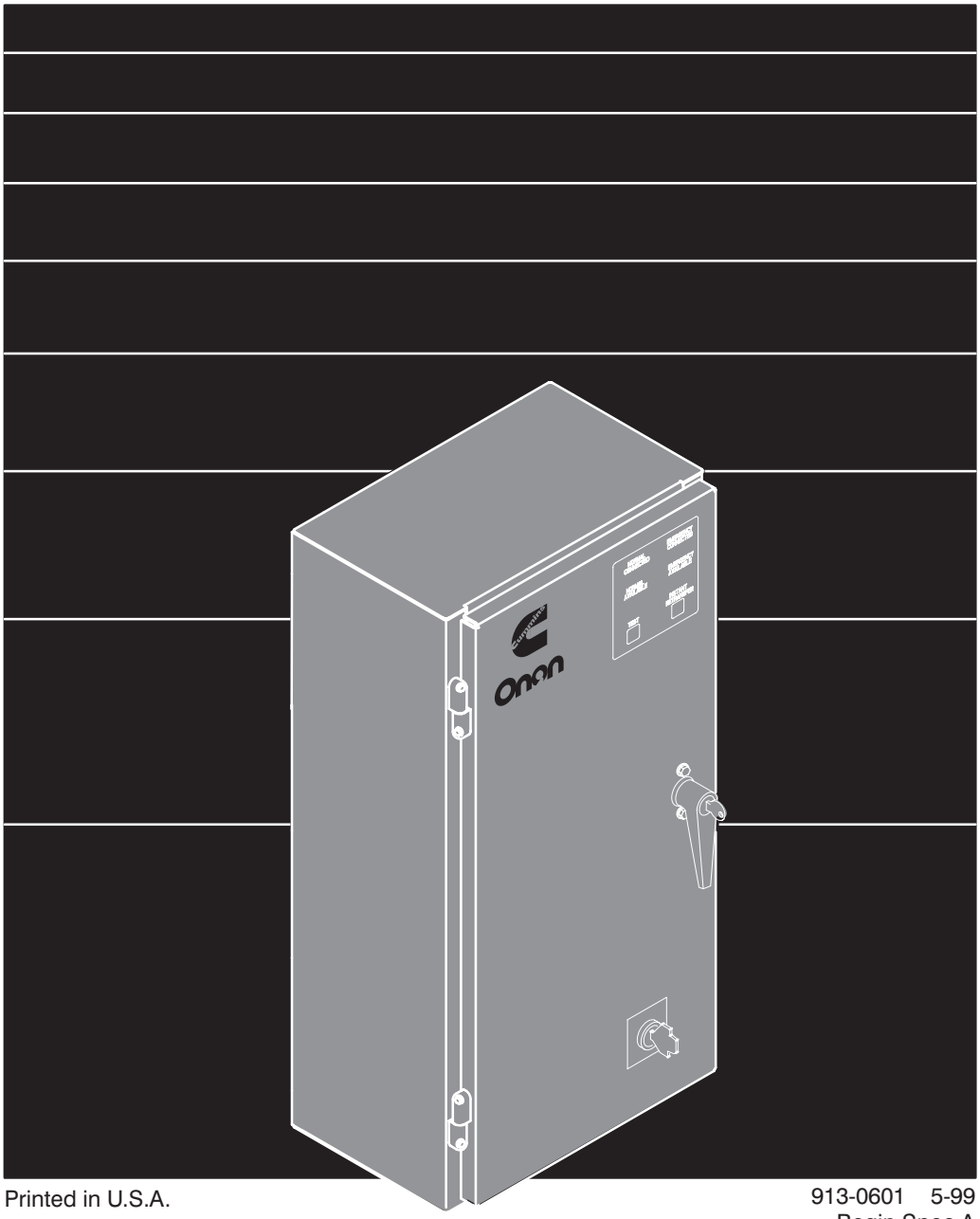
Installation Manual

LC
Automatic Transfer Panel
80 to 500 Amperes
Utility-to-Generator Set



Printed in U.S.A.

913-0601 5-99
Begin Spec A

Table of Contents

⚠WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN DEATH, SEVERE PERSONAL INJURY, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

Supplement 913-1115
Date: 3/2000
Insert with-
Title: LT III 30-260 Amp Installation Manual
Number (Date): 913-0600B (12-98)
Title: LC 80-500 Amp Installation Manual
Number (Date): 913-0601 (5-99)
Title: RST 60/100/200 Amp Installation Manual
Number (Date): 913-0602 (6-99)

PURPOSE

This Supplement is provided for Models LT III, LC and RST Transfer Switches equipped with 2-amp battery chargers rated at 12 or 24 VDC. The Float Voltage Adjustment for these battery chargers was not specified in the Installation manuals.

LT III INSTALLATION MANUAL 913-0600B ADDITIONS

1. Insert this cover sheet behind the front cover of the manual.
2. Add page 4-9 and 4-10 to Section 4: Setup and Calibration

LC INSTALLATION MANUAL 913-0601 ADDITIONS

1. Insert this cover sheet behind the front cover of the manual.
2. Add pages 4-9 and 4-10 to Section 4: Setup and Calibration

RST INSTALLATION MANUAL 913-0602 ADDITIONS

1. Insert this cover sheet behind the front cover of the manual.
2. Add pages 4-7 and 4-8 to Section 4: Setup and Calibration

Sheets Attached:
- 4-9 and 4-10 for LT III Manual
- 4-9 and 4-10 for LC Installation Manual
- 4-7 and 4-8 for RST Installation Manual

FLOAT BATTERY CHARGER

The float-charge battery charger regulates its charge voltage to continuously charge the battery. As the battery approaches full charge, the charging current automatically tapers to zero amperes or to steady-state load on the battery.

NOTE: The pulsing meter indicates the charger is working.

The battery charger is rated for 2 amperes at 12 or 24 VDC.

Power to the battery charger is supplied directly from the Normal source L1 and L3 (Figure 4-9). The output of the battery charger is connected to the GND and B+ terminals of TB2 (or TB3 if the 3-Wire Start module is used). Refer to sheet 2 of the schematic and wiring diagram package.

For Open Construction panels, power to the battery charger is supplied at TB1, terminals 1 and 4.

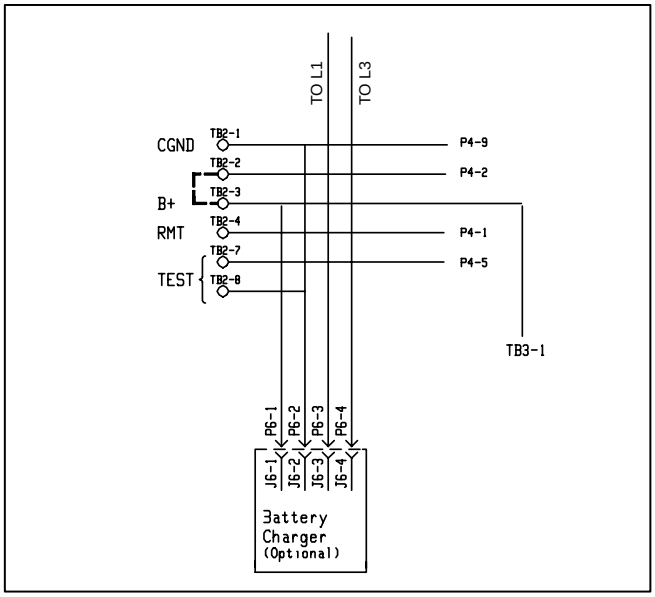


FIGURE 4-9. BATTERY CHARGER WIRING

Battery Charger Float Voltage

The float voltage is set at the correct value at the factory and should not require adjustment. However, if the battery shows signs of being overcharged or undercharged, the float voltage can be adjusted. A high specific gravity, bubbling of electrolyte, and loss of water indicate a high float voltage. A low specific gravity indicates a low float voltage.

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.***

To change the float voltage, a fully charged battery, a hydrometer, a small screwdriver, and an accurate voltmeter (0.5% accuracy) are needed. Use the following procedures to adjust the float voltage.

⚠ CAUTION ***Do not attempt to adjust or test battery charger with a deeply discharged battery. Use a fresh, fully charged battery when adjusting or testing the charger to obtain accurate results.***

⚠ CAUTION ***Always disconnect the battery charger from its AC source (remove the charger's AC input fuses) before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage DC control circuits.***

1. Turn the operation selector for the generator set to Stop and disconnect the starting battery (negative [-] lead first).

   The selector switch is located on the generator set control panel on two-wire start systems and on 3-Wire Start module on three-wire start systems.

2. Connect the fully charged battery (negative [-] lead last) to the generator set and verify the charge condition with the hydrometer.

   A fully charged lead-acid battery will have a specific gravity of 1.260 at 77° F (25° C).

3. Connect the voltmeter directly to the battery terminals and measure the voltage.

   Make sure the 12/24 volt selector switch is in the correct position.

4. Compare the voltage reading with the value shown in Table 4-1. If the voltage is above or below the recommended float voltage, open the cabinet door and adjust as specified in step 5. If the voltage is correct, proceed to step 7.

TABLE 4-1. BATTERY FLOAT VOLTAGES

Lead-Acid Batteries	
Battery Voltage	**Float Voltage**
12	13.3
24	26.6
Nickel-Cadmium Batteries	
Float Voltage Charge Per Cell 1.38 to 1.45 volts	
Example: Float charge for 10 cell battery should be 13.8 to 14.5 volts.	

5. Use a small screwdriver to turn the adjustment potentiometer (located on charger panel) counterclockwise to decrease the float voltage and clockwise to increase the float voltage. Adjust in small steps and wait five minutes for the voltage to stabilize before making additional adjustments.

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Avoid touching electrical contacts. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

6. When adjustments are complete, close and lock the transfer switch cabinet door.

7. Disconnect the voltmeter from the battery terminals and disconnect the test battery (negative [-] lead first) from the generator set.

8. Reconnect the generator set starting battery (negative [-] lead last) and place the operation selector switch in the Auto (three-wire start) or Remote (two-wire start) position.

FLOAT BATTERY CHARGER

The float-charge battery charger regulates its charge voltage to continuously charge the battery. As the battery approaches full charge, the charging current automatically tapers to zero amperes or to steady-state load on the battery.

NOTE: The pulsing meter indicates the charger is working.

The battery charger is rated for 2 amperes at 12 or 24 VDC.

Power to the battery charger is supplied directly from the Normal source L1 and L3 (Figure 4-9). The output of the battery charger is connected to the GND and B+ terminals of TB2 (or TB3 if the 3-Wire Start module is used). Refer to sheet 2 of the schematic and wiring diagram package.

For Open Construction panels, power to the battery charger is supplied at TB1, terminals 1 and 4.

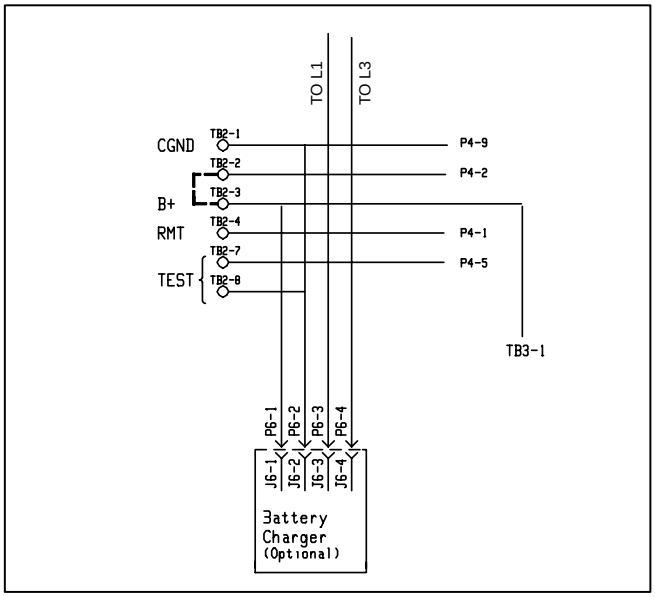


FIGURE 4-9. BATTERY CHARGER WIRING

Battery Charger Float Voltage

The float voltage is set at the correct value at the factory and should not require adjustment. However, if the battery shows signs of being overcharged or undercharged, the float voltage can be adjusted. A high specific gravity, bubbling of electrolyte, and loss of water indicate a high float voltage. A low specific gravity indicates a low float voltage.

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.***

To change the float voltage, a fully charged battery, a hydrometer, a small screwdriver, and an accurate voltmeter (0.5% accuracy) are needed. Use the following procedures to adjust the float voltage.

⚠CAUTION ***Do not attempt to adjust or test battery charger. Use a fresh, fully charged battery when adjusting or testing the charger to obtain accurate results.***

⚠CAUTION ***Always disconnect the battery charger from its AC source (remove the charger's AC input fuses) before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage DC control circuits.***

1. Turn the operation selector for the generator set to Stop and disconnect the starting battery (negative [-] lead first).

   The selector switch is located on the generator set control panel on two-wire start systems and on 3-Wire Start module on three-wire start systems.

2. Connect the fully charged battery (negative [-] lead last) to the generator set and verify the charge condition with the hydrometer.

   A fully charged lead-acid battery will have a specific gravity of 1.260 at 77° F (25° C).

3. Connect the voltmeter directly to the battery terminals and measure the voltage.

   Make sure the 12/24 volt selector switch is in the correct position.

4. Compare the voltage reading with the value shown in Table 4-1. If the voltage is above or below the recommended float voltage, open the cabinet door and adjust as specified in step 5. If the voltage is correct, proceed to step 7.

TABLE 4-1. BATTERY FLOAT VOLTAGES

Lead-Acid Batteries	
Battery Voltage	**Float Voltage**
12	13.3
24	26.6
Nickel-Cadmium Batteries	
Float Voltage Charge Per Cell 1.38 to 1.45 volts Example: Float charge for 10 cell battery should be 13.8 to 14.5 volts.	

5. Use a small screwdriver to turn the adjustment potentiometer (located on charger panel) counterclockwise to decrease the float voltage and clockwise to increase the float voltage. Adjust in small steps and wait five minutes for the voltage to stabilize before making additional adjustments.

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Avoid touching electrical contacts. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

6. When adjustments are complete, close and lock the transfer panel cabinet door.

7. Disconnect the voltmeter from the battery terminals and disconnect the test battery (negative [-] lead first) from the generator set.

8. Reconnect the generator set starting battery (negative [-] lead last) and place the operation selector switch in the Auto (three-wire start) or Remote (two-wire start) position.

FLOAT BATTERY CHARGER

The float-charge battery charger regulates its charge voltage to continuously charge the battery. As the battery approaches full charge, the charging current automatically tapers to zero amperes or to steady-state load on the battery.

NOTE: The pulsing meter indicates the charger is working.

The battery charger is rated for 2 amperes at 12 or 24 VDC.

Power to the battery charger is supplied directly from the Normal source through connector J6/P6. The output of the battery charger is connected to the GND and B+ terminals of TB2 (or TB3 if the 3-Wire Start module is used). Refer to sheets 2 and 4 of the schematic and wiring diagram package.

Battery Charger Float Voltage

The float voltage is set at the correct value at the factory and should not require adjustment. However, if the battery shows signs of being overcharged or undercharged, the float voltage can be adjusted. A high specific gravity, bubbling of electrolyte, and loss of water indicate a high float voltage. A low specific gravity indicates a low float voltage.

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark, arc, or flame while servicing batteries.***

To check and adjust the float voltage, the following tools are needed:

- a fully charged test battery
- a hydrometer
- a small screwdriver
- an accurate voltmeter (0.5% accuracy

Checking the voltage: Use the following procedures to check the float voltage.

⚠CAUTION ***Do not attempt to adjust or test the battery charger with a deeply discharged battery. Use a fresh, fully charged battery when adjusting or testing the charger.***

⚠CAUTION ***Always disconnect the battery charger from its AC source (remove the charger's AC input fuses) before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage DC control circuits.***

1. Turn the operation selector switch for the generator set to OFF and disconnect the starting battery (negative [-] lead first).

   The selector switch is located on the generator set control panel on two-wire start systems and on 3-Wire Start module on three-wire start systems.

2. Connect the fully charged battery (negative [-] lead last) to the generator set and verify the charge condition with the hydrometer.

   A fully charged lead-acid battery will have a specific gravity of 1.260 at 77° F (25° C).

3. Connect the voltmeter directly to the battery terminals and measure the voltage.

   Make sure the 12/24 volt selector switch is in the correct position.

4. Compare the voltage reading with the value shown in Table 4-1. If the voltage is above or below the recommended float voltage, open the cabinet door and adjust as specified in Step 5. If the voltage is correct, proceed to Step 7.

5. Use a small screwdriver to turn the adjustment potentiometer (located on charger panel) counterclockwise to decrease the float voltage and clockwise to increase the float voltage. Adjust in small steps and wait five minutes for the voltage to stabilize before making additional adjustments.

   ⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Avoid touching electrical contacts. Do not wear jewelry or loose clothing. Stand on a dry, non-conductive surface such as a rubber mat or wooden platform.***

6. When adjustments are complete, close and lock the transfer panel cabinet door.

7. Disconnect the voltmeter from the battery terminals and disconnect the test battery (negative [-] lead first) from the generator set.

8. Reconnect the generator set starting battery (negative [-] lead last) and place the operation selector switch in the Auto (three-wire start) or Remote (two-wire start) position.

TABLE 4-1. BATTERY FLOAT VOLTAGES

Lead-Acid Batteries	
Battery Voltage	**Float Voltage**
12	13.3
Nickel-Cadmium Batteries	
Float Voltage Charge Per Cell 1.38 to 1.45 volts Example: Float charge for 10 cell battery should be 13.8 to 14.5 volts.	

Safety Precautions

This manual includes the following symbols to indicate potentially dangerous conditions. Read the manual carefully and know when these conditions exist. Then take the necessary steps to protect personnel and the equipment.

⚠ DANGER ***This symbol warns of immediate hazards that will result in severe personal injury or death.***

⚠WARNING ***This symbol refers to a hazard or unsafe practice that can result in severe personal injury or death.***

⚠CAUTION ***This symbol refers to a hazard or unsafe practice that can result in personal injury or product or property damage.***

High voltage in transfer panel components presents serious shock hazards that can result in severe personal injury or death. Read and follow these suggestions.

Keep the transfer panel cabinet closed and locked. Make sure only authorized personnel have the cabinet and operational keys.

Due to the serious shock hazard from high voltages within the cabinet, all service and adjustments to the transfer panel must be performed only by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

1. Move the operation selector switch on the generator set or Stop/Auto/Handcrank switch on the automatic transfer panel (whichever applies) to Stop.
2. Disconnect the starting batteries of the generator set (remove the ground [–] lead first).
3. Remove AC power to the automatic transfer panel. If the instructions require otherwise, use extreme caution due to the danger of shock hazard.

Place rubber insulative mats on dry wood platforms over metal or concrete floors when working on any electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling any electrical equipment.

Jewelry is a good conductor of electricity and should be removed when working on the electrical equipment.

Do not work on this equipment when mentally or physically fatigued, or after consuming alcohol or any drug that makes the operation of equipment unsafe.

1. Introduction

INSTALLATION MANUAL

This manual provides information necessary for installation of an LC transfer panel.

TRANSFER PANEL APPLICATION

Transfer panels are an essential part of a building's standby or emergency power system. The Normal power source, commonly the utility line, is backed up by an Emergency power source, often an electric generating set. A transfer panel supplies the electrical load with power from one of these two power sources.

The load is connected to the common of the transfer panel (Figure 1-1). Under normal conditions, the load is supplied with power from the Normal source (as illustrated). If the Normal power source is interrupted, the load is transferred to the Emergency power source. When Normal power returns, the load is retransferred to the Normal power source. The transfer and retransfer of the load are the two most basic functions of a transfer panel.

TRANSFER PANEL PROTECTION

Transfer panels are continuously rated devices. With proper maintenance, they will carry load currents up to their nameplate ratings for any time duration. Transfer panels are designed to withstand normally occurring surge currents from electrical devices in their load circuits. They are also designed to withstand the surge currents, which can occur on a short circuit or fault condition, as long as the available fault current does not exceed the rating of the panel and it's protective device, and the transfer panel is installed with proper protective equipment.

All automatic transfer panels are required to be installed with appropriate overcurrent protection on the normal source side of the transfer panel, and on the emergency source side of the panel (Figure 1-1). Protective devices may be circuit breakers, fuses, or other suitable overcurrent protective system components. A list of allowable protective equipment is affixed to the transfer panel. The listed protective device must be installed at some point in the circuit between the transfer panel and the electrical services that feed the device.

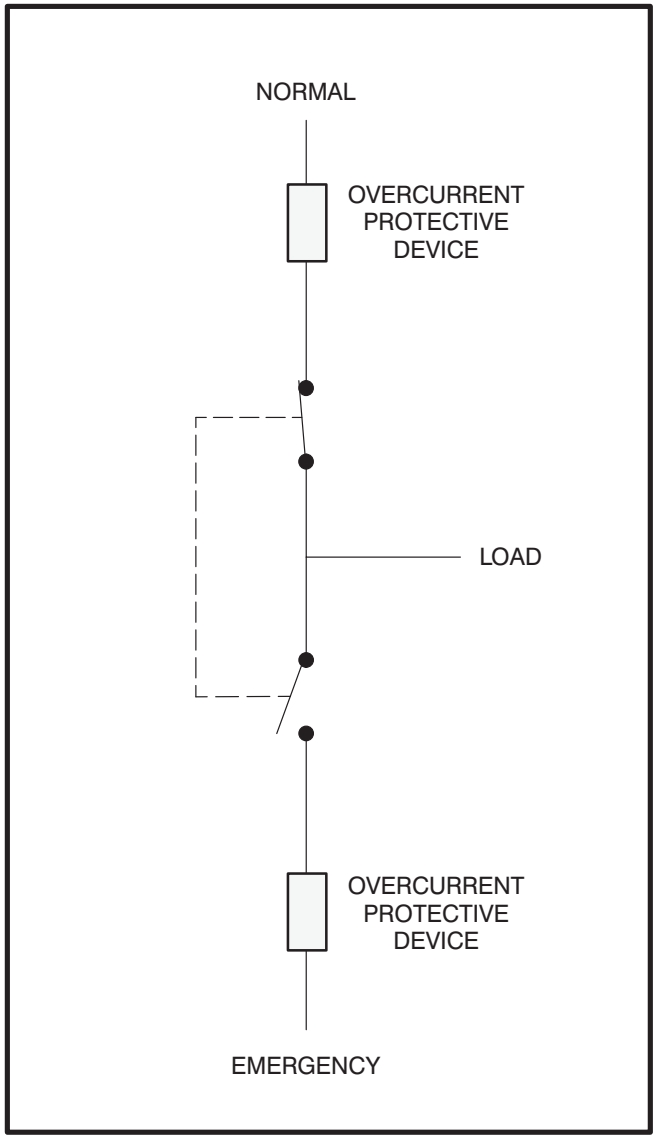


FIGURE 1-1. LOAD TRANSFER PANEL (TYPICAL FUNCTION)

AUTOMATIC TRANSFER PANELS

Automatic transfer panels, capable of automatic operation without operator involvement, perform the following basic functions:

1. Sense the interruption of the Normal power source.
2. Send a start signal to the generator set (Emergency power source).
3. Transfer the load to the Emergency power source.
4. Sense the return of the Normal power source.
5. Retransfer the load to the Normal power source.
6. Send a stop signal to the generator set.

MODEL IDENTIFICATION

Identify your model by referring to the Model and Specification number as shown on the nameplate. Electrical characteristics are shown on the lower portion of the nameplate, which is located on the cabinet door.

If it is necessary to contact a dealer or distributor regarding the transfer panel, always give the complete Model, Specification, and Serial number. This information is necessary to properly identify your unit among the many types manufactured.

HOW TO OBTAIN SERVICE

When the transfer panel requires servicing, contact your nearest dealer or distributor. Factory-trained Parts and Service representatives are ready to handle all your service needs.

If unable to locate a dealer or distributor, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS-ELECTRIC,
ENGINES-GASOLINE OR DIESEL, OR
RECREATIONAL VEHICLES-EQUIPMENT,
PARTS AND SERVICE.

For the name of your local Cummins®/Onan® or Onan-only distributor in the United States or Canada, call 1-800-888-ONAN. (This automated service utilizes touch-tone phones only.) By entering your area code and the first three digits of your local telephone number, you will receive the name and telephone number of the distributor nearest you.

For the name of your local Cummins-only distributor, or if you need more assistance, please call Onan Corporation, 1-612-574-5000, 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday.

When contacting your distributor, always supply the complete Model Number and Serial Number as shown on the nameplate.

2. Mounting

LOCATION

The location of the transfer panel varies with the application. The location and wiring must comply with the contract drawings.

There must be a service disconnect in the commercial power line ahead of the transfer panel.

A typical installation is shown in Figure 2-1. Cabinet dimensions are listed in Table 2-1.

Choose a vibration-free mounting surface that will support the weight of the panel. Avoid locations that are near flammable liquids or gases, or are hot, moist, or dusty.

⚠WARNING ***Because an electrical arc will occur during transfer, the panel must not be located near batteries, fuel tanks, solvents, or other sources of flammable liquids or gases.***

WALL MOUNTING

1. Use 3/8 inch bolts for wall mounting. Measure and mark wall for drilling. Before drilling, check the location to be sure that no wires, or plumbing, gas, or exhaust lines run behind the wall.
2. Install two mounting bolts in the wall for the top cabinet mounting keyholes.
3. With the shipping box standing so the cabinet is upright, carefully remove the top and sides of the box.
4. Raise the cabinet and mount it on the two mounting bolts in the wall. Provide support for the cabinet during installation.

   ⚠WARNING ***Improper lifting can cause severe personal injury. Have sufficient personnel for lifting and mounting the cabinet.***
5. Install two bottom mounting bolts, but do not tighten. (Do not remove the cabinet support until all bolts are installed.)
6. Push the cabinet against the wall. If the cabinet will not align flush against the wall, shim the mounting bosses as required.
7. Tighten all mounting bolts.

TABLE 2-1. APPROXIMATE CABINET DIMENSIONS

PANEL AMP RATING	HEIGHT	WIDTH	DEPTH WITH DOOR	
			CLOSED	OPEN
80, 125, 250, 275	29 in (737 mm)	18 in (457 mm)	11.31 in (287 mm)	28.12 in (714 mm)
350, 500	34 in (864 mm)	21.5 in (546 mm)	11.31 in (287 mm)	31.62 in (803 mm)

NOTE: ADD 1.7 IN. (43.2 MM) TO INCLUDE DOOR HANDLE IN *DEPTH WITH DOOR CLOSED*.

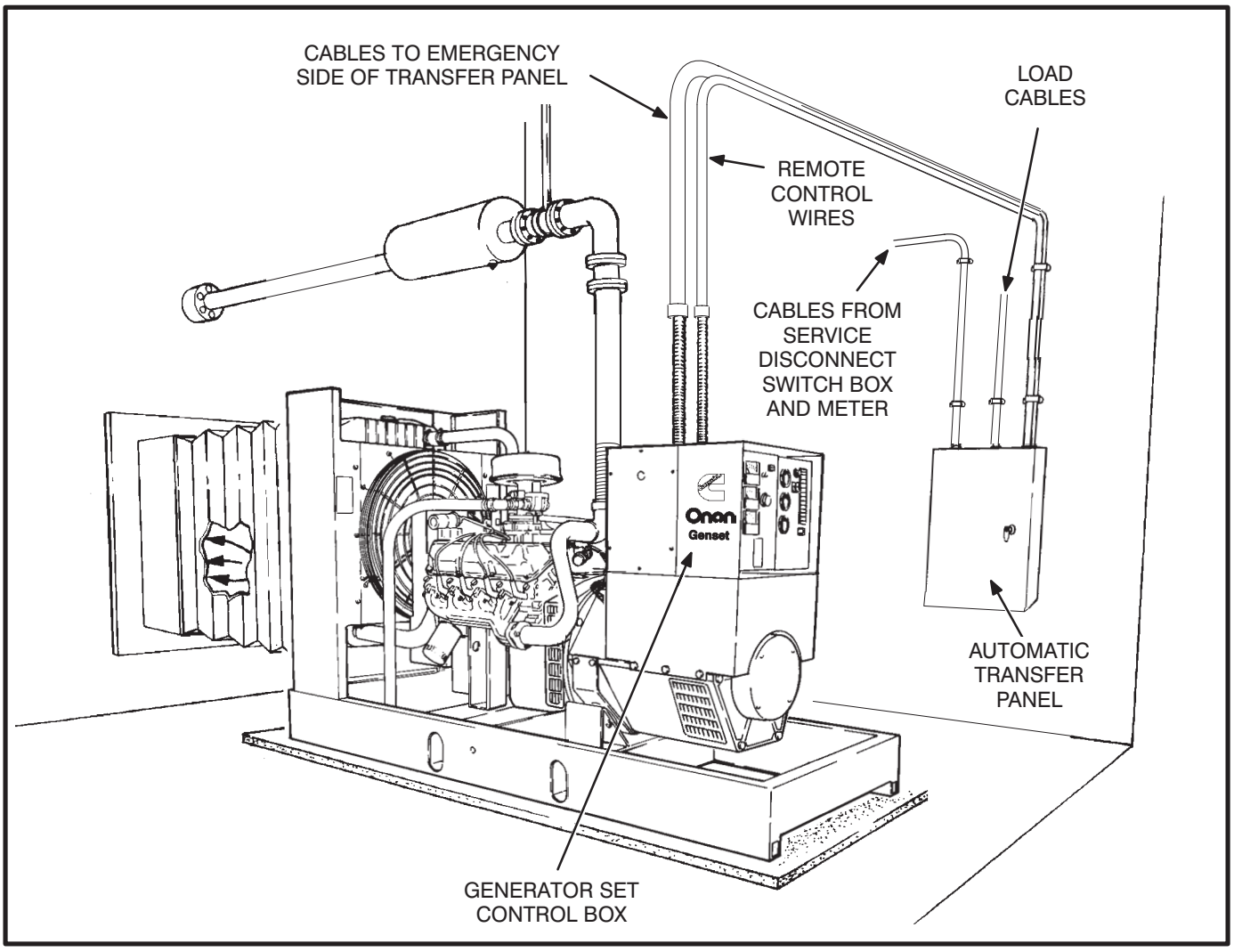


FIGURE 2-1. TYPICAL WALL-MOUNT INSTALLATION

OPEN CONSTRUCTION

Use a cabinet of the required type. The door should be secured and have safety warnings as required to meet all applicable codes. The minimum cabinet size is determined by the ampere rating of the transfer panel. Refer to Table 2-2 for the minimum cabinet dimensions.

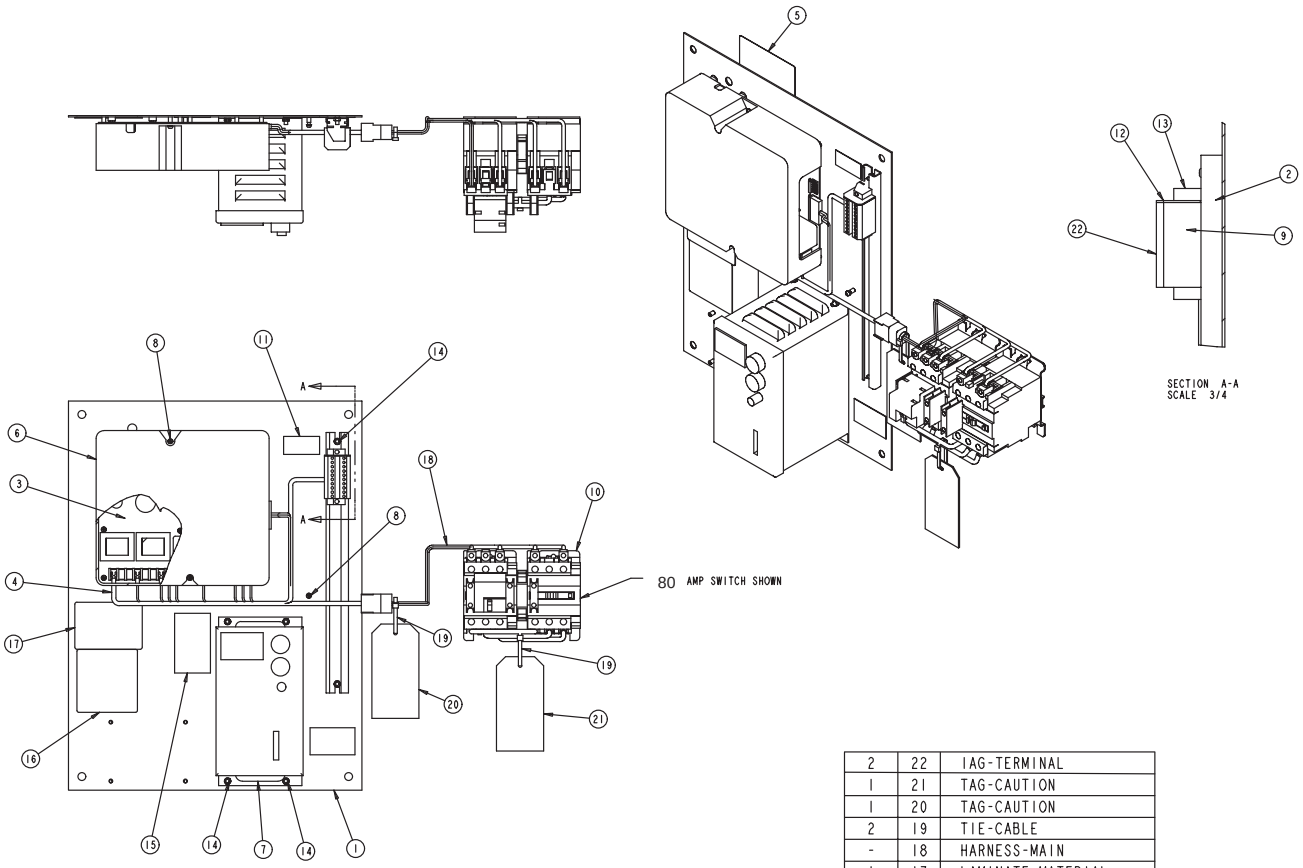
TABLE 2-2. MINIMUM CABINET DIMENSIONS (OPEN CONSTRUCTION APPLICATIONS)

PANEL RATING	HEIGHT	WIDTH	DEPTH
80, 125, 250, 275	29 in (737 mm)	18 in (457 mm)	10.25 in (260 mm)
250, 500	34 in (864 mm)	21.5 in (546 mm)	10.25 in (260 mm)

The outline drawings, supplied with the transfer panel, provide outline dimensions for mounting the transfer panel components inside the cabinet. Page one of the outline drawing shows a hole pattern that must be drilled in the cabinet door to aligning the lights on the control circuit board with the touch panel. Figure 2-3 shows page one of a typical outline drawing.

The touch panel has an adhesive back used to secure it to the front of the cabinet door. The ribbon cable routes through the top center hole of the hole pattern (Figures 2-2 and 2-3). Make sure the ribbon cable is protected from sharp edges and the routing hole does not cut or chafe the ribbon cable.

Refer to the Wiring Section for electrical connections.



QTY	ITEM	DESCRIPTION OR MATERIAL
2	22	TAG-TERMINAL
1	21	TAG-CAUTION
1	20	TAG-CAUTION
2	19	TIE-CABLE
-	18	HARNESS-MAIN
1	17	LAMINATE_MATERIAL
-	16	NAMEPLATE-XFR_SW
1	15	LABEL-DANGER
6	14	NUT-SEMS_ET
2	13	END_BRACKET_TERMINAL
1	12	ENDPLATE-TERMINAL
1	11	LABEL-TERMINAL_BLOCK
-	10	CONTACTOR
1	9	TERMINAL_BLK_SECT
11	8	SCREW-PAN_H_XREC
-	7	BATTERY_CHG_ASSY
1	6	COVER_CONT_PCB
-	5	PANEL_MEMBRANE
-	4	HARNESS-CONTROL
-	3	PCB_ASSY-XFR_SW_CONT
1	2	RAIL_TERMINAL
1	1	PLATE-OPEN_CONST

FIGURE 2-2. TYPICAL OPEN CONSTRUCTION COMPONENT LOCATION DRAWING

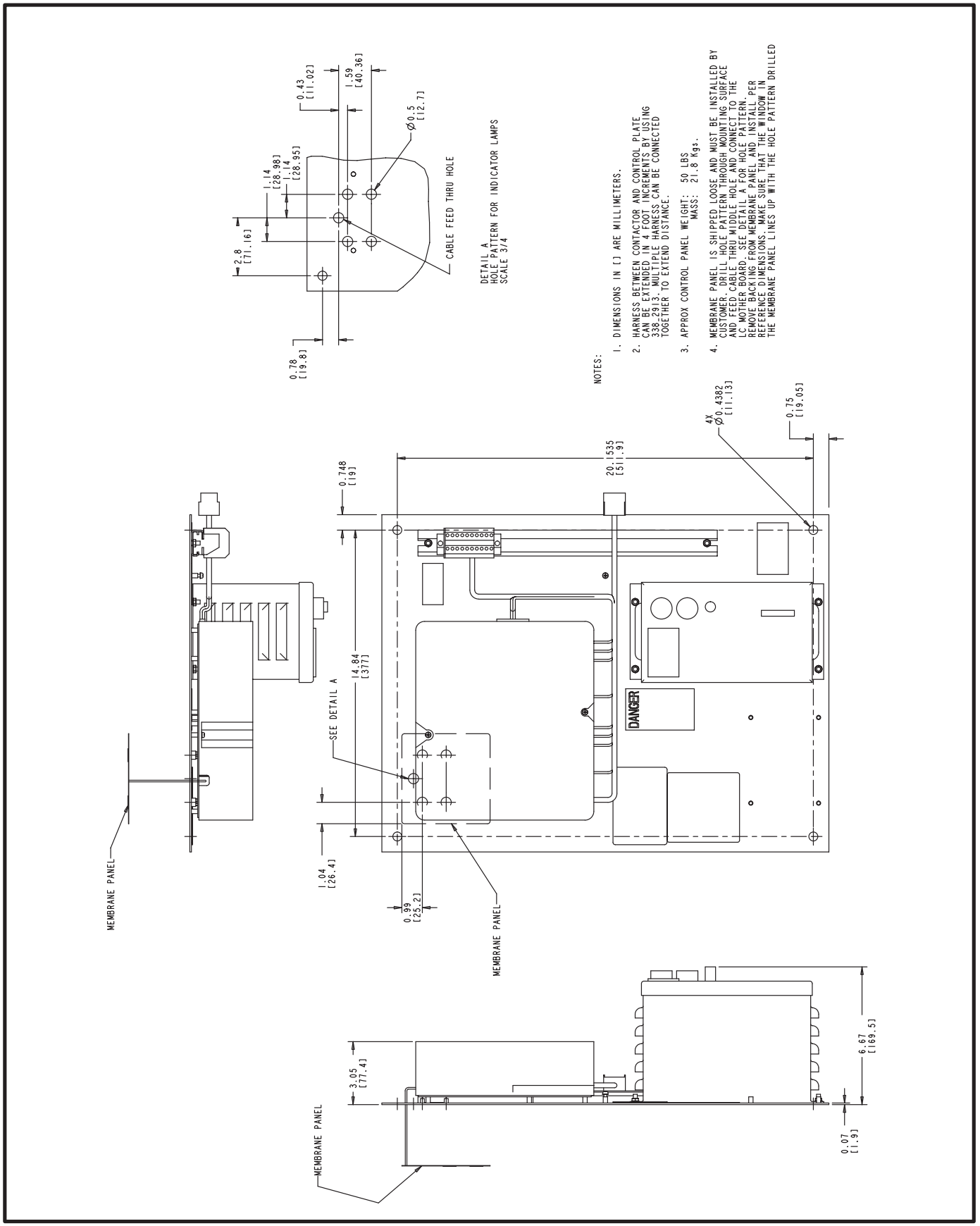


FIGURE 2-3. TYPICAL OPEN CONSTRUCTION CONTROL OUTLINE DRAWING (REFER TO OUTLINE DRAWING 310-1239 FOR CONTACTOR DIMENSIONS)

3. Wiring

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only qualified personnel are to perform the following procedures.***

When installing conduit, observe the following precautions:

1. Before beginning conduit installation, cover the transfer panel to prevent accidental entry of metal chips.
2. If using rigid conduit between the generator set and the transfer panel, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration.
3. Run control circuit wiring in separate conduit from the AC wiring; otherwise, induced currents could cause operational problems within the panel. Cutouts can be made through the top, bottom, or sides of the cabinet. (Refer to the transfer panel control box outline drawings.)

   ⚠CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the relays, contacts, and other parts of the automatic transfer panel when mounting or connecting conduit. Screwdrivers should be used carefully to prevent damage to components.***

AC CONNECTIONS

Perform wiring in the following sequence:

1. Test the operation of the generator set from its own controls.
2. Stop the generator set and remove the negative (–) lead from the cranking battery(ies) to prevent starting.

   ⚠WARNING ***Failure to prevent the generator set from starting before wiring procedures are performed presents a shock hazard that can cause severe personal injury or death.***

   Table 3-1 gives the type and range of conductor size the transfer panel will accept. Figure 3-1 shows transfer panel source and load connections.

TABLE 3-1. TERMINAL LUG CAPACITY (For Copper (CU) or Aluminum (AL) Conductors)

PANEL AMP RATING	NUMBER OF CONDUCTORS PER PHASE	SIZE RANGE OF CONDUCTORS
80	1	3 - 10 AWG CU (25-6mm)
125	1	2 - 10 AWG CU (50-6mm)
250	–	Not Supplied
275	–	Not Supplied
350	–	Not Supplied
500	–	Not Supplied
GROUND LUG	1	4 - 14 AWG CU (16-2.5mm)

3. Connect conductors of sufficient size (see contract drawings) to carry rated current from the line, load, and generator set directly to the transfer panel terminals. The Normal power and Emergency power connections are marked L1, L2, and L3. The load connections are marked T1, T2 and T3. A neutral bar is standard. See Figure 3-1.
4. On three-phase panels, phase rotation must be checked and corrected (if necessary) before any load can be connected.

   ⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Make sure that both AC power sources are disconnected.***

   ⚠CAUTION ***Equipment driven by motors can be damaged by wrong shaft rotation. Do not connect load until phase rotation has been checked.***

   A. Make sure that both AC power sources are disconnected.

   B. Connect an Onan load-test panel, phase rotation meter, or three-phase motor to the transfer panel load terminals. Connect power to the line side of the transfer panel and observe rotation. If the rotation is wrong, go to step C. If the rotation is correct, go to step D.

C. Disconnect the AC power source.

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Disconnect the AC power source.***

Reverse any two leads on the line side of the transfer panel. On a 4-wire (center tapped) delta service, the high leg must be the same for both line and generator. Reverse only the two legs that are adjacent to the neutral center tap. For example, if the high leg is phase B, then reverse phase A and C cables. Go to step E.

D. Disconnect the AC power source.

E. Make sure that the generator RUN switch is in the STOP position and connect the starting battery (negative [–] lead last).

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any arc, spark or flame while servicing batteries.***

F. Start the generator set. Check the phase rotation of the generator lead connections on the transfer panel. If this phase rotation is different than that of the line side, go to step G. If the rotation is the same, go to step H.

G. Stop the generator set and disconnect its starting battery (negative [–] lead first).

⚠WARNING ***Failure to prevent the generator set from starting before the next procedure is performed presents a shock hazard that can cause severe personal injury or death. Stop the generator set and disconnect the starting battery.***

Reverse any two leads on the generator side of the transfer panel. On a 4-wire (center tapped) delta service, the high leg must be the same for both line and generator. Reverse only the two legs that are adjacent to the neutral center tap. For example, if the high leg is phase B, then reverse phase A and C cables. Go to step I.

H. Stop the generator set and disconnect its starting battery (negative [–] lead first).

I. Remove the phase rotation test device.

5. On 120-volt panels, connect the hot side to the left (L1) lug and the neutral side to the Neutral bar. On 240-volt single phase panels, connect the two hot lines to the L1 and L3 lugs and connect the neutral line to the neutral bar.

6. Connect power cables to the load terminals T1, T2 and T3. Tighten the lugs as indicated in Table 3-2.

7. Make sure that both AC power sources are disconnected.

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Make sure that both AC power sources are disconnected.***

TABLE 3-2. LUG TORQUES

SET SCREW SOCKET SIZE (ACROSS FLATS)	MINIMUM TORQUE FOR PROPER OPERATION
3/16 IN	80 IN-LBS (9 N•m)
1/4 IN	200 IN-LBS (23 N•m)
5/16 IN	275 IN-LBS (31 N•m)
3/8 IN	375 IN-LBS (43 N•m)
1/2 IN	500 IN-LBS (57 N•m)
9/16 IN	600 IN-LBS (68 N•m)

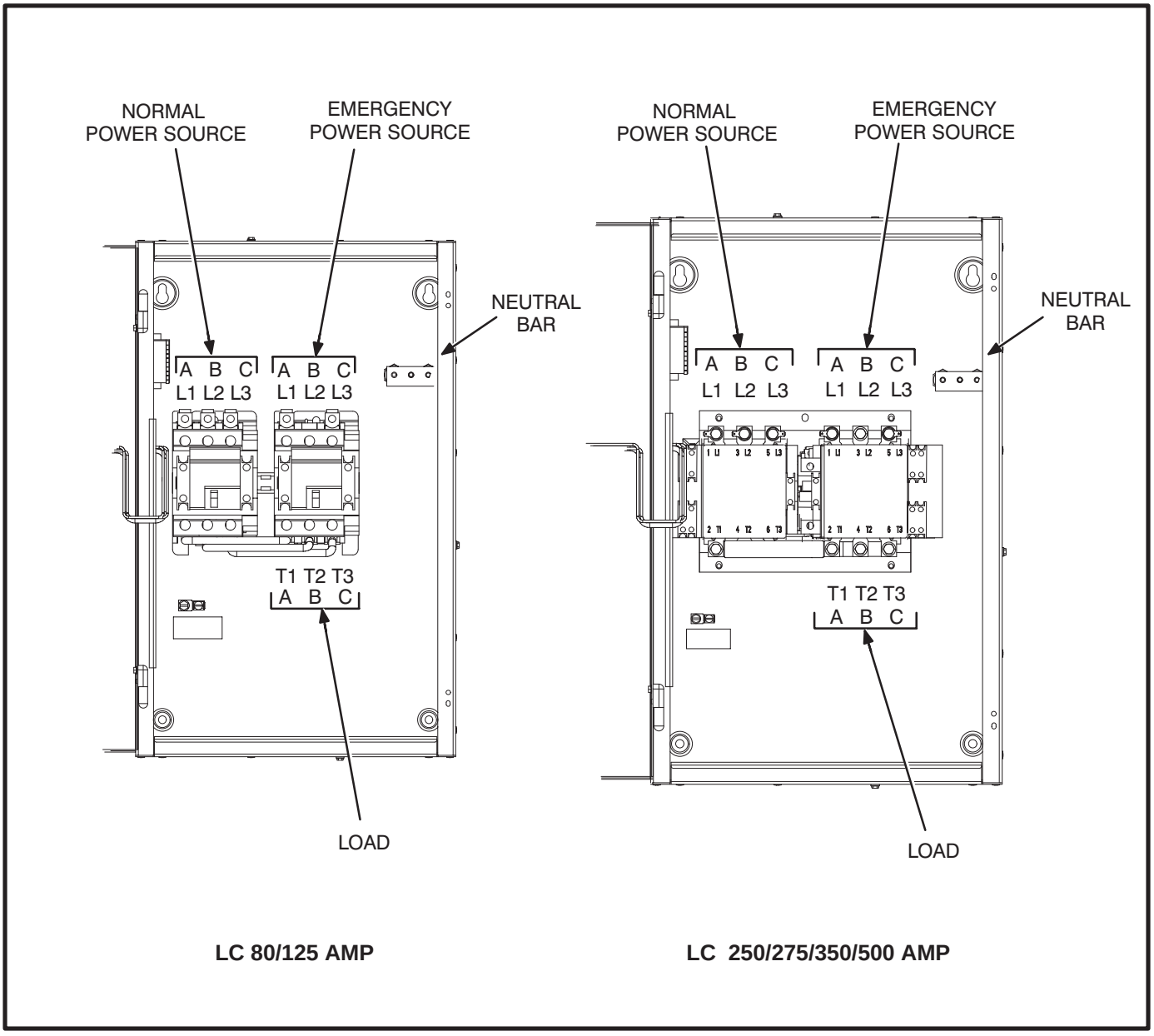


FIGURE 3-1. TRANSFER PANEL SOURCE AND LOAD CONNECTIONS

CONTROL CONNECTIONS

Connections of standard and optional control wiring are made at terminal blocks TB2 and TB3 (Figure 3-2).

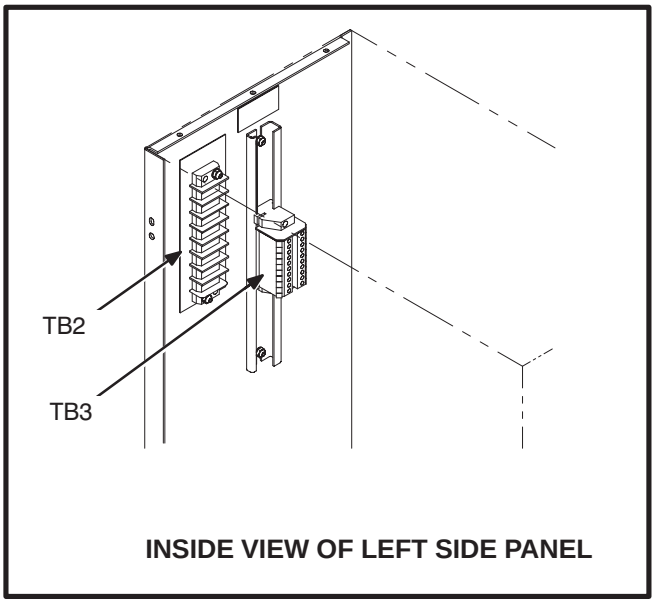


FIGURE 3-2. CONTROL WIRING CONNECTIONS

Auxiliary Contacts

Auxiliary contacts, for external alarm or control circuitry, are available for the Normal and Emergency sides of the transfer panel. Refer to Figure 3-3 for auxiliary contact locations. The contacts have ratings of 10 amperes at 600 VAC. Figure 3-3 shows the normally open and normally closed positions of the auxiliary contacts with the transfer panel in the neutral position. Moving the transfer panel to Normal or Emergency actuates the corresponding auxiliary contacts.

Use number 18 AWG (1.0mm^2) to number 10 AWG (6.0 mm^2) wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).

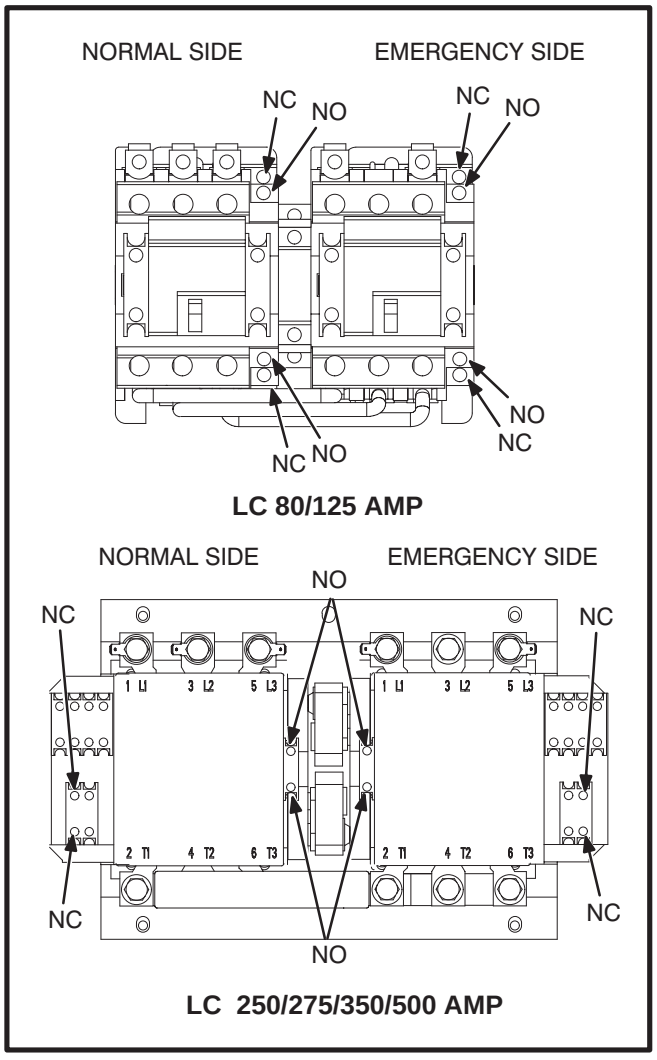


FIGURE 3-3. AUXILIARY CONTACTS

Remote Start-Stop Connections

Use number 18 AWG (1.0mm$^{2)}$ to number 12 AWG (4.0 mm^2) wire. Resistance must not exceed 0.5 ohm per line. Stranded wire is recommended. For connections to the TB2 screw terminals, use number 8 ring or spade terminals. For connections to TB3, strip the insulation back 3/8 inch (10 mm).

Two-Wire Starting: Two-wire starting for Onan water-cooled generator sets uses terminals B+, GND (ground), and RMT of terminal block TB2 (Figure 3-4).

Connect these terminals to like terminals on the generator set. A jumper (provided in envelope attached to TB2) is used between terminals TB2-2 and TB2-B+ for gensets that use a switching B+ remote start signal, and between TB2-GND and TB2-2 for gensets that require a switching ground remote start signal. Refer to your generator set schematic drawing and installation manual for remote start wiring requirements.

Three-Wire Starting: Three-wire starting for Onan air-cooled generator sets uses terminals 1, 2, 3, 4, and 5 of terminal block TB3 (Figure 3-5).

Connect terminals 1, 2, 3, and 4 to terminals on the generator set, as shown in Figure 3-5. With diesel sets that use the preheat circuit, connect terminal 5 on TB3 to terminal H on the generator set control.

Terminals 6, 7, and 8 of TB3 (Figure 3-5) are for connection to the overcrank alarm contacts. These (Form C) contacts are rated for 4 amperes at 125 VAC or 3 amperes at 30 VDC and are provided for customer use.

On 3-wire start systems that use a switching ground, check that there is a jumper (provided in envelope attached to TB2) from TB2-GND to TB2-2, and make no other connections to TB2; terminals GND, 2, B+, and RMT.

On 3-wire start systems that use a switching B+, check that there is a jumper (provided in envelope attached to TB2) from TB2-2 to TB2-B+ and another from TB2-B+ to TB3-1. Make no other connections to TB2; terminals GND, 2, B+, and RMT.

To determine whether your generator set has a switching ground or a switching B+ remote start system, measure the DC voltage from the Start terminal to the Ground terminal. (The starting battery must be connected.) If you measure 12 VDC, it is a switching ground system. If you measure 0 VDC, it is a switching B+ system.

⚠WARNING ***Improper wiring of start-stop connections can result in severe personal injury or equipment damage. Carefully follow all wiring instructions and make no other connections to TB2; terminals GND, 2, B+, and RMT when a three-wire start system is used.***

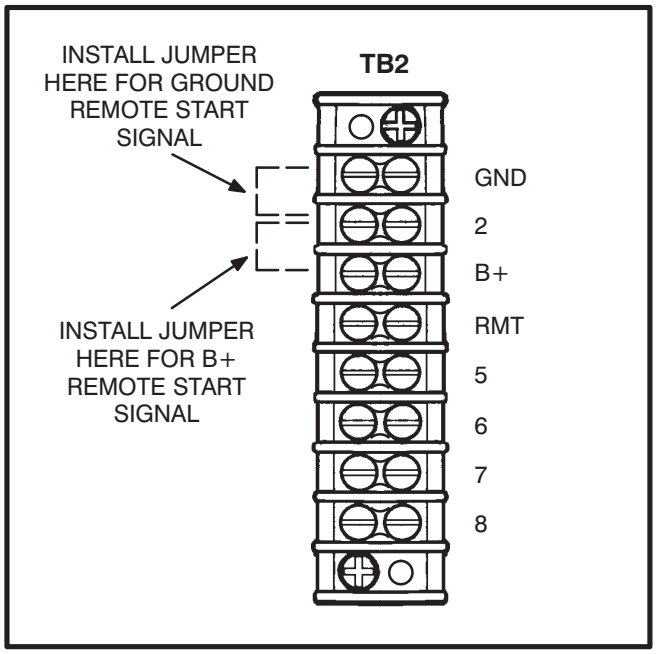


FIGURE 3-4. TB2: TWO-WIRE START CONNECTIONS

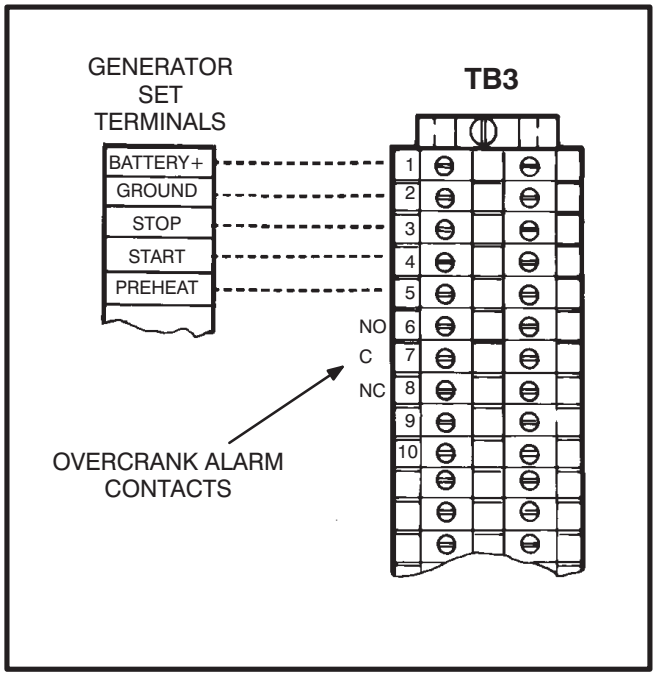


FIGURE 3-5. THREE-WIRE START CONNECTIONS

Area Protection/Remote Test Switch

The transfer panel can be wired with a remote test switch. Closure of a set of contacts across the remote test transfer inputs causes the transfer panel to sense a (simulated) utility power failure and send a start/run signal to the generator set when the Load/No-Load switch on the control circuit board (Figure 4-1) is in the Load position. With the Load/No-Load switch In the Load position, the load is transferred to the generator set when generator set power becomes available.

To add area protection equipment or a remote test switch, connect normally open contacts (from area protection equipment or a test switch) to terminals 7 and 8 of TB2 (Figure 3-6).

Use number 22 AWG (0.50mm$^{2)}$ to number 12 AWG (4.0mm$^{2)}$ wire (maximum resistance of 4 ohms per line). For connection to the screw terminal, use number 8 ring or spade terminal.

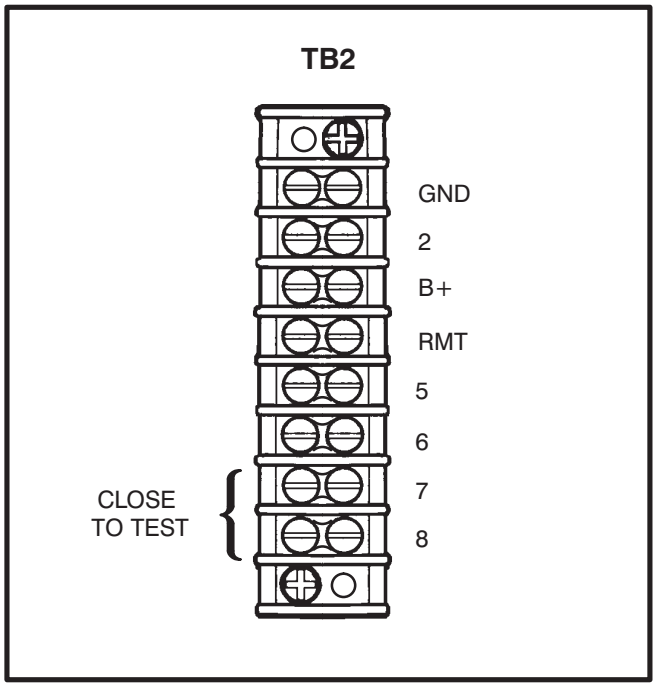


FIGURE 3-6. TB2: AREA PROTECTION / REMOTE TEST

Battery Charger Alarm Contacts Option

The optional 10-ampere battery charger can include three sets of Form C relay contacts, as an additional option.

Under normal operating conditions, the Low Bat and AC Fail relays are energized and the High Bat relay is de-energized. In response to a Low Bat or AC Fail condition, the appropriate normally energized relay (Low Bat or AC Fail) drops out. In response to a High Bat condition, the normally de-energized High Bat relay is energized.

The contacts are rated for 4 amperes at 120 VAC or 30 VDC. Connections to these contacts are made at terminals 41-42-43 (AC failure), 44-45-46 (high battery voltage), and 47-48-49 (low battery voltage) of TB3 (Figure 3-7).

Use number 22 AWG (0.50mm$^{2)}$ to number 12 AWG (4.0mm$^{2)}$ wire. For connection to the screw terminal, strip the insulation back 3/8 inch (10 mm).

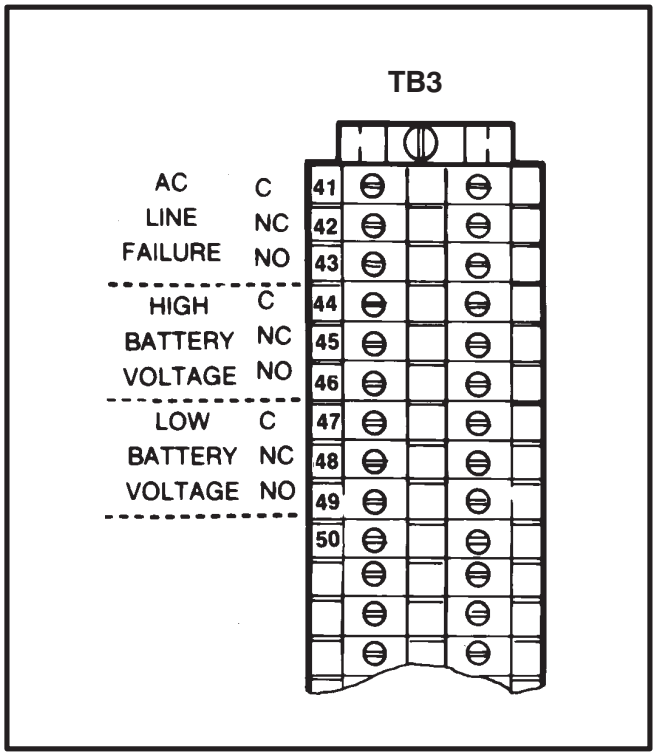
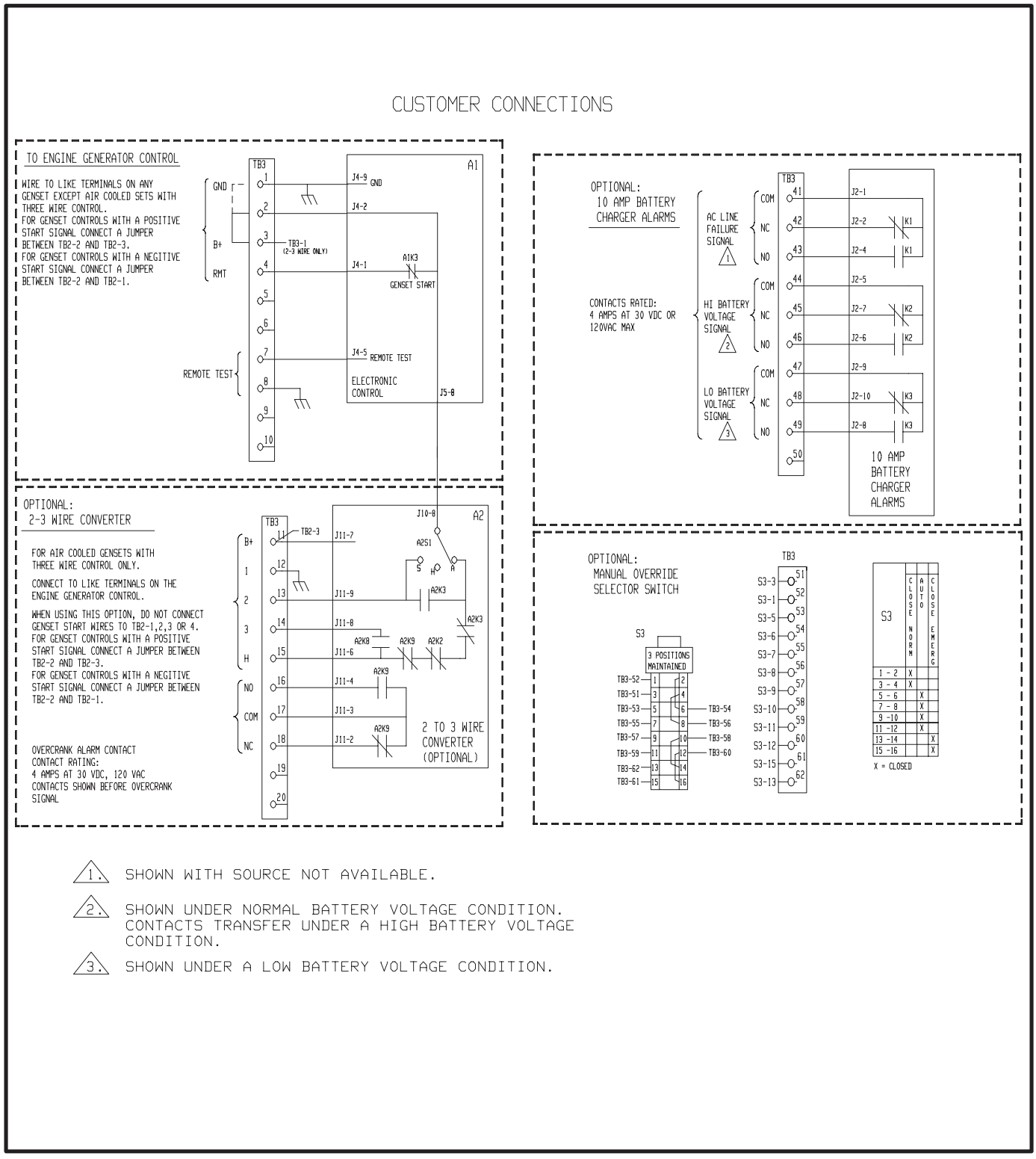


FIGURE 3-7. BATTERY CHARGER ALARM CONTACTS (SHOWN DE–ENERGIZED)

OPEN CONSTRUCTION

On open construction configurations, refer to the drawings supplied with the transfer panel for customer connections. Refer to Figure 3-1 for source and load connections. Also refer to Figure 3-8 for typical customer connections.

Use number 22 AWG (0.50mm$^{2)}$ to number 12 AWG (4.0mm$^{2)}$ wire for connection to the screw terminal. Strip the insulation back 3/8 inch (10 mm).



1. SHOWN WITH SOURCE NOT AVAILABLE.
2. SHOWN UNDER NORMAL BATTERY VOLTAGE CONDITION. CONTACTS TRANSFER UNDER A HIGH BATTERY VOLTAGE CONDITION.
3. SHOWN UNDER A LOW BATTERY VOLTAGE CONDITION.

FIGURE 3-8. TYPICAL CUSTOMER CONNECTIONS FOR OPEN CONSTRUCTION

INSPECTION AND CLEANUP

Inspect all wiring to be certain that:

- Wiring will not interfere with panel operation.
- Wiring will not be damaged as door opens and closes.
- No wiring is left loose and unconnected.

After mounting and wiring the cabinet, clean the interior with a vacuum cleaner to remove any chips, filings, or dirt from the cabinet interior and components.

Installation is not yet complete.

Do not energize the transfer panel until instructed to do so in sections 4 and 5.

4. Setup And Calibration

BEFORE CALIBRATING

The LC transfer panel is available with one of two control package options: Control package A has preset undervoltage sensing and time delays, control package B has adjustable undervoltage sensing and adjustable time delays.

After the transfer panel is installed, undervoltage sensing must be calibrated. Control package B and any optional electronic modules must be adjusted to the desired settings.

Install J1 Connector

Install connector J1 when all of the wiring is complete. Also install connectors for any installed options.

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open.***

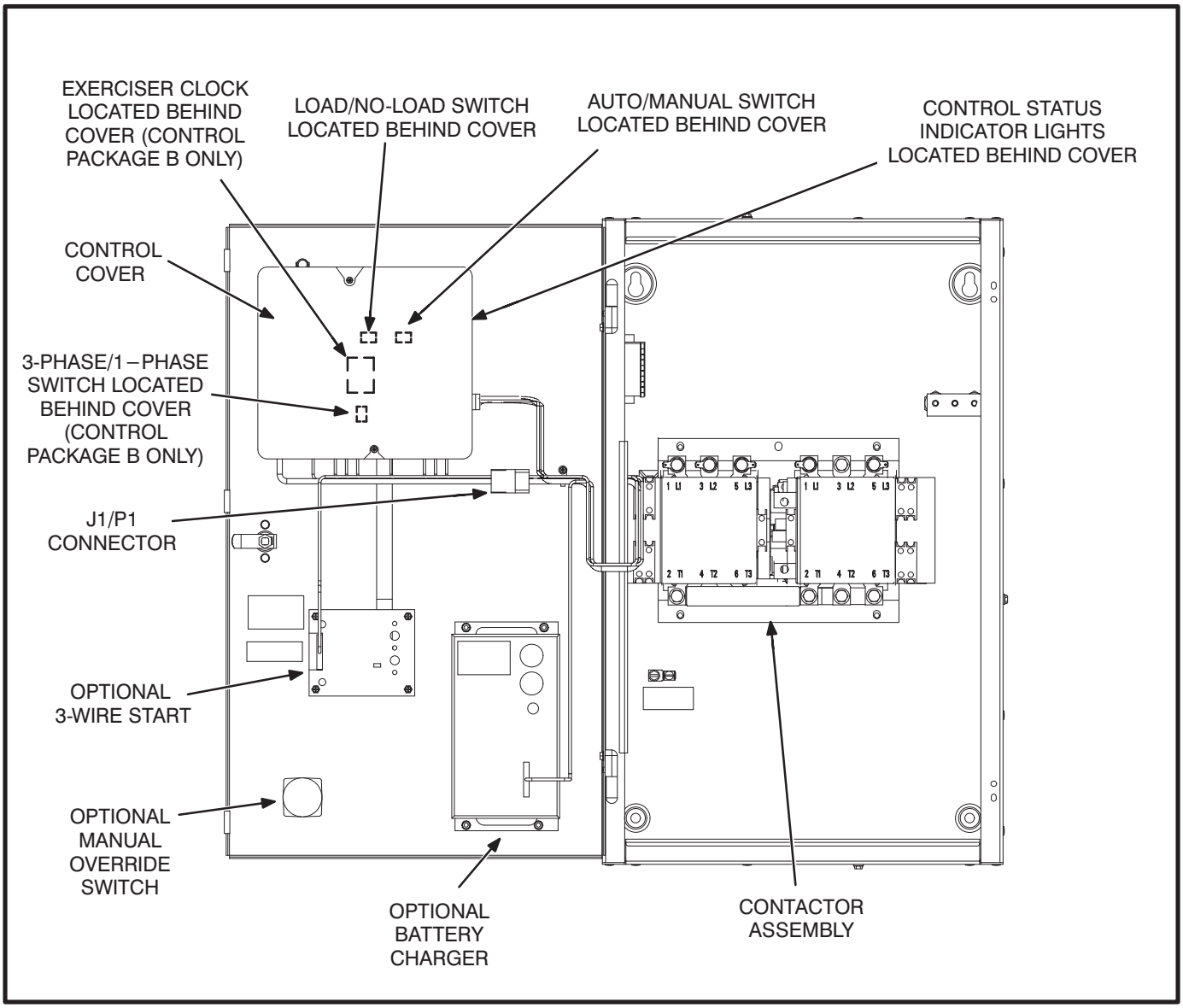


FIGURE 4-1. LOCATION OF CONTROL COMPONENTS

Connect the Battery

Make sure that the RUN switch on the generator is in the STOP position and connect the battery (negative [–] lead last). If applicable, reconnect the external battery charger.

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any arc, spark, or flame while servicing batteries.***

Connect AC Line Power

Connect AC line power to the automatic transfer panel. The Normal Available and Normal Connected lamps will light if the voltage sensors are calibrated (if equipped with Manual Override switch, it must not be set at Close to Emergency).

VOLTAGE SENSORS

Control package A has undervoltage sensing for one phase of the Normal and Emergency sides with fixed pickup and dropout settings. The Pickup voltage is preset to 85% of Normal, and Dropout is preset to 75% of Pickup.

Control package B control has three phase undervoltage sensing for the Normal side and single phase sensing of the Emergency side. This control has adjustable pickup and dropout settings. Pickup is adjustable from 85% to 100% of Normal, and Dropout is adjustable from 75% to 98% of Pickup. The adjustment procedure is described in the following section.

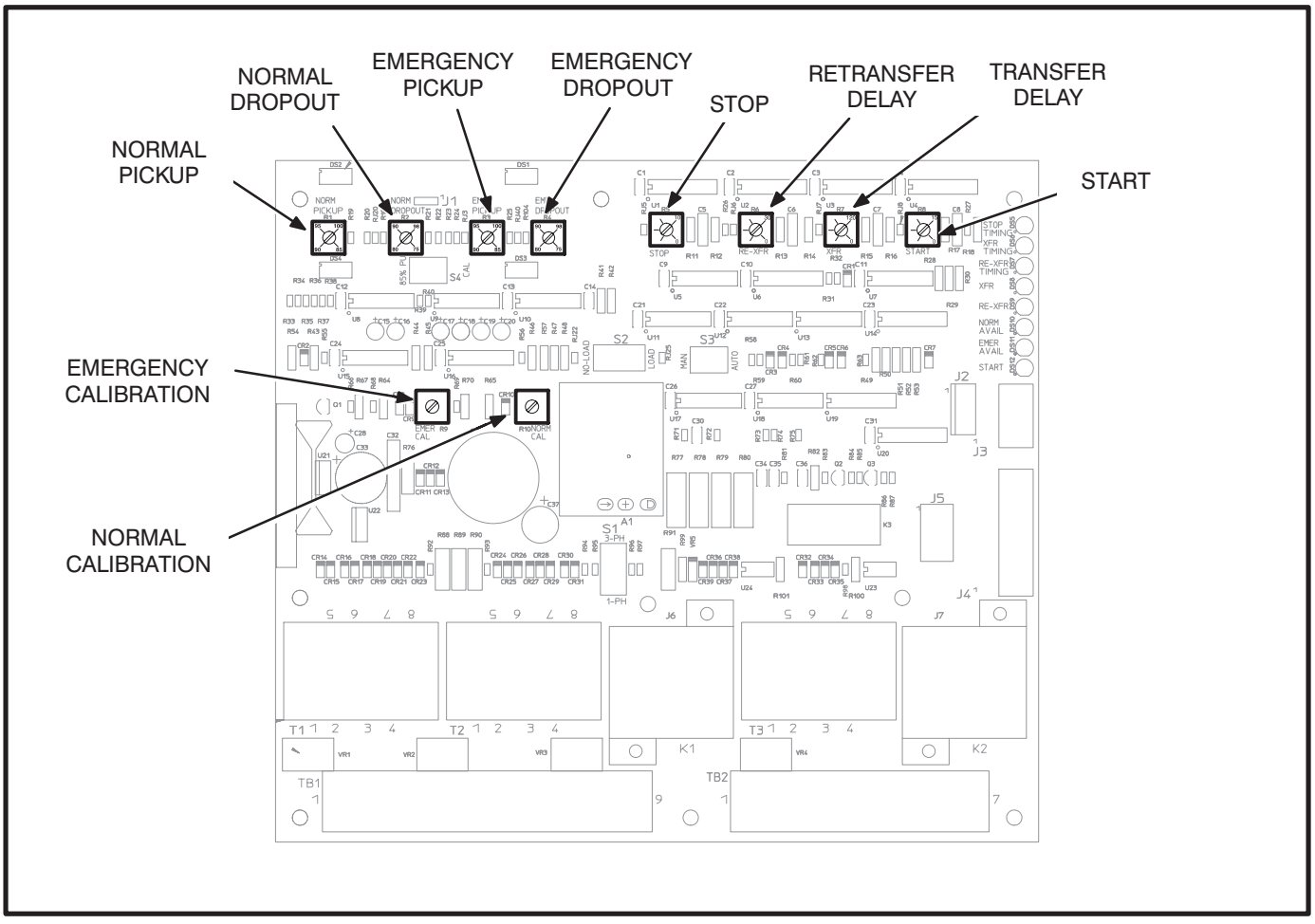


FIGURE 4-2. CONTROL PACKAGE B ADJUSTMENTS

Undervoltage Sensor Calibration

⚠CAUTION ***Incorrect setting of the calibration (Cal) adjustments will result in abnormal operation of the transfer panel.***

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open.***

All adjustments are made by turning the appropriate potentiometer with a screwdriver. The adjustment potentiometers are accessed by removing the cover from the control.

A separate voltage sensor is used for each power source. The adjustment pot locations are shown in Figure 4-3. The Normal sensor monitors the Normal (utility) power source. The Emergency sensor monitors the Emergency (generator set) power source.

The voltage sensors monitor the Normal and Emergency power sources for an undervoltage condition. To calibrate the undervoltage sensors:

1. Check that nominal voltage is present on all phases of the source being calibrated (Normal or Emergency).
2. *Control Package A:* Move the calibration switch (Figure 4-3) to the CAL position.

   Control Package B: Turn the undervoltage Pickup and Dropout potentiometers on the electronic control fully clockwise.
3. Slowly turn the undervoltage calibration (Cal) potentiometer counterclockwise until the Source Available lamp corresponding to the source sensor being calibrated turns OFF.
4. Slowly turn the undervoltage calibration (Cal) potentiometer clockwise until the Source Available lamp turns ON.
6. The undervoltage sensor is now calibrated. Repeat this procedure for the other source.

   Control Package A: Move the calibration switch (Figure 4-3) to the 85 % position.

   Control Package B: Proceed to Undervoltage Pickup and Dropout Adjustments.

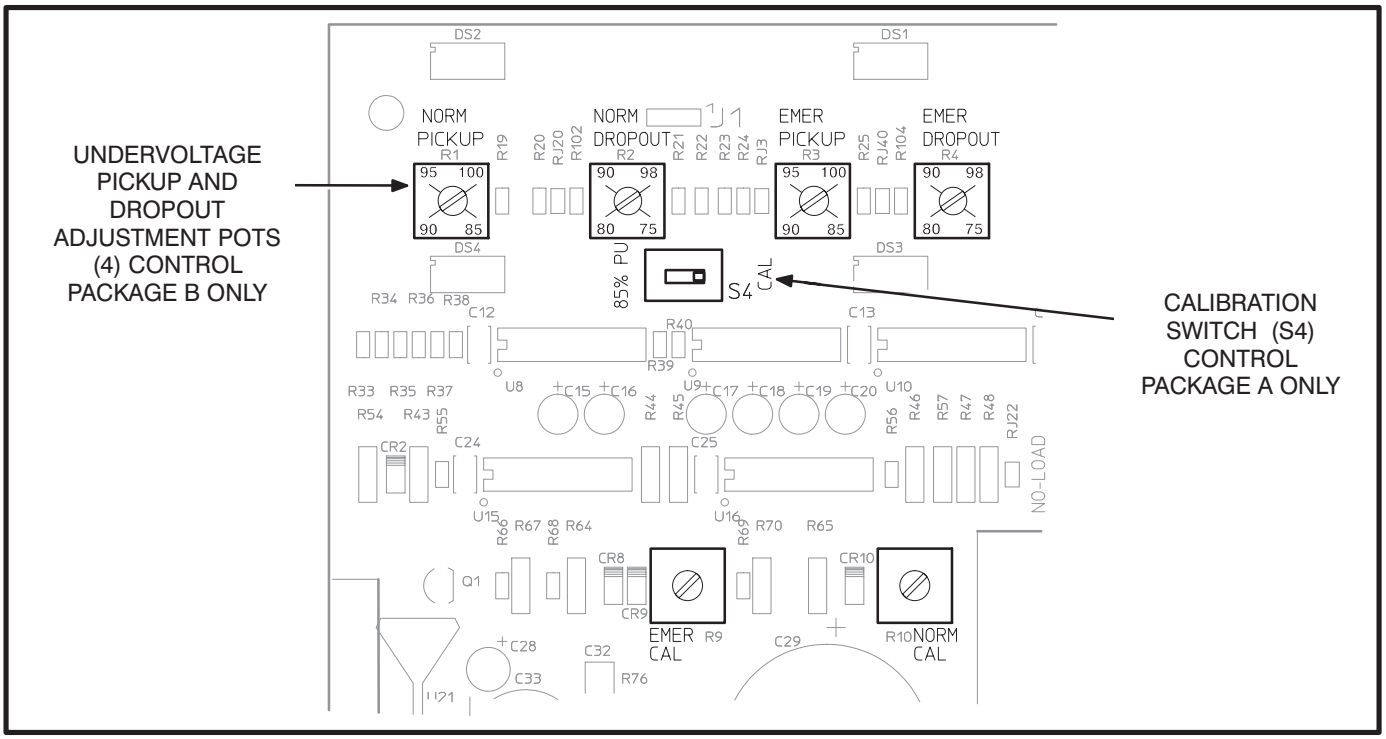


FIGURE 4-3. UNDERVOLTAGE CALIBRATION, PICKUP AND DROPOUT ADJUSTMENT

Undervoltage Pickup and Dropout Adjustments (Control Package B Only)

Undervoltage dropout occurs when an undervoltage condition is sensed. Pickup occurs when an acceptable voltage is sensed. Undervoltage dropout and pickup are preset on control package A. Undervoltage dropout and pickup are adjustable over the following ranges on control package B:

FUNCTION	ADJUSTMENT RANGE
Pickup	85% to 100% of nominal voltage
Dropout	75% to 98% of pickup voltage

To set the pickup and dropout percentages, align the slots on the potentiometers with the desired markings as shown in Figure 4-3).

TIME DELAY

The time delays control the four following functions:

- Start time delay
- Stop time delay
- Transfer time delay
- Retransfer time delay

The time delays on control package A are preset. The time delays on control package B are adjustable over the following ranges:

DELAY	ADJUSTMENT RANGE
Start	0 to 15 seconds
Stop	0 to 10 minutes
Transfer	0 to 120 seconds
Retransfer	0 to 30 minutes

To set the time delays, align the slots on the potentiometers with the desired markings, see Figure 4-4.

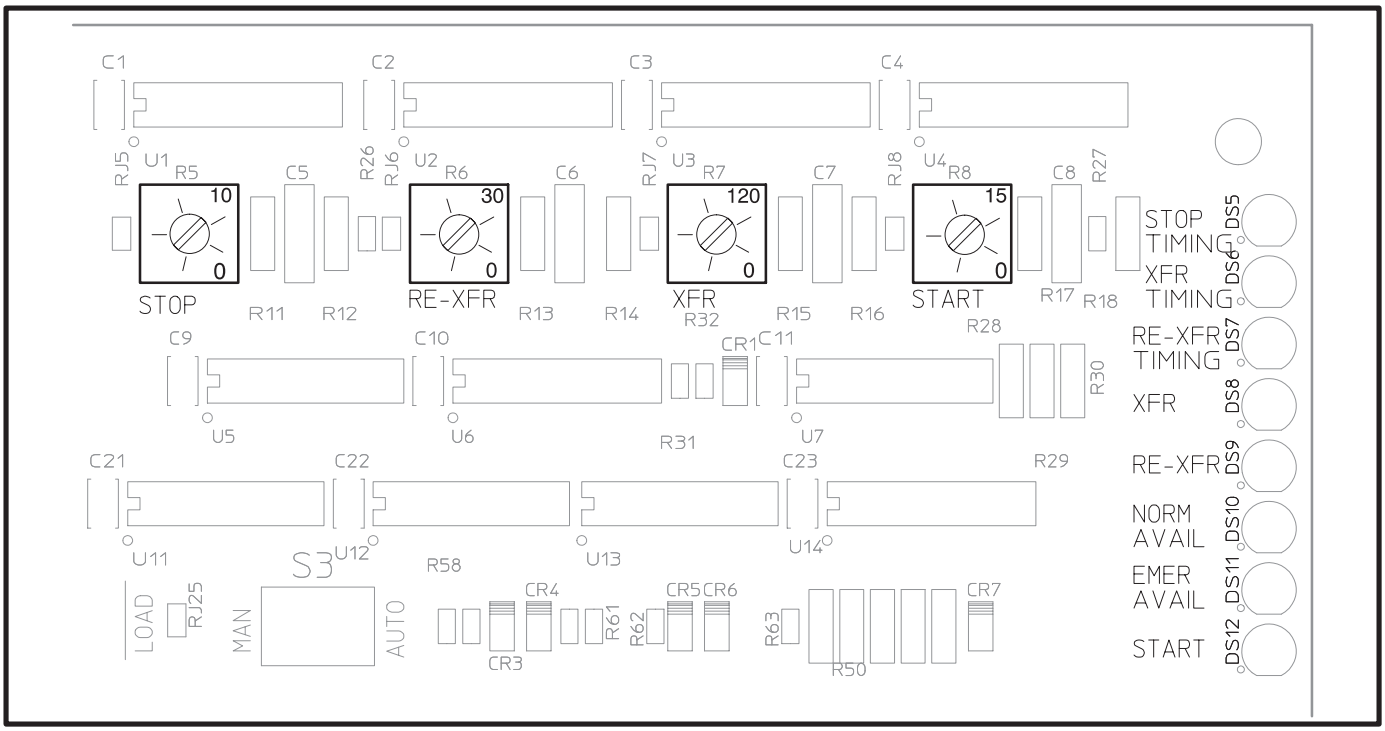


FIGURE 4-4. CONTROL PACKAGE B TIME DELAY ADJUSTMENT

3-WIRE START MODULE OPTION

The 3-Wire Start module has two adjustable timers.

The Preheat timer delays the start signal to allow preheating the generator set. The Preheat timer's range of adjustment is 0 to 60 seconds.

If a preheat delay is desired, make sure that the Preheat timer's On/Off switch is in the On position.

The Overcrank timer limits the time that the generator set starter is allowed to operate. The Overcrank timer's range of adjustment is 0 to 120 seconds.

To set the timers, align the slots on the potentiometers with the desired markings on the faceplate (Figure 4-5).

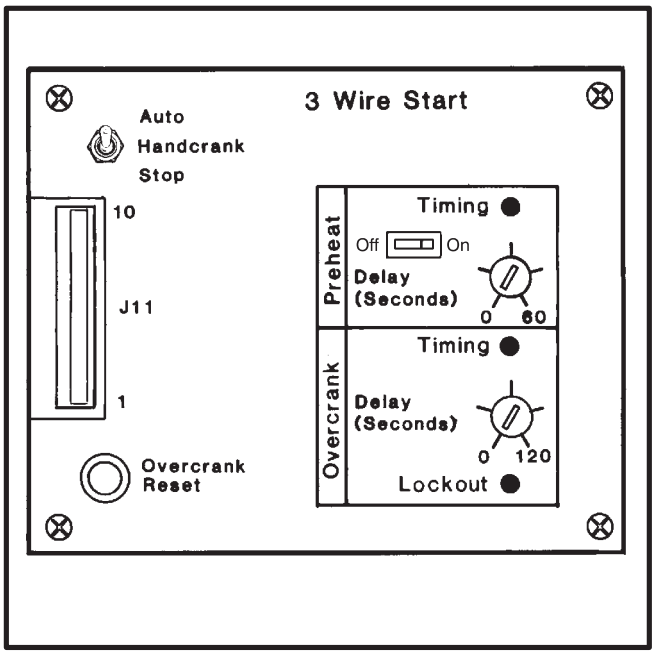


FIGURE 4-5. 3-WIRE START

PROGRAM TRANSITION OPTION (250/275/350/500 ONLY)

The Program Transition module (Figure 4-6) is used to provide a delay during transition. Programmed transition allows the transfer panel to assume a mid–transition position for an adjustable interval of time. In this position the load is not connected to either (Normal or Emergency) power source.

The delay feature allows residual voltage from inductive loads to decay to an acceptable level before transfer is completed. This module is available in either a 0.1 to 3 second or 0.1 to 30 second adjustment range. The proper adjustment is a function of the load. If assistance is needed, contact your dealer or distributor.

To set the time delay, rotate the dial to align the desired time setting on the dial with the alignment mark on the timer.

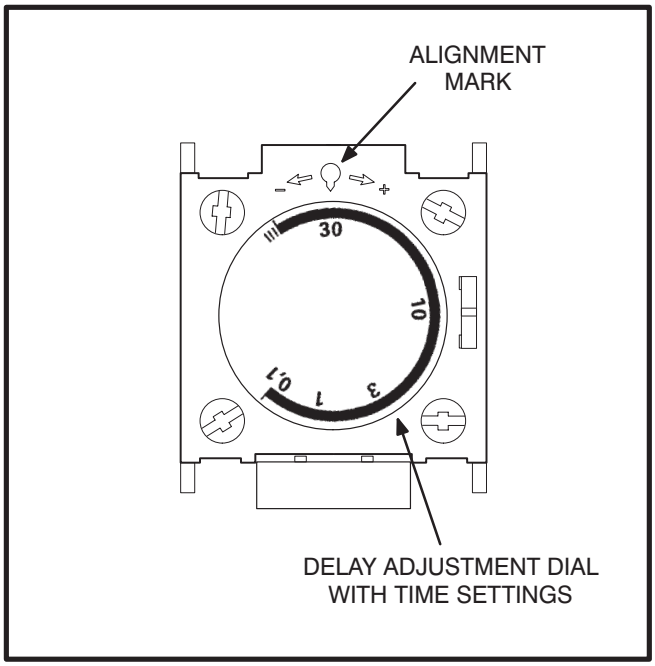


FIGURE 4-6. PROGRAM TRANSITION MODULE

EXERCISER CLOCK (CONTROL PACKAGE B ONLY)

The exerciser clock is used to start and run the generator set at programmable intervals and for selected durations. It is a 7-day, 24-hour clock that can store and execute up to four start/stop programs per day (one minute minimum duration). The exerciser clock also has a test feature that can be used to initiate a genset start and run cycle.

Programming the exerciser clock requires setting the time of day and entering the exercise start and stop times as described in the following sections. The exerciser clock has backup power for approximately six hours. After six hours the day and time will have to be reset. Exercise programs will not be lost during a power outage (exercise programs are stored in EEPROM).

To reset the exerciser clock:

Resetting the exerciser clock erases all existing day, time and exercise program settings.

Depress and hold the arrow, plus and set buttons (→) (**+**) (◗) simultaneously. Release the plus and set buttons while continuing to hold the arrow button. When all aspects of the LCD display appear, release the arrow button.

To set the day and time:

1. With the exerciser clock powered, press all three buttons simultaneously to reset the time. The time display area will show (– – : – –) and a small clock symbol will appear in the upper left-corner of the display. Refer to Figure 4-7.
2. Press the arrow (→) button once to set the day-of-week. The clock symbol will begin flashing to indicate the clock is being programmed and the display will show midnight (0:00).
3. Press the plus (**+**) button as many times as necessary until the current day-of-week is displayed.
   Example: 1 = Monday, 2 = Tuesday, etc.
4. Press the arrow (→) button again to set the hour of the day. The clock uses 24-hour (military) time.
5. Press the plus (**+**) button until the current hour is displayed.
   Example: 2:00 PM is 14:00.
6. Press the arrow (→) button again to set the minutes.

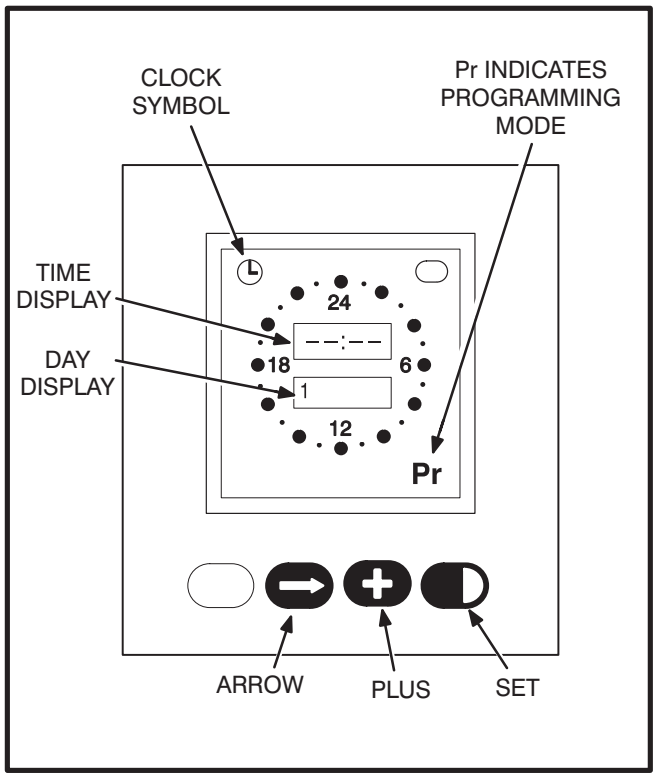


FIGURE 4-7. EXERCISER CLOCK

7. Press the plus (**+**) button until the current minutes are displayed.
   Note that by holding the plus (**+**) button down, the minutes will increment in 5 minute intervals.
8. To set or change the exercise program, press the arrow (→) button again and go to step two in the following section. To return to the normal operating mode, press the arrow (→) button eight times (clock symbol appears in the display).

To set the exercise start and stop time:

1. Press the arrow (→) button four times to start the programming mode.
2. The letters **Pr** will appear in the lower right hand corner of the display when the programing mode is reached (**Pr** will be flashing if there are no existing programs).
   Press the arrow (→) button as many times as necessary to advance to the day to be programmed.
   To clear an existing program for the day selected, press the plus and set (**+**) (◗) buttons at the same time.

3. Press the plus (**+**) button to increment the **Start** time of the exercise program. The display will show midnight (0:00). Note that by holding the (**+**) button down, the minutes will increment in 15 minute intervals. When the **Start** time is reached, press the set (◗) button (On Mode is indicated, Figure 4-8).
   Then increment the time with the plus (**+**) button to the desired **Stop** time. When the **Stop** time is reached, press the set (◗) button (Off Mode is indicated, Figure 4-8).
   Example to exercise the genset one hour:
   Set Start at 7:00 PM (19:00)
   Set Stop at 8:00 PM (20:00)
   Note that the exercise time is indicated by a band of segments illuminated around the outer ring of the clock from the start to the stop time Figure 4-8).

   To clear the program, press the plus and set (**+**) (◗) buttons at the same time.

4. Pressing the arrow (→) button advances to the next day. The program will be copied to the next day if the next day does not have an existing program.

   To change or clear the program, press the plus and set (**+**) (◗) buttons at the same time.

   Double check the program setting for each day. Press the arrow (→) button repeatedly until the clock mode is passed and the program mode (Pr) is reached. Carefully check each days program and clear any unwanted programs.

5. When finished programming, press the arrow (→) button until the clock appears in the upper left corner of the display.

During the exercise period, the ON mode is indicated in the ellipse in the upper right corner of the display (Figure 4-8).

To check the programs:

Push the arrow (→) button to review each setting.

To erase (clear) a program:

Press the arrow (→) button until the program mode (Pr) is reached. Press the arrow (→) button again to select the desired day. To clear the program for the day selected, press the plus and set (**+**) (◗) buttons at the same time.

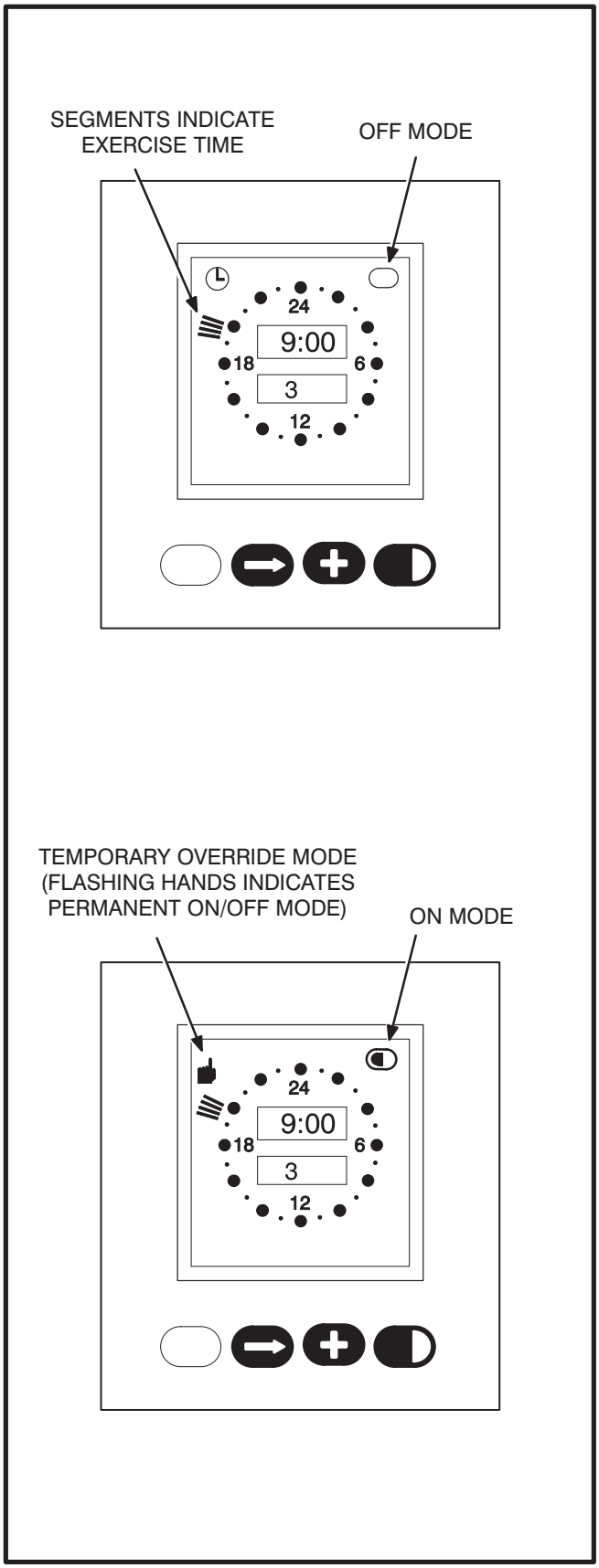


FIGURE 4-8. EXERCISER CLOCK ON/OFF MODE

To Initiate or Override an Exercise Program:

The exerciser clock has a built-in test feature. Once the clock time has been set, the set button (◗) can be used to initiate a test or to cancel a test in progress.

The Load/No Load switch, on the control circuit board (Figure 4-1) can be set to test the genset with or without load, as desired.

With the normal source connected and available, pressing the set (◗) button once will initiate a test sequence. A hand will be displayed in the upper left corner of the display and the On mode will be indicated inside the ellipse in upper right corner of the display (Figure 4-8). Pressing the set (◗) button again will stop the test and the ellipse will indicate the OFF mode.

To temporarily override an activated exercise program, *momentarily* press the set (◗) button. A small hand will appear in the upper left corner of the display (Figure 4-8). The current program will be overridden and the clock will automatically set for the next program. Momentarily pressing the set (◗) button again will return to the current program.

Permanent On/Off Mode:

Holding the set (◗) button down until a *flashing hand appears* in the upper left corner of the display initiates the permanent On/Off mode (Figure 4-8). The On mode is indicated by a continuous band of segments illuminated around the clock. The Off mode is indicated by all of the segments around the clock being off. Pressing the set (◗) button momentarily toggles between the permanent On and permanent Off modes. Holding the set (◗) button down until the clock symbol returns to the upper left corner of the display, ends the continuous On/Off mode and returns to the normal program mode.

5. Checkout

⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Use extreme caution to avoid touching electrical contacts whenever the cabinet door is open.***

⚠WARNING ***Improper operation of the generator set presents a hazard that can cause severe personal injury or death. Observe all safety precautions in your generator set Operation and Installation manuals.***

TEST OVERCRANK FUNCTION THREE-WIRE STARTING

If the optional 3-Wire Start module is installed:

1. Disconnect the positive start lead from the start solenoid or starter.
2. Move the Stop/Auto/Handcrank switch on the 3-Wire Start module to Auto.
3. Turn On the remote test switch (if connected) or press and hold the Test switch on control package B. The Lockout lamp on the 3-Wire Start module should light at the end of the crank period (0 to 120 seconds—per setting).
4. Turn off the remote test switch or release the Test switch on control package B.
5. Move the Stop/Auto/Handcrank switch to Stop and push the Overcrank Reset button (the Lockout lamp should go out).
6. Reconnect the positive lead to the starter or start solenoid.
7. Move the Stop/Auto/Handcrank switch to Auto.

STARTING TEST

Two-Wire Starting

1. Move the selector switch on the engine control to Run. The generator set should start and run.
2. Move the selector switch to Stop. The generator set should stop. Return the selector switch to Remote for automatic operation.

Three-Wire Starting

1. Move the Stop/Auto/Handcrank switch on the 3-Wire Start module to Handcrank.
2. Push the start button on the generator set control. The generator set should start and run.
3. Move the Stop/Auto/Handcrank switch from Handcrank to Stop. The generator set should stop.
4. Move the Stop/Auto/Handcrank switch to Auto. The generator set should not start.

TEST TRANSFER WITH LOAD

1. Move the Load/No-Load switch on the control circuit board to the Load position (Figure 4-1) .
2. Close the cabinet door. If optional Manual Override switch is installed, make sure it is in the Auto position.

   ⚠WARNING ***AC power within the cabinet and the rear side of the cabinet door presents a shock hazard that can cause severe personal injury or death. Close the cabinet door.***

3. ***Control Package A:*** Activate the remote test input. The generator set should start and assume the load after the start and transfer time delays.

   At the end of the test period, deactivate the remote test input. The generator will stop after the retransfer and stop time delays.

   Control Package B: Press and hold the Test switch on the front of the door. The generator set should start and assume the load after the start and transfer time delays.

   At the end of the test period, release the Test switch. The generator will stop after the retransfer and stop time delays. If desired, press the Instant Retransfer switch to bypass a long retransfer delay.

4. In anticipation of scheduled or automatic generator set exercise, check that the Load/No-Load selector switch is in the desired position. Close and lock the cabinet door.

Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
1-800-888-6626
763-574-5000 International Use
Fax: 763-528-7229

Power Generation