QF

INSTALLATION
AND
OPERATING INSTRUCTIONS

Before beginning installation procedures, these Installation and Operating Instructions should be studied carefully. The installation and operation should also be in accordance with local regulations and accepted codes of good practice.

These instructions apply to SHAKTI submersible motors, types 4",6", 8" and SHAKTI submersible pumps, type QF fitted with submersible motors, types SHAKTI FRANKLIN 4"-8", MERCURY 6"-12" and PLEUGER 6"-12".

If the pump is fitted with a motor of another motor make than SHAKTI 4",6",8" please note that the motor data may differ from the data stated in these instructions.

1. DELIVERY AND STORAGE

1.1 Delivery

SHAKTI submersible pumps are supplied from the factory in proper packing in which they should remain until they are to be installed.

During unpacking and prior to installation, care must be taken when handling the pump to ensure that misalignment does not occur due to bending.

The loose data plate supplied with the pump should be fixed close to the installation site.

The pump should not be exposed to unnecessary impact and shocks.

1.2 Storage and Handling

Storage temperature: Pump : – 20°C to +60°C.
Motor : – 20°C to +70°C.

The motors must be stored in a closed, dry and well ventilated room.

Note : If SHAKTI 4",6", 8" motors are stored for more than one year, the shaft must be turned by hand at least once a month.

If a motor has been stored for more than one year before installation, the rotating parts of the motor must be dismantled and checked before use.

The pump should not be exposed to direct sunlight.

If the pump has been unpacked, it should be stored horizontally, adequately supported, or vertically to prevent misalignment of the pump. Make sure that the pump cannot roll or fall over. During storage, the pump can be supported as shown in fig. 1.

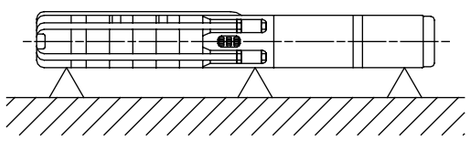

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Fig. 1

If the pump is not handled in vertical position, it must be lifted in the motor part and the pump part at the same time, see fig.2. Note : that the centre of gravity will vary, depending on pump type.

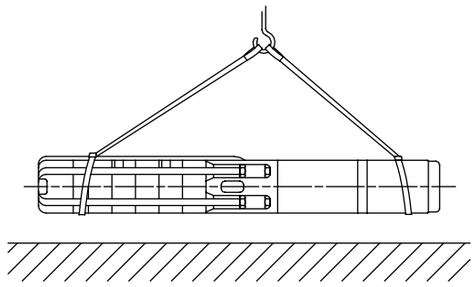

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Fig. 2

1.2.1 Frost Protection

If the pump has to be stored after use, it must be stored on a frost-free location, or it must be ensured that the motor liquid is frost-proof.

2. GENERAL DATA

2.1 Applications

SHAKTI submersible pumps, type QF are manufactured for a wide range of water supply and liquid transfer applications, such as the supply of fresh water to private homes or waterworks, water supply to nursery gardens or farms, draw down of groundwater and pressure boosting, and various industrial jobs.

The pump must be installed so that the suction interconnector is completely submerged in the liquid. The pump can be installed either horizontally or vertically, see also section 3.2 Positional Requirements.

2.2 Pumped Liquids

Clean, thin, **non-explosive** liquids without solid particles or fibers. The maximum sand content of the water must not exceed 50 g/m3. A larger sand content will reduce the life of the pump and increase the risk of blocking. When pumping liquids with a density higher than that of water, motors with correspondingly higher outputs must be used.

Note : If liquids with a viscosity higher than that of water are to be pumped, please contact SHAKTI.

The maximum liquid temperature appears from section 3.4 liquid temperature / cooling.

2.3 Sound Pressure Level

The sound pressure level has been measured in accordance with the rules laid down in the EC machinery Directive 98/37/EEC.

Sound pressure level of pumps:

Applies to pumps submerged in water, without external regulating valve.

Pump Type	$\bar{L}_{pA}$ [dB(A)]
QF1	<70
QF2	<70
QF5	<70
QF6	<70
QF12	<70
QF25	<70
QF30	<70
QF50	<70
QF75	<70
QF100	<70
QF125	<70
QF160	<70
QF210	79
QF270	79
QF360	82

Sound pressure level of motors:

The sound pressure level of SHAKTI 4",6", 8" motors is lower than 70 dB(A).

Other motor makes: See installation and operating instructions for these motors.

3. PREPARATION

Before starting work on the pump, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

3.1 Checking of Liquid in Motor

The submersible motors are factory-filled with a special non-poisonous liquid, which is frost-proof down to –20°C.

Note: The level of the liquid in the motor must be checked and the motor must be refilled, if required.

Note: If there is a risk of frost, special liquid must be used to refill the motor. Otherwise clean water may be used for refilling (however, **never** use distilled water).

Refilling of liquid is carried out as described below.

3.1.1 SHAKTI Submersible Motors 4",6", 8"

The filling hole for motor liquid is placed in the following positions:

4" : in one of the stay bolts.

1. Position the submersible pump as shown in fig. 3. The filling screw must be at the highest point of the motor.
2. Remove the screw from the filling hole.
3. Inject liquid into the motor with the filling syringe, fig. 3, until the liquid runs back out of the filling hole.
4. Replace the screw in the filling hole and tighten securely before changing the position of the pump.

Torques :

4" : 0.5 Nm.

The submersible pump is now ready for installation.

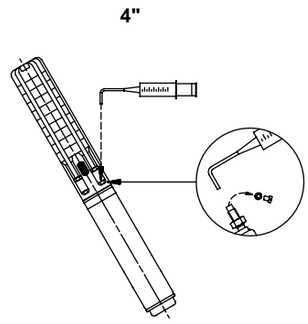

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Fig. 3

3.1.2 SHAKTI Submersible Motors 8"

To refill the motor, proceed as follows:

1. Position the submersible pump as shown in fig. 5.
2. Remove the screw (A) from the filling hole and fit the nipple with pipe and funnel supplied with the motor.
3. Remove the air vent screw (B) to allow possible air in the motor to escape.
4. Hold the funnel higher than the vent hole and pour clean water into the motor until the liquid starts dripping out of the motor.
5. Stop pouring water into the motor. Refit the screw (B) to the vent hole and remove pipe and funnel. Replace the screw (A) in the filling hole and tighten securely.

The submersible pump is now ready for installation.

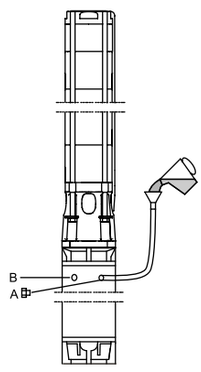

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Fig. 5

3.1.3 SHAKTI 6" & FRANKLIN Submersible Motors from 3.7 kW and up

The level of the motor liquid in SHAKTI 6", FRANKLIN 4" and 6" submersible motors is checked by measuring the distance from the bottom plate to the built-in rubber diaphragm. This distance can be measured by inserting a rule or a small rod through the hole until it touches the diaphragm, fig. 6.

Note : Take care not to damage the diaphragm.

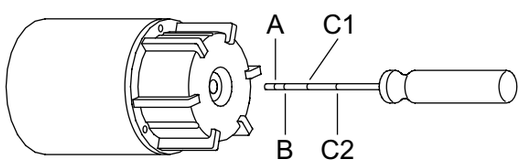

Fig. 6

The following table shows the correct distance from the outside of the bottom plate to the diaphragm.

Motor	Dimension	Distance
SHAKTI 6", 3.7 to 45 kW (see fig. 7c)	C1	44 mm
FRANKLIN 4", 0.25 to 3 kW (see fig. 7a)	A	8 mm
FRANKLIN 4", 3 to 7.5 kW (see fig. 7b)	B	16 mm
FRANKLIN 6", 4 to 45 kW (see fig. 7c)	C1	44 mm
FRANKLIN 6", 4 to 22 kW (see fig. 7d)	C2	59 mm

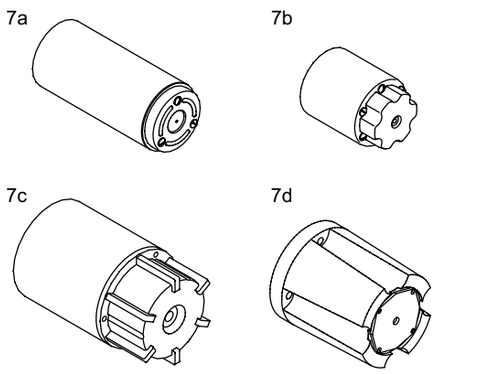

Fig. 7

If the distance is not correct, carry out an adjustment as described in section 3.1.5 FRANKLIN Submersible Motors.

3.1.4 FRANKLIN Submersible Motors

The level of the motor liquid in FRANKLIN 8" submersible motors is checked as follows:

- Prise out the filter in front of the valve at the top of the motors using a screwdriver. If the filter is slotted, unscrew. The position of the filling valve is shown in fig. 8.
- Press the filling syringe against the valve and inject the liquid, fig. 8. If the valve cone is depressed too far, it may be damaged thus causing the valve to leak.
- Remove any air in the motor by pressing the point of the filling syringe lightly against the valve.
- Repeat the process of injecting liquid and releasing air until the liquid starts running out or the diaphragm is in its correct position (FRANKLIN 4" and 6").
- Reinstall the filter after refilling with liquid.

The submersible pump is now ready for installation.

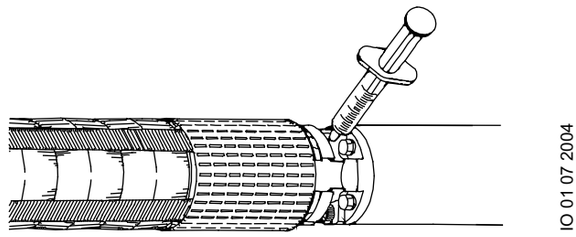

Fig. 8

3.1.5 MERCURY Submersible Motors

The level of the liquid in the motor is checked as described for FRANKLIN 8" motors, see section 3.1.5 FRANKLIN Submersible Motors.

3.1.6 PLEUGER Submersible Motors

The level of the liquid in the motor is checked as described for FRANKLIN 8" motors, see section 3.1.5 FRANKLIN Submersible Motors.

3.2 Positional Requirements

If the pump is to be installed in a position where it is accessible, the coupling must be suitably isolated from human touch. The pump can for instance be built into a flow sleeve.

Depending on motor type, the pump can be installed either vertically or horizontally. A complete list of motor types suitable for horizontal installation is shown in section 3.2.1.

If the pump is installed horizontally, the discharge port should never fall below the horizontal plane, see fig. 9.

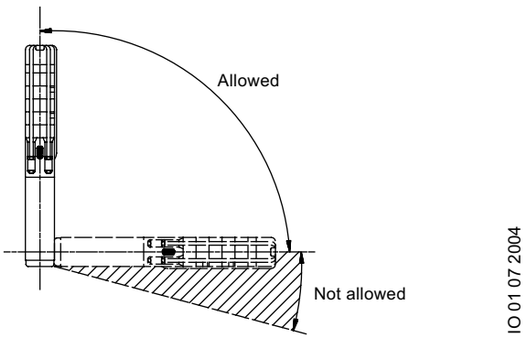

Fig. 9

If the pump is installed horizontally, e.g. in a tank, it is recommended to fit it in a flow sleeve.

3.2.1 Motors suitable for horizontal installation

Motor type	Power output 50 Hz	Power output 60 Hz
	[kW]	[kW]
4",6", 8"	All sizes	All sizes

When FRANKLIN 4" submersible motors up to and including 2.2 kW are started more than 10 times a day, it is recommended to incline the motor at least 15° above the horizontal plane in order to minimize wearing of the upthrust disc.

Note : During operation, the suction interconnector of the pump must always be completely submerged in the liquid.

In special conditions, it may be necessary to submerge the pumpeven deeper, depending on the operating conditions of the actual pump and the NPSH value.

Note : If the pump is used for pumping hot liquids (40° to 60°C), care should be taken to ensure that persons cannot come into contact with the pump and the installation, e.g. by installing a guard.

3.3 Diameter of Pump/Motor

The maximum diameter of the pump/motor is as shown in the tables on 16, 17 pages.

It is recommended to check the borehole with an inside calliper to ensure unobstructed passage.

3.4 Liquid Temperatures / Cooling

The maximum liquid temperature and the minimum liquid velocity over the motor appear from the following table.

It is recommended to install the motor above the well screen in order to achieve proper motor cooling.

Note : In cases where the stated liquid velocity can not be achieved, a flow sleeve must be installed.

If there is a risk of sediment build-up, such as sand, around the motor, a flow sleeve should be used in order to ensure proper cooling of the motor.

3.4.1 Maximum Liquid Temperature

Out of consideration for the rubber parts in pump and motor, the liquid temperature must not exceed 40°C (~105°F). See also the following table.

The pump can operate at liquid temperatures between 40°C and 60°C (~105°F and 140°F) provided that all rubber parts are replaced every third year.

Motor	Installation		
	Flow past the motor	Vertical	Horizontal
SHAKTI 4"	0.08 m/s	30°C (~85°F)	30°C (~85°F)
SHAKTI 6"	0.16 m/s	30°C (~85°F)	30°C (~85°F)
FRANKLIN 4"	0.08 m/s	30°C (~85°F)	30°C (~85°F)
FRANKLIN 6" and 8"	0.16 m/s	30°C (~85°F)	30°C (~85°F)
MERCURY	0.15 m/s	25°C (~77°F)	25°C (~77°F)
PLEUGER	0.5 m/s	30°C (~86°F)	30°C (~86°F)

Note : By free convection is meant that the borehole diameter is at least 2" larger than the diameter of the submersible motor.

Other motor makes: See motor specifications.

3.5 Pipework Connection

If noise may be transmitted to the building through the pipework, it is advisable to use plastic pipes.

Note : Plastic pipes are recommended for 4" pumps only.

When plastic pipes are used, the pump should be secured by an unloaded straining wire.

Make sure that the plastic pipes to be used are suitable for the actual liquid temperature and the pump pressure.

When connecting plastic pipes, a compression coupling should be used between the pump and the first pipe section.

4. ELECTRICAL CONNECTION

Before starting work on the pump, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

4.1 General

The electrical connection should be carried out by an authorized electrician in accordance with local regulations.

The supply voltage, rated maximum current and cos appear from the loose data plate that must be fitted close to the installation site.

The required voltage quality for SHAKTI submersible motors, measured at the motor terminals, is –10%/+6% of the nominal voltage during continuous operation (including variation in the supply voltage and losses in cables).

The pump must be earthed.

The pump must be connected to an external mains switch.

In order that the SHAKTI motors with a built-in and operational temperature transmitter can meet the EC EMC Directive (89/336/EEC), a 0.47μF capacitor (in accordance with IEC 384-14) must always be connected over the two phases to which the temperature transmitter is connected, see fig. 10.

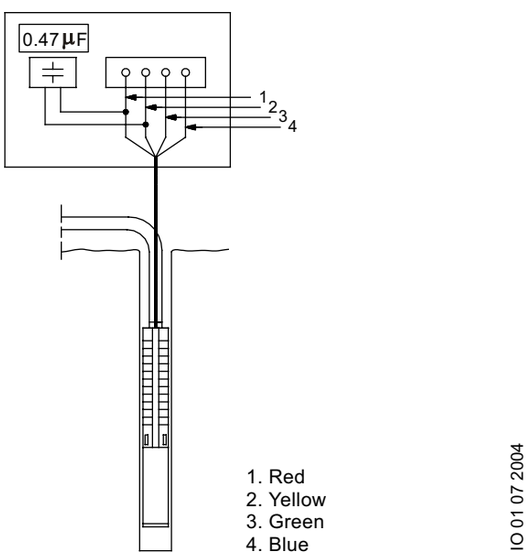

Fig. 10

The motors are wound for direct-on-line starting or star-delta starting and the starting current is between 4 and 6 times the full load current of the motor.

The run-up time of the pump is only about 1 second. Direct-online starting is therefore normally approved by the electricity supply authorities.

4.2 Motor Protection

4.2.1 Single-Phase Motors

Single-phase submersible motors, type 4" must be protected. A protective device can either be incorporated in a control box or separate.

FRANKLIN 4" PSC motors must be connected to a motor starter.

SHAKTI motors have no built-in temperature transmitter.

A Pt100 sensor is available as an accessory.

Motors with a Pt100 sensor must be protected by means of:

- a motor starter with thermal relay or
- contactor(s).

Motors without a Pt100 sensor must be protected by means of :

- a motor starter with thermal relay or
- contactor(s).

4.2.2 Required Motor Starter Settings

For cold motors, the tripping time for the motor starter must be less than 10 seconds at 5 times the rated maximum current of the motor.

Note: If this requirement is not met, the motor warranty will be invalidated.

In order to ensure the optimum protection of the submersible motor, the starter overload unit should be set in accordance with the following guidelines:

1. Set the starter overload to the rated maximum current of the motor.
2. Start the pump and let it run for half an hour at normal performance.
3. Slowly grade down the scale indicator until the motor trip point is reached.
4. Increase the overload setting by 5%.

The highest permissible setting is the rated maximum current of the motor.

For motors wound for star-delta starting, the starter overload unit should be set as above, but the maximum setting should be as follows:

Starter overload setting = Rated maximum current x 0.58.

The highest permissible start-up time for star-delta starting or auto trans former starting is 2 seconds.

4.3 Lightning Protection

The installation can be fitted with a special over voltage protective device to protect the motor from voltage surges in the electricity supply lines when lightning strikes somewhere in the area, see fig. 11.

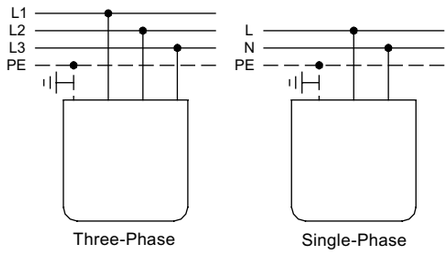

Fig. 11

The over voltage protective device will not, however, protect the motor against a direct stroke of lightning.

The over voltage protective device should be connected to the installation as close as possible to the motor and always in accordance with local regulations.

Ask SHAKTI for lightning protective devices.

4.4 Cable Sizing

Make sure that the submersible drop cable can withstand permanent submersion in the actual liquid and at the actual temperature.

SHAKTI can supply submersible drop cables for a wide range of installations.

The cross-section (q) of the cable should meet the following requirements:

1. The submersible drop cable should be dimensioned to the rated maximum current (I) of the motor.
2. The cross-section should be sufficient to make a voltage drop over the cable acceptable.

Use the largest of the cross sections found under points 1. and 2.

Pt. 1 : The following table specifies the current value of SHAKTI submersible drop cables (i.e. the maximum current tolerated by the drop cable) at an ambient temperature of maximum 30°C.

Please contact SHAKTI if the ambient temperature lies above 30°C.

When sizing the submersible drop cable, make sure that the rated maximum current does not exceed the current value (I_s).

For star-delta starting, however, size the cables so that 0.58 x the rated maximum current of the motor does not exceed the current value (Is) of the cables.

q [mm ²]	I_s [A]
1.5	14
2.5	18
4	24
6	30
10	39
16	55
25	66
35	77

If SHAKTI submersible drop cables are not used, the cross section should be selected on the basis of the current values of the actual cables.

Pt. 2 :

Note : The cross-section of the submersible drop cable must be large enough to meet the voltage quality requirements specified in section 4.1 General.

Determine the voltage drop for the cross-section of the submersible drop cable by means of the diagrams

I = Rated maximum current of the motor.
For star-delta starting
I=rated maximum current of the motor x 0.58.

Lx= Length of cable converted to a voltage drop of 1% of the nominal voltage.

$$Lx = \frac{\text{length of drop cable}}{\text{permissible voltage drop in \%}}$$

q = Cross-section of submersible drop cable.

Draw a straight line between the actual I-value and the Lx-value. Where the line intersects the q-axis, select the cross-section that lies right above the intersection.

The diagrams are made on the basis of the formulas:

Single-phase submersible motor:

$$L = \frac{U \times U}{I \times 2 \times 100 \times (\cos \times \frac{P}{q} \sin Xl)}$$

Three-phase submersible motor:

$$L = \frac{U \times U}{I \times 1.73 \times 100 \times (\cos \times \frac{P}{q} \sin Xl)}$$

where

L = Length of submersible drop cable [m]
U = Nominal voltage [V]
U = Voltage drop [%]
I = Rated maximum current of the motor [A]
cos = 0.9
p = Specific resistance: 0.02 [mm^2/m]
q = Cross-section of submersible drop cable [mm^2]
sin = 0.436
Xl = Inductive resistance: 0.078×10^{-3} [/m]

4.5 Control of Single-Phase Motors

The single-phase submersible motor with protection(saprate) which cuts out the motor in case of excessive winding temperatures while the motor is still supplied with voltage. Allow for this, when the motor forms part of a control system.

If a compressor is included in a control system together with an ochre filter, the compressor will run continuously once the motor protection has cut out the motor, unless other special precautions have been taken.

4.6 Connection of Single-Phase Motors

4.6.1 PSC Motors

The SHAKTI 4" motors are connected to the mains via an operating capacitor
which should be dimensioned for continuous operation.
Select the correct capacitor size from the following table:

Motor	Capacitor
0.37 kW	16 F / 400 V / 50 Hz
0.55 kW	20 F / 400 V / 50 Hz
0.75 kW	30 F / 400 V / 50 Hz
1.10 kW	40 F / 400 V / 50 Hz
1.50 kW	50 F / 400 V / 50 Hz
2.20 kW	75 F / 400 V / 50 Hz

The SHAKTI 4" motor incorporates motor protection and should be connected to the mains as shown in fig. 13.

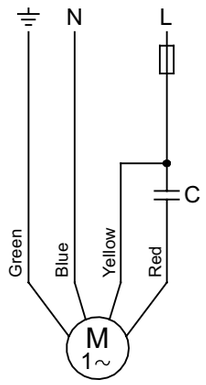

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Fig. 13

4.6.2 The FRANKLIN 4" PSC motor should be connected to the mains via the motor protection, see fig. 14.

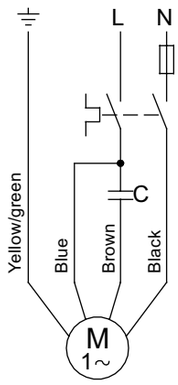

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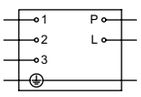
Fig. 14

4.6.3 3 - Wire Motors

SHAKTI 3-wire motors should be connected to the mains via a control box.
The connection of MCI 100 motors appears from the following table:

Motor	Cable	Control Box	Mains
Up to 0.37 kW	Red Blue Yellow Green		P L PE

4.7 Connection of Three-Phase Motors

Three-phase submersible motors must be protected, see section 4.2.2 Three-Phase Motors.
When a conventional motor starter is being used, the electrical connection should be carried out as described below.

4.7.1 Checking of Direction of Rotation

Note : The pump must not be started until the suction interconnector has been completely submerged in the liquid.
When the pump has been connected to the electricity supply, determine the correct direction of rotation as follows:

1. Start the pump and check the quantity of water and head developed.
2. Stop the pump and interchange two of the phase connections. In the case of motors wound for star-delta starting, exchange lead wire.
3. Start the pump and check the quantity of water and head developed.
4. Stop the pump.

Compare the results taken under points 1. and 3. The connection which gives the larger quantity of water and the higher head is the correct connection.

4.7.2 SHAKTI Motors, Direct-On-Line Starting

The connection of SHAKTI submersible motors wound for direct-on-line starting appears from the following table and fig. 15.

Mains	Cable/Connection
	SHAKTI 4" and 6" Motors
L1	R
L2	Y
L3	B
PE	PE

Check the direction of rotation as described in section 4.7.1 Checking of Direction of Rotation.

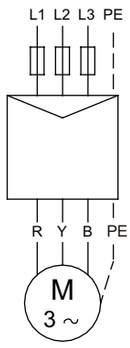


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Fig. 15

4.7.3 SHAKTI Motors, Star-Delta Starting

The connection of SHAKTI submersible motors wound for star-delta starting appears from the following table and fig.16.

Check the direction of rotation as described in section 4.7.1 Checking of Direction of Rotation.

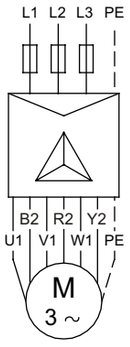

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Fig. 16

If star-delta starting is not required, but direct-on-line starting is, the submersible motors should be connected as shown in fig. 17.

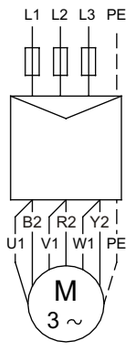

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Fig. 17

4.7.4 Connection in the Case of Unidentified Cable Marking / Connection

If it is unknown where the individual leads are to be connected to the mains in order to ensure the correct direction of rotation, proceed as follows :

Motors wound for direct-on-line starting :

Connect the pump to the mains as is expected to be right.

Then check the direction of rotation as described in section 4.7.1 Checking of Direction of Rotation.

Motors wound for star-delta starting :

The windings of the motor are determined by means of an ohmmeter, and the lead sets for the individual windings are named accordingly, see fig. 18.

R1 R2
Y1 Y2
B1 B2

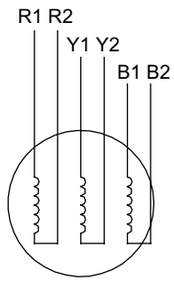

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Fig. 18

If star-delta starting is required, the leads should be connected as shown in fig. 16.

If direct-on-line starting is required, the leads should be connected as shown in fig. 17.

Then check the direction of rotation as described in section 4.7.1

Checking of Direction of Rotation.

4.7.5 FRANKLIN, MERCURY and PLEUGER Motors

The connection of FRANKLIN, MERCURY and PLEUGER motors appears from section 4.7.4 Connection in the Case of Unidentified Cable Marking/Connection.

5. PUMP INSTALLATION

Before starting any work on the pump/motor, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

5.1 Assembly of Motor and Pump

The bolts and nuts securing the straps to the pump must be tightened diagonally to the torques stated in the following table:

Straps Bolt/Nut	Torque [Nm]
M8	18
M10	35
M12	45
M16	110
QF360, 50 Hz, with more than 8 stages QF360, 60 Hz, with more than 5 stages	135

Make sure that the coupling between the pump and motor engages properly.

When assembling the motor and the pump, the nuts must be tightened diagonally to the torques stated in the following table:

Pump/Motor Staybolt Diameter	Torque [Nm]
M8	18
M12	100
M16	200
M20	390

Note : Make sure that the pump chambers are aligned when assembly has been completed.

5.2 Removal and Fitting of Cable Guard

For removal and fitting of cable guard(s), see last pages.

If the cable guard is screwed on to the pump, such as the QF360 and sleeved pumps, the cable guard should be removed and fitted by means of screws.

Note : Make sure that the pump chambers are aligned when the cable guard has been fitted.

5.3 Fitting of Submersible Drop Cable

5.3.1 SHAKTI Submersible Motors

Before fitting the submersible drop cable to the motor, make sure that the cable socket is clean and dry.

To facilitate the fitting of the cable, lubricate the rubber parts of the cable plug with non-conducting silicone paste.

Tighten the screws holding the cable to the torques stated:

4" : 1.5 Nm.

6' : 4.0-5.0 Nm.

8" : 15 Nm.

5.4 Riser Pipe

If a tool, e.g. a chain pipe wrench, is used when the riser pipe is fitted to the pump, the pump must only be gripped by the pump discharge chamber.

The threaded joints on the riser pipe must all be well cut and fit together to ensure that they do not work loose when subjected to torque reaction caused by the starting and stopping of the pump.

The thread on the first section of the riser pipe which is to be screwed into the pump should not be longer than the threads in the pump.

If noise may be transmitted to the building through the pipework, it is advisable to use plastic pipes.

Note: Plastic pipes are recommended for 4" pumps only.

When plastic pipes are used, the pump should be secured by an unloaded straining wire to be fastened to the discharge chamber of the pump, see fig. 19.

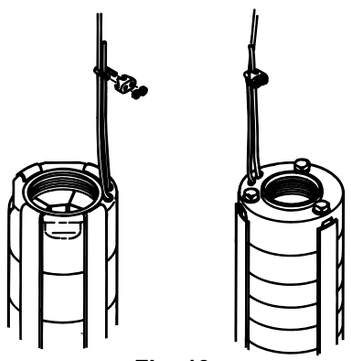

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Fig. 19

When connecting plastic pipes, a compression coupling should be used between the pump and the first pipe section.

Where flanged pipes are used, the flanges should be slotted to take the submersible drop cable and a water indicator hose, if fitted.

5.5 Maximum Installation Depth below Water Level

SHAKTI motors : 350 m.

FRANKLIN motors : 350 m.

MERCURY motors : 350 m.

PLEUGER motors : 350 m.

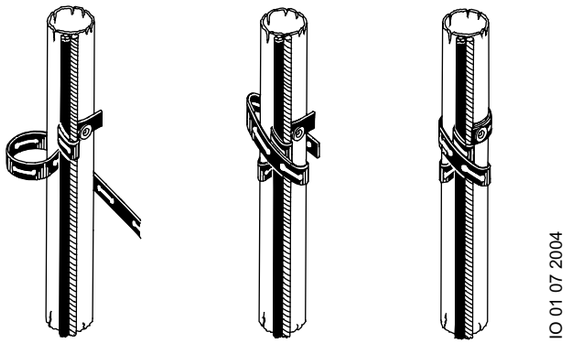
5.6 Cable Fitting

Cable clips must be fitted every 3 meters to fix the submersible drop cable and the straining wire, if fitted, to the riser pipe of the pump.

Cable Fitting: Cut off the rubber band so that the piece with no slit becomes as long as possible.

Insert a button in the first slit.

Position the wire alongside the submersible drop cable, fig.20.



Wind the band once around the wire and the cable.

Then wind it tightly at least twice around the pipe, wire and the cable.

Push the slit over the button and then cut off the band.

Where large cable cross-sections are used, it will be necessary to wind the band several times.

Where plastic pipes are used, some slackness must be left between each cable clip as plastic pipes expand when loaded.

When flanged pipes are used, the cable clips should be fitted above and below each joint.

5.7 Lowering the Pump

It is recommended to check the borehole by means of an inside calliper before lowering the pump to ensure unobstructed passage.

Lower the pump carefully into the borehole, taking care not to damage the motor cable and the submersible drop cable.

TM00 1368 2298 TM00 1369 5092

Note : Do not lower or lift the pump by means of the motor cable.

5.8 Installation Depth

The dynamic water level should always be above the suction interconnect or of the pump, see section 3.2 Positional Requirements and fig. 21.

Minimum inlet pressure is indicated in the NPSH curve for the pump.

The minimum safety margin should be 1 metre head.

It is recommended to install the pump so that the motor part is above the well screen in order to ensure optimum cooling, see section 3.4 Liquid Temperatures/Cooling.

When the pump has been installed to the required depth, the installation should be finished by means of a borehole seal.

Slacken the straining wire so that it becomes unloaded and lock it to the borehole seal by means of wire locks.

For pumps fitted with plastic pipes, the expansion of the pipes when loaded should be taken into consideration, when deciding

on the installation depth of the pump.

6. START-UP AND OPERATION

6.1 Start-Up

When the pump has been connected correctly and it is submerged in the liquid to be pumped, it should be started with the discharge valve closed off to approx. 1/3 of its maximum volume of water.

Check the direction of rotation as described in section 4.7.1 Checking of Direction of Rotation.

If there are impurities in the water, the valve should be opened gradually as the water becomes clearer. The pump should not be stopped until the water is completely clean, as otherwise the pump parts and the non-return valve may choke up.

As the valve is being opened, the drawdown of the water level should be checked to ensure that the pump always remains submerged.

The dynamic water level should always be above the suction interconnector of the pump, see section 3.2 Positional Requirements and fig. 21.

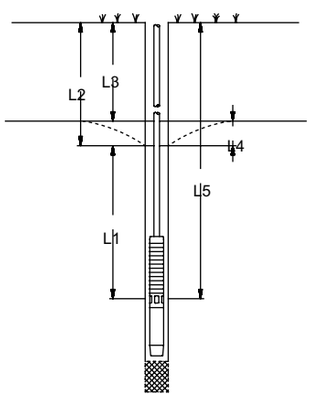


Fig. 21

L1 : Minimum installation depth below dynamic water level. Minimum 1 metre is recommended.

L2 : Depth to dynamic water level.

L3 : Depth to static water level.

L4 : Draw down. This is the difference between the dynamic and the static water levels.

L5 : Installation depth.

If the pump can pump more than yielded by the well, it is recommended to fit the control unit, or some other type of dry-running protection.

If no water level electrodes or level switches are installed, the water level may be drawn down to the suction interconnector of the pump and the pump will then draw in air.

Long time operation with water containing air may damage the pump and cause insufficient cooling of the motor.

6.2 OPERATION

6.2. 1 Minimum Flow Rate

To ensure the necessary cooling of the motor, the pump should never be set so low that the cooling requirements specified in section 3.4 Liquid Temperatures/Cooling cannot be met.

6.2.2 Frequency of Starts and Stops

SHAKTI MOTOR	Minimum 1 per year is recommended. Maximum 100 per day.
FRANKLIN	Minimum 1 per year is recommended. Maximum 100 per day.
MERCURY 6"	Minimum 1 per year is recommended. Maximum 20 per hour.
MERCURY 8"	Minimum 1 per year is recommended. Maximum 15 per hour.
MERCURY 10"	Minimum 1 per year is recommended. Maximum 10 per hour.
MERCURY 12"	Minimum 1 per year is recommended. Maximum 6 per hour.
PLEUGER	Minimum 1 per year is recommended. Maximum 100 per day.

7. MAINTENANCE AND SERVICE

The pumps are maintenance-free.

All pumps are easy to service.

Service kits and service tools are available from SHAKTI.

The SHAKTI Service Manual is available on request.

The pumps can be serviced at a SHAKTI service centre or authorised.

If a pump has been used for a liquid which is injurious to health or toxic, the pump will be classified as contaminated.

If SHAKTI is requested to service the pump, SHAKTI must be contacted with details about the pumped liquid, etc.

before the pump is returned for service. Otherwise SHAKTI can refuse to accept the pump for service.

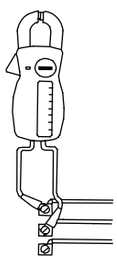
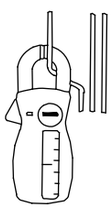
Possible costs of returning the pump are paid by the customer.

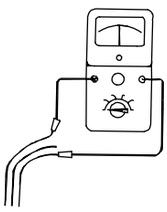
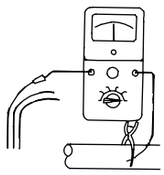
8. FAULT FINDING CHART

Fault	Cause	Remedy
1. The pump does not run.	a) The fuses are blown.	Replace the blown fuses. If the new ones blow too, the electric installation and the submersible drop cable should be checked.
	b) The ELCB or the voltage-operated ELCB has tripped out.	Cut in the circuit breaker.
	c) No electricity supply.	Contact the electricity supply authorities.
	d) The motor starter overload has tripped out.	Reset the motor starter overload (automatically or possibly manually). If it trips out again, check the voltage.Is the voltage OK, see items e) - h).
	e) Motor starter/contactor is defective.	Replace the motor starter/contactor.
	f) Starter device is defective.	Repair/replace the starter device.
	g) The control circuit has been interrupted or is defective.	Check the electric installation.
	h) The dry-running protection has cut off the the electricity supply to the pump, due to low water level.	Check the water level. If it is OK, check the water level electrodes/level switch.
	i) The pump/submersible drop cable is defective.	Repair/replace the pump/cable.
2. The pump runs but gives no water.	a) The discharge valve is closed.	Open the valve.
	b) No water or too low water level in borehole.	See item 3 a).
	c) The non-return valve is stuck in its shut position.	Pull out the pump and clean or replace the valve.
	d) The inlet strainer is choked up.	Pull out the pump and clean the strainer.
	e) The pump is defective.	Repair/replace the pump.
3. The pump runs at reduced capacity.	a) The draw down is larger than anticipated.	Increase the installation depth of the pump, throttle the pump or replace it by a smaller model to obtain a smaller capacity.
	b) Wrong direction of rotation.	See section 4.7.1 Checking of Direction of Rotation.
	c) The valves in the discharge pipe are partly closed/blocked.	Check and clean/replace the valves, if necessary.
	d) The discharge pipe is partly choked by impurities (ochre).	Clean/replace the discharge pipe.
	e) The non-return valve of the pump is partly blocked.	Pull out the pump and check/replace the valve.
	f) The pump and the riser pipe are partly choked by impurities (ochre).	Pull out the pump. Check and clean or replace the pump, if necessary. Clean the pipes.
	g) The pump is defective.	Repair/replace the pump.
	h) Leakage in the pipework.	Check and repair the pipework.
	i) The riser pipe is defective.	Replace the riser pipe.
4. Frequent starts and stops.	a) The differential of the pressure switch between the start and stop pressures is too small.	Increase the differential. However, the stop pressure must not exceed the operating pressure of the pressure tank, and the start pressure should be high enough to ensure sufficient water supply.

Fault	Cause	Remedy
	b) The water level electrodes or level switches in the reservoir have not been installed correctly.	Adjust the intervals of the electrodes / level switches to ensure suitable time between the cutting-in and cutting-out of the pump. See Installation and Operating Instructions for the automatic devices used. If the intervals between stop/start cannot be changed via the automatics, the pump capacity may be reduced by throttling the discharge valve.
	c) The non-return valve is leaking or stuck half-open.	Pull out the pump and clean/replace the non-return valve.
	d) The volume of air in the pressure / diaphragm tank is too small.	Adjust the volume of air in the pressure/diaphragm tank in accordance with its Installation and Operating Instructions.
	e) The pressure/diaphragm tank is too small.	Increase the capacity of the pressure / diaphragm tank by replacing or supplementing with another tank.
	f) The diaphragm of the diaphragm tank is defective.	Check the diaphragm tank.

9. CHECKING OF MOTOR AND CABLE

1. Supply voltage 	Measure the voltage between the phases by means of a voltmeter. On single-phase motors, measure between phase and neutral or between two phases, depending on the type of supply. Connect the voltmeter to the terminals in the motor starter.	The voltage should, when the motor is loaded, be within the range specified in section 4.1 General. The motor may burn if there are larger variations in voltage. Large variations in voltage indicate poor electricity supply, and the pump should be stopped until the defect has been remedied.
2. Current consumption 	Measure the amps of each phase while the pump is operating at a constant discharge head (if possible, at the capacity where the motor is most heavily loaded). For maximum operating current, see nameplate.	On three-phase motors, the difference between the current in the phase with the highest consumption and the current in the phase with the lowest consumption should not exceed 5%. If so, or if the current exceeds the full load current, there are the following possible faults : • The contacts of the motor starter burnt. Replace the contacts or the control box for single-phase operation. • Poor connection in leads, possibly in the cable joint. See item 3. • Too high or too low supply voltage. See item 1. • The motor windings are short-circuited or partly disjointed. See item 3.

		• Damaged pump is causing the motor to be overloaded. Pull out the pump for overhaul. • The resistance value of the motor windings deviates too much (three-phase). Move the phases in phase order to a more uniform load. If this does not help, see item 3.
Items 3 and 4: Measurement is not necessary when the supply voltage and the current consumption are normal.		
3. Winding resistance 	Disconnect the submersible drop cable at the motor starter. Measure the winding resistance between the leads of the drop cable.	For three-phase motors, the deviation between the highest and the lowest value should not exceed 5%. If the deviation is higher, pull out the pump. Measure motor, motor cable and drop cable separately, and repair/replace defective parts. **Note :** On single-phase, 3-wire motors, the operating winding will assume the lowest resistance value.
4. Insulation resistance 	Disconnect the submersible drop cable at the motor starter. Measure the insulation resistance from each phase to earth (frame). Make sure that the earth connection is made carefully.	If the insulation resistance is less than 0.5 M, the pump should be pulled out for motor or cable repair. Local regulations may specify other values for the insulation resistance.

10. DISPOSAL

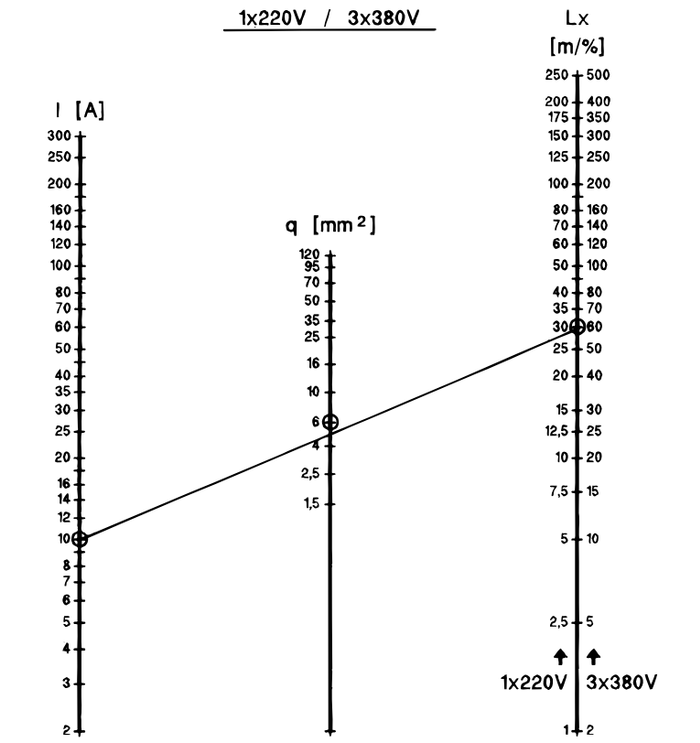
Disposal of this product or parts of it must be carried out according to the following guidelines:

1. Use the local public or private waste collection service.
2. In case such waste collection service does not exist or cannot handle the materials used in the product, please deliver the product or any hazardous materials from it to your nearest SHAKTI company representative or service workshop.

Pump			Maximum Diameter of Pump/Motor [mm]								
Type	Thread	Flange	Motor								
			Direct-On-Line Starting					Star-Delta Starting			
			4"	6"	8"	10"	12"	6"	8"	10"	12"
QF1	Rp 1¼		101								
QF2	Rp 1¼		101								
	*R 1¼		108								
QF5	Rp 1¼		101								
QF6	Rp 1½		101	138							
	*R 1½			138							
QF12	Rp 2		101	138							
	*R 2			140							
QF25	Rp 2		101								
F10+	Rp 2		131	140				143			
QF30	Rp 2½		131	140				143			
	*R 3			169	192			175	192		
QF50	Rp 3		137	143	192			147	192		
	*R 3				192				192		
QF75	Rp 3		141	145	192			150	192		
	Rp 4		145	147	192			153	192		
	*R 4				192				192		
QF100	Rp 3		141	145				150			
	Rp 4		145	147	192			153	192		
QF125	Rp 5			178	197			186	205		
		5"		200	200			200	205		
QF160	Rp 5			178	197			186	205		
		5"		208	208			212	212		
QF210	Rp 6			211	218			218	232		
		6"		222	230			226	239		
QF270	Rp 6			211	218			218	227		
		6"		211	218			218	227		
QF360	Rp 6			241	241	248	286	247	247	259	286
		6"		241	241	248	286	247	247	259	286

* Pump in sleeve

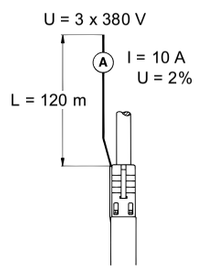
Pump			Maximum Diameter of Pump/Motor [mm]				
Type	Thread	Flange	Motor				
			Pump in Flow Sleeve				
			4"	6"	8"	10"	12"
QF1	Rp 1¼		125				
QF2	Rp 1¼		125				
	R 1¼		125				
QF5	Rp 1¼		125	200			
QF6	Rp 1½		125	200			
	R 1½			200			
QF12	Rp 2		125	200			
	R 2			200			
QF25	Rp 2		125				
QF30	Rp 2½		200	200			
	R 3			200	250		
QF50	Rp 3		200	200	250		
	R 3				250		
QF75	Rp 3		200	200	250		
	Rp 4		200	200	250		
	R 4				250		
QF100	Rp 3		200	200			
	Rp 4		200	200	250		
QF125	Rp 5			250	250		
		5"		250	250		
QF160	Rp 5			250	250		
		5"		250	250		
QF210	Rp 6			280	280		
		6"		280	280		
QF270	Rp 6			280	280		
		6"		280	280		
QF360	Rp 6			355	355	355	355
		6"		355	355		355

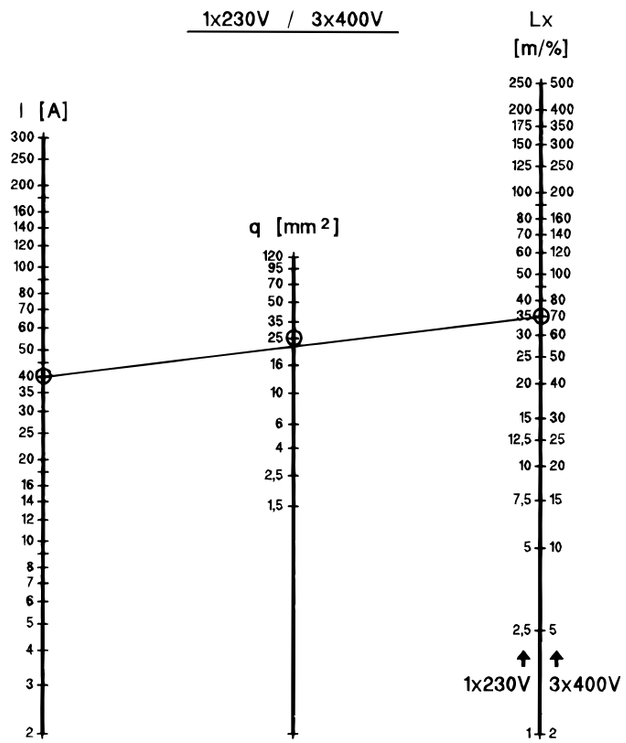


Example:

U = 3 x 380 V
I = 10 A
L = 120 m
U = 2%

$$Lx = \frac{L}{U} = \frac{120}{2} = 60\ m = q \quad 6\ mm^2$$

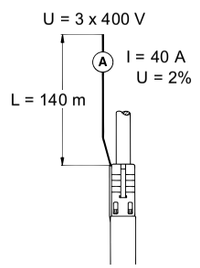


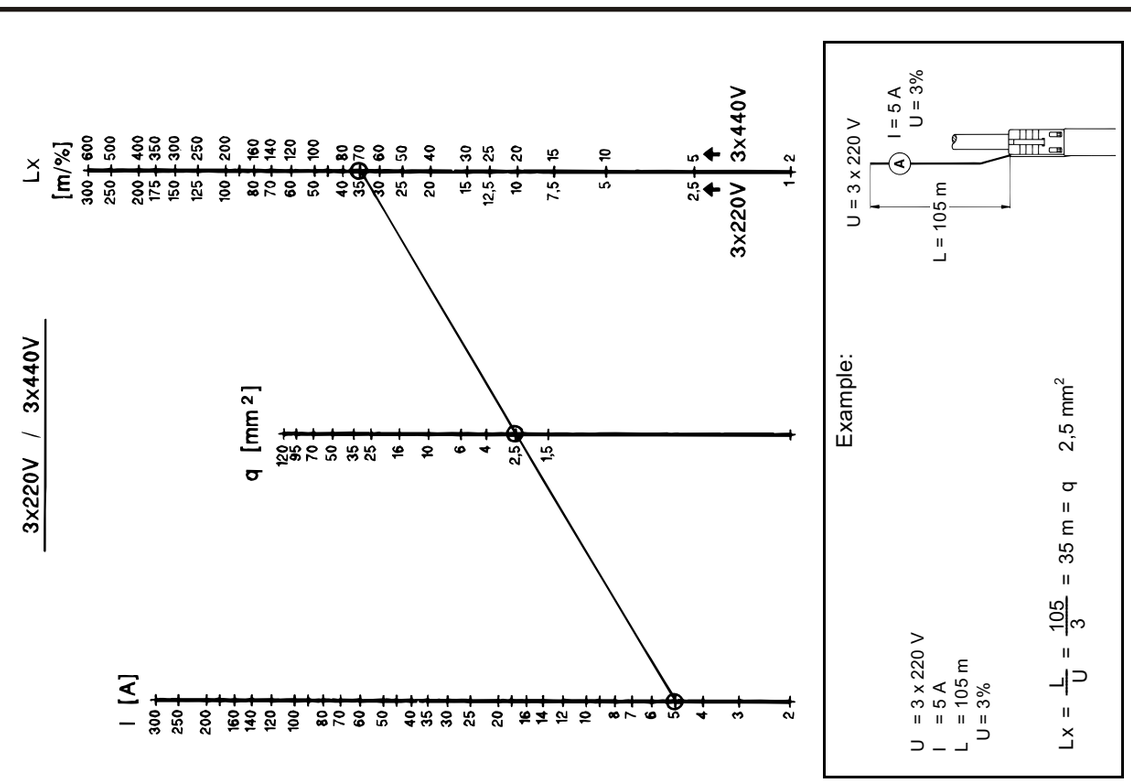


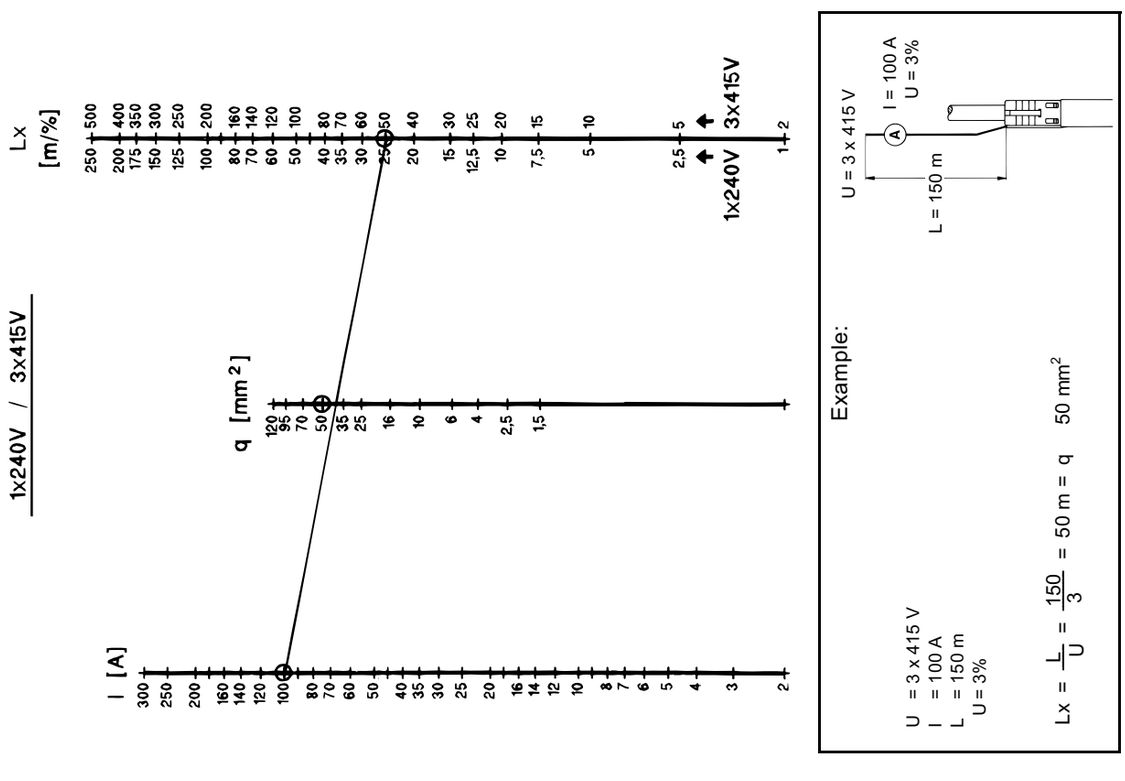
Example:

U = 3 x 400 V
I = 40 A
L = 140 m
U = 2%

$$Lx = \frac{L}{U} = \frac{140}{2} = 70\ m = q \quad 25\ mm^2$$




3x220V / 3x440V
Lx [m/%]
I [A]
q [mm²]
3x220V 3x440V
Example:
U = 3 x 220 V
I = 5 A
L = 105 m
U = 3%
Lx = L/U = 105/3 = 35 m = q 2,5 mm²


1x240V / 3x415V
Lx [m/%]
I [A]
q [mm²]
1x240V 3x415V
Example:
U = 3 x 415 V
I = 100 A
L = 150 m
U = 3%
Lx = L/U = 150/3 = 50 m = q 50 mm²

QF1,2,5,6, 12, 25

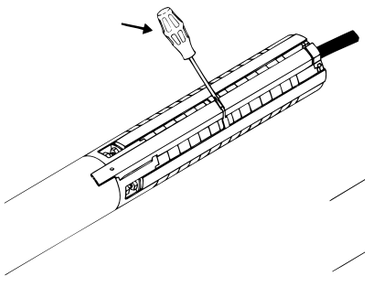


Fig. 1

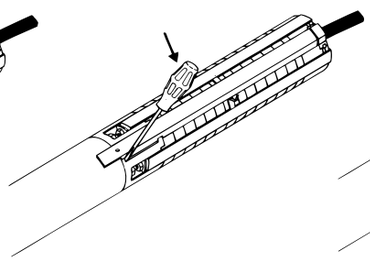


Fig. 2

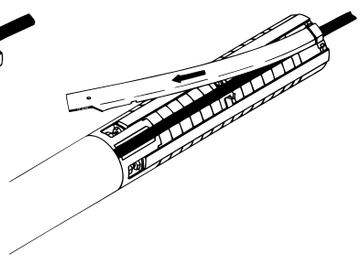


Fig. 3

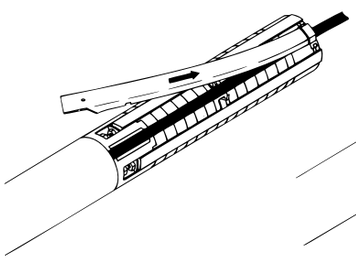


Fig. 1

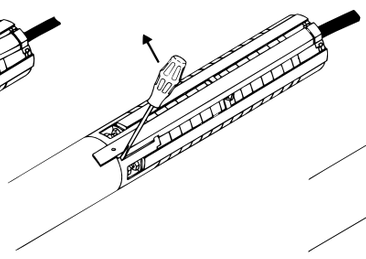


Fig. 2

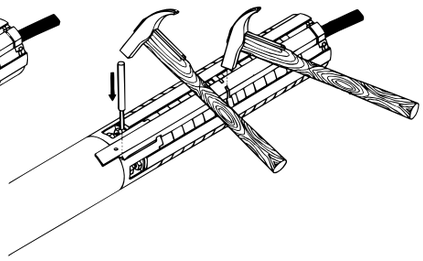


Fig. 3

QF1,2,5,6, 12, 25

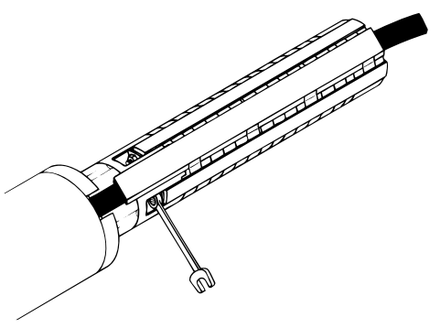


Fig. 1

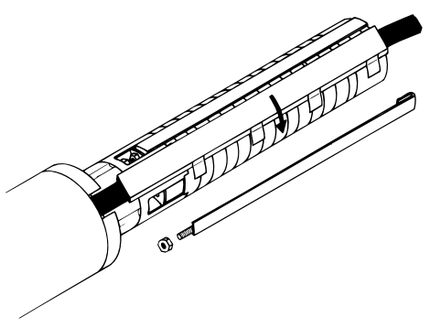


Fig. 2

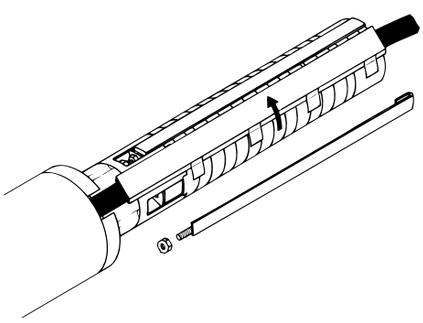


Fig. 1

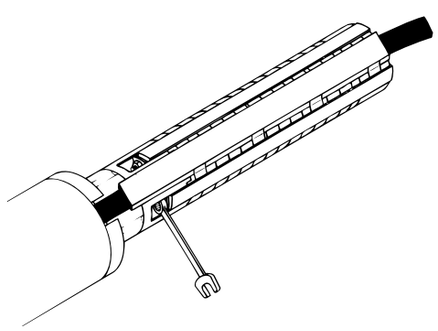


Fig. 2

QF30 - QF50 - QF75 - QF100

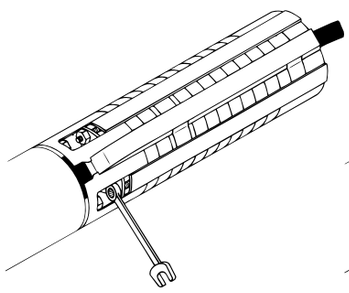


Fig. 1

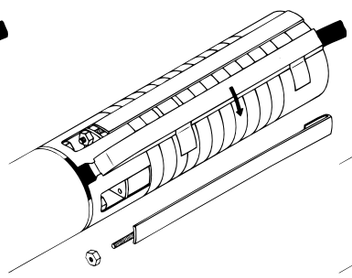


Fig. 2

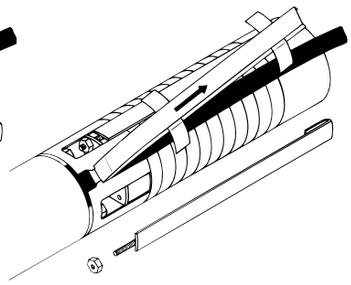


Fig. 3

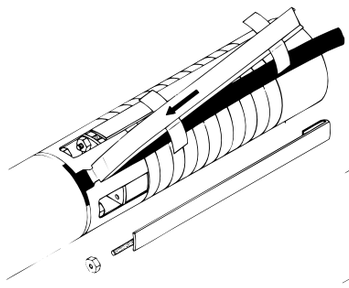


Fig. 1

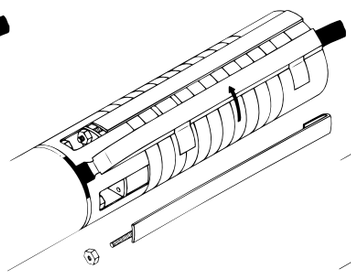


Fig. 2

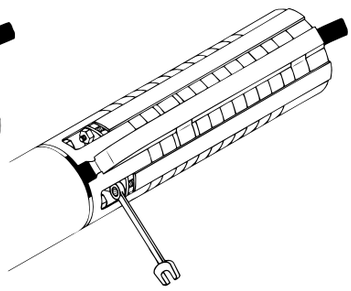


Fig. 3

QF125 - QF160 - QF210 - QF270 - QF360

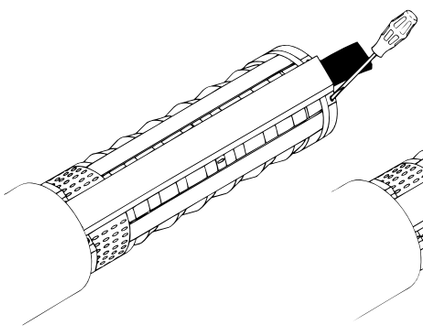


Fig. 1

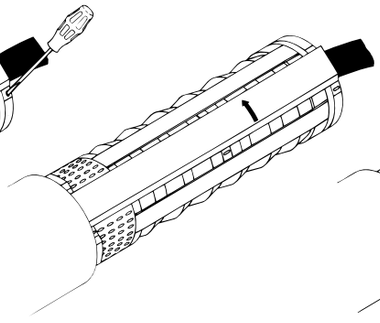


Fig. 2

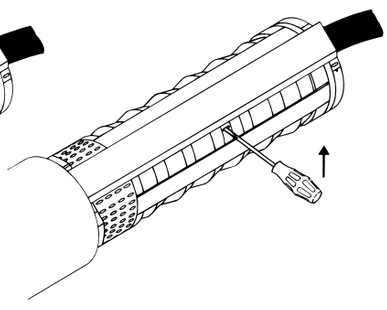


Fig. 3

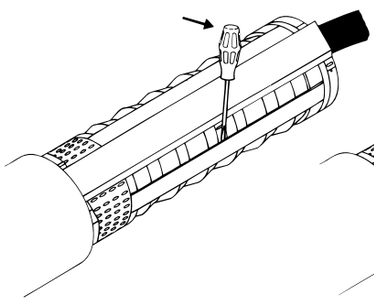


Fig. 1

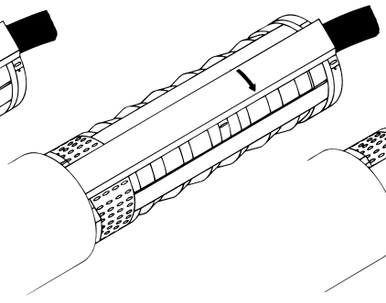


Fig. 2

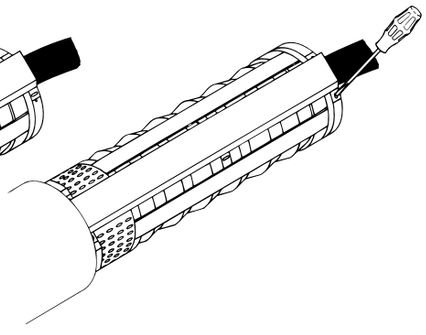


Fig. 3

Declaration of Conformity

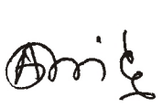
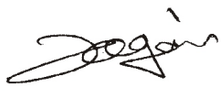
We SHAKTI PUMPS (INDIA) LIMITED declare under our sole responsibility that the products QF, & Electrical motor 4", 6", 8",10" model to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EEC Member States relating to following standard and technical specification:

Machinery Directive (98/37/EEC).
Standard used: EN 292.

Electromagnetic compatibility (89/336/EEC).
Standards used: EN 61 000-6-2 and EN 61 000-6-3.

Electrical equipment designed for use within certain voltage limits, as per low voltage Directive (73/23/EEC).
Standards used: EN 60 335-1 and EN 60 335-2-41.

And are in conformity with: IS: 9283,IS: 8034

NAME:	AJAY PATIDAR	J. UPADHYAY
POSITION:	MANAGER QUALITY DEPARTMENT	HEAD PRODUCT ENGINEERING
DATE:	15.07.2004	
SIGNED:		

From: QD 15720004 rev. 00