ALTAMIRA

TRUST SERIES

» INSTALLATION MANUAL

4" AND 6" ENCAPSULATED SUBMERSIBLE MOTORS

V1.0 05/23/2023

Table of Contents

1. Introduction

We are extremely grateful for your trust and preference for our products. ALTAMIRA TRUST series encapsulated submersible motors for 4" and 6" deep wells are manufactured to the highest quality standards in terms of construction materials and manufacturing processes, and are filled with a mixture of water and glycol to ensure excellent cooling, which allows us to offer and guarantee you a highly reliable, high performance encapsulated submersible motor. The information included in this manual is intended to guide you in the proper installation, operation, and maintenance of your submersible hydraulic system, ensuring its long service life. It is vitally important to follow the safety and warning instructions included herein. Keep this manual in a safe place for future reference.

- Perform a correct electrical installation (balanced voltage supply, necessary protections, appropriate cable gauge for both the electrical supply and the grounding system, etc.).
- Perform a correct hydraulic installation (correct coupling of motor and pump, installation of valves, etc.).
- Comply with the cooling flow required for the submersible motor. If the motor is not adequately cooled, it is advisable to install a cooling jacket.

2. Safety and warning symbols

CAUTION

Failure to follow the instructions preceded by this symbol may result in injury or damage to the motor.

DANGER

This symbol indicates safety instructions that must not be ignored, as they could result in serious or fatal injury.

Throughout this installation manual, you will find safety instructions that must be followed to ensure the correct installation, operation, and maintenance of the ALTAMIRA submersible motor. It also includes the appropriate safety measures to be taken in the event of a possible source of danger.

Ensure that your submersible motor (hydraulic assembly) complies with the established operating conditions and legal requirements.

Submersible motors should only be used in applications involving clean, clear water at room temperature. They should not be used in wastewater applications or with flammable or explosive liquids.

NOTICE

Be aware of the maximum water temperature at which your submersible motor can operate. Refer to the technical specifications sections later in this installation manual.

We are not responsible for damage resulting from use in applications other than those indicated in this manual.

It is important to take the following instructions into account:

- The motor and its cable must always be submerged in water.
- Always protect electrical and mechanical hazard points.
- Prime the pipe to prevent water hammer.
- Install check valves at least every 196 ft in the riser pipe.

3. Uses and prohibition

Uses

1. Pumping clean water.
2. Fully submerged operation.
3. Operate at the voltage and with the protections specified by the manufacturer.
4. Vertical installation.
5. Operation continuos or intermittent

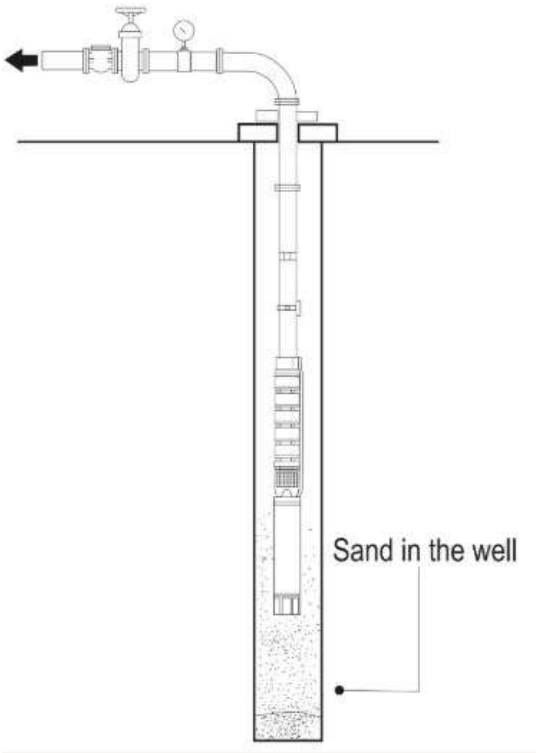
Prohibitions

1. Do not operate outside of water.
2. Do not pump water with excessive sand or mud.
3. Do not install without adequate electrical protections.
4. Do not lift or hold the motor by the electrical cable.
5. Do not use in corrosive liquids or chemicals.

4. Presence of sand in the well

The sand content in the well water must not exceed 30 ppm (1.87 grains/ft³). For water with a higher sand content, a sand trap must be used to prevent the sand from coming into contact with the motor pump.

When the well is new and you think there may be some sand content, it is recommended not to turn off the equipment after starting it, but to wait as long as possible for the water to clear and reduce the risk of starting the equipment with sand present that has fallen from the column into the interior of the equipment.



5. Transport, storage, and waste disposal

Storage

The motor must be kept in its original packaging until installation. If the motor is stored vertically, make sure it cannot tip over.

It is recommended that the motor be stored in a dry, moisture-free, and well-ventilated place. The temperature should not exceed the limits of 24.8 °F to 122 °F to avoid d amage to the motor.

Transport

The motor must be transported in its original packaging, as its design provides the necessary support and protection to prevent damage during handling.

Unpacking

Avoid any blows or impacts when opening the packaging, taking special care with the connector cable to reduce the risk of punctures.

We recommend that you perform a visual inspection to verify that the motor is in perfect condition and that none of its parts (housing, shaft, connector cable, etc.) are d amaged.

If you notice any damage to the motor, inform your distributor immediately.

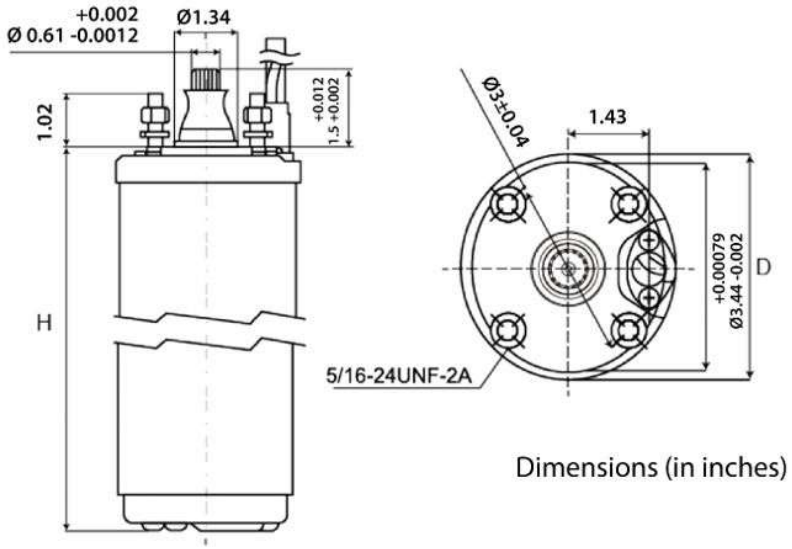
Waste disposal

To avoid damage to the environment, the product packaging must be disposed of correctly to prevent contamination caused by the decomposition of materials. Please t ake into account the environmental laws that apply in your locality.

6. Technical specifications TRUST series

6.1. 4" two-wire encapsulated submersible motors (no control box required)

MODEL	HP	kW	PHASES X VOLTAGE	S.F	FULL LOAD		MAXIMUM LOAD (S.F)		LINE-TO-LINE RESISTANCE (Ω)	EFFICIENCY (η)		POWER FACTOR (COS ϕ)		MAXIMUM AXIAL TRUST (lbs)	LOCKED ROTOR CURRENT
					AMPERE	WATTS	AMPERE	WATTS	M= RUNNING RES. S= STARTINTG RES.	FULL LOAD	MAX LOAD	FULL LOAD	MAX LOAD		
MSAT4 1/211152H	0.5	0.37	1 X 115	1.16	9.8	728	11.8	1007	M= 1.87 S= 4.88	50.8	58.8	0.94	0.97	450	26.9
MSAT4 1/212302H	0.5	0.37	1 X 230	1.6	3.3	701	4.5	953	M= 5.7 S= 10.4	52.8	62.1	0.93	0.96	450	15.8
MSAT4 3/412302H	0.75	0.55		1.5	6	1122	6.7	1368	M= 4 S= 8	49	60.3	0.75	0.83	450	23
MSAT4 112302H	1	0.75		1.4	6.5	1196	8	1540	M= 3.64 S= 7.37	62.7	68.2	0.97	0.98	675	24.2
MSAT4 1.512302H	1.5	1.1		1.3	7.7	1711	9.4	2207	M= 2.2 S= 4.59	64.3	64.8	0.95	0.96	675	31.8



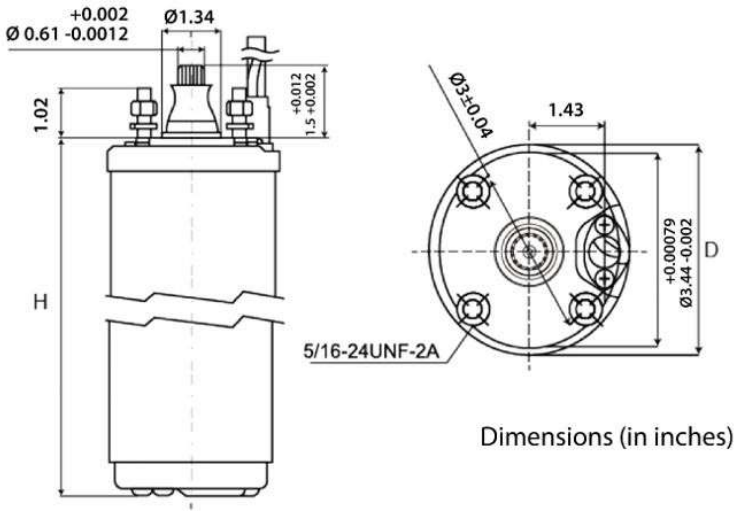
Dimensions (in inches)

Dimensions and weights

MODEL	DIMENSIONS (in)		WEIGHT (lbs)
	H	D	
MSAT4 1/211152H	11.57	3.7	19.8
MSAT4 1/212302H			
MSAT4 3/412302H	12.6		23
MSAT4 112302H	14.34		25.8
MSAT4 1.512302H	16.1		30.4

6.2. 4" three-wire encapsulated submersible motors (control box required)

MODEL	HP	kW	PHASES X VOLTAGE	S.F	FULL LOAD		MAXIMUM LOAD (S.F)		LINE-TO-LINE RESISTANCE (Ω)	EFFICIENCY (η)		POWER FACTOR (COS ϕ)		MAXIMUM AXIAL TRUST (lbs)	LOCKED ROTOR CURRENT
					AMPERE	WATTS	AMPERE	WATTS	M= RUNNING RES. S= STARTINTG RES.	FULL LOAD	MAX LOAD	FULL LOAD	MAX LOAD		
MSAT4 1/21115	0.5	0.37	1 X 115	1.6	10.6	727	12.7	1156	M= 1.27 S= 2.61	50.9	51.2	0.66	0.78	450	41.1
MSAT4 1/21230	0.5	0.37	1 X 230	1.6	5.4	752	6.5	1113	M= 4.48 S= 9.23	49.2	53.2	0.6	0.74	450	23.1
MSAT4 3/41230	0.75	0.55		1.5	7.8	1076	8.8	1463	M= 3 S= 9.56	51.1	56.4	0.6	0.72	450	33.3
MSAT4 11230	1	0.75		1.4	8.3	1248	9.8	1733	M= 2.02 S= 12.21	60.1	60.6	0.65	0.75	675	38.1
MSAT4 1.51230	1.5	1.1		1.3	9.5	1690	11	2277	M= 1.94 S= 8.47	65.1	62.8	0.84	0.89	675	44
MSAT4 21230	2	1.5		1.25	11.4	2266	13.5	2807	M= 1.61 S= 6.32	66.2	66.8	0.86	0.89	675	52.6
MSAT4 31230	3	2.2		1.15	13.9	3116	15.8	3579	M= 1.46 S= 4.16	70.6	70.7	0.97	0.97	900	74
MSAT4 51230	5	3.7		1.15	22.9	5293	27.4	6140	M= 0.92 S= 2.15	69.9	69.3	0.99	0.99	1506	106.1



Dimensions (in inches)

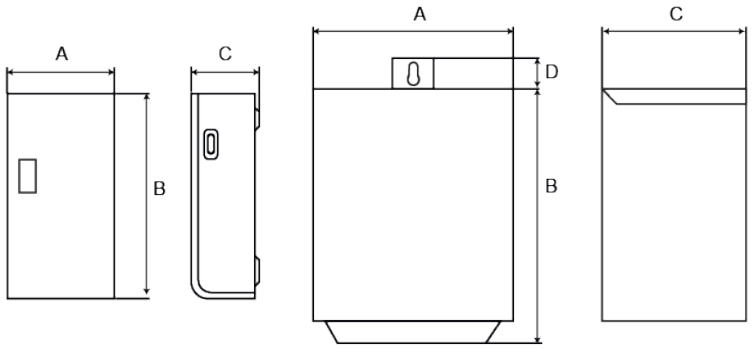
Dimensions and weights

MODEL	DIMENSIONS (in)		WEIGHT (lbs)
	H	D	
MSAT4 1/21115	9.8	3.7	19
MSAT4 1/21230			
MSAT4 3/41230	10.8		22
MSAT4 11230	11.7		17.6
MSAT4 1.5123O	13.7		28.7
MSAT4 21230	15.3		32.4
MSAT4 31230	18.6		40.3
MSAT4 51230	27.7		63.7

The following table shows the specifications of the control box for 4" three-wire single phase motors.

6.3. Control box specifications for 4" three-wire single-phase motors

MODEL	Hp	kW	VOLTAGE (V~)	START CAPACITOR (µF)	RUN CAPACITOR (µF)
CCAT 1/2115	0.5	0.37	115	250-300	–
CCAT 1/2230			230	59-71	
CCAT 3/4230	0.75	0.55		86-103	
CCAT 1230	1	0.75		105-125	
CCAT 1.5230	1.5	1.1		16	105-126
CCAT 2230	2	1.5		20	
CCAT 3230	3	2.2		45	208-250
CCAT 5230	5	3.7		80	270-324



Dimensions and weights

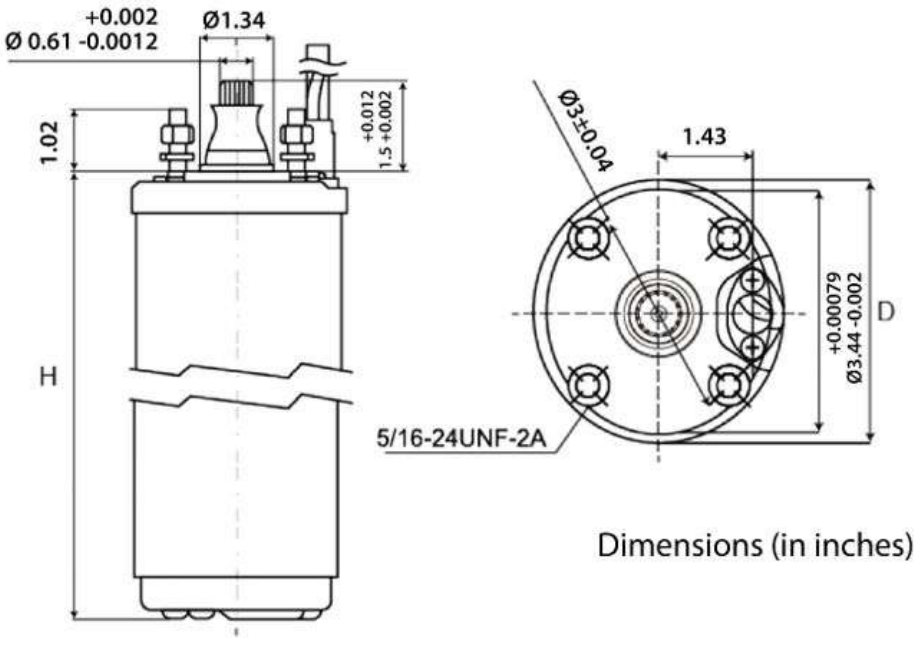
MODEL	DIMENSIONS (in)				WEIGHT (lbs)
	A	B	C	D	
CCAT 1/2115	5.08	8.5	3.04	_	2.8
CCAT 1/2230					
CCAT 3/4230					
CCAT 1230					
CCAT 1.5230	8.07	9.5	5.8	1.22	5.7
CCAT 2230					
CCAT 3230					5.9
CCAT 5230					6.4

6.4. 4" three-phase encapsulated submersible motors

MODEL	HP	kW	PHASES X VOLTAGE	S.F.	FULL LOAD		CHARGE LOAD (S.F.)		LINE-TO-LINE RESISTANCE (Ω)	EFFICIENCY (η)		POWER FACTOR (COS ϕ)		MAXIMUM AXIAL TRUST (lbs)	LOCKED ROTOR CURRENT
					AMPERE	WATTS	AMPERE	WATTS		FULL LOAD	MAXIMUM LOAD	FULL LOAD	MAXIMUM LOAD		
MSAT4 1/23230	0.5	0.4	3 X 230	1.6	2.4	547	2.8	815	6.32	67.7	72.6	0.57	0.71	450	15
MSAT4 1/23460	0.5	0.4	3 X 460	1.6	0.9	545	1.3	840	38.56	67.9	70.5	0.72	0.82	450	4.5
MSAT4 3/43230	0.8	0.6	3 X 230	1.5	3.5	810	4.3	1164	4.4	67.9	70.9	0.53	0.65	450	25.2
MSAT4 3/43460	0.8	0.6	3 X 460	1.5	1.9	836	2.2	1159	20.55	65.8	71.2	0.54	0.67	450	10.6
MSAT4 13230	1	0.8	3 X 230	1.4	3.6	1034	4.4	1417	4.65	72.5	74.1	0.71	0.8	675	20
MSAT4 13460	1	0.8	3 X 460	1.4	2.4	1150	3	1489	15.91	65.2	70.5	0.48	0.58	675	19.1
MSAT4 1.53230	1.5	1.1	3 X 230	1.3	4.8	1434	6.4	1889	3.16	76.7	75.7	0.73	0.82	675	34.8
MSAT4 1.53460	1.5	1.1	3 X 460	1.3	2.5	1513	3	1986	14.51	72.7	72	0.74	0.8	675	15.5
MSAT4 23230	2	1.5	3 X 230	1.3	6.5	1966	7.5	2461	2.57	76.3	76.2	0.76	0.81	675	34.1
MSAT4 23460	2	1.5	3 X 460	1.3	3.7	1989	4.1	2461	8.05	75.4	76.2	0.68	0.74	675	23.1
MSAT4 33230	3	2.2	3 X 230	1.2	9.8	2853	10.6	3277	1.55	77.1	77.2	0.73	0.77	900	56
MSAT 33460	3	2.2	3 X 460	1.2	4.9	2906	5.6	3325	6.62	75.7	76.1	0.74	0.77	900	28.8
MSAT4 53230	5	3.7	3 X 230	1.2	15.7	4914	17.3	5681	0.98	75.3	74.9	0.78	0.81	1506	88.4
MSAT4 53460	5	3.7	3 X 460	1.2	8.7	4780	9.5	5462	3.29	77.4	77.9	0.68	0.72	1506	68.4
MSAT4 7.53230	7.5	5.5	3 X 230	1.2	24.7	7106	26.9	8193	0.6	77.4	77.2	0.73	0.77	1506	126.2
MSAT4 7.53460	7.5	5.5	3 X 460	1.2	10.9	6953	12.1	8037	2.54	79.1	78.7	0.79	0.83	1506	78.3

NOTE

For proper protection and starting of three-phase motors, it is recommended to install an Enerwell starter.



Dimensions (in inches)

Dimensions and weights

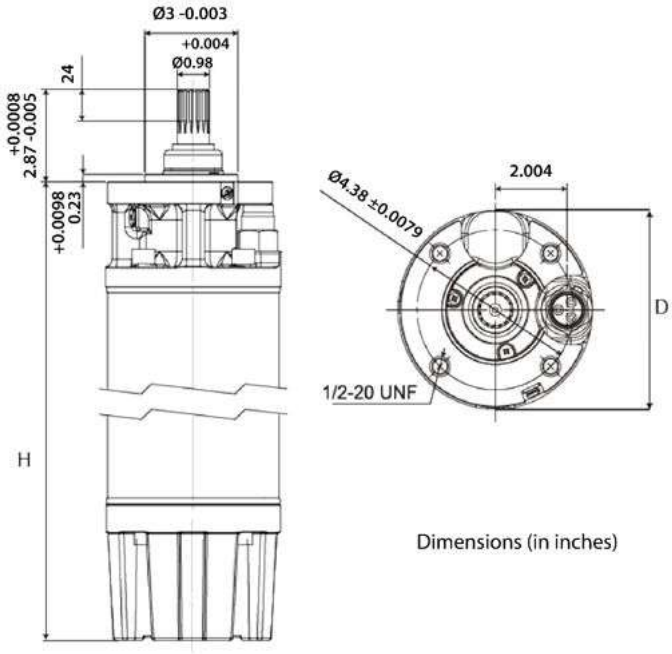
MODEL	DIMENSIONS (in)		WEIGHT (lbs)
	H	D	
MSAT4 1/23230	9.7	3.7	19.4
MSAT4 1/23460			
MSAT4 3/43230	10.8		21.8
MSAT4 3/43460			
MSAT4 13230	11.7		24.03
MSAT4 13460			
MSAT4 1.53230			
MSAT4 1.53460			
MSAT4 23230	13.8		29.32
MSAT4 23460			
MSAT4 33230	15.6		33.5
MSAT4 33460			
MSAT4 53230	21.7		48.5
MSAT4 53460			
MSAT4 7.53230	27.7		64.6
MSAT4 7.53460			

6.5. 6" encapsulated submersible three-phase motors

MODEL	HP	kW	PHASES X VOLTAGE	S.F	FULL LOAD		MAXIMUM LOAD (S.F)		LINE-TO-LINE RESISTANCE (Ω)	EFFICIENCY (η)		POWER FACTOR (COS ϕ)		MAXIMUM AXIAL TRUST (lbs)	LOCKED ROTOR CURRENT
					AMPERE	WATTS	AMPERE	WATTS		FULL LOAD	MAX LOAD	FULL LOAD	MAX LOAD		
MSAT6 7.53230	7.5	5.5	3 X 230	1.15	22.1	6884	24.2	7896	0.56	79.7	80.1	0.78	0.81	3484	139
MSAT6 7.53460	7.5	5.5	3 X 460	1.15	11	6849	12.1	7857	2.27	80.3	80.5	0.78	0.81	3484	64.8
MSAT6 103230	10	7.5	3 X 230	1.15	27.9	9506	31.4	11001	0.55	78.9	78.4	0.85	0.87	3484	112
MSAT6 103460	10	7.5	3 X 460	1.15	14.3	9214	15.9	10583	1.62	81.4	81.5	0.8	0.83	3484	71.6
MSAT6 153230	15	11	3 X 230	1.15	40.2	13871	46.1	16281	0.32	79.3	77.7	0.85	0.86	3484	156
MSAT6 153460	15	11	3 X 460	1.15	21.2	13547	23.9	15656	0.123	81.2	80.8	0.8	0.82	3484	67.2
MSAT6 203230	20	15	3 X 230	1.15	54	18963	63.5	22668	0.22	79.1	76.1	0.86	0.84	3484	213
MSAT6 203460	20	15	3 X 460	1.15	28.6	18293	31.7	21011	1.2	82	82.1	0.8	0.83	3484	152
MSAT6 253230	25	18.5	3 X 230	1.15	69.1	22589	77.8	26330	0.19	81.9	80.8	0.81	0.83	3484	317.1
MSAT6 253460	25	18.5	3 X 460	1.15	34	22024	38	25388	0.86	84	83.8	0.81	0.83	3484	142.3
MSAT6 303230	3	22	3 X 230	1.15	81	27027	93	31158	0.12	81.4	81.2	0.77	0.81	3484	451
MSAT6 303460	30	22	3 X 460	1.15	37.6	26097	43	30263	0.54	84.3	83.6	0.87	0.88	3484	148.2
MSAT6 403460	40	30	3 X 230	1.15	55	35587	61.7	40925	0.36	84.3	84.3	0.85	0.87	6182	394
MSAT6 503460	50	37	3 X 460	1.15	67.8	44048	77.2	50776	0.33	84	83.8	0.84	0.84	6182	409

NOTE

For proper protection and starting of three-phase motors, it is recommended to install an Enerwell starter.



Dimensions (in inches)

Dimensions and weights

MODEL	DIMENSIONS (in)		WEIGHT (lbs)
	H	D	
MSAT6 7.53230	24.7	5.43	98.1
MSAT6 7.53460			
MSAT6 103230	26.06		105.8
MSAT6 103460			
MSAT6 153230	28.6		119.04
MSAT6 153460			
MSAT6 203230	31		132.3
MSAT6 203460			
MSAT6 253230	33.7		147.8
MSAT6 253460			
MSAT6 303230	35.7		158.7
MSAT6 303460			
MSAT6 403460	41.22		188.7
MSAT6 503460			264.6

NOTE

Trust Series encapsulated submersible motors are capable of operating at a maximum temperature of 86°F.

The rotor height range for 4" models is 1,498 in. to 1,508 in.

The rotor height range for 6" models is 2,869 in. to 2,874 in.

7. Preliminary inspection

7.1. Physical test of the motor

Check that the motor connector is not bent or punctured (with any holes). A connector in poor condition causes a decrease in insulation and consequently premature d amage to the motor windings.

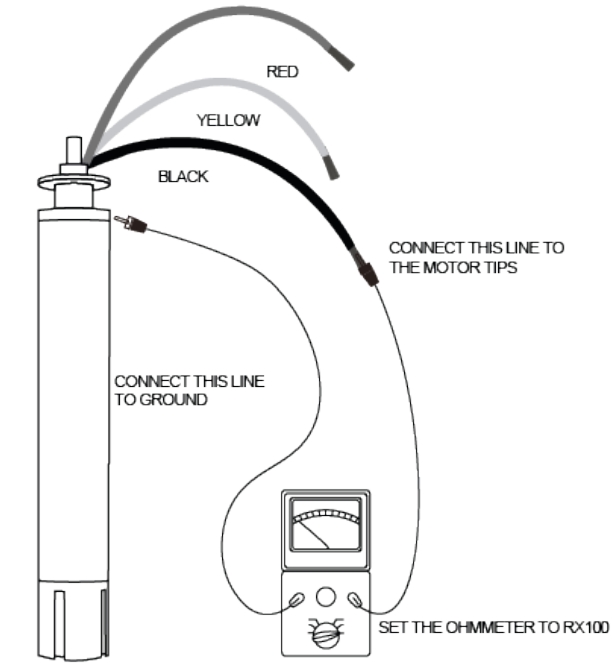
Check that the motor is not damaged.

7.2. Insulation test

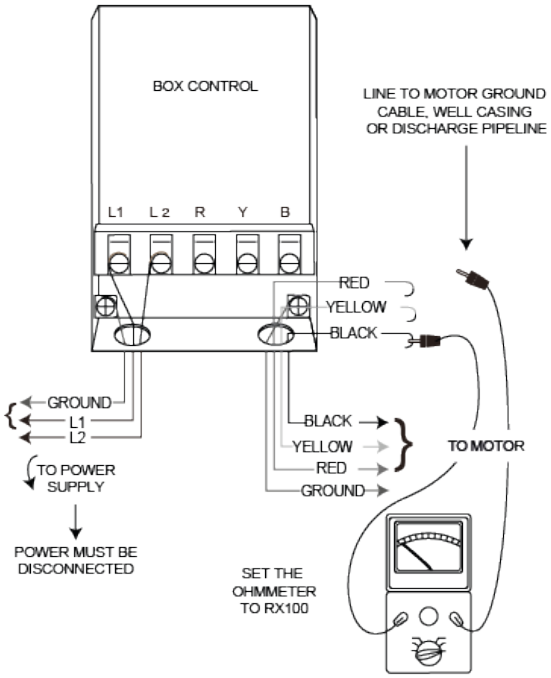
Check the motor insulation with a 500 Vdc meter (Megger) before installation and when the motor is already installed with its appropriate length of submersible cable.

To perform the insulation test, the negative tip of the Megger must make ground contact on the motor and the other measuring tip of the Megger must be connected to each of the motor lines (one at a time per test).

The motor insulation resistance must be measured on each motor power line and confirmed to be within the permissible range, according to the table of "Normal Values i n Ohms and Megaohms between Motor Lines and System Ground."



Insulation reading on the well motor



Insulation reading on the motor inside the well

Normal values in ohms and megaohms between motor lines and system ground

Condition of motor and lines	Value in ohms	Value in megohms
New motor (with connector)	200,000,000 (or more)	200 (or more)
Used motor that can be reinstalled in the well	10,000,000 (or more)	10 (or more)

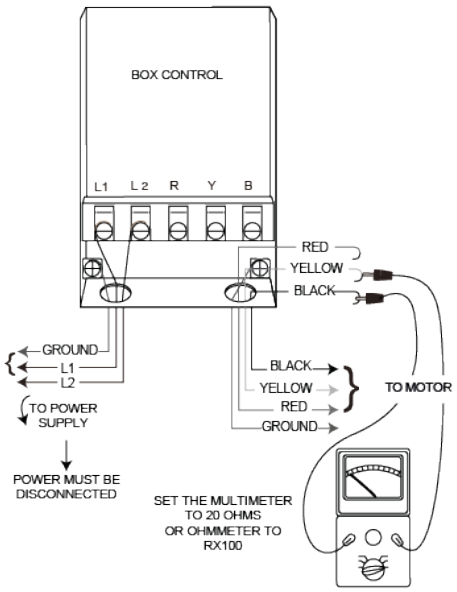
Motor in well (readings are for submersible cable plus motor)	Value in ohms	Value in megaohms
New motor	2,000,000 (or more)	2 (or more)
Motor in good condition	500,000 - 2,000,000	0.5 - 2
Damage to insulation, locate and repair	Less than $500,000	Less than 0.5

Insulation resistance varies very little with capacity. Motors of all power, voltage, and phase capacities have similar insulation resistance values. The table above is based o n readings taken with a megohmmeter with a 500 Vdc output. Readings vary if a l ower voltage ohmmeter is used; consult your distributor if you have any doubts about t he readings.

7.3. Winding resistance test

Before you begin, check the resistance of the windings using a multimeter set to the 20 Ω scale or an ohmmeter set to RX1, making sure to calibrate the meter to zero. For three-wire motors, measure between yellow and black (main winding) and between yellow and red (start winding). For two-wire motors, measure the resistance line to line, and for three-phase motors, measure line to line in all three combinations.

Reading the resistance of the motor windings



7.4. Submersible motor cable resistance (OHMS)

The values shown below are for copper conductors. If an aluminum conductor submersible cable is used, the resistance will be higher. To determine the actual r

esistance of the aluminum submersible cable, divide the ohms readings in this table b y 0.61. This table, Resistance in Ohms per 100 Feet of Cable (Two Conductors) a t 50°F, shows the total resistance of the cable from the control to the motor and v ice versa.

7.5. Measuring Winding Resistance

When measured through the submersible cable, the resistance must be subtracted from the ohmmeter reading to obtain the resistance in the motor winding.

The values in ohms for the different cable gauges are shown in the following table:

Resistance in ohms per 100 feet of cable (two conductors) 50 °F

AWG or MCM wire size (copper)	14	12	10	8	6	4	2
Ohms	0.544	0.338	0.214	0.135	0.082	0.052	0.032

1/0	2/0	3/0	4/0	250 CFM	300 CFM	350 CFM	400 CFM	500 CFM	700 CFM
0.021	0.017	0.013	0.01	0.009	0.007	0.006	0.006	0.004	0.003

8. Electrical connections

Electrical connections must be made by qualified personnel specialized in electrical installations.

DANGER

Before beginning any installation, check that there is no voltage at any point in the installation.

CAUTION

Check that the voltage and frequency shown on the motor nameplate correspond to those available in the mains supply.

Check that the voltage and frequency shown on the motor nameplate correspond to those available in the mains supply.

Protections

Install a general control and protection panel, the most suitable and appropriate for the motor to be installed, with a CLASS 10A or 10 overload relay with a disconnection time of less than 10s at 500% nominal IN with temperature compensation.

A good ground connection must be provided to prevent current from passing to the user due to a failure of the insulation of the active conductors.

CAUTION

Ensure that the electrical system of the power supply connection has a residual current device (RCD) and a residual operating current that does not exceed 30 mA.

8.1. Connecting the motor power cable

In most cases, it is necessary to install a submersible cable and connect it to the motor. Below are the tables for selecting a submersible cable according to the motor's HP.

Be sure to select the correct cable to avoid damage to the conductors due to overheating or premature motor failure.

It is necessary to connect the connectors very well to contribute to a long service life of the motor and electrical components.

8.2. Tables for selecting submersible cables

Single-phase motors

3-wire cable, 60 Hz Maximum length in meters.

Motor Capacity			167 °F Insulation – Copper Wire Gauge (AWG)										
Voltage	HP	kW	14	12	10	8	6	4	2	0	00	000	0000
115	1/3	0.25	40	64	104	165	256	396	597	887	1079	1283	1542
	1/2	0.37	30	49	76	119	189	293	445	658	802	957	1149
	1	0.75	23	37	59	94	149	235	368	576	721		
230	1/3	0.25	168	268	424	668	1036	1600	2426				
	1/2	0.37	122	198	311	491	765	1183	1792	2658			
	3/4	0.55	91	146	232	366	570	881	1332	1972	2399	2859	
	1	0.75	76	122	192	302	469	725	1100	1634	1987	2371	2850
	1.5	1.1	58	94	146	235	366	570	869	1305	1597	1920	2323
	2	1.5	46	76	119	189	296	466	719	1103	1366	1667	2042
	3	2.2	37	58	91	143	229	363	564	881	1100	1362	1692
	5	3.7		34	55	85	137	216	338	530	661	817	1015

NOTE

- Lengths NOT shown in gray comply with the amperage of the U.S. National Electrical Code for individual conductors or 167°F sheathed cable.
- The lengths marked in gray comply with the amperage of the U.S. National Electrical Code only for single conductor cable rated at 167 °F, in open air or water, not in magnetic conduit. If other cable is used, both national and local electrical codes must be considered. Flat network cable is considered sheathed cable.
- Values marked in gray are only acceptable for INDIVIDUAL conductors that do not have a protective jacket. For jacketed cable, only consider values not marked in gray.
- The cable lengths in the table "3-wire cable, 60 Hz (service input for motor - maximum length in meters)" allow for a voltage drop of 5% when operating at the maximum amperage specified on the nameplate. If a voltage drop of 3% is desired, multiply the lengths in this table by 0.6 to obtain the maximum cable length.
- This table is based on copper wire. If aluminum wire is used, it must be two gauges larger than the copper wire, and oxidation inhibitors must be used on the connections.

Three-phase motors

Three-phase cable for 167 °F, 60 Hz. Maximum length in meters.

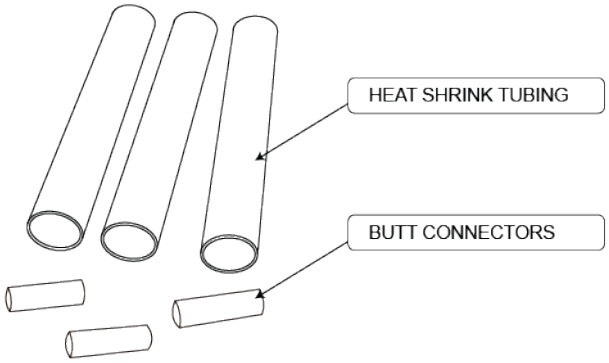
Motor Capacity			167 °F Insulation – Copper Wire Gauge (AWG)											Copper Wire Gauge (MCM)				
Voltage	HP	kW	14	12	10	8	6	4	2	0	0	0	0	250	300	350	400	500
230 Volts, 60 Hz, Three-Phase, Three-Wire	1/2	0.37	283	454	716	1128	1756	2716										
	3/4	0.55	204	329	518	786	1277	1978	3005									
	1	0.75	171	277	436	689	1073	1664	2527									
	1.5	1.1	128	204	323	509	796	1234	1878	2795								
	2	1.5	98	155	247	390	613	956	1454	2185	2676							
	3	2.2	73	119	189	302	469	732	1116	1667	2039	2444	2950					
	5	3.7	43	70	113	180	280	436	668	1003	1228	1478	1789	2027	2304	2579	2810	
	7.5	5.5		49	79	128	198	311	475	713	875	1049	1268	1436	1628	1820	1981	2289
	10	7.5			58	94	149	232	357	536	658	796	963	1094	1250	1402	1530	1780

8.3. Cable tie for submersible motor pumps

A well-made submersible cable tie (with secure, waterproof joints) contributes to long motor life, while a poor tie is a cause of premature damage to the windings.

Select the tie kit according to the gauge of the cables to be joined (tied).

Cable tie kit



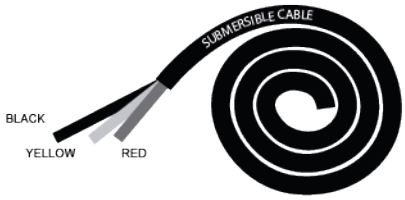
Procedure:

1. Cut the motor connector cables in a staggered manner (to different lengths).
   Connecting cables with staggered cuts

MOTOR CABLES

> **NOTE**
> When using color-coded cables (yellow, red, and black), it is important to make the connection so that the colors match, in order to facilitate identification of the cables in future inspections or measurements from outside the well or cistern with the equipment inside the water.

2. On the submersible flat power cable, remove part of the outer sheath or jacket that serves as mechanical protection. When doing this, it is very important not t o damage the individual insulation of the cables.
   Submersible flat power cable.

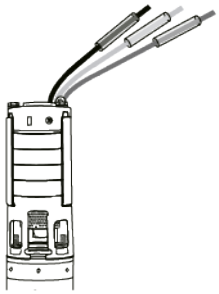


NOTE

It is important to note that, similar to the submersible flat cable, the connector cables in some brands of motors have two layers covering each conductor: the inner layer is electrical insulation (heat-shrink tubing must be applied over this layer) and the second layer is for mechanical protection.

Connector cable.

3. Remove the individual insulation (from the motor connector cables and the submersible cable) as necessary to allow both ends to be joined using butt connectors.
4. Before joining the cables, do not forget to place each heat-shrinkable tube on each of the motor connector cables.
   Placing the heat-shrinkable tube before joining the cables.

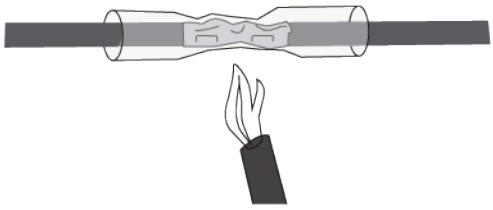


5. Connect each pair of corresponding cables using the butt connectors. Ensure that the connection is very secure. Clean this surface with alcohol and allow it to dry.
   Cable connection.

6. Place the heat-shrink tubing over the connection you made, leaving the butt connector in the center. Apply heat to the outside of the tubing, doing so evenly from the center of the tubing toward the sides to prevent bubbles from forming.

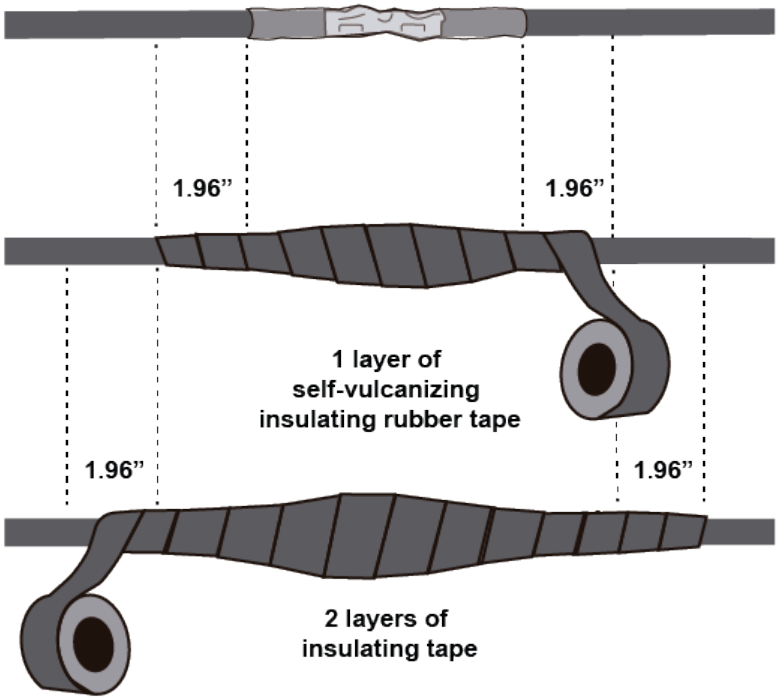
The tube will immediately reduce in diameter to fit the thickness of the cable and seal its ends. Allow it to cool. Repeat this step until you have completed the procedure on all three wires.

Placing the heat-shrink tubing on the cable joint.



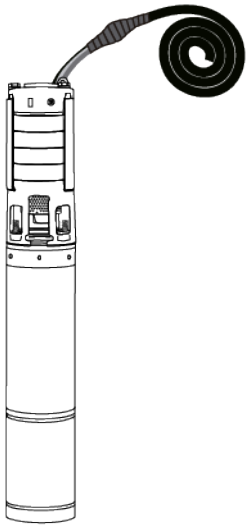
7. Wrap each cable joint with a layer of self-vulcanizing rubber insulating tape. This layer should cover 1.96" beyond each end of the heat-shrink tubing. Then apply two layers of electrical insulating tape for external protection (exceeding 1.96" at each end of the vulcanizing tape). Make sure the taping is as tight and airtight as possible.

   Correct taping of the cable.



8. Finally, for external mechanical protection of the three joints made above, join the three cables and tape them, covering them with two layers of insulating tape.

   Mechanical protection tape for cables.



Use of cables of different gauges.

Combinations of cables can be used in an installation in order to reuse existing cable sections. To do this, the corresponding calculation must be made, depending on the power of the equipment to be installed and the amount of cable available, in order to determine whether it is advisable to use the existing cable or whether it is better to purchase the entire length of cable required.

To apply the formula, you must know the gauge you already have and check the maximum length allowed for that gauge (see TABLES FOR SELECTING SUBMERSIBLE CABLES). Then, depending on the power and voltage of the motor to be installed, the appropriate gauge for the installation is determined. With the gauge, the maximum length allowed must be checked to find out how much cable is needed to complete the power supply installation to the motor.

Once all the data has been gathered, the formula must be applied, bearing in mind that the result must not be greater than 1. If the value is greater than 1, a smaller gauge than the one already selected must be chosen and the calculation must be performed again, until the result of the formula does not exceed 1.

NOTE

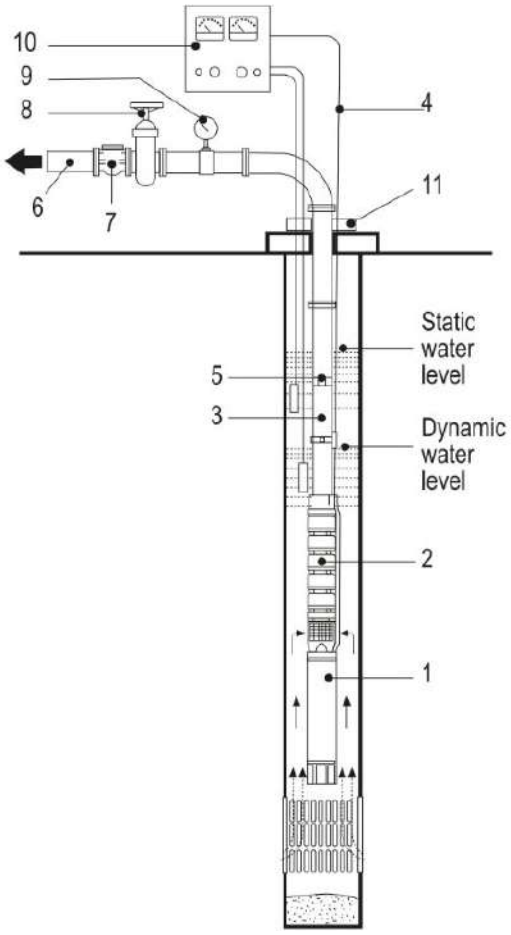
The lengths in the formula must be entered in feet.

$$\frac{Existing\ length}{Maximum\ permitted\ length} + \frac{Required\ lenght}{Maximum\ permitted\ length} = 1$$

9. Installation

9.1. Installation diagram

1. Submersible motor
2. Submersible pump
3. Column piping
4. Submersible cable for power supply to the motor pump
5. Column check valve
6. Discharge pipe
7. Check valve
8. Gate valve
9. Pressure gauge
10. Control panel and power supply
11. Suspension elements

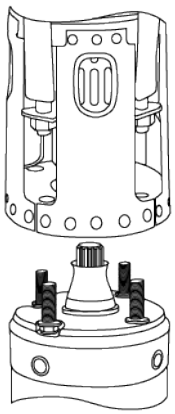


9.2. Pump-motor coupling

- Before coupling, check that the rotor turns smoothly and that it is at the correct height. Also, make sure that the pump shaft is free of obstructions, allowing frictionless movement.
- The pump must always be coupled to the motor in a vertical position; never couple it in a horizontal position. Check that the coupling fits the motor shaft without forcing the couplings, then tighten the corresponding nuts and bolts.
  The four nuts must be tightened evenly in a cross pattern.
- Make sure you have the necessary tools on hand to make the coupling maneuver easier.
- Check that the coupling surfaces are free of dust or dirt.
- Once the coupling has been made, ensure that the cable guard supplied with the pump is installed correctly.

CAUTION

Never place in operation the motor pump without before submerging it in water.



IMPORTANT

Poor alignment places additional loads on the main components of the motor, as well as bending on the shafts, causing efficiency losses and increased energy consumption due to friction and mechanical imbalance; this causes harmful vibrations to the equipment, affecting the efficiency of the motor pump.

Mounting position

ALTAMIRA submersible motors are designed to operate in a vertical position.

9.3. Cooling jacket

If the conditions in which the motor pump is installed do not guarantee the minimum water flow required for the motor to cool properly, then it is very important to install a cooling jacket.

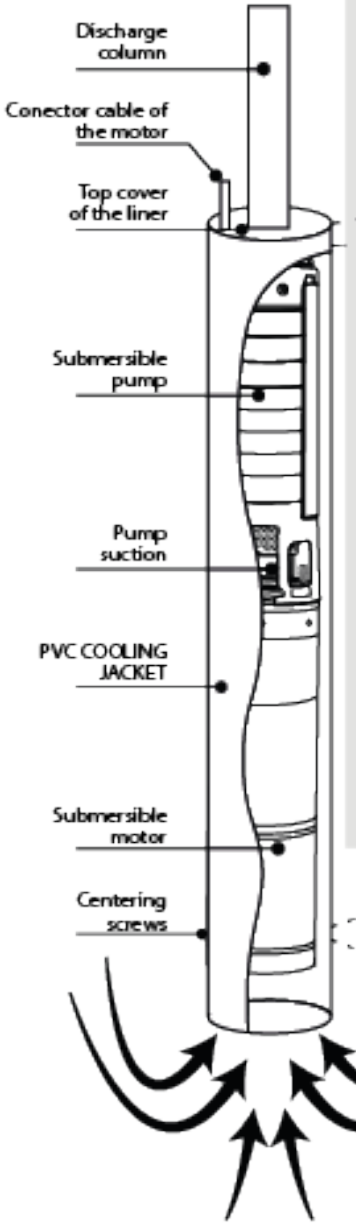
It is recommended to install a cooling jacket in the following cases:

- The diameter of the well is very large and does not meet the flow requirements of the motor.
- The pump will be installed in an open body of water (lake, dam, etc.).
- In cisterns, ponds, or similar structures.
- The well has a "top feed."
- The pump is installed in front of or below the slots or perforations in the pipe through which water is fed into the well.

IMPORTANT

To select the appropriate diameter for the cooling jacket, consult your authorized distributor.

Example of a simple cooling jacket construction using PVC pipe and a few extra accessories (pipes, screws, nuts, etc.).



Alternatives for constructing the top cover of the cooling jacket: (Choose one of your preference)

Round PVC cover

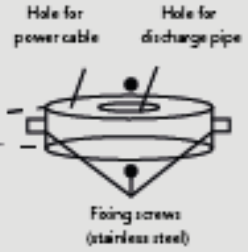


Figure A

Round cover made of PVC. Nylamid or similar with a diameter that adapts very well with the internal measurement of the PVC pipe. Fix that cover of the main pipe through srews or pins (stainless steel). See Figure A.

PVC adapter

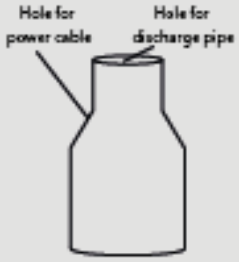


Figure B

Use a PVC adapter with concentric reduction (comercially available). Choose the adapter with a diameter that fits the main pipe of the liner and on the other side with a reduction to a suitable diameter through which the discharge pipe will pass. Use special PVC glue to join this part to the main pipe of the cooling jacket. See Figure B.

PVC pipe

Figure C

Make longitudinal cuts to the PVC pipe. Apply heat and mold around the discharge pipe, leaving a hole for the motor cable outlet. See Figure C.

Screws and locknuts installed on the bottom of the cooling jacket to center the motor and help the flow to be evenly distributed around the motor.

The purpose of a cooling jacket is to "force" all the pumped water to pass through the outer walls of the motor before reaching the pump suction and that is how achieve better cooling of the motor.

9.4. Installation of the equipment in the water well

CAUTION

The motor pump must be handled with great care and attention, avoiding any type of impact or shock.

Do not use the connector cable as a means of lifting. Doing so may damage the cable, compromise the safety of the equipment, and cause accidents during installation. Use only the attachment points designed for lifting the motor pump.

Place the motor pump on the hoist to begin installation as follows:

- Check that the bolts on the counterflange applied to the pump inlet are correctly tightened.
- Attach one of the two supports to the upper end of the first pipe.
- Secure the power cable to the column pipe using plastic cable ties.
- Lift the motor pump and lower it into the well until the support rests on the well head.
- Attach the first bracket to the second pipe, fitted with the other bracket at its upper end.
- Remove the first bracket and lower the assembly until the second bracket rests on the well head.
- Repeat the operation until the desired depth is reached.

The motor pump must be installed at a depth of at least 16.4 ft below the dynamic water level of the well.

Prevent the motor pump from touching the bottom of the well once it has been installed.

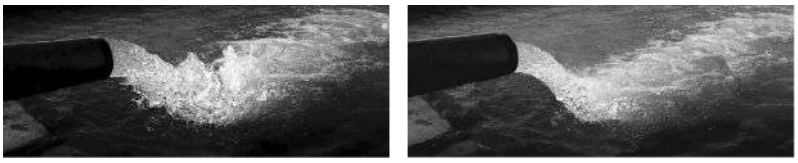
The bracket attached to the last pipe, resting on the well head, supports the motor pump and the pipe. It is advisable to install a check valve or gate valve on the pipe a t the well outlet to regulate the motor pump according to its characteristics and the w ell's flow rate.

10. Start-up

Turn on the main control for the motor power supply and check that the motor is rotating correctly.

Correct rotation of the motor pump.

In SUBMERSIBLE motor pumps already installed in a well or cistern, we cannot directly perceive the direction of rotation of the motor, but we can deduce it b y observing the flow and pressure it delivers. Therefore, start the equipment m omentarily and observe the flow or, failing that, the pressure gauge reading, then t urn off the equipment, reverse the rotation, and start the equipment again. Observe t he flow and pressure delivered by the equipment again and compare them with what y ou observed during the first start-up. The operation that delivered greater flow (and p ressure) indicates the correct direction of rotation.



The image on the left shows the correct rotation, as there is greater flow and pressure compared to the image on the right (reverse rotation, lower flow and pressure).

NOTE

In single-phase motors, it is not necessary to check the direction of rotation of the motor.

DANGER

To reverse the rotation of three-phase electric motors, reverse two of the three power phases. Be sure to make this change with the motor turned off and to work without power while changing phases in order to prevent accidents.

Grounding

DANGER

The motor, control cabinets, metal piping, and any other metal components must be grounded to avoid a high risk of electric shock.

11. Performance/startup

Proper performance of the motor pump depends on checking the direction of rotation, current balance, and hydraulic behavior immediately after start-up.

11.1. Verification of direction of rotation (three-phase motors)

1. Briefly turn on the equipment.
2. Observe flow and pressure.
3. If the flow is low, reverse two phases.
4. The correct direction is the one that delivers the highest flow and pressure.

NOTE

For single-phase motors, rotation verification does not apply.

11.2. Current balance check

1. Measure the current on all three lines.
2. Obtain the average current.
3. Determine the line furthest from the average.
4. Calculate the imbalance using the following formula: Imbalance (%) = (Difference ÷ Average) × 100

Example of current imbalance calculation:

Suppose we measure the current in the three lines of a three-phase motor.

- Line 1: 10.2 A
- Line 2: 9.8 A
- Line 3: 11.0 A

Step 1: Obtain the average.

- Average = (10.2 + 9.8 + 11.0) ÷ 3
- Average = 31.0 ÷ 3
- Average = 10.33 A

Step 2: Identify the current furthest from the average.

Absolute differences:

- Line 1: |10.2 – 10.33| = 0.13
- Line 2: |9.8 – 10.33| = 0.53
- Line 3: |11.0 – 10.33| = 0.67
  The largest difference is 0.67 A (Line 3).

Step 3: Apply the formula

Imbalance (%) = (Difference ÷ Average) × 100

- Imbalance (%) = (0.67 ÷ 10.33) × 100
- Imbalance (%) = 0.06486 × 100
- Imbalance = 6.49%

11.3. Permitted values

- Ideal imbalance: ≤ 2%
- Maximum allowed:
  - 5% (motor with service factor)
  - 10% (full load)

If the imbalance persists in the same line when rotating phases:

- The problem is in the power source.

If it changes along the motor line:

- The problem is in the motor, wiring, or connections.

12. Guide to identifying and solving possible faults

Inspections and repairs must always be carried out by qualified personnel in specialized workshops.

> ⚠ **CAUTION**
> Ensure that the equipment is disconnected from the power supply before performing maintenance operations.
>
> The power cord must be replaced by the manufacturer, its authorized distributor, or a qualified person.

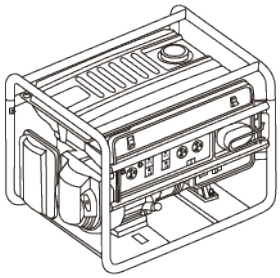
CORRECTION ACTIONS FOR POSSIBLE FAULTS		
ANOMALY	**PROBABLE CAUSE**	**CORRECTIVE ACTION**
Motor does not start	1- Blown fuses	1- Replace fuses
	2- Loose or faulty	2- Check that all terminals are properly tightened
	3- Power supply failure	3- Report the power outage to the utility company
Motor consumes excessive current	1- Low supply voltage	1- Check the electrical power supply
	2- Foreign material in pump	2- Perform maintenance on the pump; replace the pump if necessary
	3- Pump operating outside efficiency curve	3- Ensure the pump is in proper working condition; replace it if necessary
	4- Improper cable selection	4- Select cable of the correct size
Pump not delivering	1- Check valve improperly installed	1- Adjust the position of the check valve
	2- Pump misaligned with motor	2- Check that the pump is properly coupled to the motor
	3- Leaks in piping	3- Check that the piping has no leaks
	4- Motor not running	4- Possible loose connection or power supply issue to the motor
Pump supplying low flow rate	1- Motor rotating incorrectly	1- Swap the phases (three-phase motor)
	2- Worn pump	Replace the pump

13. Generator power supply

The generation capacity must be checked, taking into account the voltage variation, which must be between -10% and +6% of the nominal value.

Generators must be calibrated so that during start-up voltage they supply at least 65% of the nominal voltage to ensure adequate torque.

Start the generator first before connecting the load and disconnect the load before turning off the generator.



Generator capacity

MOTOR		GENERATORS			
HP	kW	EXTERNALLY REGULATED		INTERNALLY REGULATED	
		kW	KVA	kW	KVA
1/2	0.37	2	2.5	1.5	1.9
3/4	0.55	3	3.8	2	2.5
1	0.75	4	5	2.5	3.13
1.5	1.1	5	6.25	3	3.8
2	1.5	7.5	9.4	4	5
3	2.2	10	12.5	5	6.25
5	3.7	15	18.75	7.5	9.4
7.5	5.5	20	25	10	12.5
10	7.5	30	37.5	15	18.75

14. Maintenance

Preventive maintenance ensures reliable operation and extends the service life of the submersible motor.

14.1. General considerations

- Inspections must be performed by qualified personnel.
- Always disconnect the equipment before working on it.
- Check electrical protections, stable voltage, and proper grounding.

14.2. Electrical maintenance

- Inspect the submersible cable and its connections.
- Check the integrity of the insulation.
- Ensure connections are secure and free of moisture.

14.3. Motor maintenance

- Measure insulation resistance with a 500 VDC Megger.
- Compare readings with previous records.
- Confirm that the mechanical seal is leak-free.
- Verify that the motor is filled with coolant.
- Check that there is no sand in the mechanical seal area.

14.4. Hydraulic maintenance

- Check check valves, column piping, and connection points.
- Check performance if there is sand in the well.
- Avoid operating at low water levels to prevent overheating.

14.5. Power cable replacement

This should only be done by:

- Qualified technician.