6’’ 8’’ Submersible Motors
Installation & Maintenance Manual

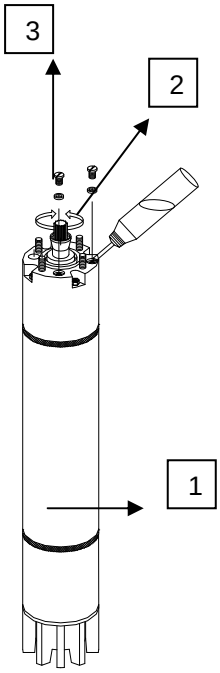
WARNING

Liquid level MUST be checked before installation!

WARNING Risk of damage to the motor if instructions are not followed.

ATTENTION!

PRIOR TO MOTOR INSTALLATION. PERFORM THE FOLLOWING PROCEDURE:



1. REVIEW INSTRUCTION MANUAL AND FOLLOW STANDARD SAFETY PROCEDURES.
2. DISCONNECT ELECTRICAL POWER SUPPLY TO MOTOR.
3. PLACE MOTOR (ITEM 1) IN VERTICAL POSITION AS SHOWN.
4. MANUALLY VERIFY MOTOR SHAFT (ITEM 2) IS FREE TO ROTATE IN BOTH DIRECTIONS.
5. REMOVE (UNSCREW) FILLER PLUG AT THE TOP SIDE OF THE MOTOR (ITEMS 3).
6. SLOWLY FILL MOTOR WITH TAP OR BOTTLED IN THE MOTOR.
7. REINSTALL AND TIGHTEN FILLER PLUG (ITEMS 3).
8. DO NOT OPEN THE FILLER PLUG WHEN THE MOTOR IN HORIZONTAL POSITION

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1. SAFETY INFORMATION

Read this documentation carefully before installation. It contains fundamental instructions for installation, operation and maintenance. The symbols shown below together with the words "DANGER" and "WARNING" indicate a risk of danger if instructions are not followed.

DANGER Risk of electric shock if instructions are not followed.

DANGER Risk of injury and/or damage to person and/or property if instructions are not followed.

WARNING Risk of damage to the motor, pump and/or systems if instructions are not followed.

2. MOTOR

impo CE

SUBMERSIBLE MOTOR

TYPE ……. ….. kW ….. HP

VOLTAGE …… V $^{+\ldots\ \%}_{-\ldots\%}$ **….. A …… Hz**

SPEED ……. *min*$^{-1}$ Cosϕ ……..

MAXIMUM STARTS … /h 3~

WATER LUBRICATED

REWINDABLE STATOR

2.1 GENERAL INFORMATION

IMPO Electric submersible motors are reliable apparatus designed to provide many years of operation without the need for routine maintenance provided they are installed correctly. We therefore recommend reading this manual carefully and following the instructions contained thoroughly. We decline any responsibility for injury to persons and/or damage to property due to failure to follow our instructions. This manual is for use in standard applications: please refer to your sales contract for instructions regarding special versions. Please contact technical support or our sales department for further inquiries.

2.2 APPLICATIONS AND SERVICE

IMPO Electric submersible motors have been designed to be connected to all types of radial and semi-impeller, submersible pumps for use in domestic, industrial and agricultural systems for the lifting of substantially clean water. Please contact our technical support department for information regarding other types of installation.

3. TECHNICAL SPECIFICATIONS

IMPO Electric submersible motors are asynchronous, electric motors with a squirrel cage rotor and are the so called "wet-end" types, that is to say that the winding of the motor is immersed completely under water, or under a water based mix, and this acts as the motor's internal liquid coolant. IMPO motors are rewindable and offer IP68 grade of protection. Motors are protected against dust and against access to dangerous parts with wiring protected against the effects of the submersion. All motors can operate indifferently in both the clockwise and counterclockwise directions.

3.1 OPERATION AND TEMPERATURE

The submersible motors can operate continuously to supply nominal power provided they are powered by nominal voltage and frequency and the external water temperature outside the motor does not exceed 25°C (77°F), according to NEMA standards. Variations in the power supply voltage must be contained to within roughly 10% of the nominal value. The service factor is 1 for 50 Hz motors, and 1.15 for 60 Hz motors. In applications where the water to be managed has a temperature in excess of 25°C (77°F), it is possible to use these motors but the power must be downgraded according to a specific correction coefficient; please refer to **TABLE 1.** Otherwise, motors can be constructed with winding wires that are specific for high temperatures. By way of example, a standard, 20 Hp motor working with an external water temperature of 35°C (95°F), can be used to deliver maximum power of 20 x 0.80 = 16 HP.

Standard version motors can be used with external water temperatures of up to 40°C (104°F) provided they are downgraded correctly. In this calculations water flow speed around the motor considered not less then 0,5 m / sec in 6'', 1 m / sec in 8''.

WATER TEMPERATURE	CORRECTION COEFFICIENT
25°C (77°F)	1.00
30°C (86°F)	0.90
35°C (95°F)	0.80
40°C(104°F)	0.70

TABLE 1

3.2 WINDING

International standards do not have, at this time, a code for the Insulation Class of wet-end type,submersible motors. The insulation class of an electric motor is defined according to the insulating materials used to construct it. As an international standard is not available for submersible motors, the specification considers the insulating material used for the winding wires: PE2.

The winding wire is in insulated copper with particular thermoplastic resins.

For our applications, PE2 (radiated ethylene resin) is used for the winding wire as this offers excellent dielectric properties and resists temperatures up to 95°C (203°F).

3.3 COOLING

The class of the method used for cooling is IC40: machine with surface cooling using the surrounding flow, with free convection. The cooling of the motor is provided by the flow of the external water, which touches its surface, therefore the efficiency of cooling depends on the temperature of the liquid and its speed as it touches the external surface of the motor.

In applications where the water has a high temperature, a method to cool the motor efficiently is to artificially increase the speed of the flow of the liquid that runs over the external parts of the motor. Generally, each time the speed of the liquid is doubled there is an improvement in temperature of approximately 5°C (41°F). The minimum speed of the liquid flow must exceed 0,5 m / sec for 6'', 1 m / sec for 8''.

4. INSTALLATION

WARNING Check that the motor is filled with liquid coolant.

Submersible motors are generally installed in a vertical, or slightly inclined position in wells whose minimum diameter is equal to the diameter of the bulk of the motor and whose depth is compatible with the capacity of the pump that it is connected to.

With adequate caution, these motors can also be installed horizontally; this application is usually used in tanks and basins. It is essential to ensure that the motor is sufficiently cooled (see previous paragraph), therefore make sure that the motor is completely immersed under water and that the water is flowing freely.

The connection with the submersible pump varies according to the size of the motor:

6" Motors - connection by means of flange and shaft end, according to NEMA MG1-18.413 standards, with toleration according to the same standards.

8" Motors - connection by means of flange and shaft end, according to NEMA MG1-18.424 standards, with toleration according to the same standards.

DANGER Handle the motor with appropriate lifting equipment. Any knock or impact can damage it even if there is no sign of external damage.

WARNING Check that the motor drive shaft and the pump drive shaft can turn freely.

Connecting the submersible motor to the pump:

Place the motor in a vertical position with the shaft lug bolt directed towards the top and secure it so that it can not move or fall while it is being connected. Lift the pump with a crane or a hoist and put it into position over the motor; check that both flanges are centered and then screw down with the fasteners provided.
Use a screwdriver to lever the connection coupling of the two drive shafts and check that the pump has some axial play.

5. POWER SUPPLY CABLE

The choice of the power supply cables for the connection of the motor to the control panel is extremely important, as these parts must fulfill three fundamental requirements:

A) The cable must be suitable for operation in wet environments and its class of insulation must be above the nominal voltage for the system.

B) The capacity of the cable must be in excess of the charge current; this value is equal to the nominal current of the motor for the type with three terminal wires, and is equal to 58% of the nominal current of the motor for the type with six terminals.

C) Voltage drops along the power supply line must be contained to within strict limits (max 5%). When choosing the cable, it is important to take into account the planned place of installation operating conditions. These are important for the specifications of the cable and can damage it. For the connection of submersible motors, the operating conditions can be considered to be in a shaft for the ascending part in the well, and on a wall or aerial for the external part. In both cases, the environment must be considered to be damp/wet and therefore regulations require the use of cables with external sheathing.

5.1 CHOOSING ELECTRICAL CABLES

The capacity of a cable is its ability to conduct current while generating a quantity of heat that does not damage the insulation of the wire, thus guaranteeing a preestablished life of approximately 20-30 years. Therefore, the capacity of a cable is directly linked to:

A) Its capacity to produce and disperse the heat produced, a factor influenced by various elements such as the type of operation, the location temperature, the type and shape of the wire.

B) The maximum operating temperature of the insulation, a factor influenced by the type and quality of the same.

The capacity of the cables are defined by the CEI-UNEL standards and the relative data is supplied according to a room temperature of 30°C (86°F). For applications where the room temperature is different to that envisaged by the standard, the capacity of the cable is calculated by applying a correction factor; refer to **TABLE 2** for the factors to be applied according to various temperatures. The correction factor for the capacity is also applied in cases where the motor is the type with six terminal wires, or where the lines have been doubled to reduce the sections of the wires.

ROOM TEMPERATURE	CORRECTION FACTOR
10°C(50°F)	1.22
15°C(59°F)	1.17
20°C (68°F)	1.12
25°C (77°F)	1.06
30°C (86°F)	1
35°C (95°F)	0.94
40°C(104°F)	0.87
45°C(113°F)	0.79
50°C (122°F)	0.71
55°C(131°F)	0.61
60°C(140°F)	0.50

TABLE 2

6. CABLE CONNECTION

DANGER The connection of the wire that exits the motor to the wire that must be brought to the control panel is particularly delicate and must be executed with great care by skilled personnel.

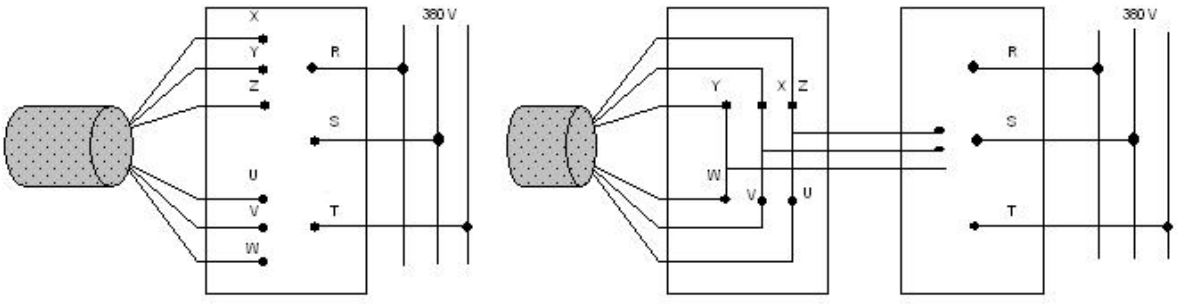
The wires can be connected using various methods: using the apposite connections boxes filled with resin, which polymerizes at room temperature; using heat-shrinkable tubing, or using specific adhesive tape. The external sheathing of the three-pole cable must first be stripped for a length of 10-20 cm, according to the section of the cable, and then the ends of the wires must be cut so that connections do not overlap. Remove the internal sheathing of the wires for a length of 2-3 cm, according to the section of the wire, and then complete connections using crimp-on connectors. Follow the instructions provided with the connection boxes or the heat-shrinkable tubing. If the use of insulating tape is preferred, the surface of the cables to be taped must be cleaned thoroughly and tape in auto-vulcanizing rubber must be used to secure each connection and then to bind the cables together. The connections must then be protected with corrosion-proof, polyvinyl chloride, adhesive tape for electrical use, which is suitable for use underwater.

6.1 WIRING DIAGRAMS

In our motors, a series of three wires exits the motor in addition to a fourth, yellow-green wire for earth connection; these must be connected to the terminals for the controls.

Motor Junction Scheme

Star Delta **Direct**



7. CHECKING THE DIRECTION OF ROTATION

WARNING The direction of rotation of the pump, which is indicated on its plate, is extremely important for the correct operation of the system. When the motor and the cables have been connected, use a crane or hoist to lift the pump and motor assembly and provide a short pulse of electric current. The electric pump tends to take the opposite direction of that of the drive shaft of the motor due to the recoil. Check if the direction of rotation of the drive shaft of the motor is correct; if not, swap over the terminals of the control panel to change it.

8. ADJUSTMENT OF PROTECTION DEVICES

Adjust the overload relay of the appliance to the value of the nominal current of the motor and start it. With an ammeter check the three phases, the amp-draw must be balanced (the maximum acceptable unbalance is 8%) and must be less than the value of the current shown on the label of the motor. Reduce slowly the calibration of the overload relay until it starts. Increase the calibration of the relay by 5% and start the motor again. If the relay starts again, it will be necessary to increase calibration by a further 5% or otherwise leave the fixed value.

9. MAINTENANCE

Routine maintenance is not required for İMPO submersible electric motors; however, situations may arise when maintenance is necessary. To locate the cause of any problem quickly and to respond correctly, follow the instructions given in point 8 of the table "MALFUNCTION OR FAULTS, CAUSES AND ACTIONS"

DANGER Before starting any maintenance, disconnect the motor from the main power supply or generator if any.

DANGER The maintenance should be performed only by qualified personnel.

10. POSSIBLE MALFUNCTION OR FAULTS

MALFUNCTION OR FAULT	LIKELY CAUSES	ACTION
The overload relay trips, amp-draw is not balanced.	The voltage is not the same on all 3 phases.	Check the appliance and the line.
	The cable is to ground.	Repair or replace the cable
	the coil-winding is to ground.	Disassemble the motor and rewind it.
	The pump or the motor are jammed.	Disassemble and overhaul it.
	The connection of the motor is not correct.	Check the connection
Lower head than the declared one.	Wrong direction of rotation.	Reverse the direction of rotation.
	Leaks in delivery pipe.	Replace the pipe or gasket.
	Worn internal parts.	Dismantle and overhaul.
	Air or gas in the water.	Call the manufacturer.
Delivery inadequate.	Impellers clogged.	Dismantle and overhaul.
	The level in the well becomes lower than usual.	Check the capacity of the well.
The functioning of the assembly is irregular.	The pump operates at to low a head.	Regulate the gate valve on the deliver pipe.
	The water level is to close to the inlet.	Reduce the rate of flow.
		Lower the installation depth of the pump.
The assembly vibrates.	Mechanical parts worn out.	Dismantle and overhaul.
	The NPSH of the system is insufficient.	Reduce the rate of flow.
		Lower the installation depth of the pump.

If the problem involves situations not listed in the table, call technical support.