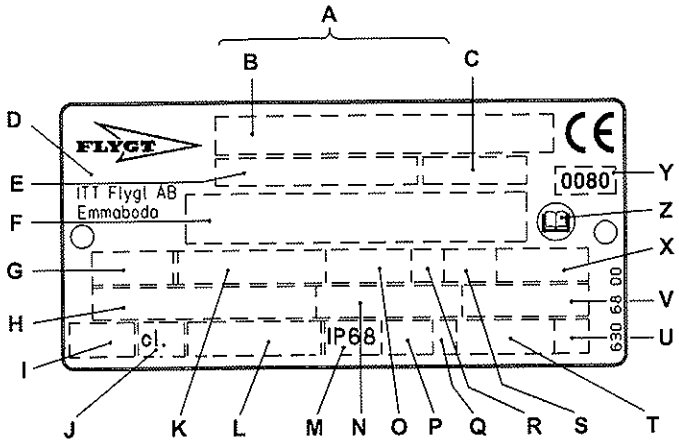
Hence, the guarantee does not cover faults caused by deficient maintenance, improper installation, incorrectly executed repair work or nomal wear and tear.

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

Flygt guarantees that spare parts will be kept for 15 years after that the manufacture of this product has been discontinued.

DATA PLATE INTERPRETATION

General data plate

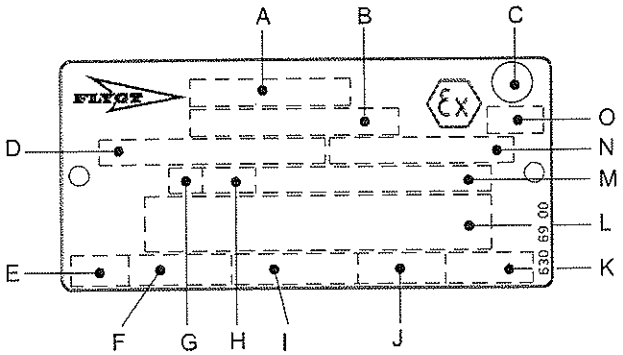


A Serial number
B Product code + Number
C Curve code / Propeller code
D Country of origin
E Product number
F Additional information
G Phase; Type of current; Frequency
H Rated voltage
I Thermal protection
J Thermal class
K Rated shaft power
L International standard
M Degree of protection
N Rated current
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
Y Notifiedbody/Only for EN-approved Ex-products
Z Read Installation Manual

Approval plates

These approval plates apply to an explosion-proof submersible Flygt pump. The plates are used together with the general data plate on the pump.

EN: European Norm
ATEX Directive
EN 50014, EN 50018, EN 1127-1
⟨Ex⟩ II 2 G EEx dII T3

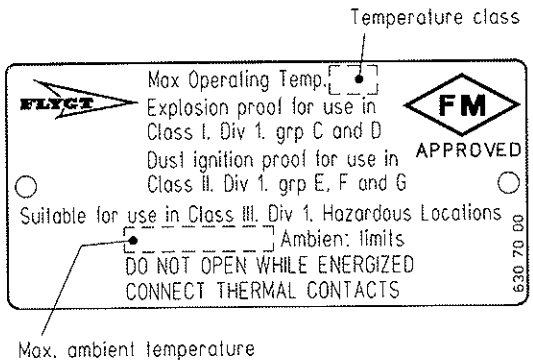


A Approval
B Approval authority + Approval Number
C Approval for Class I
D Approved drive unit
E Stall time
F Starting current / Rated current
G Duty class
H Duty factor
I Input power
J Rated speed
K Controller
L Additional information
M Max. ambient temperature
N Serial number
O ATEX marking

EN approval for the Cable entry

Certificate number: INERIS 03ATEX9008 U
⟨Ex⟩ II 2 G or IM2 EEx d IIC or EEx d I

FM: Factory Mutual according to standard 3615 as:
Class I Div. I Grp C and D
Class II and III Div. I Grp E, F and G



PRODUCT DESCRIPTION

Introduction

Thank you for buying a submersible ITT Flygt pump. In this Installation, Care and Maintenance manual you will find general information on how to install and service the 3202 pump to give it a long and reliable life.

Application

This Installation, Care and Maintenance manual applies to a submersible Flygt pump.
If you have bouth an Ex-approved pump (please see approval plate on your pump or Parts List) special handling instructions apply as described in this document.

The pump is intended to be used for;

— pumping of waste water
— pumping of raw or clean water
— pumping of sludge

Installation alternatives

P = semi permanent wet well arrangement with pump installed by means of twin guide bars with automatic connection to discharge.

S = transportable version with hose connection or flange for connection to discharge pipeline.

T = permanent dry well or in-line arrangement with flange connection to suction and discharge pipework; vertical mounting.

Z = permanent dry well or in-line arrangement with flange connection to suction and discharge pipework; horizontal mounting.

In **T, S** and **Z** installations the pump must be equipped with cooling jacket.

For further information on applications, contact your nearest Flygt representative.

Pump versions

LT= low head execution
MT = medium head execution
HT = high head execution

Liquid temperature: max. 40°C (104°F)
Also available in an execution for liquid temperature up to 70°C (158°F) only with cooling jacket.

Higher temperatures than 40°C (104°F) are not permitted for Ex-approved pumps.

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

The pH of the pumped liquid: 5.5 -14

Lowest liquid level: See illustration page 8

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

Recycling

Local and/or private laws and regulations regarding recycling must be followed. If there are no laws or regulations, or the product is not accepted by an authorized recycling company, the product or it's parts can be returned to the nearest Flygt sales company or service workshop.

Weights

Weight including connections, but without motor cable in kg (lb).

Pump type	With cooling jacket	Without cooling jacket	Discharge connection
NP 3202 HT	570 (1254)	519 (1142)	91 (200)
NP 3202 MT	580 (1279)	529 (1166)	101 (223)
NP 3202 LT	790 (1742)	739 (1629)	217 (478)
NS 3202 HT	580 (1279)		—
NS 3202 MT	610 (1345)		—
NS 3202 LT	900 (1984)		—
NT 3202 HT	630 (1389)		—
NT 3202 MT	670 (1477)		—
NT 3202 LT	1030 (2271)		—
NZ 3202 HT	630 (1389)		—
NZ 3202 MT	650 (1433)		—
NZ 3202 LT	960 (2116)		—

Motor data 50 Hz

50 Hz, 30.0 kW, 1475 r/min
3-phase, 4-pole

Voltage V	Rated current A	Starting current A
380 D	54	340
400 D	54	360
415 D	52	340
440 D	51	365
660 Y	33	203
690 Y	32	207

50 Hz, 22.0 kW, 975 r/min
3-phase, 6-pole

Voltage V	Rated current A	Starting current A
380 D	44	225
400 D	43	238
415 D	41	222
440 D	40	239
660 Y	25	130
690 Y	25	137

50 Hz, 37.0 kW, 1475 r/min
3-phase, 4-pole

Voltage V	Rated current A	Starting current A
380 D	69	435
400 D	66	460
415 D	63	395
440 D	61	420
660 Y	40	257
690 Y	38	265

50 Hz, 30.0 kW, 975 r/min
3-phase, 6-pole

Voltage V	Rated current A	Starting current A
380 D	59	320
400 D	59	320
415 D	55	292
440 D	54	315
660 Y	34	175
690 Y	34	185

50 Hz, 45.0 kW, 1475 r/min
3-phase, 4-pole

Voltage V	Rated current A	Starting current A
380 D	84	570
400 D	82	605
415 D	76	495
440 D	73	530
660 Y	48	340
690 Y	47	345

50 Hz, 37.0 kW, 975 r/min
3-phase, 6-pole

Voltage V	Rated current A	Starting current A
380 D	72	385
400 D	71	410
415 D	68	385
440 D	68	415
660 Y	42	222
690 Y	41	234

Motor data 60 Hz

60 Hz, 45 hp, (34 kW) 1775 r/min
3-phase, 4-pole

Voltage V	Rated current A	Starting current A
230Y//	102	625
460 D	52	365
460YSER	51	315
575 D	41	279
600 D	40	293

60 Hz, 35 hp, (26 kW) 1170 r/min
3-phase, 6-pole

Voltage V	Rated current A	Starting current A
230Y//	84	450
460 D	43	246
460YSER	42	225
575 D	34	197
600 D	34	208

60 Hz, 60 hp, (45 kW) 1775 r/min
3-phase, 4-pole

Voltage V	Rated current A	Starting current A
460 D	68	465
575 D	55	385
600 D	54	405

60 Hz, 45 hp, (34 kW) 1170 r/min
3-phase, 6-pole

Voltage V	Rated current A	Starting current A
460 D	55	335
575 D	44	262
600 D	43	276

60 Hz, 70 hp, (52 kW) 1775 r/min
3-phase, 4-pole

Voltage V	Rated current A	Starting current A
460 D	80	615
575 D	63	410
600 D	61	435

60 Hz, 60 hp, (45 kW) 1170 r/min
3-phase, 6-pole

Voltage V	Rated current A	Starting current A
460 D	72	420
575 D	58	346
600 D	57	355

DESIGN OF THE PUMP

Motor
Squirrel-cage 3-phase induction motor for 50 Hz or 60 Hz.
The motor is started by means of direct on-line or star delta start.
The motor can be run continuously or intermittently with a maximum of 30 evenly spaced starts per hour.
Flygt motors are tested in accordance with IEC 34-1.

The stator is insulated in accordance with class H (180° C, 360 F). The motor is designed to supply its rated output at ± 10% variation of the rated voltage. Without overheating the motor, ± 10% variation of the rated voltage can be accepted provided that motor does not run continuously at full load.

Monitoring equipment
The stator incorporates three thermal contacts connected in series that activate an alarm at overtemperature.
The thermal contacts: open at 140° C (285 F). The sensors shall be connected to Flygt's monitoring unit MiniCAS II or equivalent unit.
The monitoring equipment shall be of a design that makes automatic restart impossible.
The 3202 is supplied with inspection sensor FLS10 for sensing the presence of any liquid in the inspection chamber.

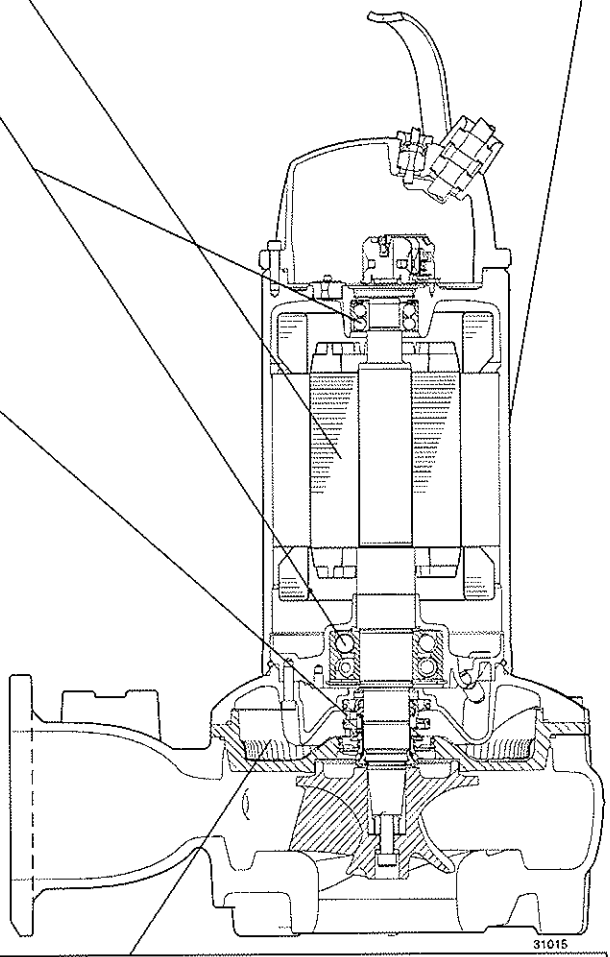
Cooling
The pump is cooled by the ambient liquid. For lowest liquid level, see illustration below.

Bearings
The support and main bearing of the shaft are both double row angular contact ball bearings.

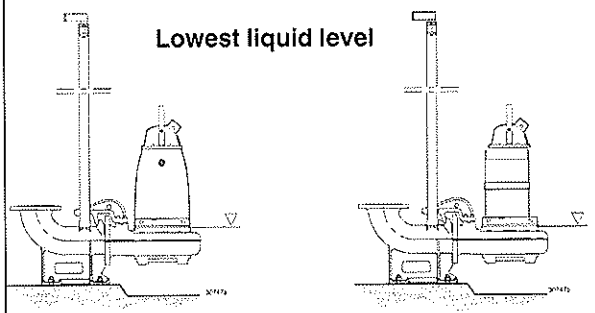
Mechanical seal unit
The pump has one shaft mechanical seal unit consisting of two independently operating seals:

Alt I	Inner seal:	Corrosion resistant tungsten carbide WCCR/WCCR
	Outer seal:	Corrosion resistant tungsten carbide WCCR/WCCR
Alt II	Inner seal:	Corrosion resistant tungsten carbide WCCR/WCCR
	Outer seal:	Silicon Carbide RSiC/RSiC

Without cooling jacket

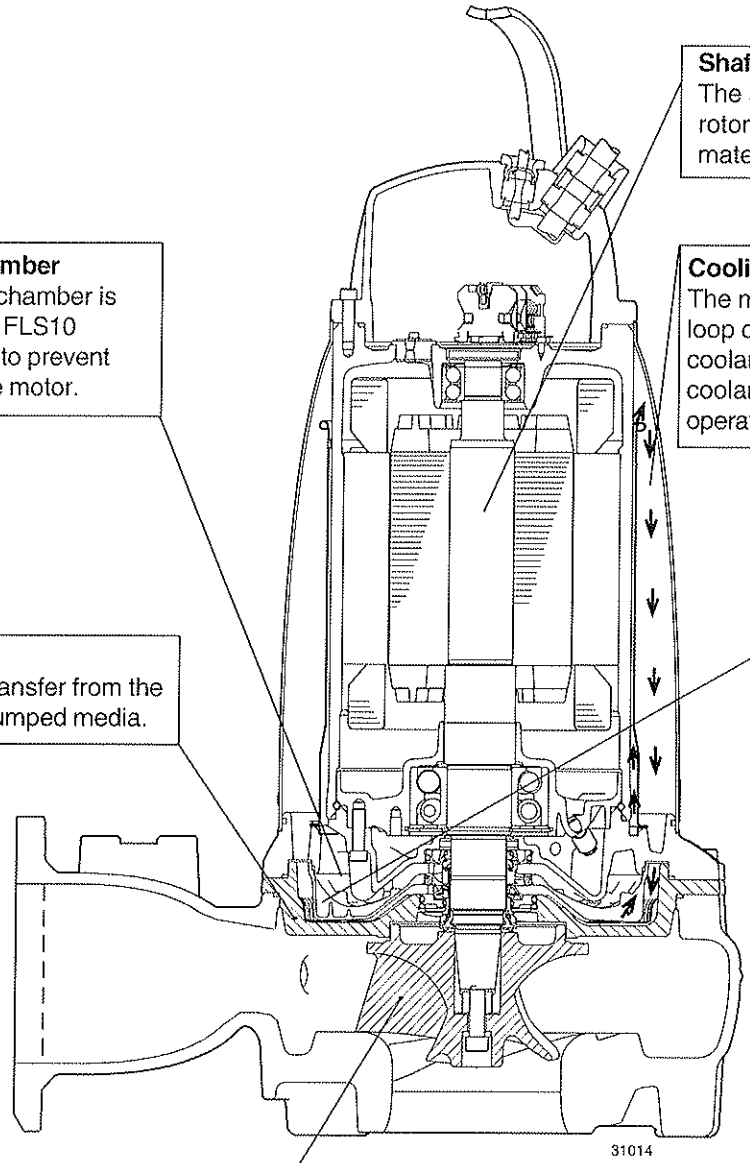


Lowest liquid level



Seal housing
A coolant fluid lubricates and cools the mechanical seal unit and acts as a buffer between the pumped media and the electric motor.

With cooling jacket



Shaft
The shaft is delivered with the rotor as an integral part. Shaft material; stainless steel.

Inspection chamber
The inspection chamber is equipped with a FLS10 leakage sensor to prevent damages on the motor.

Cooling
The motor is cooled by a closed loop cooling system. An integrated coolant pump circulates the coolant whenever the pump is operated.

Flow diffusor
Provides heat transfer from the coolant to the pumped media.

Seal housing
The coolant lubricates and cools the mechanical seal unit and acts as a buffer between the pumped media and the electric motor.

Impeller
The pump is equipped with a N-impeller, a semi-open two-vane impeller.

TRANSPORTATION AND STORAGE

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

WARNING!
Always lift the pump by its lifting handle never by the motor cable or the hose.

The pump is frostproof as long as it is operating or is immersed. If the pump is hoisted from the sump when the temperature is below the freezing point, the impeller and shaft seal may freeze.

A frozen impeller and shaft seal can be thawed by allowing the pump to stand immersed in the liquid for a short period before it is started. Never use a naked flame to thaw the pump. The pump should run for a few seconds after being taken up in order to expel all remaining water from the hydraulic end.

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 shaft 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 shaft seal and the cable entry.

Follow the instructions under the heading "Before starting".

INSTALLATION

Handling equipment

Always pay extra attention to safety aspects when working with lifting equipment.
Lifting equipment is required for handling the pump. The lifting chain and the schackle should be in stainless steel and inspected every year.



— Stay clear of suspended loads.

— Always lift the pump by its lifting handle - never by the motor cable or the hose.

The minimum height between the lifting hook and the floor shall be sufficient to lift the pump out of the sump.

The lifting equipment shall be able to hoist the pump straight up and down in the sump, preferably without the need for resetting the lifting hook.

Oversized lifting equipment could cause damage if the pump should stick when being lifted.

Make sure that the lifting equipment is securely anchored and in good condition.

Check that the lifting handle and chain are in good condition.

To ensure proper installation, please see the dimensions on the dimensional drawing.

WARNING! The end of the cable must not be submerged. It must be above flood level, as water could penetrate through the cable into the junction box or the motor.

For automatic operation of the pump (level control), it is recommended that the level regulators should be used at low voltage. The data sheet delivered with the regulators gives the permissible voltage. Local rules may specify otherwise.

Clean out all debris from the sump before the pump is lowered down and the station is started.



NOTE for Ex version page 3.

— Minimum stop level should be according to the dimensional drawing.

— The pump must never run dry.

The information below applies only to pumps that are approved by CSA.

WARNING!

The machine is not to be installed in locations classified as hazardous in accordance with the national electric code.

ANSI/NFPA 70-1990

WARNING!

The tank of a sewage machine station must be vented in accordance with local plumbing codes.

Safety precautions

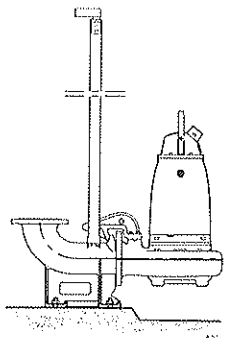
In order to minimize the risk of accidents in connection with service and installation work, the following rules should be followed:

1. Never work alone. Use a lifting harness, safety line and a respirator as required. Do not ignore the risk of drowning.
2. Make sure there are no dangerous gases within the work area.
3. Check the explosion risk before welding or using electric hand tools.
4. Before the pump is installed check that the cable and cable entry have not been damaged during the transportation.
5. Observe strict cleanliness. Do not ignore health hazards.
6. Bear in mind the risk of electrical accidents.
7. Make sure that the lifting equipment is in good condition and comply to local ordinances.
8. Provide a suitable barrier around the work area, e.a. guard rail.
9. Make sure you have a clear path of retreat.
10. Use safety helmet, safety goggles and protective shoes.
11. All personnel who work with sewage systems must be vaccinated against diseases to which they may be exposed.
12. A first-aid kit must be close at hand.
13. Note that special rules apply to installation in explosive athmosphere.

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

Installation alternatives

P- installation



In the P installation, the pump is installed on a stationary discharge connection and operates completely or partially submerged in the pumped liquid.
In addition to the pump the following items are required:

Guide bars consisting of two hot dip galvanized or stainless steel pipes.

Guidebar bracket for attaching the guide bars to the access frame or the upper part of the sump.

Level regulators or other control equipment for start, stop and alarm.

Cable holder for holding the cable and regulating the height of the level regulators.

Access frame (with covers) to which the upper guide bar bracket and cable holder can be attached.

Discharge connection for connecting the pump to the discharge line. The discharge connection has a flange which fits the pump casing flange and a bracket for attaching the guide equipment.

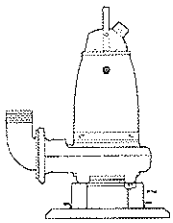
Bushings for vibration damping between the guide bars and the discharge connection.

Instructions

- Provide a barrier around the pump pit, for example a guardrail.
- Arrange for a cable between the sump and the electric control box. Make sure that the cables are not sharply bent or pinched.
- Place the access frame in position.
- Align the frame so that it is horizontal and then grout it in place.
- Grout the anchor bolts in place. Be careful when aligning and positioning the discharge connection in relation to the access frame.
- Place the discharge connection in position and tighten the nuts.
- Secure the guide bars in the bracket.

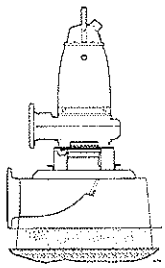
- Check that the guide bars are placed vertically by using a level or a plumb line.
- Connect the discharge pipe to the discharge connection.
- Bolt the cable holder to the access frame. Thread the level regulator cables through the holes in the cable holder and adjust the height of the level regulators.
- Protect bolts and nuts with corrosion preventive compound.
- Lower the pump along the guide bars.
- Fasten the lifting chain (stainless steel) on the access frame and the cables on the cable holder. Make sure that the cables cannot be sucked into the inlet of the pump. Support straps are required for deep installations.
- Run the cables up to the electric control box.
- Clean out debris from the sump before starting up the station.
- The pump can be hoisted up along the guide bars for inspection without any connections having to be undone.

S-installation

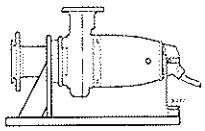


In the S- installation, the pump is transportable and intended to operate completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe, see "Parts list".
The pump stands on a base stand.
WARNING! Watch for the starting jerk which can be powerful.

T/Z- installation



T



Z

In the T- installation, the pump is installed in a stationary position in a dry well next to the wet sump.

In the Z-installation the pump is installed in a horizontal position on a support stand and a bell-mouth is connected to the inlet pipe.

The pump has a watertight motor and will therefore not be damaged in the event of flooding.

The pump is equipped with a cooling jacket.

In addition to the pump the following items are required:

Support stand for anchoring the pump to a base.

Shut-off valves to permit the pump to be removed for service.

Level regulators or other control equipment for start, stop and alarm.

WARNING! The risk of freezing is particularly significant at certain T- or Z-installations.

Instruction
Bolt the base stand to the concrete base by means of the anchor bolts. Bolt the pump to the base stand and the suction connection.
Connect the motor cable, suction line and discharge line.
Make sure that the weight of the pump does not bear on the system piping.

ELECTRICAL CONNECTIONS



— **Before starting work on the pump, make sure that the pump and the control panel are isolated from the power supply and cannot be energized.**

— **If the pump is equipped with automatic level control, there is a risk of sudden restart.**

— **If persons are likely to come into physical contact with the pump or pumped media (liquid), e.g on construction sites and farms, the earthed (grounded) socket must have an additional earth-(ground-) fault protection device (GFI) connected.**

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



NOTE for Ex version page 3.

— **All electrical equipment must be earthed (grounded). 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 (ground) lead is correctly connected by testing it.**

- Check the data plate to determine which voltage supply is valid for your pump.
- Check that the main voltage and frequency agree with the specifications on the pump data plate.
- If the pump can be connected to different voltages, the connected voltage is specified by a yellow sticker.
- Connect the motor cable to the starter equipment as illustrated in the wiring diagrams.
- When the pump is connected to the public mains it may cause flicker of incandescent lamps when starting. In this case the supply authority should be notified before installing the pump.

Leads that are not in use must be isolated.

The cable should be replaced if the outer sheath is damaged. Contact a Flygt service shop.
Make sure that the cable does not have any sharp bends and is not pinched.

Under no circumstances may the starter equipment be installed in the sump.

WARNING! For safety reasons, the earth (ground) lead should be approx. 120 mm (4.8") longer than the phase lead. If the motor cable is jerked loose by mistake, the earth (ground) lead should be the last lead to come loose from its terminal. This applies to both ends of the cable.

The motor is convertible between different voltages as stated on the data plate. This conversion is done on the terminal board or the contactor.

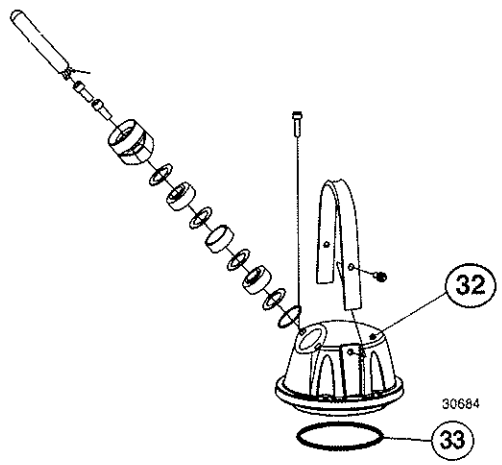


— **Bear in mind the risk of electrical shock and the risk of explosion if the electrical connections are not correctly carried out.**

When using a variable-frequency-drive (VFD) the shielded cable (type Screened SUBCAB®) should be used in order to fulfil European CE requirements. Contact your Flygt representative and ask your VFD-supplier for electrical limitations. Also please see VFD-recommendation Flygt article no. 893472.

Connection of stator and motor leads

- Check on the data plate which connection, Y, D or YD, is valid for the voltage supply. Then, depending on voltage, arrange the connection on the terminal board in accordance with Y, D or YD. See figure.
- Connect the motor cable to the connection block, U1, V1, W1 and earth (ground). Connect the leads from the motor control circuit.
- If star-delta start is used, motor cables are connected as shown in the figure. Links (jumper strips) are not used with star-delta start.
- Make sure that the pump is correctly earthed (grounded).
- Install the O-ring (33) and connection cover (32).
- Tighten the screws and the gland nut so that the cable entry unit bottoms out.
- Connect the motor cable to the starter equipment. Check the direction of rotation, see "Before starting".
- If the direction of rotation is wrong, transpose two of the phase leads.
- 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 and circuit breakers are of the proper amperage.
- The incorporated **thermal contacts** must be connected and in use. The pump must be connected to an overload protection which must be set to rated power.



CABLE CHART

SUBCAB® 4GX/SUBCAB® AWG, 6-leads, Y

3202

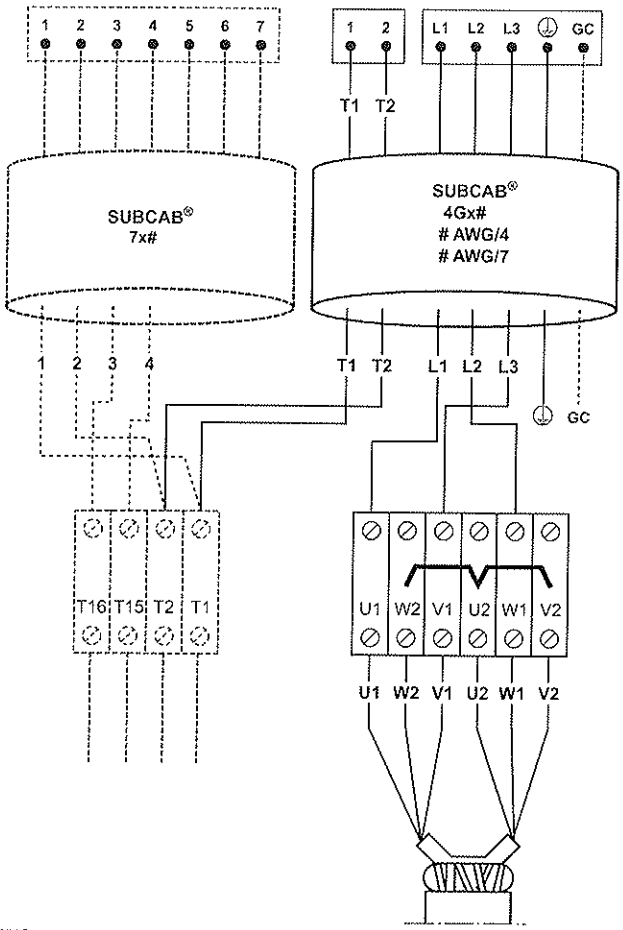


Bild 2

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⏚ Groundcheck GC	yellow/green	yellow/green yellow	⏚
Control	**SUBCAB® Cable lead**	**SUBCAB® AWG Cable lead**	**Terminal board**
T1	T1	orange	T1
T2	T2	blue	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
W2, black	W2
V1, brown	V1
U2, green	U2
W1, yellow	W1
V2, blue	V2

SUBCAB® 4GX/SUBCAB® AWG, 6-leads, D

3202

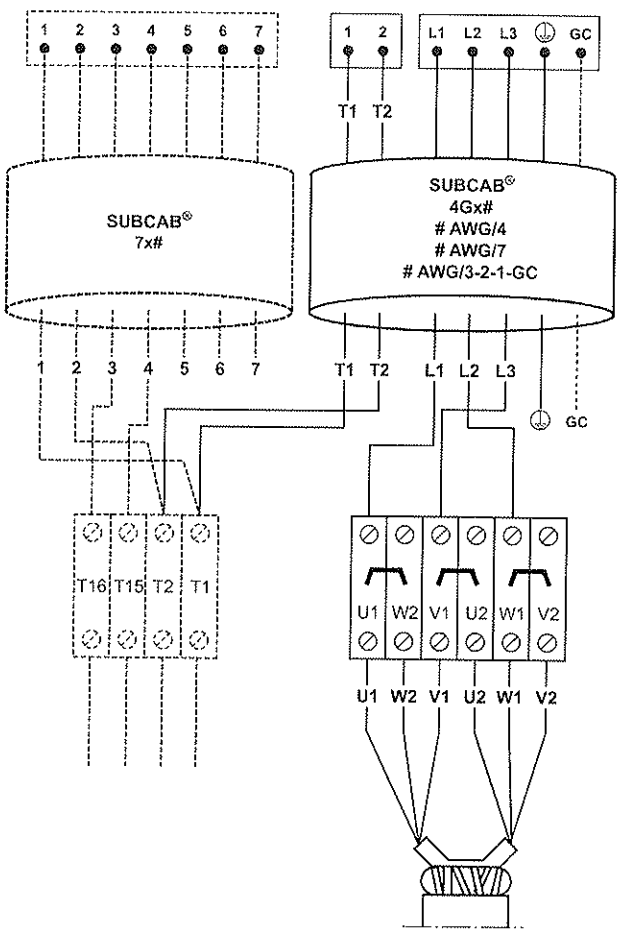


Bild 5

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⏚ Groundcheck GC	yellow/green	yellow/green yellow	⏚
Control	**SUBCAB® Cable lead**	**SUBCAB® AWG Cable lead**	**Terminal board**
T1	T1	orange	T1
T2	T2	blue	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
W2, black	W2
V1, brown	V1
U2, green	U2
W1, yellow	W1
V2, blue	V2

CABLE CHART

SUBCAB® 4GX/SUBCAB® AWG, 60 Hz only, 9-leads, 460 V, Y ser.

3202

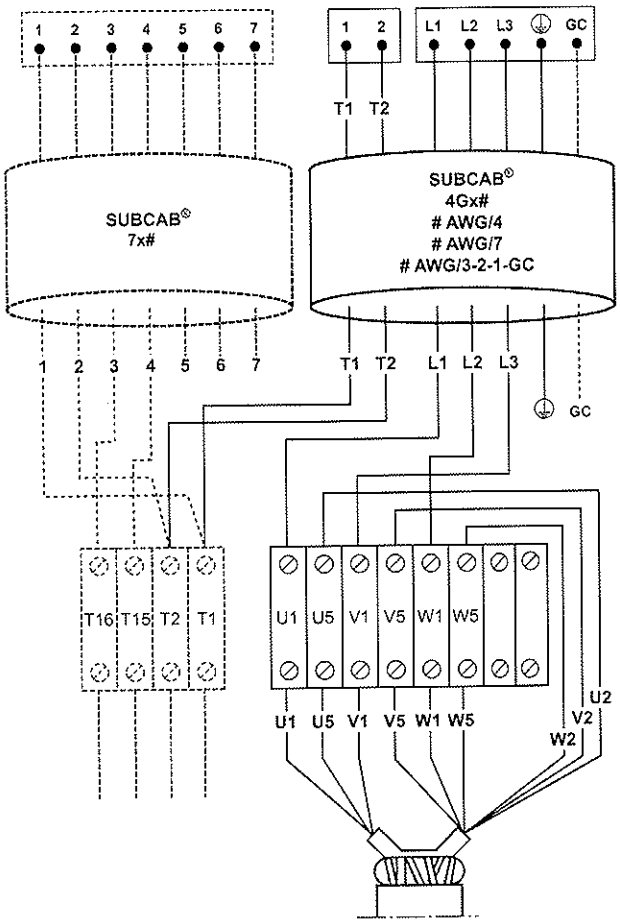


Bild 8

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⏚ Groundcheck GC	yellow/green	yellow/green yellow	⏚
Control	**SUBCAB® Cable lead**	**SUBCAB® AWG Cable lead**	**Terminal board**
T1	T1	orange	T1
T2	T2	blue	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
U5, red	U5
U2, green	U5
V1, brown	V1
V5, brown	V5
V2, blue	V5
W1, yellow	W1
W5, yellow	W5
W2, black	W5

SUBCAB® 4GX/SUBCAB® AWG, 60 Hz only, 9-leads, 230 V, Y //

3202

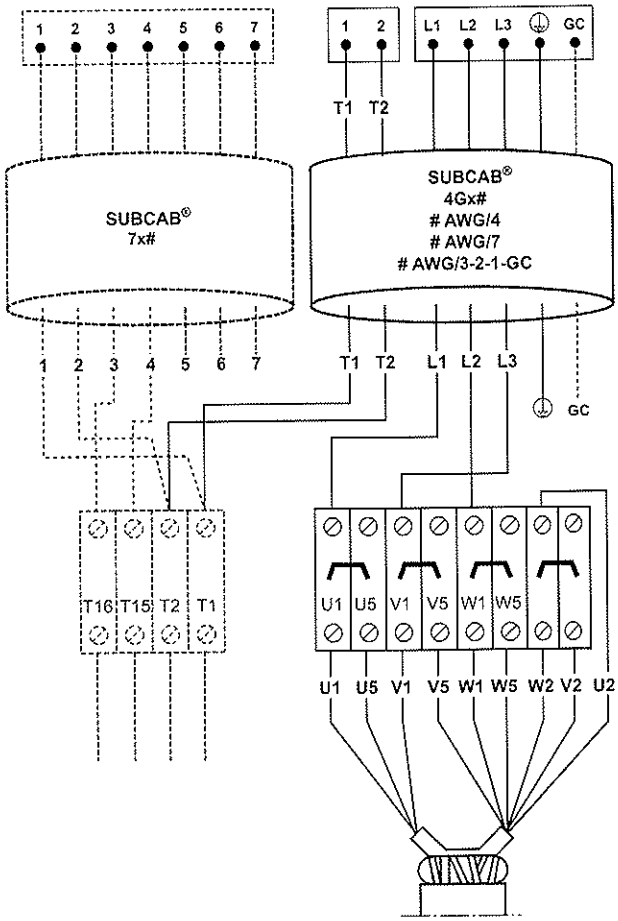


Bild 10

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⏚ Groundcheck GC	yellow/green	yellow/green yellow	⏚
Control	**SUBCAB® Cable lead**	**SUBCAB® AWG Cable lead**	**Terminal board**
T1	T1	orange	T1
T2	T2	blue	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
U5, red	U5
V1, brown	V1
V5, brown	V5
W1, yellow	W1
W5, yellow	W5
W2, black*	
V2, blue*	
U2, green*	

**Connected together at terminal*

CABLE CHART

SUBCAB® 7GX, 6-leads, Y/D

3202

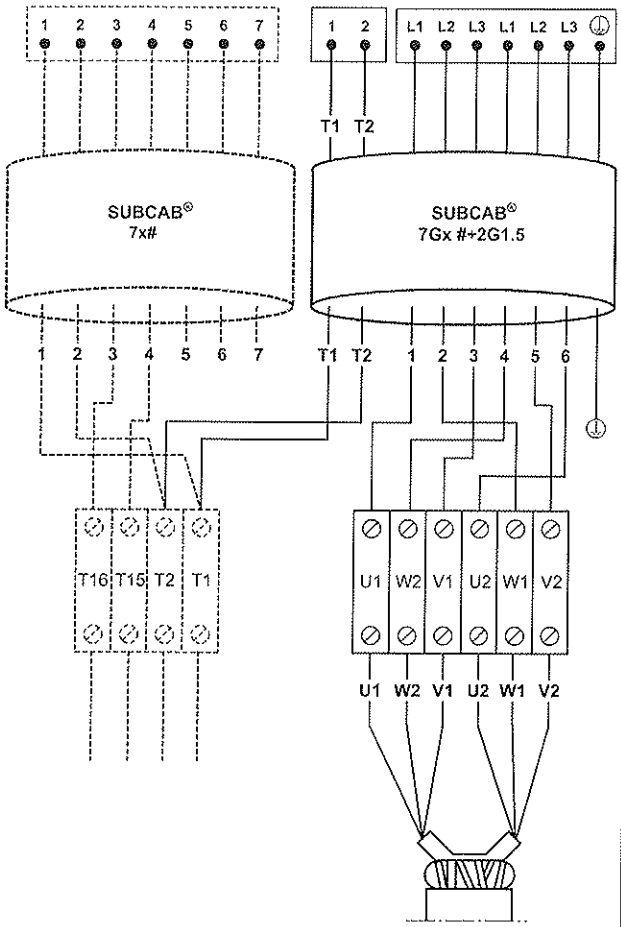


Bild 12

Mains	Lead	Lead
L1	1	U1
L2	2	W1
L3	3	V1
L1	4	W2
L2	5	V2
L3	6	U2
⏚	yellow/green	⏚
Control	**Cable lead**	**Terminal board**
T1	T1	T1
T2	T2	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
W2, black	W2
V1, brown	V1
U2, green	U2
W1, yellow	W1
V2, blue	V2

SUBCAB® 4GX/SUBCAB® AWG, 60 Hz only, 2 motor cables in-parallel, 9-leads, 230 V, Y //

3202

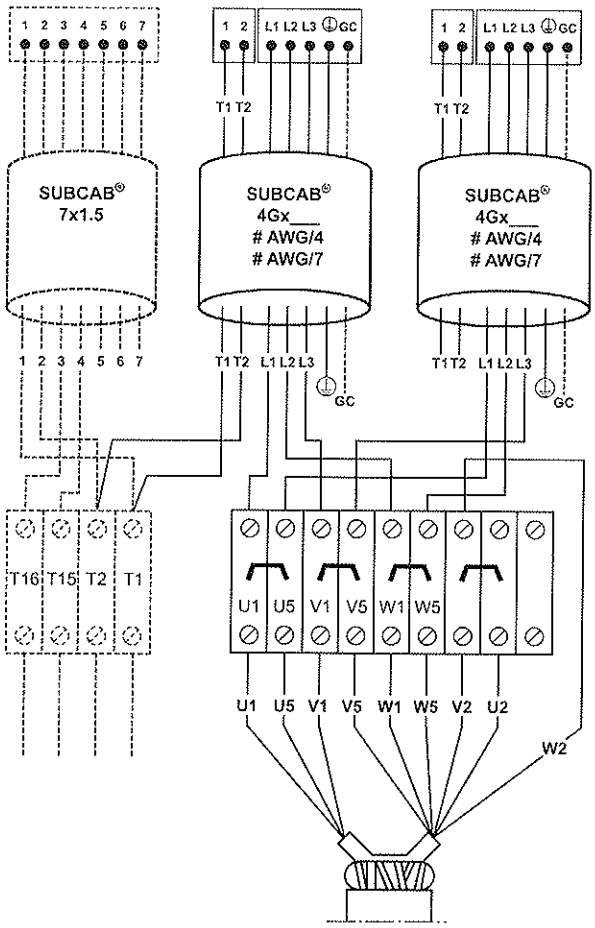


Bild 13

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⏚ Groundcheck GC	yellow/green	yellow/green yellow	⏚
Control	**SUBCAB® Cable lead**	**SUBCAB® AWG Cable lead**	**Terminal board**
T1	T1	orange	T1
T2	T2	blue	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
U5, red	U5
V1, brown	V1
V5, brown	V5
W1, yellow	W1
W5, yellow	W5
W2, black*	
V2, blue*	
U2, green*	

**Connected together at terminal*

CABLE CHART

SUBCAB® 4GX/SUBCAB® AWG, 60 Hz only, 2 motor cables in parallel, 9-leads, 460 V, Y ser

3202

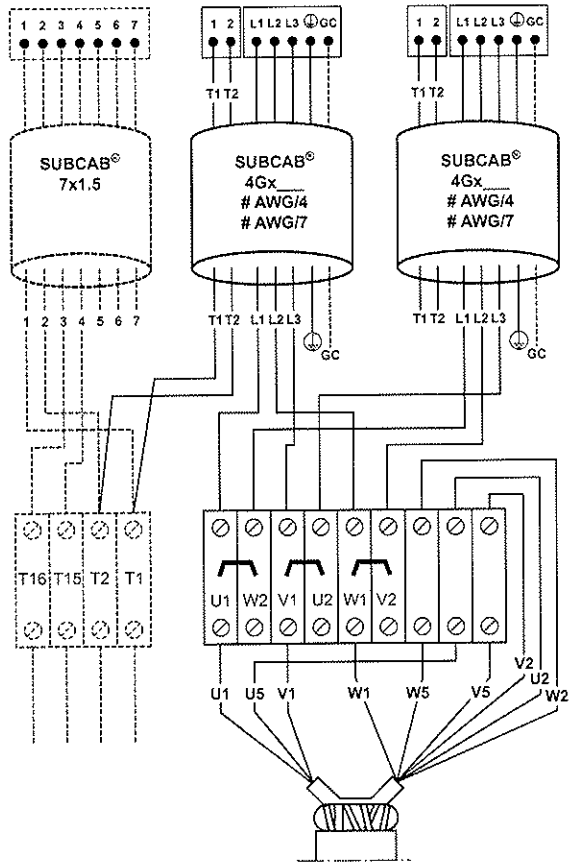


Bild 14

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⏚ Groundcheck GC	yellow/green	yellow/green yellow	⏚
Control	**SUBCAB® Cable lead**	**SUBCAB® AWG Cable lead**	**Terminal board**
T1	T1	orange	T1
T2	T2	blue	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
V1, brown	V1
W1, yellow	W1
U2, green*	
U5, red*	
V2, blue**	
V5, brown**	
W2, black***	
W5, yellow***	

**U2 and U5 connected together at terminal*
***V2 and V5 connected together at terminal*
****W2 and W5 connected together at terminal*

SUBCAB® 4GX/SUBCAB® AWG, 2 motor cables in parallel, 6-leads, Y

3202

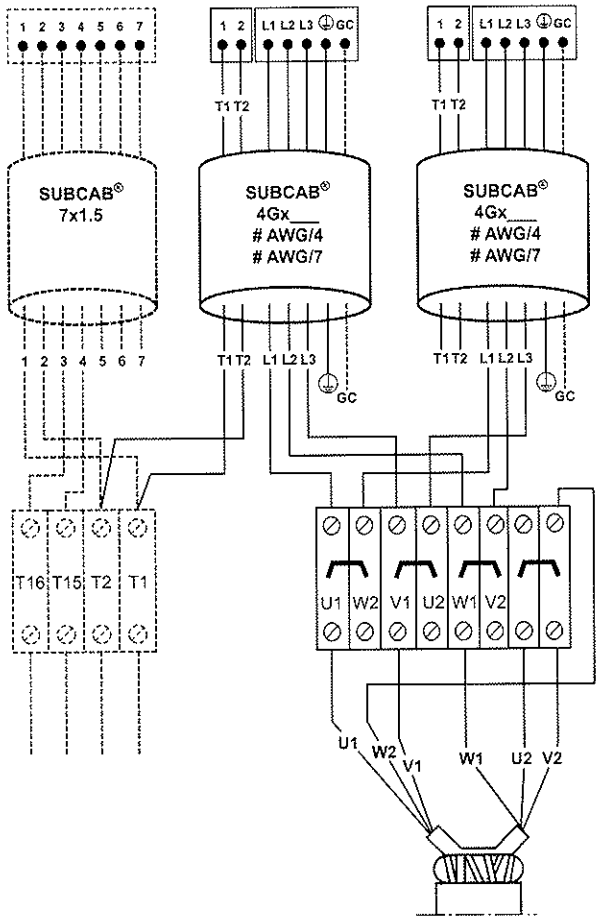


Bild 15

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⏚ Groundcheck GC	yellow/green	yellow/green yellow	⏚
Control	**SUBCAB® Cable lead**	**SUBCAB® AWG Cable lead**	**Terminal board**
T1	T1	orange	T1
T2	T2	blue	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
V1, brown	V1
W1, yellow	W1
U2, green*	
V2, blue*	
W2, black*	

**Connected together at terminal*

CABLE CHART

SUBCAB® 4GX/SUBCAB® AWG, 2 motor cables in parallel, 6-leads, D

3202

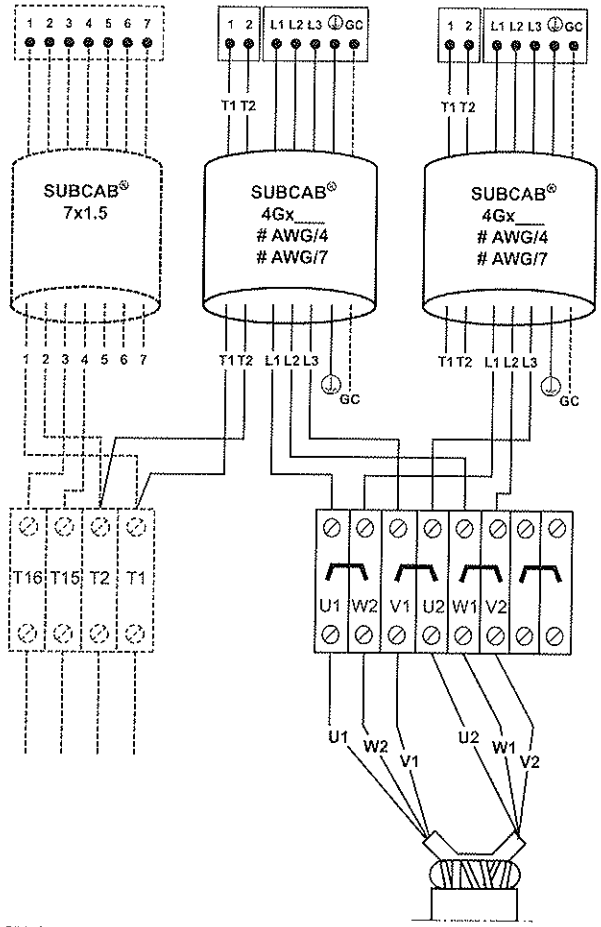


Bild 16

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L1	brown	red	U1
L2	black	black	W1
L2	black	black	W1
L3	grey	white	V1
L3	grey	white	V1
⏚ Groundcheck GC	yellow/green	yellow/green yellow	⏚
Control	**SUBCAB® Cable lead**	**SUBCAB® AWG Cable lead**	**Terminal board**
T1	T1	orange	T1
T2	T2	blue	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
V1, brown	V1
W1, yellow	W1
U2, green	
V2, blue	
W2, black	

SUBCAB® 4GX, 2 motor cables, Y/D, 6-leads

3202

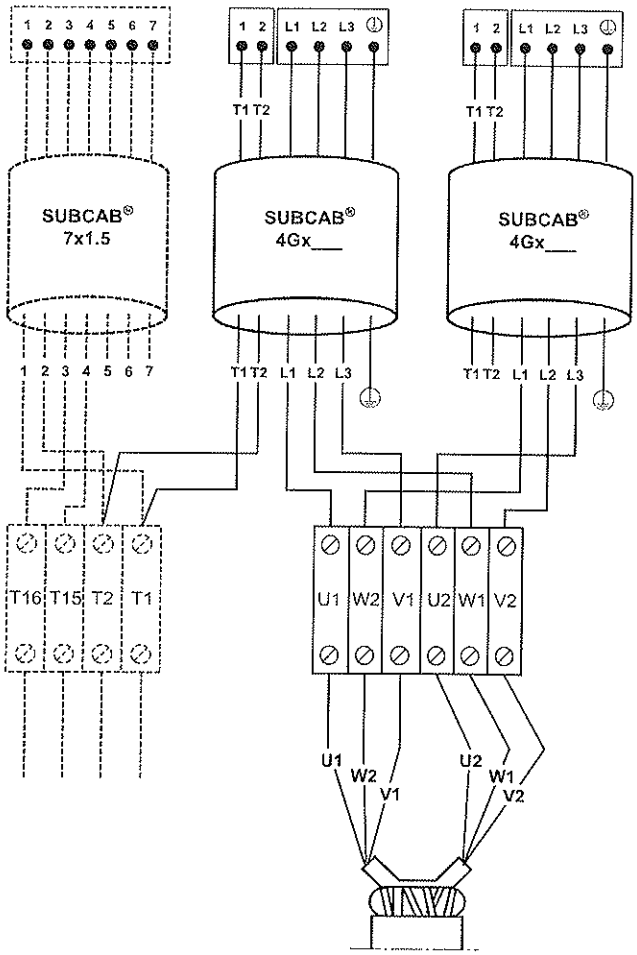


Bild 17

Mains	Lead	Terminal board
L1	brown	U1
L2	black	W1
L3	grey	V1
L1	brown	W2
L2	black	V2
L3	grey	U2
⏚	yellow/green	⏚
Control	**Cable lead**	**Terminal board**
T1	T1	T1
T2	T2	T2

Stator leads connection: Stator lead	Terminal board
U1, red	U1
W2, black	W2
V1, brown	V1
U2, green	U2
W1, yellow	W1
V2, blue	V2

CABLE CHART

SUBCAB® Screened, 6-leads, Y

3202

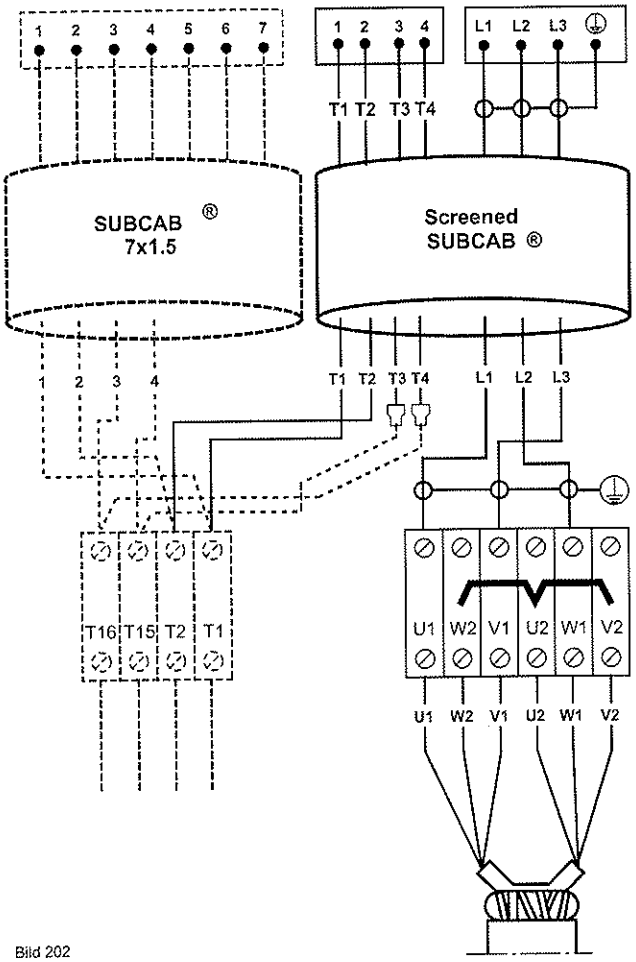


Bild 202

Mains	Lead	Lead
L1	Brown	U1
L2	Black	W1
L3	Grey	V1
⏚	Screen from leads	⏚
Control	**Cable lead**	**Terminal board**
T1	White T1	T1
T2	White T2	T2
T3	White T3	T15
T4	White T4	T16

Stator leads connection: Stator lead	Terminal board
U1, red	U1
W2, black	W2
V1, brown	V1
U2, green	U2
W1, yellow	W1
V2, blue	V2

SUBCAB® Screened, 6-leads, D

3202

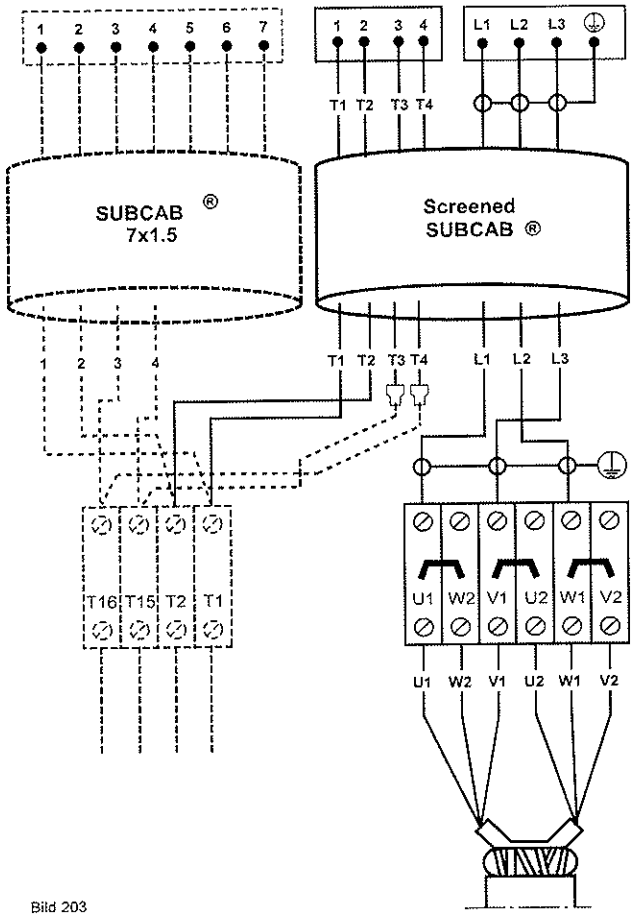


Bild 203

Mains	Lead	Lead
L1	Brown	U1
L2	Black	W1
L3	Grey	V1
⏚	Screen from leads	⏚
Control	**Cable lead**	**Terminal board**
T1	White T1	T1
T2	White T2	T2
T3	White T3	T15
T4	White T4	T16

Stator leads connection: Stator lead	Terminal board
U1, red	U1
W2, black	W2
V1, brown	V1
U2, green	U2
W1, yellow	W1
V2, blue	V2

CABLE CHART

NSSHÖU ../3E+st, 6-leads, Y

3202

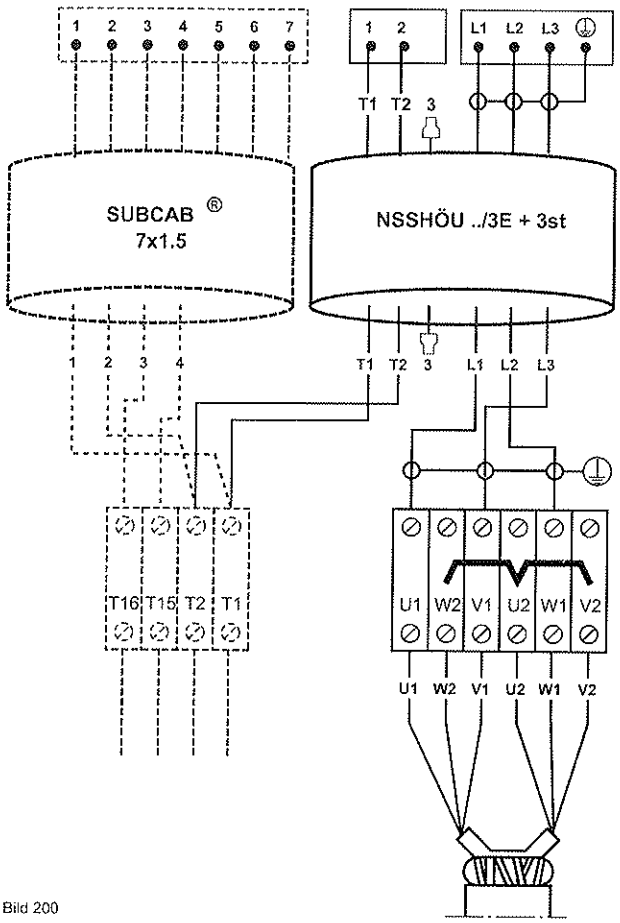


Bild 200

Mains	Lead	Lead
L1	Brown	U1
L2	Black	W1
L3	Grey	V1
⏚	Screen from leads	⏚
Control	**Cable lead**	**Terminal board**
T1	Black (1)	T1
T2	Brown (2)	T2
T3	Grey (3)	Unused

Stator leads connection:

Stator lead	Terminal board
U1, red	U1
W2, black	W2
V1, brown	V1
U2, green	U2
W1, yellow	W1
V2, blue	V2

NSSHÖU ../3E+st, 6-leads, D

3202

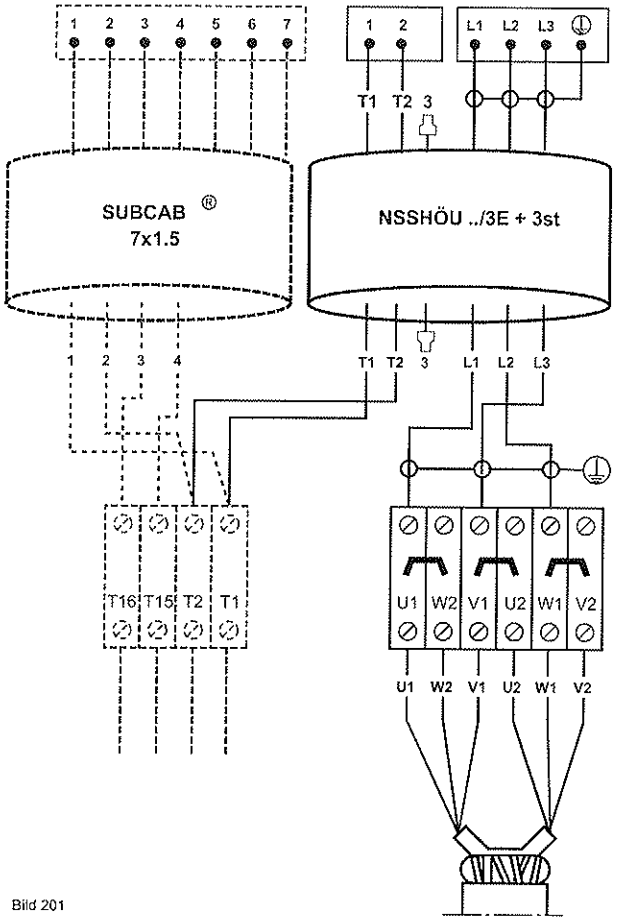


Bild 201

Mains	Lead	Lead
L1	Brown	U1
L2	Black	W1
L3	Grey	V1
⏚	Screen from leads	⏚
Control	**Cable lead**	**Terminal board**
T1	Black (1)	T1
T2	Brown (2)	T2
T3	Grey (3)	Unused

Stator leads connection:

Stator lead	Terminal board
U1, red	U1
W2, black	W2
V1, brown	V1
U2, green	U2
W1, yellow	W1
V2, blue	V2

Sensor connections

Monitoring equipment

FLS10 is a small float switch and it is installed in the inspection chamber. FLS is connected to max 12 V.

Thermal switches are incorporated into the stator and are rated 250 V, 2,5 A (cosφ =1) / 1,6 A (cosφ =0,6).

The sensors are connected as standard to the Flygt monitoring relay MiniCAS II (see diagrams below).

In case optional sensors are used the more advanced monitoring relay MAS 711 can be used.

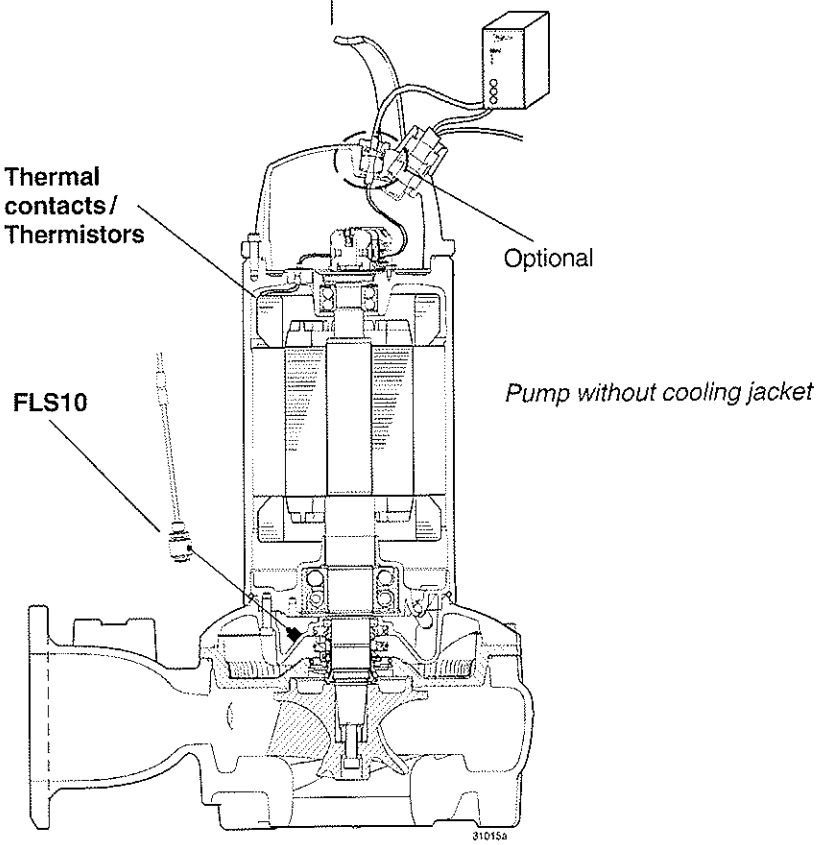
For a **PTC-thermistor** (PTC = Positive Temperature Coefficient), there is a significant increase in resistance at a certain temperature that can be utilized for monitoring the temperature.

PTC-thermistor

T= 25 °C	R ≤ 100 Ohm
T=135 °C (T_{REF} - 5 °C)	R ≤ 550 Ohm
T=145 °C (T_{REF} + 5 °C)	R ≥ 1330 Ohm

Three thermistors are connected in series and have a resistance of approx. 150-300 ohms at room temperature.

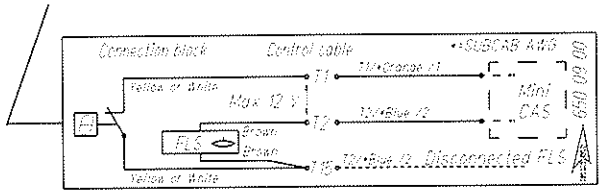
The label in the junction box shows if the pump is equipped with optional sensors.



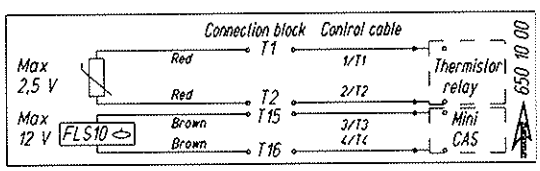
Sensor connection for standard configuration

The pump is as standard equipped with either thermal contacts or thermistors.

A)Thermal contacts



B)Thermistors



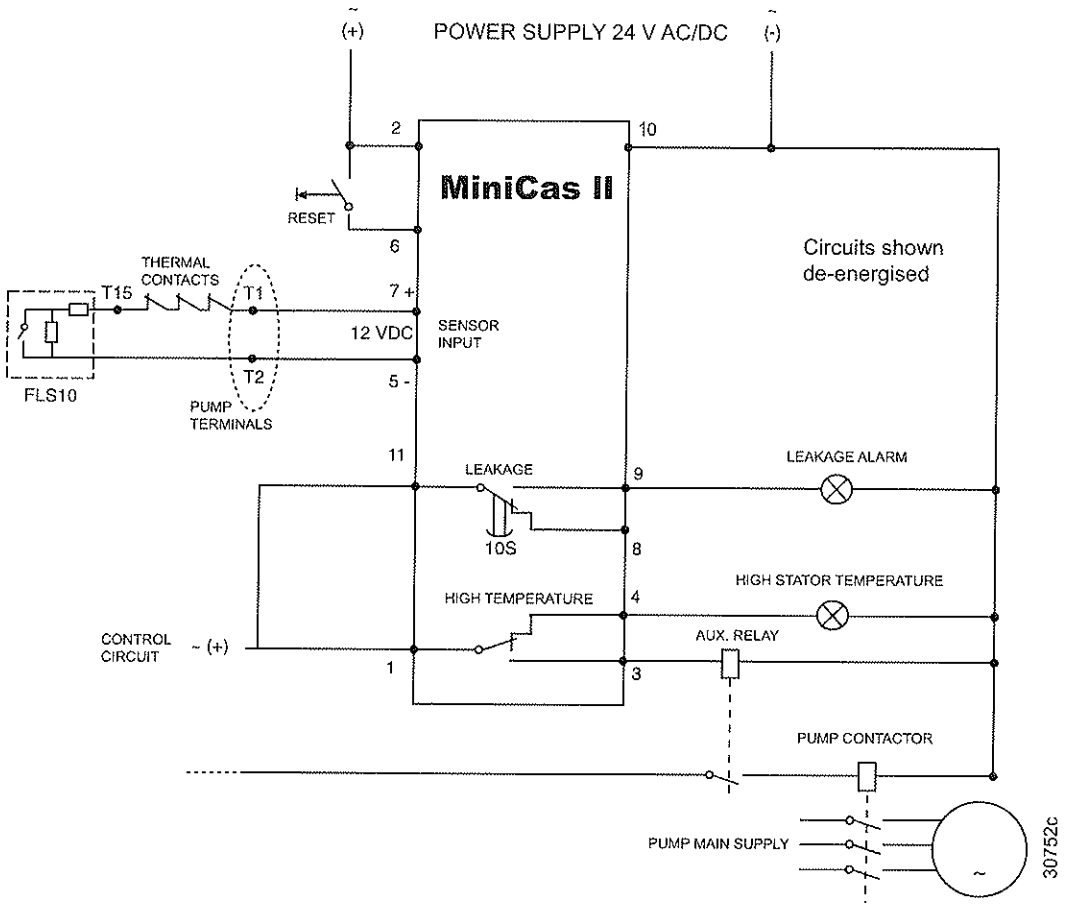
FLS10 + thermal contacts

0 mA = *Overtemperature*

10 mA = *OK*

28 mA = *Leakage*

Tolerance 10%



Sensor Connection Table

(For further information please contact Flygt representative.).

Sensor	Sensor lead	Thermal connection	Control cable	Connected to
Thermal contacts + FLS10	White Brown White+Brown	T1 T2 T15	T1/*Orange T2/*Blue = SubCab /* SubCabAWG	Mini CAS II Mini CAS II
Thermistors + FLS10	Red Red Brown Brown	T1 T2 T15 T16	1 2 3 4	Thermistor relay Thermistor relay Mini CAS II Mini CAS II

OPERATION

Before starting

- Check that the visible parts of the pump and installation are undamaged and in good condition. Remove the fuses or open the circuit breaker and check that the impeller can be rotated freely.
- Verify that the supply voltage matches the pump data plate voltage rating.
- Conduct insulation integrity check.
- Conduct phase to phase resistant check.
- Check that the monitoring equipment works.
- Check the direction of rotation. 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. See figure.
- In case of dry installation, check the direction of rotation through the inlet elbow access cover.
- Transpose two phase leads if the impeller rotates in the wrong direction (3-phase).



— **Before starting work on the pump, make sure that the pump is isolated from the power supply and cannot be energized. This applies to the control circuit as well.**

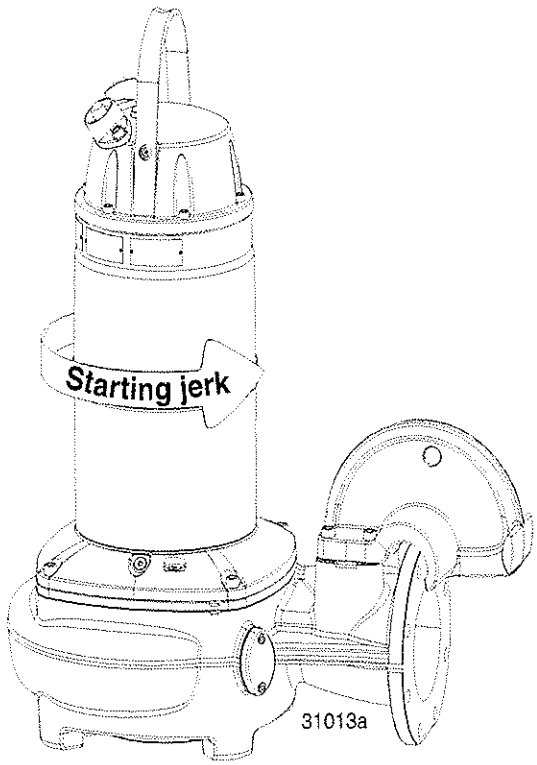


— **NOTE for Ex version page 3.**

— **Make sure that the pump cannot roll or fall over and injure people or damage property.**

— **In some installations the pump surface and the surrounding liquid may be hot. Bear in mind the risk of burn injuries.**

— **In some installations and at certain operating points on the performance curve, the noise level of 70 dB or the noise level specified for the actual pump may be exceeded.**



Watch the starting jerk which can be powerful.

CARE AND MAINTENANCE

Service/Inspection

ITT Flygt recommends a preventive maintenance program based on Intermediate and Major Services at regular intervals. For standard sewage applications where the temperature of the pumped liquid is 40° C (104° F) or less an *Intermediate Service* should be performed every 8000 hours or every 2 years, whichever occurs first.

The time between *Major Service* could vary considerably depending on operating conditions and the need for a Major Service will be determind during the regular Intermediate Services.
However, a minimum of 20 000 hours of operation could be anticipated.

For applications other than sewage water or for specific operating conditions, other service intervals may be recommended.

Pump	Intermediate Service running 8 000 h or 2 years
Junction box	Check that it is clean and dry.
Terminal board	Check that the connections are properly tightened.
Insulation check	Check that the resistance between earth and phase lead is more than 5 MΩ. Conduct phase to phase resistance check.
Cable	Check that the rubber sheating (jacket) is undamaged.
Seal housing	Fill up with new coolant if necessary. Check freezing point (lower than -13° C (9° F)).
Inspection chamber	Drain all liquid if any. Check the resistance of FLS10. Normal value approx.1200 Ω, alarm approx. 430 Ω.
O-rings	Always replace the O-rings of the filling plugs and at the junction cover. Always grease new O-rings.
Thermal contacts	Check the resistance. Normally closed circuit; interval 0 - 1 Ω.
Thermistor	Check the resistance 20 - 250 Ω, (measuring voltage max 2 V DC).
Impeller	Check impeller clearance and adjust if necessary.
Lifting handle	Check the screws and the condition of the lifting handle.
Rotation direction	Check the rotation of the impeller.
Lifting device	Check that local safety regulations are followed.
Voltage and amperage	Check running values.

Pumpstation	Intermediate Service running 8 000 h or 2 years
Electrical cabinets/panels	Check that they are clean and dry.
Connection to power	Check that the connections are properly tightened.
Overload and other protections	Check correct settings.
Personnel safety other protections	Check guard rails, covers and
Level regulators	Check condition and function.
Pump	**Major Service**
Support and main bearing.	Replace with new bearings.
Mechanical seal unit.	Replace with new seal units.
Pump stations same as Intermediate Service.	

If any indication of alarm between inspections, please see instructions below.	Actions
FLS10	Drain the fluid in the inspection chamber. Fill with new coolant if necessary. Check freezing point (lower than -13° C (9° F)). Check the inspection chamber again after one week of operation. If leakage has occured, drain the fluid and change the mechanical seal unit and replace with new coolant.
Thermistor/Thermal contact	Check coolant level. (pump with cooling jacket) Check start and stop levels.
Overload protection	Check that the impeller can rotate freely.



— **NOTE for Ex version page 3.**

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

— Make sure that the pump cannot roll or fall over and injure people or damage property.

— Check every year that the lifting equipment is in good condition.

The pump is designed for use in liquids which can be a healthrisk. In order to prevent injury to the eyes and skin, observe the following points when working on the pump:

— Make sure that the pump has been thoroughly cleaned.

— Beware of the risk of infection.

— Follow local safety regulations.

— Always wear goggles and rubber gloves.

— Rinse the pump thoroughly with clean water before starting work.

— Rinse the components in water after dismantling.

— The coolant chamber may be under pressure. Hold a rag over the filling plug to prevent splatter.

Proceed as follows if fluids have splashed into your eyes:

— Rinse your eyes immediately in running water for 15 minutes. Hold your eyelids apart with your fingers.

— Contact an eye specialist.

On your skin:

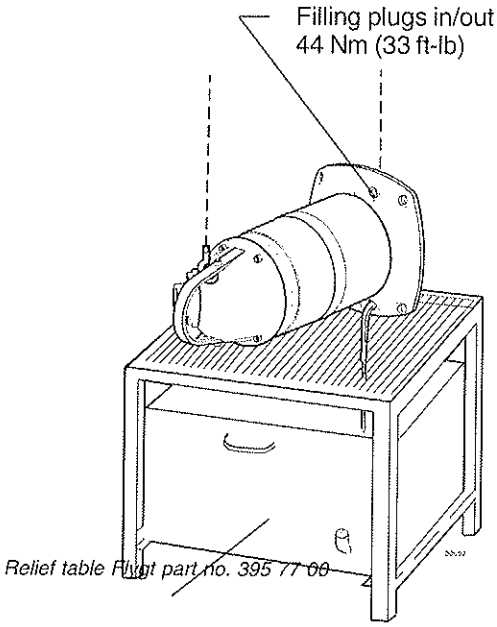
— Remove contaminated clothes.

— Wash your skin with soap and water.

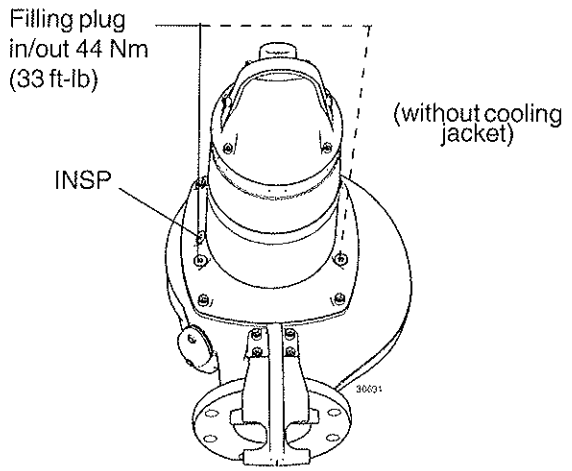
— Seek medical attention, if required.

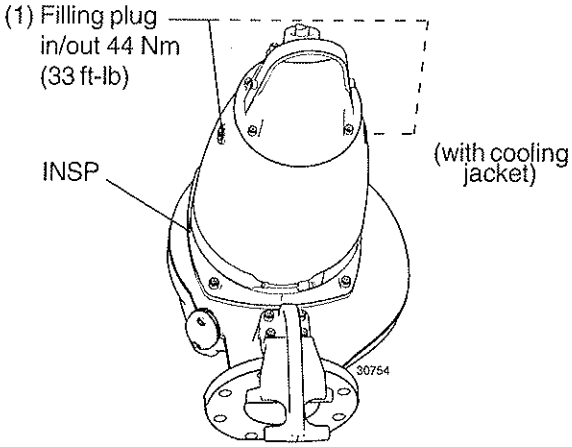
Changing the coolant

Emptying coolant
(without cooling jacket)

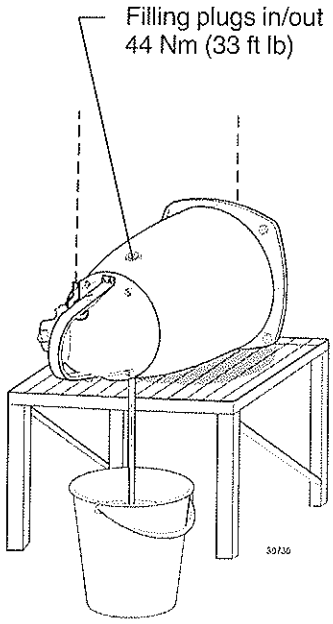


Filling coolant





Emptying coolant
(with cooling jacket)



1. Lift the pump horizontally with **two** overhead cranes and place on a relief table.

2. Turn the pump so that one of the filling plugs holes faces downwards.
   WARNING! If the mechanical seal unit leaks, the seal housing may be under pressure. Hold a rag over the filling plug to prevent splatter.

3. Unscrew the filling plug. It is easier to drain the water-glycol if the other filling plug is also removed.

4. Pump **without** cooling jacket: Raise the pump to an upright position. Fill with coolant to the same level as the filling plugs; approx. 5.5 litres (5.8 US quarts).
   Pump **with** cooling jacket; approx. 31 litres (32.5 US quarts).
   Coolant: a mix of water and stabilized monopropyleneglycol in a mixture ratio of 70/30 % volume part.

   Known trade marks of monopropyleneglycol are: Dowcal N (individual components are approved by FDA), Dowcal 20. These are non-poisonous, heat-and-cold resistant and inhibiting of corrosion.

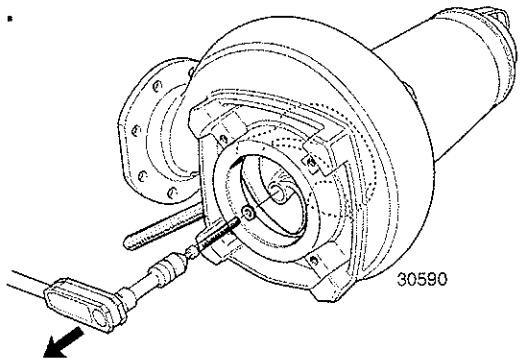
   Use of other type of glycol jeopardize the function of the pump.

   If there is no risk of freezing even clean water with anti-corrosive is acceptable as coolant.

5. Always replace the O-rings of the filling plugs. Put the plugs back and tighten them.

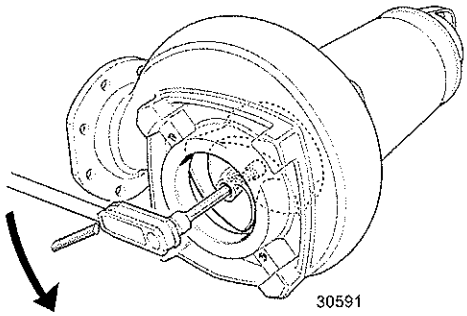
Removing the impeller

1.



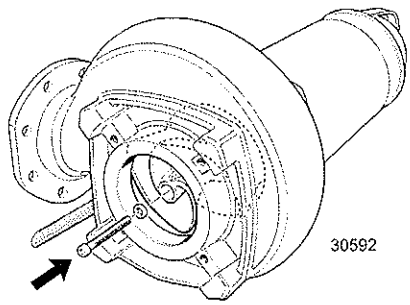
Place the pump horizontally. Remove the flush valve cover and it's O-ring. Insert a rod (wood or plastic) through the hole and lock the impeller in place. Remove the impeller screw.

2.



Using a 17 mm / 0.67 in hexagon bit adaptor (allen socket) with a 100 mm / 3.94 in extension (minimum length) turn the adjustment screw counter clockwise until the impeller breaks free from the shaft.

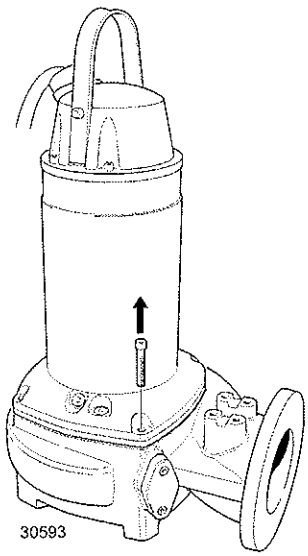
3.



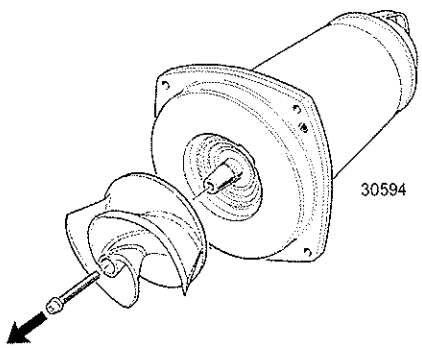
Install the impeller and screw. Tighten ligthly by hand, just to prevent the impeller from falling off.

4.

Remove the rod and raise the pump. Remove the pump housing. Using a crane, lift the drive unit off the pump housing.



5.



Place the drive unit horizontally. Remove the impeller screw.

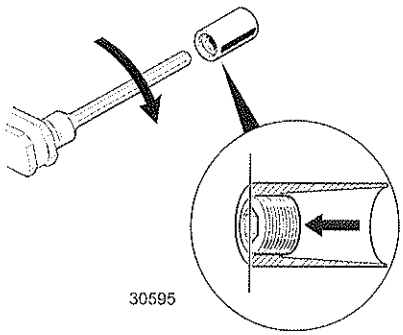
Worn impellers can have very sharp edges. Use protective gloves!

WARNING! When laying the pump on its side do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.

Installing and setting clearance

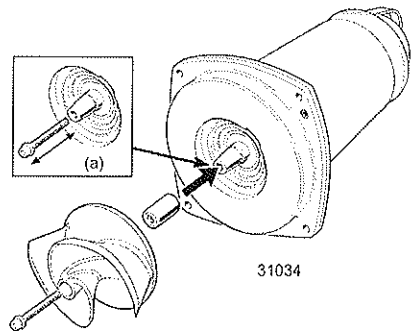
(If you fail with the impeller installation, you **must** start again from step 1)

1.



Make sure that the end of the shaft is clean and free from burrs. Polish off any flaws with fine emery cloth. Grease the end of the shaft, conical sleeve, the threads of the adjustment screw and the impeller screw. Align the edge of the adjustment screw with the edge of the conical sleeve so that they are flush.

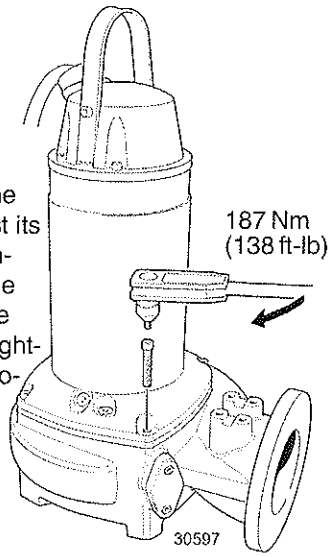
2.



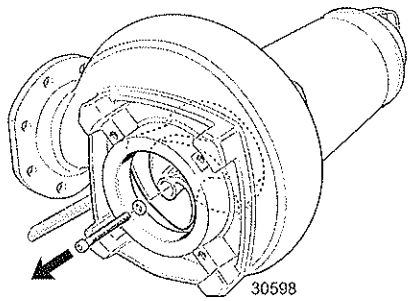
Before assembling, check that the impeller screw is clean and easy to screw into the shaft end (a). This is to prevent the shaft to rotate with the impeller screw. Assemble the conical sleeve and the impeller onto the shaft. Fit the impeller screw onto the shaft. Tighten the impeller screw lightly by hand, just to prevent the impeller from falling off.

3.

Fit the drive unit to the pump housing. Adjust its position so that the inspection hole is on the same side as the hole for the flush valve. Tighten the screws in diagonally opposite pairs.

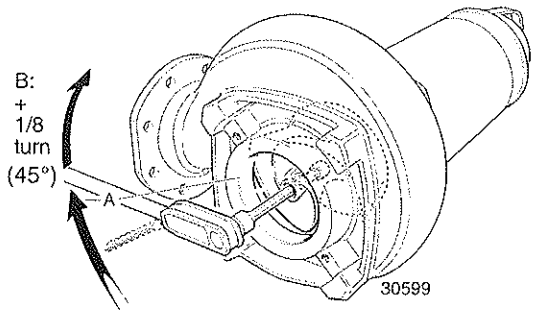


4.



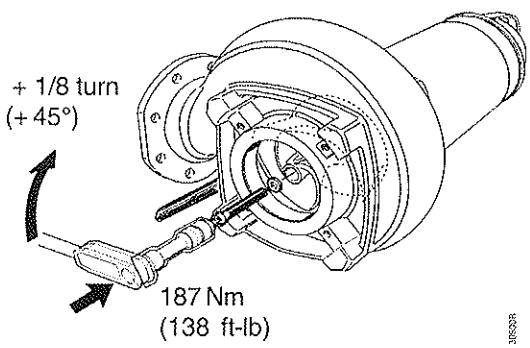
Place the pump horizontally. Remove the flush valve cover and it's O-ring. Insert a rod (wood or plastic) through the hole and lock the impeller in place. Remove the impeller screw.

5.



Turn the gland screw clockwise until the impeller makes contact with the pump housing. Tighten it a further 1 /8 turn, 45°. This will insure the correct clearance between the impeller and the bottom of the pump housing in the next step.

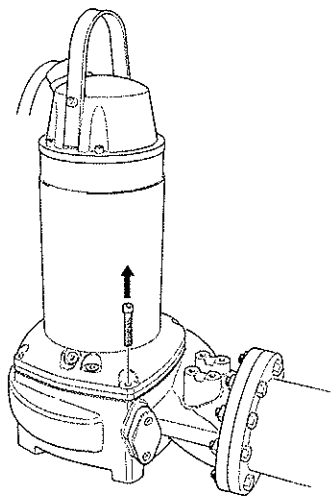
6.



Fit the washer and the greased impeller screw and tighten, torque to 187 Nm / 138 ft-lb.Tighten it a further 1 /8 turn, 45°. Remove the rod used to lock the impeller. Fit the O-ring, flush valve cover and secure with screws, torque to 44 Nm / 33 ft-lb.

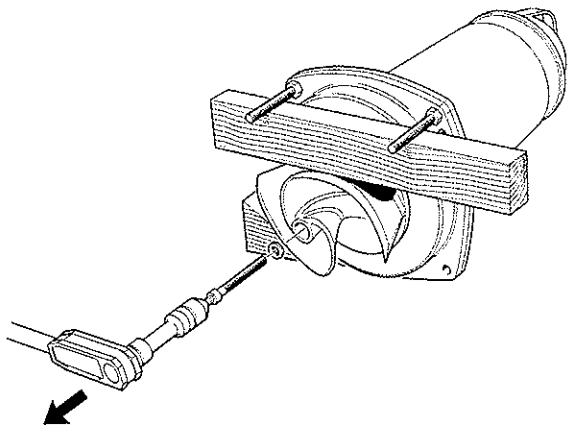
Removing the impeller - dry installation (T-installation)

1.



Remove the drive unit from the pump housing.

2.

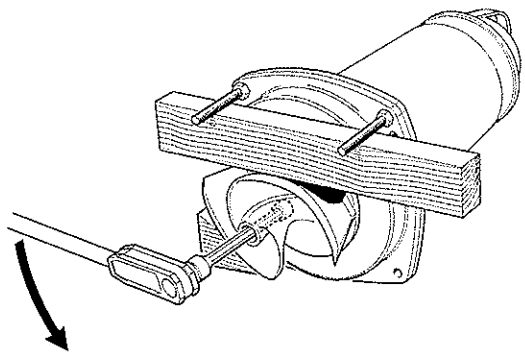


Place the drive unit horizontally. Lock the impeller in place and remove the impeller screw.

WARNING! When laying the pump on its side do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.

Worn impellers can have very sharp edges. Use protective gloves!

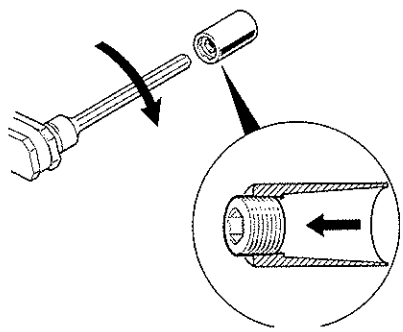
3.



Using a 17 mm / 0.67 in hexagon bit adaptor (allen socket) with a 100 mm / 3.94 in extension (minimum length) turn the adjustment screw counter clockwise until the impeller breaks free from the shaft. Remove the impeller.

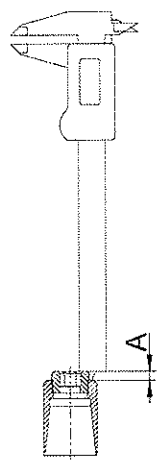
Installing and setting clearance

1.



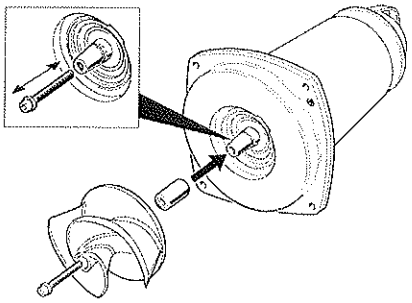
Make sure that the end of the shaft is clean and free from burrs. Polish off any flaws with fine emery cloth. Grease end of shaft, conical sleeve and the threads of the adjustment screw and the impeller screw. Unscrew the adjustment screw approximately 5 mm / 0.2 in.

2.



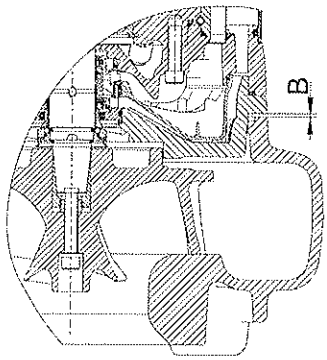
Measure and note the distance A.

3.



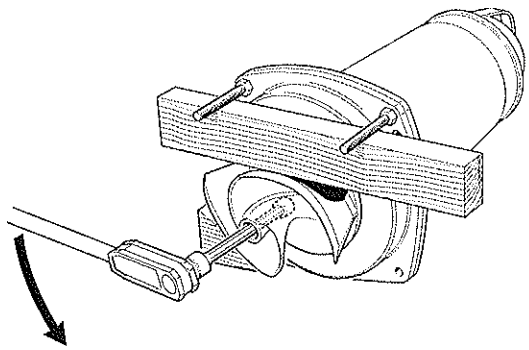
Before assembling, check that the impeller screw is clean and easy to screw into the shaft end (a). This to prevent the shaft to rotate with the impeller screw. Assemble the conical sleeve and the impeller onto the shaft. Fit the impeller screw with washer onto the shaft and tighten to 187 Nm /138 ft-lb.

4.



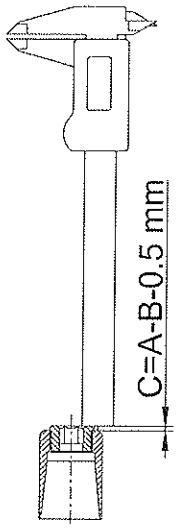
Make sure that the O-ring is removed from the seal housing cover. Place the drive unit in the pump housing. Check the distance between the seal housing cover and the pump housing with a feeler gauge. Check diametrically at four points.
Note the largest measured distance, B. See fig.

5.



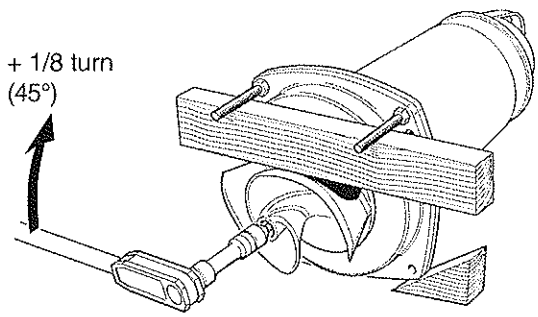
Lift the drive unit out of the pump housing and remove the impeller and conical sleeve.

6.



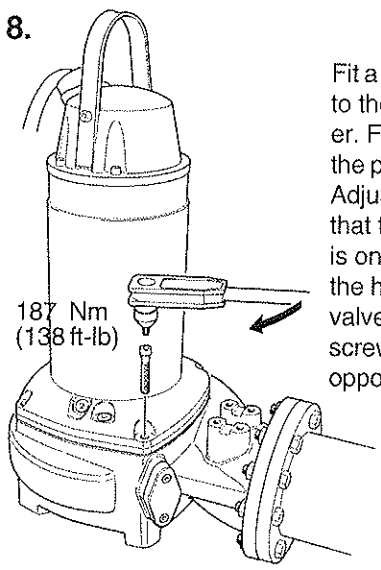
Calculate the measure C according to formula:
C = A - B - 0,5 mm / 0.02 in
Unscrew the adjustment screw until C is reached.

7.



Fit the conical sleeve, impeller and impeller screw with washer and tighten to 187 Nm /138 ft-lb. Tighten it a further 1 /8 turn, 45°.

8.



Fit a new greased O-ring to the seal housing cover. Fit the drive unit to the pump housing. Adjust its position so that the inspection hole is on the same side as the hole for the flush valve. Tighten the screws in diagonally opposite pairs.

FAULT TRACING (TROUBLE SHOOTING)

A universal instrument multimeter (VOM), a test lamp (continuity tester) and 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.

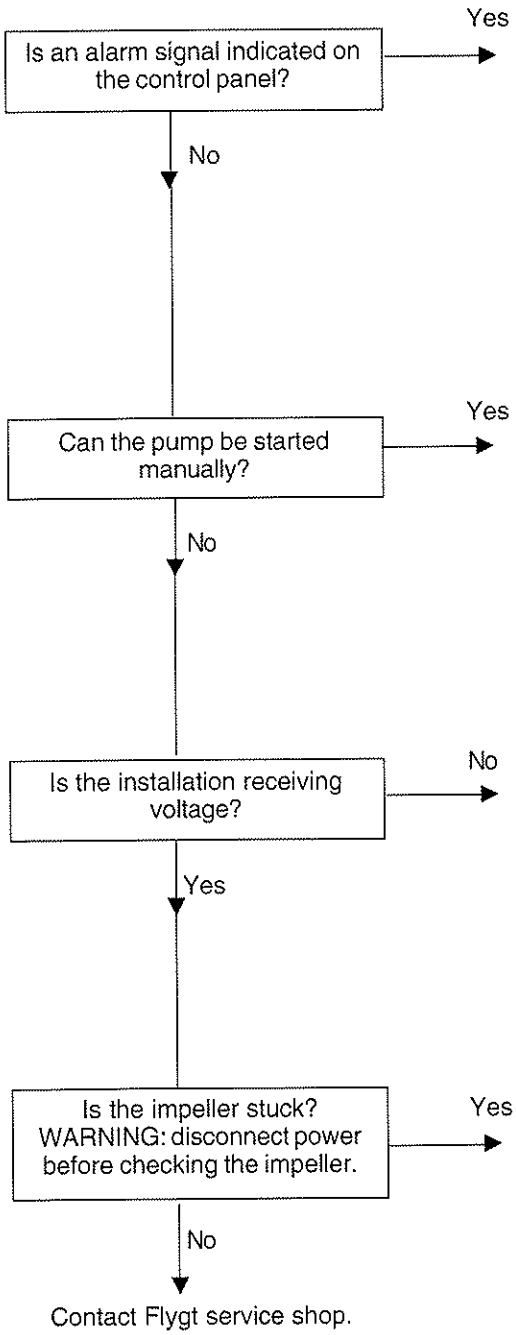
Always make sure that there is no one near the pump when the power supply is turned on.

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.

1. Pump fails to start



Check the cause:

— If the stator temperature is high, check that the impeller rotates freely.

— If there is a fault in the thermistors/thermal contacts, contact a Flygt service shop.

— If the FLS10 indicates an alarm.

— Check that the overload protection is reset.

a) Fault in level equipment (start level regulator). Clean or replace.

b) Fault in control equipment.

Check:

— that the thermal contacts have not opened.

— that all connections are intact.

— relay and contactor coils.

— that the control switch "Man/Auto" makes contact in both positions.

Check:

— that the main power switch is on.

— that there is control voltage to the starter equipment and its fuses are intact.

— that there is voltage in each phase of the supply line.

— that all fuses have continuity and are tight.

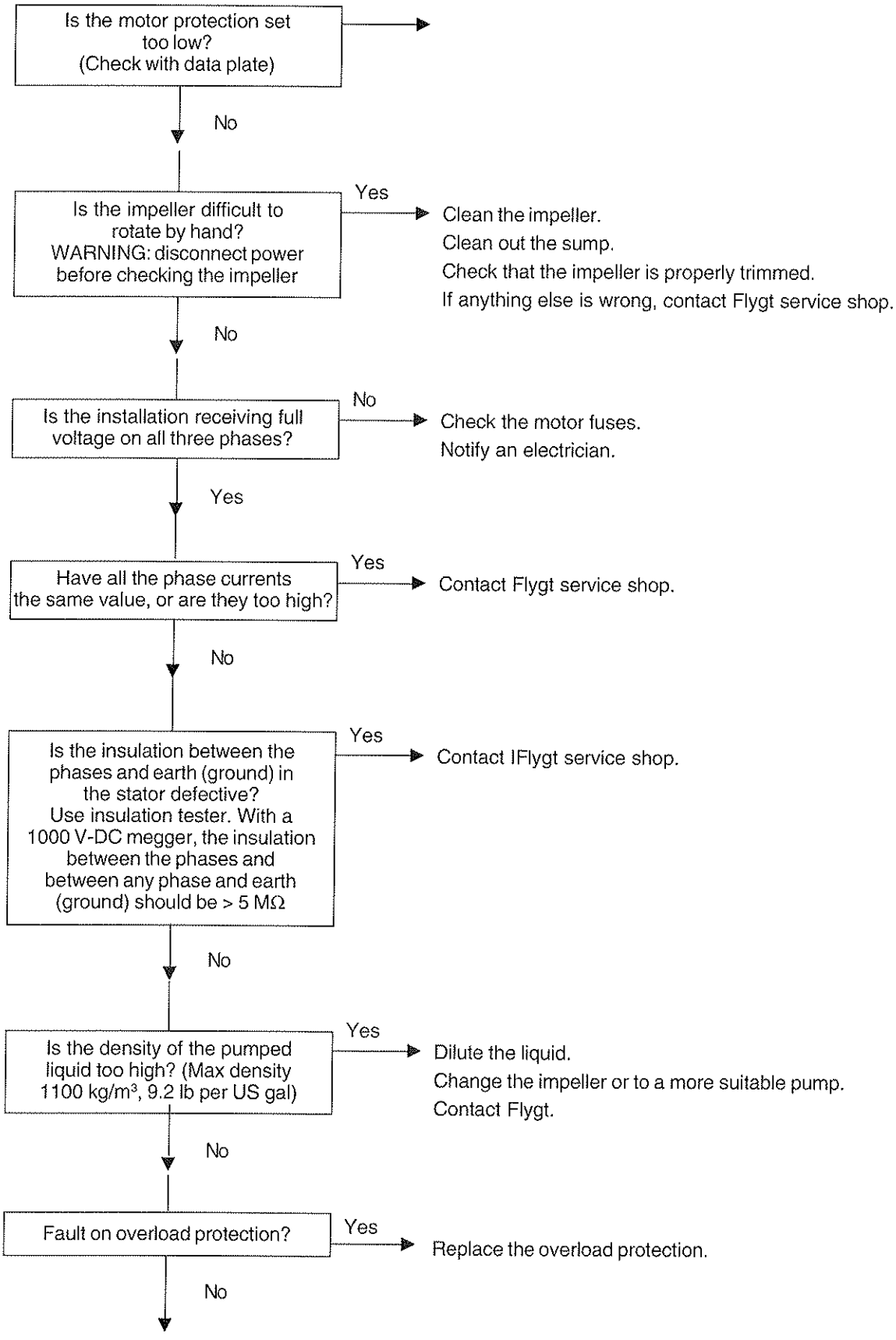
— that the overload protection is reset.

— that there is no brake in the motor cable.

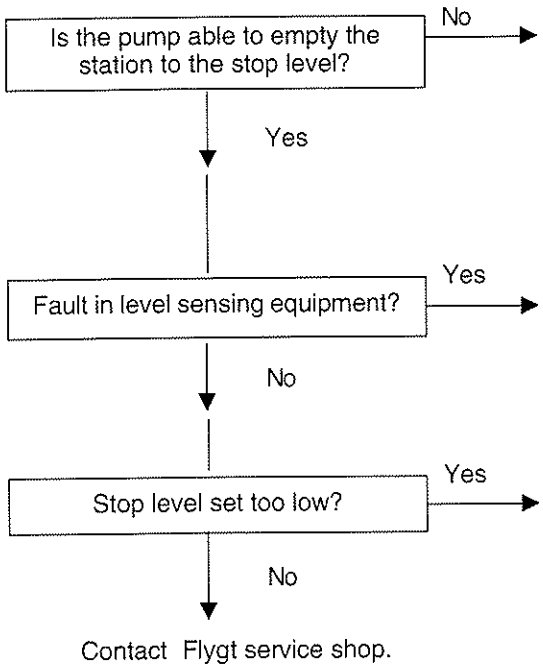
Clean.

Clean the sump.

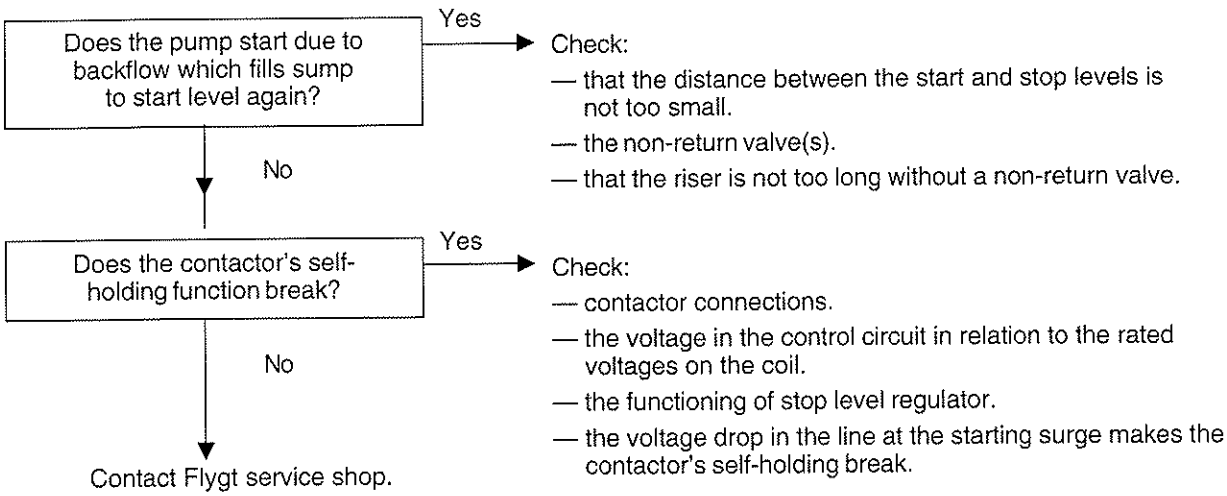
2. Pump starts but motor protection trips



3. The pump does not stop (when level control is used)



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 and impeller are not clogged.
— that the impeller rotates freely.
— that the suction lift has not been altered.
— for leakage in the pump installation.
— for wear on the impeller, pump and casing/flange.

See also under "Inspection".

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

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