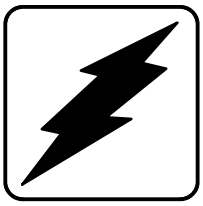
Operation and Installation

Automatic Transfer Switches



Models:

KB

Electrical Controls
S340 Solid-State

Contactors/Bypass Isolation Switches
1600 to 4000 Amperes

ISO 9001
KOHLER GENERATORS
INTERNATIONALLY REGISTERED
U.S.A. Plant ISO Registered

KOHLER®
POWER SYSTEMS

TP-5724 9/94a

Table of Contents

Safety Precautions and Instructions

A transfer switch, like any other electromechanical device, can pose potential dangers to life and limb if improperly maintained or imprudently operated. The best way to prevent accidents is to be aware of the potential dangers and to always use good common sense. In the interest of safety, some general precautions relating to operating of a transfer switch follow. Below are some general precautions relating to the operation of a transfer switch. SAVE THESE INSTRUCTIONS.

DANGER

Danger indicates the presence of a hazard that ***will*** cause ***severe*** personal injury, death, or substantial property damage if the danger is ignored.

WARNING

Warning indicates the presence of a hazard that ***can*** cause ***severe*** personal injury, death, or substantial property damage if the warning is ignored.

CAUTION

Caution indicates the presence of a hazard that ***will*** or ***can*** cause ***minor*** personal injury or property damage if the caution is ignored.

NOTE

Note is used to notify people of installation, operation, or maintenance information that is important but not hazard-related.

Safety decals are affixed to the transfer switch in prominent places to advise the operator or service technician of potential hazards. The decals are reproduced here to improve operator recognition. For a further explanation of decal information, refer to the safety precautions throughout this manual. Before operating or servicing the transfer switch, be sure you understand the messages of these decals. Replace decals if missing or damaged.

Hazardous Voltage/ Electrical Shock

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect power sources before servicing. Barrier must be installed after adjustments, maintenance, or servicing.

Hazardous voltage can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

Hazardous voltage can cause severe injury or death. Keep unauthorized persons away from the generator set and take precautions to prevent unqualified personnel from tampering with the transfer switch. Have the generator set and electrical circuits serviced only by qualified technicians. Wiring should be inspected at the recommended interval shown in the service schedule—replace leads that are frayed or in poor condition. Do not operate electrical when standing in water or on wet ground.

Hazardous voltage can cause severe injury or death. To prevent the possibility of electrical shock, disconnect harness plug before installing any accessories involving connection to transformer assembly primary terminals 76, 77, 78, and 79. Terminals are at line voltage!

NOTE

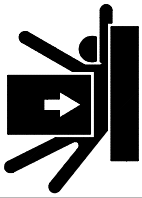
Hardware Damage! Transfer switch may use both American standard and metric hardware. Use the correct size tools to prevent rounding of bolt heads and nuts.

NOTE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. American Standard hardware uses a series of markings and metric hardware uses a numeric system to indicate hardness. Check markings on bolt head and nuts for proper identification.

Heavy Equipment

⚠ WARNING



Unbalanced weight.
Improper lift can cause severe injury, death, or equipment damage.

Use adequate lifting capacity.
Never leave automatic transfer switch standing upright unless it is securely bolted in place.

Introduction

This manual provides operation and initial installation instructions for Kohler automatic transfer and bypass/isolation switches that use a 1600- to 4000-ampere contactor as the power switching device and S340 logic.

Read through this manual and carefully follow all procedures and safety precautions to ensure safe, reliable operation of your automatic transfer switch. Keep a copy of this manual with the automatic transfer switch for future reference.

All information found in this publication is based on data available at time of printing. The manufacturer reserves the right to make changes to this literature and the products represented at any time without notice and without incurring obligation.

In communications regarding the automatic transfer switch, please include the PART and SERIAL numbers provided on the nameplate attached to the transfer switch. Enter the numbers in the spaces provided below. This information will enable the authorized Spectrum service distributor/dealer to supply the correct part or information for your particular model.

Service Assistance

For service or information, consult the yellow pages of the telephone directory under the heading GENERATORS—ELECTRIC for the Authorized Kohler Service Distributor/Dealer.

KOHLER CO., Kohler, Wisconsin 53044
Phone 920-565-3381
Fax 920-459-1646 (North American Sales)
920-459-1614 (International Sales)
For Sales and Service in U.S.A. and Canada
Phone 1-800-544-2444

In communications regarding the automatic transfer switch, please include the PART and SERIAL numbers provided on the nameplate attached to the transfer switch. Enter the numbers in the spaces provided below. This information will enable the authorized Kohler service distributor/dealer to supply the correct part or information for your particular model.

Part No. _____

Serial No._____

Notes

Section 1. Specifications

Transfer Switch Description

Purpose of Automatic Transfer Switch

An Automatic Transfer Switch (ATS) is a device used for transferring critical electrical loads from a normal (preferred) source of electrical power to an emergency (standby) source. This transfer occurs automatically when the normal source voltage fails, or is substantially reduced, and the emergency source's voltage has reached an acceptable level.

Upon normal source failure, the automatic transfer switch controller signals the generator set(s) to start and transfer to the emergency source. The automatic transfer switch controller continuously senses for an acceptable normal source and will retransfer the load to the normal source after it has been restored to an acceptable level. After retransfer of the load, the generator set start signal is removed and the generator set(s) is allowed to shut down.

Purpose of Bypass/Isolation Switch

A bypass/isolation switch is a manually operated device used in conjunction with an ATS to provide a means of directly connecting load conductors to either a normal (preferred) power source or to an emergency (standby) power source, and is also used to disconnect the automatic transfer switch from the power sources and the load for inspection and maintenance.

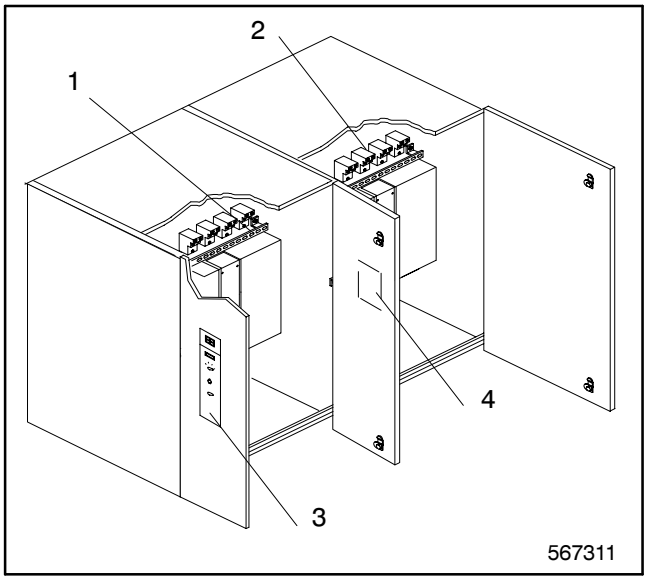
The bypass switch also functions as a manual transfer, allowing the load to be transferred from one source to the other, if required, with the automatic transfer switch totally removed from the system.

Components of Switch

A typical bypass/isolation transfer switch includes the actual power switching device, the bypass/isolation switching device and the logic controller to perform power monitoring and transfer sequencing tasks. See Figure 1-1.

The basic switching device used in these models is a true power transfer switch. The switch is electrically actuated and then mechanically latched in the selected position. However, the switch also includes provisions for manual mechanical operation in emergency conditions. Within the switch, there are two sets of multipole contactors. One set is used to select power from the normal source while the other set is used to select power from the emergency source. The two sets of contacts are mechanically interlocked within the switch so that only one set of contactors can be closed at a time. With this feature it is possible to select one power source to feed the load without cross-coupling that power source to the other power source.

The three functional units that make up the automatic transfer switch are mounted in an enclosure with hinged front doors. The controller mounts on the back of the door so its controls and indicators are available to an operator. A signal cable with in-line connectors to facilitate component replacement and door removal connects the controller to the switching devices.



1. ATS
2. Bypass/Isolation Switch
3. Logic Controller
4. Statue Panel

Figure 1-1. Transfer Switch Components

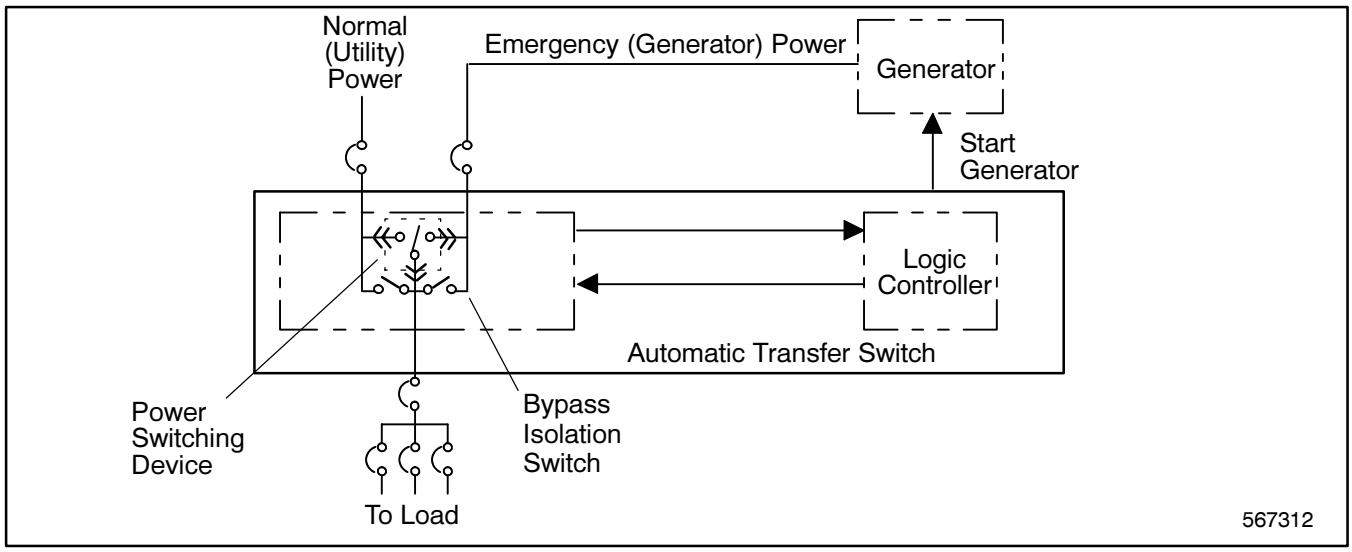


Figure 1-2. Basic Bypass/Isolation Transfer Switch Block Diagram

Ratings

A nameplate is attached to the automatic transfer switch enclosure. See Figure 1-3. The nameplate label includes a factory part number coded to provide characteristic and rating information that affects installation and operation. Copy the part number into the blank spaces provided in the introduction and then use the tables in Figure 1-5 to interpret the part number.

Also copy the part number and serial number from the nameplate into the spaces provided in the **Service Assistance** section of this manual for use when requesting service or parts.

NOTE

The automatic transfer switch and bypass/isolation switch have identical current ratings.

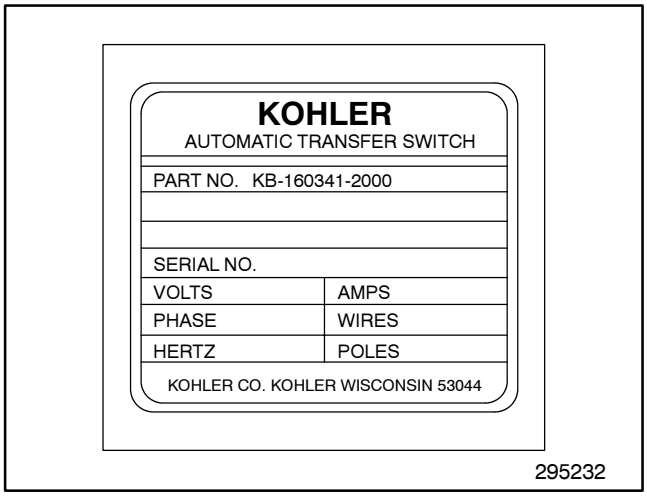


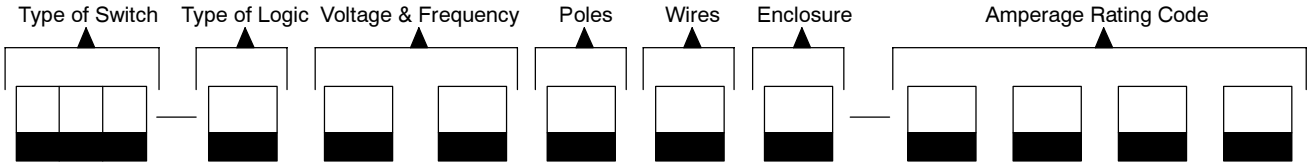
Figure 1-3. Transfer Switch Nameplate

Switch Rating (Amps)	Overcurrent Protection Device			Current Limiting Fuses			Specific Manufacturer's Molded Case Circuit Breakers			
	RMS SYM (Amps)									
	480 Volt	600 Volt	Time (Cycles)	RMS SYM (Amps)	Fuse Size (Amps)	Fuse Type	RMS SYM (Amps)	Manufacturer	Type	Max. Size (Amps)
150	35,000	22,000	3	200,000	450	J	42,000	Square D Westinghouse	IL HKD,KDC,LCL	400 400
225	35,000	22,000	3	200,000	600	J	42,000	GE Siemens/ITE Square D Westinghouse	TJL HL6 IL HKD,KDC,LCL	600 600 400 400
260	35,000	22,000	3	200,000	600	J	42,000	GE Siemens/ITE Square D Westinghouse	TJL HL6 IL HKD,KDC,LCL	600 600 400 400
400	35,000	22,000	3	200,000	600	J	42,000	GE Siemens/ITE Square D Westinghouse	TJL TKL,TBC HL6 HN,SHK,SHP MH,MAG-GARD, PA, PH, NA,NC HMC,TRI-PAC,NB	600 800 600 800 800 800
600	50,000	42,000	3	200,000	1,200	L	65,000	Square D Westinghouse	mag-gard nc tri-pac pb	1,200 1,600
800	50,000	42,000	3	200,000	1,200	L	65,000	Square D Westinghouse	MAG-GARD NC MAG-GARD PH TRI-PAC PB	1,200 2,000 1,600
1000	65,000	65,000	3	200,000	3,000	L	85,000	Square D	MAG-GARD PH	2,000
1200	65,000	65,000	3	200,000	3,000	L	85,000	Square D Westinghouse	SE(LS TRIP),SEH (LS TRIP) TRI-PAC PB	2,500 1,600
1600 2000 3000 4000	100,000 100,000 100,000 100,000	100,000 100,000 100,000 100,000	3 3 3 3	200,000 200,000 200,000 200,000	4,500 4,500 6,000 6,000					

Figure 1-4. Withstand and Current Closing Ratings

Interpreting a Transfer Switch Part Number

Record the transfer switch part number in the boxes below. The transfer switch part number defines characteristics and ratings as explained in the accompanying chart.



Kohler Part Number Key

This diagram explains the Kohler Transfer Switch model numbering system. The sample number shown is for a solid-state logic automatic transfer and bypass/isolation switch, 480-Volt, 60-Hertz, 3-phase, 3-pole, 4-wire, 150-ampere model in a NEMA Type 1 enclosure.

SAMPLE PART NUMBER

KB-166341-0150

Type Of Transfer Switch

KB Automatic Transfer and Bypass Isolation Switch

Includes domestic packing. Add prefix PE for above- or below-deck export packing.

Type Of Logic

1: Solid State

Voltage & Frequency Phase-to-Phase

240V AC Max.*	600V AC Max.	600V AC Max.
21: 110 Volt, 50 Hz	60: 600 Volt, 60 Hz	67: 190 Volt, 50 Hz
22: 120 Volt, 60 Hz	61: 110 Volt, 50 Hz	68: 208 Volt, 60 Hz
23: 220 Volt, 50 Hz	62: 120 Volt, 60 Hz	69: 440 Volt, 60 Hz
24: 240 Volt, 60 Hz	63: 220 Volt, 50 Hz	70: 400 Volt, 50 Hz
27: 190 Volt, 50 Hz	64: 240 Volt, 60 Hz	71: 380 Volt, 50 Hz
28: 208 Volt, 60 Hz	65: 550 Volt, 60 Hz	72: 380 Volt, 60 Hz
	66: 480 Volt, 60 Hz	73: 416 Volt, 50 Hz

Number of Poles

2: 2-pole, 1-phase
3: 3-pole, 3-phase
4: 3-pole, 1-phase
5: 3-pole, 3-phase with overlapping neutral contacts

Number of Wires

2: 2 wire
3: 3 wire
4: 4 wire

Type of Enclosure

0: Open	3: NEMA Type 3R
1: NEMA Type 1	4: NEMA Type 1 CSA**
2: NEMA Type 12	7: Open CSA**

Amperes

0030: 30 amperes	0800: 800 amperes
0070: 70 amperes	1000: 1000 amperes
0100: 100 amperes	1200: 1200 amperes
0104: 104 amperes	1600: 1600 amperes
0150: 150 amperes	2000: 2000 amperes
0225: 225 amperes	2500: 2500 amperes
0260: 260 amperes	3000: 3000 amperes
0400: 400 amperes	4000: 4000 amperes
0600: 600 amperes	

* Available in 30-100 ampere sizes only.

** CSA versions available up to 2000 amperes.

Figure 1-5. Transfer Switch Model Designations

Specifications

Specifications for automatic transfer switches covered by this manual are listed below:

Logic Specifications

- The normal source voltage is monitored across live lines of 1-phase switches, and all phases of normal power are monitored line-to-line in 3-phase switches.
- Switches have modular type construction.
- Controller has adjustable normal source voltage sensing from 72 to 100% of nominal for pickup and 70 to 98% for dropout.
- Controller has close differential voltage sensing on all phases.
- LEDs indicate switch status. They light as each monitored function is complete. The LEDs also serve as a diagnostic aid.
- Main logic board contains the standard electronics and is field interchangeable.
- Accessory plug-in cards are key interlocked to prevent incorrect insertion.

ATS/BIS Specifications

- All models are UL-1008 listed and meet NEMA standard ICS 2-447.
- Transfer switch is CSA certified up to and including 2000 amperes.
- All models are 100% equipment rated and can be applied at the rated current, either open or enclosed, without derating.
- Switches are rated for all classes of load, both inductive and noninductive.
- Contactors offer high-speed transfer, 1/6 second or less, including relay operating time for all ampacities exclusive of time delays.
- All switches meet the transient overvoltage impulse withstand test in accordance with the proposed NEMA Standard ICS 1-109 and voltage surge withstand capability in accordance with ANSI/IEEE C37.90-1978.
- Contactors use a reliable single-coil solenoid operating mechanism.
- Contactors are mechanically held, electrically operated.
- Switches are suitable for emergency and standby applications without modification. Transfer switch meet rating requirements of Articles 700, 701, and 702 of the National Electrical Code and UL-1008 Table 23.2 for emergency systems.
- Contactors use true double-throw, inherently interlocked construction.
- NEMA Type 3R enclosures have gasketed doors plus all features of the NEMA type 1 enclosures and meet the above NEMA and UL standards.
- Solid neutral bars are used on two-pole and three-pole switches. They are of the insulated/groundable type and use separate connectors for normal, emergency, and load power connections.
- Contacts are readily accessible from the front for easy inspection.
- Contactors have no possible neutral position.
- All components are front accessible and front removable.

Notes

Section 2. Transfer Switch Operation

Switches and Indicators

Description of Bypass/Isolation Switch Components

Isolation Handle. The isolation handle controls the three positions of the ATS: connected, test, or disconnected. Turn the isolation handle clockwise to move the ATS to the CONNECTED position and counterclockwise to move the ATS to the DISCONNECTED position.

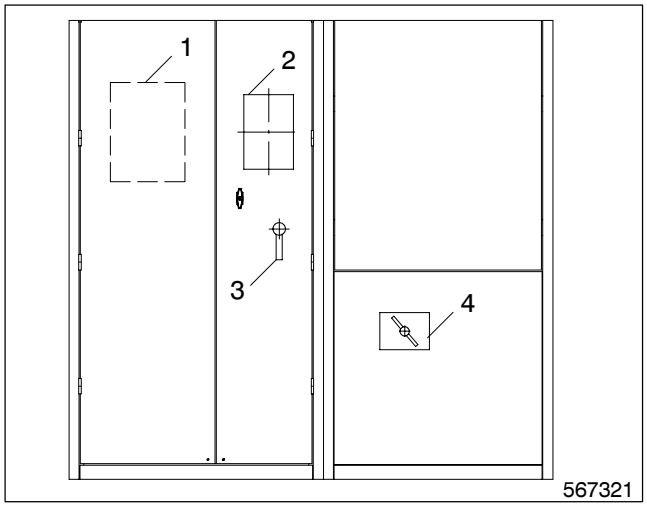
Bypass Handle. The bypass handle opens and closes the bypass contactors.

Bypass Handle, Bypass Position. When the bypass handle is in the BYPASS position, the bypass contacts are closed on the same source as the ATS.

Bypass Handle, Automatic Position. When the bypass handle is in the AUTOMATIC position, the bypass contacts are isolated from the sources and load.

Status Panel. The status panel has lamps that display information on the availability of sources, position of the bypass and ATS contacts, and the physical position of the ATS. Refer to **Description of the Bypass/Isolation Status Panel Lamps** for descriptions of each lamp.

Logic Controller. The logic controller controls the functions of the transfer switch. Refer to **Description of Logic Controller Switches and Indicators** for more information.



1. Logic Panel
2. Status Panel
3. Isolation Handle
4. Bypass Handle

Figure 2-1. Bypass/Isolation Components

Description of the Bypass/Isolation Status Panel Lamps

Normal Available. Normal available lamp illuminates when the normal power source is available.

Emergency Available. Emergency available lamp illuminates when the emergency power source is available.

Closed On Normal (Bypass Switch). Closed on normal (bypass switch) lamp illuminates when the normal source bypass contacts are closed on the bus.

Closed On Emergency (Bypass Switch). Closed on emergency (bypass switch) lamp illuminates when the emergency source bypass contacts are closed on the bus.

Closed On Normal (ATS Switch). Closed on normal (ATS) lamp illuminates when the normal source ATS contacts are closed on the bus.

Closed On Emergency (ATS Switch). Closed on emergency (ATS) lamp illuminates when the emergency source ATS contacts are closed on the bus.

ATS Position, Test. ATS position, test lamp illuminates when the ATS is physically in the TEST location.

ATS Position, Disconnected. The ATS position, disconnected lamp illuminates when the ATS is physically isolated from the switch.

ATS Position, Connected. The ATS position, connected lamp illuminates when the ATS is physically attached to both the source and the load.

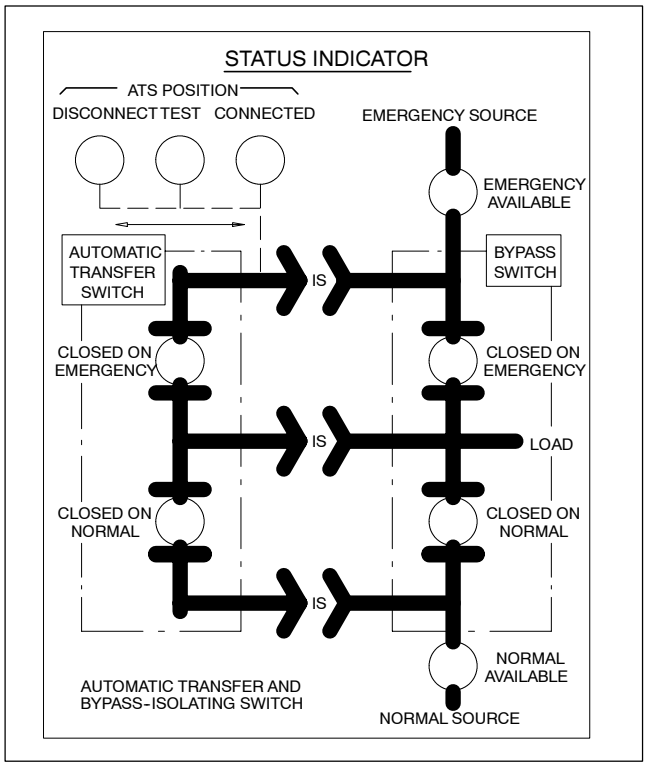


Figure 2-2. Bypass/Isolation Status Indicator

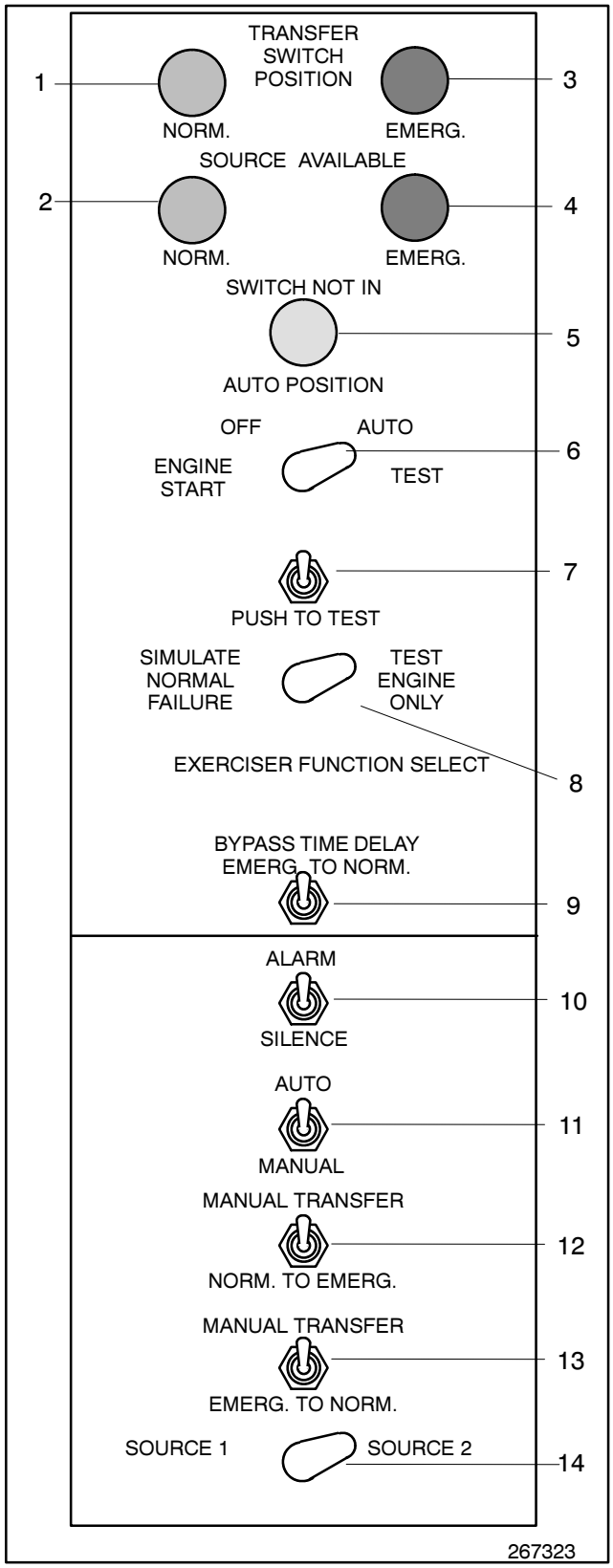


Figure 2-3. Transfer Switch Control Switches & Indicators

Description of Logic Controller's Switches and Indicators

Various optional control switches and indicator lamps *may* be present on the transfer switch door. For identification of switches and indicators and an explanation of their function, refer to Figure 2-3 and the following descriptions.

1. **Normal Transfer Switch Position Lamp (green).** Lamp illuminates to indicate that the load is connected to the normal source. **Standard accessory 12-A, C**.
2. **Normal Source Available Lamp (white).** Lamp illuminates to indicate presence of normal source voltage. **Standard accessory 12-E, G**.
3. **Emergency Transfer Switch Position Lamp (red).** Lamp illuminates to indicate that the load is connected to the emergency source. **Standard accessory 12-B, D**.
4. **Emergency Source Available Lamp (white).** Lamp illuminates to indicate presence of emergency source voltage. **Standard accessory 12-F, H**.
5. **Switch-Not-in-Auto Lamp (white).** Lamp illuminates to indicate that the four-position selector switch (item 6) is not in the automatic position, preventing automatic transfer switch operation. **Optional accessory 7-D, E, F**.
6. **Four-Position Selector Switch.** Switch selects transfer switch mode of operation. *ENGINE-START* position signals the generator set to start. *OFF* position prevents automatic transfer switch operation by de-energizing control circuits and opening the engine-start circuit. If the generator set is started locally (at the generator set controller) and the generator line circuit breaker is closed, the switch will transfer to emergency. *AUTO* position enables automatic transfer switch operation. *TEST* position simulates a normal-source failure. **Optional accessory 7-D, E, F**.
7. **Test Switch.** *AUTO* position allows automatic transfer switch operation. *TEST* position simulates a normal source failure.

8. **Plant Exerciser Selector Switch**. *SIMULATE-NORMAL-FAILURE* position will exercise the generator set under load. *TEST-ENGINE-ONLY* position will exercise the generator set unloaded **Optional accessory 23-G**.
9. **Bypass Time Delay Emerg. to Normal.** Operating the switch will cause the emergency-to-normal time delay to be overridden. It will cause the transfer switch to transfer to normal immediately if the normal source is available. **Optional accessory 8-A, C**.
10. **Alarm Silence Switch.** Operating the switch will silence the audible alarm that sounds when the transfer switch is in the emergency position. **Optional accessory 31-B**.
11. **Auto-Manual Selector Switch.** *AUTO* position selects automatic transfer switch operation. *MANUAL* position allows operation of transfer switch using the manual transfer toggle switches below. **Optional accessory 29-F, G, H, J**.
12. **Manual Transfer, Normal-to-Emergency Switch.** Operating the switch will allow normal-to-emergency transfer if the normal source is available after any time delay. **Optional accessory 29-F, B, G, D**.
13. **Manual Transfer, Emergency-to-Normal Switch**. Operating the switch will allow an emergency-to-normal transfer if the normal source is available after any time delay. **Optional accessory 29-B, D, H, J, C, E**.
14. **Preferred-Source Selector Switch.** Selects either the normal or emergency source as the source that the transfer switch will transfer to if the selected source is available. Sources may be two utilities or two generator sets. **Optional accessory 10-A, B, C, D**.

ATS Sequence of Operation

Operation of the typical automatic transfer switch is divided into two separate sequences: (1) failure of normal power and the resulting transfer to emergency power and (2) restoration of normal power and the resulting transfer back to normal power. A brief description of both sequences is provided below. Note that these sequences may be affected by accessories described in Section 4, Accessories.

- **Failure of Normal Power,** either loss or deterioration of one or more phases, is detected by monitors within the controller. The monitor that detects the failure starts a time delay, called Time Delay Engine Start (TDES). If power is restored before the time delay expires, the timer is reset. But, if the failure persists and the time delay expires, the controller issues a signal to start the standby (emergency) power generator. This time delay scheme is used to prevent unnecessary starting of the generator during short power interruptions.

  A second set of monitors within the controller check the status of the emergency power. When the voltage and frequency of the emergency (generator) power are acceptable, these monitors start a timing cycle, called Time Delay Normal to Emergency (TDNE) which is provided to allow the generator outputs to stabilize. At the end of this timing cycle the controller issues a signal to the transfer switch operators to remove normal power and then connect emergency power to the load.

  Once it is switched, the transfer switch is mechanically latched in the emergency position, supplying power to the load from the emergency source until normal power is restored.

- **Restoration of Normal Power** automatically begins a sequence that transfers the load back to the normal power source. The monitors within the controller continue to check the status of the normal power, even when the load is operating from emergency power. When these monitors detect stable normal power, a time delay called Time Delay Emergency to Normal (TDEN) is started. If the normal power fails again before the time delay expires, the time delay is reset. This timing period is included to ensure that the normal power is stabilized before it is reconnected to the load.

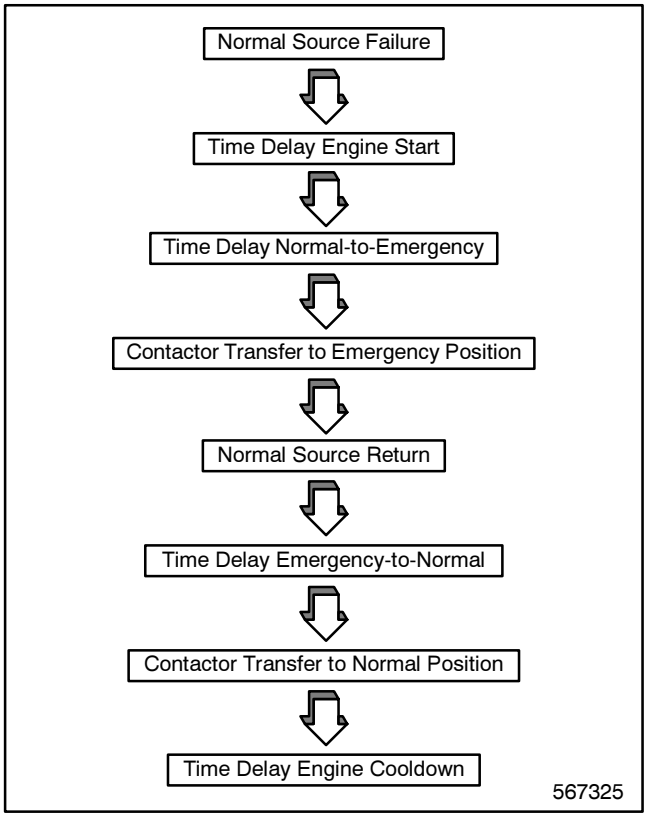


Figure 2-4. Logic Board Operation

If the normal power remains acceptable and the time delay expires, the controller will issue signals to the transfer switch to remove emergency power and reconnect normal power to the load. After switching, the transfer switch is mechanically latched in the normal position. The controller starts a timer called Time Delay Engine Cooldown (TDEC) simultaneously with the power transfer. After this time delay expires, the generator engine is stopped.

Operation of the Bypass/Isolation Switch

To place the ATS in the Automatic Mode

This procedure explains how to return the ATS to service after inspection and maintenance.

1. Open the cabinet door and remove the isolation handle stored on the right side of the carriage frame.
2. Close the cabinet door and insert the handle through the door and onto the isolation shaft.
3. Rotate the isolation handle clockwise until the test lamp illuminates and the disconnected lamp turns off (approximately 7 or 8 turns).

The Electrical Operation Test can be performed at this time to verify the electrical operation of the ATS.

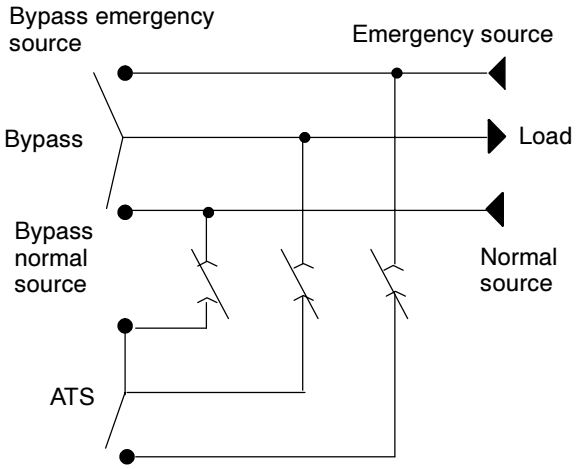
4. Continue to rotate the isolation handle clockwise until the handle stops (approximately 6 or 7 turns). The closed on normal or closed on emergency lamp will illuminate (depending on source supplying power to the load); the test lamp will turn off.

If the Normal source is supplying power to the load

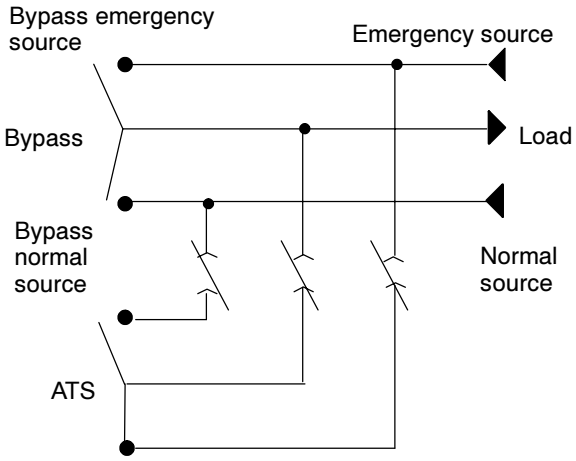
1. Verify that the normal source is supplying power to the load by observing the closed on normal (bypass) lamp is illuminated.
2. Push in the bypass handle and turn it clockwise to the automatic position. The closed on normal (ATS) lamp will illuminate.

If the Emergency source is supplying power to the load

1. Verify that the emergency source is supplying power to the load by observing the closed on emergency (bypass) lamp is illuminated.
2. Pull out the bypass handle and turn it clockwise to the automatic position. The closed on emergency (ATS) lamp will illuminate.



Bypass in the open position and ATS in the normal position



Bypass in the open position and ATS in the emergency position

567326

To Bypass the ATS to the Normal Source

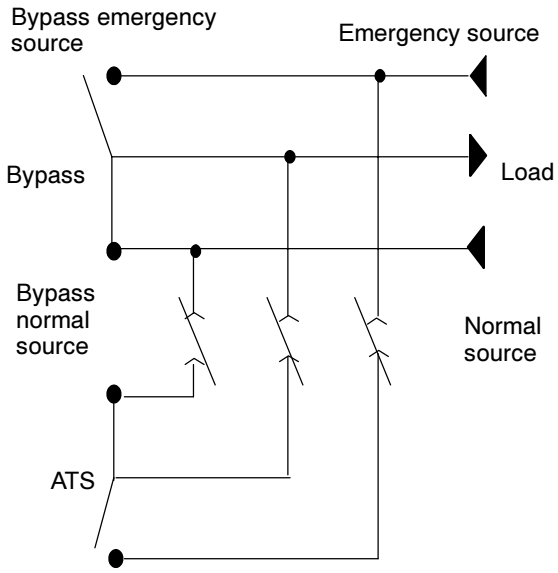
This procedure explains how to bypass the closed ATS contacts. Bypassing is required before the ATS can be tested or isolated. The bypass switch must be in automatic position and the isolation handle must be in the connected position (turned clockwise until it stops). The connected lamp will illuminate.

1. Verify that the normal source is supplying power to the load by observing the closed on emergency (ATS) lamp is illuminated on the status indicator panel.
2. Push in the bypass handle and turn it counterclockwise to the bypass position. The closed on normal (bypass) lamp will illuminate.

To Bypass the ATS to the Emergency Source

This procedure explains how to bypass the closed ATS contacts. Bypassing is required before the ATS can be tested or isolated. The bypass switch must be in automatic position and the isolation handle must be in the connected position (turned clockwise until it stops). The connected lamp will illuminate.

1. Verify that the emergency source is supplying power to the load by observing the closed on normal (ATS) lamp is illuminated on the status indicator panel.
2. Pull out the bypass handle and turn it counterclockwise to the bypass position. The closed on emergency (bypass) lamp will illuminate.



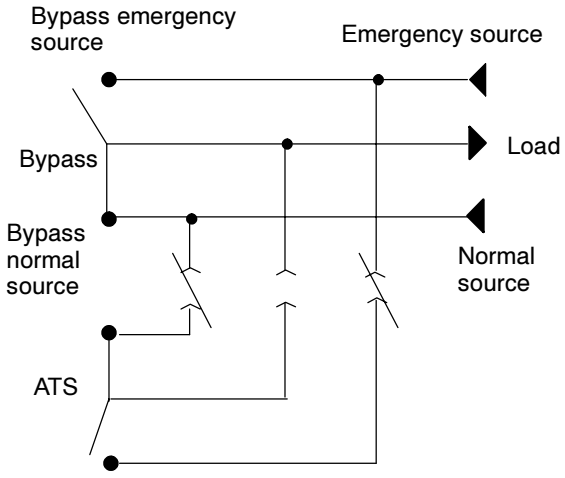
Bypass in the normal position and ATS in the normal position

567327

To Test the ATS

This procedure explains how to place the ATS in the test position.

1. Bypassing the ATS is described in **To Bypass the ATS to the Normal Source** or **To Bypass the ATS to the Emergency Source** depending on which source is supplying power to the load.
2. Open the right cabinet door and remove the isolation handle stored on the right side of the carriage frame. Close the cabinet door and insert the handle through the door into the isolation shaft.
3. Rotate the isolation handle counterclockwise until the test lamp illuminates (approximately 6 or 7 turns).



Bypass in the normal position and ATS in the test position (ATS load connection is open)

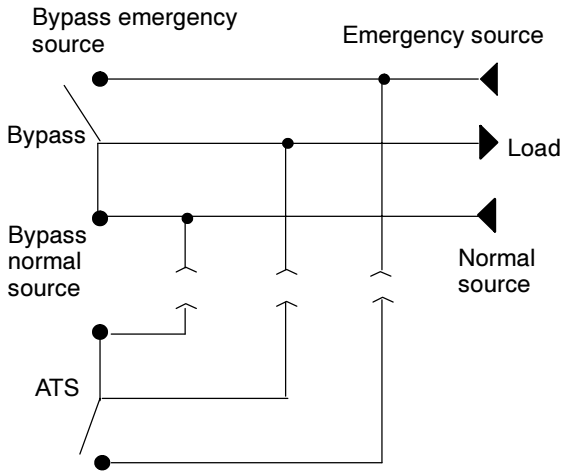
567328

To Isolate the ATS

This procedure explains how to isolate the ATS. Isolating is required before any service work can be performed on the ATS. Observe the ATS position lamp on the status indicator panel.

1. Bypassing the ATS is described in **To Bypass the ATS to the Normal Source** or **To Bypass the ATS to the Emergency Source** depending on which source is supplying power to the load.
2. Open the right cabinet door and remove the isolation handle stored on the right side of the carriage frame. Close the cabinet door and insert the handle through the door into the isolation shaft.
3. Rotate the isolation handle counterclockwise until the test lamp illuminates (approximately 6 or 7 turns).
4. Continue to rotate the isolation handle counterclockwise until the handle stops (approximately 10 or 11 turns). The disconnected lamp will illuminate and the test lamp will turn off.
5. Remove the isolation handle and store it inside the enclosure on the right side of the carriage frame.

The transfer switch can now be removed for inspection and maintenance.



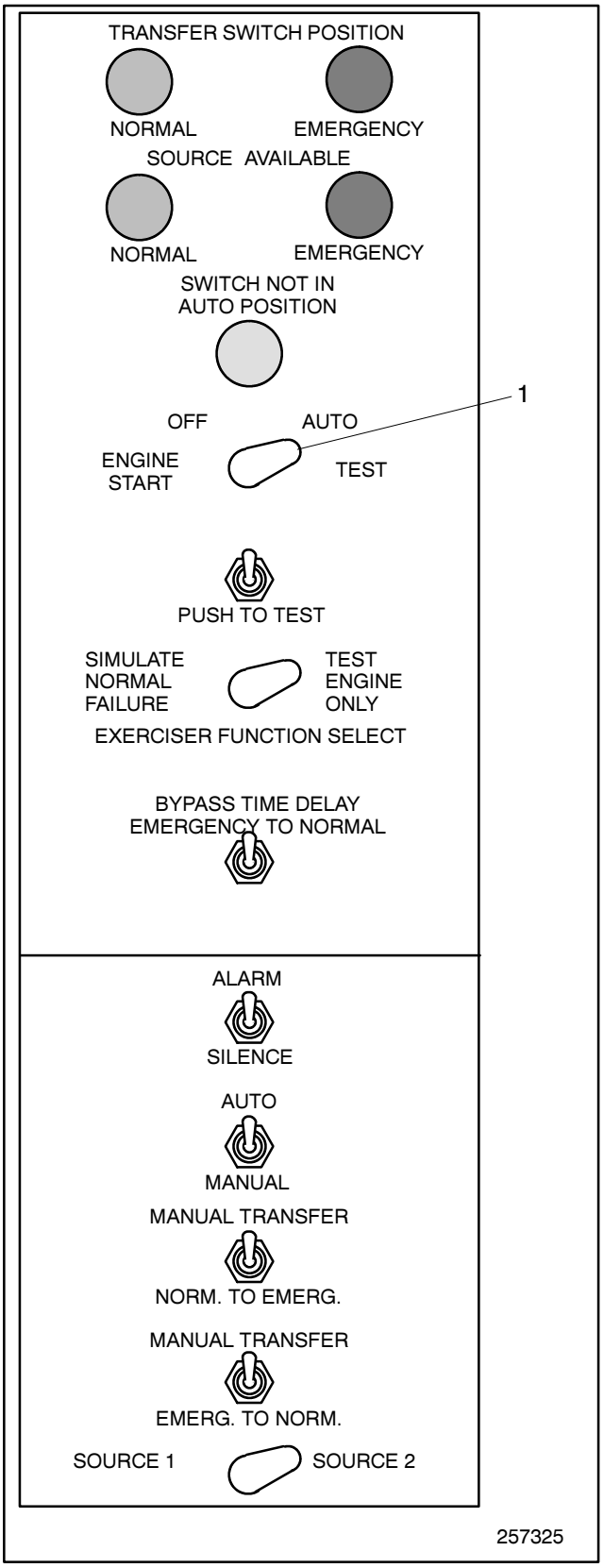
Bypass in the normal position and ATS in the isolate position

567329

Electric Operation Test

This procedure will check the electrical operation of the automatic transfer switch without interrupting the load. Confirm that the ATS is in the test position and bypassed. Confirm that the engine start control is in the automatic position.

1. Move and hold the test switch to the test position until the engine starts and runs.
2. The ATS will transfer to the emergency position after the time delay normal to emergency timer is complete. The ATS closed on emergency lamp will illuminate. If Time Delay Normal to Emergency (TDNE) is used, the transfer will occur after the time delay.
3. The ATS will retransfer to the normal source after the Time Delay Emergency to Normal (TDEN) has completed timing.

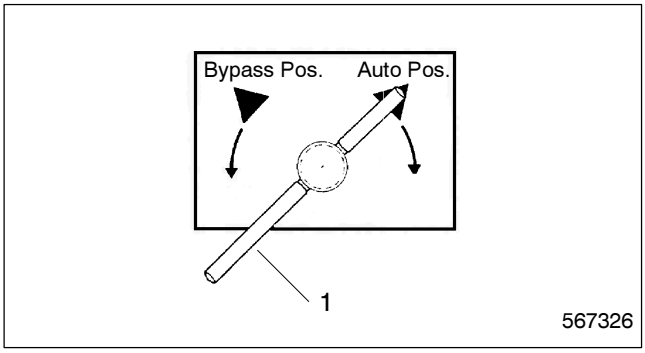


1. Test Selector Switch

Figure 2-5. Transfer Switch Control Switches & Indicators

Bypass/Isolation Switch Operation Notes

1. When the ATS is in the test or isolate position the bypass switch acts as a manual transfer switch.
2. The ATS will not operate if any of the following are true:
   a. The harness plugs are disconnected.
   b. The ATS is not in the automatic or test positions.
   c. The ATS is in the automatic position and the bypass switch is not open.
3. The bypass handle will not turn.
   a. Verify that either the normal source available or the emergency source available lamp is illuminated.
   b. Verify that the ATS is closed on the same source as the one to be bypassed.



1. Bypass Handle

Figure 2-6. Bypass Handle

Preventive Maintenance

Reasonable care in preventive maintenance will insure high reliability and long life for the switch.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect power sources before servicing. Barrier must be installed after adjustments, maintenance, or servicing.

Clean and inspect the switch once a year. De-energize all sources, then brush and vacuum away any excessive dust accumulation. Remove the ATS barriers and check the condition of the contacts. Replace the contacts when pitted or worn excessively. Reinstall the barriers carefully.

Maintain transfer switch lubrication. The transfer switch is lubricated and under normal operating conditions no further lubricating is required. Renew factory lubrication if the switch is subjected to severe dust or abnormal operating conditions. Relubricate the operator if the TS coil is replaced.

Exercise the generator under load. To test the generator set with load perform the Electric Operation Test procedure. Service to the load is not interrupted during this test.

Manual Load Transfer

This procedure allows manual transfer of the load to the opposite source if the ATS is out of service. A brief interruption to the load occurs during the manual transfer.

1. Bypass and isolate the ATS as described earlier in this section.
2. Check that both normal available and emergency available lamps are illuminated. Start the generator set if necessary.
3. Turn the bypass handle clockwise to the automatic position.
4. Pull out or push in the bypass handle; if the switch is in the emergency position pull the handle out, if the switch is in the normal position push the handle in. Turn the bypass handle back counterclockwise to the bypass position (select opposite source).

Disconnecting the Control Panel

The harness disconnect plug P1 is furnished for repair purposes only and should not be unplugged. If the control panel requires isolation, perform the following steps:

Disconnecting the Plug

1. Bypass and isolate the ATS by following the steps earlier in this section. Verify that the ATS Position Disconnected lamp is illuminated.

2. Remove the isolation handle.
3. Open the cabinet doors.
4. Separate the quick-disconnect plug by squeezing the latches. Do not pull on the harness wires.

Reconnecting the Plug

1. The harness plug and socket in the control panel are keyed. Carefully align the P1 plug with the J1 socket (in the control panel) and press it straight in until both latches click.
2. Close the cabinet doors.
3. Install the isolation handle. Carefully follow the directions earlier in this section to put the transfer switch into the automatic position.

Notes

Section 3. Removal and Reconnection of the ATS

To Remove the ATS

This procedure explains how to remove the ATS switch for inspection and maintenance.

1. Bypass and isolate the ATS by following the **To Isolate the ATS** procedure in Section 2. Be sure that the ATS POSITION DISCONNECTED lamp is illuminated.
2. Remove the isolation handle.
3. Open the ATS cabinet door all the way and remove the bottom enclosure pan.
4. Disconnect the multipin plugs J2 and J5.
5. Roll the ATS out of the cabinet on its built-in cart.

To Reconnect the ATS

This procedure explains how to install the ATS after inspection and maintenance.

1. Open the ATS cabinet door all the way. Remove the bottom louvered enclosure pan (if not already removed).

   NOTE

   Clean debris from the enclosure tracks and floor. All arc chutes and inphase barriers must be in place on the ATS.

2. Verify that the ATS contacts are in the normal position.
3. Roll the ATS cart into the cabinet (isolation contacts facing inward). Align the rollers between the floor guides and push the carriage in until the crank pins engage the latch plates on both sides.
4. Reconnect the multipin harness plugs (J2 and J5).
5. Close the cabinet door and install the bottom enclosure pan.
6. Refer to the **To place the ATS in the Automatic Mode** procedure in Section 2 to return the ATS to its normal state of operation.

Notes

Section 4. Accessories

Optional Accessories

Time Delays	
❑ KA-01-B	(TDNE) Time Delay on Transfer from Normal to Emergency (adjustable 1 to 30 minutes) TDNE delays transfer of the switch from the normal source to the emergency source. This overrides momentary power outages or fluctuations that may occur on the system if the emergency source is utility, or allows the emergency source to stabilize before accepting the load if the emergency source is a generator set. The timer begins timing when the emergency source appears, but will not transfer to it until the time delay setting has elapsed.
❑ KA-02-A	(TDES) Time Delay on Engine Starting (adjustable 3 to 20 seconds). TDES delays initiation of the engine-start circuit in order to ignore momentary power outages or fluctuations. This timer begins timing when the normal source fails. It is intended for use when the emergency source is an engine generator and does not affect the transfer switch's ability to transfer from normal to emergency.
❑ KA-02-F	(TDES) Time Delay on Engine Starting (adjustable 20 to 240 seconds). TDES delays initiation on the engine-start circuit in order to ignore momentary power outages or fluctuations. This timer begins timing when the normal source fails. It is intended for use when the emergency source is an engine generator and does not affect the transfer switch's ability to transfer from normal to emergency.
❑ KA-02-G	(TDES) Time Delay on Engine Starting (adjustable 0.5 to 6 seconds). TDES delays initiation of the engine-start circuit in order to ignore momentary power outages or fluctuations. This timer begins timing when the normal source fails. It is intended for use when the emergency source is an engine generator and does not affect the transfer switch's ability to transfer from normal to emergency.
❑ KA-02-H	(TDES) Time Delay on Engine Starting (adjustable 3 to 30 minutes). TDES delays initiation of the engine-start circuit in order to ignore momentary power outages or fluctuations. This timer begins timing when the normal source fails. It is intended for use when the emergency source is an engine generator and does not affect the transfer switch's ability to transfer from normal to emergency. It is a separate relay and not part of the main logic board. Not necessary if they are UL listed.
❑ KA-04-C	(TDEC) Time Delay for Engine Cool-Off (adjustable 1 to 30 minutes). TDEC permits the generator to run under a no-load condition after transfer from emergency to normal. This timer begins when the switch transfers to normal.

Time Delays (continued)	
❑ KA-04-D	(TDEC) Time Delay for Engine Cool-Off (set at 5 minutes). TDEC permits the generator to run under a no-load condition after transfer from emergency to normal. This timer begins when the switch transfers to normal. It does not require a logic cage. This is a separate relay.
Source Monitors	
❑ KA-05-A	Underfrequency card for emergency source (adjustable 45 to 60 Hz). Monitors generator frequency (monitors one phase only). If the emergency source fails or is outside of the card setting and normal is available, the switch will immediately transfer to normal.
❑ KA-05-C	Overfrequency card for emergency source (adjustable 55 to 65 Hz). Monitors one phase only. Plug-in printed circuit card.
❑ KA-05-D	Undervoltage card for emergency source. Monitors emergency source voltage (monitors one phase only). The switch will immediately transfer to normal if the emergency source fails or is outside of the card setting and normal is available. Adjustable voltage sensing from 72 to 100% of nominal for pickup and 70 to 98% for dropout.
❑ KA-05-E	Overvoltage card for emergency source (adjustable from 100 to 115%, nominally set at 115% drop to out unless otherwise specified). Monitors emergency source voltage (monitors one phase only). The switch will immediately transfer to normal if the emergency source fails or is outside of the card setting and normal is available.
❑ KA-05-F	Undervoltage card for emergency source. Monitors three phases. The switch will immediately transfer to normal If the emergency source fails or is outside of the card setting and normal is available. Adjustable voltage sensing from 72 to 100% of nominal for pickup and 70 to 98% for dropout.
❑ KA-05-G	Overvoltage card for emergency source (adjustable from 100 to 115%, nominally set at 115% dropout unless otherwise specified). Monitors three phases. If the emergency source fails or is outside of the card setting and normal is available, the switch will immediately transfer to normal.
❑ KA-05-H	Phase sequence relay permits transfer in either direction only when both sources have same phase rotation.

Test Switches	
❑ KA-06-A	Test switch for separate mounting. The momentary test switch will interrupt power to the normal source relay and simulate a power failure on normal as long as the switch is held in the test position. (Omitted if accessory KA-07 is selected.)
❑ KA-06-C	Maintained contact test switch for separate mounting.
❑ KA-06-D	Maintained contact test switch for mounting on enclosure door.
❑ KA-06-E	Test switch for separate mounting. The key-operated test switch will interrupt power to the normal source relay and simulate a power failure on normal as long as the switch is held in the test position. (Omitted if accessory KA-07 is selected).
❑ KA-06-F	Test switch mounted on the enclosure door. The key-operated test switch will interrupt power to the normal source relay and simulate a power failure on normal as long as the switch is held in the test position. (Omitted if accessory KA-07 is selected).
❑ KA-06-G	Maintained contact key-operated test switch for separate mounting.
❑ KA-06-H	Maintained contact key-operated test switch mounted on the enclosure door.
❑ KA-06-L	Three-position test switch. Permits three modes of operation: test with Load (momentary contact), Auto, Test without Load (maintained contact). For separate mounting.
❑ KA-06-M	Three-position test switch. Permits three modes of operation: test with Load (momentary contact), Auto, Test without Load (maintained contact). Mounted on the enclosure door.
❑ KA-07-C	Four-position selector switch (selector switch with white light, for separate mounting). Permits four modes of switch operation: Test, Auto, Off and Engine Start. The Off position de-energizes the control circuitry and opens the engine-start circuit. The transfer switch will not operate nor will the engine start on power failure. The Test position simulates a normal power failure. The Auto position returns the transfer switch to automatic operation. The Engine Start position closes the engine-start circuit. The switch will transfer only if the normal source fails. A white lamp will light in all positions except the Auto position (accessory KA-06 is omitted if accessory KA-07 is selected). NEMA Type 1 only.

Test Switches (continued)	
❑ KA-07-D	Four-position selector switch (selector switch with white light, installed on enclosure door). Permits four modes of switch operation: Test, Auto, Off and Engine Start. The Off position de-energizes the control circuitry and opens the engine-start circuit. The transfer switch will not operate nor will the engine start on power failure. The Test position simulates a normal power failure. The Auto position returns the transfer switch to automatic operation. The Engine Start position closes the engine-start circuit. The switch will transfer only if the normal source fails. A white lamp will light in all positions except the Auto position (accessory KA-06 is omitted if accessory KA-07 is selected). NEMA Type 1 only.
❑ KA-07-E	Four-position key-operated selector switch (selector switch with white light, installed on enclosure door). Permits four modes of switch operation: Test, Auto, Off and Engine Start. The Off position de-energizes the control circuitry and opens the engine start circuit. The transfer switch will not operate nor will the engine start on power failure. The Test position simulates a normal power failure. The Auto position returns the transfer switch to automatic operation. The Engine Start position closes the engine start circuit. The switch will transfer only if the normal source fails. A white lamp will light in all positions except the Auto position (accessory KA-06 is omitted if accessory KA-07 is selected). NEMA Type 1 only.
❑ KA-07-F	Four-position key-operated selector switch (selector switch with white light, for separate mounting). Permits four modes of switch operation: Test, Auto, Off and Engine Start. The Off position de-energizes the control circuitry and opens the engine start circuit. The transfer switch will not operate nor will the engine start on power failure. The Test position simulates a normal power failure. The Auto position returns the transfer switch to automatic operation. The Engine Start position closes the engine start circuit. The switch will not transfer unless the normal source fails. A white lamp will light in all positions except the Auto position (accessory KA-06 is omitted if accessory KA-07 is selected. NEMA Type 1 only.
❑ KA-07-H	Four-position key-operated selector switch (selector switch with white light, mounted on NEMA Type 3R or 12 enclosure door). Permits four modes of switch operation: Test, Auto, Off and Engine Start. The Off position de-energizes the control circuitry and opens the engine start circuit. The transfer switch will not operate nor will the engine start on power failure. The Test position simulates a normal power failure. The Auto position returns the transfer switch to automatic operation. The Engine Start position closes the engine start circuit. The switch will transfer only if the normal source fails. A white lamp will light in all positions except the Auto position (accessory KA-06 is omitted if accessory KA-07 is selected). Not UL listed.

Time Delay Override Switches	
❑ KA-08-A	Override-to-normal pushbutton. Bypasses accessory KA-03-C and allows manual transfer at any time after normal power is restored. For separate mounting.
❑ KA-08-C	Override-to-normal pushbutton. Bypasses accessory KA-03-C and allows manual transfer at any time after normal power is restored. Enclosure-door mounted.
Transfer-Inhibit Switches	
❑ KA-09-F	Inhibitor switch to prevent transfer in either direction for separate mounting. Also opens engine-start circuit. Not UL listed.
❑ KA-09-G	Inhibitor switch to prevent transfer in either direction for enclosure mounting. Also opens engine-start circuit. Not UL listed.
❑ KA-09-H	Inhibitor key-operated switch to prevent transfer in either direction for separate mounting. Also opens engine-start circuit. Not UL listed.
❑ KA-09-J	Inhibitor key-operated switch to prevent transfer in either direction for enclosure mounting. Also opens engine-start circuit. Not UL listed.
Preferred-Source Switches	
❑ KA-10-A	Two-position selector switch. This switch permits selection of either the normal or emergency source as the preferred power source. The preferred source is the one the switch will always transfer to if that source is available. For use with either two commercial power sources or one commercial power source and one engine-generator. For separate mounting.
❑ KA-10-B	Two-position selector switch. This switch permits selection of either the normal or emergency source as the preferred power source. The preferred source is the one the switch will always transfer to if that source is available. For use with either two commercial power sources or one commercial power source and one engine-generator. Mounted on the enclosure door.
❑ KA-10-C	Two-position selector switch for separate mounting. This switch permits selection of either the normal or emergency source as the preferred power source. The preferred source is the one the switch will always transfer to if that source is available. For use when both sources are engine-generators.
❑ KA-10-D	Two-position selector switch. This switch permits selection of either the normal or emergency source as the preferred power source. The preferred source is the one the switch will always transfer to if that source is available. For use when both sources are engine-generators. Mounted on the enclosure door.
❑ KA-10-E	Two-position selector switch with electric automatic operation (50 Hz). This switch permits selection of either the normal or emergency source as the preferred power source. The preferred source is the one the switch will always transfer to if that source is available. For use when both sources are engine-generators. Uses accessory KA-23 Plant Exerciser Timer. For separate mounting. Not UL listed.
❑ KA-10-F	Two-position selector switch with electric automatic operation (60 Hz). This switch permits selection of either the normal or emergency source as the preferred power source. The preferred source is the one the switch will always transfer to if that source is available. For use when both sources are engine-generators. Uses accessory KA-23 Plant Exerciser Timer. Mounted on the enclosure door.

Pilot Lights	
❑ KA-12-A	Pilot light to normal supply for separate mounting. Green lamp indicates transfer switch in normal position and normal power is supplying load. Up to four pilot lights can be paralleled. Does not require accessory KA-15.
❑ KA-12-B	Pilot light emergency supply for separate mounting. Red lamp indicates transfer switch in emergency position and emergency power is supplying load. Up to four pilot lights can be paralleled. Does not require accessory KA-15.
❑ KA-12-C	Pilot light to normal supply enclosure door mounted. Green lamp indicates transfer switch in normal position and normal power is supplying load. Up to four pilot lights can be paralleled. Does not require accessory KA-15.
❑ KA-12-D	Pilot light emergency supply enclosure door mounted. Red lamp indicates transfer switch in emergency position and emergency power is supplying load. Up to four pilot lights can be paralleled. Does not require accessory KA-15.
❑ KA-12-E	Pilot light to normal supply for separate mounting. White lamp indicates normal power is present. Up to four pilot lights can be paralleled.
❑ KA-12-F	Pilot light emergency supply for separate mounting. White lamp indicates emergency power is present. Up to four pilot lights can be paralleled.
❑ KA-12-G	Pilot light to normal supply enclosure door mounted. White lamp indicates normal power is present. Up to four pilot lights can be paralleled.
❑ KA-12-H	Pilot light emergency supply enclosure door mounted. White lamp indicates emergency power is present. Up to four pilot lights can be paralleled.
❑ KA-12-T	Push-to-test lamp switch, enclosure-mounted. Tests position-indicating lights.
❑ KA-12-U	Push-to-test lamp switch for separate mounting. Tests position-indicating lights. Not UL listed.
Auxiliary Contacts	
❑ KA-14-C	Relay auxiliary contacts (normal source 2 N.O. and 2 N.C.). Relay coil is energized when normal power is available.
❑ KA-14-D	Relay auxiliary contact (emergency source 2 N.O. and 2 N.C.). Relay coil is energized when emergency power is available. Suitable for use in operating louvers.

Meters	
❑ KA-18-G	Frequency meter mounted in enclosure door (not available with NEMA Type 3R and 12 enclosure).
❑ KA-18-H	Running-time meter mounted in enclosure door (not available with NEMA Type 3R and 12 enclosure).
❑ KA-18-J	Voltmeter, ammeter and selector switch mounted in enclosure door (not available with NEMA Type 3R and 12 enclosure).
Plant Exerciser	
❑ KA-23-C	Plant exerciser for periodic no load exercising of the emergency generator set. Timer is adjustable over a 336-hour (14-day) period in increments of 30 minutes. Timer does not simulate a normal source failure.
❑ KA-23-D	Plant exerciser for periodic exercising under load. Timer is adjustable over a 336-hour (14-day) period in increments of 30 minutes. The timer simulates a normal power failure. Includes override circuit to provide immediate retransfer to normal if emergency fails.
❑ KA-23-G	Plant exerciser with a two-position selector switch marked (Load/No Load) that permits either operation. Timer is adjustable over a 336-hour (14-day) period in increments of 30 minutes. When switched to No Load, the timer does not simulate a normal source failure. The automatic transfer switch is not affected. The generator set is signaled to run unloaded for the set time period. When switched to Load, the timer simulates a normal power failure. Includes override circuit to provide immediate retransfer to normal if emergency fails.
❑ KA-23-P	Solid-state plant exerciser for periodic no load exercising of the emergency generator set. Timer is adjustable over 7-day period in any time increment desired.
❑ KA-23-R	Solid-state plant exerciser for periodic exercising under load. Timer is adjustable over 7-day period in any time increment desired. Includes override circuit to provide immediate retransfer to normal if emergency fails.
❑ KA-23-S	Solid-State plant exerciser with a two-position selector switch marked that permits either operation. Timer is adjustable over 7-day period in any time increment desired. Includes override circuit to provide immediate retransfer to normal if emergency fails.

Battery Chargers	
❑ KA-24	Solid-state battery charger. Two-ampere maximum charge rate with automatic adjustable float. For 12 or 24 VDC.
❑ KA-26-C	Overvoltage protection for the normal source. Plug-in printed circuit card. Adjustable from 100 to 115%, nominally set at 115% unless otherwise specified. Monitors one phase only.
❑ KA-26-C	Overvoltage protection for the normal source. Plug-in printed circuit card. Adjustable from 100 to 115%, nominally set at 115% unless otherwise specified. Monitors ALL phases.
❑ KA-26-D	Area protection with override circuit. For use with an external area protection panel. Starts engine and transfers the load to emergency upon receiving an open contact signal from the area protection panel. In the event the emergency source fails and the normal source is present, the override circuit will bypass the area protection panel signal and retransfer the switch to the normal source.
❑ KA-26-G	Overfrequency protection for the normal source. Adjustable from 50 to 65 Hz. Monitors one phase only. Plug-in printed circuit card.
❑ KA-26-H	Underfrequency protection for the normal source. Adjustable from 45 to 60 Hz. Monitors one phase only. Plug-in printed circuit card.
Logic Protection Fuse	
❑ KA-28-A	Intelligence circuit fuses. Provides fuses for all non-essential circuitry. Used with accessories KA-12, KA-14, and KA-31. One KA-28-A used per accessory.
Manual Switch Operation	
❑ KA-29-O	Manual Switch operation from emergency to normal with override circuit permitting transfer if connected source fails and other source is available. Plus a two-position selector switch providing automatic or manual operation. For separate mounting. Key switch available.
❑ KA-29-P	Manual Switch operation from emergency to normal, with override circuit permitting transfer if connected source fails and other source is available. Plus a two-position selector switch providing automatic or manual operation. Mounted on the enclosure door. Key switch available.
❑ KA-29-Q	Manual Switch operation from emergency to normal and normal to emergency with override circuit permitting transfer if connected source fails and other source is available. For separate mounting. Key switch available.
❑ KA-29-R	Manual Switch operation from emergency to normal and normal to emergency with override circuit permitting transfer if connected source fails and other source is available. Mounted on the enclosure door.
❑ KA-29-S	Manual Switch operation from emergency to normal and normal to emergency with override circuit permitting transfer if connected source fails and other source is available. Plus a two-position selector switch providing automatic or manual operation. For separate mounting.

Manual Switch Operation	
❑ KA-29-T	Manual Switch operation from emergency to normal and normal to emergency with override circuit permitting transfer if connected source fails and other source is available. Plus a two-position selector switch providing automatic or manual operation. Mounted on the enclosure door. Key switch available.
❑ KA-29-U	Manual Switch operation from emergency to normal with override circuit permitting transfer if connected source fails and other source is available. For separate mounting. Key switch available.
❑ KA-29-V	Manual Switch operation from emergency to normal, with override circuit permitting transfer if connected source fails and other source is available. Mounted on the enclosure door. Key switch available.
Cranking Limiters	
❑ KA-30-A	Cranking limiter. Opens the 2-wire engine start circuit after its time delay is completed. It is initiated by an engine-start contact closure. Adjustable from 30 to 200 seconds.
❑ KA-30-B	Cranking limiter. Opens the 3-wire engine start circuits after its time delay is completed It is initiated by and engine-start contact closure. Adjustable from 30 to 200 seconds. No cranking disconnect.
❑ KA-30-C	Cranking limiter. Opens the 3-wire engine start circuits after its time delay is completed It is initiated by and engine-start contact closure. Adjustable from 30 to 200 seconds with cranking disconnect.
Audible Alarms	
❑ KA-31-A	Audible alarm. Sounds alarm when the automatic transfer switch is in the emergency position. A silencing switch is included. For separate mounting.
❑ KA-31-B	Audible alarm. Sounds alarm when the automatic transfer switch is in the emergency position. A silencing switch is included. Mounted in the enclosure.

Source Monitors (continued)	
❑ KA-34-A	Inphase monitor. Monitors single phase of the normal and emergency sources and permits transfer in either direction only when the phase angles of both sources are within ±15 degrees and have a frequency difference within ±2 cycles. If the source from which the switch is transferring fails or voltage drops below 70%, the monitor limitations will be overridden and it will permit immediate transfer. For use with utility generator or two generator set sources. Accessory operates in either direction.
❑ KA-34-E	Inphase monitor. Monitors the normal and emergency sources and permits transfer in either direction only when the phase angles of both sources are within ±15 degrees and have a frequency difference within ±2 cycles. If the source from which the switch is transferring fails or voltage drops below 70%, the monitor limitations will be overridden and it will permit immediate transfer. For use with two utility sources. Not UL listed. Accessory operates in either direction.
❑ KA-34-B	Sync-check relay. Monitors single-phase normal and emergency sources. Will not permit transfer until phase voltages have been within ±10 degrees for approximately 60 milliseconds. If the source from which the switch is transferring fails or voltage drops below 70% the sync-check relay permits immediate transfer. Accessory operates in either direction.
❑ KA-34-C	Sync-check relay. Monitors single-phase normal and emergency sources. Will not permit transfer until phase voltages have been within ±10 degrees for approximately 60 milliseconds. If the source from which the switch is transferring fails or voltage drops below 70% the sync-check relay permits immediate transfer. Operates in emergency to normal direction. Uses closed on normal accessory KA-15-A.
❑ KA-34-D	Sync-check relay. Monitors normal and emergency sources. Will not permit transfer until phase voltages have been within ±10 degrees for approximately 60 milliseconds. If the source from which the switch is transferring fails or voltage drops below 70% the sync-check relay permits immediate transfer. Operates in normal to emergency direction. Uses closed on emergency accessory KA-15-A.

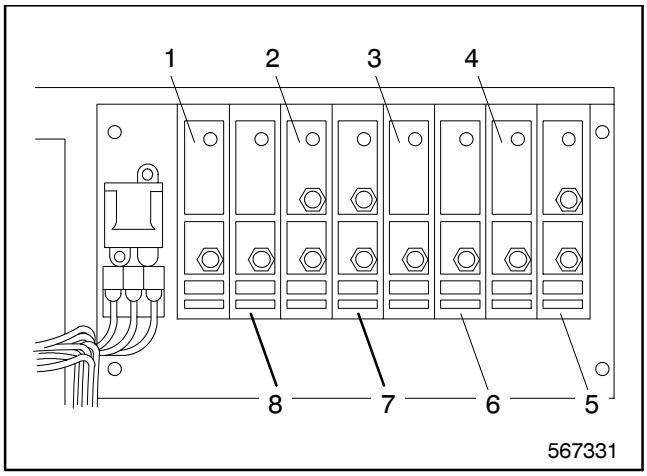
Load-Shedding Contacts	
❑ KA-35-G	Load-shedding contacts (2 N.O. and 2 N.C.) that operate from an adjustable 0.6 to 60 seconds prior to transfer in either direction and reset immediately after transfer.
❑ KA-35-H	Load-shedding contacts (2 N.O. and 2 N.C.) that operate from an adjustable 0.6 to 60 seconds prior to transfer in either direction and reset 3 seconds after transfer.
❑ KA-35-J	Load-shedding contacts (2 N.O. and 2 N.C.) that operate immediately at time of transfer in either direction (contact reset is adjustable 0.6 to 60 seconds after transfer).
❑ KA-35-K	Load-shedding contacts (2 N.O. and 2 N.C.) that operate 0.3 seconds before transfer, and 3 to 300 seconds (adjustable) after transfer in both directions.
❑ KA-35-L	Load-shedding contacts (2 N.C.) that operate 3 to 300 seconds (adjustable) before and after transfer in both directions.
❑ KA-35-M	Load-shedding contacts (2 N.C.) that operate 0.3 to 30 seconds (adjustable) before and after transfer.
Overlapping Neutral Contacts	
❑ KA-36-A	Overlapping neutral contacts. Provides switched neutral contacts for applications requiring a four-pole switch. Normal and emergency source neutrals are both connected to load during transfer for 100 milliseconds or less.

Enclosure Heaters	
❑ KA-39-B	Space heaters for enclosed switches for use in ambient temperatures that do not exceed 80 °F (27 °C). Thermostatically controlled. Wattages are 50W (30-150A), 100W (225-400A) and 200W (600-800A).
Dead Bus Relay	
❑ KA-54-A	Provides Automatic operation when external contact (not furnished with switch) is open. Closing contact causes transfer to normal, whether normal is energized or not (dead bus), using emergency power. Can be used to shed generator set load. Not UL listed.
CSA Certification	
	Bilingual nameplate and CSA certification is provided as an enclosure option, for 30-2000 ampere switches only. KN-1 type must have override circuitry in Accessory 29. This makes them K-1 type.

Loose Accessories

Logic Panel Wire harness Extension	
❑ PA-295771	5-foot extension KA-37-A
❑ PA-295772	10-foot extension KA-37-B
❑ PA-295773	20-foot extension KA-37-C
Elevator Control Switch	
❑ PA-297872	Six-position selector to control up to six elevator circuits. For surface mounting, NEMA Type 1 enclosure. **Note:** this accessory is available only as a part of a factory quotation for an entire elevator control system. Not UL listed.
❑ PA-297873	Six-position selector to control up to six elevator circuits. For flush mounting. **Note:** this accessory is available only as a part of a factory quotation for an entire elevator control system. Not UL listed.
Neutral Lug Assembly	
❑ PA-295070	30-150 ampere
❑ PA-295071	225-260 ampere
❑ PA-295072	400 ampere
❑ PA-295073	600-800 ampere
❑ PA-297583	1000-1200 ampere
❑ PA-294151	1600 ampere
❑ PA-297607	2000 ampere
❑ PA-297606	2500-3000 ampere

Accessory Cards



1. Emergency Underfrequency
2. Emergency Overfrequency
3. Emergency Overvoltage
4. Emergency Undervoltage
5. Normal Overvoltage
6. Normal Overfrequency
7. Normal Underfrequency
8. Time Delay Engine Cooldown

Figure 4-1. Accessory Cards

Each plug-in card has a locknut that can be adjusted using a screwdriver. The locknut prevents the preset setting from accidentally changing. Accessory cards are held in place by two captive screws. All empty card slots are covered with blank plastic strips. Each sensing or time-delay card includes an LED which illuminates when the monitored voltage or frequency is within its preset limits. The LED on the time-delay cards also illuminates after the preset time has elapsed.

Accessory 4. Time Delay Engine Cooldown

Accessory 4-C-S (Time Delay Engine Cooldown) allows the engine to run at no load for an adjustable time (1-30 min.) after transferring back to normal. Upon normal source restoration the TDEC timing circuit keeps the engine running for a cooldown period. After a time delay, the board signals the EC Relay to pick up and shut the generator off. See Figure 4-2 for connections.

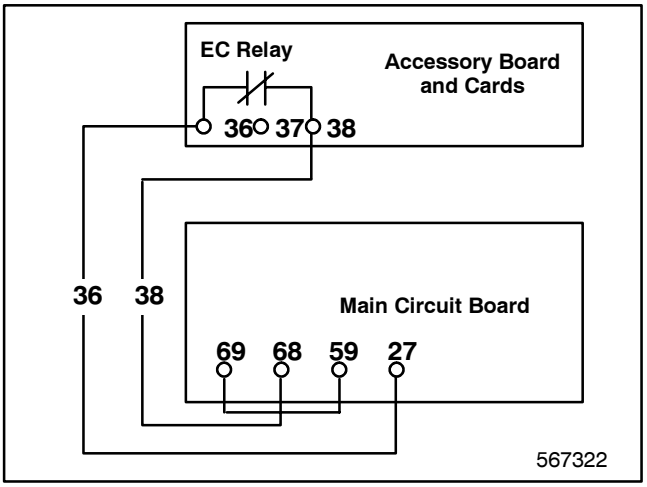


Figure 4-2. TDEC Connections

Accessory 4-D-S (Delay for Engine Cooldown) is fixed at 5 minutes. It is designed to start the engine cooldown after transfer is made to normal.

Accessory 5. Frequency, Volts, and Phase Sequence

Accessory 5-A is an under-frequency card for emergency source (adjustable 45-60 Hz). It monitors generator frequency (one phase only) and will initiate transfer to the normal source if available.

Accessory 5-C is an overfrequency card for emergency source (adjustable 50-65 Hz). It monitors generator frequency (one phase only) and initiates transfer to the normal source if available.

Accessory 5-D (one-phase) is an undervoltage card for emergency source (adjustable—factory set to drop out at 70% voltage and to pick up again at 90% voltage, unless otherwise specified). It monitors generator voltage and initiates transfer to normal source if available.

Accessory 5-F (three-phase) is an undervoltage card for emergency source (adjustable—factory set to drop out at 70% voltage and to pick up again at 90% voltage, unless otherwise specified). It monitors generator voltage and initiates transfer to normal source if available.

Accessory 5-E is an overvoltage card for emergency source (adjustable—factory set to drop out at 115% voltage and to pick up again at 105% voltage, unless otherwise specified). It monitors generator voltage (one phase only) and initiates transfer to normal source if available.

Accessory 5-H is a Phase Sequence Relay. It prevents transfer in either direction unless both sources have same phase rotation.

Accessory 6. Test Selector Switch

Accessories 6-A, C-H have a two-position switch, either momentary or maintained contact, toggle or key operated. This switch selects one of two modes of operation, automatic or test:

Automatic mode enables automatic transfer switch operation depending upon the source available.

Test mode simulates a normal source failure for as long as the switch is held or remains in the TEST position. See Figure 4-3 for connections.

NOTE

If selector switch is in the TEST position, no transfer to the normal source occurs even if emergency source fails or is unacceptable.

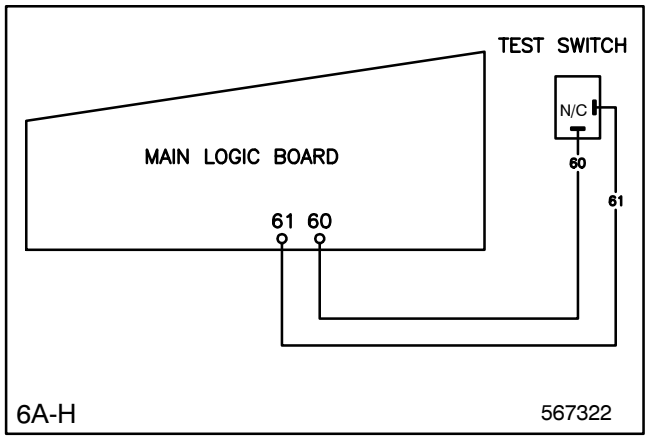


Figure 4-3. Maintained Test Switch Connection

Accessories 6-L, 6-M use a three-position switch that selects one of three modes of operation:

Automatic mode enables automatic transfer switch operation depending upon source available.

Test with load mode initiates transfer of load to the generator set.

Test without load mode signals generator set to start and run unloaded. See Figure 4-4 for connections.

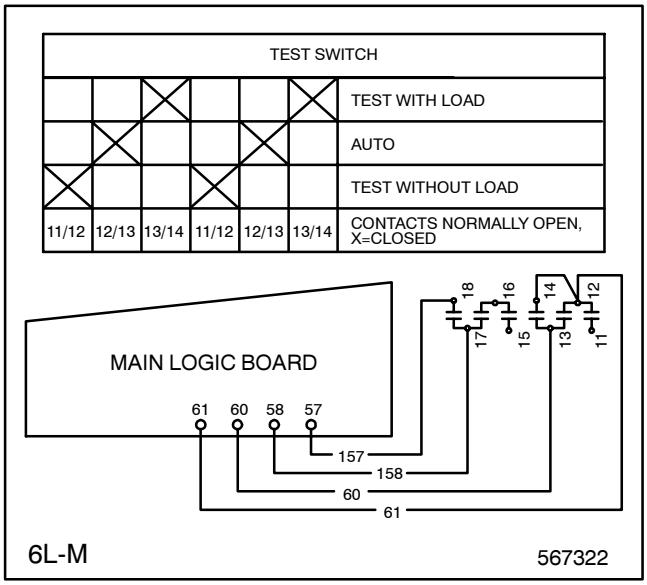


Figure 4-4. Three-Position Switch Connection

Accessory 7. Operation Mode Selector Switch with Lamp

Accessories 7-C, 7-D, 7-E, and 7-F use a four-position switch with lamp to select one of four operation modes. The lamp lights to show that the switch is not in the AUTO position.

Engine start closes the engine-start circuit to test run generator set. The transfer switch will not transfer unless the normal source fails.

Off mode de-energizes control circuits and opens the engine-start circuit. The transfer switch will not operate.

Automatic mode enables automatic transfer switch operation.

Test mode simulates normal source failure. See Figure 4-5 for connections.

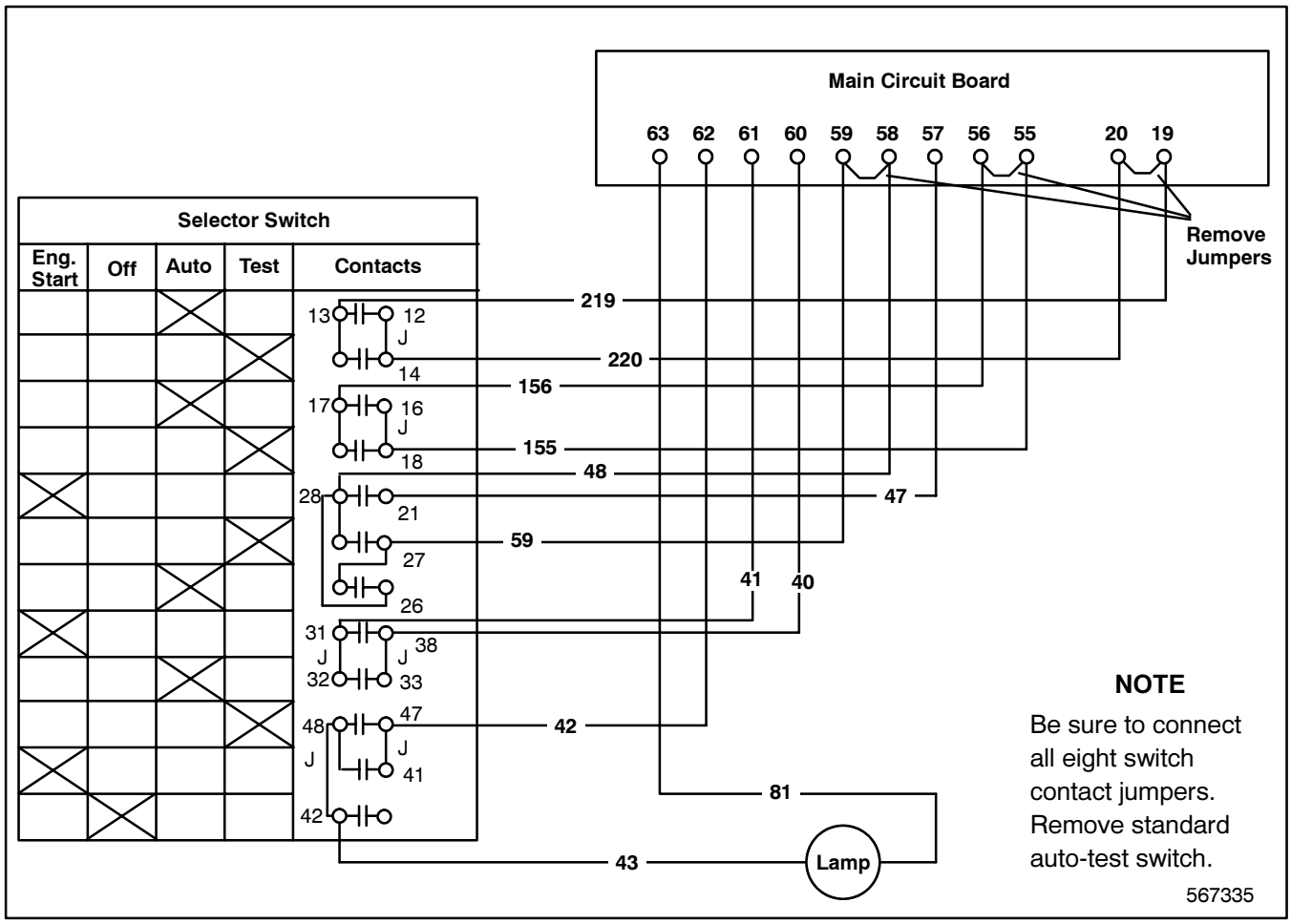


Figure 4-5. Four-Position Switch Connection

Accessory 8. Bypass Time Delay Override Switch

Accessories 8-C, 8-D are emergency to normal bypass time delays that may be used to override the standard time delay emergency to normal when transferring to the normal source. See Figure 4-6 for connections.

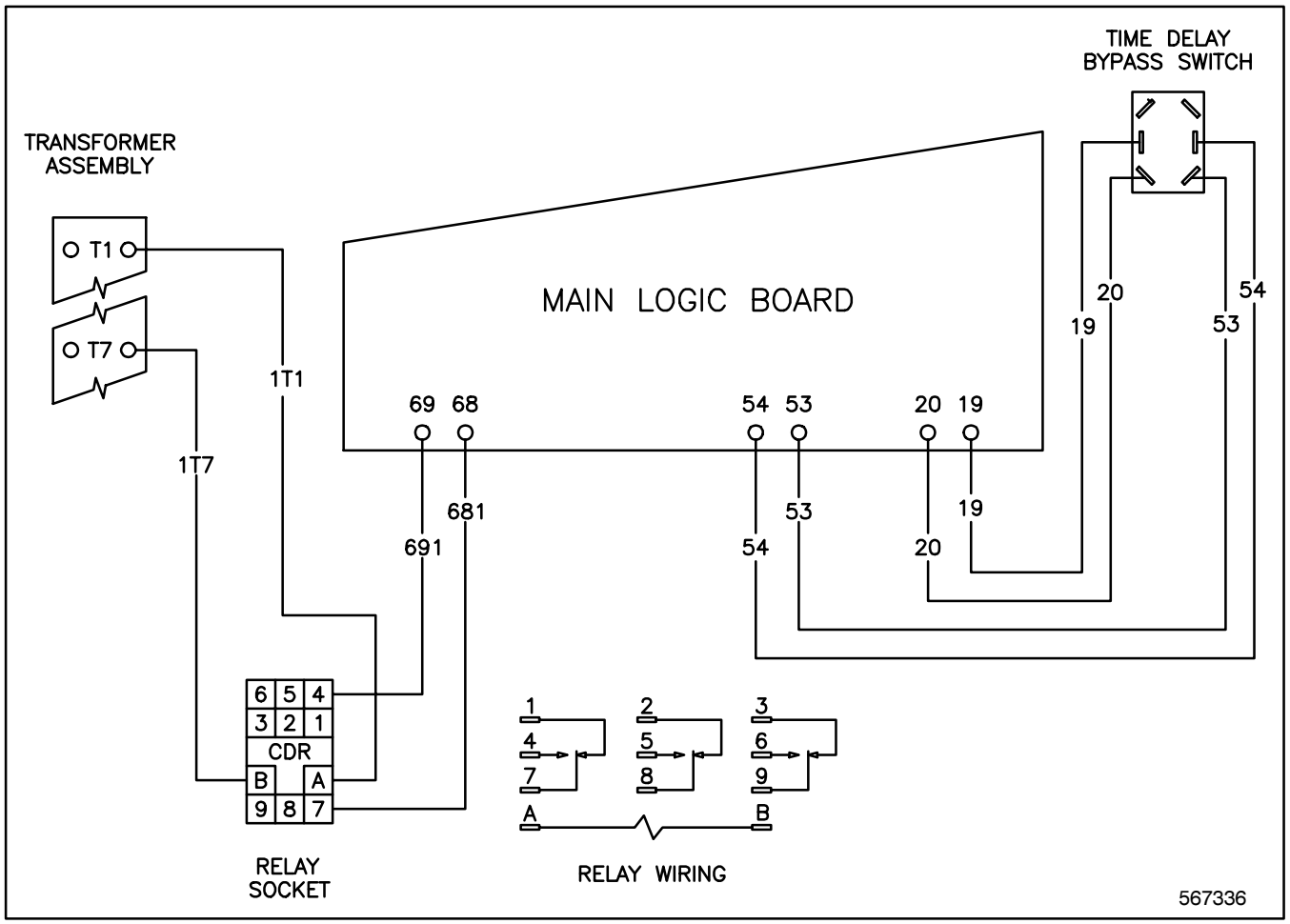


Figure 4-6. Bypass Switch Connection Accessories 8C and 8D

Accessory 12. Panel Lamps

All panel lamps, if furnished, are mounted on the transfer switch enclosure door or shipped loose as specified.

Accessories 12-A and 12-C have a normal-position lamp that lights when the transfer switch is connected to the normal source. See NO TAG for connections.

Accessories 12-B and 12-D have an emergency-position lamp that lights when the transfer switch is connected to the emergency source. See Figure 4-8 for connections.

Accessories 12-E and 12-G have a normal-source light when the normal source is available. See Figure 4-9 for connections.

Accessories 12-F and 12-H have an emergency-source lamp that lights when the emergency source is available. See Figure 4-10 for connections.

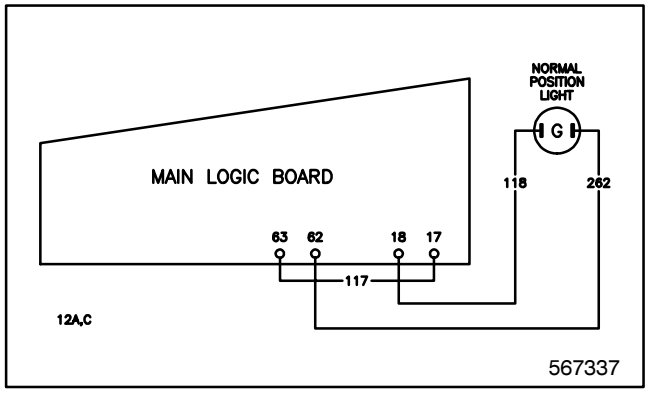


Figure 4-7. Accessories 12-A, C Connections

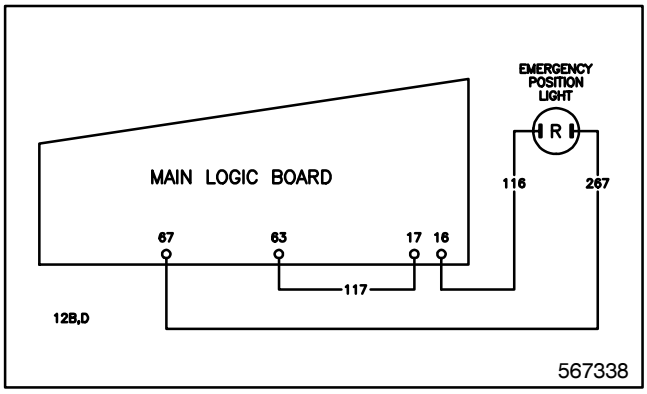


Figure 4-8. Accessories 12-B, D Connections

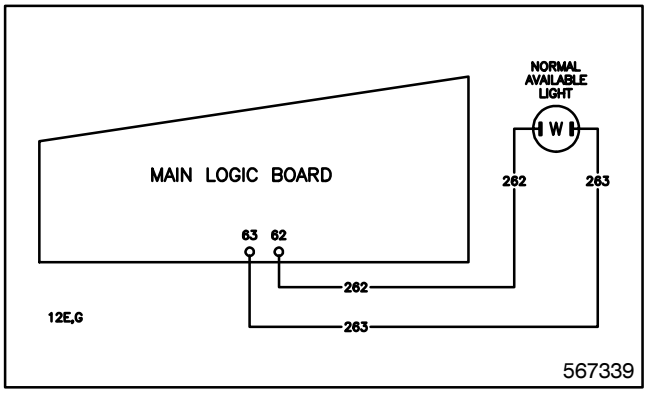


Figure 4-9. Accessories 12-E, G Connections

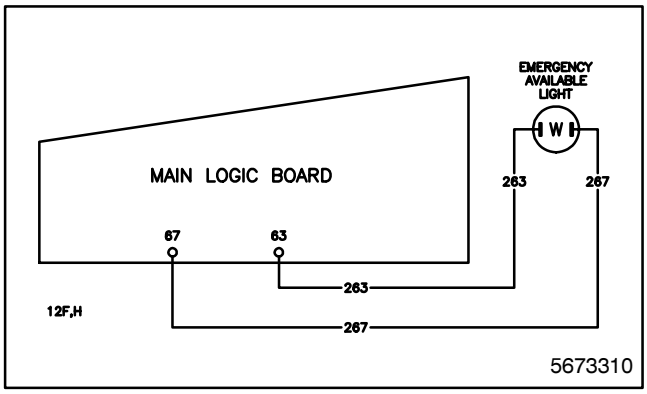


Figure 4-10. Accessories 12-F, H Connections

Accessory 14. Auxiliary Contacts

These relay contacts operate from the voltage source and are energized as soon as normal or emergency power is available. They are located on the left-hand side of the inner panel mounted on the door. Contacts are rated for 10 amperes, 1/3 HP at 120 vac.

Accessory 14-C has three sets of contacts on the normal side. See Figure 4-11 for connections.

Accessory 14-D has three sets of contacts on emergency side. See Figure 4-12.

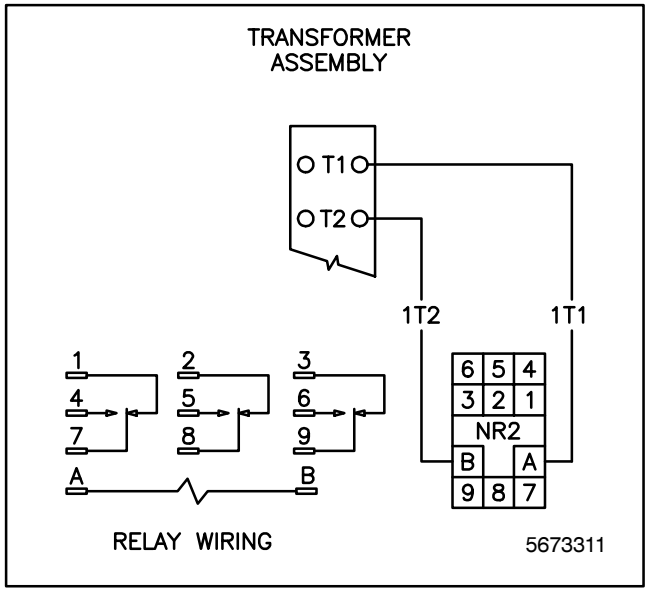


Figure 4-11. Accessory 14-C Connections

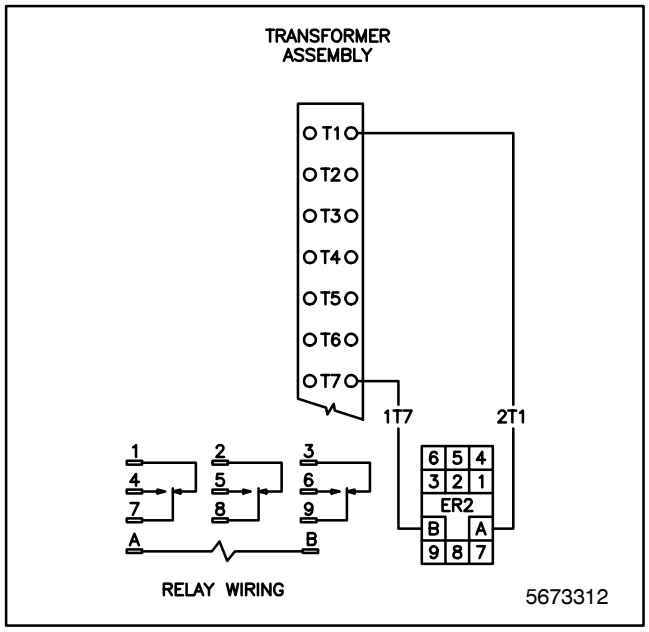


Figure 4-12. Accessory 14-D Connections

Accessories 23-C, D & G. 14-Day Generator Set Exercising Timer

This timer, if furnished, is used for periodic exercising of the emergency generator set. The generator set should be exercised under load once each week for a minimum of 30 minutes. Optional accessory 23 can be added later in kit form. Include the transfer switch serial number and switch number when ordering.

Accessory 23 signals the generator set to run unloaded for the set time period. Timer does not simulate a normal source failure. The transfer switch is not affected.

Accessory 23-C has an override circuit designed to return the switch to normal if the emergency source fails during an exercise run. Normal LEDs on logic cards will stay off until the exerciser completes timing.

Accessory 23-D timer simulates a normal source failure. The transfer switch transfers load to the emergency generator during the exercise period.

Accessory 23-G includes a two-position switch to simulate a normal-source failure or to test the generator set only.

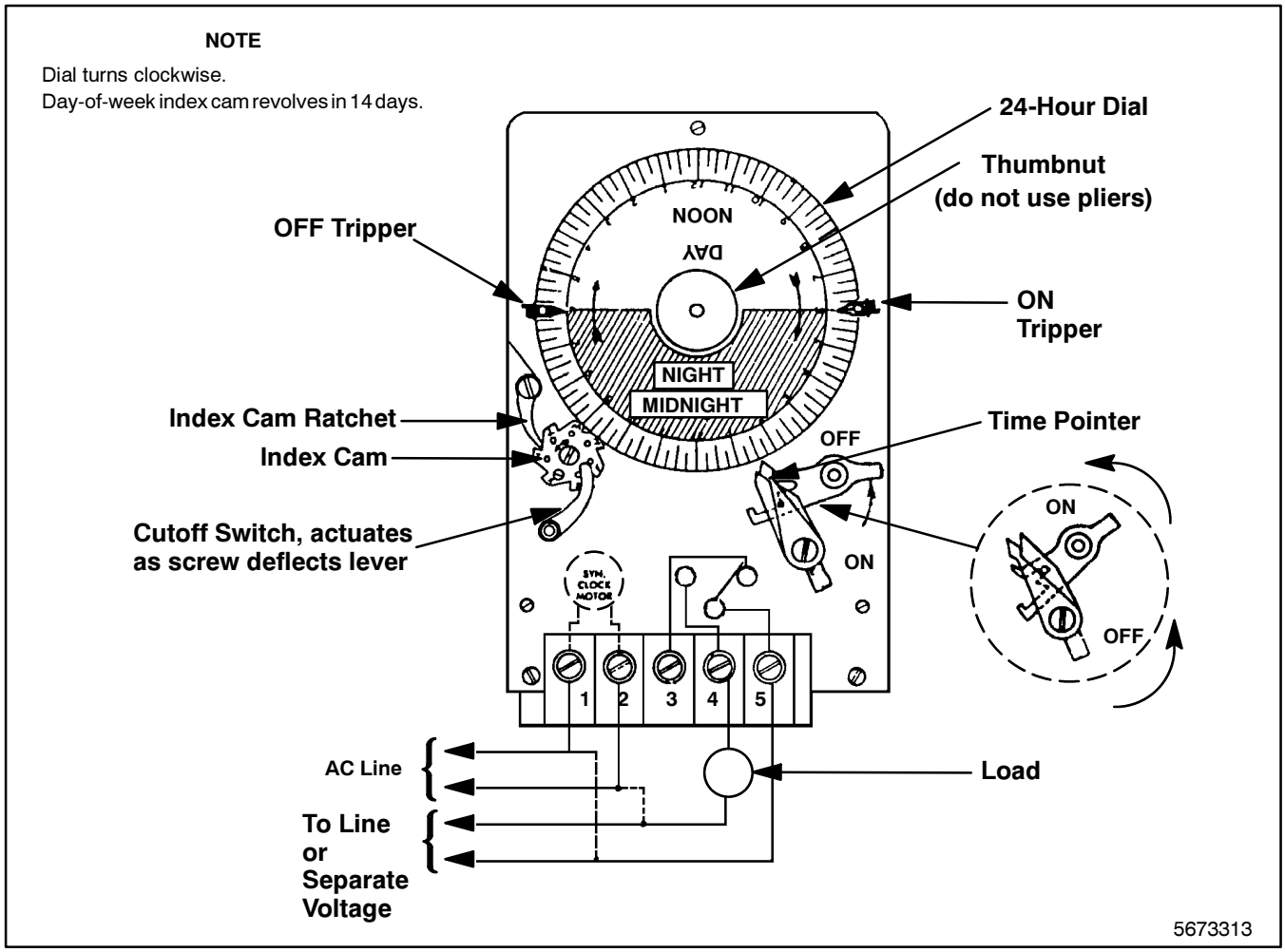


Figure 4-13. Exercise Timer (Accessory 23) Connections & Setting

Exercise Day and Period Adjustment Procedure

1. Decide what day (or days) of the week to exercise the generator set.
2. Remove the screw from the index cam lobe marked with the decided day(s).
3. Hold the 24-hour dial to prevent it from turning, then unscrew the thumbnut by turning it clockwise.
4. Set the black ON tripper to the time of day when the exercise period should start. Set the copper OFF tripper to the time of day when the exercise period should stop.
5. The index cam has 14 day positions. Turn the index cam counterclockwise until the desired exercise day is under the tip of the cutoff switch lever. Thread a supplied screw into each position hole except the position(s) for the desired exercise day(s).
6. Turn the dial clockwise until the actual time of day aligns with the time pointer. Hand tighten the thumbnut (turn it counterclockwise) while holding the dial to prevent it from turning. Do not use excessive force to turn thumbnut.

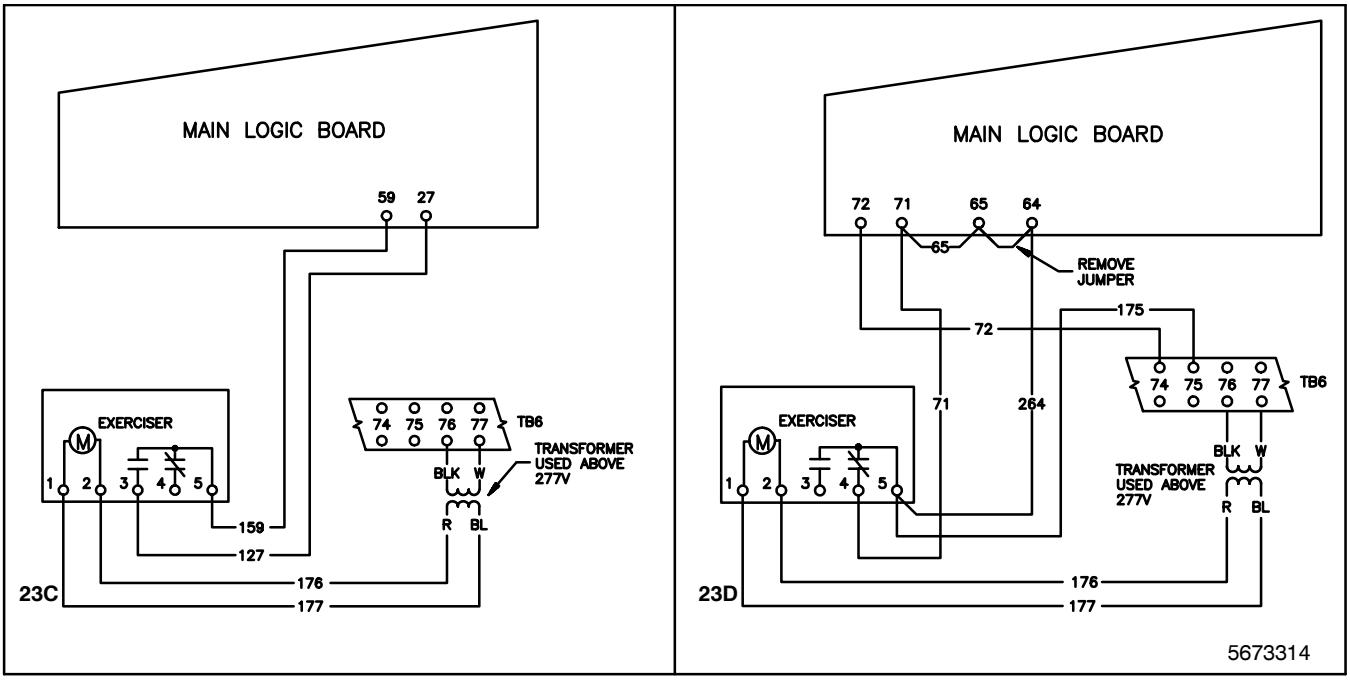


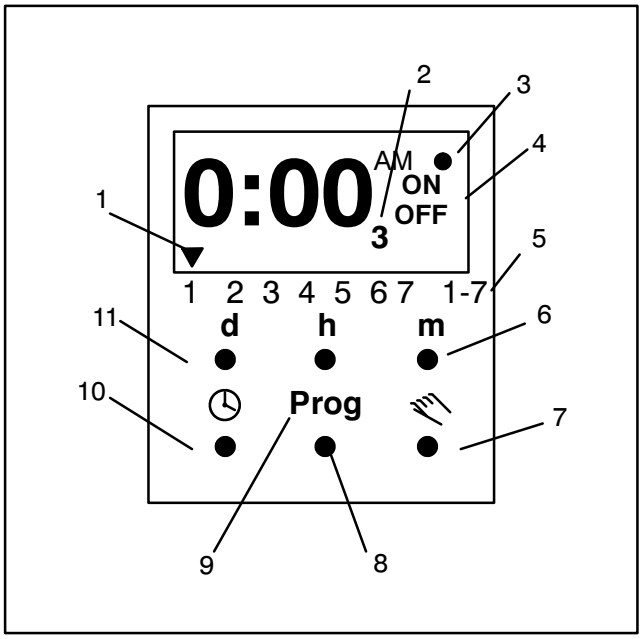
Figure 4-14. Exercise Timer (Accessory 23) Connections

Accessories 23-P, R, S: 7-Day, Solid-State Generator Set Exercise Timer

Accessory 23-P signals the generator set to run unloaded for the set time period. Timer does not simulate a normal source failure. The transfer switch is not affected.

Accessory 23-R simulates a normal source failure. The transfer switch transfers load to the emergency generator during the exercise period.

Accessory 23-S includes a switch to select between Simulate Normal Failure (exercise generator under load) and Test Engine Only (exercise generator set without load).



1. Day of Week
   1 = Monday
   2 = Tuesday
   3 = Wednesday
   4 = Thursday
   5 = Friday
   6 = Saturday
   7 = Sunday
2. Response Time Number for the weekday indicated (1 ON, 1 OFF, 2 ON, 2 OFF, etc.) ☰ OFF Holiday program
3. Dot indicates permanent override control ON or OFF
4. Switch Position ON or OFF
5. Programmed Daily display, 1-7
6. Minute Setting
7. Override and Permanent Control
8. Program Entry/Recall
9. Hours/Holiday Setting
10. Time Setting
11. Weekday Setting

Figure 4-15. Plant Exerciser Features

Adjustment

See for Figure 4-15 operational information. Remove the transparent timer cover when making adjustments. Replace the cover when adjustment is complete.

NOTE

The display will remain for about 40 seconds after an entry is interrupted (postponed) or finished. Then it will switch to normal automatic operation.

To Reset & Clear Memory:

1. The power supply must be connected to the plant exerciser before setting the clock timer. Check to see that the in-line disconnect plug attaching the contactor to the logic panel is connected.
2. Press he following four keys simultaneously to reset the timer's programming. This will clear the memory and permit new programming. Press the **d**, , **m** and buttons.

Setting Day of Week and Time

1. During the day and time setting procedure, hold down the button.

   NOTE

   This timer may be set as either a seven-day or a one-day timer. To set the generator set to run during certain hours of every day, refer to Entering Daily Time Periods, following.

2. Press the **d** button to select the weekday. The arrow on the display will move to indicate the day of the week selected (1-7).
3. Set the time by pressing the **h** button or the **m** button for hours or minutes. If the button is depressed for more than one second, the quick sequence will start allowing faster time change. When nearing the desired time, release the button to use the slow sequence so the desired time is not passed.

   NOTE

   Some earlier models may use a 24-hour clock. Use military time when setting.

4. After the time-and day-setting procedure is complete, release the button.

Daylight Savings Time Adjustment

If this semiannual time change applies in the area, use the following procedure to conveniently set the hour without having to completely reset the timer.

1. To add 1 hour, press the **d** and the **h** buttons simultaneously.
2. To subtract 1 hour, press the **d** and the **m** buttons simultaneously.

Setting Exercise Start and Stop Times

A maximum of four time periods (four start and four stop times) is programmable for each day of the week. A maximum of 28 time periods (28 start and 28 stop times) is possible. For exercising the generator set, only one start and stop period per week is usually necessary.

1. Decide upon a convenient day and time to test run the generator set that will not disturb usual work or living routines. It is recommended that exercising be done when observation by a responsible person is possible.

   NOTE

   If the setting procedure is interrupted, postponed, or finished, the display will show the actual time after approximately 40 seconds. The system will then switch to normal automatic operation.

2. Press the **Prog** button once. Press the **d** button. The display will show an arrow above 1 which indicates Monday (2 = Tuesday, 3 = Wednesday, etc.). Press the **d** button until the arrow is above the decided weekday. Press the button to store the selected day. Enter start/stop commands for the selected day.
3. When ON is indicated on the right-hand side of the display, set the START time by pressing the **h** button and/or the **m** button.
4. Store the START time command by pressing the **Prog** button. This command places the program in the OFF mode.
5. When OFF is indicated on the right side of the display, press the **d** button until the arrow is above the decided weekday. Press the button to store the selected day. Set the STOP time by pressing the **h** button and/or the **m** button.
6. Store the STOP time command by pressing the **Prog** button. This command places the program in the ON mode for the next set of response times.
7. Now set periods 2, 3, and 4 of the same weekday using the same procedure, if required. To override/cancel exercise periods 2, 3, and 4 and go to another weekday, press the **d** button until the required weekday is shown.
8. If programming is complete, press the button. The timer is now set to function as programmed.

Entering Daily Time Periods

Set the timer to run the generator set during certain hours of every day.

After resetting and cleaning the timer's memory, set the timer as a one-day timer. Set up to six time periods (6 start and 6 stop times) in this mode.

To use the daily-program mode, do not set a current day of the week. Rather, leave the day pointer above the **1-7**. Set the ON/OFF times following steps 3-8 in section Setting Exercise Start and Stop Times, preceding.

Program Recall/Check

1. To check or verify the programmed START/ON and STOP/OFF times, simultaneously press the **Prog** button and **d** button for each respective day. Press the **Prog** button to display START/ON and STOP/OFF response times. The timer displays daily response times for each day following the normal program locations (1 ON, 1 OFF, 2 ON, 2 OFF, 3 ON, 3 OFF).
2. On days where entering a daily response time and a normal display occurs, such as 3 ON with an arrow appearing above **1-7**, press the ⏲ button to finish the recall procedure.

Program Change

1. To change one or more previously programmed START or STOP times without clearing the entire memory press the **Prog** button and **d** button until the required weekday is shown. Press ☜ to store the selected day.
2. Change the 1 ON time by pressing the **h or m** button. Press the **Prog** button to advance to the next time setting. Clear the program by pressing **h** and **m** buttons simultaneously.
3. Press the **Prog** and **d** buttons to advance to the next program requiring a change.
4. When all changes are complete, press ⏲ . The timer is now set to function as programmed.

Vacation/Holiday Setting

The Vacation/Holiday Setting suspends the automatic program sequence from 1 to 45 days.

1. During the vacation/holiday setting procedure, press and hold the **h** button.
2. Press ☜ for the number of nonexercising days desired. After 45 days the display returns to zero. The vacation/holiday program starts at 12:00 a.m. the next day and is indicated on the display by ≡ OFF.

NOTE

The vacation/holiday setting places the exercise cycle (plant exerciser) on hold only. Should failure of the utility/normal power source occur, the transfer switch will start the generator set and transfer to the emergency/generator power source when voltage/frequency conditions are met. When utility/normal power is restored, the transfer switch will return to the utility/normal power position.

3. To recall/check the remaining vacation/ holidays, press **h**. The display will momentarily show the number of days.
4. To change the number of vacation/holidays, press and hold **h** while pressing ☜ each time until the desired number of vacation/holidays is displayed.

Temporary Program Override

1. Press ☜ to alternate between the ON and OFF modes. To bypass the present programmed mode and place the plant exerciser in the ON or OFF mode (as displayed on the readout). **Changing the OFF mode will signal the generator set to start.** The plant exerciser will remain in this position until the next programmed mode changes it.
2. If override is no longer required, press ☜ to place plant exerciser in normal automatic mode.

If the normal functioning mode is not known, use the following procedure to put the timer in the normal automatic mode.

Permanent Program Override

Press ☜ and **m** simultaneously to switch between modes ON ● and OFF ●. The automatic normal programmed mode bypasses the present programmed mode and places the plant exerciser in one of the other two modes. The plant exerciser will remain in the ON ● or OFF ● position until the permanent override is manually changed.

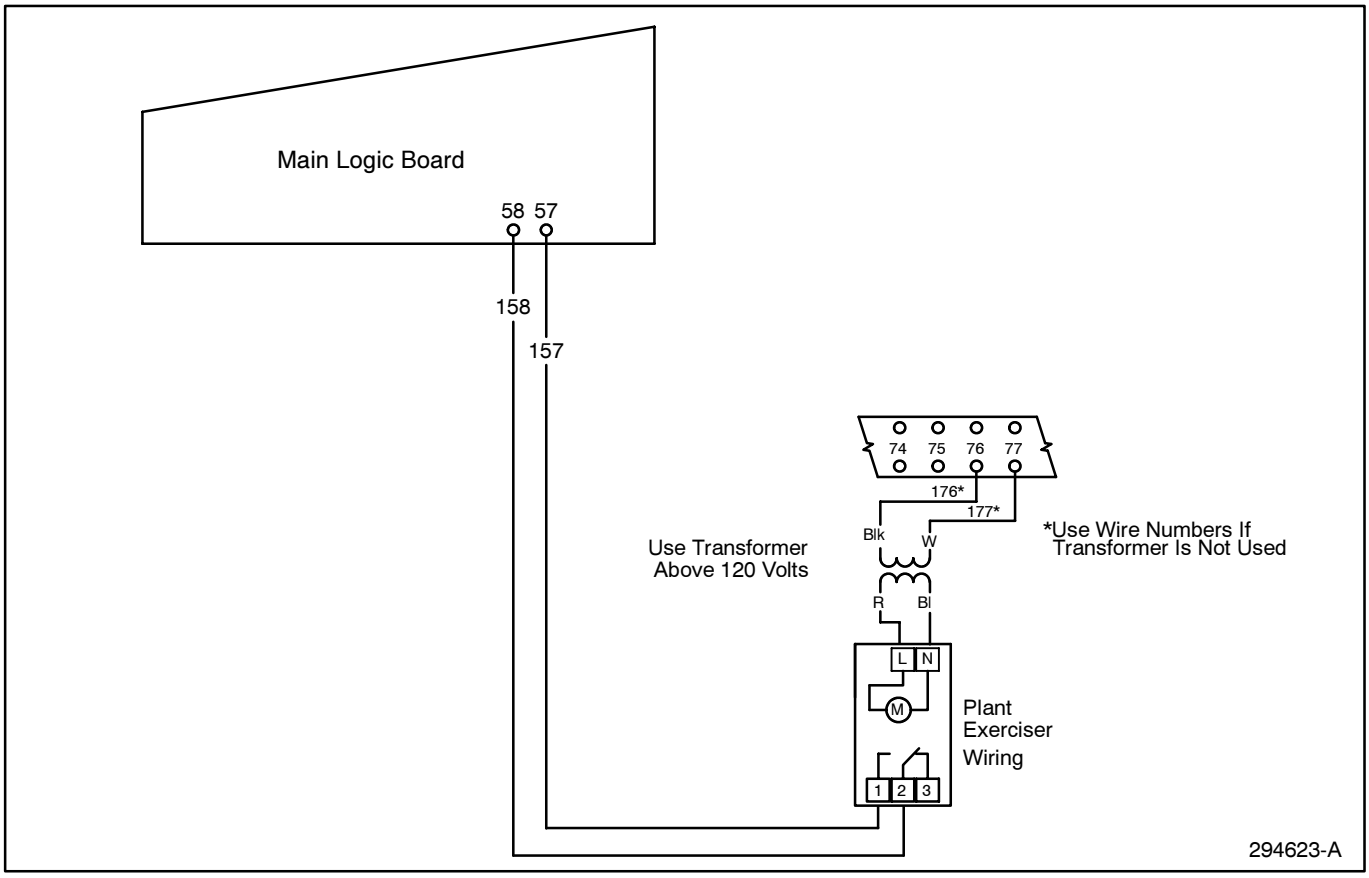


Figure 4-16. Generator Set Exercise Without Load, Accessory 23-P

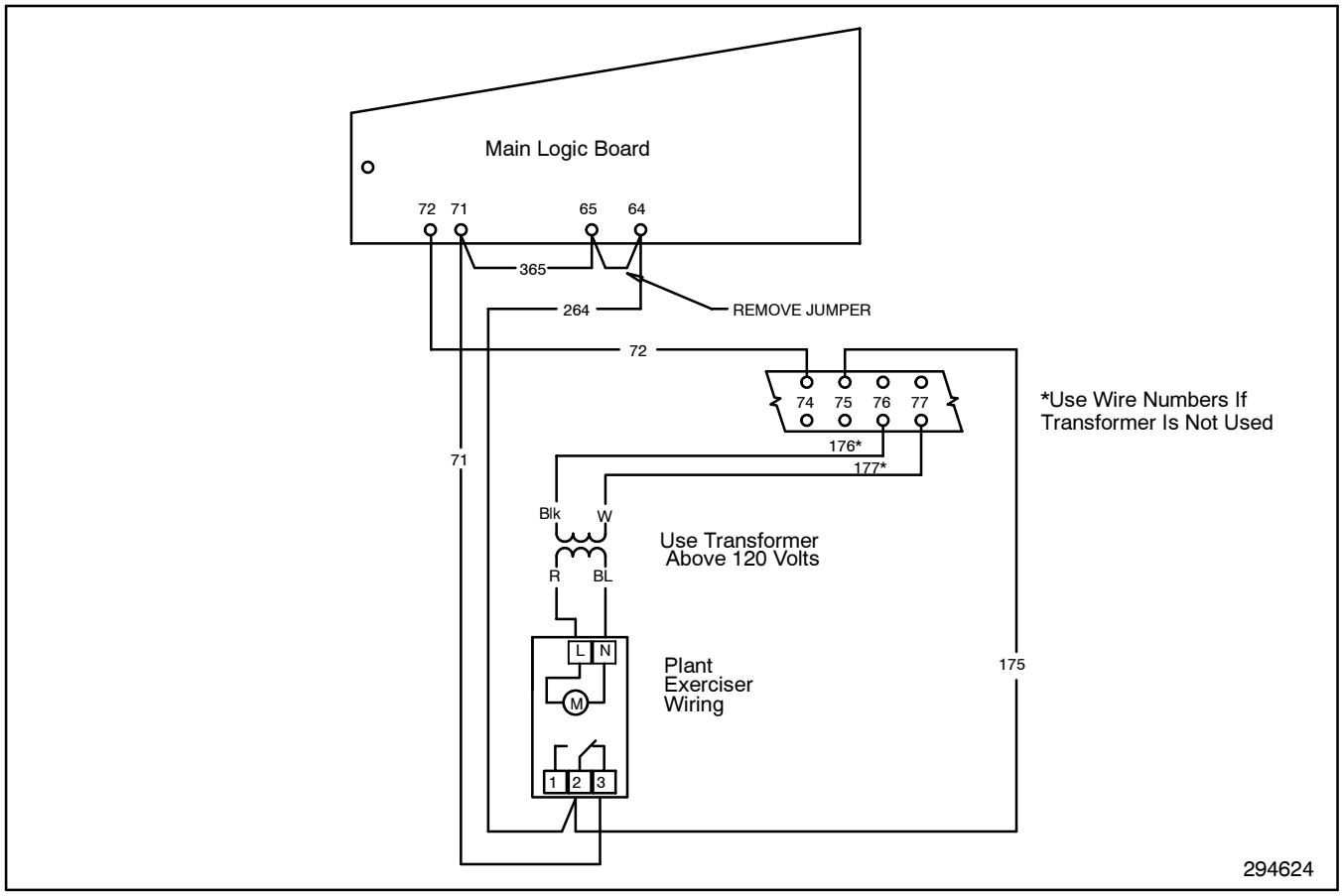


Figure 4-17. Generator Set Exercise With Load, Accessory 23-R

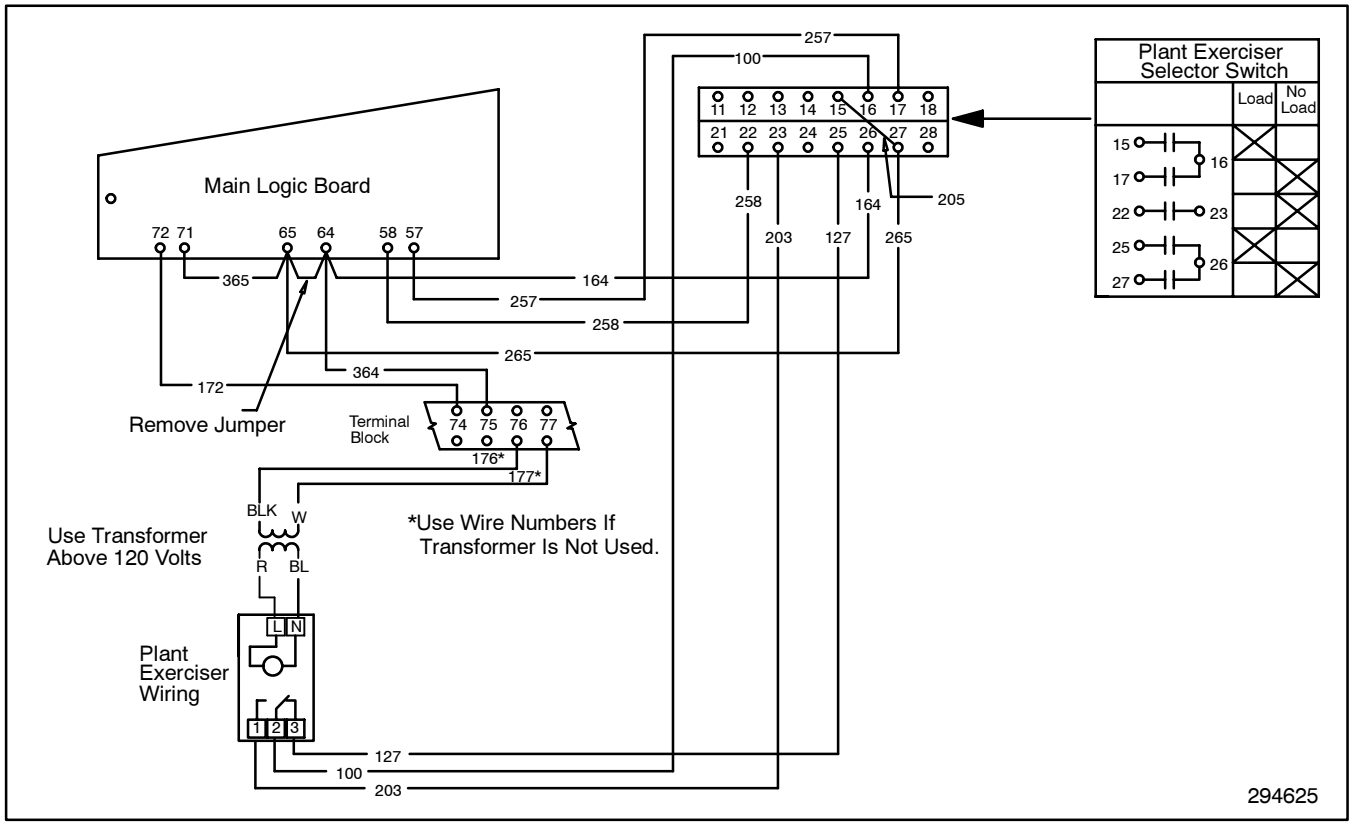


Figure 4-18. Simulate Normal Failure or Test Engine Only, Accessory 23-S

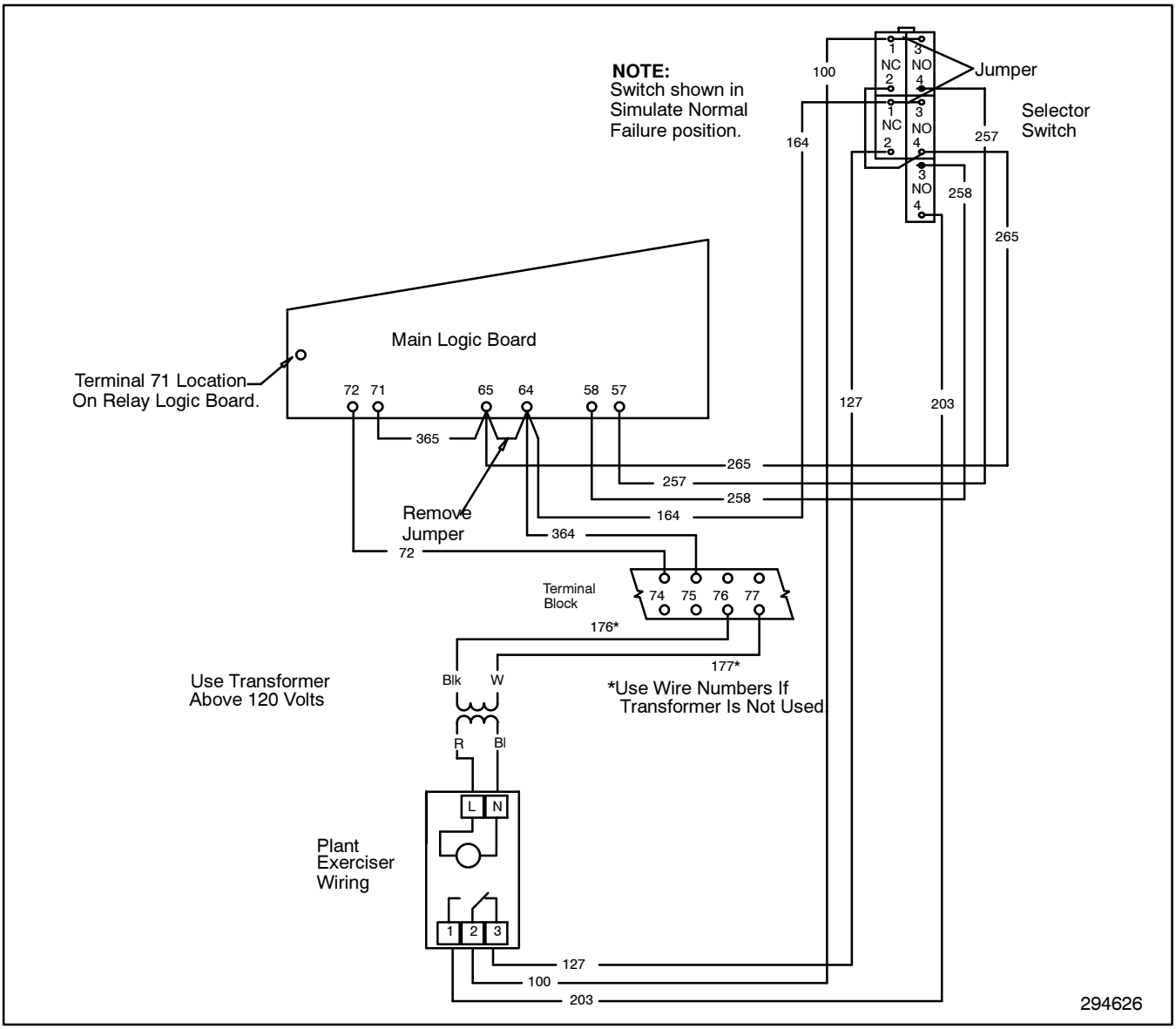


Figure 4-19. Simulate Normal Failure or Test Engine Only, Accessory 23-S3

Accessory 24. Battery Charger

Automatic, adjustable-float battery chargers are mounted below the main circuit board on the enclosure door. Select charger according to normal line-to-line voltage. See Figure 4-20 and Figure 4-21 for connections.

Shock Hazard! Terminals 78 and 79 are at line voltage. Disconnect harness plug before installing battery charger.

Accessory 24-A 12-volt output

Accessory 24-B 24-volt output

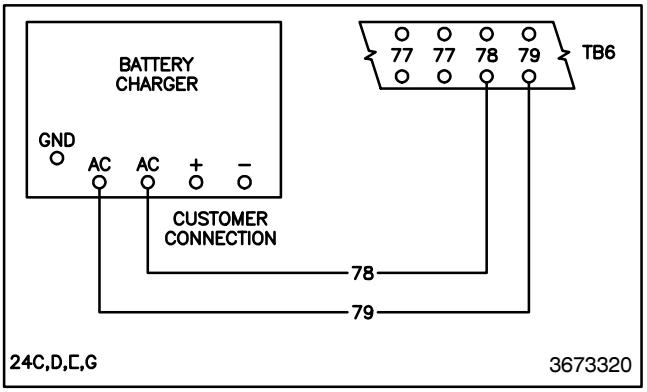


Figure 4-20. Accessories 24-C,D,E Connections

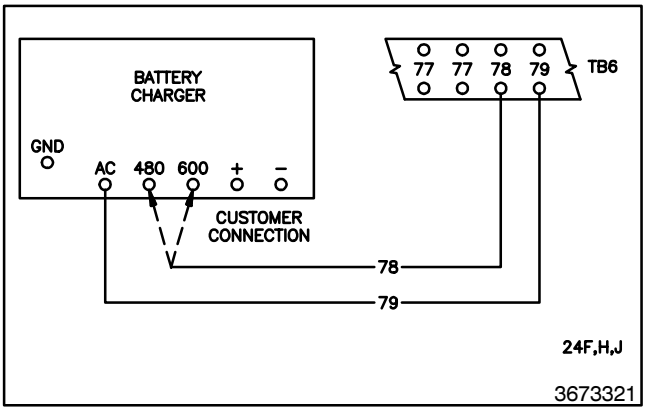


Figure 4-21. Accessories 24-F,H,J Connections

Accessory 34. Motor Load Transfer, Inphase Monitor or Sync-Check Relay

Accessory 34 is a control for transfer and retransfer of motor loads to prevent inrush currents from exceeding normal starting currents and tripping circuit breakers causing possible mechanical damage to motor couplings.

Accessory 34-A and E are inphase monitors that sample the relative phase angle between the source supplying a motor load and the alternate source to which it is being transferred. Once the two voltages are within a predetermined phase angle and approaching zero phase angle difference, the monitor signals the transfer switch to operate, allowing reconnection to close inphase.

An inhibit circuit prevents transfer when both sources are moving away from synchronism. An inhibit circuit is designed to prevent actuation of the output relay in case the monitor is energized while both sources are within the allowed acceptance window.

When power is applied to the inphase monitor, the built-in enabling circuit activates a two-second delay before the monitor goes into its sampling mode. Disconnection of the enabling input automatically resets the monitor.

Voltage bypass is included in the monitor so that if the source supplying the load drops below 70% of system voltage during retransfer, the output relay of the inphase monitor will energize immediately, causing a random transfer to the alternate source. If both sources are below 70% of system voltage, the output relay is prevented from operating.

Accessory 34-A is intended for use when utility-to-generator or generator-to-generator sources are involved. See Figure 4-22 for connections.

Accessory 34-E is used when both sources are directly inphase (utility-to-utility). In this situation, the inphase inhibit option is cancelled, allowing load transfer between synchronized sources.

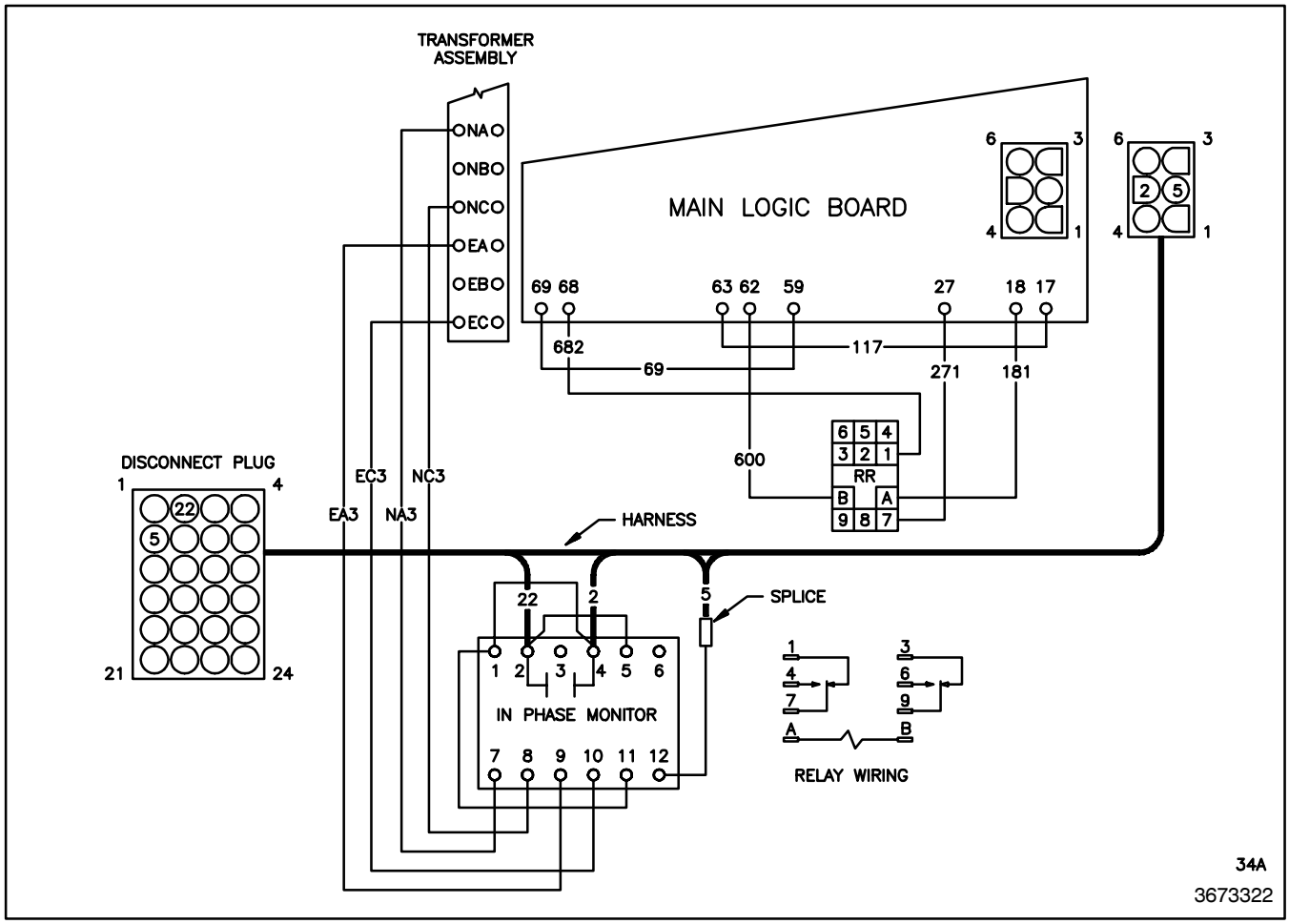


Figure 4-22. Inphase Monitor Connections

Accessories 34-B, C, and D are sync-check relays that monitor normal and emergency sources. The sync-check relays will not transfer load until phase voltages are above pickup voltage and the phase angle difference is below the pickup setting. The phase angle window is adjustable from ±5 to ±30°. Pickup time delay is approximately 50 milliseconds.

A voltage bypass is included in the sync-check relay in case the source supplying the load drops below 70% of system voltage during retransfer. The sync-check relay energizes immediately, causing a random transfer to the alternate source. If both sources are below 70% of system voltage, the relay is prevented from operating.

Accessory 34-B operates for emergency-to-normal and normal-to-emergency transfer. Accessory 34-C operates only in the emergency-to-normal direction.

Accessory 34-D operates only in the normal-to-emergency direction. See Figure 4-23 for connections. Accessories 34-C and 34-D require option 15-A.

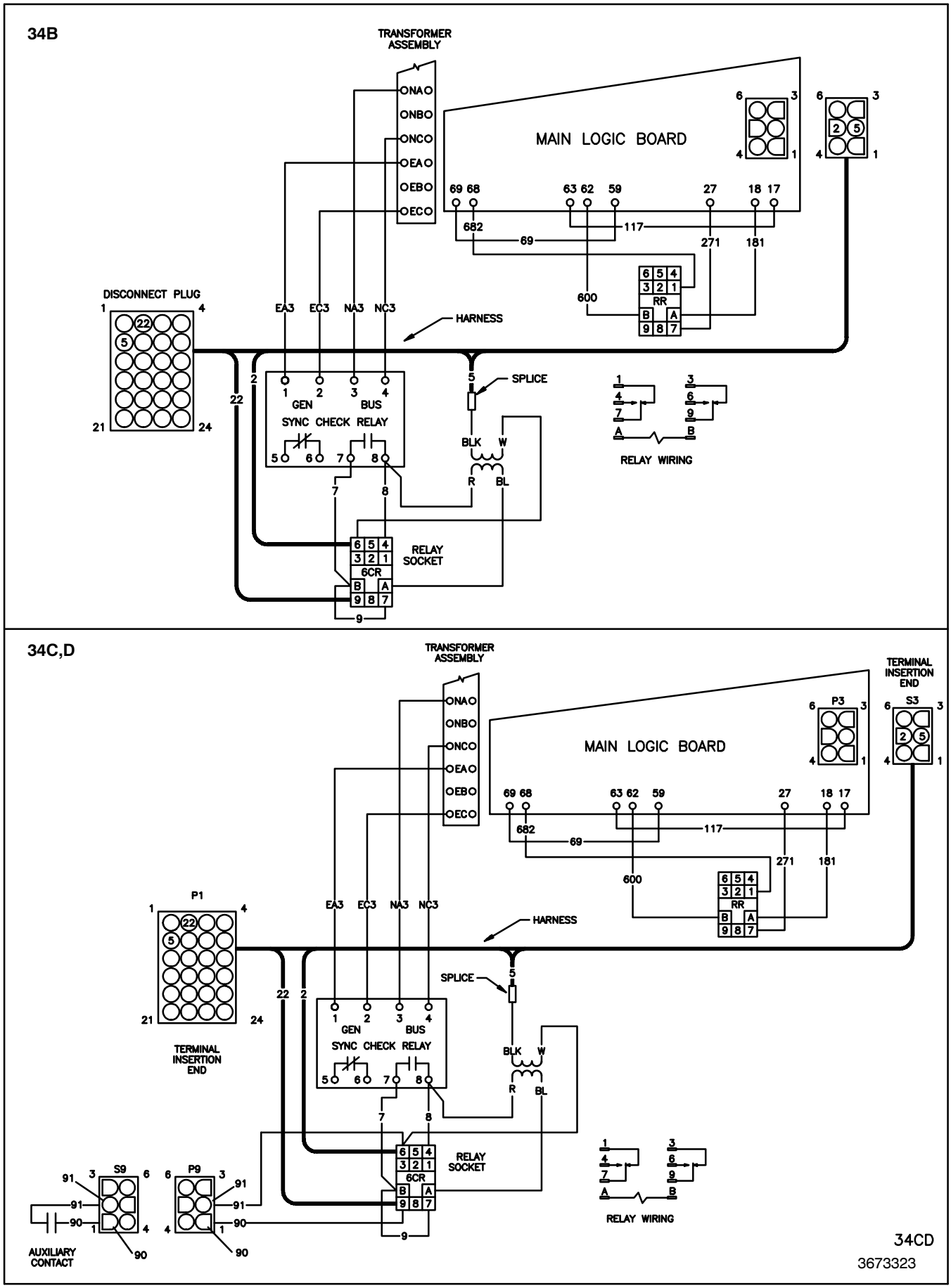


Figure 4-23. Sync-Check Relay Connections

Accessory 35. Load-Shedding Contacts

Load-shed contacts (2NO, 2NC) are controlled by an adjustable time delay to operate before and/or after transfer. The contacts are provided for use in disconnecting and adding a load. See Figure 4-24.

⚠ WARNING

Hazardous voltage.
Can cause severe injury or death.

Do not open enclosure until all power sources are disconnected.

(under 600 Volt)

Shock Hazard! Disconnect harness plug before installing any accessories involving connection to transformer assembly primary terminals 76, 77, 78, and 79. Terminals are at line voltage!

Accessory 35-G operates from 0.6 to 60 seconds prior to transfer and resets immediately after transfer.

Accessory 35-H operates from 0.6 to 60 seconds prior to transfer and resets 3 seconds after transfer.

Accessory 35-J operates immediately at time of transfer, and from 0.6 to 60 seconds after transfer.

Accessory 35-K operates 0.3 seconds before transfer and from 3 to 300 seconds after transfer.

Accessory 35-L operates from 3 to 300 seconds before and after transfer.

Service Voltage	Amps, 2 Poles
120 AC	10.0
240 AC	10.0
480 AC	10.0
600 AC	7.5
12 DC	10.0
24 DC	10.0
32 DC	10.0
125 DC	0.4

Figure 4-24. Relay Contact Ratings

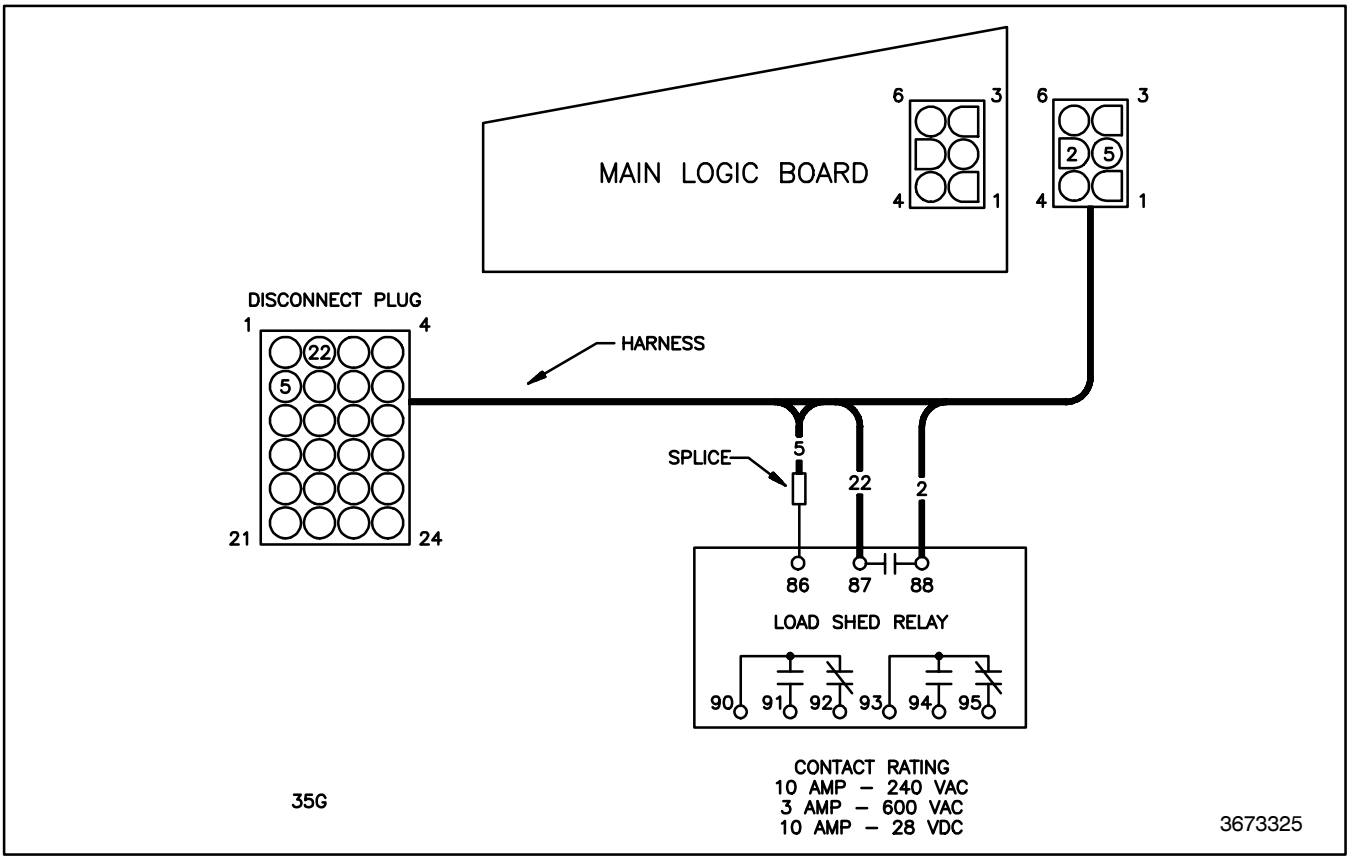


Figure 4-25. Accessories 35-G, H Connections

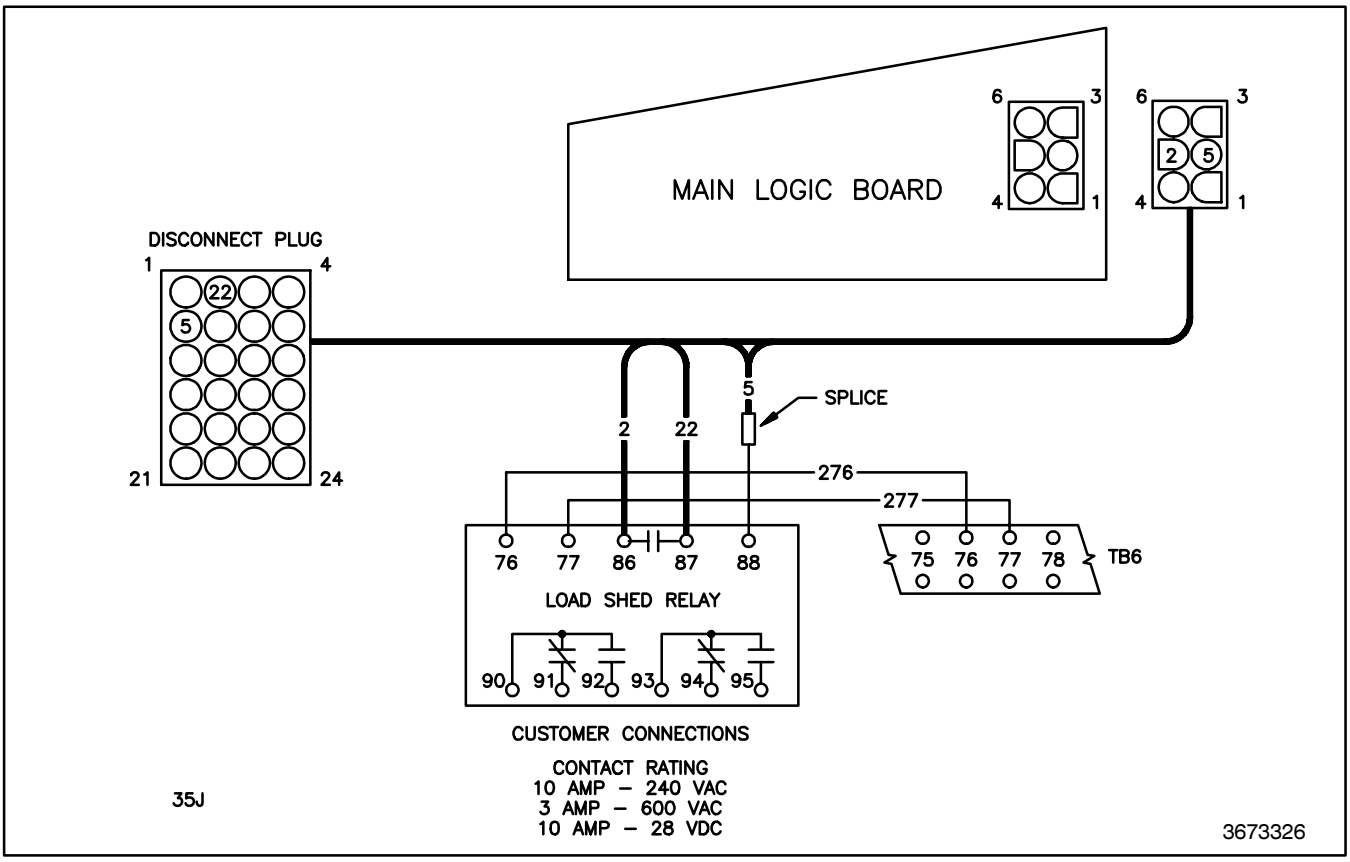
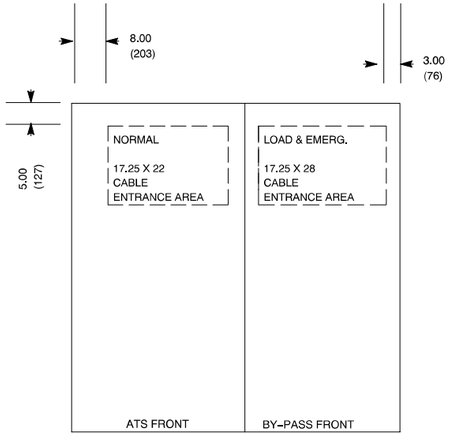


Figure 4-26. Accessories 35-J, K Connections

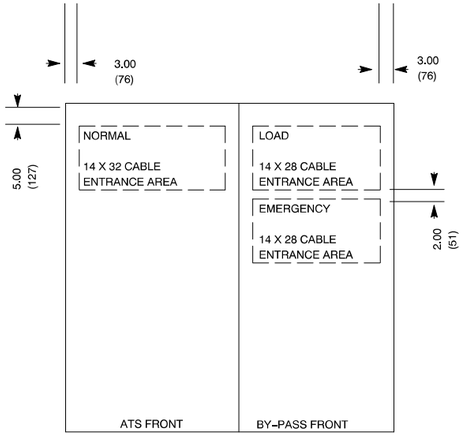
Notes

Section 5. Diagrams and Drawings

Notes



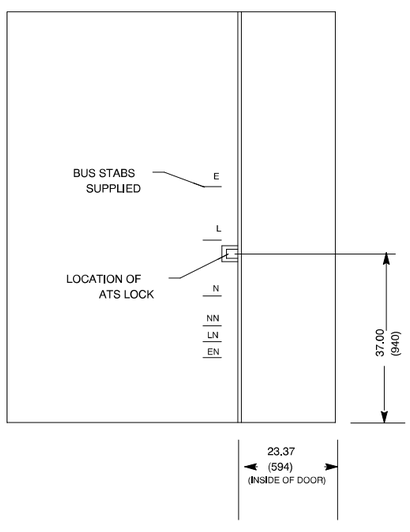
CABLE ENTRANCE (BOTTOM OF ENCLOSURE AS SEEN FROM TOP)



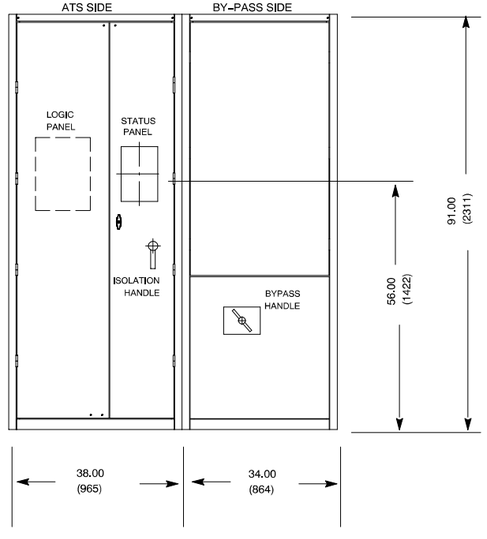
CABLE ENTRANCE (TOP OF ENCLOSURE)

NOTES:

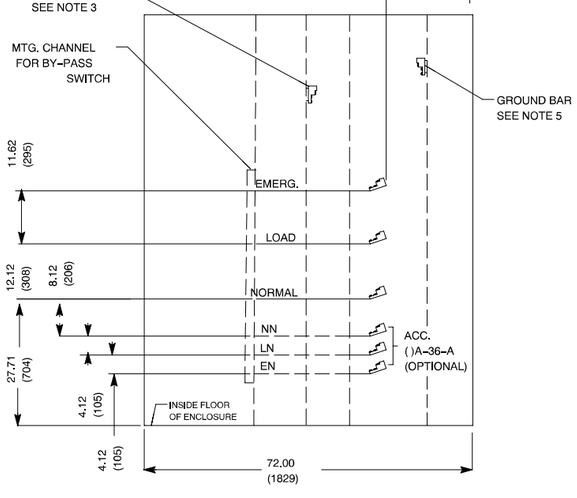
NEMA TYPE 1 – GENERAL PURPOSE, INDOOR FREE STANDING, FRAME CONSTRUCTION – FLOOR CONSTRUCTION.
1. SWITCHBOARD IS FRAME CONSTRUCTION 12 GAUGE FORMED FRAME, N.E.C. STD. GAUGE PAN TYPE DOORS AND COVERS. ALL DOORS SUPPLIED WITH LOCKABLE HANDLE AND CAPTIVE SCREWS AS REQUIRED.
2. FINISH – ANSI 61 GREY
3. SUPPLIED WITH SOLID NEUTRAL AS REQUIRED
4. AL–CU SCR. LUGS AS FOLLOWS:
   N–E–L & N (6) #2–600 MCM CABLES PER PHASE
   TOP OR BOTTOM CABLE ENTRY.
5. GROUND BAR WITH (1) #2–600 MCM CABLE.
6. ALL DOOR KNOCKOUTS PUNCH FLUSH.
7. RECOMMENDED REAR CLEARANCE– 36 INCHES.



LEFT SIDE VIEW (ATS)



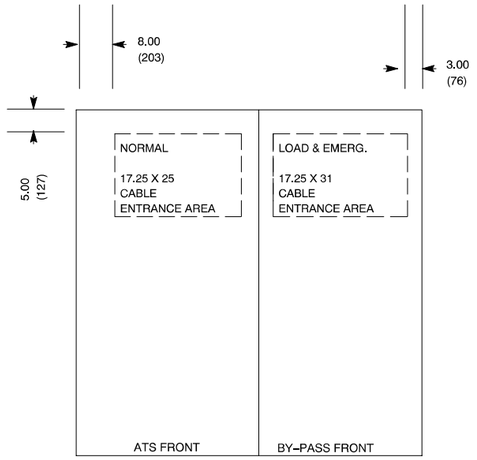
FRONT VIEW



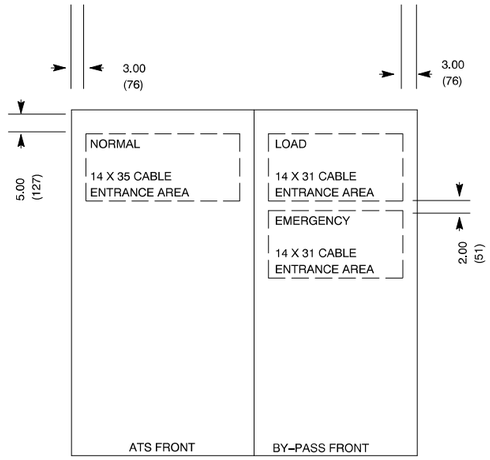
RIGHT SIDE VIEW (BY–PASS)

ADV-5781-B

Enclosure Dimensions, 1600-2000 Amp



CABLE ENTRANCE (BOTTOM OF ENCLOSURE AS SEEN FROM TOP)



CABLE ENTRANCE (TOP OF ENCLOSURE)

NOTES:

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FRAME CONSTRUCTION – FLOOR CONSTRUCTION.
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5. GROUND BAR WITH (1) #2–600 MCM CABLE.
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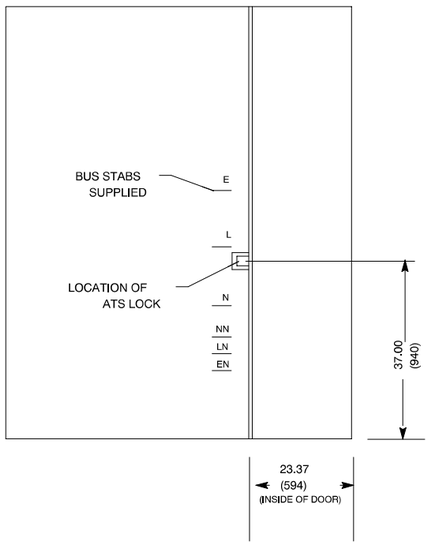
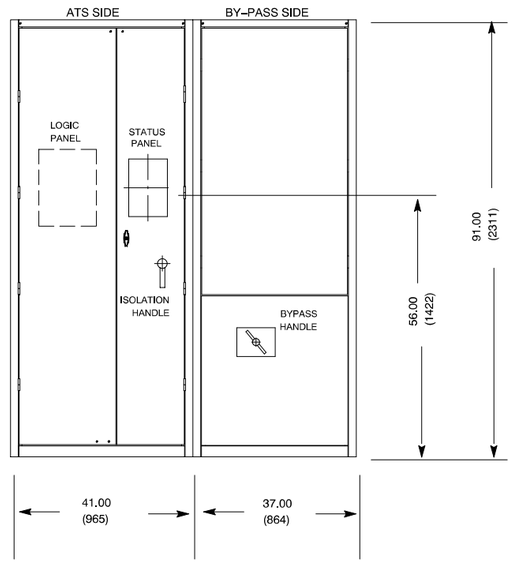
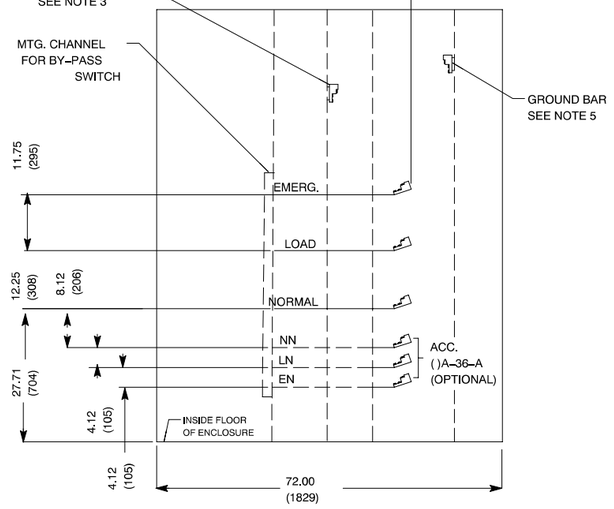
7. RECOMMENDED REAR CLEARANCE– 36 INCHES.



LEFT SIDE VIEW (ATS)



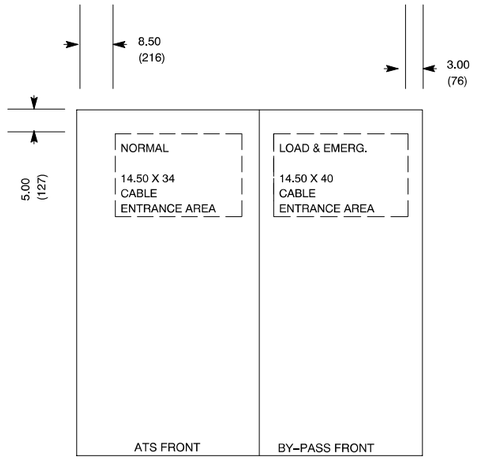
FRONT VIEW



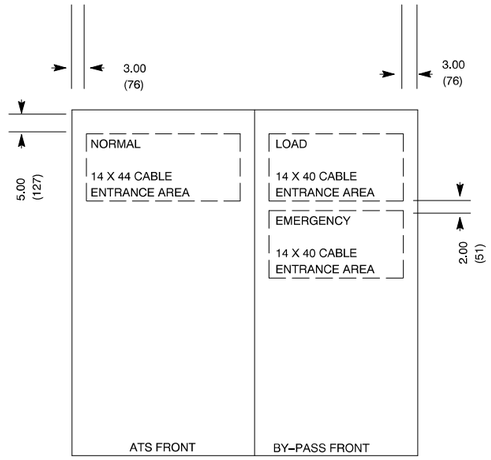
RIGHT SIDE VIEW (BY–PASS)

ADV-5782-B

Enclosure Dimensions, 2500-3000 Amp



CABLE ENTRANCE (BOTTOM OF ENCLOSURE AS SEEN FROM TOP)



CABLE ENTRANCE (TOP OF ENCLOSURE)

NOTES:

NEMA TYPE 1 – GENERAL PURPOSE, INDOOR FREE STANDING, FRAME CONSTRUCTION – FLOOR CONSTRUCTION.
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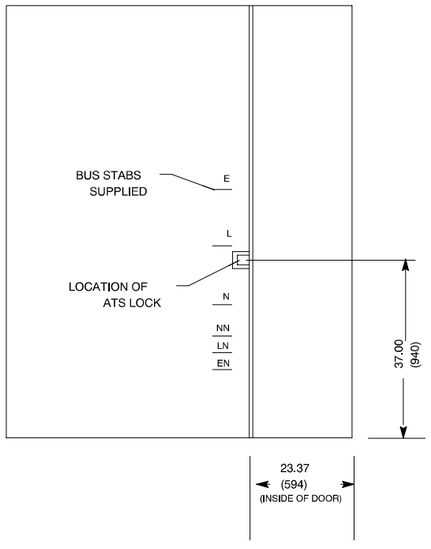
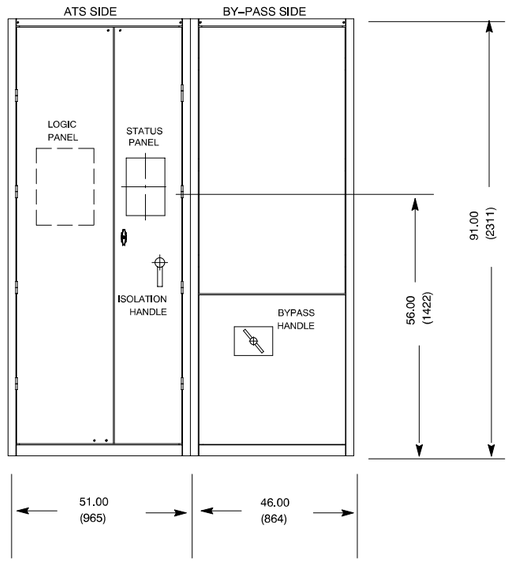
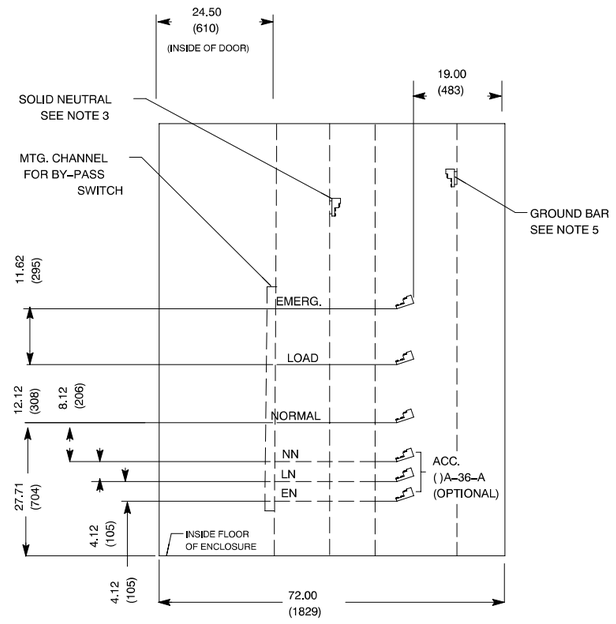


LEFT SIDE VIEW (ATS)



FRONT VIEW

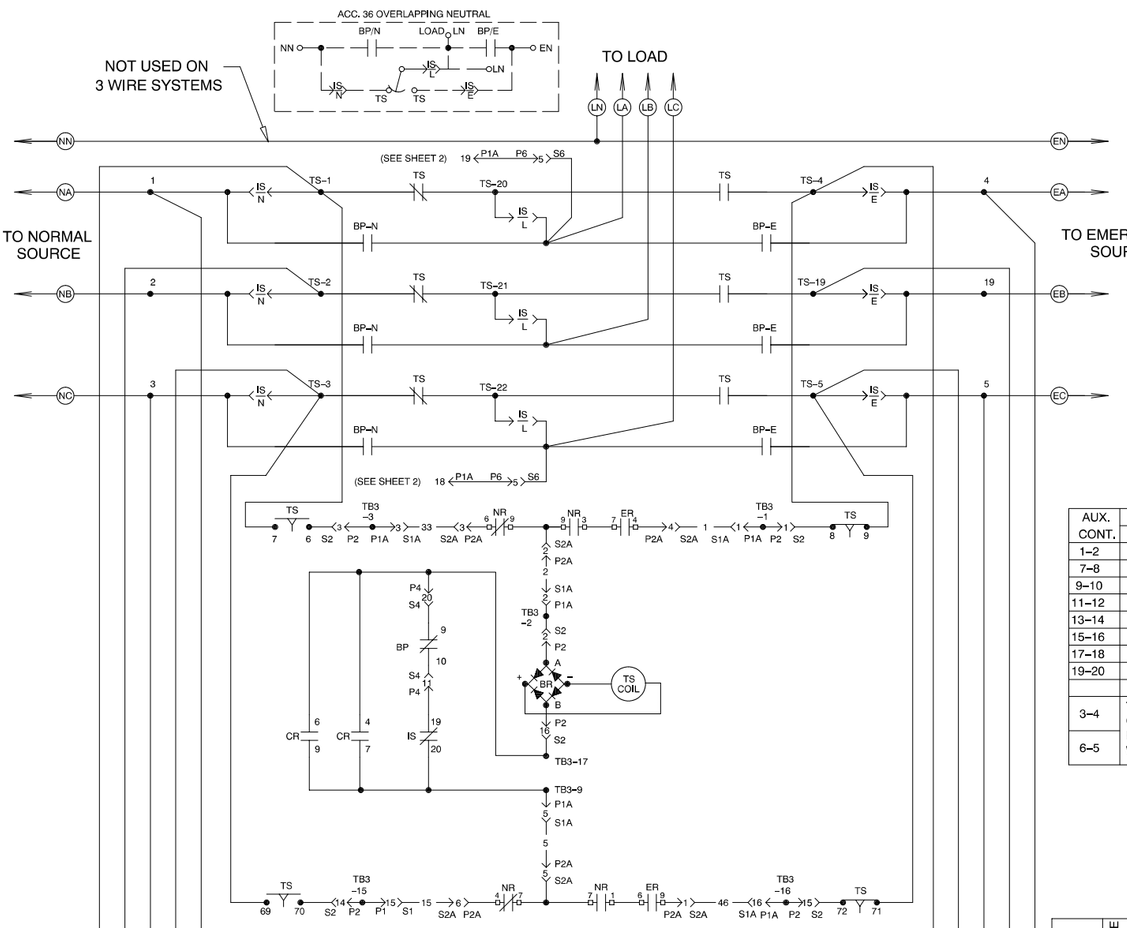


RIGHT SIDE VIEW (BY–PASS)

ADV-5783-B

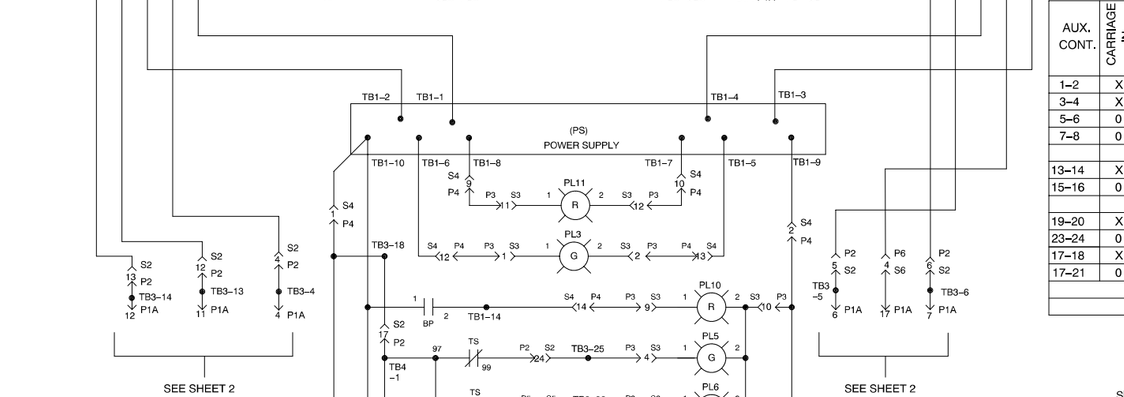
Enclosure Dimensions, 4000 Amp

Schematic Diagram, 1600-2000 Amp



BYPASS CONTACTS

AUX. CONT.	BYPASS HANDLE POSITION		
	EMERG	AUTO	NORMAL
1–2	X	0	0
7–8	0	0	X
9–10	0	X	0
11–12	X	0	0
13–14	0	0	X
15–16	X	0	0
17–18	X	0	X
19–20	X	0	X
3–4	THESE CONTACTS CAN BE EITHER OPEN OR CLOSED IN AUTOMATIC POSITION DEPENDING UPON WHETHER HANDLE IS IN OR OUT		
6–5			



ISOLATION CONTACTS

AUX. CONT.	CARRIAGE IN		MAIN CONT. ENGINE		TEST POSITION		CARRIAGE OUT
1–2	X	X	X	X	X	0	0
3–4	X	X	X	X	X	0	0
5–6	0	0	0	0	X	X	X
7–8	0	0	0	0	X	X	X
13–14	X	0	0	0	0	0	0
15–16	0	0	0	0	0	0	X
19–20	X	0	0	0	0	0	0
23–24	0	0	0	0	X	X	X
17–18	X	X	X	X	X	0	0
17–21	0	0	0	0	0	X	X
X – CLOSED CONTACT							
0 – OPEN CONTACT							

NOTE: DIAGRAM SHOWN WITH NORMAL ENERGIZED

SIGNAL LIGHTS

PL1 –GREEN, INDICATES WHEN AUTOMATIC TRANSFER SWITCH IS CONNECTED TO NORMAL SOURCE.

PL2 –RED, INDICATES WHEN AUTOMATIC TRANSFER SWITCH IS CONNECTED TO EMERGENCY SOURCE.

PL3 –GREEN, INDICATES WHEN NORMAL SOURCE IS AVAILABLE.

PL4 –AMBER, INDICATES AUTOMATIC TRANSFER SWITCH IN TEST POSITION.

PL5 –GREEN INDICATES AUTOMATIC TRANSSFER SWITCH CONTACT IS CLOSED ON NORMAL.

PL6 –RED, INDICATES AUTOMATIC TRANSFER SWITCH CONTACTS CLOSED ON EMERGENCY.

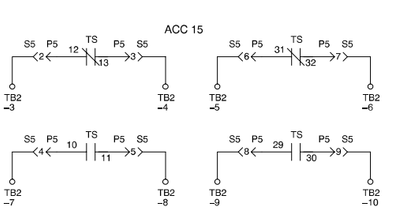
PL7 –GREEN, INDICATES AUTOMATIC TRANSFER SWITCH CONTACTS TO SOURCE

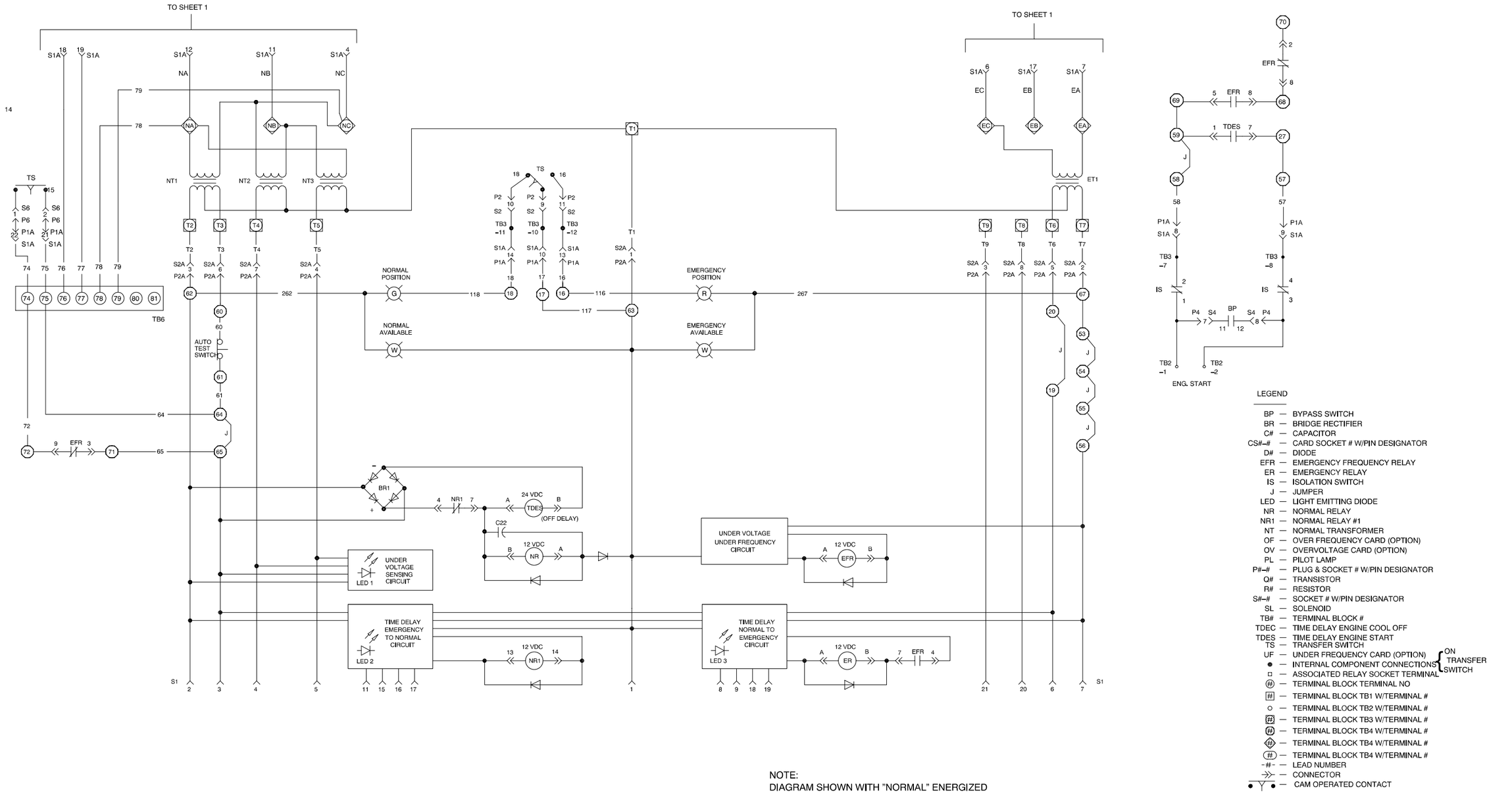
PL8 –RED, INDICATES AUTOMATIC TRANSFER SWITCH DISCONNECTED FROM SOURCE.

PL9 –GREEN, INDICATES BYPASS NORMAL CONTACTS CLOSED.

PL10–RED, INDICATES BYPASS EMERGENCY CONTACTS CLOSED.

PL11–RED, INDICATES EMERGENCY SOURCE AVAILABLE.





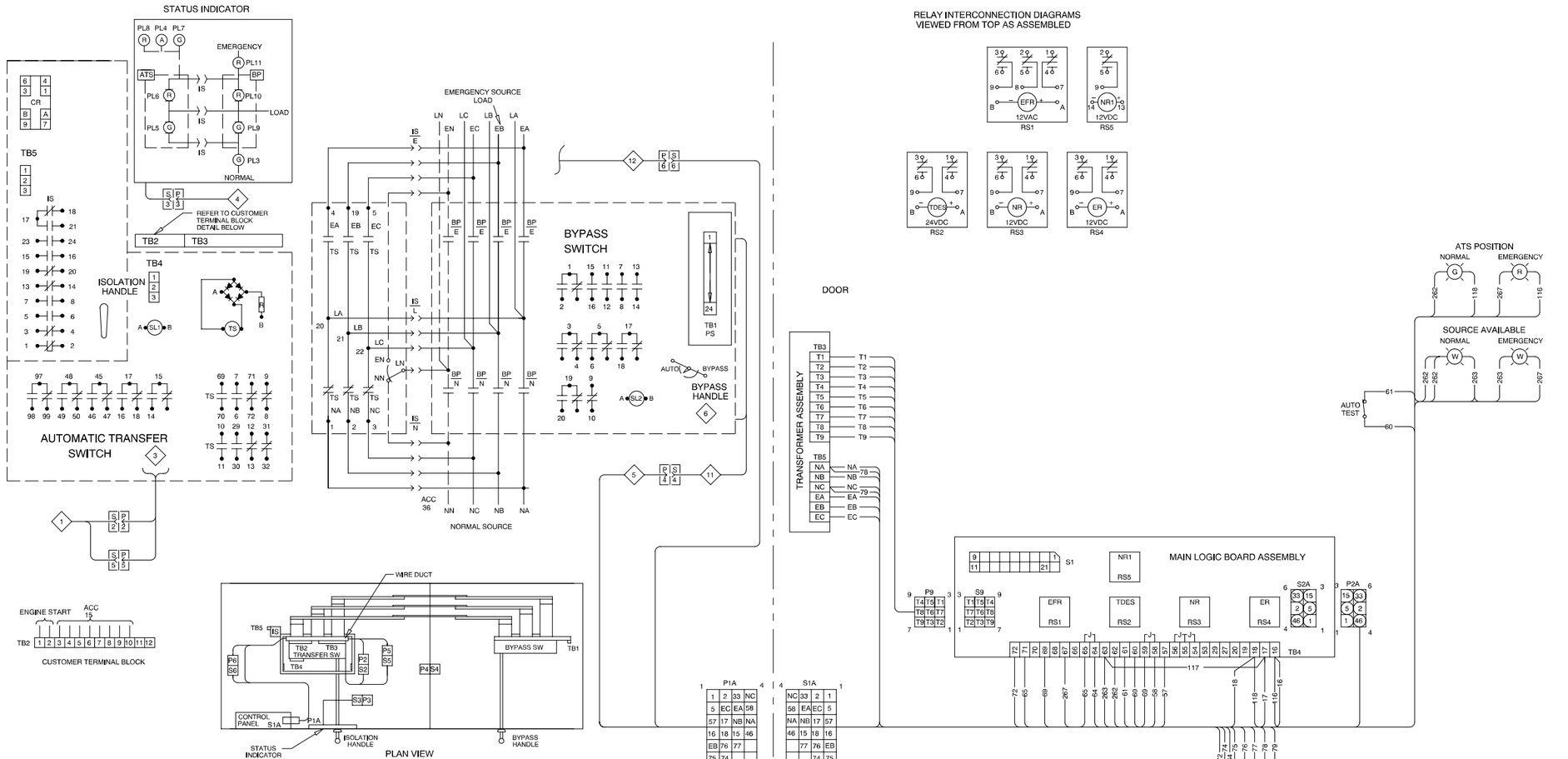
NOTE:
DIAGRAM SHOWN WITH "NORMAL" ENERGIZED

LEGEND

- BP — BYPASS SWITCH
- BR — BRIDGE RECTIFIER
- C# — CAPACITOR
- CS#–# — CARD SOCKET # W/PIN DESIGNATOR
- D# — DIODE
- EFR — EMERGENCY FREQUENCY RELAY
- ER — EMERGENCY RELAY
- IS — ISOLATION SWITCH
- J — JUMPER
- LED — LIGHT EMITTING DIODE
- NR — NORMAL RELAY
- NR1 — NORMAL RELAY #1
- NT — NORMAL TRANSFORMER
- OF — OVER FREQUENCY CARD (OPTION)
- OV — OVERVOLTAGE CARD (OPTION)
- PL — PILOT LAMP
- P#–# — PLUG & SOCKET # W/PIN DESIGNATOR
- Q# — TRANSISTOR
- R# — RESISTOR
- S#–# — SOCKET # W/PIN DESIGNATOR
- SL — SOLENOID
- TB# — TERMINAL BLOCK #
- TDEC — TIME DELAY ENGINE COOL OFF
- TDES — TIME DELAY ENGINE START
- TS — TRANSFER SWITCH
- UF — UNDER FREQUENCY CARD (OPTION) { ON TRANSFER SWITCH
- ● — INTERNAL COMPONENT CONNECTIONS { ON TRANSFER SWITCH
- □ — ASSOCIATED RELAY SOCKET TERMINAL { ON TRANSFER SWITCH
- (#) — TERMINAL BLOCK TERMINAL NO
- [#] — TERMINAL BLOCK TB1 W/TERMINAL #
- ○ — TERMINAL BLOCK TB2 W/TERMINAL #
- [#] — TERMINAL BLOCK TB3 W/TERMINAL #
- (#) — TERMINAL BLOCK TB4 W/TERMINAL #
- ◇(#) — TERMINAL BLOCK TB4 W/TERMINAL #
- (#) — TERMINAL BLOCK TB4 W/TERMINAL #
- -#- — LEAD NUMBER
- — CONNECTOR
- — CAM OPERATED CONTACT

321678B-

Schematic Diagram, 1600-2000 Amp



WIRE NO.	INTER-CONNECTIONS SOCKET S2 & S5 ⟨1⟩	WIRE NO.	ATS-CONNECTIONS PLUG P2 & P5 ⟨3⟩	WIRE NO.	INTER- CONNECTING PLUG P3 ⟨4⟩	WIRE NO.	BYPASS SWITCH ON PANEL WIRING ⟨6⟩	WIRE NO.	INTER-CONNECTIONS SOCKET S4 ⟨11⟩
1	S2-1, TB3-1	1	TS-8, P2-1	26	P3-5, TB3-26	4	TB1-2 , NC	18	S4-1, TB1-10
2	S2-2, TB3-2	2	TS-A, P2-2	19	P3-10, TB3-19	5	TB1-4 , EC	19	S4-2, TB1-9
3	S2-3, TB3-3	3	TS-6, P2-3	46	P3-7, IS-16	6	TB1-3 , EA	20	S4-3, BP-3
4	S2-4, TB3-4	4	TS-3, TS-69, P2-4	47	P3-6, IS-14	14	TB1-1, NA	21	S4-4, BP-5
5	S2-5, TB3-5	5	TS-5, TS-71, P2-5	48	P3-3, TB5-1	18	BP-1, BP-15, BP-7	23	S4-5, BP-14
6	S2-6, TB3-6	6	TS-4, TS-9, P2-6	25	P3-4, TB3-25		BP-13, TB1-10	24	S4-6, BP-16
7		7	TS-14, S6-1			49	BP-20, SL2-A	35	S4-7, BP-11
8		8	TS-15, S6-2			37	BP-4, TB1-12, TB1-13	36	S4-8, BP-12
10	S2-9, TB3-10	10	TS-17, P2-9		INTER- CONNECTING PLUG P4 ⟨5⟩	37	BP-6, TB1-13, BP-17	41	S4-11, BP-10
11	S2-10, TB3-11	11	TS-18, P2-10			19	TB1-9, SL2-B	44	S4-14, TB-14
12	S2-11, TB3-12	12	TS-16, P2-11			44	BP-2, TB1-14	45	S4-15, BP-8
13	S2-12 TB3-13	13	TS-2, P2-12	18	P4-1, TB3-18	55	BP-18, BP-19	17	S4-20, BP-9
14	S2-13, TB3-14	14	TS-1, TS-7, P2-13	19	P4-2, TB3-19			52	S4-9, TB1-8
15	S2-14, TB3-15	15	TS-70, P2-14	20	P4-3, TB3-20			50	S4-10, TB1-7
16	S2-15, TB3-16	16	TS-72, P2-15	21	P4-4, TB3-21			39	S4-12, TB1-6
17	S2-16, TB3-17	17	TS-B, P2-16	23	P4-5, TB3-23			40	S4-13, TB1-5
18	S2-17, TB3-18	18	P2-17, TB4-4, TS-97	24	P4-6, TB3-24				
19	S2-18, TB3-19		TB4-1, TS-45	35	P4-7, TB2-1				
20	S2-19, TB3-20	20	TS-47, P2-19	36	P4-8, TB2-2				
21	S2-20, TB3-21	21	TS-46, P2-20	41	P4-11, IS-19		INTER- CONNECTIONS ⟨7⟩		
22	S2-21, TB3-22	19	SL1-B, TB4-3, P2-18	44	P4-14, P3-9				
23	S2-22, TB3-23	23	TS-50, P2-22	45	P4-15, P3-8	7	TB3-7, IS-2		INTER-CONNECTIONS SOCKET S6 ⟨12⟩
24	S2-23, TB3-24	24	TS-49, P2-23	17	P4-20, TB3-17	8	TB3-9, IS-4		
25	S2-24, TB3-25	25	TS-99, P2-24	52	P4-9, P3-11	9	TB3-9, IS-20, CR-7, CR-9		
26	S5-1, TB3-26	26	TS-98, P5-1	50	P4-10, P3-12	18	TB3-18, IS-5, IS-7,	74	P6-1, P1-22
27	S5-2, TB2-3	27	TS-12, P5-2	39	P4-12, P3-1		IS-13, IS-15, IS-23	75	P6-2, P1-21
28	S5-3, TB2-4	28	TS-13, P5-3	40	P4-13, P3-2	51	IS-24, IS-17	76	P6-5, P1-18
29	S5-4, TB2-7	29	TS-10, P5-4			20	TB3-20, IS-6	77	P6-6, P1-19
30	S5-5, TB2-8	30	TS-11, P5-5			21	TB3-21, IS-8	EB	P6-4, P1-17
31	S5-6, TB3-5	22	P2-21, TB4-2#, TS-48			22	TB3-22, IS-21		
32	S5-7, TB2-6		TB4-2, SL1-A			19	TB3-19, CR-B		
33	S5-8, TB2-9	31	TS-31, P5-6			35	TB2-1, IS-1		
34	S5-9, TB2-10	32	TS-32, P5-7			36	TB2-2, IS-3		
		33	TS-29, P5-8			48	IS-18, TB5-1, CR-A		
		34	TS-30, P5-9			17	TB3-17, CR-4, CR-6		

GENERAL NOTES

1. SWITCH DE-ENERGIZED AND CONNECTED TO NORMAL SOURCE, WITH BYPASS HANDLE IN AUTOMATIC POSITION AND ISOLATION HANDLE IN CLOSED POSITION.
2. ALL WIRES ARE #16 AWG STRANDED COPPER.
3. ⊠ INDICATES CUSTOMER CONNECTION POINTS.
4. ● INDICATES FACTORY CONNECTION POINTS.
5. CONNECTION POINTS THAT HAVE BOTH CUSTOMER CONNECTIONS AND FACTORY CONNECTIONS ARE SHOWN AS COSTOMER CONNECTION POINTS
6. ALL FEATURES AND OPTIONS SHOWN ARE UL RECOGNIZED.
7. CUSTOMER REMOTE CONTACTS THAT ARE CONNECTED TO A.T.S. CONTROLS SHOULD BE SUITABLE FOR LOW ENERGY CIRCUITS.
8. REFER TO OPERATOR'S MANUAL FOR WIRING OF OPTIONAL ACCESSORIES.
9. MATING PLUG AND SOCKET TERMINAL NUMBERS MATCH WHEN PLUGGED TOGETHER.
10. SL1- (SOLENOID LOCK) TO PREVENT CONNECTING ATS UNLESS SOURCE TO LOAD IS SAME AS SOURCE BYPASSED.
11. SL2- ALLOW BYPASS ONLY TO THE SOURCE TO WHICH THE TRANSFERS SWITCH LOAD IS CONNECTED.
12. ⟨N⟩ INDICATES WIRE RUN.
13. AN OPERATORS MANUAL IS FURNISHED WITH EACH AUTOMATIC TRANSFER SWITCH. REFER TO THIS PUBLICATION PRIOR TO INSTALLATON AND OPERATION OF THE SWITCH.

LEGEND

ACC — ACCESSORY
BP — BYPASS SWITCH
EFR — ENGINE FAILURE RELAY
ER — EMERGENCY RELAY
GR — GREEN
IL — INDICATING LIGHT
J — JUMPER
NR — NORMAL RELAY
PL — PILOT LIGHT
P# — PLUG NUMBER
R — RED
RECT — RECTIFIER
RES — RESISTOR
S# — SOCKET NUMBER
SL — SOLENOID
T — TRANSFORMER
TB — TERMINAL BOARD
TDES — TIME DELAY ENGINE START
TS — TRANSFER SWITCH

321679-

Logic Interconnection, 1600-2000 Amp

Section 6. Installation

Kohler automatic transfer switches are shipped factory wired and tested, ready for installation. The actual installation process consists of mechanically mounting and electrically wiring the unit to the normal and emergency power sources, to the load circuits, and to the generator.

Upon Receipt of Unit

Unpacking

Allow the equipment to warm up to room temperature for 24 hours (minimum) prior to unpacking to prevent condensation on the electrical apparatus from surrounding moist air if it is uncrated after cold weather storage.

Unpack the transfer switch as soon as possible after receipt since failure to do so may cause difficulty in making claims for damage not evident upon receipt. Carefully unpack to avoid damaging any of the transfer switch components. Remove all packing material and dirt that may have accumulated in the transfer switch or any of its components.

Inspection

Carefully unpack or uncrate the automatic transfer switch and check for shipping damage. If damage is discovered, immediately file damage claims with the shipping company and notify the distributor/dealer.

Lifting

The approximate weight of each automatic transfer switch covered by this manual is given in Figure 6-1. For lifting, use a spreader bar. Attach the bar only to the enclosure's mounting holes or lifting brackets; do not lift the unit at any other points. Ensure the front door is in place and latched closed when moving or mounting the unit.

⚠ WARNING

Unbalanced weight.
Improper lift can cause severe injury, death, or equipment damage.

Use adequate lifting capacity.
Never leave automatic transfer switch standing upright unless it is securely bolted in place.

Storage

Protect the automatic transfer switch at all times from excessive moisture, construction grit, and metal chips. Avoid storage in low temperature, high humidity areas where moisture could condense on the unit.

Mechanical Installation

To plan the installation, use the dimensions given on the enclosure dimension drawings in Section 4. Select the mounting site to match local electrical code restrictions for the enclosure type. Mount the automatic transfer switch as near the load and power sources as possible. Also be sure to allow adequate space for switch servicing and full opening of the enclosure door.

Specifications		Nominal Weight Lbs. (kg)
Amp.	Poles	NEMA Type 1 Enclosed
1600	3	4802 (2178)
1600	3*	5002 (2269)
2000	3	4802 (2178)
2000	3*	5002 (2269)
2500	3	6366 (2888)
2500	3*	6766 (3069)
3000	3	6366 (2888)
3000	3*	6766 (3069)
4000	3	7768 (3524)
4000	3*	8368 (3796)

* 3 Pole with overlapping neutral contacts.

Figure 6-1. Transfer Switch Weight

Remove the Transfer Switch

The transfer switch is shipped inside the ATS enclosure in the fully engaged position (connected).

Before installing the enclosure, remove the ATS by completing the following steps:

1. Open the Enclosure door and install the two ramps stored on the right side.
2. Remove the isolation handle which is stored on the lower right front of the ATS carriage frame.
3. Position the isolation handle onto the protruding isolation shaft and turn it counterclockwise (approximately 10 turns) until it stops.
4. Unplug J2 and J5 harness plugs.
5. Roll the ATS out of the cabinet.
6. Cover the ATS to keep it clean and free of moisture.

Supporting Foundation

Verify that the supporting foundation and adjacent area is level and straight. This is very important. Verify that the structure of the enclosure is straight and square. Allow at least 36 inches for the ATS to roll out. Refer to Section 4, Diagrams and Drawings for required door opening space.

If bottom cable entry is used, verify that the conduit stubs are located correctly. Refer to section 4, Diagrams and Drawings for specified area. Provide cable bending space and clearance to live parts. When a concrete floor is poured, use interlocking conduit spacer caps or a wood or a metal template to maintain proper conduit alignment.

Mounting

Refer to Section 4, Diagrams and Drawings for proper dimensions. Mount the transfer switch according to the details and instructions shown on the diagrams.

Bolt the sections together so that they are lined up on the front face. See Figure 6-2.

Electrical Connections

All internal electrical connections are prewired. The only wiring necessary when installing the transfer switch is the connections from the transfer switch to the external devices.

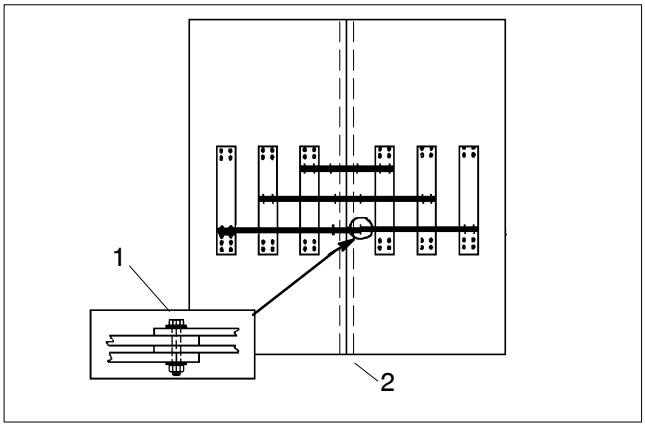
⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect power sources before servicing. Barrier must be installed after adjustments, maintenance, or servicing.

NOTE

For easy access during installation wiring, the front door and sides of the enclosure can be removed. Simply disconnect the cable plug that connects the front door components to the internal components and then lift the door off its hinge pins or unbolt the side covers.



1. Grade 5 Hardware
2. Shipping Split

Figure 6-2. Bus Bar Connections

Testing Power Cable

Do not connect the power cables to the transfer switch until they are tested. Installing power cables in conduit, cable troughs, and ceiling-suspended hangers often requires considerable force. The pulling of cables can damage insulation and stretch or break the conductor's strands. Test the cables after installation and before final connection to verify that no damage or defects exist on the cables.

Connecting Power Cables

After the power cables have been tested, connect them to the appropriate terminal lugs on the Bypass Switch. Refer to Section 5 Diagrams and Drawings for your specific switch. Make sure the lugs provided are suitable for use with the cables being installed. Standard terminal lugs are solderless screw type and will accept the wire size list on the ADV's in Section 5 Diagrams and Drawings. Be careful when stripping insulation from the cables; avoid nicking or ringing the conductor. Remove surface oxides from cables by cleaning with a wire brush. When aluminum cable is used, apply joint compound to conductors. Tighten the cable lugs to the torque specified on the rating label.

Bus Connections

Use grade 5 hardware to connect bus tie plates at shipping split and to appropriate terminal plates on the Bypass Switch (If lugs are not used). Wipe off the bus surfaces before they are joined. If the bus is very dirty, gently clean the surface with a non-flammable solvent. Avoid touching the cleaned surfaces.

If grade 5 hardware is used, tighten the bolted joints to the torque specified in Figure 6-3.

Harnesses

All internal connections are made at the factory. The bypass switch, transfer switch and control panel are joined together by an interconnecting wiring harness. Align the appropriate plug halves of P1 and push them together until the latches click.

Note any optional accessories that are furnished on this switch. Refer to Section 4, Accessories for additional information and wiring diagrams.

Engine Starting Contacts

The engine control contacts are located on the bypass-isolation switch. Connect the generator conductors for the start signal to terminals TB-1 and TB-2 as shown in the enclosure dimension drawings provided in Section 5 of this manual.

In cases where the normal, emergency, and load connections are made to a rear connected bus bar, a compression washer, flat washer, and a minimum grade 5 bolt must be used and torqued to the values in Figure 6-3.

Bolt Diameter in Inches	Torque	
	Ft. lbs	Nm
5/16	12	16.3
3/8	20	27.1
1/2	50	68.8
5/8	95	128.9
3/4	155	210.3

Figure 6-3. Tightening Torque for Bolt Joints on Bus Bar

Installing the transfer switch

After the enclosure is installed and power cables or bus are connected to the bypass switch, roll in the ATS carriage. Clean the floor of the cabinet. If necessary, use a vacuum cleaner. Verify that no tools are left inside.

NOTE

Do not apply any electrical power to the transfer switch yet.

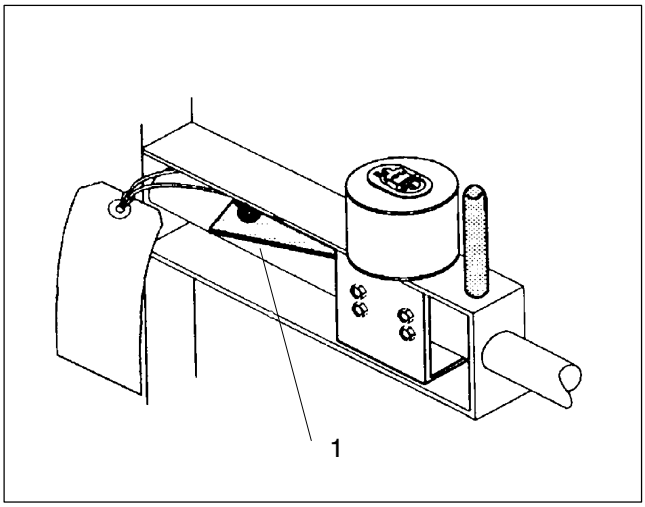
1. Place the bypass handle in the bypass position and closed on the normal source.
2. Verify that the isolation handle is fully counterclockwise against the stop.
3. Close the ATS normal source contacts using the manual operator handle (Maintenance handle is stored on the lower carriage).
4. Check that all arc chutes and interphase barriers are in place on the ATS and bypass switches.
5. Grasp the ATS carriage frame and roll it into the cabinet (Isolation contacts facing inward).
6. Align the ATS carriage rollers between the floor guides and push the carriage in until the crank pins engage the latch plates on both sides of the ATS carriage.

Nonpowered Inspections

Perform the following inspections before applying electrical power to the transfer switch to verify that the isolation contacts are aligned. If necessary, add shims under the floor of the enclosure to adjust the alignment.

NOTE

The solenoid SL1 locks the isolation shaft to inhibit the operation of the drawout (isolation contacts) unless the ATS and the bypass/isolation switches are closed on the same source. This solenoid must be energized to unlock. An interference tag is installed at the factory to defeat the function of the solenoid during the following inspections. See Figure 6-4.



1. Interface Tag

Figure 6-4. interface Tag

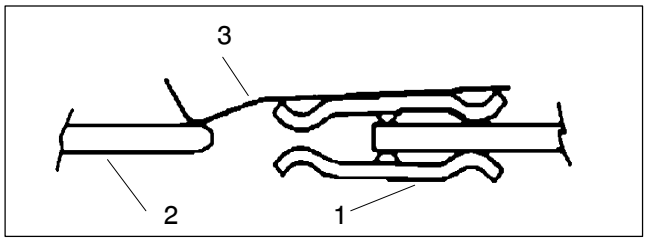
Inspection 1

Move the ATS from the disconnected position to the test position.

NOTE

Do not force the isolation handle. Verify that the sensing leads on the isolation contacts do not hit the stabs heads but instead slide on them.

1. Turn the isolation handle clockwise approximately 7 or 8 turns.
2. Observe that the ATS is pulled inward and the sensing leads' contacts make contact with the stabs as shown in Figure 6-5.



1. Contact Fingers
2. Stab
3. Sensing Lead

Figure 6-5. Isolation Contact Alignment

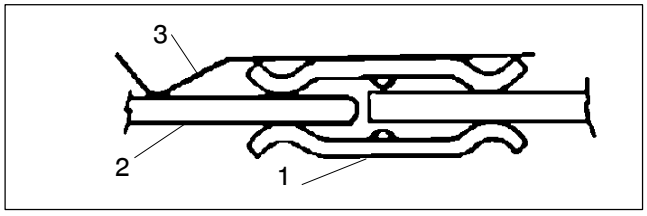
Inspection 2

Move the ATS from the test position to the connected position.

NOTE

Do not force the isolation handle. Verify that the isolation contact fingers do not hit the stabs heads but slide on both sides when the ATS is in the connected position.

1. Turn the isolation handle clockwise until it stops (approximately 6 to 7 turns). Remove the interference tag from the solenoid latch.
2. Observe that the ATS is pulled inward and the isolation contact fingers make contact with the stabs as shown in Figure 6-6. Check that the bypass switch's switched neutral contacts have opened.



1. Contact Fingers
2. Stab
3. Sensing Lead

Figure 6-6. Isolation Contact Alignment

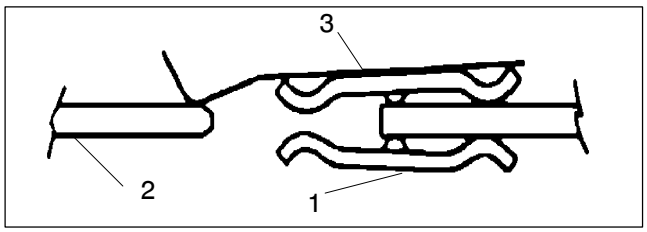
Inspection 3

Move the ATS from the connected position to the test position.

NOTE

Do not force the isolation handle. Verify that the isolation contact fingers disconnect from the stab when the ATS is in the test position. The sensing leads on the isolation contacts must touch the stab.

1. Turn the isolation handle counterclockwise until the isolation contacts fingers separate (approximately 6 to 7 turns).
2. Observe that the ATS is pushed outward and the isolation contact fingers are disconnected from the stabs. The sensing leads on the isolation contacts must touch the stabs as shown in Figure 6-7.



1. Contact Fingers
2. Stab
3. Sensing Lead

Figure 6-7. Isolation Contact Alignment

Functional Tests

The functional test consists of three checks: voltage checks, manual operation, and electrical operation

NOTE

Perform these checks in the order given to avoid damaging the switch.

Read and understand all instructions on installation drawings and labels affixed to the switch. Note any optional accessories that have been furnished with the switch and review their operation.

If the handles are not in the correct position, follow the instructions for bypassing and isolating the ATS in Section 2. Do not force handles while performing tests. Electrical interlocks prevent a wrong sequence of operation.

Performing the following voltage check and manual operation test before attempting to electrically test the ATS. The purpose is to verify that all switches operate smoothly and that there is no damage from shipping or installation.

Voltage Checks

First check nameplate for rated voltage. The transfer switch rated line voltage should be the normal and emergency line voltage. Place the transfer switch in the normal position before proceeding.

1. Close the normal source circuit breaker. Verify that the following lamps on the indicator panel are illuminated: Normal Source Available, Closed on Normal (ATS), Closed on Normal (BIS), and Test.
2. Use an accurate voltmeter to check phase-to-phase and phase-to-neutral voltages present at the bypass switch normal source terminals.
3. Close the emergency source circuit breaker.
4. Manually start the generator at the set using the engine control switch on the generator set controller. Verify that the emergency available lamp illuminates on the status indicator panel.
5. Use an accurate voltmeter to check for phase-to-phase and phase-to-neutral voltages and phase rotation at the bypass switch emergency-source terminals.
6. If necessary, adjust the generator voltage regulator following the generator set manufacturer's instructions. The automatic transfer switch will respond only to rate voltage and frequency specified on the nameplate. Verify that phase rotation is the same as the normal source.
7. Shut down the generator set using the engine control switch on the generator set controller.

Manual Operation Check

This procedure will check the manual operation of the bypass switch and ATS. Observe the lamps on the status indicator panel. The Closed on Normal (bypass) and Test lamps should be illuminated.

1. Isolate the ATS: Install the isolation handle and turn it counterclockwise until it stops

(approximately 7 or 8 turns). The ATS is now in the disconnected position. The Disconnected lamp should be illuminated.

NOTE

A detachable manual operator handle is provided on the transfer switch for maintenance purposes only.

NOTE

Do not manually operate the transfer switch unless the isolation handle is in the Open position and the Disconnected lamp is on.

2. Insert the manual handle into the hole in the rotating weight as shown in Figure 6-8. Move the installed handle up and down to manually operate the transfer switch. The switch should operate smoothly without binding. Return the transfer switch to the normal position. Remove the manual operator handle and store it on the transfer switch in the place provided.

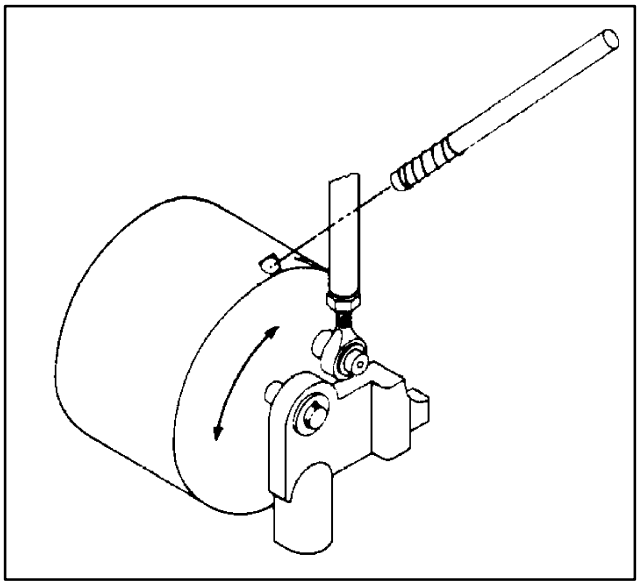


Figure 6-8. Operating Lever

Electrical Operation Test

Before performing the electrical operation test place the transfer switch in the bypassed and isolation positions and perform the following procedure:

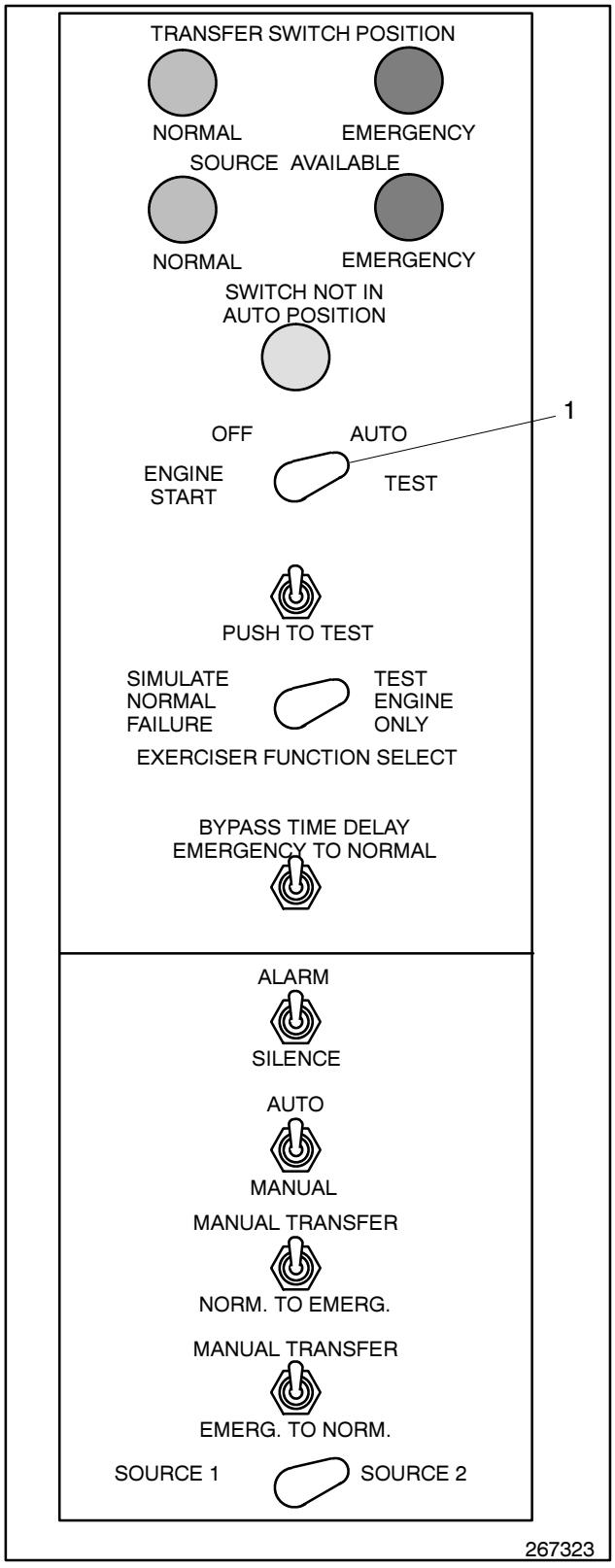
1. Turn the isolation handle clockwise until the test lamp illuminates and the disconnect lamp turns off (Approximately 7 or 8 turns).
2. Place the test selector switch, if equipped, in the TEST position. See Figure 6-9.
3. Move the door-mounted test switch to the TEST position and hold it for generator set start. The generator set should start and run after the Time Delay Engine Start (TDES) has completed timing.
4. The transfer switch will transfer to the emergency position and the closed emergency lamp will illuminate. The transfer will occur after the Normal-to-Emergency Time Delay (TDNE has completed timing.
5. Release the door-mounted test switch. The transfer switch will retransfer to normal after the Emergency-to-Normal Time Delay (TDEN) has completed timing. The closed lamp will illuminate.
6. Time Delay Engine Cooldown (TDEC, if equipped) allows the engine to continue running for an additional unloaded running time. The transfer switch TDEC will complete timing before any TDEC function in the generator set begins timing.

NOTE

Do not close the isolation contacts unless the transfer switch and bypass switch are in the same position.

7. Turn the isolating handles clockwise until it stops (approximately 6 or 7 turns). The connected lamp will illuminate and the test lamp will turn off.
8. Remove the isolation handle and store it inside the enclosure on the carriage frame on the right side.
9. Turn the bypass handle clockwise to the automatic position. The closed on emergency lamp will turn off.

This completes the functional test of the transfer switch. The generator set's starting control should be left in the automatic position.



1. Test Selector Switch

Figure 6-9. Transfer Switch Control Switches & Indicators

Appendix A. Glossary of Abbreviations

Abbreviations are used throughout this manual. Normally in the text they will appear in complete form with the abbreviation following in parenthesis the first time they are used. After that they will appear in the abbreviated form. The commonly used abbreviations are shown below.

Abbreviation	Description
AC	alternating current
AHWT	anticipatory high water temp.
ALOP	anticipatory low oil pressure
AM	amplitude modulation
Amp	ampere
Amps	amperes
ANSI	American National Standard Institute
API	American Petroleum Institute
approx.	approximate, approximately
A/R	as required, as requested
A/S	as supplied, as stated, as suggested
ASA	American Standards Association
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
aux.	auxiliary
AWG	American Wire Gauge
AWM	appliance wiring material
bhp	brake horsepower
bmep	brake mean effective power
Btu	British thermal unit
°C	Celsius degree
cc	cubic centimeter
CCA	cold cranking Amps.
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CID	cubic inch displacement
cm	centimeter, centimeters
cmm	cubic meters per minute
co.	company
cont'd.	continued
C.S.A.	Canadian Standards Association
cu. in.	cubic inch, cubic inches
cyl.	cylinder
dBA	decibels
DC	direct current
DCR	direct current resistance
deg.	degree
dept.	department
dia.	diameter
e.g.	example given
EMI	electromagnetic interference
etc.	etcetera, (and so forth)
ext.	external
°F	Fahrenheit degree
fl. oz.	fluid ounce, fluid ounces
FM	frequency modulation
fs	full scale
ft.	foot, feet
ft. lbs.	foot pound, foot pounds
ga.	gauge
gal., gals.	gallon, gallons
gal./hr.	gallons per hour
gph	gallons per hour
gpm	gallons per minute
gr.	grade
grd.	ground
HCHT	high cylinder head temperature
HET	high exhaust temperature
Hg	mercury (element)
H_2O	water
hp	horsepower
hr, hrs	hour
HWT	high water temperature
Hz	hertz (cycles per second)
ID	inside diameter
in.	inch(es)
inc.	incorporated
in. lbs.	inch pounds
int.	internal
int.-ext.	internal-external
ISO	International Standards Organization
J	joule, joules
JIS	Japanese Industry Standard
kg	kilogram, kilograms
kg/cm^2	kilograms per square centimeter
kgm	kilogram meter(s)
km	kilometer, kilometers

Abbreviation	Description
kPa	kiloPascal, kiloPascals
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt amperes
kW	kilowatt, kilowatts
kWH	kilowatt hour
L	liter, liters
LxWxH	length x width x height
LED, LEDs	light emitting diode
lb., lbs.	pound, pounds
L/hr.	liter per hour, liters per hour
L/min.	liter(s) per minutes
LOP	low oil pressure
LP	liquefied petroleum
LWT	low water temperature
m	meter, meters
m^3	cubic meter, cubic meters
max.	maximum
MCM	one thousand circular mils.
mi.	mile, miles
mil	one one-thousandth of an inch
min.	minimum
mJ	millijoule, millijoules
MJ	mega joule, mega joules
mm	millimeter, millimeters
m^3/min	cubic meters per minute
MPa	megaPascal
mph	miles per hour
MS	military standard
mW	milliwatt, milliwatts
MW	megawatt, megawatts
N/A	not available
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	Newton meter, Newton meters
no., nos.	number, numbers
NPT	National Standard taper pipe
	thread per general use
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed, oversize
OV	overvoltage
oz.	ounce, ounces
PF	power factor
pot.	potentiometer
ppm	parts per million
psi	pounds per square inch
pt., pts.	pint, pints
qt., qts.	quart, quarts
qty.	quantity
ref.	reference
RFI	radio frequency interference
rms	root mean square
rpm	revolutions per inch
SAE	Society of Automotive Engineers
sec.	second, seconds
SCR	silicon controlled rectifier
spec, specs	specification
sq.	square
sq. cm	square centimeters
sq. in.	square inch, square inches
tach	tachometer
TDC	top dead center
temp.	temperature
TIF	telephone influence factor
turbo	turbocharger
UNC	Unified coarse thread (was NC)
UNF	Unified fine thread (was NF)
UL	Underwriter's Laboratories, Inc.
US	undersize
V	volt, volts
VAC	Volts alternating current
VDC	volts direct current
W	watt, watts

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