



**LAYNE BOWLER  
SUBMERSIBLE PUMPS**

**USER INSTRUCTIONS:  
INSTALLATION, OPERATION, MAINTENANCE**

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## **1. INTRODUCTION AND SAFETY**

### **1.1 General**

*These Instructions must always be kept close to the product's operating location or directly with the product.*

The unit is produced with great care and commitment to continuous quality control, utilizing sophisticated quality techniques, and safety requirements.

Layne Bowler as were designed pumps deep well type submersible pumps, suitable for domestic usage and agricultural irrigation wells having clean, in moderate chemical content levels and non-corrosive water.

These instructions are intended to facilitate familiarization with the product and its permitted use. Operating the product in compliance with these instructions is important to help ensure reliability in service and avoid risks. The instructions may not take into account local regulations; ensure such regulations are observed by all, including those installing the product.

*These instructions should be read prior to installing, operating, using and maintaining the equipment in the usage region of the product. The equipment must not be put into service until all the conditions relating to safety, noted in the instructions, have been met.*

### **1.2 CE marking and approvals**

It is a legal requirement that machinery and equipment put into service within certain regions of the world shall conform with the applicable CE Marking Directives covering Machinery and, where applicable, Low Voltage Equipment, Electromagnetic Compatibility (EMC), Pressure Equipment Directive (PED) and Equipment for Potentially Explosive Atmospheres (ATEX). Where applicable, the Directives and any additional Approvals, cover important safety aspects relating to machinery and equipment and the satisfactory provision of technical documents and safety instructions.

Where applicable this document incorporates information relevant to these Directives and Approvals. To confirm the Approvals applying and if the product is CE marked, check the serial number plate markings and the Certification, see section 10, *Certification*.

### **1.3 Disclaimer**

Information in these User Instructions is believed to be reliable. In spite of all the efforts of Layne Bowler to provide sound and all necessary information the content of this manual may appear insufficient and is not guaranteed by Layne Bowler as to its completeness or accuracy.

Layne Bowler manufactures products to exacting International Quality Management System Standards as certified and audited by external Quality Assurance organizations. Genuine parts and accessories have been designed, tested and incorporated into the products to help ensure continued product quality and performance in use. As Layne Bowler cannot test parts and accessories sourced from other vendors the incorrect incorporation of such parts and accessories may adversely affect the performance and safety features of the products. The failure to properly select, install or use authorized Layne Bowler parts and accessories is considered to be misuse. Damage or failure caused by misuse is not covered by the Layne Bowler warranty. In addition, any modification of Layne Bowler products or removal of original components may impair the safety of these products in their use.

The limits given in the data sheet may not be exceeded.

### **1.4 Duty conditions**

This product has been selected to meet the specifications of your purchaser order. The acknowledgement of these conditions has been sent separately to the Purchaser. A copy should be kept with these instructions.

***The product must not be operated beyond the parameters specified for the application. If there is any doubt as to the suitability of the product for the application intended, contact Layne Bowler for advice, quoting the serial number.***

If the conditions of service on your purchase order are going to be changed (for example liquid pumped, temperature or duty) it is requested that the user seeks the written agreement of Layne Bowler before start up.

## 1.5 Safety

### 1.5.1 Identification of Important Safety Situations

Some safety precautions that were indicated in this manual have to be followed by persons for keeping away dangerous and hazardous results. These type situations were indicated specially by signs shown below.



Electrical safety instructions where non-compliance will involve a high risk to personal safety or the loss of life.



Safety instructions where non-compliance would affect personal safety and could result in loss of life.



“Hazardous and toxic fluid” safety instructions where non-compliance would affect personal safety and could result in loss of life.



Safety instructions where non-compliance will involve some risk to safe operation and personal safety and would damage the equipment or property.

### 1.5.2 Personnel qualification and training

Installation, inspection and maintenance of the unit must be done by qualified persons to carry out the work involved. Always coordinate repair activity with operations and health and safety personnel, and follow all plant safety requirements and applicable safety and health laws and regulations.

Non-compliance may result in the following:

- Failure of important unit functions
- Failure of stipulated methods of maintenance and repair
- Risks to personnel from electrical, mechanical or chemical effects
- Danger to the environment by leakage during production of dangerous media

## 2. TRANSPORT AND STORAGE

### 2.1 Consignment receipt and unpacking

Submersible pumps are subjected to a thorough inspection before leaving the factory and are supplied with operating instructions for fitting, starting, care etc, that conform to international safety regulations.

When the shipment receipted, it must be checked against the delivery and shipping documents for its completeness and that there has been no damage in transportation. Any shortage and or damage must be reported to Layne Bowler.



*While transporting and installation, there become any crushing or collapsing on the motor surface, stop the process and contact with LAYNE BOWLER. Contrary this, usage of pump at this situation will be out of guaranties*

Each product has a unique serial number. Check that this number corresponds with that advised and always quote this number in correspondence as well as when ordering spare parts or further accessories.

### 2.2 Handling and lifting



Take special care when handling the pump unit. Make certain that it does not hit against walls, steel structures or floors etc.

### 2.2.1 Erection of long units



For transport, ensure that the hoist has an adequate carrying capacity.

Units that are delivered or stored in several subassemblies due to extreme length must be assembled during installation into the well. Special fitting instructions must be requested from the manufacturer for this.

This will be supplied according to that special product so if this instructions were not supplied contact with Layne Bowler.

A unit that is shipped on a transport rail due to its extreme length must be lifted into the vertical position on this rail (i.e. an auxiliary carrier) before fitting into the well.



*Due to the danger of sagging, pump units that exceed the permissible length must be supported by an auxiliary carrier (U or H carrier) when lifted into the vertical position. This carrier may only be removed after the pump unit is hanging vertically from the crane or lifting block. (See Figure 2-1.)*



Power cables must not be used for lifting or moving the motor.

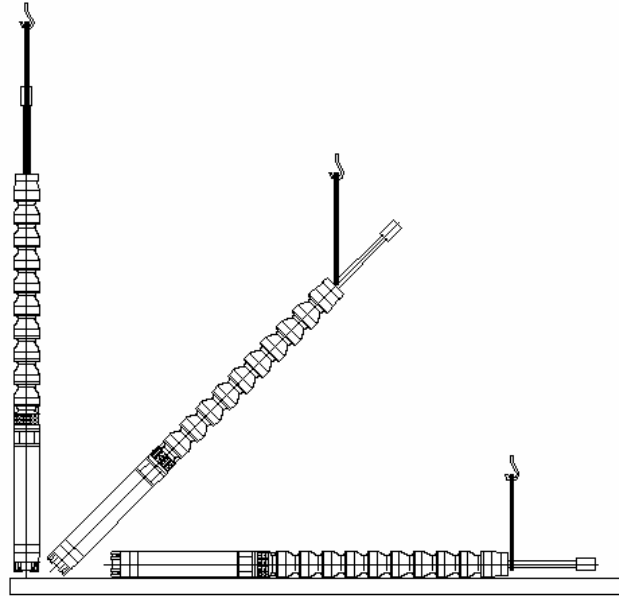
### 2.3 Storage



*Submersible pump units need special storage conditions. For functional reasons some inner parts (eg the stator and rotor plates) cannot be produced from corrosion-resistant materials and are therefore sensitive to any type of air humidity.*

For storage between one and 24 months, it is recommended that the shaft of the unit be turned at intervals of approximately 8 weeks. For this it may be necessary to remove a mounted pressure housing, including the check valve. On pump units where this is not possible, the pump and motor must be separated.

If needed, separate instructions should be requested from Layne Bowler.



**Figure 2.1**



*If the pump unit is stored for more than 24 months a complete visual inspection at the Layne Bowler manufacturing plant is recommended. An authorized Layne Bowler factory representative can also carry out this inspection.*

At the end of the service life of the product or its parts, the relevant materials and parts should be recycled or disposed of using an environmentally acceptable method and local regulations



*Make sure that hazardous substances are disposed of safely and that the correct personal protective equipment is used. The safety specifications must be in accordance with the current regulations at all times.*

### 3. DESCRIPTION

Each unit is individually manufactured to the special requirements of the customer. The specific technical data regarding head, delivery rate, current requirement, minimum permissible flow velocity on the external motor surfaces etc can be found in the data sheet delivered with the unit or in the order confirmation. The unit is delivered;

- Pump unit
- User Instructions
- Technical data sheet

#### 3.1 Normal operating conditions

- Temperature: see data sheet
- Sand content: max. 50 mg/l
- No impurities that could lead to deposits and blockages within the pump or to deposits on the motor surface
- No water hammer
- Maximum 3 minutes operation against closed slide valve
- Operation within prescribed voltage tolerances
- Permissible operational range: 70 to 120 % of the best efficiency point (BEP)
- Correctly selected and adjusted motor protection

- Observation of the maximum permissible starting frequency



*If other working conditions are required, please contact Layne Bowler for advice.*

### **3.2 General description**

Submersible motor pumps are subjected to a thorough inspection before leaving the factory and are supplied with operating instructions for fitting, starting and care that conform to general safety regulations.

Standard submersible motor pumps are used to transport cold clean water under normal operating conditions.

Layne Bowler submersible pump has been developed for installation in wells and as a result has a distinctive slim design. Layne Bowler submersible pump, because of its various features, can also be used for other applications with different design modifications.

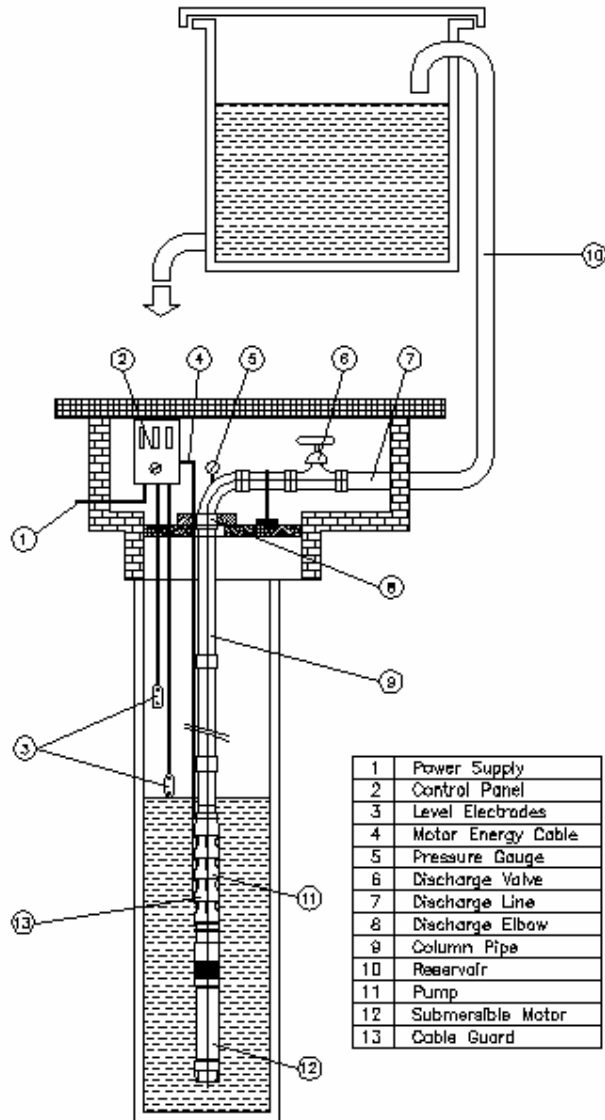
The submersible pump consists of a submersible motor, a submersible pump and usually a check valve. The complete pump unit is freely suspended on the rising main, which is supported at the wellhead.

Other uses or applications must be agreed by the manufacturer.

Power cables and, if applicable, signal cables are fixed to the riser pipes by means of cable clips.

The ideal construction of a water supply system is shown in Figure 3-1. Since this shows a basic arrangement, the actual layout must be adapted to local and technical conditions.

The additional listed components are recommendations for operational safety and the protection of the pump unit.



**Figure 3.1**

### 3.3 Submersible motor

The so-called “wet” electric motor is a water-filled three-phase AC squirrel-cage motor with a watertight winding, which is operating in water and is designed especially for direct drive of submersible pumps. The motor filling-water cools the winding and bearings as well as lubricating the thrust and radial bearings.

The submersible-motor-pump is connected to the lower end of a riser pipe and submerged in the pumped medium. The power supply is through water resistant power cables fastened to the riser pipes with cable clips.

For operation the motor must be filled with potable water. Antifreeze can be added to the potable water if there is a risk of freezing. As the motor is hermetically sealed and equipped with a pressure/volume compensating device the motor filling remains in the motor for the duration of operation.

Although the motor filling-water and the pumped liquid surrounding the motor will mix if there is leakage from the seals, the motor remains operative due to its water-lubricated journal bearings.



Basically, "wet" motors operate maintenance-free with the ammeter acting as a monitoring device.

The stator winding consists of winding wire provided with special insulation.

The power cables are connected to the winding by a special watertight splice and leave the motor through stuffing boxes.

The winding and cable connections are tested at high voltage according VDE 0530 IEC60034-1 immersed in water, at twice the operating voltage plus 1 000 volts, or a minimum of 2 000 volts.

The rotor winding consists of induction welded copper bars with short-circuit rings. The rotors are dynamically balanced and are protected against corrosion by a protective varnish. The drive shaft end is made of stainless steel.

The "Mitchell type" axial thrust bearing is located in the motor base and is designed to handle very high thrust loads; they are dimensioned so that they can support the axial thrust of the pump's rotating assembly as well as all hydraulic loads.

The thrust bearing is bi-directional. A fixed counter-thrust bearing is also provided. The journal bearings are slide bearings. The motor filling liquid lubricates the journals and thrust bearings.

The motor can be equipped with a single directional operating mechanical seal.

The motors can have different operating modes and starting procedures. Essentially, these are:

- Direct-on-line (DOL)
- Star-delta starting
- Starting via an auto-transformer
- Starting via soft-starter.
- Static-frequency converter operating
- Single-phase motor

For direct-on-line (DOL), Star-delta starting and starting via an auto-transformer only the particular starting procedures, the electrical data and the connection diagram for the motor and the operating data for the motor have to be followed. These are marked in the technical data sheet.

For all other operating modes special procedures have to be followed according to the application.

The direction of rotation depends on the pump type. Reversing two phases of the power supply will change the direction of rotation of all three-phase squirrel-cage motors; changing the direction of rotation of a single-phase motor is not possible.

Either one or two temperature sensors PT100 (RTD) can be installed with pressure and watertight connections to a signal cable. As the temperature sensors are mounted on the winding head they can only be removed after dismantling the motor.

### **3.4 Pump and check valve**

The dynamically balanced impellers are fixed to the pump shaft by means of conical lock collets. The pump shaft runs in journal bearings that are lubricated by the pumped medium.

The check valve of pump types is an integral part of the pump mounted onto the discharge casing of the pump.

## **4 INSTALLATION**

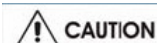
### **4.1 Hydraulic installation**

A typical design for a water supply system is shown in Figure 3.1. As this shows a basic arrangement, the actual layout must be adapted to local conditions. (The additional components listed are recommendations for operational safety and protection of the pump unit.)

## 4.2 General advice for installation

The following criteria must be taken into account to determine the installation position and depth:

- Vertical installation in the well above the filter line, so that an adequate motor cooling flow is guaranteed along the external motor surface
- Sufficient water cover
- Static water level at least 2 m above the pump outlet
- A dynamic water level above the suction housing
- Flow rate
- Supply conditions of the pumping medium depends on the installation conditions



*Regardless of the above, the pump unit should be installed above the well screen whenever possible, to avoid foreign matter being drawn directly into the pump inlet, and also to ensure that there is sufficient water flowing across the motor to assist heat transfer. If this is not possible a flow shroud should be provided to induce the flow of water over the motor.*



*Pump units can only be operated with a completely filled and immersed motor. The liquid level of the motor must always be checked before installation, and if necessary adjusted according to the information on the data card supplied with the motor.*

## 4.3 Checks before installation

Before beginning installation, check the dependability of auxiliary equipment, particularly hoists, as well as comparing the information on the data sheet with that on the rating plate on the motor.

Ensure that the line voltage (measured between two phases) is equal to the motor voltage shown on the rating plate.

The maximum permissible voltage fluctuation can be seen in the data sheet. Greater voltage and frequency fluctuations must be stated in the order and confirmed by the factory. In case of doubt, contact Layne Bowler, or the nearest factory representative before starting up the unit.

Before installing, the insulating resistance of the motor must be measured.

Ensure that the well diameter is large enough down to the installation depth, so that the pump unit can be installed without difficulties. If the riser connections are made of pipes with flanges, these must have cut outs for the cable if the well diameter is narrow.

When lowering the unit, ensure the power cable is neither squeezed nor scraped. To protect the power cables, we recommend that the well head is lined with a rubber sheet at the entry point of the power/signal cable into the well pipe and it is fed into the well shaft using a cable roller.

During lowering, the unit must always hang freely and must not become wedged in the well shaft. Always ensure that the pump can be rotated freely. If needed, attach a cable clip every 3 m (approx 10 ft.) of pipe length.

For especially narrow and deep wells, the insulating measurements should be repeated to determine possible damage to the power cables in time.

## 4.4 Installation of pre-assembled pump units

Mount the first length of pipe, which should not be longer than 1 m (39 in.), onto the assembled pump unit. Fasten the power cables, control lines and instrument leads (if any) with cable clips onto the pipe. See the Figure 4.1.

#### 4.5 Riser pipes with flange connections

- a) Mount a "lifting dolly" to the riser pipe flange, and hang the complete unit on a suitable hoist.
- b) Lower the pump unit into the well, allowing sufficient pipe to protrude above the well to enable the installation clamp to be mounted onto the riser pipe.
- c) Continue to lower the unit until the installation clamp rests on the well rim flange.
- d) Remove the lifting dolly, and attach it to the next riser pipe to be installed.
- e) Fasten the power cable, control lines and instrument leads (if any) with cable clips to the riser pipe.
- f) Lift the next pipe to be installed into a vertical position and bolt it to the pipe resting on the well rim flange.
- g) When this has been completed lift the unit sufficiently to enable the supporting clamp to be removed.



*Do not allow the pipe to be lowered or to slip whilst carrying out this operation. This could result in damage to hands and in extreme cases loss of fingers.*

- h) Install the remaining riser pipes as described from point b). to e).
- i) Finally mount the wellhead support plate onto the last length of riser pipe. Feed the power cables and, if necessary, the control lines and/or instrument leads through the corresponding holes in the wellhead support plate and connect them to the junction box or control panel.

#### 4.6 Riser pipes with pipe couplings

- a) Connect a lifting clamp underneath the pipe socket of the screwed riser pipe and lift the complete pump unit with a suitable hoist.
- b) Lower the pump unit into the well as far as the installation clamp mounted underneath the socket of the riser pipe.
- c) Lower the unit and rest it on the well rim flange.

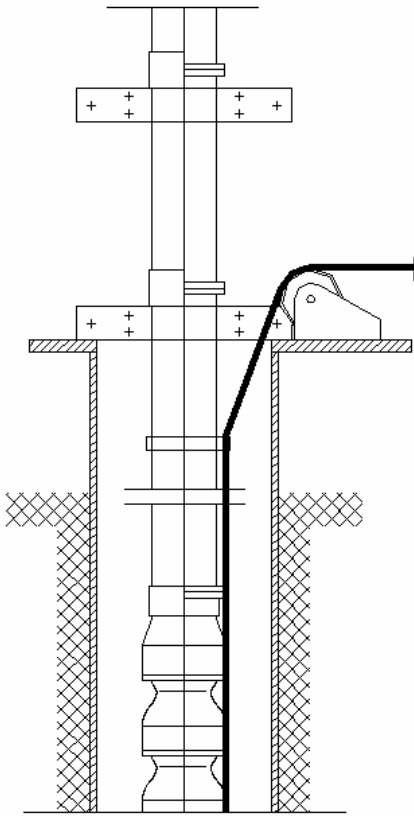


*Do not let the pump unit slip through the installation clamp.*

- d) Remove the lifting clamp and attach it to the next riser pipe and connect this to the pipe already installed.
- e) Fasten the power cables and, if necessary, the control lines and/or instrument leads with cable clips onto the riser pipe.
- f) Lift the unit and remove the resting supporting clamp.
- g) Install the remaining riser pipes as described from point b) to f).
- h) Finally mount the wellhead support plate onto the last riser pipe. Feed the power cables and, if necessary, the control lines and/or instrument leads through the corresponding holes in the wellhead support plate and connect them to the junction box or control panel.

#### 4.7 Assembly of submersible motor pumps before installation

Submersible motor pump units that are delivered in subassemblies have to be assembled during or before installation. For assembly of these submersible motor pump units the specific installation instructions have to be requested from the manufacturer if they have not been delivered with the unit.



**Figure 4.1**

## **5. ELECTRICAL CONNECTIONS**

### **5.1 Motor**



*All work on the electrical system must be performed by a qualified Electrician in accordance with relevant local, national and international regulations.*

The connection diagrams in the following sections show the basic structure of the connection possibilities and the line arrangement of the mains and motor power cable.

Detailed information about the connection of motors and, if necessary, of control and monitoring devices can be taken from the appropriate circuit diagrams from the control panel manufacturer.

To ensure a good connection with the least possible contact resistance when connecting the power lines, the conductor ends should not be tin-plated.

If the conductor ends are tin-plated, these should be removed. The exposed fine-strand wires must be connected to the electrical supply with suitable terminal screws or by crimping or soldered cable lugs.

### 5.1.1 Labeling of conductor ends and rotation direction of three-phase motors

The conductor ends of the power cables are labeled so that all three-phase motors rotate clockwise (seen from the coupling ends and towards the shaft) when connected to a clockwise rotating system according to Figure 5.1 to 5.5.

Counter clockwise rotation occurs if two phases of the main connection are transposed from that shown in the clockwise connection diagrams.

Power supply cables with round or flat cross-sections are connected to the motor. Depending on power consumption or if the installation circumstances are restricted then several single core cables can be used.

**Note :** *Motors having different connections, see the additional instruction given by extra appendix related to that application such as; direct start, soft starting or else variable frequency convertor connection.*

### 5.2 Protective measures against shock hazard voltages

Protective measures against shock-hazard voltages must be taken according to IEC regulations and the local electricity supply company ordinances.

According to IEC-regulations the protective conductor must be connected directly to the motor on new systems. This also applies when the unit is installed in an inaccessible well.



*If there is no earth lead on the motor, a separate earth lead must be connected to the motor using the earth screw supplied. This is labeled with a ⊕ symbol.*

### 5.3 Motor protection

Motor protection is mainly done by the panel. So the panel can have or not these protection. Some of them is explained below.

To protect the motor against current overload, a thermal overload relay must be provided. The tripping time of the relay should have temperature compensation to allow for variations in ambient temperature. It should also have accelerated tripping under single-phase conditions.

Trip reset should only be possible manually. The setting of the thermal overload relay must be chosen according to the data sheet provided with the panel according to the motor.

For star-delta motor starters, it is important that the protection relay is in the motor line. The adjusted current level will then be 58% of the operational current. If the protection relay has been installed in the power line in exception to this rule, the adjusted current is the same as the operational current.

The value given in the data sheet is a standard value for the operating point. If the actual operational current in the operating point of the pump is less than this given value, the motor protection must be adjusted lower so that there is effective protection and malfunctions can be indicated in time.



*The motor protection adjustment must never be set higher than the highest permissible value given in the data sheet. Testing the correct operation of a motor protection switch by deliberate single phasing is not permitted!*

### 5.4 Short circuit protection

To prevent a short circuit in the power cable and the motor, safety precautions must be taken according to local regulations.

## 5.5 Resistance sensor PT100 (RTD) – if applicable, adjustment of motor temperature protection relay

The adjustment of the motor temperature protection relays depends on the rated output and the flow conditions along the motor surface. The permissible temperatures are shown on the enclosed data sheet as far as the motor is equipped with Pt100 resistance sensors. Examples of values are:

- At 60 °C (140 °F) high temperature: early warning
- At 65 °C (149 °F) high temperature: motor shut down

## 6. MOTOR FILLING

The motor must be filled with clean, oil-free and grease-free drinking water, to which antifreeze can be added if there is a risk of freezing.

Never use distilled water.

All motors delivered ready-filled by the manufacturer have antifreeze added which gives protection down to -15 °C (5 °F) unless specifically ordered (certain regions only) filled only with drinking water. For specifically ordered units filled only with drinking water the client is responsible for ensuring that storage and use do not permit freezing.

This standard concentration is always the same unless the customer or operator expressly states a different preference.

For units supplied with a header tank, the fitting of an audible or visual alarm is recommended to monitor the filling level of the motor in case of leakage. This can be, for example, a float switch installed in the overhead tank.

See for details, motor installation manual given by the producer.

## 7. COMMISSIONING START-UP, OPERATION AND SHUTDOWN

### 7.1 Commissioning

#### 7.1.1 General notes


Due to the slender design of the submersible motors, different current values can be measured in the individual phases. This is especially true for two-pole motors. These differences can be reinforced by voltage differences between the phases already present from the line side.

This effect can be reduced to a minimum by transposing the line side phase connections in clockwise order.

Details concerning the electrical switchgear must be taken from the Operating Instructions from the control panel manufacturer.

#### 7.1.2 First switching on

After the pump unit has been fully installed and all pipelines have been connected upstream and downstream as far as the control valve, the control valve is closed except for a small gap for venting the ascending pipeline. After this, the unit can be switched on.

 **CAUTION** S-type pump units (pumps with axial impellers) must never be started against a closed slide valve. Overloading could then occur, with consequent damage to the motor.

After switching on, the pressure at the manometer must be greater than the head given in the data sheet minus the water depth.

If the pressure at the manometer is less than that given in the data sheet, the drive is rotating in the wrong direction. When the direction of rotation is incorrect, the pump will have no or extremely reduced performance.

**CAUTION**

The unit must not be driven for longer than three minutes in the wrong direction.

If incorrect rotation occurs, exchange two phases with one another on the motor power cable in the control panel.

**CAUTION**

Do not transpose anything on the star delta contactor combination.

Single-phase machines are wired within the motor so that they have the correct rotation on every supply system with the prescribed voltage when connected. The direction of rotation on these machines cannot be changed.

As the empty ascending pipeline is being filled, the ammeter may show a higher current than in the data sheet even after the switching-on current has decayed during the initial switching-on.

After this the operational current must be lower than the highest permissible current given in the data sheet.

Open the slide valve slowly, so that the well is not overloaded by too great a flow and sand is also not swept up. Watch the current consumption of the motor on the ammeter whilst opening the valve. Slowly open the slide valve until the ammeter just shows the operational current according to the data sheet.

When the design operating point for the pump unit has been reached, current consumption must approximate with that given in the data sheet.

The fitting conditions and electrical connections must be checked once again if this is not the case.

The pressure pipe can be connected if there are no abnormalities during and after the test run, if this has not yet been carried out.

## 7.2 Operation

After the unit has operated for a period of time, it is possible that a minimal readjustment of the motor circuit breaker may be required, due to changed operating conditions, for example by the sinking of the water level.

**CAUTION**

Do not select a motor protection adjustment setting greater than the highest permissible value given in the data sheet.

For monitoring the water level in the well and in the header tank, we recommend water level detectors or water level measuring units.

### 7.2.1 Starting frequency

The amount of regularly spaced starts per hour can be found in the motor data sheet. More frequent starts are only permissible if agreed with the manufacturer.

Maximum number of permissible starts in sequence:


- Cold motor: 3 starts
- Warm motor: 2 starts
- Resting time after each cycle: 5 minutes

It is suggested that the motor is protected by a time relay against unauthorized reconnection.

## 8. MAINTENANCE

Submersible pump units normally run without needing maintenance.

If a pump unit should stand idle for a lengthy period of time, perform a 10 minute test run every month, so that potential malfunctions can be recognized in time.

 **CAUTION** The pump unit must be completely submersed in pumping medium for this test run.

### 8.1 General information

As the units are normally used at very great depths, it is recommended that the following checks are performed and recorded at regular intervals, in order to recognize malfunctions in time:

- Current consumption
- Head
- Flow
- System voltage
- Operating hours
- Insulation test
- Temperature (only if temperature sensors PT100 [RTD] exist)

Current consumption of the motor is the most important test for monitoring the unit.

For finding problems, their cause and elimination, see Section 9, *Faults, causes and remedies*.

### 8.2 Measuring insulation of the motor (including power cable)

Before initial starting, or after long storage or idle time, the insulation resistance of the drive must be measured.



*During and after measurement, the conductor ends of the motor power cable and/or the connection terminals may carry dangerous voltage (up to the test voltage) and must not be touched. Before measuring, ensure that there is no line voltage.*

To measure the insulation of the system, disconnect all leads of the power supply cable.

All leads must be carefully cleaned to remove dirt or corrosion. Follow the instructions given with the insulation measurement instrument.

Insulation measurement is always performed with a measuring-circuit voltage of 500 volts. The value must be read for the duration of a minute.

The motor windings or power cable, charged up to the measuring-circuit voltage, must be discharged after measurement using the insulation-measuring device.

The minimum insulation resistance and critical insulation resistance limits for measurements at a winding temperature of 25 °C (77 °F) are as follows:

- |  |               |
|--|---------------|
| - New motors   | : over 500 MΩ |
| - Minimum insulation value of new motors with power supply cable | : 5.0 MΩ      |
| - Critical insulation value after longer operational time        | : 0.5 MΩ      |

If the insulation value is near the minimum causes could be increased air humidity and/or dirty, moist conductor ends or a winding temperature higher than 25 °C (77 °F).

A relatively low insulation resistance does not definitely show that the motor will break down due to insulation problems.

However the insulation must be inspected, if after measurements over a longer period, an extreme drop in the insulation resistance occurs within a short time.



If the insulation resistance falls below the minimum value, the cause must be determined or the faulty part (power cable, line connection or windings) identified and the insulation weakness removed.

### 8.2.1 Motors with one power supply cable



*The cable conductors become charged with the test voltage while measuring the blank ends of the power cable and they must therefore be insulated.*

Only one lead must be measured to earth as all other leads are internally connected.

### 8.2.2 Motors with two power supply cables



*The cable conductors become charged with the test voltage while measuring the blank ends of the power cable and they must therefore be insulated.*

The following insulating measurements of the winding and power cables are possible, depending on the internal motor connections:

- 1) two cables on open phase connection - measurement to be taken between each core of the cable and earth.
- 2) two parallel cables with internal star connection - measurement to be taken between one core and earth.
- 3) two parallel cables with individual coil systems (star or delta connection) - measurement to be taken between one core of each system and earth.

### 8.3 Pump units

The pump unit can be operated without maintenance, insofar as there are no irregularities in operation or pumping, caused by sand or a corrosive pumping medium, that make premature removal necessary.

Fluctuating and/or rapidly increasing current consumption indicate mechanical problems in the pump or motor.

Strong oscillation of the pressure, and at the same time of the ammeter, can be caused by irregular water inflow.

### 8.4 Removal of the pump unit

When lifting the pump to withdraw it, take account of the pump weight plus the weight of the water column contained within the riser pipe if the pump unit does not have a check valve with drain holes. (If the check valve does have drain holes the weight of the water column is not applicable.)

### 8.5 Overhaul of the pump unit

The structural design of a submersible pump unit makes assembly and disassembly possible using simple tools.

In case of removal, installation instructions specific to the unit can be requested from the manufacturer.

It is recommended, however, that the unit is examined by Layne Bowler technicians or that it is overhauled at a Layne Bowler authorized service depot.

When taking the unit out of service and before starting removal work, studying these operating instructions once again is recommended.

For special advice regarding additional information or for purchasing replacement parts, the following information is required:

- Serial number of the unit from the nameplate (also printed on the stator housing)
- Description of the unit type according to the nameplate
- For questions regarding replacement parts:
  - a. item number from the sectional drawing

- b. part description and number as shown in the parts list
- c. quantity of parts required
- For problems:
  - a. short description of the problem and/or the effects
  - b. description of the faulty part(s) as shown in the parts list

Please refer all questions directly to the main factory or to a factory representative.

## 9. DEFECT IDENTIFICATION AND ELIMINATION

### 9.1 Maintenance

Layne Bowler submersible pumps do not require continuous service. In order to prevent whole system from breakdowns, periodic servicing is very advantageous.

#### 9.1.1 Operating To Closed-Valve

Normal vertical turbine pumps can be operated at critical point on request and this does not result in breakdown. But not all the pumps are of normal installation and every pump to be used like this. should be taken special care on. Check and take into account the following point when operating a pump close to or on closed-valve (critical point).

- Thrust bearing capacity must be suitable.
- It's an important point to reject heat since all the power will convert to heat when operating on closed-valve.
- Keep in mind that lubrication in water lubricated pumps depends on pumped water circulation. If liquid temperature increases due to low flow circulation, this may disturb lubrication performance.

It is better for the customer to specify on order that it is possible to operate the pump on critical point. This should be taken into account for warranty.

If the pump will remain idle in well for a long time, though this is not a problem, pump should be operated a short time once in 15-20 days to prevent a possible locking on rotating parts.

Operating values recorded during first operation should be checked periodically once in 1-2 months and changes should be noted if any.

Electric control panel should be checked, contacts to be cleaned and mechanical parts cleaned of rust to be lubricated once in 6 months.



***During electric panel maintenance, current must be cut out from feeding line***

## 9.2 Troubleshooting

PROBLEM	CAUSE	SOLUTION
<p><b>A)</b> Pump is not starting and motor is not absorbing current.</p>	<ol style="list-style-type: none"> <li>1. No electricity in line.</li> <li>2. Fuse blew out.</li> <li>3. Problem in board connections.</li> <li>4. If phase protection relay exists, potential change is out of allowed region or at least one of the phases has no potential.</li> <li>5. Water level decreased below lower water electrode probe.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the line, contact electric.</li> <li>2. Check fuse size, replace with proper one.</li> <li>3. Check board connections and wiring, eliminate loosening, ruptures and troubles.</li> <li>4. Measure potential in each phase, run the pump when the voltage gets normal. Contact with an state electrician. If voltage does not normalize for a long time.</li> <li>5. Check static and dynamic water levels, if a decrease exists, lower pump with additional pipe.</li> </ol>
<p><b>B)</b> Fuse continuously blows out.</p>	<ol style="list-style-type: none"> <li>1. Short cut in board</li> <li>2. Short cut in feed line or motor</li> </ol>	<ol style="list-style-type: none"> <li>1. Check board elements and wiring isolation, eliminate breakdowns.</li> <li>2. Check the feeding cable between the motor and the control panel.</li> </ol>
<p><b>C)</b> Thermal relay cuts out.</p>	<ol style="list-style-type: none"> <li>1. Thermal relay calibration is wrong.</li> <li>2. Changes in feed potential or at least one phase is gone.</li> <li>3. Motor absorbs 3-6 times more (over) current. (no voltage change or phase cut.).</li> </ol>	<ol style="list-style-type: none"> <li>1) Check thermal relay settings and recalibrate as described in this book.</li> <li>2) See A.4</li> <li>3. Get rid of the motopump from the well,               <ol style="list-style-type: none"> <li>i) Motopump rotor could be locked due to sand, rotate the rotor by means of a wrench. If rotation of rotor gets normal, check the motor itself by megger. If problem is solved, fixed again the pump to the well.</li> <li>3.ii) If rotation of rotor does not get normal, there could be a mechanical problem through the pump itself or motor. Contact authorized agent or factory.</li> </ol> </li> </ol>

<p><b>D)</b> Motopump does not pump water and motor absorbs less current</p>	<p>Read pressure on the manometer</p> <ol style="list-style-type: none"> <li>1. If it is higher than the calibrated pressure, it is closed-valve.</li> <li>2. If no pressure and there isn't phase sequence relay on the board, motor is trying to rotate in reverse direction since phases got mixed up.</li> <li>3. Water level relay and/or probe is malfunctioning.</li> <li>4. If no pressure there is a problem in motor coupling, motor is rotating idle.</li> <li>5. Check-valve does not open since it got stuck in discharge case in the pump. (no pressure on manometer.)</li> </ol>	<ol style="list-style-type: none"> <li>1. Open the valve and set it to previous pressure value.</li> <li>2. Change phase sequence on the board and restart the motopump.</li> <li>3. Check water level relay, probe and water level in the well. If level has dropped, add pipe to pump and absolutely use relay and probe.</li> <li>4. Contact authorized agent or factory.</li> <li>5. Contact authorized agent or factory.</li> </ol>
<p><b>E)</b> Motopump does low amount of water.</p>	<p>Read pressure on the manometer</p> <ol style="list-style-type: none"> <li>1. If it is higher than the calibrated pressure, it is closed-valve.</li> <li>2. If phase sequence relay does not exist, motor is rotating in reverse direction since phases got mixed up.</li> <li>3. There is frequency drop in feeding.</li> <li>4. There is rupture on the discharge line or leakage on the connections.</li> <li>5. There is rupture on column pipes or leakage on the connections.</li> <li>6. Pump strainer or pump is clogged or pump parts are worn due to long-time use.</li> </ol>	<ol style="list-style-type: none"> <li>1. Open the valve to the appropriate value watching from the pressure gauge.</li> <li>2. Change phase sequence on the board and restart the pump.</li> <li>3. Measure frequency and wait until it gets normal.</li> <li>4. Check and repair discharge line.</li> <li>5. Lift the pump out, check and repair column assembly.</li> <li>6. Contact to authorize agent or factory.</li> </ol>
<p><b>F)</b> There is sudden fluctuations on pump flow (if it is visible, intermittently flow).</p>	<ol style="list-style-type: none"> <li>1. Pump capacity is higher than the well capacity.</li> <li>2. Pump is absorbing air since water level is insufficient.</li> </ol>	<ol style="list-style-type: none"> <li>1. Throttle the valve till the current is constant with water flow in order and absolutely use level probes.</li> <li>2. Lower pump by adding more pipes.</li> </ol>

## 10. SPARE PARTS

### 10.1 Spare Part Table

See tables on the corresponding drawings.

### 10.2 Spare Part Order

Following data required on order:

- Pump serial no (on the label)
- Pump model (on the label)
- Production Date (on the label)
- Material to order
  - i. Part no.
  - ii. Part name
  - iii. Quantity

<b>CAUTION</b>
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*During warranty, if customer carries out repairing, validity of warranty is ended. Repairing must be carried out by LAYNE BOWLER or authorized agent in order for warranty to be valid.*

## 11. WARRANTIES

### 11.1 Limits of Use

Maximum allowable water temperature: 35C<sup>o</sup>  
Maximum sand amount : 50 g/m<sup>3</sup>  
Maximum permissible potential change : ±10% of nominal voltage  
Liquid to be pumped : Clean water

Applications violating the above limitations, unless clearly stated in the sale contract, are not taken into warranty range; none of the warranty conditions is valid.

For applications out of these limitations, customer has to warn directly or by means of agent in offer grade and in order grade different applications must be stated clearly and signed in the contract.

### 11.2 Warranties

All the products are warranted for 12 months starting from the sending or direct delivery date and warranty and warranty certificate is sent to customer with the product.

Request your completely filled warranty certificate.

Warranty covers the breakdowns informed in 10 days including the day breakdown occurred with all material and workmanship.

Warranty given by Layne Bowler will lose validity, if there become any application contrary to "INSTALLATION, OPERATION AND MAINTENANCE MANUAL".

Warranty does not include

- Natural wears, wears cause by galvanic flows and chemical wears,
- Wears caused by the sand and silt in the well more than 50 g/m<sup>±3</sup>,
- Applications going out of the limits of use,
- Wrong improper use,
- Replace parts and/or repairment performed customer and/or unauthorized personnel.
- Every kind of changes made of the product without Layne Bowler's permission.

After taken out of the well, broken down product will be sent to Layne Bowler without loosening any bowl nut or dismantling any part just as it was delivered. This a must, in order to make correct trouble shooting, otherwise warranty is invalid.

Layne Bowler takes on removing breakdowns caused by material and workmanship failures by repairing or partially or fully renewing the product in her factory, according to her opinions.

**PUMP AND WELL INFORMATIONS**

**(Fill absolutely and completely these information)**

**a) Pump Information**

Pump serial number	:
Type	:
Stage	:
Date	:
Capacity on operating point	:
Dynamic water level	:
Manometric head read from pressure gauge	:
Motor type	:
Power	:
Voltage	:
Nominal current	:
Starting type	: