

Application, Installation,  
and Operation Of  
Reliance®  
Tandem Seal Single and  
Polyphase Duty Master® A-C  
Submersible Pump Motors

UL Listed for Class I  
Groups C and D  
in Water or Sewage  
(Short Time Duty,  
15 minutes in Air)

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**A-C MOTORS**

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*“Solutions  
You Can  
Trust”*

Instruction Manual B-3629-12  
April, 1996

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 **IMPORTANT**

**It is important that these instructions be studied by the personnel installing and operating this equipment. Read thoroughly before starting. Keep these instructions for future reference.**

 **IMPORTANT**

**The motors specified in this instruction book are U/L listed for application in Class I Groups C and D explosion-proof environments. All repairs, other than lead reconnects and outer seal replacement, shall be performed by an authorized Reliance service facility. Any other repairs performed by the customer or non-Reliance service facilities negates the U/L listing and motor warranty.**

# RECEIVING AND HANDLING

## ACCEPTANCE

Thoroughly inspect this equipment before accepting shipment from the transportation company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept them until the freight or express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight or express agent at once and request him to make an inspection. We will assist you in collecting claims for loss or damage in shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material. Claims for loss or damage in shipment must not be deducted from the Reliance Electric invoice, nor should payment of the Reliance Electric invoice, be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest Reliance Electric Sales Office for assistance. Please keep a written record of all such communications.

## UNPACKING

If facilities for the shelter of equipment are not available, repack motor and store shaft down until ready for use.

After unpacking and inspecting to see that all parts have been received in good condition, turn the motor shaft by hand to be sure that there are no obstructions to free rotation.

The motor should be checked for oil leaks after being removed from the crate. If positive indication of an oil leak is found around the shaft seal or drive end bracket, notify the nearest Reliance Electric Sales Office.

## APPLICATION

All Reliance Submersible Pump Motors include thermal devices as standard. These devices are

required by UL on all motors 1 HP and larger listed Class I, Groups C and D. These devices are not recognized by UL for motors less than 1 HP but are included by Reliance for additional motor protection. **Motors less than 1 HP are supplied with a cautionary label and are suitable on applications where vapor or gas ignition temperatures exceed 280°C. These motors are listed for Class I, Group D only.**

**Reliance Electric stocks common ratings through 100 HP continuous duty submerged in liquid, 15 minutes duty in air at nameplate horsepower. Designs through 250 HP and special continuous in air ratings are also available. (Continuous in Air Designs have a 1.0 Service Factor.)**

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 guiderails. The flow from the pump is needed during the installation process to insure that solids are cleared from the discharge flange area to insure proper seating.
3. When low-level cutoff controls fail.
4. When low-level sensors are positioned at the bottom of the pump assembly.

*NOTE: Outer shaft seal must be in liquid when motor is operated, whether motor is submerged or in air.*

*Seals cannot be run in a dry environment without a significant reduction in seal life. If seal is to be run in a dry environment, a special design seal must be supplied. Standard seals applied in dry seal applications will not be covered by warranty.*

## CONTINUOUS OPERATION GASES OR VAPORS

**It is the driven equipment manufacturer's responsibility to insure this motor product is properly applied.**

Horsepower requirements are a function of pump design, impeller size & head and flow conditions. In gas operating time is a function of pit size, pump capacity, and flow conditions. Only the pump manufacturer can insure 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 insure the motor product 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.

With reference to the diagram in figure 1, the following load conditions should be noted:

- A. Below level #1 (bottom of the pump) fluid is not pumped and no load is reflected to the motor.
- B. 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.
- C. Time described in B above should not be greater than 15 minutes if full motor nameplate horsepower is required for this operation. (See Application Instructions).

D. The above application notes do not make allowance for:

- (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 maximum flow conditions exist, the influent flow will usually provide excellent cooling of the pump motor.

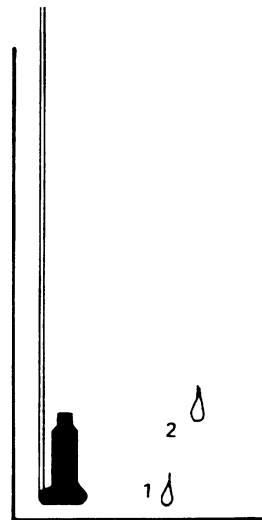


FIGURE 1

## INSTALLATION

### IMPORTANT

Read this manual thoroughly before installation.

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 200 feet in depth and/or 200 P.S.I. at motor seal.

3. Thermal Protectors must be connected. Leads marked P1 and P2 (See Figure 2).
4. Moisture Sensing Probes must be connected. Leads marked W1 and W2. (See Figure 3).
5. Check your power supply against final nameplate connection voltage.

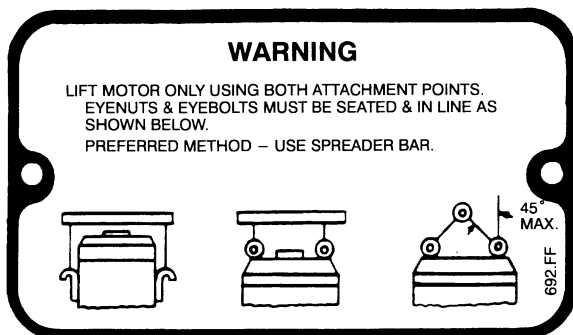
If required, the impeller should be heated slightly before pressing it on the shaft. *Under no circumstances should the impeller be driven on*

by pounding as this will damage the seal. When removing impeller warm slightly with a torch and pry impeller off evenly with either small pry bars or a wheel puller.

When the submersible pump motor leaves the factory it is ready for installation. No adjustment, venting or oil filling is required. For THREE PHASE motors the only connection to the motor lead cable is the power supply. For SINGLE PHASE motors the motor lead cable and power supply must be properly connected at the Control Box. Motor will operate successfully with frequency not more than 5% and voltage not more than 10% above or below nameplate data. Performance within this range will not necessarily be the same as the established performance at exact rated voltage and frequency.

All submersible pump motors will operate in either direction of rotation. To reverse direction of a THREE PHASE motor, interchange any two motor leads at the starter. To reverse direction of rotation of a SINGLE PHASE motor the proper connections must be made in the motor connection chamber; refer to the W/D's supplied in the motor connection chamber and Control Box.

Lifting eyes are supplied for purpose of installation and servicing. **(Do not use motor lead cables for lifting means.)** Normal care should be exercised to prevent mechanical damage to the seal, the frame and the insulated cable.



## STARTING

**CAUTION:** Surface temperature of motor enclosure may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. (When installing, protection should be provided by user to protect against accidental contact with hot surface) .

On initial start up the motor and pump should be checked for proper rotation prior to final application.

The unit is designed to protect all power connections against moisture. All Reliance Submersible Pump Motors have a lead connection chamber. – THREE PHASE dual voltage motors have 9 motor leads and SINGLE PHASE dual voltage motors have 8 motor leads in this chamber. All Submersible Pump Motors have 2 thermal protector leads and 2 moisture sensing probe leads in this chamber.

Leads are tagged for easy identification. A connection diagram is provided in the lead chamber. Motors can be connected for either high or low voltages. (Some motor ratings are built as single voltage units and as such are not reconnectable).

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 in standard cable lengths of 25 feet.

Leads are brought through an epoxy sealed connector providing a mechanically strong water tight seal. The cap and cable assembly are available from Reliance Electric as a replacement part assembly. When replacing the lead wire cap, care should be taken not to nick or damage the "O" ring seal. Replace any damaged or nicked "O" rings.


**WHEN REPLACEMENT CABLE ASSEMBLY IS REQUIRED, ORDER FROM RELIANCE ELECTRIC CO. USING MOTOR IDENTIFICATION NUMBER.**

# MAINTENANCE

With proper application and installation of monitoring devices, periodic inspection of motor seals is not required. Should a malfunction occur the motor has been equipped with a moisture detection system and thermal protection which will provide advance warning of impending failure allowing the user to plan a maintenance program before failure occurs.

## GENERAL NOTES: ALL PARTS

1. Reliance® Submersible Motors utilize an explosion-proof Class I, Groups C and D, tandem seal design, with an oil chamber separate from the winding area.
2. Wound Stators – Reliance Submersible Motors utilize a wound stator which has been pressed into the frame. The stator insulation system has been designed for the temperature and electrical rating involved. If the motor failure is analyzed to encompass a winding failure, return the motor to an authorized Reliance Electric Service Shop.
3. Encapsulated Lead Connector Assembly – The lead connector assembly has been especially encapsulated to insure integrity of the motor. The connector can be removed from the motor in order to reconnect leads. 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 Reliance Electric Company.

 **WARNING**

**MOTOR MAY CONTAIN GAS UNDER PRESSURE DUE TO HIGH TEMPERATURES FROM OPERATION WITHOUT BEING SUBMERGED. DISASSEMBLY MAY CAUSE BODILY INJURY. FOR ASSISTANCE CONTACT A RELIANCE OFFICE.**

4. Hardware – All hardware is stainless steel and should be replaced with the same type.
5. If the Conduit Connection is used, a corrosion resistant conduit such as stainless steel is recommended.

6. When replacement cable assembly is required, order from Reliance Electric Industrial Co. using motor identification number.

## MECHANICAL REPAIRS

U/L listed motors must be returned to an authorized Reliance Electric Service Facility for repairs other than to replace the outer seal. (See note on Table of Content page.)

To inspect the outer seal proceed as follows:

1. Remove outer snap ring (3), replace as needed.
2. Remove rotating outer seal (4), replace as needed.
3. Approved lubricating and insulating oil shall meet Reliance approved source sheet 4824-18-AF. Manufacturer's materials currently meeting this specification are as follows:

ITEM	MANUFACTURER	MANUFACTURER'S IDENTIFICATION OF MATERIAL
1	Sun Oil Company	Sun Fleet Regular SAE 10W
2	Standard Oil Co.	Sohio 62 SAE 10W
3	Shell Oil Company	Rotella 10 SAE 10W

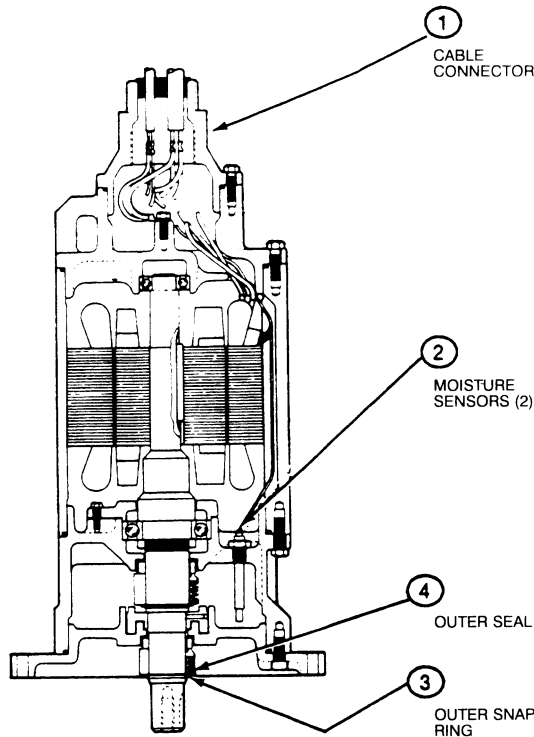
## MOTOR INSPECTION

After assembly, run motor in shaft down position for 30 seconds minimum to one minute maximum to allow seals to seat; then check for oil leakage. In some cases, a slight oil mist will appear around the seal. Wipe clean after test.

## PAINTING AND SHIPPING


Before painting motor, cover exposed seal. Remove any paper, tape, etc., from seal area before crating motor. These motors can be shipped in shaft up or shaft down position. Care must be taken that exposed seal is not damaged during shipment. Carton must protect exposed seal from dirt, dust and damage.

## ELECTRICAL REPAIRS



### LEAD RECONNECT

The cable connector assembly may be removed to reconnect the leads without negating the U/L listing or the warranty.


 <b>WARNING</b>
<b>MOTOR MAY CONTAIN GAS UNDER PRESSURE DUE TO HIGH TEMPERATURES FROM OPERATION WITHOUT BEING SUBMERGED. DISASSEMBLY MAY CAUSE BODILY INJURY. FOR ASSISTANCE CONTACT A RELIANCE OFFICE.</b>

## PROCEDURE

1. Loosen four bolts, securing lead cable connector (1), two complete turns.
2. Attempt to break the cable connector seal thus relieving gas pressure within the motor. If gas pressure is not relieved loosen the bolts another turn and try again. Continue this process until the pressure is relieved and/or the cap is removed. Be extremely careful until the cable connector assembly is removed.
3. Remove cable connector and reconnect to desired voltage as shown on connection diagram inside the cable connector.
4. Insulate connectors with 4824-13-AU heat shrinkable plastic. If the 4824-13-AU shrinkable plastic is not available, tape may be used, but it should be an oil resistant type. Enough wraps should be used to insure the buildup will be sufficient to prevent the connector from breaking through the insulation. The following procedure should be employed: Five layers of plastic electrical tape followed by two layers electrical grade woven adhesive tape, such as Mystik 7020 or 3M #27, for oil and abrasion resistance.
5. Place "O" ring over fit and coat fit with Chevron SRI grease (not excessive).
6. Place cable connector back on motor, install four bolts, and tighten.

## THERMAL PROTECTION SYSTEM

### THERMAL PROTECTION

 <b>IMPORTANT</b>
<b>Reliance Submersible Pump Motors are equipped with thermal protection devices. Failure to properly connect or utilize this system voids motor warranty.</b>

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 2" in accordance with NEMA MG 1-12.53. When the motor is so marked locked rotor protection is not provided by the winding over temperature protector. It is suggested that over current protection be used in the motor starter to insure locked rotor protection.

**! WARNING**

**MOTOR CONTROLLER MAY HAVE AUTOMATIC OR MANUAL OVERLOAD RESET. DISCONNECT ALL POWER LEADS TO MOTOR WHEN PERFORMING ANY WORK ON MOTOR OR DRIVEN EQUIPMENT.**

**A MANUAL, MOMENTARY START SWITCH IS REQUIRED TO PREVENT AUTOMATIC RESTART OF MOTOR WHEN THERMOSTAT RESETS.**

If current through the thermostat will exceed the values listed in Figure 2 an intermediate control circuit relay must be used to reduce the current or the thermostat will not work properly.

Purchase Moisture Detector Here

## MOISTURE DETECTION SYSTEM

### MOISTURE SENSING PROBES

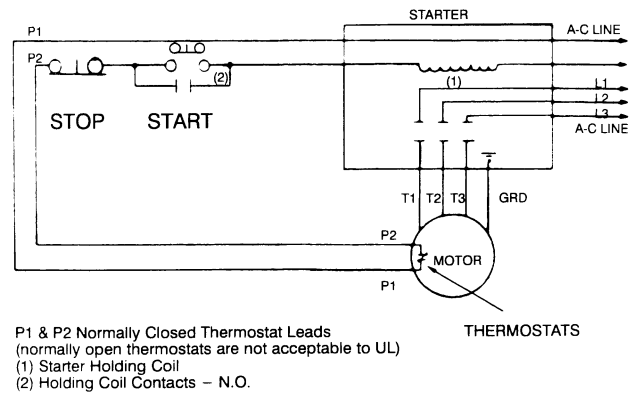
**! IMPORTANT**

**Reliance Submersible Pump Motors are equipped with moisture detection devices. Failure to properly connect or utilize this system voids motor warranty.**

Moisture sensing probes, leads marked W<sub>1</sub>, and W<sub>2</sub>, must be used in conjunction with an induction relay. This device will detect moisture entering the oil chamber due to failure of the outer seal and, when properly connected to a

### Alternating Current

Volts	Continuous Amperes	Inrush Amperes
110-120	3.0	30
220-240	1.5	15
440-480	0.75	7.5
550-600	0.6	6.0



**FIGURE 2  
TYPICAL THERMAL PROTECTOR  
WIRING DIAGRAM**

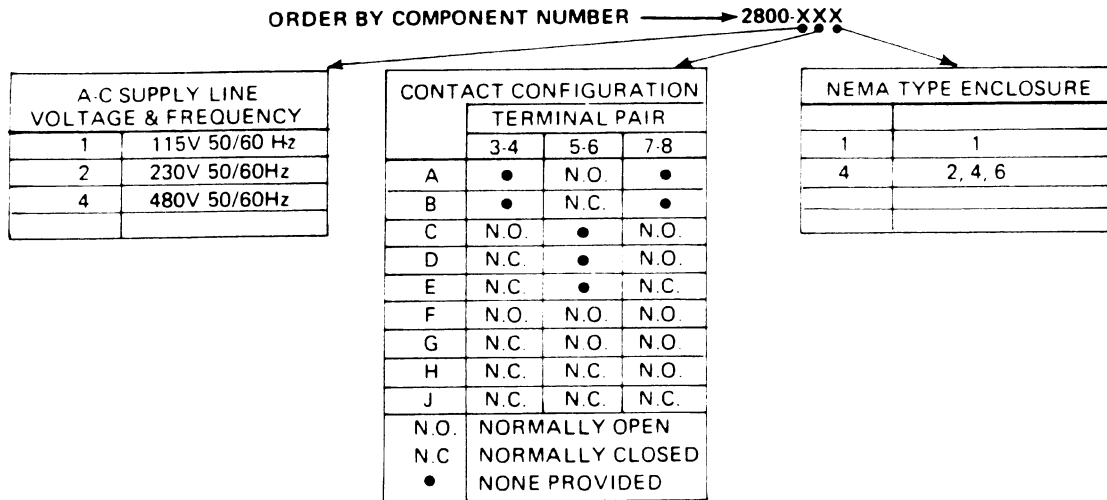
warning device, will provide notification of needed maintenance. Integrity of system requires periodic test.

### CONTROLS AND SIGNAL DEVICES

A control and signal device (not supplied by Reliance) must be installed at the job site to complete the moisture detection system.

**Compatible controls are available from:  
 Charles F. Warrick Co., Normandy Court,  
 Royal Oak, Michigan 48073, (810) 549-4900.**

## CONTROL SELECTION AND ORDERING FOR CHARLES F. WARRICK CO. CONTROLS



Line voltages are nominal values and may be anywhere from nominal minus 15% to nominal plus 10%.

# TYPE 2800-XXX MOTOR MOISTURE DETECTOR CONTROL

### INSTALLATION

All type 2800-XXX controls are identified by a specific component number which follows the format 2800-XXX where the X's are replaced by numbers and letters indicative of the A-C supply line voltage and frequency, contact configuration and enclosure. Each control has a data label on the right hand side of the terminal block. In addition, each enclosed control has another data label on the outside of the enclosure cover.

Mount the control on a vertical surface with the transformer on the left hand side and accomplish all indicated wiring. Terminals on the control are numbered and are in the same relative position as the terminals shown on the wiring diagram.

Terminal pair 1-2 must be continuously energized from an A-C supply line of electrical characteristics shown on the data label.

Contacts must be wired into the electrical load circuit(s) of the warning devices as required. Each contact used for load duty must be wired in series with the load and that series branch circuit connected across a power source compatible with the load.

Wiring must be provided from the moisture detector sensor probe leads of the RELIANCE ELECTRIC motor designated W1 and W2 to terminals 9 and 10 of the 2800-XXX control.

Control leads should not be installed in the same conduit as power leads. Induced voltage can cause false moisture signals.

**CONTACT OPERATION**

Normally open load contacts close and normally closed load contacts open when the sensor probes detect the influx of moisture within the motor.

**TEST PROCEDURE**

A normally closed pushbutton and neon indicating lamp are provided as means of checking the moisture sensing components.

When the pushbutton is depressed, the indicating lamp will be illuminated to indicate (A) power is supplied to the control, (B) the control is operative, and (C) wiring to the moisture sensing probes in the motor is intact. This procedure should be performed periodically to confirm integrity of circuit.

**SIGNAL DEVICES**

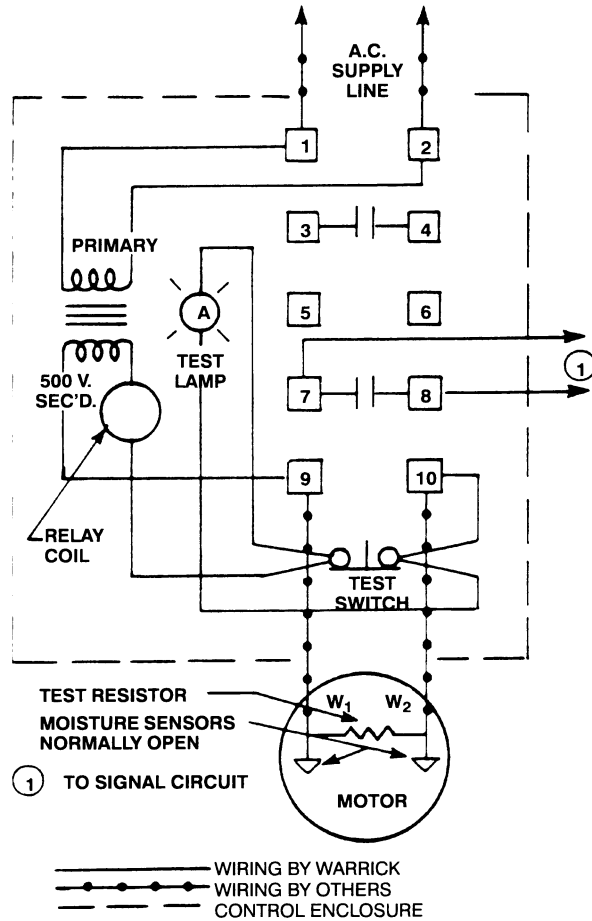
The signal device may be audible (bell, buzzer, horn or siren) or visible (incandescent or neon lamp) or both – a signal device of your choice may be obtained from your local electrical supply house.

**SYSTEM OPERATION**

It is recommended that upon indication (by warning light, etc.,) of outer seal failure that the motor be removed from the installation and the oil and outer seal be replaced as soon as possible.

If reconditioning is not performed within a 30 day period it is recommended that the inner seal be thoroughly inspected and replaced if required.

When ordering parts or reporting trouble give Sales Office complete Nameplate Data.

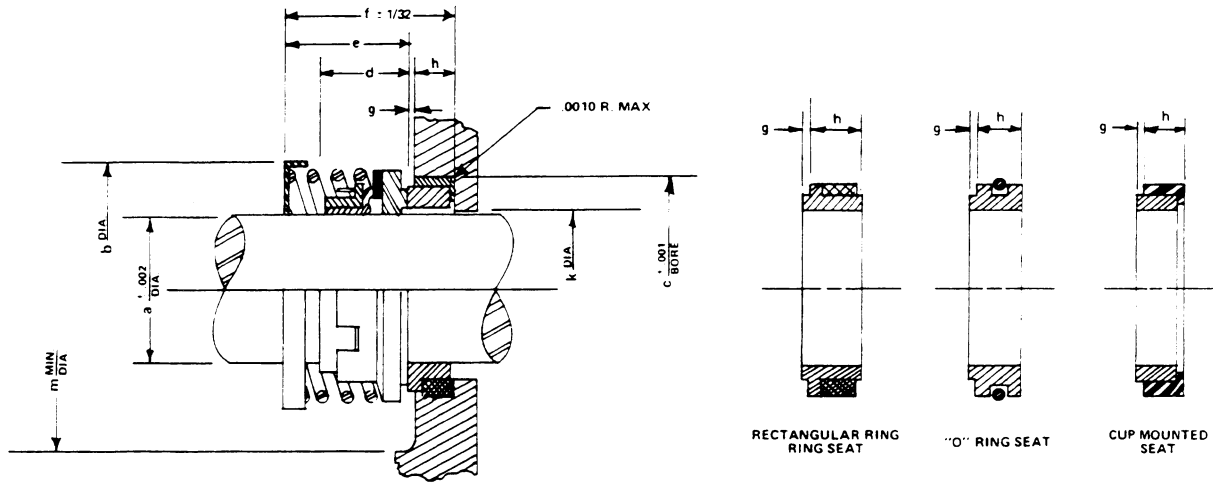


**FIGURE 3  
MOISTURE SENSING CIRCUIT  
TYPICAL WIRING DIAGRAM**

**LEAD COLOR CODING**

		BLACK LEAD	WHITE LEAD	RED LEAD	ORANGE LEAD	GREEN LEAD
Power Cable	Polyphase	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	—	Ground
	Single Phase	T <sub>1</sub>	T <sub>4</sub>	T <sub>A</sub>	—	Ground
Control Cable	All	P <sub>1</sub>	P <sub>2</sub>	W <sub>1</sub>	W <sub>2</sub>	Ground

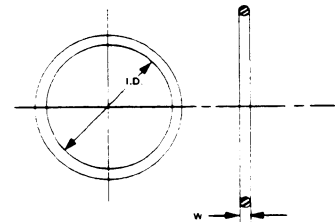
# STANDARD REPLACEMENT SEAL CROSS REFERENCE



PURCHASING SPECIFICATIONS													
Part No. 64262-	a	Crane Type Seal	Type Seat	Spring Code No.	b	c	d	e	f	g	h	k	m
12-A	1.250	T-21	Cup Ceramic	BP1C1	1-15/16	1.875	47/64	1-1/16	1-1/2	1/16	3/8	1-7/16	2-3/16
12-B	1.500	T-21	Cup Ceramic	BP1C1	2-3/16	2.125	47/64	1-1/8	1-9/16	1/16	3/8	1-11/16	2-3/16
12-C	1.750	T-21	Cup Ceramic	BP1C1	2-5/8	2.500	49/64	1-3/8	1-7/8	1/16	7/16	1-15/16	2-7/8
12-D	2.000	T-21	Cup Ceramic	BP1C1	2-7/8	2.750	49/64	1-1/2	2	1/16	7/16	2-3/16	3-3/16
12-E	2.250	T-21	Cup Ceramic	BP1C1	3-1/8	3.125	49/64	1-11/16	2-1/4	1/16	1/2	3-7/16	3-7/16
12-G	3.00	T-21	Cup Ceramic	BP1C1	4.00	4.125	2.687	2.062	2.687	0.06	0.56	3.19	4.50
18-F	2.75	T-21	Cup Ceramic	BP1C1	3.75	3.500	0.796	1.125	1.75	0.03	0.595	2.94	4.12
18-G	3.00	T-21	Cup Ceramic	BP1C1	4.00	3.875	0.796	1.125	1.75	0.06	0.56	3.19	4.50
18-N	2.75	T-21	Cup Ceramic	BP1C1	3.75	3.50	0.796	1.125	1.75	0.06	0.56	2.94	4.12
8-J	3.25	T-21	Cup Ceramic	BP1C1	4.84	4.125	2.187	2.187	2.968	0.06	0.69	3.44	4.88

# STANDARD REPLACEMENT "O" RING CROSS REFERENCE

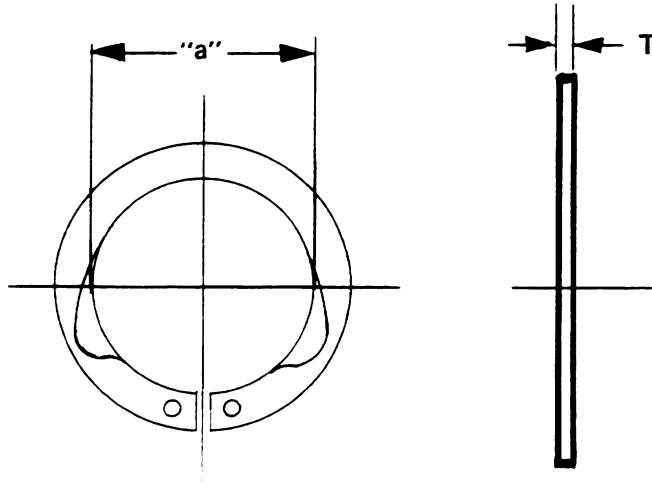
Part No. 421900	I.D.	Nominal W.	UL Listed Material	Approved Suppliers and Compound Number	
60-FU	3.750	0.139	BUNA N	National Seal	No. B-46A
72-FU	4.500	0.125	BUNA N	Parker Seal	N-219-7
94-FU	5.875	0.125	BUNA N	Precision Rubber	No. 1197
100-FU	6.250	0.125	BUNA N	Crane Packing	No. 2561
124-FU	7.750	0.125	BUNA N		
144-FU	9.000	0.125	BUNA N		
168-FU	10.500	0.125	BUNA N		
192-FU	12.000	0.125	BUNA N		
208-FU	13.000	0.140	BUNA N		
240-FU	15.000	0.140	BUNA N		



TO BE USED AT 9-1/2 I.D.  
@ 3/32 NOM. THICKNESS

# STANDARD REPLACEMENT SNAP RING CROSS REFERENCE

Part No. 47174-5-	a	T	Shaft Size	Waldes Catalog Number	Remarks
A	1.156 + .010 - .015	.050 ± .002	1-1/4	5108-125-H	#420 Stainless
B	1.387 + .010 - .015	.050 ± .002	1-1/2	5108-150-H	#420 Stainless
C	1.637 + .013 - .020	.062 ± .003	1-3/4	5108-177-H	#420 Stainless
D	1.850 + .013 - .020	.062 ± .003	2	5108-200-H	#420 Stainless
E	2.081 + .015 - .025	.078 ± .003	2-1/4	5108-225-H	#420 Stainless
H	2.543 + .015 - .025	.093 ± .003	2-3/4	5100-275-H	#420 Stainless
F	2.775 + .020 - .030	.093 ± .003	3	5100-300-H	#420 Stainless
G	3.006 + .020 - .030	.093 ± .003	3-1/4	5100-325-H	#420 Stainless



NOTE: *Outer shaft seal must be in liquid when motor is operated, whether motor is submerged or in air.*

*Seals cannot be run in a dry environment without a significant reduction in seal life.*



Reliance Electric / 24701 Euclid Avenue / Cleveland, Ohio 44117 / (216) 266-7000

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## Series 1 – Electromechanical Controls

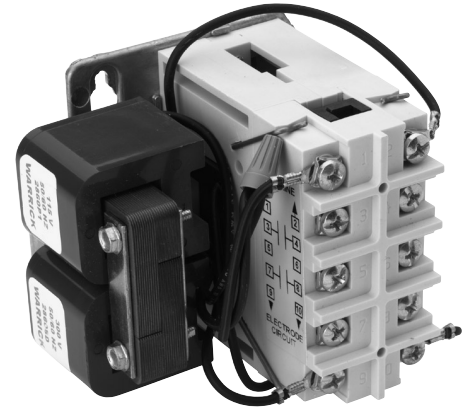
- ▶ 2 or 3 Pole Output Contact
- ▶ U.L. “Limit Control”
- ▶ Up to 20K Ohms/cm Sensitivity
- ▶ U.L. “Motor Control”

One of Warrick’s first products, Series 1 electromechanical controls offer 2 or 3 pole output contacts with 16 amp rating. These versatile controls can be configured for single level service, differential control, low water cutoff (with manual reset or lock out capability) control and many other functions.

### Specifications

<b>Contact Design</b>	2 or 3 pole, single throw, electromechanical relay
<b>Contact Rating (110 VAC)</b>	16 amp Resistive 1 hp
<b>Mode of Operation</b>	Direct only
<b>Sensitivity</b>	0 - 20K ohm maximum, factory set
<b>Primary Voltage</b>	24 VAC, 115 VAC, 230 VAC, 460 VAC, 575 VAC (+10%/-15%)
<b>Power Consumption</b>	4 watts (15 VA)
<b>Secondary Voltage</b>	25 VAC, 75 VAC, 150 VAC, 300 VAC, 500 VAC*
<b>Temperature</b>	-30°F to 130°F
<b>Approvals</b>	U.L. Rec., FM, CSA, U.L. Listed Limit Control, U.L. 353
<b>Connections</b>	All screw type connections

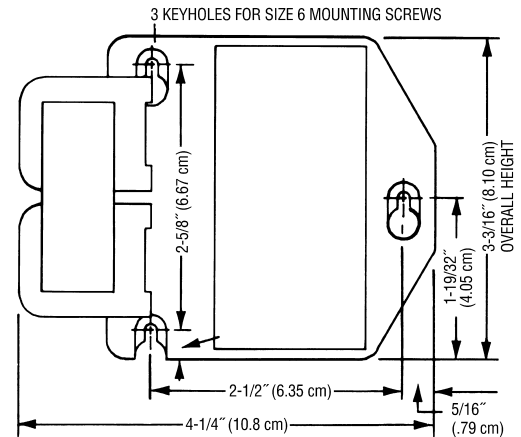
\* Due to high secondary voltage, if personnel can come in contact with electrodes, we suggest using Series 16, 26 or 19 controls.



### Applications

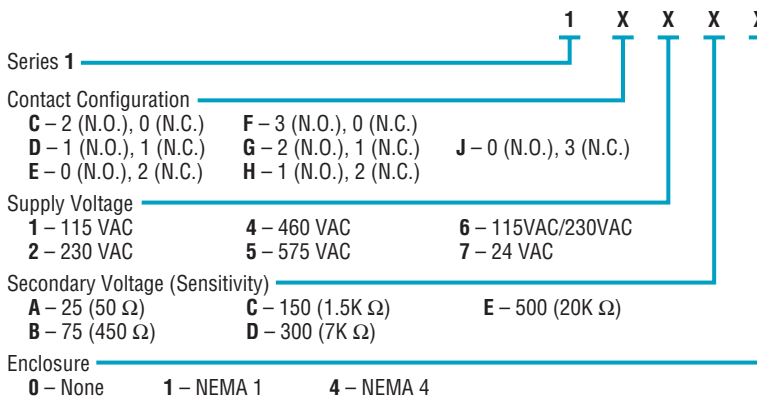
- General Purpose
- On/Off Control
- Pump Control
- Boiler Level Control
- Boiler LLCO

### Dimensions

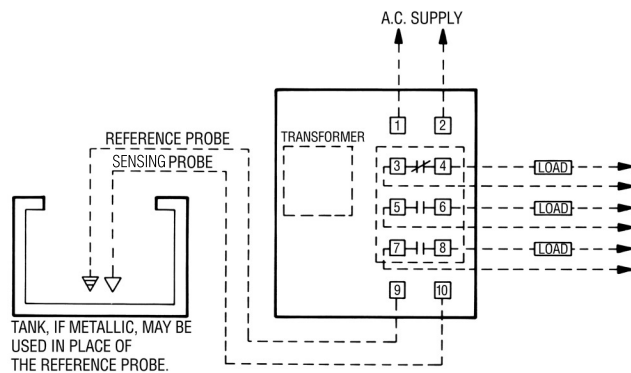


### How to Order

Use the **Bold** characters from the chart below to construct a product code.

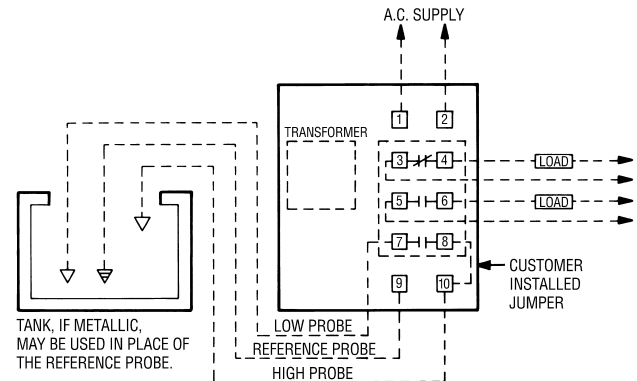


### Typical Single Level Wiring



- Notes:
1. Load contacts shown are non-powered.
  2. Series 1 shown in these diagrams is G configuration.

### Typical Differential Wiring



# Warrick® Series 1 Electromechanical Controls Installation and Operation Bulletin

This bulletin should be used by experienced personnel as a guide to the installation of Series 1 controls. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Gems Sensors or its representatives if further information is required.

## IMPORTANT!

**Before proceeding to install the control, Read and thoroughly understand these instructions.**

## General

Series 1 controls are simple, industrial type controls for low sensitivity applications. They contain 2 or 3 pole contacts with high contact ratings. The transformer/relay combinations allow for multiple primary and secondary voltages. They are suitable for use in non-hazardous locations with conductive liquids less than 20,000 Ohm/cm specific resistance.

## Specifications

**Control Design:** Electrical-Mechanical level relay for use with conductivity probes.

**Contact Design:** 2 or 3 SPST (Non-Powered): Offered in both N.O. and N.C. - See contact configuration chart.

**Contact Rating:** 16A @ 115VAC; 8A @ 230VAC, 1H.P. @ 115 of 230 VAC

**Supply Voltage:** 24, 115, 230, 460, 575 nominal, plus 10%, minus 15%, 50/60 Hz.

**Supply Current:** 115, 230, 460, 575 VAC, Relay energized draws 15VA.

**Secondary Voltage:** 25, 75, 150, 300, 500 VAC RMS with open circuit on probes.

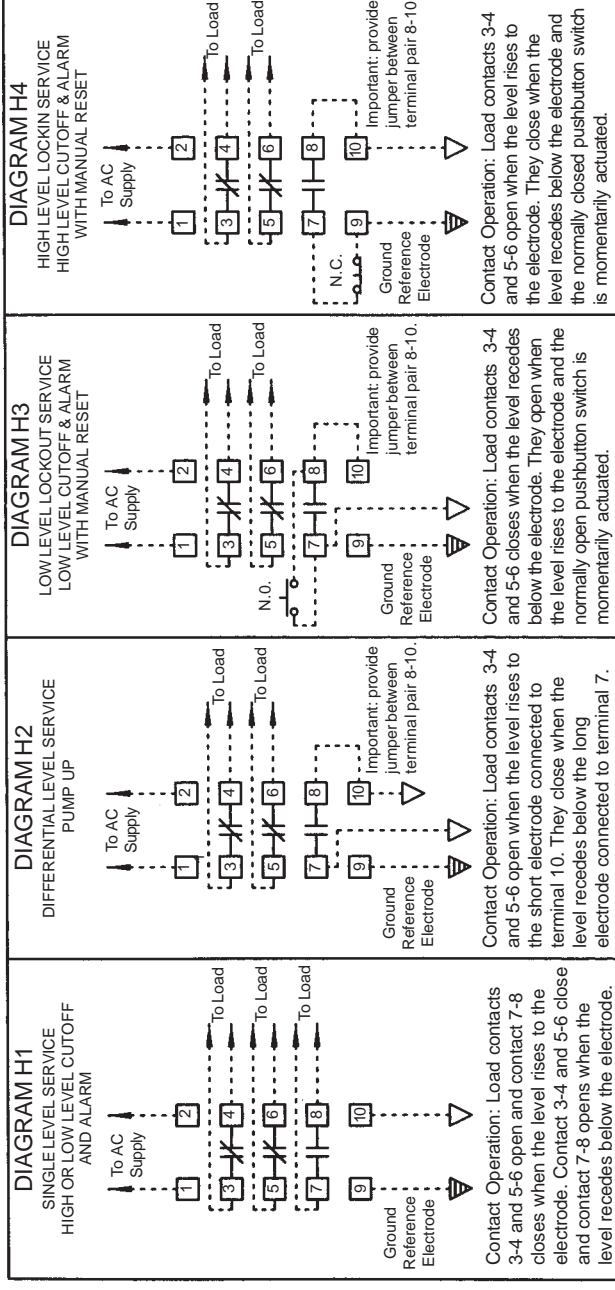
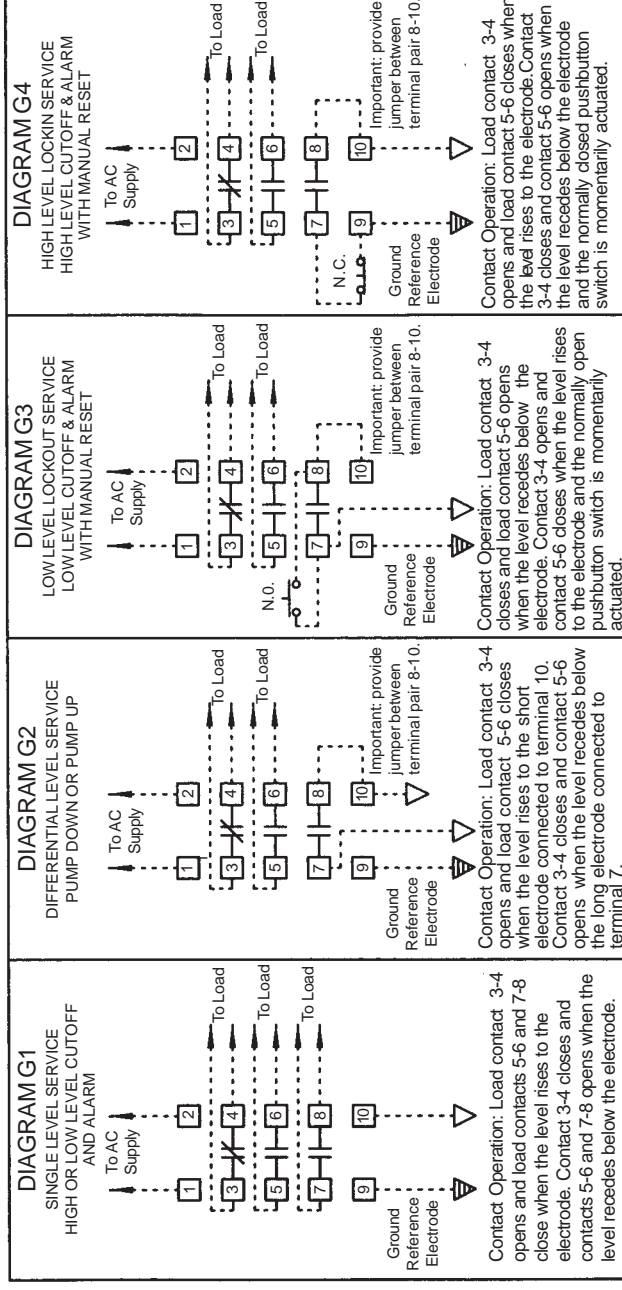
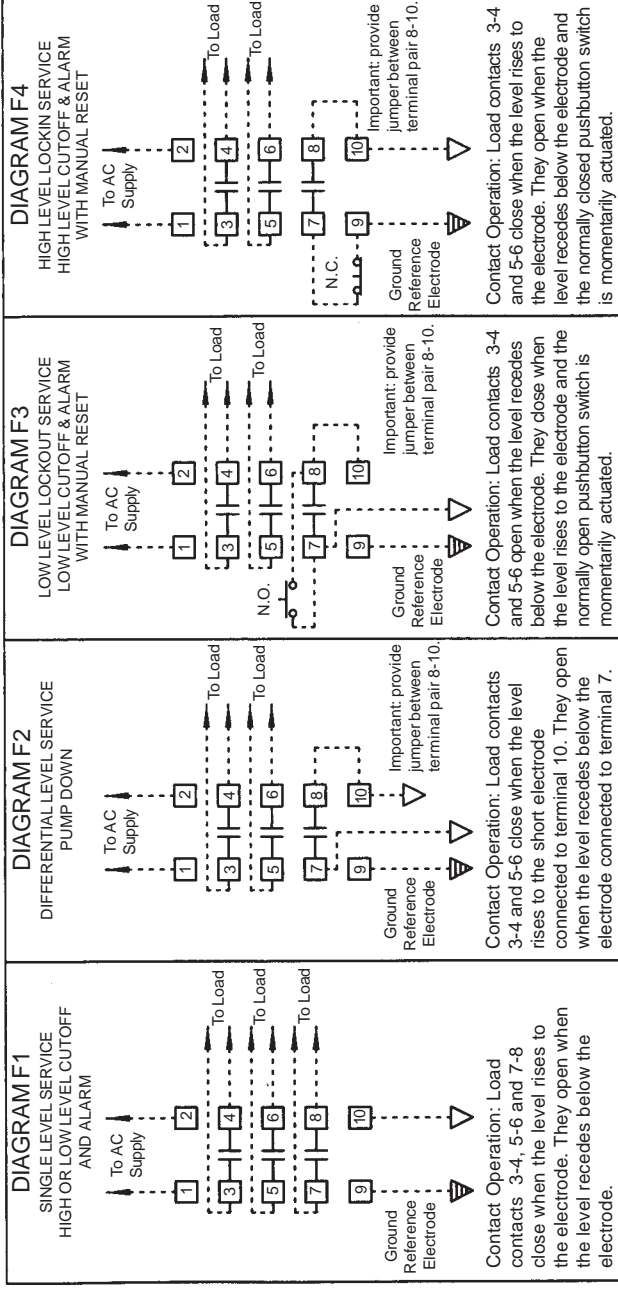
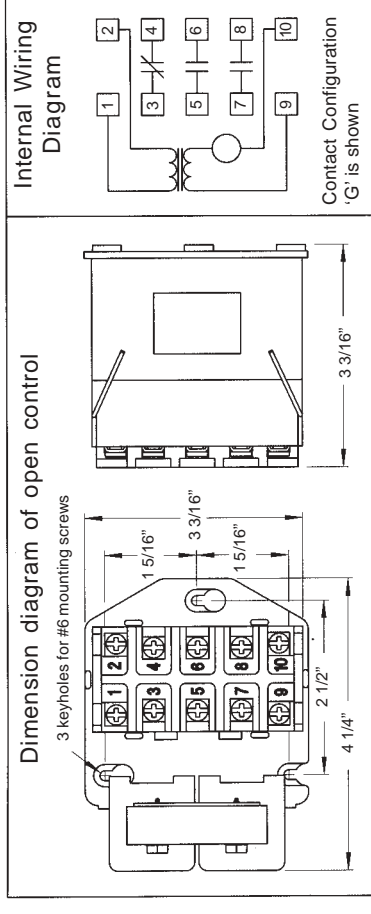
**Secondary Current:** 6VA with short circuited electrode circuit.

**Sensitivity:** Models operate from 50 to 20,000 OHM maximum specific resistance – Factory Set.

**Temperature:** -30 to +130°F ambient.  
**Terminals:** #8 pan head screw with captivated wire clamping plate. Maximum of 1 – #12 or 2 – #14 AWG prepared wires per terminal. Use prepared conductors only, when wiring this control.

**Time Delays:** NONE

**Listings:** Open Type – UL recognized, Enclosed Type – UL Listed (File MP1430, Limit Control) CSA – Motor Control, Open or Enclosed



## Application Table

Basic Service	Function	**Required Electronics	Wiring Diagram	Contacts <sup>^^</sup>	
				Symbol <sup>^</sup>	N.O.
Single Level	High Level Alarm or Low Level Cutoff	2	C-1	C	2
	High Level Cutoff or Low Level Alarm	2	E-1	F	3
			J-1	E	0
			D-1	J	0
High or Low Level Cutoff or Alarm	2	G-1	D	1	
		H-1	G	2	
		C-2	H	1	
		F-2	H	1	
Differential Level	Pump Down	3	C-2	C	2*
	Pump Up	3	D-2	F	3*
			H-2	D	1*
Low Level Lockout	Pump Down or Pump Up	3	G-2	G	2*
	Low Level Alarm with Manual Reset	2	D-3	D	1*
	Low Level Alarm with Manual Reset	2	H-3	H	1*
High Level Lockout	Low Level Cutoff with Manual Reset	2	C-3	C	2*
	Low Level Cutoff and Alarm with Manual Reset	2	F-3	F	3*
			G-3	G	2*
	High Level Alarm with Manual Reset	2	C-4	C	2*
High Level Lockout	High Level Cutoff with Manual Reset	2	D-4	D	1*
	High Level Cutoff and Alarm with Manual Reset	2	H-4	H	1*

\* One normally open contact required to seal electrode circuit. Number of normally open contacts available for load duty therefore one less than figure indicated.

\*\* Terminal 9 of control assumed connected to a reference electrode. Terminal 9 may be grounded to the vessel if the vessel is metallic.

^ Letters represent 2nd place symbol in the component number of the control.

^^ All contacts available for load duty unless otherwise indicated by footnote.

### Mounting and Wiring Instructions

The Series 1 control may be wired in various ways. Select the wiring diagram, on pages 3 and 4, that matches the contact configuration of your model number and your application. The Application Table on this page can assist you in determining which wiring diagram to use.

**The Series 1 control must be mounted on a vertical surface with the transformer on the left-hand side.** The control should be mounted in an enclosure of proper Nema integrity and wired following N.E.C. and local codes. Terminals on the control are numbered and are in the same relative position as the terminals shown in the wiring diagrams.

Each control has a data label on the right hand side of the terminal block. Terminal pair 1-2 must be continuously energized from an AC supply line of the same electrical characteristics as shown on the data label. Each dry contact used for load duty must be wired in series with the load, and that series branch connected across a power source compatible with the load.

### Grounding:

Series 1 controls mounted in an enclosure have a grounding terminal and wires provided for adequate grounding of the control and conduit entrances to any external metal parts that may become energized. Conduit connections on fiberglass enclosures must be connected via the green ground wire provided for in the enclosure. **Caution:** Bonding between conduits must be made.

Wiring must be provided to the electrodes as shown. Terminal 9 is a reference electrode termination and may be grounded to the vessel if the vessel is metallic. When the vessel is non-metallic, terminal 9 must be connected to an additional electrode of a length equal to, or longer than, the longest electrode used in the vessel. If the electrode fitting used has a metallic body and is supported directly upon a metallic vessel, the ground reference connection is facilitated by securing that end of the reference conductor beneath the head of one of the four screws which fasten the terminal housing to the body of the fitting. The jumper between terminal pair 8-10 and the pushbutton switch wiring on diagrams X2, X3 and X4 are required field connections.

The control-to-fitting wire distance should not exceed those listed in the secondary voltage chart located on page 3.

## Series 1 X X X X X

Contact Configuration		AC Line Voltage		Secondary Voltage		Enclosure		Options			
Letter	N.O.	#	Voltage	Letter	Sec. Volts	Sensitivity	Dist/FT.*	#	Type	Letter	Type
C	2	0	115 VAC	A	25	50	75.000	0	OPEN	A	N.O. Reset Sw.
D	1	1	230 VAC	B	75	450	7.500	1	NEMA 1	C	N.C. Reset Sw.
E	0	2	460 VAC	C	150	1.5K	1.750	4	NEMA 4		
F	3	0	575 VAC	D	300	7.0K	500				
G	2	1	115/230 VAC	E	500	20.0K	150				
H	1	2	24 VAC								
J	0	3									

\* Distance based on 14 AWG wire type THHN or MTW

**Note:** For liquids of known specific resistance choose a sensitivity greater than and closest to that value in ohm/cm.

## Dashed Lines Represent Field Wiring

