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# AC Submersible Pump Motors

## Installation and Operating Manual

**BALDOR • RELIANCE**

February 2024

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**Important:**

Be sure to check [www.baldor.com](http://www.baldor.com) for the latest software, firmware and drivers for your ECM product. Also, you can download the latest version of this manual in Adobe Acrobat PDF format.

**Note: Baldor Electric Company, became ABB Motors and Mechanical, Inc. on March 1, 2018. Nameplates, Declaration of Conformity and other collateral material may contain the company name of Baldor Electric Company and the brand names of Baldor-Dodge and Baldor-Reliance as well as the company name of ABB until such time as all materials have been updated to reflect our new corporate identity of ABB.**

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# Section 1

## General Information

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- Overview** This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements.  
A Warning statement indicates a possible unsafe condition that can cause harm to personnel.  
A Caution statement indicates a condition that can cause damage to equipment.
- Important:** This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor District Office for more information or clarification.  
Before you install, operate or perform maintenance, become familiar with the following:
- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
  - The National Electrical Code
  - Local codes and Practices
- Safety Notice:** This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.  
Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code, IEC and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.
- WARNING:** **The Adjustable Speed Controller may apply hazardous voltages to the motor leads after power to the controller has been turned off. Verify that the controller is incapable of delivering hazardous voltages and that the voltage at the motor leads is zero before proceeding. Failure to observe this precaution may result in severe bodily injury or death.**
- WARNING:** **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**
- WARNING:** **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**
- WARNING:** **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**
- WARNING:** **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. Protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**
- WARNING:** **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**
- WARNING:** **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**
- WARNING:** **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**
- WARNING:** **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**
- WARNING:** **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**
- WARNING:** **Pacemaker danger - Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**
- WARNING:** **Incorrect motor rotation direction can cause serious or fatal injury or equipment damage. Be sure to verify motor rotation direction before coupling the load to the motor shaft.**
- WARNING:** **Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.**
- WARNING:** **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**
- WARNING:** **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**
- WARNING:** **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

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**Safety Notice** Continued

- Caution:** To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.
- Caution:** If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.
- Caution:** Never raise or lower the motor/pump by the power cords. Use lifting eyes provided in the motor casting (opposite drive end) and attach a cord/cable to lift the weight of the motor and pump. Failure to lift this motor properly may seriously damage the lead connections and water seals and seriously damage the motor.
- If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor District Office or an Authorized Baldor Service Center.

**Receiving**

Each BaldorReliance Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

**Handling**

The motor must be stored shaft down in its' original packaging until it is to be into service. The motor should only be lifted using the lifting eyes provided, see Figure 2-1. If the motor must be stored for more than 6 months, the procedures described in MN417 must be followed to prevent motor damage.

- Caution:** Never raise or lower the motor/pump by the power cords. Use lifting eyes provided in the motor casting (opposite drive end) and attach a cord/cable to lift the weight of the motor and pump. Failure to lift this motor properly may seriously damage the lead connections and water seals and seriously damage the motor.
1. Only use the lifting eyes provided to lift the motor. Never attempt to lift the motor by the power cords.
  2. Be sure the motor is stored shaft down until ready to install.

# Section 2

## Installation & Operation

### Overview

Installation should conform to the National Electrical Code as well as local codes and practices.

All BaldorReliance Submersible Pump Motors Include thermal devices as standard. Normally, there are four conditions during which a submersible sewage pump may be operated in gases or vapors.

1. When the wet well is being dewatered.
2. When the pump motor assembly is being lowered down the guide rails. The flow from the pump is needed during the installation process to ensure that solids are cleared from the discharge flange area to ensure proper seating.
3. When low-level cutoff controls fail.
4. When low-level sensors are positioned at the bottom of the pump assembly.

### Continuous Operation Gasses Or Vapors

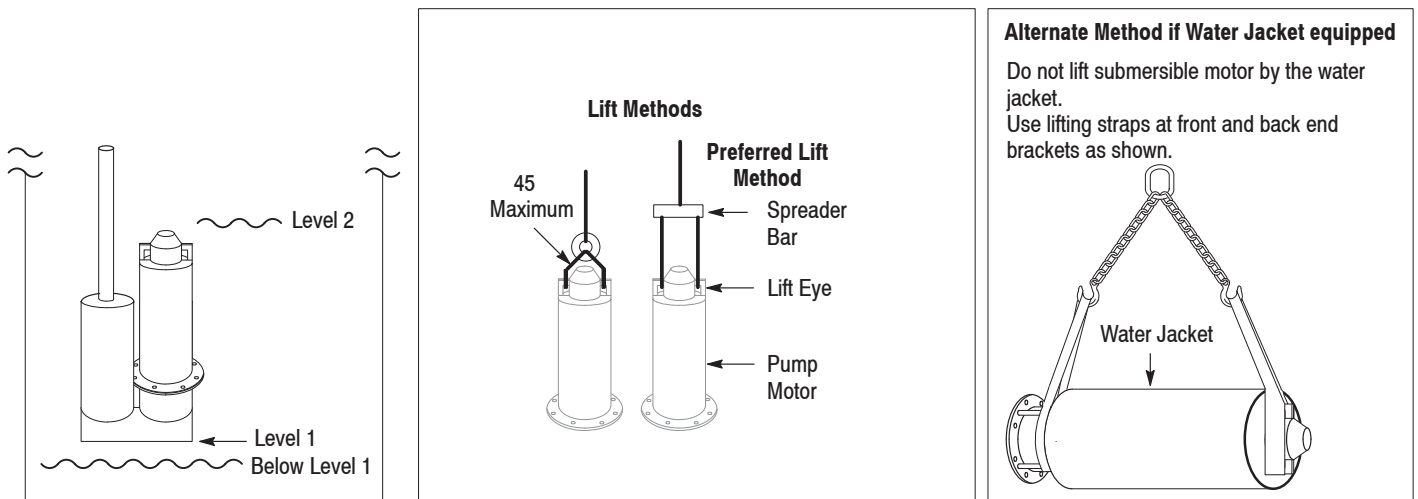
Be sure you have selected the correct motor for your application. The horsepower rating of the motor is determined by the pump design, impeller size & head and flow conditions.

Operating time is a function of pit size, pump capacity, and flow conditions. Only the pump manufacturer can ensure that the pump motor is properly applied for continuous in-gas or vapor operation. As with any motor product, it is essential that proper consideration be given to the load characteristics to ensure the motor will not be overloaded. Should such an overload occur, thermostats embedded in the windings will provide a signal to deenergize the motor. However, proper consideration of the application will prevent such an overload.

### Caution:

**Lift using Lift Eyes only. Lifting by power cords will cause motor damage. Use spreader bar to evenly distribute lift force. Angle of lift rope (no spreader bar) should not exceed 45° from vertical, excessive lift angle can damage motor.**

Figure 2-1



The following load conditions should be noted, refer to Figure 2-1:

1. Below Level 1 (below the pump) fluid is not pumped and no load is reflected to the motor.
2. One pump should always be sized sufficiently large to draw the well down (even under maximum flow conditions). The maximum amount of time the motor will operate fully loaded and uncovered is the amount of time required to draw the well down from Level 2 (top of the motor) to the bottom of the pump.
3. Time described in 2 should not be greater than 15 minutes.
4. These notes do not make allowance for the following:
  - a. The heat exchanger effect of the attached pump. It is pumping a relatively cool fluid and will remove some heat.
  - b. The motor does not operate fully loaded completely in gas. It is fully loaded as the motor is being uncovered.
  - c. If the well is being drawn down from the top of the motor and the maximum flow conditions exist, the influent flow will usually provide excellent cooling of the pump motor.

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**WARNING:** Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

**WARNING:** The Adjustable Speed Controller may apply hazardous voltages to the motor leads after power to the controller has been turned off. Verify that the controller is incapable of delivering hazardous voltages and that the voltage at the motor leads is zero before proceeding. Failure to observe this precaution may result in severe bodily injury or death.

**Installation** When the submersible pump motor leaves the factory it is ready for installation. No adjustment, venting or oil filling is required.

**Considerations**

1. The user must select a motor starter and over-current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other local codes.
2. Maximum submergence of motor is not to exceed 160 ft (49m) in depth and or 100 PSI (690 kpas) at the external motor seal for Tandem Seal designs. For slurry seal designs the maximum external motor seal pressure is 15 PSI (103 kpas).
3. Thermal Protectors must be connected. Leads marked P1 and P2 (See Figure 2-2).
4. Moisture Sensing Probes must be connected. Leads marked W1 and W2. (See Figure 2-3).
5. Check your power supply against final nameplate connection voltage.
6. Motor will operate properly with frequency not more than  $\pm 5\%$  and voltage not more than  $\pm 10\%$  above or below nameplate rating.
7. Performance within this range will not necessarily be the same as the established performance at exact rated voltage and frequency.
8. For three phase motors only: To reverse direction of a three phase motor, interchange any two motor lead connections at the starter.

**Installation Procedure**

To prevent damage to the motor, do not use force to drive pump on (drive impeller onto motor shaft) or to remove pump from motor shaft.

1. Turn off and lockout all power and verify the voltage at the motor starter connectors are zero.
2. Connect the motor power leads to the connectors in the motor starter. (See "Grounding").

Note: The motor lead cable assembly for all Submersible Pump Motors has 3 marked power leads plus two ground leads, two thermal leads and two moisture sensing probe leads.

3. Three Phase Motors ONLY.
  - a. Turn off and lockout all power and verify the voltage at the motor starter connectors are zero.
  - b. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.
  - c. Remove all unused shaft keys and loose rotating parts to prevent them from flying off.
  - d. Momentarily apply power and check the direction of rotation of the motor shaft. Motors are designed for bi-directional shaft rotation. When voltages in an A-B-C phase sequence are applied to leads U/T1, V/T2, W/T3 clockwise shaft rotation facing the opposite drive end will result. If shaft rotation is incorrect, change the direction of rotation as follows:
    - i. Turn off and lockout all power and verify that the voltage at the motor leads is zero.
    - ii. Reverse any two of three motor power leads at the motor starter.
    - iii. Restore power and verify correct rotation.
    - iv. Turn off and lockout all power and verify that the voltage at the motor leads is zero.
4. Connect the two Thermal Protectors at the motor starter as shown in Figure 2-2.
5. Connect the two Moisture Sensing Probes at the motor starter as shown in Figure 2-3.
6. Follow pump manufacturer's instructions and mount the pump on the motor shaft.
7. Secure the pump case to the motor flange.
8. Attach drain piping to pump.
9. Use spreader bar and lifting eyes (see Figure 2-1) to lower the motor/pump assembly to the proper depth. Be sure that motor wires are not damaged (contact with metal objects etc.)
10. Set control parameter values (if applicable) according to motor nameplate values.



## Grounding

In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

Motors with resilient cushion rings usually must be provided with a bonding conductor across the resilient member. Some motors are supplied with the bonding conductor on the concealed side of the cushion ring to protect the bond from damage. Motors with bonded cushion rings should usually be grounded at the time of installation in accordance with the above recommendations for making ground connections. When motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit over current protective device being used.

There are applications where grounding the exterior parts of a motor or generator may result in greater hazard by increasing the possibility of a person in the area simultaneously contacting ground and some other nearby live electrical parts of other ungrounded electrical equipment. In portable equipment it is difficult to be sure that a positive ground connection is maintained as the equipment is moved, and providing a grounding conductor may lead to a false sense of security.

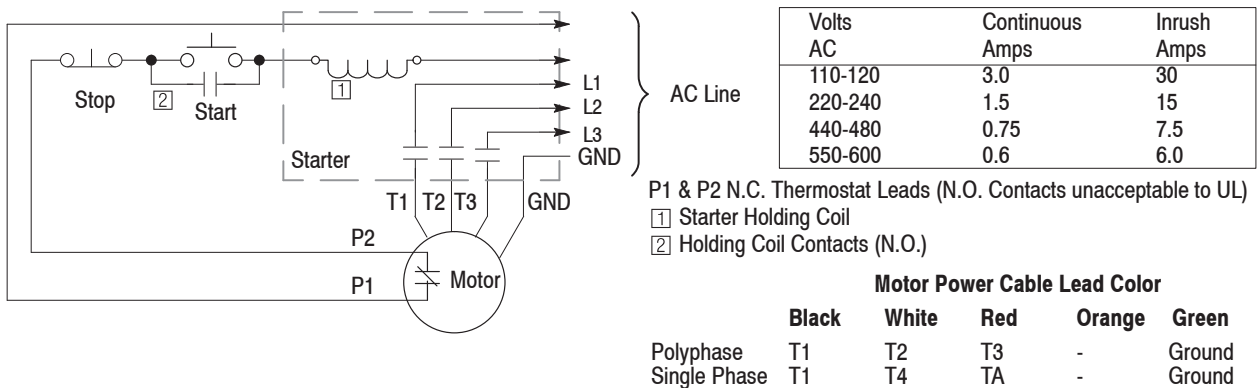
Select a motor starter and over current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes. Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn-to-turn, phase-to-phase, and ground insulation of stator windings are subject to the resulting dielectric stresses.

Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

## Thermal Protection

Thermostat leads marked P1 & P2 must be connected in series with the stop button of the 3-wire pilot circuit of the magnetic motor controller, so that the thermostat will open the circuit before dangerous temperatures are reached. Thermostats are automatic reset for use in a normally closed circuit where the thermostat is connected in series with the holding coil of the magnetic starter. Thermostats provide "Over Temperature" Protection in accordance with NEMA MG 1-12.53. Thermostats do not provide winding over temperature protection (locked rotor). It is suggested that over current protection be used in the motor starter to ensure locked rotor protection.

Figure 2-2 Thermal Protection Circuit



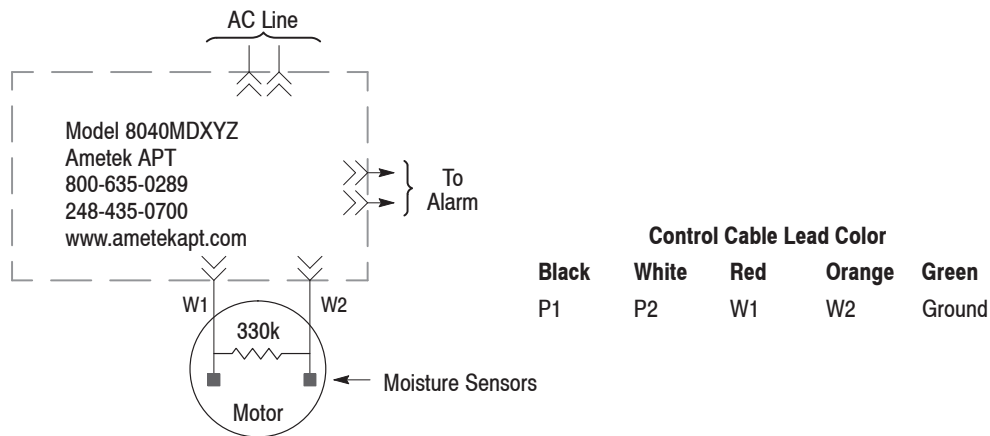
## Moisture Protection

The submersible moisture protection system consists of the non-wicking cable cap assembly and the dual moisture sensing probes. The cable cap assembly prevents moisture from wicking through the cable assembly even when the cable jacket has been punctured. Dual moisture sensing probes extend into the oil chamber located between the tandem mechanical seals. Should the outer seal fail, water will enter the oil chamber through the labyrinth slinger paths and create a water/oil emulsion in the oil chamber. The moisture detector control applies voltage to the moisture probes. The presence of water in the oil chamber increases the conductivity sufficiently to increase current flow through the probe circuit. A leakage detector control such as Ametek APT Series 8040MD Moisture Detector (or equivalent) must be purchased separately. The leakage detector control system must be connected for the warranty and the U/L listing to be valid. The connection diagram for the Ametek APT device is shown in Figure 2-3.

**Figure 2-3 Moisture Sensing Circuit**

**IMPORTANT:**

**Failure to properly connect and use this leakage detector system voids motor warranty.**



Note: For all physical, electrical, price, warranty and other information about the moisture detector or relay, please contact the manufacturer directly.

- WARNING:** Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. Protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.
- WARNING:** Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.
- WARNING:** Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.
- WARNING:** Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.

**Operation**

During operation, observe the motors performance. It should run smoothly with little noise.  
 Note: Never operate these type 21 seals in a dry-run condition.

Motor operation may stop for one of the following trip conditions:

1. If moisture infiltrates the motor, the moisture detector circuit will activate.
2. If the motor overheats, the Thermal Protection circuit will activate.
3. Other condition detected by motor starter (over current, over voltage, etc. if equipped)

Unbalanced voltage or single--phase operation of poly phase motor may cause excessive heating and ultimate failure. Only a slight unbalance of voltage applied to a poly phase motor will cause large unbalanced currents and resultant overheating. Periodic checks of phase voltage, frequency and power consumption of a motor (measured at the motor starter) while in operation are recommended; such checks assure the correctness of frequency and voltage applied to the motor and yield an indication of the load offered by the apparatus which the motor drives. Comparisons of this data with previous no load and full--load power demands will give an indication of the performance of the complete machine. Any serious deviations should be investigated and corrected.

If a problem with the motor occurs, contact your Baldor District Office for repair.

Should the lead connector assembly be damaged or the integrity of the encapsulation be in question, it is required that a replacement lead connector assembly be ordered from Baldor, contact your Baldor District Office. Renewal instructions will be provided with the replacement parts.

**Lubrication**

New Baldor submersible motors ship with the oil reservoir properly filled with lubricant. Care should be taken when handling motor to ensure no damage occurs that allows lubricant to leak from motor.

Maintenance should only be performed by qualified motor repair facility due to the water tight construction of this motor. Ceramic and other seals are easily damaged and special tools are required for service.

Recommended lubricant is Shell Rotella 10 SAE 10W.

The appropriate amount of lubricant is given in Table 2-1.

**Table 2-1 Oil Amount by Frame Size**

Frame Size	Oil Spec	Quantity	
		Min. Quarts	Max. Quarts
180TY	4824-18-AF	1.0	1.5
210TY	4824-18-AF	2.0	2.5
250TY	4824-18-AF	3.0	3.5
320TY	4824-18-AF	3.0	3.5
360TY	4824-18-AF	3.75	4.0
440TY	4824-18-AF	3.75	8.0

## Section 3

### Lead Cable Connection - Use this section when applicable

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#### Overview

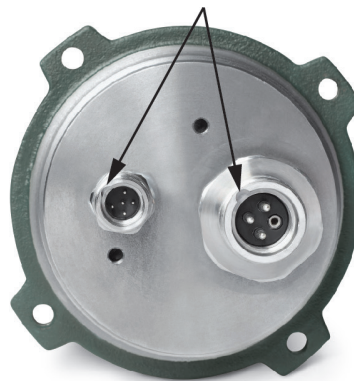
Each lead cable has a UL certification tag that is attached to the cable. This tag states the UL certification rating along with the voltage and current rating at the stated ambient temperature. The tag also states the Tightening Torque for the connection nut.

**Figure 3-1 Thermal Protection Circuit**



To insure the cable is properly mated to the receptacle, the receptacle has a notch and the cable insert has a pro-trusion that will align with the notch.

**Figure 3-2 Receptacle notch for mating with the cable**



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**Figure 3-3 Cable receptacle**



Insert the cable into the receptacle. Insure that the protrusion on the cable lines up with the receptacle notch. Insert the cable and make sure the cable is fully inserted.

The cable should bottom out inside the receptacle.

**Figure 3-4 Set screw, nut and cable**



Make sure the set screw on the nut is backed out so it will not scratch the cable. Slide the nut into place and turn the nut counter-clockwise (loosening direction) until you feel and hear (you will hear a click) the threads mesh. This will insure that no cross-threading will occur when tightening the nut. Tighten the nut by hand and then use a wrench until the proper tightening torque is achieved. The proper tightening torque is stated on the tag attached to the cable. Once the nut is properly tightened, tighten the set screw to prevent the nut from loosening.







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