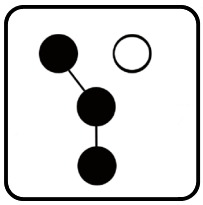
Service

Automatic Transfer Switches



Models:

KSS/KSP
KGS/KGP

Power Switching Device:
Standard and Bypass/Isolation

Electrical Controls:

Decision-Maker® MPAC 1500

Decision-Maker® MPAC 1200

Decision-Maker® MPAC 750

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
Power Systems

TP-6921 10/14

Table of Contents

Table of Contents, continued

Table of Contents, continued

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

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

WARNING

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

CAUTION

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

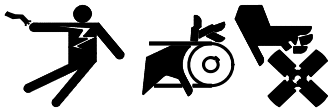
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

(Decision-Maker® 3+ and 550 Generator Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

Hazardous Voltage/ Moving Parts

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before servicing. Install the barrier after adjustments, maintenance, or servicing.

DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

WARNING

Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING

Hazardous voltage.
Backfeed to the utility system can cause severe injury, death, or property damage.

Before energizing the transfer switch, verify that both the normal and emergency contacts are not left in the closed position.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Short circuits. Hazardous voltage/current 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

Making line or auxiliary connections. Hazardous voltage can cause severe injury or death. To prevent electrical shock deenergize the normal power source before making any line or auxiliary connections.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Removing the transfer switch from bypass/isolation models. Hazardous voltage can cause severe injury or death. Bypass and isolate the transfer switch before removing it from the enclosure. The bypass/isolation switch is energized. Do not touch the isolation contact fingers or the control circuit terminals.

⚠ WARNING

Spring-loaded parts.
Can cause severe personal injury or property damage.

Wear protective goggles when servicing spring-loaded parts. Hold parts securely during disassembly.

Disassembling the solenoid. Spring-loaded parts can cause severe personal injury or property damage. The spring in the solenoid assembly exerts substantial force on the coil. Hold the coil assembly securely when removing the screws.

Heavy Equipment

⚠ WARNING

Unbalanced weight.
Improper lifting can cause severe injury or death and equipment damage.

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

Notice

NOTICE

Improper operator handle usage. Use the manual operator handle on the transfer switch for maintenance purposes only. Return the transfer switch to the normal position. Remove the manual operator handle, if used, and store it in the place provided on the transfer switch when service is completed.

NOTICE

Foreign material contamination. Cover the transfer switch during installation to keep dirt, grit, metal drill chips, and other debris out of the components. Cover the solenoid mechanism during installation. After installation, use the manual operating handle to cycle the contactor to verify that it operates freely. Do not use a screwdriver to force the contactor mechanism.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Notes

This manual provides service information for Kohler® Model KSS/KSP and KGS/KGP transfer switches equipped with the following Decision-Maker® MPAC electrical controls.

- Decision-Maker® MPAC 750 (Model KSS)
- Decision-Maker® MPAC 1200 (Model KSS or KSP)
- Decision-Maker® MPAC 1500 (Model KGS or KGP)

This manual includes troubleshooting, repair, and maintenance procedures for the transfer switches and electrical controls.

The information included in this manual is intended solely for use by trained and qualified service personnel of authorized service distributors/dealers.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this literature and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual.

The equipment service requirements are very important to safe and efficient operation. Inspect parts often and perform required service at the prescribed intervals. Obtain service from an authorized service distributor/ dealer to keep equipment in top condition.

List of Related Materials

Figure 1 lists the part numbers for related literature. Separate operation and installation manuals contain operation and installation information not provided in this manual. Refer to the parts catalog for instructions to obtain replacement parts.

Document	Document Part Number
Specification Sheet, KSS/KSP ATS	G11-130
Specification Sheet KGS/KGP ATS	G11-132
Specification Sheet, Decision-Maker® MPAC 750 Controller	G11-126
Specification Sheet, Decision-Maker® MPAC 1200 Controller	G11-127
Specification Sheet, Decision-Maker® MPAC 1500 Controller	G11-128
Operation and Installation Manual, Model KSS/KSP ATS	TP-6834
Operation and Installation Manual, Model KGS/KGP Bypass/Isolation Switch	TP-6836
Operation Manual, Decision-Maker® MPAC 750 Controller	TP-6865
Operation Manual, Decision-Maker® MPAC 1200 Controller	TP-6866
Operation Manual, Decision-Maker® MPAC 1500 Controller	TP-6883
Operation Manual, Modbus Protocol	TP-6113
Operation Manual, SiteTech Software	TP-6701
Parts Catalog, Transfer Switch	TP-6433
Wiring Diagram Manual, Models KSS/KSP/KGS/KGP ATS	TP-6918

Figure 1 Related Materials

Service Assistance

For professional advice on generator set power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric.
- Visit the Kohler Power Systems website at KOHLERPower.com.
- Look at the labels and stickers on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

Headquarters Europe, Middle East, Africa (EMEA)
Kohler Power Systems Netherlands B.V.
Kristallaan 1
4761 ZC Zevenbergen
The Netherlands
Phone: (31) 168 331630
Fax: (31) 168 331631

Asia Pacific
Power Systems Asia Pacific Regional Office
Singapore, Republic of Singapore
Phone: (65) 6264-6422
Fax: (65) 6264-6455

China
North China Regional Office, Beijing
Phone: (86) 10 6518 7950
(86) 10 6518 7951
(86) 10 6518 7952
Fax: (86) 10 6518 7955

East China Regional Office, Shanghai
Phone: (86) 21 6288 0500
Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka
India Regional Office
Bangalore, India
Phone: (91) 80 3366208
(91) 80 3366231
Fax: (91) 80 3315972

Japan, Korea
North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Latin America
Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

This section explains the transfer switch sequence of operation during the following events:

- Controller powerup or reset
- Preferred source loss and return
- Test
- Exercise
- Emergency source loss and return

The Sequence of Operation descriptions in the following sections explain the transfer switch normal operation for standard and programmed transition models. Operation can be affected by faults such as the normal or emergency contacts failing to open or close when signaled to do so.

1.1 Controller Power-up/Reset

Following is an explanation of the sequence of operation when power is initially applied to the controller or a controller reset occurs.

1. Controller self test is executed.
2. System parameters are downloaded from nonvolatile memory.
3. Contactor position and source availability are determined.
4. If neither source is acceptable, the contactor does not change position.
5. If both sources are available, the controller immediately transfers the contactor to the preferred source.
6. If only one source is available, the controller immediately transfers the contactor to that source, executing only the off-position and load control time delays.

   If the available source is the preferred source, and the contactor is in the standby position, the contactor transfers to preferred, the engine cooldown time delay runs, and then the engine start contacts open.

   If the available source is the preferred source and the contactor is already in the preferred position, the engine start contacts open immediately, bypassing the engine cooldown time delay.

1.2 Sequence of Operation, MPAC 750 Controller

The Sequence of Operation describes the transfer switch normal operation. The MPAC 750 controller operates using standard transition only (no programmed- or closed-transition operation).

Operation can be affected by faults such as the normal or emergency contacts failing to open or close when signaled to do so.

1.2.1 Source N Loss and Return

Following is an explanation of the transfer switch sequence of operation when Source N failure is detected.

Source N Fails

1. Engine start time delay expires.
2. The generator is signaled to start.
3. The generator starts and Source E becomes available.
4. Preferred-to-standby time delay expires.
5. Contactor transfers to Source E.

Source N Returns

1. Standby-to-preferred time delay expires.
2. Contactor transfers to Source N.
3. Engine cooldown time delay expires.
4. The engine start contacts open, signaling the generator to stop.

1.2.2 Exerciser Operation

Unloaded Exercise Sequence Starts

1. Exerciser timer begins.
2. The generator is signaled to start.
3. The generator starts and Source E becomes available.

Unloaded Exercise Sequence Ends

1. Engine cooldown time delay expires.
2. The engine start contacts open, signaling the generator to stop.

Loaded Exercise Sequence Starts

1. Exerciser timer begins.
2. The generator is signaled to start.
3. The generator starts and Source E becomes available.
4. Preferred-to-standby time delay and pre-transfer load control sequences run.
5. Contactor transfers to Source E.

Source E Fails (Source N is available)

1. Exerciser is deactivated.
2. Contactor immediately transfers to Source N.
3. Immediate failure to acquire standby alarm.
4. Engine cooldown time delay expires.
5. Engine start contacts open.

Loaded Exercise Sequence Ends

1. Contactor transfers to preferred.
2. Engine cooldown time delay expires.
3. The engine start contacts open, signaling the generator to stop.

1.2.3 Test Sequence

Unloaded Test Function is Initiated

1. The generator set is signaled to start.
2. The generator starts and Source E becomes available.

Unloaded Test Function is Ended

1. Engine cooldown time delay expires.
2. The generator is signaled to stop.

Loaded Test Function is Initiated

1. The generator is signaled to start (engine start contacts close).
2. The generator starts and Source E becomes available.
3. Preferred-to-standby time delay expires.
4. Contactor transfers to Source E.

Source E Fails (Source N is available)

1. Test function is deactivated.
2. Contactor immediately transfers to Source N.
3. Immediate failure to acquire standby alarm.
4. Engine cooldown time delay expires.
5. Engine start contacts open.

Loaded Test Function is Ended

1. Standby-to-preferred time delay sequence runs.
2. Contactor transfers to Source N.
3. Engine cooldown time delay expires.
4. The engine start contacts open, signaling the generator to stop.

1.3 Sequence of Operation, MPAC 1200 and 1500, Standard Transition

Operation can be affected by faults such as the normal or emergency contacts failing to open or close when signaled to do so.

Pre-transfer signals can overlap the preferred-to-standby and standby-to-preferred time delays. The longest time delay will control the time before transfer.

1.3.1 Preferred Source Loss and Return, Standard Transition

Following is an explanation of the transfer switch sequence of operation when Preferred Source failure is detected.

Preferred Source Fails

1. Load control contacts open.
2. Engine start time delay expires.
3. The generator is signaled to start.
4. The generator starts and the standby source becomes available.
5. Preferred-to-standby time delay expires.
6. Contactor transfers to standby.
7. Post-transfer load control sequences run.
8. Load control contacts close.

Preferred Source Returns

1. Standby-to-preferred and pre-transfer load control time delays expire.
2. Load control contacts open.
3. Contactor transfers to preferred source.
4. Post-transfer load control sequences and engine cooldown time delay expire.
5. Load control contacts close.
6. The engine start contacts open, signaling the generator to stop.

1.3.2 Exerciser Operation, Standard Transition

Unloaded Exercise Sequence Starts

1. Exerciser timer begins.
2. The generator is signaled to start (engine start contacts close).
3. The generator starts and the standby source becomes available.
4. The load bank control is activated (as programmed).

Unloaded Exercise Sequence Ends

1. The load bank control is deactivated (as programmed).
2. Engine cooldown time delay expires.
3. The engine start contacts open, signaling the generator to stop.

Loaded Exercise Sequence Starts

1. Exerciser timer begins.
2. The generator is signaled to start (engine start contacts close).
3. The generator starts and the standby source becomes available.
4. Preferred-to-standby time delay and pre-transfer load control sequences run (as programmed).
5. Load control contacts open.
6. In-phase monitor or transfer to OFF (as programmed).
7. Contactor transfers to standby.
8. Post-transfer load control sequences run (as programmed).
9. Load control contacts close.

Emergency Source Fails (Normal Source is available)

1. Exerciser is deactivated.
2. Load control contacts open.
3. Contactor immediately transfers to preferred.
4. Immediate failure to acquire standby alarm.

5. Post-transfer load control sequences and engine cooldown time delay expire.
6. Load control contacts close.
7. Engine start contacts open.

Loaded Exercise Sequence Ends

1. Exercise time period ends or the END button is pressed.
2. Time delay standby-to-preferred and pre-transfer load control sequences run as programmed.
3. Load control contacts open.
4. In-phase monitor or transfer to OFF as programmed.
5. Contactor transfers to preferred.
6. Post-transfer load control sequences and engine cooldown time delay expire.
7. Load control contacts close.
8. Engine start contacts open, signaling the generator to stop.

1.3.3 Test Sequence, Standard Transition

Unloaded Test Function is Initiated

1. The generator set is signaled to start (engine start contacts close).
2. The generator starts and the standby source becomes available.
3. The load bank control is activated.

Unloaded Test Function is Ended

1. The END button is pressed.
2. The load bank control is deactivated.
3. Engine cooldown time delay expires.
4. The generator is signaled to stop (engine start contacts open).

Loaded Test Function is Initiated

1. The generator is signaled to start (engine start contacts close).
2. The generator starts and the standby source becomes available.
3. Preferred-to-standby time delay and pre-transfer load control time delays expire.
4. Load control contacts open.
5. In-phase monitor or transfer to OFF operates as programmed.
6. Contactor transfers to standby.
7. Post-transfer load control time delays expire and load control contacts close.

Emergency Source Fails (Normal Source is available)

1. Test function is deactivated.
2. Load control contacts open.
3. Contactor immediately transfers to preferred.
4. Immediate failure to acquire standby alarm.
5. Post-transfer load control sequences and engine cooldown time delay expire.
6. Load control contacts close.
7. Engine start contacts open.

Loaded Test Function is Ended

1. The END button is pressed.
2. Standby-to-preferred time delay and pre-transfer load control sequences run.
3. Load control contacts open.
4. In-phase monitor or transfer to OFF operates as programmed.
5. Contactor transfers to preferred.
6. Post-transfer load control sequences operate as programmed.
7. Load control contacts close.
8. Engine cooldown time delay expires.
9. The engine start contacts open, signaling the generator to stop.

1.4 Sequence of Operation, MPAC 1200 and 1500, Programmed-Transition

Programmed-transition models operate with a pause in the off position during transfer. The time in the off position is set through the off-to-standby and off-to-preferred time delays.

Operation can be affected by faults such as the normal or emergency contacts failing to open or close when signaled to do so.

1.4.1 Preferred Source Loss and Return, Programmed Transition

Preferred Source Fails

1. Load control contacts open.
2. Engine start time delay expires.
3. The generator is signaled to start (engine start contacts close).
4. The generator starts and the standby source becomes available.
5. Preferred-to-standby time delay expires.
6. Contactor transfers to OFF position.
7. Off-to-standby time delay expires.
8. Contactor transfers to standby source.
9. Post-transfer load control sequences run.
10. Load control contacts close.

Preferred Source Returns

1. Standby-to-preferred and pre-transfer load control time delays expire.
2. Load control contacts open.
3. Contactor transfers to OFF position.
4. Off-to-preferred time delay expires.
5. Contactor transfers to preferred source.
6. Post-transfer load control sequences and engine cooldown time delay expire.
7. Load control contacts close.
8. The generator is signaled to stop (engine start contacts open).

1.4.2 Exerciser Operation, Programmed Transition

Unloaded Exercise

The unloaded exercise sequence is the same as for standard transition. See Section 1.2.2.

Loaded Exercise Sequence Starts

1. Exerciser timer begins.
2. The engine start contacts close, signaling the generator set to start.
3. The generator starts and the standby source becomes available.
4. Preferred-to-standby time delay and pre-transfer load control sequences run.
5. Load control contacts open.
6. Contactor transfers to OFF position.
7. Off-to-standby time delay expires.
8. Contactor transfers to standby source.
9. Post-transfer load control sequences run.
10. Load control contacts close.

Emergency Source Fails (Normal Source is available)

1. Exerciser is deactivated.
2. Immediate failure to acquire standby alarm.
3. Load control contacts open.
4. Contactor transfers to OFF position.
5. Off-to-preferred time delay expires.
6. Contactor transfers to preferred source.
7. Post-transfer load control sequences and engine cooldown time delay expire.
8. Load control contacts close.
9. Engine start contacts open.

Loaded Exercise Sequence Ends

1. Pre-transfer load control sequences run.
2. Load control contacts open.
3. Contactor transfers to OFF position.
4. Off-to-preferred time delay expires.
5. Contactor transfers to preferred source.
6. Post-transfer load control sequences and engine cooldown time delay expire.
7. Load control contacts close.
8. The engine start contacts open, signaling the generator to stop.

1.4.3 Test Sequence, Programmed Transition

Unloaded Test Sequence

The unloaded test sequence is the same as for standard transition. See Section 1.2.3.

Loaded Test Sequence is Initiated

1. The generator is signaled to start (engine start contacts close).
2. The generator starts and the standby source becomes available.
3. Pre-transfer load control time delays expire and load control contacts open.
4. Preferred-to-standby time delay expires.
5. Contactor transfers to the OFF position.
6. Off-to-standby time delay expires.
7. Contactor transfers to standby.
8. Post-transfer load control time delays expire and load control contacts close.

Emergency Source Fails (Normal Source is available)

1. Test function is deactivated.
2. Immediate failure to acquire standby alarm.
3. Load control contacts open.
4. Contactor moves to the OFF position.
5. Off-to-preferred time delay expires.
6. Contactor transfers to preferred.
7. Post-transfer load control sequences and engine cooldown time delay expire.
8. Load control contacts close.
9. Engine start contacts open.

Loaded Test Sequence is Ended

1. Standby-to-preferred time delay and pre-transfer load control sequences run.
2. Load control contacts open.
3. Contactor moves to the OFF position.
4. Off-to-preferred time delay expires.
5. Contactor transfers to preferred.
6. Post-transfer load control sequences and engine cooldown time delay expire.
7. Load control contacts close.
8. The engine start contacts open, signaling the generator to stop.

2.1 Introduction

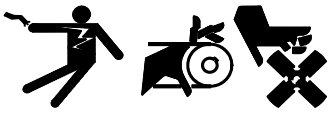
Regular preventive maintenance ensures safe and reliable operation and extends the life of the transfer switch. Preventive maintenance includes periodic testing, cleaning, inspecting, and replacing of worn or missing components. Section 2.5 contains a service schedule of recommended maintenance tasks.

Maintenance or service must be performed in accordance with all applicable codes and standards.

Keep records of all maintenance or service.

Replace all barriers and close and lock the enclosure door after maintenance or service and before reapplying power.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

(Decision-Maker® 3+ and 550 Generator Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Short circuits. Hazardous voltage/current 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

Servicing the transfer switch controls and accessories within the enclosure. Hazardous voltage can cause severe injury or death. Disconnect the transfer switch controls at the inline connector to deenergize the circuit boards and logic circuitry but allow the transfer switch to continue to supply power to the load. Disconnect all power sources to accessories that are mounted within the enclosure but are not wired through the controls and deenergized by inline connector separation. Test circuits with a voltmeter to verify that they are deenergized before servicing.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

Screws and nuts are available in different hardness ratings. To indicate hardness, American Standard hardware uses a series of markings and metric hardware uses a numeric system. Check the markings on the bolt heads and nuts for identification.

2.2 Inspection and Service

2.2.1 General Inspection

External Inspection. Inspect the transfer switch weekly.

- Look for signs of vibration, leakage, excessive noise, high temperature, contamination, or deterioration.
- Remove accumulations of dirt, dust, and other contaminants from the transfer switch's exterior with a vacuum cleaner or by wiping with a dry cloth or brush. *Do not use compressed air to clean the switch because it can cause debris to lodge in the components and damage the switch.*
- Replace any worn, missing, or broken external components with manufacturer-recommended replacement parts. Contact a local authorized distributor/dealer for part information and ordering.
- Tighten loose external hardware.

Contact an authorized distributor/dealer to inspect and service the transfer switch when any wear, damage, deterioration, or malfunction of the transfer switch or its components is evident or suspected.

2.2.2 Internal Inspections and Maintenance

Internal Inspection. Have an authorized distributor/dealer perform an annual inspection of the transfer switch. Inspect the switch more frequently if it is located in a dusty or dirty area or when any condition noticed during an external inspection may have affected internal components. Disconnect all power sources, open the transfer switch enclosure, and inspect internal components. Look for:

- Accumulations of dirt, dust, moisture, or other contaminants
- Signs of corrosion
- Worn, missing, or broken components
- Loose hardware
- Wire or cable insulation deterioration, cuts, or abrasions
- Signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor
- Other evidence of wear, damage, deterioration, or malfunction of the transfer switch or its components

Cleaning. Use a vacuum cleaner or a dry cloth or brush to remove contaminants from internal components. *Do not use compressed air to clean the switch because it can cause debris to lodge in the components and damage the switch.*

Lubrication. Maintain the transfer switch lubrication. If the transfer switch is subject to extremely dusty or abnormal operating conditions, lubricate all movements and linkages yearly. Lubricate the solenoid operator if the TS coil is replaced. Do not use oil; order the lubrication kit shown in the Parts Catalog.

Disconnect power and manually operate the transfer switch mechanism to verify that it operates smoothly without binding. If lubricating the outer mechanism of the transfer switch does not eliminate binding, replace the transfer switch assembly.

Periodically oil the enclosure door locks and screws.

Part Replacement and Tightening. Replace worn, missing, broken, deteriorated, or corroded internal components with manufacturer-recommended replacement parts. Tighten loose internal hardware.

Terminal Tightening. Loose connections on the power circuits can lead to overheating or explosion. Tighten all lugs to the torque values shown on the label on the switch. Tighten engine start, input/output, and auxiliary connections to the torque indicated on the decals affixed to the unit.

Signs of Overheating. Replace components damaged by overheating and locate the cause of the overheating. Overheating could be caused by loose power connections, overloading, or a short circuit in system. After tightening the power terminals, perform a millivolt drop test to locate areas with high contact resistance. See Section 2.3.3. Check the line circuit breakers in the system to be sure that they do not allow the load to exceed the switch rating. Use the controller troubleshooting and schematics to locate a control circuit short.

Wire Repair or Replacement. Replace wiring when there is any doubt about its condition or when there is extensive damage or deterioration. If the damaged or deteriorated wires are part of a wiring harness, replace the entire wiring harness.

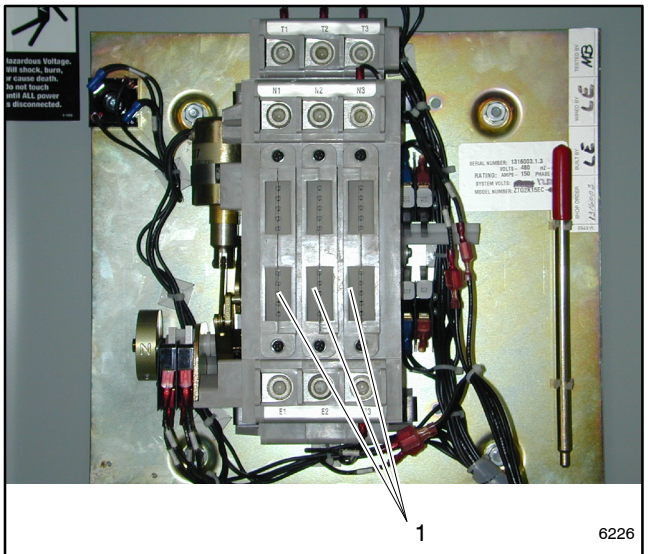
Power Circuit Wiring. Have damage to line voltage and power circuit wiring evaluated and repaired or replaced by a qualified electrician.

Control Circuit Leads. Repair minor damage to leads in low power and control circuits operating up to 250 volts. Carefully splice and insulate the connections. Tape minor control circuit wire insulation cuts or abrasions. Repair moderately damaged leads, where conductors are cut or insulation is damaged over sections shorter than about 100 mm (4 in.) or less than about 25% of the length of the wire, by cutting out the damaged section and splicing in wire of the same type. Use UL-listed insulated (250 V minimum) connectors and follow the connector manufacturer's instructions. Fabricate new leads using the same type of wire and UL-listed insulated (250 V minimum) connectors and follow the connector manufacturer's instructions.

Transfer Switch Inspection. Remove the arc chute assemblies or covers at the front of the transfer switch and inspect the main contacts inside the transfer switch. See Figure 2-1 or Figure 2-2.

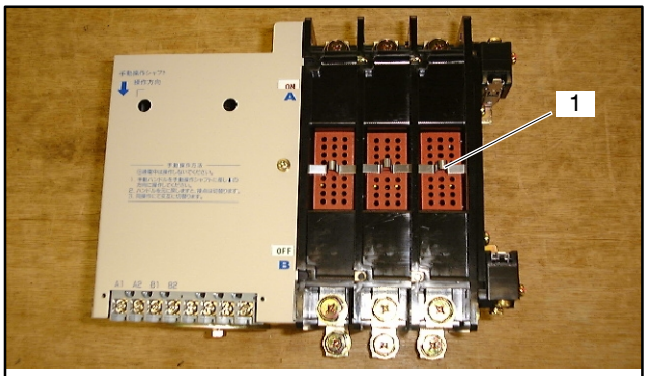
Note: A clamp or fixture must be attached before removing the arc chutes on 600-amp Model KSP programmed-transition switches. See Section 8.4.7 for complete instructions.

Remove surface deposits with a clean cloth. *Do not use an emery cloth or a file.* Discoloration of the contact surface does not affect performance. If the contacts are pitted, show signs of overheating, or are worn, replace the contacts. The contacts are worn if the contact surface material, a layer of silvery-colored metal, is worn through to the metal below. Check the condition of the arc chutes. If arc chutes show signs of disintegration, replace the arc chute assembly.



1. Arc chute assemblies

Figure 2-1 Typical Arc Chute Assemblies, 40–600 Amp Model KSS



1. Arc chute retainer clips

Figure 2-2 Typical Arc Chute Assemblies, 800–1000 Amp Model KSS and All Model KSP

2.2.3 Model KGS/KGP Bypass/Isolation Switches

For Model KGS/KGP bypass/isolation switches, perform the following additional maintenance checks every year.

- Apply dielectric grease to movable finger assemblies, if possible.
- Take thermal readings of each socket after the socket has been energized for at least 3 hours. Any readings on the socket surface that exceed 65°C (149°F) indicate a need to replace the socket. Record the amperage levels when taking the thermal readings.
- With the transfer switch removed, locate the bolt that retains the pin for each power connector and ensure that it is properly torqued.
- With the bypass de-energized, locate the bolt that retains the socket for each power connector (where accessible) and verify that it is properly torqued.

2.3 Testing

Periodic testing is important in any transfer switch application. It helps to ensure that the generator set will start and the transfer switch mechanisms and control circuits will operate when needed.

2.3.1 Weekly Generator Set Exercise

Use the exerciser to start and run the generator set once a week to maximize the reliability of the emergency power system. See the transfer switch operation and installation manual for additional information about the exerciser.

2.3.2 Monthly Automatic Operation Test

Test the transfer switch's automatic control system monthly. See Section 6.4.4 or the transfer switch operation and installation manual for the test procedure. Verify that the expected sequence of operations occurs as the switch transfers the load to the emergency source when a normal source failure occurs or is simulated. After the switch transfers the load to the emergency source, end the test and verify that the expected sequence of operations occurs as the transfer switch retransfers to the available normal source and signals the generator set to shut down after a cooldown period.

Note: The ATS will not transfer the load during the test sequence if the test DIP switch is set to the unloaded position.

2.3.3 Other Tests

Every Year

Measure the voltage drop to help locate high-resistance contacts in the ATS. The test procedure measures the voltage drop across a contact and the current in the circuit, then uses those measured values to find the contact resistance.

The purpose of the test is to locate any contact that has significantly higher resistance than others. An unusually high voltage across one set of contacts may signal unacceptably high resistance in the contacts.

Run the test with the ATS under a moderate and balanced load. Use the following procedure to take voltage measurements and calculate resistances for each phase of both Source N and Source E.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Millivolt Drop Test Procedure

1. Apply a balanced load of at least 10% of the switch rating. (Currents of 10 amps or greater will give more accurate results than lower currents.)

2. Carefully measure the voltage on each phase of both sources from the source lug to the load lug. Take several readings to ensure accuracy. The readings may be erratic because of the small voltage measured, load fluctuations, and meter circuit contact resistances.

   Note: To obtain accurate readings, keep the meter as far as possible from current-carrying conductors and the meter leads as short, direct, and at right angles to current-carrying conductors as possible. This minimizes the effect of induced voltages (transformer effect) in the vicinity of the current-carrying conductors.

3. Use an ammeter to measure the current flow through the circuit.

4. Calculate the contact resistance using the following formula:

$$R = V \div I$$

Where:
V = measured voltage in *millivolts*
I = measured current in amps
R = calculated resistance in milliohms

Compare the calculated values for resistance (R) to the values in the table in Figure 2-3. If the calculated resistance is significantly higher (2 times larger or more) than the value shown in the table, disconnect power, check the connections and lug torques, and repeat the test. If the second measurement also indicates that the resistance is too high, replace the contact. See the ATS parts catalog for replacement part ordering information. Refer to the table of contents in the front of this manual to locate the contact replacement procedure for your switch.

Transfer Switch Rating, Amps	Maximum Contact Resistance, milliohms (mΩ)
30–200	0.250
225–400	0.200
600–800	0.175
1000–1200	0.085
1600–3000	0.050

Figure 2-3 Maximum Contact Resistance

Every Three Years

Test the wire insulation. Use the following procedure to check for insulation breakdown and replace any faulty components.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

Wire Insulation Breakdown Test Procedure

1. Disconnect all power sources by opening upstream circuit breakers or switches to the transfer switch. Disconnect the load from the transfer switch by opening circuit breakers or switches leading from the transfer switch. Disconnect the transfer switch wiring harness from the controller at connector P1.

2. Use a hi-pot tester or meggar to check the insulation resistance phase-to-phase and phase-to-neutral, and phase-to-ground if neutral and ground are isolated. For a hi-pot tester, the maximum potential is 500 VAC and the maximum test time is 1 second.

3. Verify that the measured insulation resistance exceeds 1.24 megohms (MΩ).

4. If the hi-pot tester indicates wire insulation breakdown or if the measured resistance is less than 1.24 MΩ, isolate the leakage current using an instrument designed for this purpose. Replace the faulty components.

   Note: You may need to disconnect power conductors from the lugs to isolate the problem. If you disconnect the power conductors, see transfer switch operation and installation manual for reconnection instructions.

Every Five Years

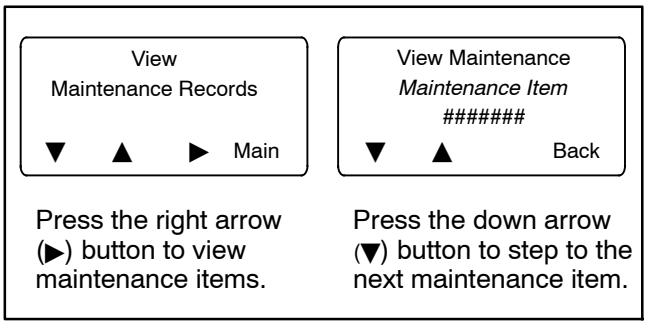
Check the normal and emergency source setpoint calibration according to the procedures in Section 4.5, System Settings.

2.4 View Maintenance Records

Maintenance records can be viewed on any of the Decision-Maker® MPAC controllers using a personal computer and Kohler SiteTech software. In the Parameters screen in SiteTech, click on ATS Run Time to view operation and maintenance records. See Section 3 and the SiteTech Operation Manual for more information about SiteTech.

The Decision-Maker® MPAC 1200 and 1500 controllers also allow viewing the maintenance records using the controller display and pushbuttons. From the main screen, press the down arrow button until View Maintenance Records is displayed. Press the right arrow button to enter the maintenance records menu, and then use the down arrow button to step through the maintenance records.

See Section 4.7 and Figure 4-9 for instructions to reset the maintenance records.



Maintenance Items	
Total Min Not in Pref	Reset Fail Transfer
Reset Min Not Pref	Total Loss Pref Tran
Total Min in Standby	Reset Loss Pref Tran
Reset Min in Standby	Transfer Time N>E
Total Min Operation	Transfer Time E>N
Reset Min Operation	System Start Date
Total Transfers	Last Maint Date
Reset Transfers	Last Loss Date/Time
Total Fail Transfer	Last Loss Duration

2.5 Service Schedule

Follow the service schedule in Figure 2-4 for the recommended service intervals. The transfer switch operator can perform tasks marked by an X. An authorized distributor/dealer should inspect the switch annually and perform all service marked by a D.

System Component or Procedure	See Section	Visually Inspect	Check	Adjust, Repair, or Replace	Clean	Test	Interval
Electrical System							
Check for signs of overheating or loose connections: discoloration of metal, melted plastic, or a burning odor.	2.2.2	X	X				Y
Check the transfer switch's external operating mechanism for cleanliness. Clean and relubricate if dirty.*	2.2.2	X		D	D		Y
Check wiring insulation for deterioration, cuts, or abrasion. Repair or replace wiring to regain the properties of the original wiring.	2.2.2	X					Y
		D	D	D			Y
Check the transfer switch's main power switching mechanisms' mechanical operation and integrity.	2.2.2	D	D			D	Y
Tighten control and power wiring connections to specifications.	2.2.2		D	D			Y
Check the transfer switch's main power switching contacts' condition. Clean or replace the main contacts or replace the transfer switch assembly as necessary.	2.2.2	D		D	D		Y
Perform a millivolt drop test to check for high contact resistances on power circuits. Tighten connections, clean main contacts, or adjust or replace main contacts or transfer switch assembly to eliminate high contact resistances.	2.3.3		D	D	D	D	Y
Test wire and cable insulation for electrical breakdown.	2.3.3					D	Every 3 Years
Check calibration of voltage-sensing circuitry and setpoints, and recalibrate circuitry as necessary.	2.3.3		D			D	Every 5 Years
Control System							
Test the transfer switch's automatic control system.	O/I/M	X				X	M
Test all LED indicators, time delays, and remote control systems for operation.	O/I/M	D	D	D		D	Y
General Equipment Condition							
Inspect the outside of the transfer switch for any signs of excessive vibration, leakage, high temperature, contamination, or deterioration.*	2.2.1	X			X		M
Check that all external hardware is in place, tightened, and not badly worn.	2.2.1	X	X	X			M
Inspect the inside of the transfer switch for any signs of vibration, leakage, noise, high temperature, contamination, or deterioration. Check for metal discoloration, melted plastic, or a burning odor.*	2.2.2	X					M
		D	D		D		Y
Check that all internal hardware is in place, tightened, and not badly worn.	2.2.2	X					M
		D	D				Y

***** Service more frequently if the ATS operates in extremely dusty or dirty areas.

See Section: Read these sections carefully for additional information before attempting maintenance or service.

Visually Inspect: Examine these items visually.

Check: Requires physical contact with or movement of system components, or the use of nonvisual indications.

Adjust, Repair, or Replace: Includes tightening hardware and lubricating the mechanism. May require replacement of components depending upon the severity of the problem.

Clean: Remove accumulations of dirt and contaminants from external transfer switch's components or enclosure with a vacuum cleaner or by wiping with a dry cloth or brush. *Do not use compressed air to clean the switch because it can cause debris to lodge in the components and cause damage.*

Test: May require tools, equipment, or training available only through an authorized distributor/dealer.

Symbols used in the chart:

O/I/M=See the transfer switch operation/installation manual.
X= The transfer switch operator can perform these tasks.
D=An authorized distributor/dealer must perform these tasks.
W=Weekly
M=Monthly
Q=Quarterly
S=Semiannually (every six months)
Y=Yearly (annually)

Figure 2-4 Service Schedule

3.1 Connection

Kohler® SiteTech® software can be used with Decision-Maker® MPAC controllers to check the transfer switch status, change adjustable controller settings, and update the application code on the controller. SiteTech software is available to Kohler authorized distributor and dealers.

SiteTech can be used with Decision-Maker® MPAC 750, 1200, and 1500 controllers. For the MPAC 750 controller, which has no display or navigation buttons, SiteTech is required for viewing and changing controller settings.

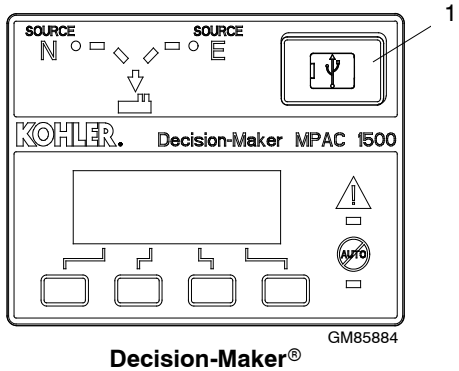
The controller must have power to communicate with SiteTech. Use a USB cable to connect a laptop computer to the the MPAC controller's USB port. The cable should have a male mini-B connector on one end for the controller and the appropriate connector for your computer's USB port on the other end. The USB port is located on the front of the controller. See Figure 3-1 for the USB port location on the controller. It is not necessary to open the ATS enclosure to connect your computer.

3.2 Using SiteTech

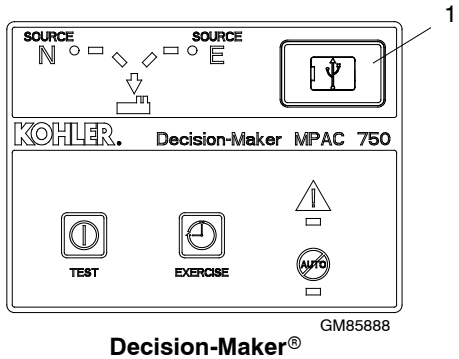
Start the SiteTech program. The Kohler SiteTech icon and then a screen similar to the one shown in Figure 3-2 appear. The program takes a few moments to read the data from the controller.

The following tabs appear in the blue field near the top of the screen.

- Parameters. View and adjust transfer switch settings from this view. See Section 3.4 for a list of parameters that can be viewed and adjusted using SiteTech.
- Common Alarms. View and adjust events assigned to common alarms 1 and 2.
- Time-Based Load Control. See the controller operation manual for information about load control settings. (MPAC 1200 and 1500 only)
- Current-Based Load Control. See the controller operation manual for information about load control settings. (MPAC 1500 only)
- Exercise Setup. View and adjust the exercise schedule. (MPAC 1200 and 1500 only)
- Prog Inputs. View and adjust programmable inputs on the controller and optional input/output modules.
- Prog Outputs. View and adjust programmable outputs on the controller and optional input/output modules.



Decision-Maker®
MPAC 1200 and 1500



Decision-Maker®
MPAC 750

1. USB port (behind cover)

Figure 3-1 Decision-Maker® MPAC Controllers

3.2.1 Changing Settings

Not all settings are adjustable. Settings that cannot be changed have a gray background. Scroll up and down to see the parameter groups. Click on the down arrow next to each group to reveal the individual settings in that group.

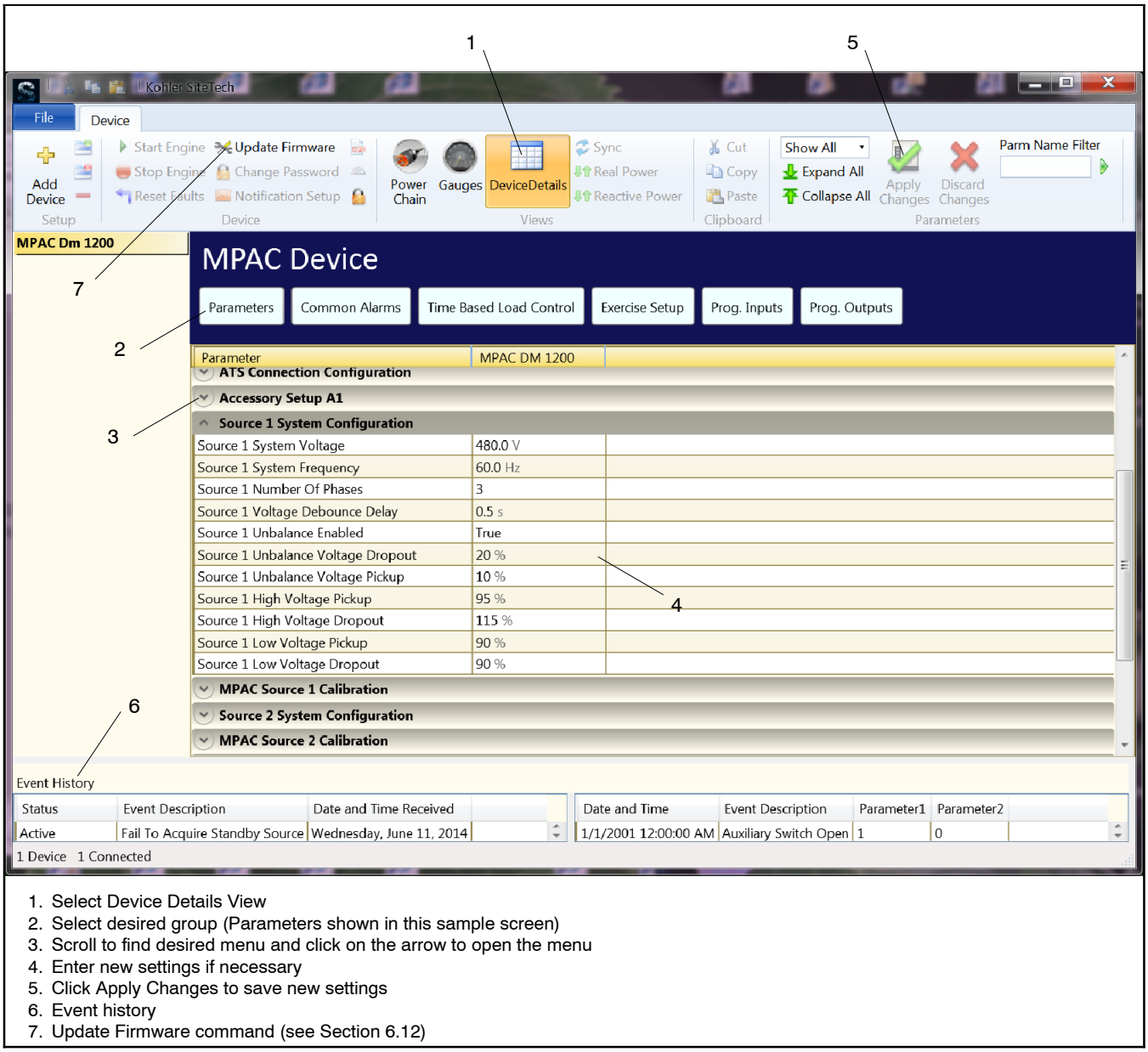
Type in the new value for the setting. New settings appear in bold on the screen. New settings for more than one parameter can be entered. Then click Apply Changes near the top of the screen. If the setting is accepted by the controller, the new setting appears in normal (non-bold) text. If the setting is not accepted, the

old setting reappears in the cell. Refer to the controller operation manual for default settings and adjustment ranges.

See TP-6701, SiteTech Software Operation Manual, for more detailed instructions.

3.2.2 Update Firmware

See Section 6.12 for instructions to update the controller firmware.



1. Select Device Details View
2. Select desired group (Parameters shown in this sample screen)
3. Scroll to find desired menu and click on the arrow to open the menu
4. Enter new settings if necessary
5. Click Apply Changes to save new settings
6. Event history
7. Update Firmware command (see Section 6.12)

Figure 3-2 Sample SiteTech Screen for Decision-Maker® MPAC 1200 Controllers

3.3 Exporting and Importing Parameter Settings

SiteTech software allows the generator set installer or service technician to save the device settings in a file and use that file to reload those settings later.

After the device has been installed and set up for the application, save the settings to a file on the computer. Setting files are saved as spreadsheets with the file extension .xls. Give the file a suitable name that identifies the specific device, and store it in a secure location.

Note: Saving the settings to a file is strongly recommended.

Saving the device settings to a file immediately after system startup creates a file that can be used to restore the device to the desired settings in the event of a system problem. The file can also be used to quickly set up a new controller if the device must be replaced in the future.

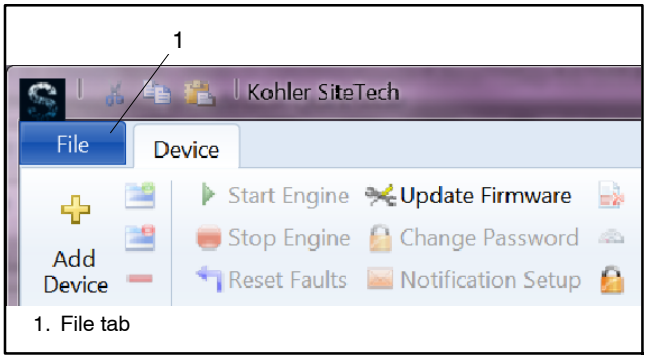
The settings and events are saved in a spreadsheet file that can be opened using Microsoft® Excel software. Open the file to view the settings and events, if desired. Some settings can be modified in the file using Excel. See Section 3.3.2 for important information about editing the file.

3.3.1 Export Parameters

The Export command saves the parameter settings to a spreadsheet file.

File Export Procedure

1. Click on the *File* tab in the upper left corner of the screen to open the file import and export commands screen. See Figure 3-3 and Figure 3-4.



1. File tab

Figure 3-3 Click the File Tab

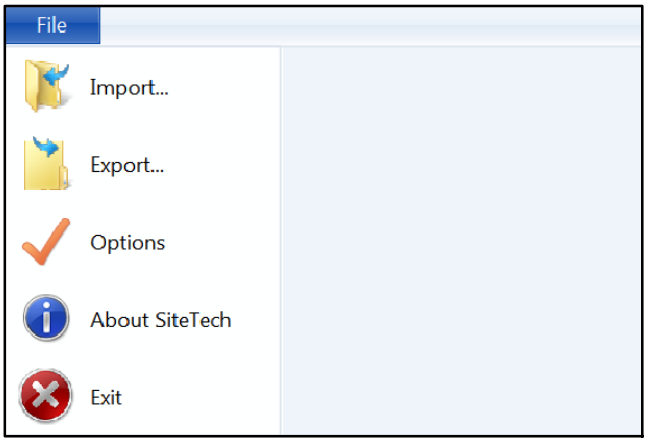


Figure 3-4 Import and Export Commands

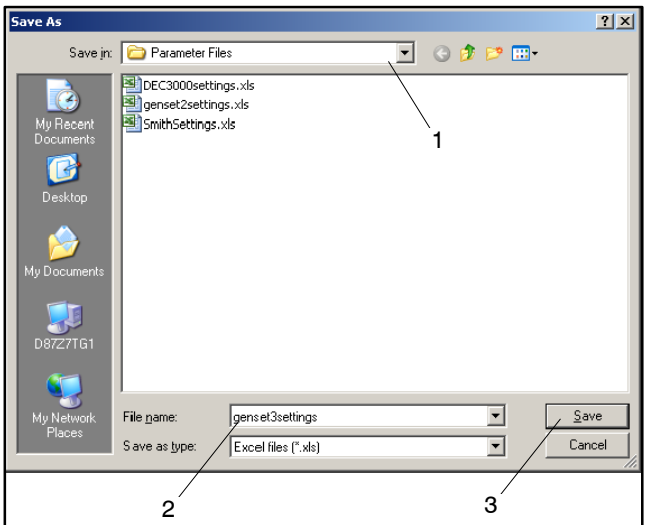
2. Click on Export. The Save As dialog window will open. See Figure 3-5.

3. The default location to save the file is shown at the top of the dialog box. Use the down arrow to select a different file location on the PC, if necessary.

4. In the File Name box, type in a suitable name for the file. Use a name that clearly identifies the device for future reference.

5. Click Save to save the file to the selected directory on the PC. The settings and events will be saved in a spreadsheet file that can be viewed on a PC, edited, and used to import the settings to another device.

Note: When more than one device is connected, the file export command will export all the settings for each device into the spreadsheet.



1. File will be saved to this location on the PC. Use the down arrow to change the location, if necessary.
2. Type in a suitable file name.
3. Click Save.

Figure 3-5 Save As Dialog Box for File Export

3.3.2 Editing Parameter Files

The parameter files created by the Export command can be opened using Excel software and reviewed for service or troubleshooting purposes. Some parameter settings can be changed in the Excel file and then reloaded onto the device using the Import Parameters command.

Note: Do not modify any settings that are not labeled "Write" in the Access column of the spreadsheet.

Only settings that are labeled "Write" in the Access column *and* have simple numerical values or True or False in the last column of the spreadsheet should be modified. See Figure 3-6. Change only the values shown in the device column of the spreadsheet.

Use this feature with caution. Be sure that the new values are within the acceptable range for each parameter. Refer to the documentation provided with the controller or device for default settings and adjustment ranges.

Access	Value	Sample Values	Change Allowed in Spreadsheet?
Write	Simple numerical values	0 57.5	YES
Write	True or False	True False	YES
Write	Numbers in parentheses	(0)	NO
Write	Mixed text and numbers	Off(0) 12 V (12)	NO
Read	Any	—	NO
Locked	Any	—	NO

Figure 3-6 Parameter Changes Allowed in Spreadsheet

3.3.3 Import Parameters

The Import command allows the operator to import device settings from a file. Use setting files created by the Export command in SiteTech. (See Section 3.3.1.) Setting files are saved as spreadsheets with the file extension .xls. Parameters not included in the files are not changed.

Use the Import Parameters command to set up more than one controller to the same settings, or to import the device settings to a new controller after the controller has been replaced.

The parameter file can contain settings for more than one device. Select the device you want to use as the source device and then select the target device. SiteTech may select the connected device as the target device for you. See Figure 3-7 and Figure 3-8.

File Import Procedure

1. Click on the File tab in the upper left corner of the screen to reveal the file import and export commands. See Figure 3-4.

2. Click on Import. A dialog window will open. See Figure 3-7.

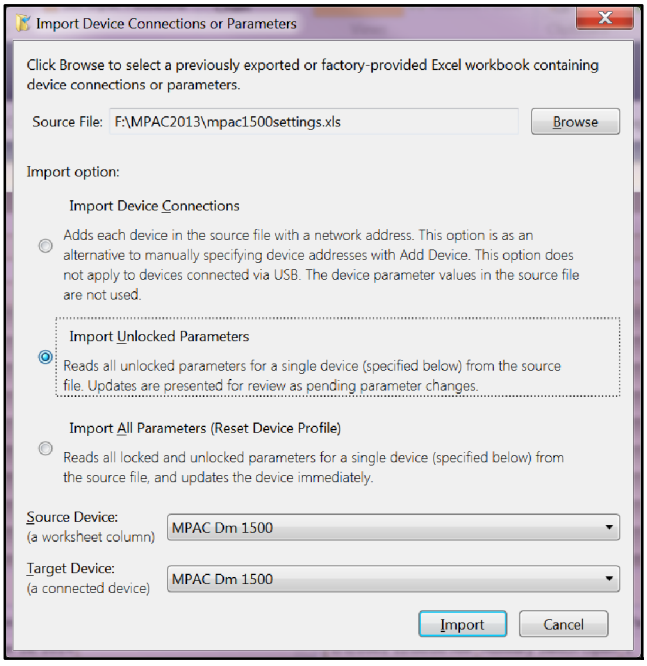
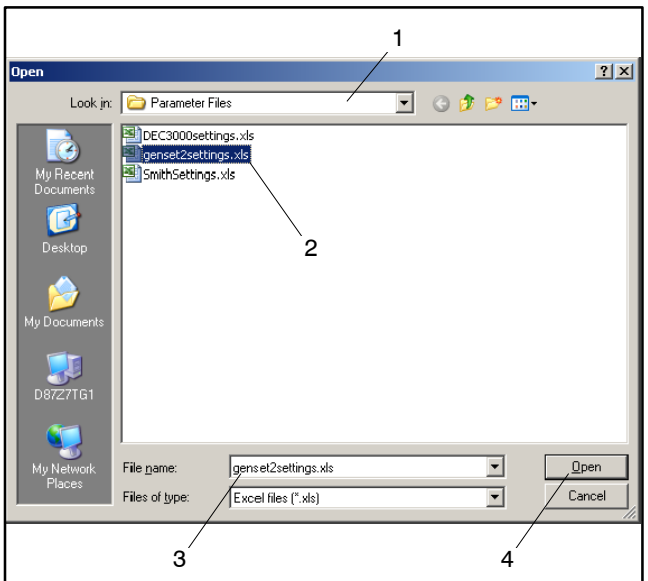


Figure 3-7 Import Parameters Window

3. Click on the Browse button. A window will open. See Figure 3-8.



1. File location. Click down arrow to change, if necessary.
2. Select the desired file from the list.
3. Name of selected parameter file should appear here.
4. Click Open.

Figure 3-8 Open Dialog Box for File Import

4. The default location to find the file is shown at the top of the dialog box. Use the down arrow to select a different file location on the PC, if necessary.

5. Click on the name of the file to select it. Check that the selected file name appears in the File Name box near the bottom of the window.

6. Click Open.

7. The selected file now appears in the Source File box. See Figure 3-7.

8. Click on Import Unlocked Parameters. See Figure 3-7.

9. Check that the Source Device and the Target Device windows both show MPAC Dm 1500.

10. Click the Import button to load the new parameters onto the controller. See Figure 3-7.

11. New settings will appear in bold face on the SiteTech screen. Click on Apply Changes to load the new settings onto the device. Click Discard Changes if you decide not to load the new settings onto the device.

3.4 Parameters

The following table lists the parameters that are available using a personal computer and Kohler SiteTech software. The parameters are divided into groups as shown. The access column indicates which parameters can be adjusted using SiteTech. Parameters marked “Write” can be adjusted; parameters marked “Read” are for monitoring only and cannot be adjusted using SiteTech.

See Section 3.1 for instructions to connect a computer to the controller’s USB port and Section 3.2 for an illustration of a sample screen from SiteTech. See TP-6701, SiteTech Software Operation Manual, for more detailed instructions to use the software.

For adjustable parameters and time delays, see the applicable controller operation manual for default settings and adjustment ranges.

Group	Parameter	Access	Units
Identity	Vendor	Read	
	Product	Read	
	Firmware Version	Read	
	Sub MPAC Firmware Version	Read	
ATS Metering Summary	MPAC ATS Contactor Position	Read	
	Key Switch Press Status	Read	
	Preferred Source	Read	
	Preferred Source Available	Read	
	Standby Source Available	Read	
	Exercise In Progress	Read	
	In Phase Monitor Active	Read	
	Load Control In Progress	Read	
	Peak Shave In Progress	Read	
	Loaded Test Occurring	Read	
	Unloaded Test Occurring	Read	
	Auto Loaded Test Occurring	Read	
	Synchronous Check Occurring	Read	
	User Forcing To Off	Read	
	Dip Switch Status	Read	
	Closed Transition In Phase Delta *	Read	degrees
ATS Information	ATS Serial Number	Write	
	Controller Serial Number	Write	
	Contactor Serial Number	Write	
	Fpga Firmware Version	Read	
	ATS Designation	Write	
	ATS Load	Write	
	ATS Branch	Write	
	ATS Location	Write	
Source 1 Metering	MPAC Source 1 Rotation Actual	Read	
	Source 1 Voltage L1-L2	Read	Volts
	Source 1 Voltage L2-L3	Read	Volts
	Source 1 Voltage L3-L1	Read	Volts
	Source 1 Voltage L1-N *	Read	Volts
	Source 1 Voltage L2-N *	Read	Volts
	Source 1 Voltage L3-N *	Read	Volts
	Source 1 Frequency	Read	Hz

* Not applicable to the Decision-Maker® MPAC 750 controller.
ms = milliseconds

Group	Parameter	Access	Units
Source 2 Metering	MPAC Source 2 Rotation Actual	Read	
	Source 2 Voltage L1-L2	Read	Volts
	Source 2 Voltage L2-L3	Read	Volts
	Source 2 Voltage L3-L1	Read	Volts
	Source 2 Voltage L1-N *	Read	Volts
	Source 2 Voltage L2-N *	Read	Volts
	Source 2 Voltage L3-N *	Read	Volts
	Source 2 Frequency	Read	Hz
ATS Load Metering	Load Current L1 *	Read	Amps
	Load Current L2 *	Read	Amps
	Load Current L3 *	Read	Amps
ATS Load Metering Calibration	Calibration Factor Load Current L1 *	Write	
	Calibration Factor Load Current L2 *	Write	
	Calibration Factor Load Current L3 *	Write	
ATS Run Time	ATS Controller Clock Date Time	Write	
	ATS Total Hours Of Operation	Read	hours
	ATS Total Hours Not In Preferred	Read	hours
	ATS Total Hours In Standby	Read	hours
	ATS Total Switch Transfers	Read	
	ATS Total Failure To Transfers	Read	
	ATS Total Loss Of Preferred Transfers	Read	
	Transfer Time Source 1 To Source 2	Read	ms
	Transfer Time Source 2 To Source 1	Read	ms
	MPAC ATS Date Of Last Maintenance	Write	
	ATS Hours Of Operation Since Maintenance	Read	hours
	ATS Hours Not In Preferred Since Maintenance	Read	hours
	ATS Hours In Standby Since Maintenance	Read	hours
	ATS Switch Transfers Since Maintenance	Read	
	ATS Failure To Transfers Since Maintenance	Read	
	ATS Loss Of Preferred Transfers Since Maintenance	Read	
	Last Outage Date Time	Read	
	Last Outage Duration	Read	hours
	System Start Date	Write	
	Daylight Saving Adjust Enabled *	Write	
	Move Forward Date Day Of Week	Write	
	Move Forward Date Week Of Month	Write	
	Move Forward Date Month Of Year	Write	
	Move Backward Day Of Week	Write	
	Move Backward Week Of Month	Write	
	Move Backward Month Of Year	Write	
	Closed Transition Dual Source Connected Time *	Read	ms
	Source 1 To Open Time *	Read	ms
	Source 1 To Close Time *	Read	ms
	Source 2 To Open Time *	Read	ms
	Source 2 To Close Time *	Read	ms

* Not applicable to the Decision-Maker® MPAC 750 controller.
ms = milliseconds

Group	Parameter	Access	Units
ATS Connection Configuration	MPAC ATS Phase Rotation Setting	Write	
	ATS Contactor Rating	Write	Amps
	Fail To Synchronize Enabled	Write	
	Manual Transfer Mode *	Write	
	Transition Mode	Write	
	Mode Of Operation	Write	
	Manual Transfer Switch Position *	Write	
	Closed Programmed Transition Override Mode *	Write	
	Synchronous Voltage Phase Angle *	Write	degrees
	Synchronous Voltage Differential *	Write	%
	Synchronous Frequency Differential *	Write	Hz
	Service Entrance Configuration *	Write	
	Save Configuration Parameters	Write	
	MPAC Dm ATS Preferred Source	Write	
Accessory Setup A1	Accessory Setup A1 Extended Engine Start Timer Enabled	Write	
	Accessory Setup A1 Inphase Monitor Enabled	Write	
	Accessory Setup A1 Remote Test Loaded	Write	
	Accessory Setup A1 Commit To Transfer	Write	
	Accessory Setup A1 Peak Shave Retransfer Delay Bypass	Write	
	Accessory Setup A1 Three Source Simultaneous Engine Start Mode	Write	
	Accessory Setup A1 Three Source Preferred Source Toggle	Write	
	Accessory Setup A1 Inphase Monitor Transfer Angle	Write	
Source 1 System Configuration	Source 1 System Voltage	Write	Volts
	Source 1 System Frequency	Write	Hz
	Source 1 Number Of Phases	Write	
	Source 1 Voltage Debounce Delay	Write	sec.
	Source 1 Unbalance Enabled *	Write	
	Source 1 Unbalance Voltage Dropout *	Write	%
	Source 1 Unbalance Voltage Pickup *	Write	%
	Source 1 High Voltage Pickup	Write	%
	Source 1 High Voltage Dropout	Write	%
	Source 1 Low Voltage Pickup	Write	%
	Source 1 Low Voltage Dropout	Write	%
MPAC Source 1 Calibration	MPAC Source 1 Calibration Factor Voltage L1-L2	Write	Volts
	MPAC Source 1 Calibration Factor Voltage L2-L3	Write	Volts
	MPAC Source 1 Calibration Factor Voltage L3-L1	Write	Volts
	MPAC Source 1 Calibration Factor Voltage L1-N *	Write	Volts
	MPAC Source 1 Calibration Factor Voltage L2-N *	Write	Volts
	MPAC Source 1 Calibration Factor Voltage L3-N *	Write	Volts

* Not applicable to the Decision-Maker® MPAC 750 controller.
ms = milliseconds

Group	Parameter	Access	Units
Source 2 System Configuration	Source 2 System Voltage	Write	Volts
	Source 2 System Frequency	Write	Hz
	Source 2 Number Of Phases	Write	
	Source 2 Voltage Debounce Delay	Write	sec.
	Source 2 Unbalance Enabled *	Write	
	Source 2 Unbalance Voltage Dropout *	Write	%
	Source 2 Unbalance Voltage Pickup *	Write	%
	Source 2 High Voltage Pickup	Write	%
	Source 2 High Voltage Dropout	Write	%
	Source 2 Low Voltage Pickup	Write	%
	Source 2 Low Voltage Dropout	Write	%
	Source 2 Frequency Debounce Delay	Write	s
	Source 2 High Frequency Pickup	Write	%
	Source 2 High Frequency Dropout	Write	%
	Source 2 Low Frequency Pickup	Write	%
	Source 2 Low Frequency Dropout	Write	%
MPAC Source 2 Calibration	MPAC Source 2 Calibration Factor Voltage L1-L2	Write	Volts
	MPAC Source 2 Calibration Factor Voltage L2-L3	Write	Volts
	MPAC Source 2 Calibration Factor Voltage L3-L1	Write	Volts
	MPAC Source 2 Calibration Factor Voltage L1-N *	Write	Volts
	MPAC Source 2 Calibration Factor Voltage L2-N *	Write	Volts
	MPAC Source 2 Calibration Factor Voltage L3-N *	Write	Volts
ATS Delays	ATS Transfer From Preferred Delay	Write	sec.
	ATS Transfer From Standby Delay	Write	sec.
	ATS Transfer Off To Preferred Delay *	Write	sec.
	ATS Transfer Off To Standby Delay *	Write	sec.
	ATS Source 2 Engine Start Delay	Write	sec.
	ATS Source 2 Engine Cool Down Delay	Write	sec.
	ATS Fail To Acquire Standby Delay	Write	sec.
	ATS Source 2 Extended Engine Start Delay	Write	sec.
	ATS Fail To Synchronize Delay	Write	sec.
	Active Time Delay	Read	
	Active Delay Time Remaining	Read	sec.
	Active Delay Time Delay Preset	Read	sec.

* Not applicable to the Decision-Maker® MPAC 750 controller.
ms = milliseconds

Group	Parameter	Access	Units
ATS Timed Load Control	Timed Disconnect LCR 1 From Source 1 *	Write	sec.
	Timed Disconnect LCR 2 From Source 1 *	Write	sec.
	Timed Disconnect LCR 3 From Source 1 *	Write	sec.
	Timed Disconnect LCR 4 From Source 1 *	Write	sec.
	Timed Disconnect LCR 5 From Source 1 *	Write	sec.
	Timed Disconnect LCR 6 From Source 1 *	Write	sec.
	Timed Disconnect LCR 7 From Source 1 *	Write	sec.
	Timed Disconnect LCR 8 From Source 1 *	Write	sec.
	Timed Disconnect LCR 9 From Source 1 *	Write	sec.
	Timed Connect LCR 1 From Source 2 *	Write	sec.
	Timed Connect LCR 2 From Source 2 *	Write	sec.
	Timed Connect LCR 3 From Source 2 *	Write	sec.
	Timed Connect LCR 4 From Source 2 *	Write	sec.
	Timed Connect LCR 5 From Source 2 *	Write	sec.
	Timed Connect LCR 6 From Source 2 *	Write	sec.
	Timed Connect LCR 7 From Source 2 *	Write	sec.
	Timed Connect LCR 8 From Source 2 *	Write	sec.
	Timed Connect LCR 9 From Source 2 *	Write	sec.
	Timed Disconnect LCR 1 From Source 2 *	Write	sec.
	Timed Disconnect LCR 2 From Source 2 *	Write	sec.
	Timed Disconnect LCR 3 From Source 2 *	Write	sec.
	Timed Disconnect LCR 4 From Source 2 *	Write	sec.
	Timed Disconnect LCR 5 From Source 2 *	Write	sec.
	Timed Disconnect LCR 6 From Source 2 *	Write	sec.
	Timed Disconnect LCR 7 From Source 2 *	Write	sec.
	Timed Disconnect LCR 8 From Source 2 *	Write	sec.
	Timed Disconnect LCR 9 From Source 2 *	Write	sec.
	Timed Connect LCR 1 From Source 1 *	Write	sec.
	Timed Connect LCR 2 From Source 1 *	Write	sec.
	Timed Connect LCR 3 From Source 1 *	Write	sec.
	Timed Connect LCR 4 From Source 1 *	Write	sec.
	Timed Connect LCR 5 From Source 1 *	Write	sec.
	Timed Connect LCR 6 From Source 1 *	Write	sec.
	Timed Connect LCR 7 From Source 1 *	Write	sec.
	Timed Connect LCR 8 From Source 1 *	Write	sec.
	Timed Connect LCR 9 From Source 1 *	Write	sec.
	Number Of Source 2 Timed Lcrs *	Write	
	Number Of Source 1 Timed Lcrs *	Write	
ATS Current Based Load Control	Source 1 Load Control Mode *	Write	
	Source 2 Load Control Mode *	Write	
Modbus	Modbus Enabled	Write	
	MPAC Modbus Baud Rate	Write	b/sec
	Modbus Slave Address	Write	
	Modbus Parity	Read	
	Modbus Stop Bits	Read	

* Not applicable to the Decision-Maker® MPAC 750 controller.
ms = milliseconds

Group	Parameter	Access	Units
Network Configuration	DHCP Enabled	Write	
	Static IP Address	Write	
	Static Subnet Mask	Write	
	Static Default Gateway	Write	
	DHCP Server	Write	
	Modbus Tcp Unit Id	Write	
	Modbus Tcp Server Enabled	Write	
Network Status	MAC Address	Read	
Digital Input Output Descriptions	Software Controlled Output 1 Description *	Write	
	Software Controlled Output 2 Description *	Write	
	Software Controlled Output 3 Description *	Write	
	Software Controlled Output 4 Description *	Write	
	Remote Monitored Input 1 Description *	Write	
	Remote Monitored Input 2 Description *	Write	
	Remote Monitored Input 3 Description *	Write	
	Remote Monitored Input 4 Description *	Write	
Installed Boards	Expansion Board 1 *	Read	
	Expansion Board 2 *	Read	
	Expansion Board 3 *	Read	
	Expansion Board 4 *	Read	
	Alarm Board *	Read	
	Battery Option Board Installed *	Read	
MPAC Dm Digital Input Output Status	Main Logic Board User Outputs	Read	
	Main Logic Board User Inputs	Read	
	Expansion Board 1 User Outputs *	Read	
	Expansion Board 2 User Outputs *	Read	
	Expansion Board 3 User Outputs *	Read	
	Expansion Board 4 User Outputs *	Read	
	Expansion Board 1 User Inputs *	Read	
	Expansion Board 2 User Inputs *	Read	
	Expansion Board 3 User Inputs *	Read	
	Expansion Board 4 User Inputs *	Read	
	Software Controlled User Outputs *	Write	
	Software Controlled User Outputs Assigned *	Read	
	Remote Monitoring User Inputs *	Read	
	Remote Monitoring User Inputs Assigned *	Read	
	Main Logic Board Hardware Outputs *	Read	
MPAC Digital Input A1	MPAC Digital Input A1 Event	Write	
MPAC Digital Input A2	MPAC Digital Input A2 Event	Write	
MPAC Digital Input B1	MPAC Digital Input B1 Event *	Write	
MPAC Digital Input B2	MPAC Digital Input B2 Event *	Write	
MPAC Digital Input C1	MPAC Digital Input C1 Event *	Write	
MPAC Digital Input C2	MPAC Digital Input C2 Event *	Write	

* Not applicable to the Decision-Maker® MPAC 750 controller.
ms = milliseconds

Group	Parameter	Access	Units
MPAC Digital Input D1	MPAC Digital Input D1 Event *	Write	
MPAC Digital Input D2	MPAC Digital Input D2 Event *	Write	
MPAC Digital Input E1	MPAC Digital Input E1 Event *	Write	
MPAC Digital Input E2	MPAC Digital Input E2 Event *	Write	
MPAC Digital Output A1	MPAC Digital Output A1 Event	Write	
MPAC Digital Output A2	MPAC Digital Output A2 Event	Write	
MPAC Digital Output B1	MPAC Digital Output B1 Event *	Write	
MPAC Digital Output B2	MPAC Digital Output B2 Event *	Write	
MPAC Digital Output B3	MPAC Digital Output B3 Event *	Write	
MPAC Digital Output B4	MPAC Digital Output B4 Event *	Write	
MPAC Digital Output B5	MPAC Digital Output B5 Event *	Write	
MPAC Digital Output B6	MPAC Digital Output B6 Event *	Write	
MPAC Digital Output C1	MPAC Digital Output C1 Event *	Write	
MPAC Digital Output C2	MPAC Digital Output C2 Event *	Write	
MPAC Digital Output C3	MPAC Digital Output C3 Event *	Write	
MPAC Digital Output C4	MPAC Digital Output C4 Event *	Write	
MPAC Digital Output C5	MPAC Digital Output C5 Event *	Write	
MPAC Digital Output C6	MPAC Digital Output C6 Event *	Write	
MPAC Digital Output D1	MPAC Digital Output D1 Event *	Write	
MPAC Digital Output D2	MPAC Digital Output D2 Event *	Write	
MPAC Digital Output D3	MPAC Digital Output D3 Event *	Write	
MPAC Digital Output D4	MPAC Digital Output D4 Event *	Write	
MPAC Digital Output D5	MPAC Digital Output D5 Event *	Write	
MPAC Digital Output D6	MPAC Digital Output D6 Event *	Write	
MPAC Digital Output E1	MPAC Digital Output E1 Event *	Write	
MPAC Digital Output E2	MPAC Digital Output E2 Event *	Write	
MPAC Digital Output E3	MPAC Digital Output E3 Event *	Write	

* Not applicable to the Decision-Maker® MPAC 750 controller.
ms = milliseconds

Group	Parameter	Access	Units
MPAC Digital Output E4	MPAC Digital Output E4 Event *	Write	
MPAC Digital Output E5	MPAC Digital Output E5 Event *	Write	
MPAC Digital Output E6	MPAC Digital Output E6 Event *	Write	
MPAC Common Alarm A1	MPAC Common Alarm A1 Common Alarm	Read	
	MPAC Common Alarm A1 Alarm Audible	Write	
	MPAC Common Alarm A1 Assigned To Common Alarm 2	Write	
	MPAC Common Alarm A1 Assigned To Common Alarm 1	Write	
MPAC Common Alarms A2 through A64.	The parameters shown above for common alarm A1 also appear for common alarms A2 through A64.		
Exerciser Summary	Enabled *	Read	
	Loaded *	Read	
	Interval *	Read	
	Repeat Rate *	Read	
	Start Date *	Read	
	Start Time *	Read	
	Event Run Duration *	Read	
	Running *	Read	
	Source *	Read	
MPAC Dm Exerciser Scheduler A1	MPAC Dm Exerciser Scheduler A1 Enabled *	Write	
	MPAC Dm Exerciser Scheduler A1 Loaded *	Write	
	MPAC Dm Exerciser Scheduler A1 Interval *	Write	
	MPAC Dm Exerciser Scheduler A1 Repeat Rate *	Write	
	MPAC Dm Exerciser Scheduler A1 Start Date *	Write	
	MPAC Dm Exerciser Scheduler A1 Start Time *	Write	
	MPAC Dm Exerciser Scheduler A1 Event Run Duration *	Write	min
	MPAC Dm Exerciser Scheduler A1 Running *	Read	
	MPAC Dm Exerciser Scheduler A1 Source *	Read	
MPAC Dm Exerciser Scheduler A2 through A21.	The parameters shown above for exerciser schedule A1 also appear for exercises A2 through A21. *		
Special Parameters	Profile		
	Saved Date		
	File Version		
	Address		
	Password		

* Not applicable to the Decision-Maker® MPAC 750 controller.
ms = milliseconds

3.5 Calibration

SiteTech can be used to adjust the controller calibration. Refer to Sections 4.5 and 6.9 for instructions to measure the voltage and current (if equipped with the current sensing accessory) and check the controller calibration.

Voltage Calibration

Voltage calibration parameters appear in the MPAC Source 1 Calibration and MPAC Source 2 Calibration groups in SiteTech. Note that there are separate settings for line-to-line and line-to-neutral voltages on all phases.

If the voltage measured at the ATS source lugs does not match the voltage shown on the controller display, enter the actual measured voltage into the corresponding voltage calibration parameter. For example, enter the measured line-to-neutral voltage into MPAC Source 1 Calibration Factor Voltage L1-N. Then click on Apply Changes.

Current Calibration

Current calibration is also possible for transfer switches equipped with the current sensing accessory. Current calibration factors appear in the ATS Load Metering group.

If the current measured at the ATS does not match the current displayed on the controller, enter the measured current value (in amps) into the corresponding Calibration Factor Load Current L1, L2, or L3 setting in SiteTech. For example, enter the amps measured on line 1 into Calibration Factor Load Current L1. Then click on Apply Changes.

4.1 Initial Checks

Read and follow all safety precautions in this manual and on labels on the switch. Only trained and qualified personnel should service the transfer switch and connected equipment.

Refer to the wiring diagrams provided with the switch or the wiring diagram manual when troubleshooting the transfer switch and controller.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

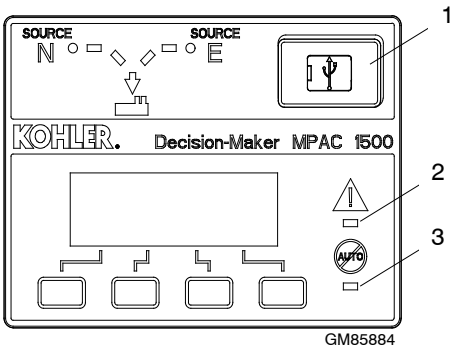
Only authorized personnel should open the enclosure.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

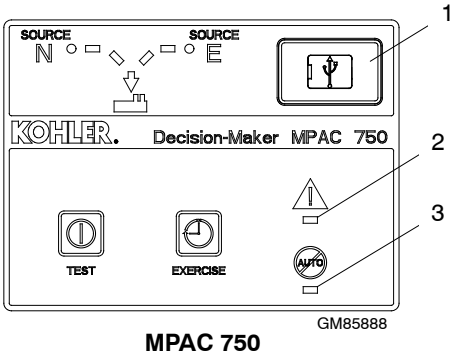
When troubleshooting a problem, check the following things first.

- Check the Service Required LED and the transfer switch controller display for fault or warning indications. See Figure 4-1 for the system alert LED location on the controller's user interface. If a fault or warning is indicated, proceed to Section 4.12.
- Check the event history log. The log lists the 100 most recent transfer switch events, including transfers and DIP switch setting changes as well as faults and alarms. See Section 4.3 for instructions to view the event history log.
- Check for loose connections as described in Section 4.2.
- Check the system settings and time delays. See Section 4.5, System Settings.

System settings and time delays can be viewed and changed using the display and pushbuttons on the MPAC 1200 and MPAC 1500 controllers' user interface. A personal computer connected to the controller's USB port and Kohler SiteTech software can also be used to view and change settings on the MPAC controllers. For the MPAC 750 controller, SiteTech is required for viewing and changing settings. See Section 3 and the SiteTech Operation Manual for instructions to use the software.



MPAC 1200 and 1500



MPAC 750

1. USB port (behind cover)
2. System Alert LED
3. Not in AUTO LED

Figure 4-1 Decision-Maker® MPAC Controllers

4.2 Check for Loose Connections

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

Procedure to check connections

1. Disable the generator set:
   a. Move the generator set master switch to the OFF position or press the OFF button on the generator set controller.
   b. Disconnect power to the battery charger, if equipped.
   c. Disconnect the battery, negative (–) lead first.
2. Disconnect power to the transfer switch by turning off all main circuit breakers..
3. Check for loose connections. Check the source lugs, controller harnesses, and generator set engine start connection.

4.3 View Event History

When troubleshooting, check the event history for faults, transfer attempts, or other events leading to the current condition. The history lists the 100 most recent transfer switch events, including transfers and DIP switch setting changes as well as faults and alarms.

MPAC 1200 and 1500: From the main screen, step to View Event History and display recent events as shown in Figure 4-2. Possible event descriptions are listed in Figure 4-3. A personal computer connected to the controller's USB port and Kohler SiteTech software can also be used to view the event history. See Section 3 and the SiteTech Software Operation Manual for more information.

MPAC 750: Use a personal computer connected to the controller's USB port and Kohler SiteTech software to view the event history.

If a fault condition or alarm is displayed, proceed to Section 4.12.

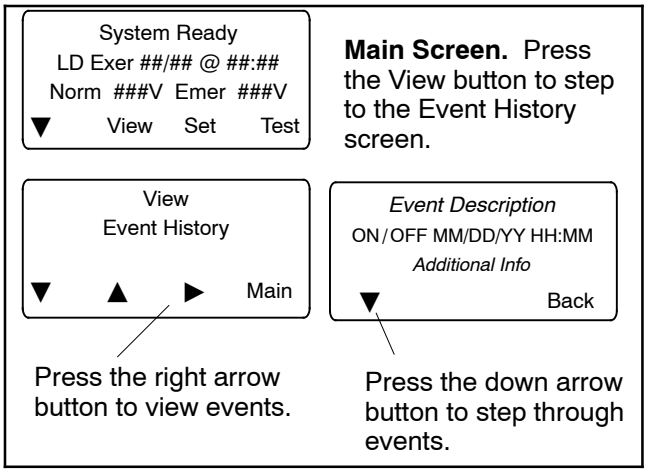
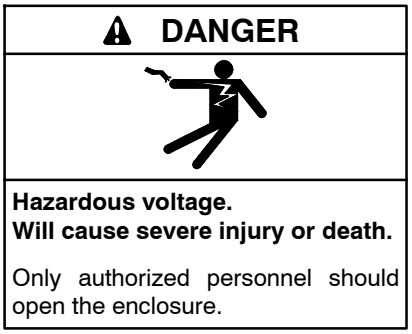


Figure 4-2 Viewing Event History

Event Descriptions	
End Time Delay Btn	Low Battery Voltage
Test Btn	Remote Common Alarm
Exercise Btn	Bypass Contactor Dis
Lamp Test	3 Src System Disable
Service Req'd Reset	Over Frequency
Maint DIP Switch	Under Frequency
Pwd DIP Switch	Phase Loss
Manual Option Switch	Phase Rotation Error
New Module	Over Voltage L1-L2
Contactor in Off	Over Voltage L2-L3
Contactor in Src N	Over Voltage L3-L1
Contactor in Src E	Under Voltage L1-L2
Low Battery	Under Voltage L2-L3
Exerciser Active	Under Voltage L3-L1
Fail to Acquire Pref	Voltage Imbalance
Fail to Acquire Stby	Auto Loaded Test End
Fail to Sync	Test Loaded Changed
Fail to Transfer	Pref Source Changed
I/O Module Lost Comm	Reload Dflt Params
Aux Switch Fault	MODBUS Peak Shave
Aux Switch Open	MODBUS Forced to OFF
Breaker Trip	MODBUS System Test
Battery Backup Low	Battery Control Out
Rem End Time Delay	
Forced Trans to Off	
Peak Shave Mode	
Inhibit Transfer	
Remote Test	

Figure 4-3 Events

4.4 System Power



Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

4.4.1 Controller Display is OFF

If the transfer switch display is off, check for power to the controller. See Section 6.3 for instructions. Also see the troubleshooting flowcharts in Section 4.14.

4.4.2 Generator is Not Running

If utility power is not available and the emergency generator set is not running:

1. Check that the generator is in AUTO mode.

2. Try to start the generator set by moving the master switch to the RUN position or pressing the RUN button on the generator controller.

   a. If the engine does not start, troubleshoot the generator set as described in the generator set documentation.

   b. If the engine starts, check the engine start circuit from the ATS to the generator set. See Section 6.7.

4.4.3 Source Voltage, Frequency, and Phase Rotation Checks

Check for power to the transfer switch. Follow the voltage check procedures below to check voltage at the Source N (normal) or Source E (emergency) lugs.

The voltage, frequency, and phase rotation of the transfer switch and the power sources must be the same to avoid damage to loads and the transfer switch. Compare the voltage and frequency ratings of the utility source, transfer switch, and generator set, and verify that the ratings are all the same.

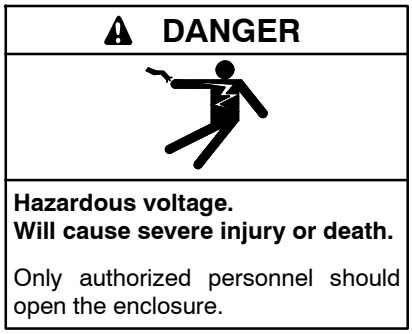
The phase rotation on the MPAC 750 controller is set to ABC and cannot be changed.

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

Note: Source N is the source connected to the normal side of the transfer switch. Source E is the source connected to the emergency side of the transfer switch.

The voltage check procedure requires the following equipment:

- A digital voltmeter (DVM) with electrically insulated probes capable of measuring the rated voltage and frequency
- A phase rotation meter



Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Voltage, Frequency, and Phase Rotation Measurement Procedure

Note: Perform voltage checks in the order given to avoid damaging the transfer switch.

1. Verify that the generator set master switch is in the OFF position and both power sources are disconnected from the transfer switch.
2. Disconnect the power switching device and controller wiring harnesses at the inline disconnect plug, if they are connected.
3. Manually operate the transfer switch to position E. See the transfer switch operation and installation manual for manual operation instructions.
4. If Source N is a generator set, start the generator by moving the generator set master switch to the RUN position or pressing the RUN button on the generator controller.
5. Close the Source N circuit breaker or switch.
6. Use a voltmeter to check the Source N (normal) phase-to-phase and phase-to-neutral (if applicable) terminal voltages and frequency.

   a. If Source N is the utility and the measured input does not match the voltage and frequency shown on the transfer switch nameplate, *STOP!* The transfer switch does not match the application—order the correct transfer switch.

   b. If Source N is a generator set and the generator set output voltage and frequency do not match the nominal system voltage and frequency shown on the transfer switch nameplate, follow the manufacturer's instructions to adjust the generator set. The automatic transfer switch will only function with the rated system voltage and frequency specified on the nameplate.

7. Use a phase rotation meter to check the phase rotation at the Source N (normal) terminals. Rewire the transfer switch Source N terminals to obtain the correct phase sequence if necessary.

   The default setting for the phase rotation on the controller is ABC. If the application uses a phase rotation of CBA, use the Set Sources screen to change the phase rotation setting on the controller. See the controller operation manual for instructions.

   Note: The phase rotation on the MPAC 750 controller is set to ABC and cannot be changed.

8. If the source is a generator set, stop the generator set by moving the master switch to the OFF position.
9. Disconnect Source N by opening upstream circuit breakers or switches.
10. Manually operate the transfer switch to position N.
11. Repeat steps 4 through 8 for Source E. Then proceed to step 12.
12. Disconnect both sources to the transfer switch by opening the circuit breakers or switches.
13. Connect the power switching device and controller wiring harnesses together at the inline disconnect plug.

    Note: Do not connect or disconnect the controller wiring harness when power is connected.

14. Close and lock the transfer switch enclosure door.
15. Reconnect both power sources by closing the circuit breakers or switches.
16. Move the generator set master switch to the AUTO position or press the AUTO button on the generator controller.

    Note: If the engine cooldown time delay setting is not set to zero (default setting), the generator set may start and run until the Time Delay Engine Cooldown (TDEC) ends.

4.5 System Settings

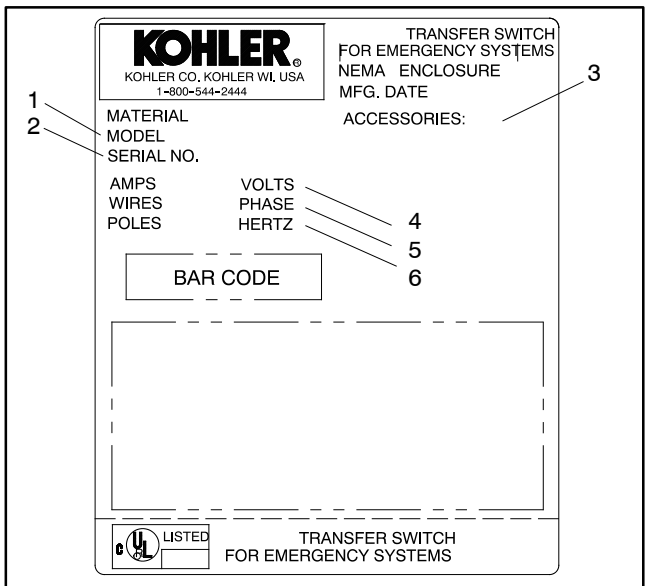
If the ATS does not recognize the source, check that the source voltage and frequency settings on the controller match the actual source parameters. Compare the controller settings to the ratings on the ATS nameplate and to the measured source parameters.

4.5.1 Controller Source Settings

Check the controller settings for source voltage, frequency, and phase. See the controller operation manual for instructions.

Check the controller settings and compare them to the voltage rating, frequency rating, and number of phases shown on the ATS nameplate. The nameplate is attached to the cover of the controller assembly, which is mounted on the inside of the transfer switch door. See Figure 4-4 for an illustration of the nameplate.

Note: The system voltage and frequency shown on the ATS nameplate must match the Source N and Source E voltage and frequency settings. Do not enter settings that do not match the nameplate ratings of the ATS.



1. Model designation
2. Serial number
3. Factory-installed accessory numbers
4. Voltage rating
5. Frequency rating
6. Number of phases (single or three)

Figure 4-4 Typical Transfer Switch Nameplate

Use the procedure in Section 4.4.3 to measure the source voltage, frequency, and phase rotation, and compare the measured values to the controller settings. Follow the instructions in the controller operation manual to change the controller settings if they do not match the measured source parameters.

4.5.2 Voltage and Frequency Pickup and Dropout Settings

Figure 4-5 illustrates the relative values of the voltage pickup and dropout settings. Typical frequency pickup and dropout settings relate to the nominal source frequency in a similar way.

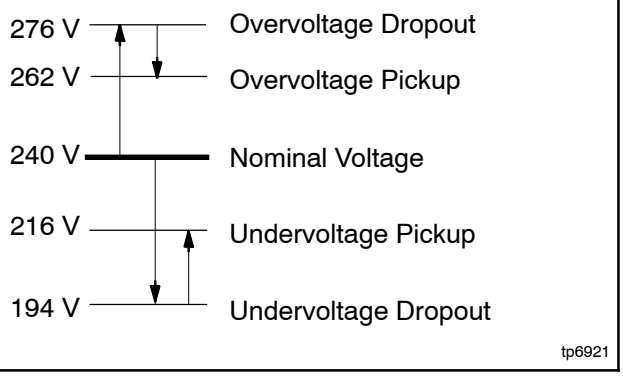


Figure 4-5 Relationship Between Voltage Pickup and Dropout Settings (default settings for 240-volt system shown)

If the source voltage rises above the overvoltage dropout setting or falls below the undervoltage dropout setting for a time longer than the debounce time, the controller will consider the source as failed. The source voltage must return to a level within the range of the pickup values for the controller to recognize the source as restored.

Choose pickup and dropout settings that allow a tolerable variation in the source parameters to prevent nuisance transfers caused by small changes in the source voltage and frequency.

Voltage and Frequency Sensing		
Parameter	**Default**	**Adjustment Range**
Undervoltage dropout	90% of pickup	75%–98%
Undervoltage pickup	90% of nominal	85%–100%
Overvoltage dropout *	115% of nominal*	106%–135%
Overvoltage pickup	95% of dropout	95%–100%
Voltage dropout time	0.5 sec.	0.1–9.9 sec.
Unbalance enable †	Disable	Enable/Disable
Unbalance dropout †	20%	5%–20%
Unbalance pickup †	10%	3%–18%

* 690 volts, maximum. Default = 110% for 600 volt applications.
† Not applicable to the MPAC 750 controller

Figure 4-6 Voltage Settings

Parameter	**Default**	**Adjustment Range**
Underfrequency dropout	99% of pickup	95%–99%
Underfrequency pickup	90% of nominal	80%–95%
Overfrequency dropout	101% of pickup	101%–115%
Overfrequency pickup	110% of nominal	105%–120%
Frequency dropout time	3 sec.	0.1–15 sec.

Figure 4-7 Frequency Settings(not applicable to the MPAC 750 controller)

4.6 Time Delays

Check the time delays when troubleshooting problems with transfer switch operation.

On the MPAC 1200 and MPAC 1500 controllers, use the View Time Delays screen or a personal computer connected through the controller's USB port and Kohler SiteTech software to check the settings for the adjustable time delays. To change settings on the MPAC 750 controller, a personal computer connected through the controller's USB port and Kohler SiteTech software are required.

Figure 4-8 shows the factory settings and adjustment ranges for the adjustable time delays. See the Operation Manual for more information.

Observe the controller's display to identify which time delay is executing at any given time. Initiate a test and observe as each programmed time delay executes. Compare the operation to the test sequence described in Section 1.

Time Delay Description	Description/Note	Default Time	Adjustment Range
Engine Start, Source S2	Source S2 – Util/Gen and Gen/Gen modes	3 sec	0–6 sec*
Engine Start, Source S1 †	Source S1 – Use for Gen/Gen mode	3 sec	
Engine Cooldown, Source S2	Source S2 – Util/Gen and Gen/Gen modes	5 sec	0–60 min
Engine Cooldown, Source S1 †	Source S1 – Gen/Gen mode	2 sec	
Transfer, preferred to standby	Transfer delay, preferred to standby	3 sec	
Transfer, standby to preferred	Transfer delay, standby to preferred	15 min	
Xfr Off>Stby †	Time in the OFF position (Preferred to Standby for programmed transition models only)	1 sec	
Xfr OFF>Pref †	Time in the OFF position (Standby to Preferred for programmed transition models only)	1 sec	
Fail to Acquire Pref †	If the preferred source does not reach acceptable voltage and stabilize within the allowed time, the Fail to Acquire Preferred Source fault is activated.	1 min	
Fail to Acquire Stby	If the standby source does not reach acceptable voltage and stabilize within the allowed time, the Fail to Acquire Standby Source fault is activated.	1 min	
In-Phase Xfr Fail (found in the Set Sources menu)	For in-phase monitoring: the time allowed for the two sources to come into synchronization within specified phase angle before a Fail to Sync fault is activated.	30 sec	
Load # Disc N>E †	Disconnect load before-transfer to standby source. Used for time-based and current-based load control.	0 sec	
Load # Rec N>E †	Reconnect load after-transfer to standby source. Used for time-based load control.	0 sec	
Load # Disc E>N †	Disconnect load before-transfer to preferred source. Used for time-based and current-based load control.	0 sec	
Load # Rec E>N †	Reconnect load after-transfer to preferred source. Used for time-based load control.	0 sec	
Load # Add Source1/Source2 †	For current-based load control.	0 sec	
Load # Remove Srce1/Srce2 †	For current-based load control.		

* The optional external battery module allows extended engine start time delays from 0–60 min.

† Not applicable to the MPAC 750 controller.

Figure 4-8 Time Delays

4.7 Reset Data, MPAC 1200 and 1500

Be sure to read and understand the information in this section before resetting.

This section refers to the Reset Data menu on Decision-Maker® MPAC 1200 and 1500 controllers, shown in Figure 4-9.

Note: See Section 4.8 for reset instructions for the Decision-Maker® MPAC 750 controller.

4.7.1 Reset Maintenance Records

Reset the maintenance records after transfer switch service to update the last maintenance date and totals since reset that are displayed in the maintenance records screen.

4.7.2 Reset Event History

Resetting the event history clears the events from the event history log.

4.7.3 Reset Default Parameters

Resetting to the default parameters will reset **all** parameters, **including the system voltage and frequency**, to a factory default setting. The default system voltage and frequency settings may not match the settings for your application.

The transfer switch will not operate correctly if the system voltage and frequency do not match the sources. Use the Set Sources screen to set the system voltage and frequency after resetting to the default parameters. See the controller operation manual for instructions.

4.7.4 Reset and Disable Test Password

Reset the Test password to return the test password to the default, 0000.

Disable the test password to allow the user to start a test without entering a password.

Note: Disable the test password only during service unless the transfer switch is installed in a secure location.

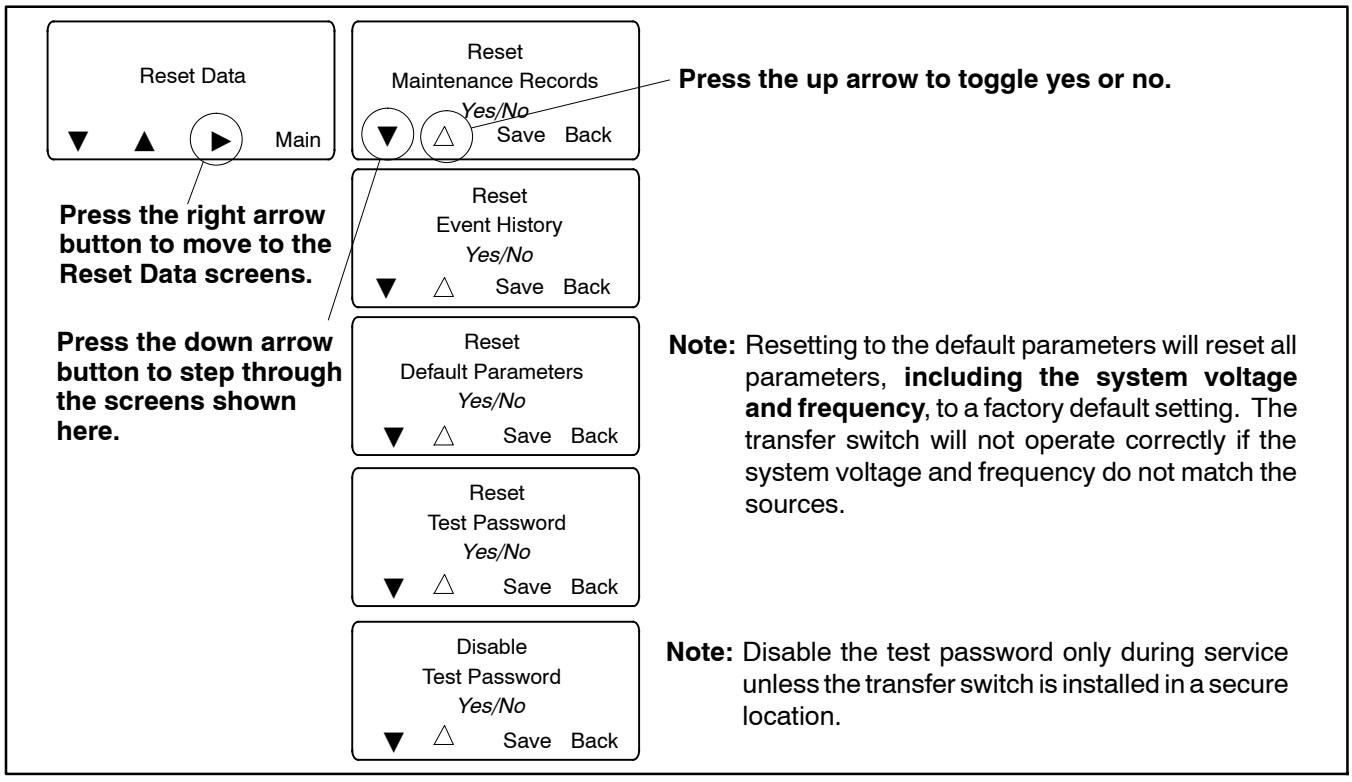


Figure 4-9 Reset Data, MPAC 1200 and MPAC 1500 Controllers

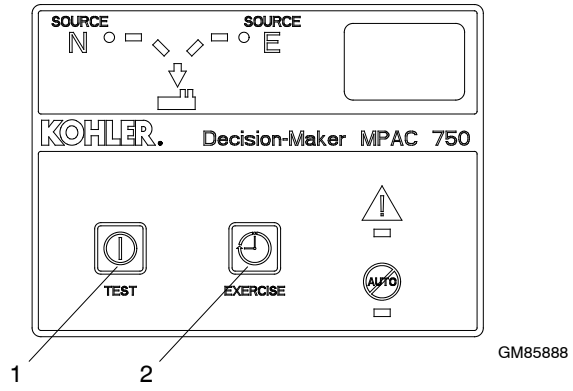
4.7.5 Reset Data Procedure, MPAC 1200 and MPAC 1500

Use the Reset Data menus to set records or parameters back to factory default settings. See Figure 4-9.

1. Use the black arrow buttons to step to the desired screen. See the following sections for information about each reset screen.
2. Press the open up arrow button to toggle Yes or No until Yes is displayed.
3. Press Save to reset the displayed records to the factory defaults. Pressing Back exits the screen without resetting.

4.8 Controller Reset, MPAC 750

To reset the controller processor while retaining all parameter settings, press the Test and Exercise buttons at the same time and hold for 15 seconds.



1. Test button
2. Exercise button

Press and hold the Test and Exercise buttons for 15 seconds to reset the controller.

Figure 4-10 Controller Reset, MPAC 750

4.9 Warnings and Faults

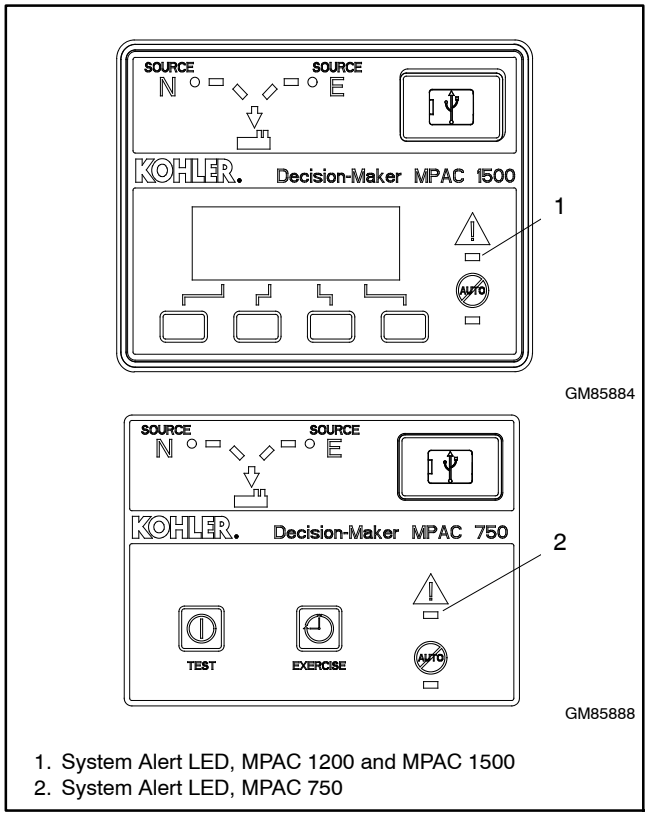
When a fault exists, the System Alert indicator lights, a designated output and the common fault output are turned on. On MPAC 1200 and 1500 controllers, an appropriate message is displayed to indicate the fault. See Figure 4-11 for the location of the System Alert indicator.

ATS warnings and faults are shown in Figure 4-12. There are three types of warning/fault conditions:

Warning. Warnings automatically reset with a source availability change or a transfer request.

Fault Requiring Manual Reset. Under these conditions, normal ATS operation is halted. Active modes are turned off. If the contactor is in the preferred source position, the engine cooldown time delay executes and the engine start contacts open, allowing the generator set to shut down. See Section 4.9.1 or 4.9.2 for instructions to reset faults.

Self Resetting Faults. Under these conditions, active modes are turned off. If the contactor is in the preferred source position, the engine cooldown time delay executes and the engine start contacts open, allowing the generator set to shut down. When the fault condition is corrected, the fault is automatically cleared from the controller and normal ATS operation continues.



1. System Alert LED, MPAC 1200 and MPAC 1500
2. System Alert LED, MPAC 750

Figure 4-11 Fault Indication

Condition	Type	Description
Failure to Acquire Standby Source	Warning	The source voltage did not reach the acceptable range within a set time (see Time Delays). For example, the standby source generator set did not start.
Failure to Acquire Preferred Source †	Warning	
IPM Synching (In-Phase Monitor Synching)	Warning (status)	The two sources did not come into phase within the Fail to Synchronize time delay. **Note:** If the sources do become in phase, the warning is automatically cleared and normal ATS operation continues.
External Battery Low †	Warning	The voltage of the battery connected to the external battery supply module (EBSM) is low.
Failure to Transfer	Warning	The signal to transfer is sent to the contactor and the main shaft auxiliary switch fails to indicate a complete ATS position change. The controller will attempt to transfer the unit three times before the fault is indicated.
Auxiliary Switch Fault	Manual Reset Fault	The main shaft auxiliary switches indicate that the ATS is in more than one position, or the position changed when no signal was sent to initiate the change.
Auxiliary Switch Open	Manual Reset Fault	The main shaft auxiliary switches indicate that the ATS is in neither position (all inputs are open).
Src N (or Src E) Rotation Err †	Self-Resetting Fault	The detected phase rotation of one or both sources does not match the preselected setting.
I/O Module Lost Comm †	Self-Resetting Fault	An I/O device has stopped communicating or does not have a correct address specified. Fault resets if communication is reestablished.
Module Status Change †	Self-Resetting Fault	An accessory module has been disconnected OR a new module is detected. See Section 4.10.1 to reset.
Module Status Conflict †	Self-Resetting Fault	An accessory module has been replaced with a different type of module. See Section 4.10.2 to correct.
External Fault (Remote Common Alarm)	Self-Resetting Fault	The input contact assigned to the remote common alarm input function is closed.
† Not applicable to the MPAC 750 controller.		

Figure 4-12 Warnings and Faults

4.9.1 Fault Reset, MPAC 1200 and 1500 Controllers

To clear a fault or warning condition and reset the System Alert LED, go to the Main screen and press the down arrow button to open the Reset screen. See Figure 4-11 and Figure 4-13. Then press the button labelled Reset. A fault reset does not change the controller settings.

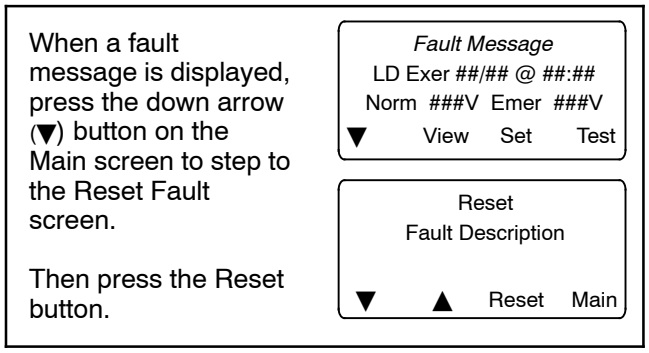
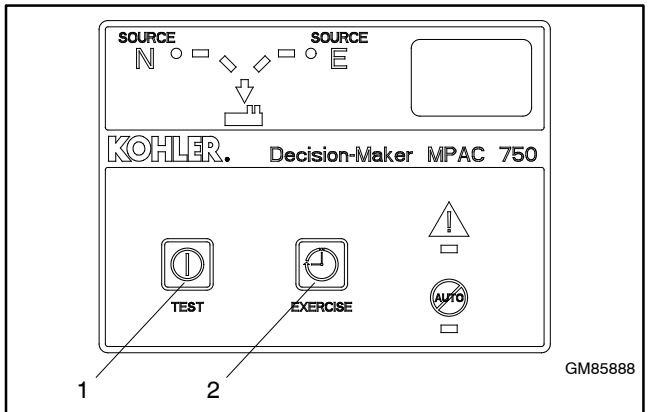


Figure 4-13 Fault Reset, MPAC 1200 and 1500

4.9.2 Fault Reset, MPAC 750 Controller

To clear a fault or warning condition and reset the System Alert LED, press the Test and Exercise buttons at the same time and hold for 2 seconds. See Figure 4-13.



1. Test button
2. Exercise button

Press and hold the Test and Exercise buttons for 2 seconds to clear a fault condition.

Figure 4-14 Fault Reset, MPAC 750

4.10 Accessory Module Faults

This section explains faults related to the optional accessory modules, including I/O modules, the alarm module, and the extended battery supply module (EBSM).

4.10.1 Module Status Change

If the Module Status Change message appears on the controller display, first verify that the cable from the controller to the accessory module assembly is not loose or disconnected.

The Module Status Change message automatically clears if the fault condition is corrected (self-resetting fault).

Module Connection (new or reconnected module)

Installing or reconnecting one or more accessory modules triggers the Module Status Change message.

1. If the ATS display shows Module Status Change, press the Reset button. See Figure 4-15.

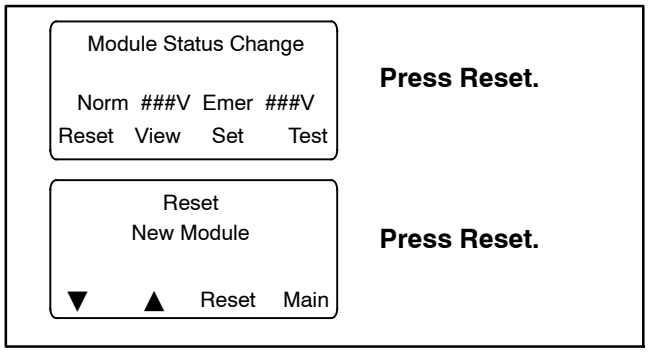


Figure 4-15 Screens after Module Connection

2. The ATS display will show Reset New Module. Press the Reset button from that screen. The controller recognizes the module type(s).

3. Navigate to the Set Input/Outputs>Set Aux I/O screen to check that the controller has recognized the connected modules. See Figure 4-17.

See the transfer switch operation/installation manual for instructions to assign programmable inputs and outputs to I/O modules or assign functions to the audible alarm for an Alarm Module.

Disconnected Module

If one or more accessory modules are disconnected from the controller, the message Module Status Change appears. See Figure 4-16. Pressing the Reset button displays the message Check Module Setup to Clear Fault.

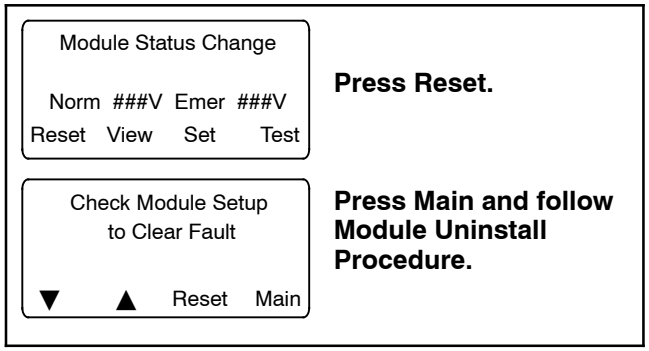


Figure 4-16 Screens after Module Disconnection

When modules are physically disconnected from the transfer switch, they must be uninstalled through the controller keypad. Use the following procedure to uninstall modules after disconnection.

Module Uninstall Procedure

1. If the ATS display shows Module Status Change, press the button labelled Reset.
2. If the ATS display shows Check Module Setup to Clear Fault,, press Main to return to the main screen.
3. Press Set to enter setup mode.
4. Enter the setup password.
5. Press the down arrow to step to the Set Inputs/Outputs screen. See Figure 4-17.
6. Navigate to the Set Auxiliary I/O screen. See Figure 4-17. Press the right arrow button to see the status of module 1. Press the down arrow to step to the next module, if necessary, until the screen shows Status: Lost.
7. Press the right arrow button to move to the Uninstall Module screen. Verify that the screen says Uninstall Module Yes. (Press the open arrow button to toggle no/yes, if necessary.)
8. When Yes is displayed, press Save to uninstall the module.
9. Repeat the uninstall procedure for additional modules, if necessary.

Other Module Status Change Conditions

A Module Status Change message that cannot be cleared as described above may indicate a failure of the controller's real-time clock. Carefully follow the procedures above to attempt to reset the fault. If the fault cannot be reset, replace the controller. See Section 6.13.

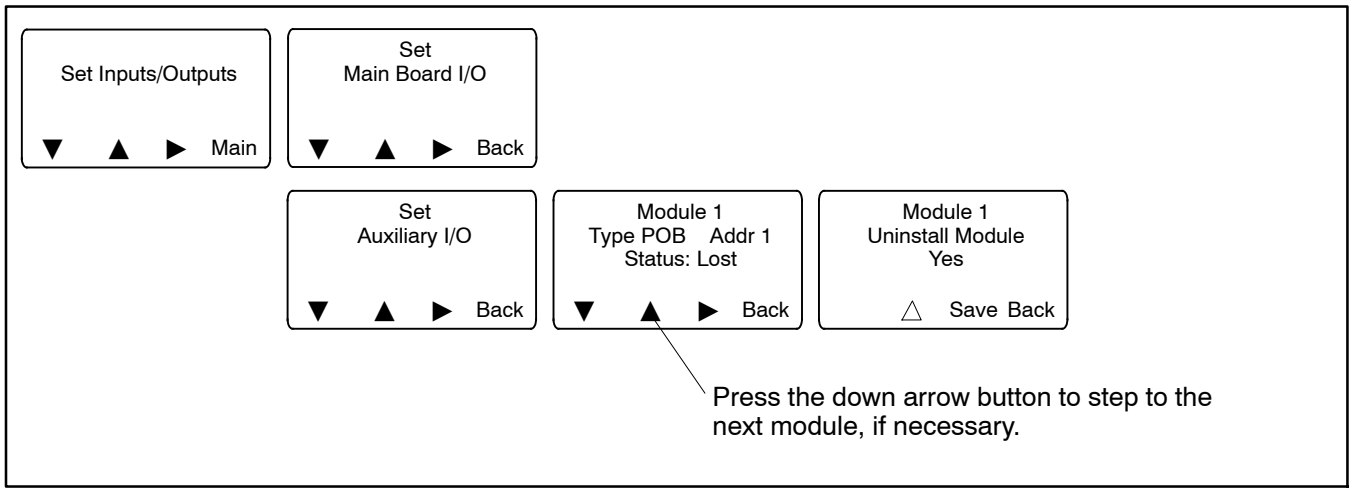


Figure 4-17 Uninstall Module

4.10.2 Module Status Conflict

The message Module Status Conflict appears if one type of module is replaced with another type of module that has the same address. Follow the procedure below to resolve the conflict.

Procedure to Clear a Module Status Conflict

1. Disconnect power to the transfer switch.
2. Disconnect the module.
3. Close the enclosure door and reconnect power to the ATS. The display will show Module Status Change.
4. Press the button labelled Reset. The display will show Check Module Setup to Clear Fault.
5. Follow the procedure in Section 4.10.1 to uninstall the module through the ATS controller keypad.
6. Disconnect power to the ATS.
7. Connect the new module.
8. Close the enclosure door and reconnect power to the ATS. The display will show Module Status Change. See Figure 4-15.
9. Press the button labeled Reset to display Reset New Module. Press the reset button from that screen. The controller will now recognize the new module type.
10. Navigate to the Set Auxiliary I/O screen to check the status and settings for the new module. See Figure 4-17. Press the right arrow button to see the status of module 1. Press the down arrow to step to the next module, if necessary,

See the transfer switch operation/installation manual for instructions to assign programmable inputs and outputs to I/O modules or assign functions to the audible alarm for an Alarm Module.

4.11 Common Alarms

Any of the functions listed in Figure 4-18 can be assigned to Common Alarms 1 and 2. Common alarms 1 and 2 can then be assigned to output functions which activate when any of the conditions assigned to the common alarm are present. Common Alarms 1 and 2 can also be set to sound the alarm horn on the optional Alarm Module.

Functions that can be Assigned to Common Alarms	
Aux Switch Fault *	Src E Over Freq
Aux Switch Open *	Src E Over Voltage
Battery Backup Low *	Src E Rotation Err *
Contactor in Off	Src E Under Freq
Contactor in Pref	Src E Under Voltage
Contactor in Src E	Src E Voltage Unbal
Contactor in Src N	Src N Loss of Phase
Contactor in Stby	Src N Over Freq
Exerciser Active	Src N Over Voltage
Fail to Acquire Pref *	Src N Rotation Err *
Fail to Acquire Stby *	Src N Under Freq
Fail to Transfer *	Src N Under Voltage
IPM Synching	Src N Voltage Unbal
Load Bank Control	Stby Src Available
Load Control Active	System Ready
Low Battery *†	Test Mode Active
Non-Emergency Trans	Critical Service Required
Not in Auto	Man Transfer Waiting
Peak Shave Active †	Module Lost Comm *
Pref Src Available	Non-Critical Service Req
Remote Common Alarm *	Source E Available
Remote Monitor In #1–4	Source N Available
Fail to Sync	Breaker Trip
Src E Loss of Phase	Modbus-Controlled RDO #1–4
* Assigned to Critical Service Required † Assigned to Non-Critical Service Required	

Figure 4-18 Common Alarm Functions

If the common alarm is activated, the specific condition that triggered the alarm will be shown on the ATS controller display screen. Check the display to identify the problem and then refer to the troubleshooting tables in Sections 4.12 and 4.13.

Use the View Common Alarms screen to identify which functions have been assigned to each common alarm. See the operation and installation manual for instructions to check the view screens and to change the settings, if necessary.

Selected functions as noted in Figure 4-18 are grouped into the Critical Service Required and Non-Critical Service Required functions. The Critical Service Required and Non-Critical Service Required functions can be assigned to activate the alarm horn on the optional Alarm Module. If any of the conditions included in the Critical Service Required or Non-Critical Service Required function occurs, the alarm horn will sound. The message on the ATS display will identify which condition (for example, Fail to Acquire Standby) triggered the alarm and caused the horn to sound.

4.12 Events and Faults Troubleshooting Table

The following tables list the faults and alarms that may be shown on the controller's display screen or listed in the event history log. The tables also list the possible causes for each problem and suggested procedures to identify and correct the source of the problem.

The event history log also lists transfers and other normal events not shown in these tables. The event history log can be saved to an electronic file. Refer to the transfer switch operation/installation manual for instructions to save the event log to a file.

Fault or Event Message	Possible Cause	Check	See Section
Overfrequency, Underfrequency	Frequency settings	Check that the system frequency setting matches the actual source frequency (50 or 60 Hz).	4.5
		Check the over/underfrequency pickup and dropout settings. See Section 4.5.2 and the Setup Program Operation Manual.	4.5
		Check that the frequency debounce setting is long enough to prevent nuisance faults caused by brief frequency variations.	4.5
	Source availability, stability	Check that the source frequency matches the nominal system frequency and stays within the range of the pickup and dropout settings.	4.4.3 4.5
	Source connections	Check for loose connections. Check wiring.	W/D
Overvoltage, Undervoltage	Voltage settings	Check that the system voltage setting matches the actual source voltage.	4.5
		Check the over/undervoltage pickup and dropout settings.	4.5 4.5.2
		Check that the voltage debounce setting is long enough to prevent nuisance faults caused by brief voltage dips or spikes.	4.5
	Source availability, stability	Check that the source voltage matches the nominal system voltage and stays within the range of the pickup and dropout settings.	4.5
	Source connections	Check for loose connections. Check wiring.	W/D
	Calibration error	Check the ATS calibration.	6.9
Loss of Phase	Single/three phase setting does not match source	Check that the controller single/three phase setting matches the source.	4.5
	One phase of the source has been lost	Check that all phases of the source are available.	4.4.3
	Source connections	Check for loose connections.	
Source Rotation Error	Phase rotation setting (ABC or BAC) does not match source	Check that the controller phase rotation setting matches the source phase rotation (ABC or BAC). Check the source connections to the transfer switch and verify that A,B, and C are connected to the appropriate lugs. Change the controller phase rotation setting or rewire the source connections if necessary.	4.5
Failure to Transfer	Transfer switch mechanism problem	See Section 4.13, Troubleshooting.	4.13

Fault or Event Message	Possible Cause	Check	See Section
Auxiliary Switch Fault or Auxiliary Switch Open	Controller cannot determine the transfer switch position	Check wiring and connections to position microswitches. See the schematic drawing for connections.	W/D
		Test position microswitch operation. Replace microswitch if necessary.	
		Transfer switch in intermediate position. Manually operate the transfer switch, following safety precautions and instructions for your model. See the Table of Contents for manual operation procedures for your unit.	TOC
		Check the control contact operation. Inspect for signs of coil damage or overheating and replace coil if necessary. See the Table of Contents for coil control contact test procedures for your unit.	TOC
Failure to Acquire Standby	Generator set did not start	See Failure to Start Generator Set, below.	
	Open circuit breaker	Check and close ATS source and generator set circuit breakers.	—
	ATS does not recognize the standby source	Check source voltage, frequency, phase rotation settings and compare to actual values.	4.4.3 4.5
		Check for loose source connections. Check the labels on the switch for tightening torques.	2.2.2
		Check for open switch or circuit breaker to the source.	—
		Check ATS calibration.	6.9
		Check voltage sensing. See Figure 4-20 (KS) or Figure 4-26 (KG), Voltage Sensing Troubleshooting flowchart.	4.14
Failure to Acquire Preferred	Open circuit breaker	Check and close ATS source and generator set circuit breakers.	
	ATS does not recognize the source	Check source voltage, frequency, phase rotation settings and compare to actual values.	4.4.3 4.5
		Check for loose source connections. Check the labels on the switch for tightening torques.	2.2.2
		Check for open switch or circuit breaker.	—
		Check ATS calibration.	6.9
		Check voltage sensing. See Figure 4-20 (KS) or Figure 4-26 (KG), Voltage Sensing Troubleshooting flowchart.	4.14
External Battery Low	Low generator set engine starting battery voltage	Check battery connections and voltage. Charge or replace battery if voltage is low.	Generator set manuals
Inphase Monitor (IPM) Synching	The two sources did not synchronize within the Fail to Sync time delay. The ATS will continue to monitor for synchronization.	Adjust inphase monitor angle.	ATS O/I/M
		It may be necessary to adjust the generator set frequency in order to achieve source synchronization.	Generator set manuals
Fail to Sync (closed-transition models)	The two sources did not synchronize within the Fail to Sync time delay. The ATS will continue to monitor for synchronization.	Check the synchronization settings for voltage differential, frequency differential, and phase angle. See the Controller Operation Manual. The programmed-transition override function can be set to allow a programmed-transition transfer in the event that the sources do not synchronize. See TP-6714 for instructions. The IPM Synching output can be connected to customer-supplied equipment to boost the generator set if the sources do not synchronize.	Controller Operation Manual

Fault or Event Message	Possible Cause	Check	See Section
Module Status Change	A new accessory module is detected	Press the reset button to open Reset New Module screen. Then press Reset again.	4.10.1
	A module has been disconnected	Check connections from the controller to the I/O module assembly and at the top of each I/O module. Verify that the module is securely installed. If a module has been removed, go to Set Inputs/Outputs screen and uninstall the module.	4.10.1
	Communication to an installed I/O module has been lost	Check I/O module connections.	4.10.1
	Real-time clock failure on logic board	If the procedures in Section 4.10.1 fail to clear the error message, replace the controller's logic board.	4.10.1 6.13
Module Status Conflict	One type of module was replaced with another type of module that has the same address	Follow the procedure in Section 4.10.2 to uninstall the old module and then install the new module.	4.10.2
External Fault	Fault condition in customer- supplied equipment connected to external input	Identify and correct the cause of the fault condition.	Manuals for connected equipment
	Loose or faulty connection	Check connection to external input.	ATS OIM

4.13 Transfer Switch Operation Troubleshooting Table

Always follow the safety precautions at the beginning of this manual when troubleshooting and servicing the transfer switch.

The following table lists potential problems with possible causes and suggested remedies. Section numbers in the last column refer to other sections of this manual. TOC refers to the Table of Contents in this manual; check the table of contents for service procedures for your size (amps) and type (standard or programmed-transition, standard or bypass/isolation) of transfer switch in Sections 7 through 10.

Problem	Possible Cause	Check	See Section
Generator set engine does not start	Engine start time delay is running	Check the controller display to see if the engine start time delay is active. Wait for the engine start time delay to expire. Press End Delay button to end the delay early, if necessary.	4.6
		See the ATS controller Operation Manual for instructions to change the engine start time delay setting, if necessary.	ATS O/I/M
	Loose engine start connection	Check for loose engine start connection on the ATS and the generator set. Tighten connections and/or replace wiring if necessary.	ATS O/I/M Generator manuals
	No engine start signal from the ATS	Follow the procedure in Section 6.7 to test the engine start contact operation.	6.7
	Generator set master switch not in the AUTO position	Check that the generator set is in AUTO. Refer to the generator manuals for instructions, if necessary.	Generator set manuals
	Generator set problem	If the ATS is sending an engine start signal and the the generator set is in AUTO, troubleshoot the generator set for failure to start. Refer to the generator set and engine manuals for instructions.	
Generator set engine runs when it should not	ATS does not recognize the Normal source	Is the normal (utility source available? Check the normal source available LED on the ATS controller. If not lit, check for utility voltage to the transfer switch normal lugs. Check source connections to the transfer switch. Check that the switches or circuit breakers between the utility power source and the ATS are closed. Check that the ATS settings for voltage, frequency, and phase rotation are correct for the normal source. Check the transfer switch voltage calibration.	— 4.5
	ATS not in the expected position	Check the ATS position LEDs to verify that the ATS is in the normal position. Check the position of the preferred source selector switch, if equipped. If the preferred source selector switch is set to Emergency, the ATS will remain in the emergency position and generator set will run, even if the utility source is available.	6.1
	Exerciser is running	Check the controller display for Exerciser Active message. Press the END button to end an exercise run, if necessary. A remote switch may be signalling an exercise run. Check for remote exercise inputs.	ATS O/I/M
O/I/M= Operation and Installation Manual; O/M = Operation Manual; TOC = Table of Contents, this manual; W/D = Wiring Diagrams			

Problem	Possible Cause	Check	See Section
Generator set engine runs when it should not (continued)	Test sequence is running	Check the controller display for indication that a test sequence is active. Press the END TEST button to end a test sequence, if necessary. A remote switch may be signalling a test run. Check for remote test inputs.	ATS O/I/M
	Engine cooldown time delay operating	Check for Engine Cooldown message on the controller display. Press End Delay button to end the cooldown delay, if necessary. Check the ATS controller engine cooldown time delay setting.	4.6 ATS O/I/M
		Check the generator set controller for operation of a separate engine cooldown cycle.	Generator O/M
	Engine start connection closed	Check the wiring and connections to the engine start contacts on the ATS and the generator set. Check for shorts or incorrect connections. Disconnect the engine start leads to see if engine stops.	ATS O/I/M W/D
		Test the engine start contact operation.	6.7
	Generator set master switch not in AUTO	Move the generator set master switch to the AUTO position. Wait for the generator set engine cooldown delay, if necessary.	Generator set manuals
	Other generator set problem	Disconnect the engine start leads from the ATS. If the engine continues to run, troubleshoot the generator set.	
In-phase monitor does not operate	Inphase monitor function not enabled	Check that the inphase monitor option in the Set Sources menu on the ATS controller is enabled.	O/M
	Low source voltage	If voltage of the connected source falls below 70% of nominal, the in–phase monitoring is terminated and transfer is allowed.	O/M
	Inphase monitor option not available (programmed-transition models)	Not available on programmed-transition models. Center-OFF position makes the inphase monitor option unnecessary.	—
Exerciser does not start generator set	Exerciser not set	Use View Exercise Setup screen to check exerciser settings. See the ATS controller operation manual for instructions to check and change the exerciser settings.	O/M
	Check that exercise run duration is not set to zero	Use View Exercise Setup screen to check exerciser settings. See the ATS controller operation manual for instructions to check and change the exerciser settings.	O/M
	Loose or open engine start connection	Check the wiring and connections to the engine start terminals on the ATS and the generator set. Engine start terminal locations vary with transfer switch model and size. See the ATS installation manual or ADV drawing for the engine start terminal location, if necessary.	ATS O/I/M
	Engine start problem	Follow the procedure in Section 6.7 to test the engine start operation. Also see *Generator set engine does not start* in this table.	6.7
Exerciser does not run regularly or at all	Exerciser not set	Use View Exercise Setup screen to check exerciser settings.	O/M
	Maintenance DIP switch SW1B closed	Check for Maintenance Mode message on controller display.	—
		Check the DIP switch setting.	6.8

O/I/M= Operation and Installation Manual; O/M = Operation Manual; TOC = Table of Contents, this manual; W/D = Wiring Diagrams

Problem	Possible Cause	Check	See Section
Exerciser does not run regularly or at all, cont'd	Exercise interval different than expected	Use View Exercise Setup screen to check exerciser settings.	O/M
Failure to transfer	Alternate source is not available	Check that the source available LED on the ATS controller is lit. Check the source connections to the ATS normal and/or emergency lugs. Check that circuit breakers and/or switches between the source and ATS are closed.	2.2.2
		Check source voltage and frequency.	4.4.3
		Check that the ATS settings for voltage, frequency, and phase rotation are correct for the both sources.	4.5
		Check the transfer switch voltage calibration.	6.9
	AC voltage sensing is incorrect	Perform troubleshooting procedures in Figure 4-20 (KS) or Figure 4-26 (KG), voltage sensing troubleshooting flowchart.	4.14
	Unloaded exercise selected	Use View Exercise Setup screen to check exerciser settings.	O/M
	Unloaded test sequence selected	Press the End Test button, wait for the test sequence to stop, and then select a Loaded or Auto Loaded test sequence. For remote tests, check the Remote Test loaded/ unloaded setting. See the ATS Operation Manual for instructions.	ATS O/M
	Pre-transfer time delays operating	Check controller display for time delay indication. See the operation manual for information on time delays during normal operation.	ATS O/I/M
		Check the time delay settings on the ATS controller.	4.6
	Maintenance DIP switch enabled	Check DIP switch setting.	6.8
	Connected source available	Check the Source Available LEDs. if the normal or preferred source is available the ATS will not transfer automatically.	6.1
	Preferred source selection set to emergency and emergency source is available	Check the preferred source selection and the Source Available LEDs.	—
	Supervised transfer control switch (optional) in manual position	Check the position of the supervised transfer control switch, if equipped. Move the switch to the TRANSFER or AUTO position, as appropriate for the application.	ATS O/I/M
	Fail to sync time delay expired (closed-transition models)	If the sources do not synchronize with the fail to sync time delay, the fail to sync message is displayed on the controller. The programmed-transition override function provides options for transfer after the fail to sync time delay expires. See instructions for programmed-transition override in the ATS controller operation manual.	O/M
	In-phase monitor transfer angle setting (if enabled)	Check the transfer angle setting. A small transfer angle may prevent transfer because the two sources may not fall within range.	O/M
Slow or no transfer to utility	Perform the troubleshooting procedures in the Transfer Troubleshooting flowcharts in Figure 4-22 and Figure 4-23 (KS) or Figure 4-28 and Figure 4-29 (KG).		4.14

O/I/M= Operation and Installation Manual; O/M = Operation Manual; TOC = Table of Contents, this manual; W/D = Wiring Diagrams

Problem	Possible Cause	Check	See Section
Failure to transfer Transfer switch mechanical binding	Jammed or damaged solenoid	Inspect and test solenoid coil.	5.4.1
	Faulty or worn core spring	Inspect and replace damaged parts.	TOC
	Bent main contact shaft	Inspect and replace damaged parts.	TOC
	Jammed main contacts	Check for foreign object.	
	Contact lever or pushbutton jammed against solenoid counterweight	Test control contacts. See the Table of Contents for test procedures for your model transfer switch.	TOC
	Loose hardware.	Check for and tighten loose hardware.	2.2.2
	Accumulation of dirt or other foreign material	Clean. Lubricate if necessary.	2.2.2
Failure to transfer Transfer switch electrical malfunction	Damaged or wrong coil	Check for signs of overheating (warped or melted plastic, dark stains, etc.). Measure the coil resistance to check for damaged coil. Verify that the coil voltage rating matches the transfer switch voltage rating and source voltage. Replace the coil and rectifier.	5.4
	Damaged or wrong rectifier	Inspect for damage. Replace the rectifier and coil.	5.3
	Corroded or fused contacts	Inspect contacts. Clean or replace. Do not use an emery cloth or file. See the Table of Contents for contact replacement procedures for your model.	2.2.2 TOC
	Coil control contact operation	Test coil control contact operation. See the Table of Contents for control contact test procedures for your model transfer switch.	TOC
	Faulty connections	Check leads and harnesses for loose connections, broken leads, or incorrect connections.	W/D
	Wrong voltage	Check system voltage, controller system voltage and over/undervoltage pickup and dropout settings, and controller meter calibration.	4, 6
Chattering noise when attempting to transfer	Coil control contact operation	See the Table of Contacts for control contact test procedures for your model transfer switch.	TOC
	Low voltage	Check source voltage and connections.	4.4.3
	Incorrect spring	See the Table of Contents for coil replacement instructions for your model transfer switch.	TOC
	Wrong coil	Check coil voltage rating and verify that it matches the transfer switch voltage rating.	—
O/I/M= Operation and Installation Manual; O/M = Operation Manual; TOC = Table of Contents, this manual; W/D = Wiring Diagrams			

Problem	Possible Cause	Check	See Section
No LEDs illuminated and/or display is blank	No power to the transfer switch	Check that source switches or circuit breakers between the sources and the transfer switch are closed.	—
		Verify that at least one source is available. Check for utility or gen set voltage to the ATS.	4.4.3
		Check source connections to the normal and emergency lugs on the ATS.	
	No power to the controller	Check that the transfer switch harness is connected to the controller.	Figure 6-9
		Check the harness for loose connections or broken leads (continuity check).	W/D
	One or more faulty LEDs	Press the Lamp Test button to check the operation of all LEDs.	6.1.4
		Replace the controller if one or more LEDs do not light during the lamp test.	6.13
		If no LEDs light during the lamp test, troubleshoot power and connections to the controller as described above.	6.3
	See Figure 4-21 (KS) or Figure 4-27(KG), Blank Display Troubleshooting.		4.14
Strange characters on controller display or controller lockup	See Figure 4-24 (KS) or Figure 4-30 (KG), Troubleshooting Display Errors or Controller Lockup.		4.14
Source available LED off when Source is available	Malfunctioning LED	Press the Lamp Test button to check the operation of all LEDs. Replace the controller if one or more LEDs do not light. If no LEDs light, troubleshoot power and connections to the controller.	6.1.4
	Source settings do not match actual source parameters	Check the source voltage, frequency, and phase rotation settings. See the ATS Operation Manual for instructions.	4.5
	Incorrect ATS meter calibration	Check calibration.	6.9
Position LED not lit	Position microswitch malfunction	Check the operation of the position microswitches.	6.10
	Transfer switch in intermediate position	Manually operate the transfer switch and check the position LED operation.	TOC
		Check the control contact operation.	TOC
		Check for evidence of solenoid coil damage. Test solenoid coil resistance and operation.	5.4
		Replace the coil if necessary.	TOC
	LEDs not functioning	See *No LEDs illuminated* in this table.	—
O/I/M= Operation and Installation Manual; O/M = Operation Manual; TOC = Table of Contents, this manual; W/D = Wiring Diagrams			

4.14 MPAC Controller Troubleshooting Flowcharts

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Problems with the transfer switch controller can often be traced to incorrect controller settings, faulty wiring, or a bad circuit board. Use the troubleshooting flowcharts in this section to diagnose problems and identify the parts that require service or replacement. Do not replace the entire controller assembly.

The MPAC 750 and 1200 controllers for the Models KSS and KSP are covered in Section 4.14.1. The MPAC 1500 controller for Models KGS and KGP is covered in Section 4.14.2.

4.14.1 MPAC 750 and 1200 Controllers for Models KSS/KSP

Use the troubleshooting flowcharts in Figure 4-20 through Figure 4-24 to diagnose and correct the following controller problems.

- Incorrect voltage sensing
- Blank display
- Slow or no transfer to utility
- Strange characters on display or controller lockup

Refer to the operation/installation manual and wiring diagrams provided with the transfer switch during the procedure. See Figure 4-19 for an illustration of the controller connections referred to in the flowcharts.

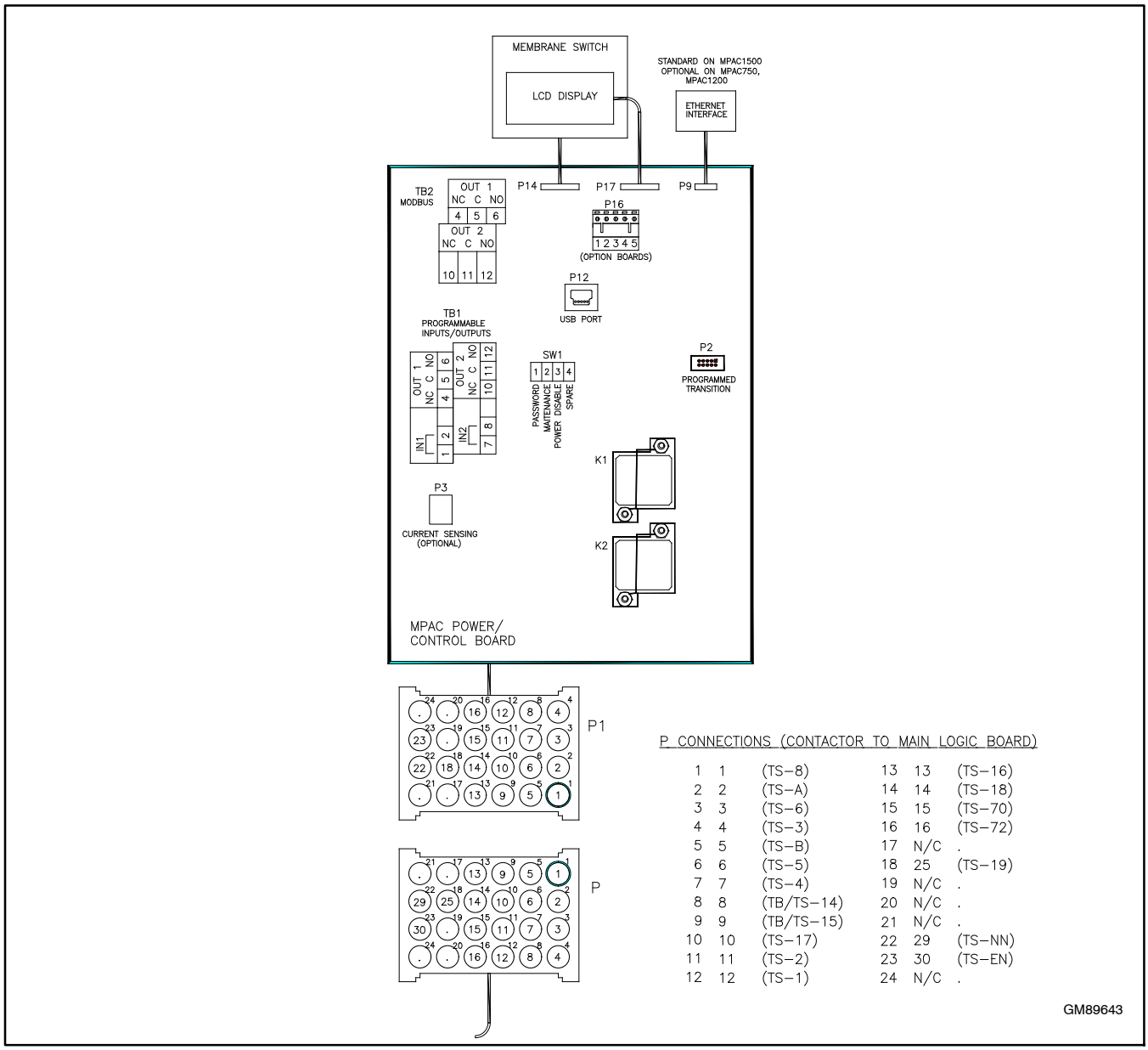


Figure 4-19 MPAC Controller Circuit Board P1 Connector, Models KSS/KSP

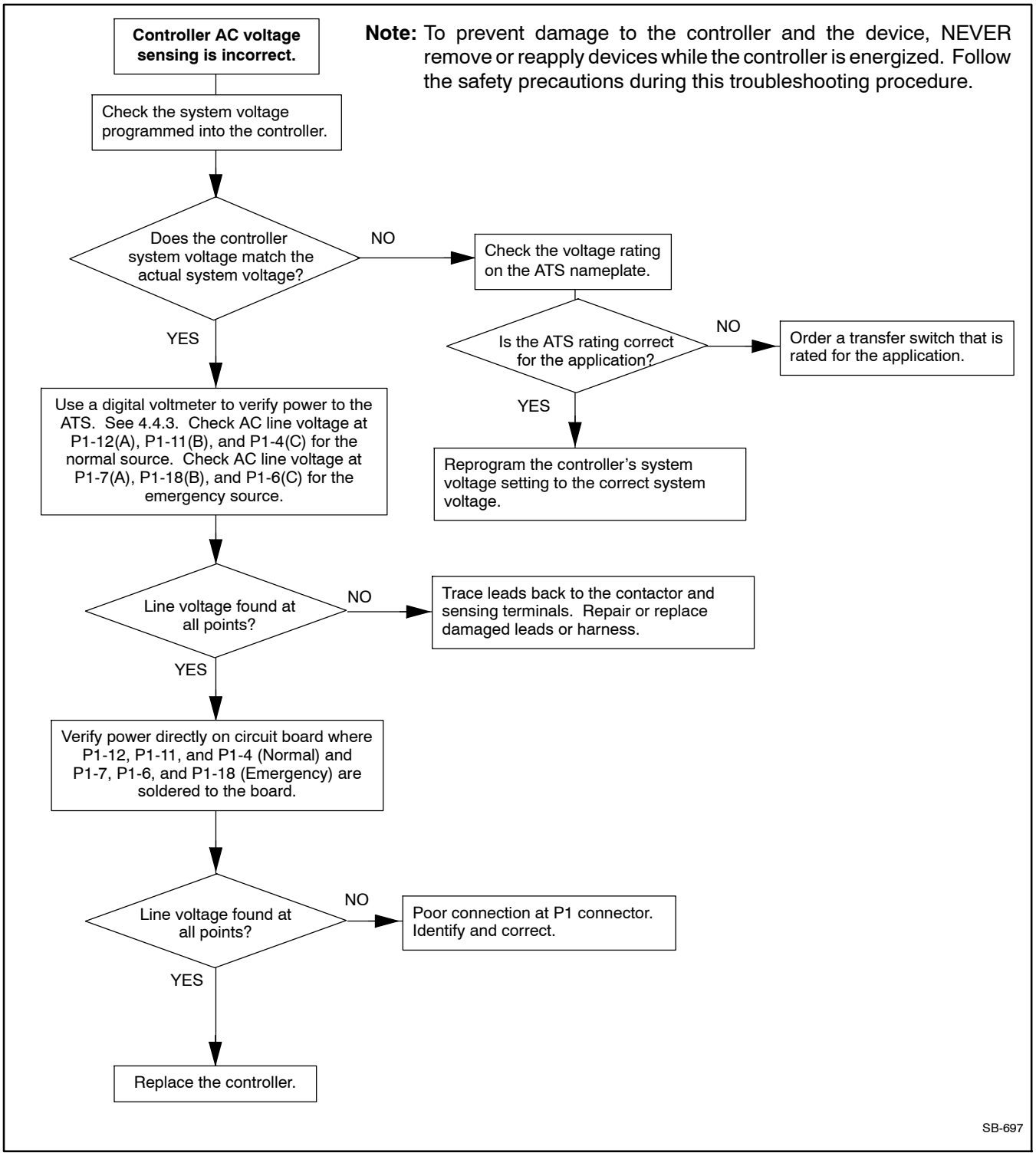


Figure 4-20 Voltage Sensing Troubleshooting, Models KSS/KSP

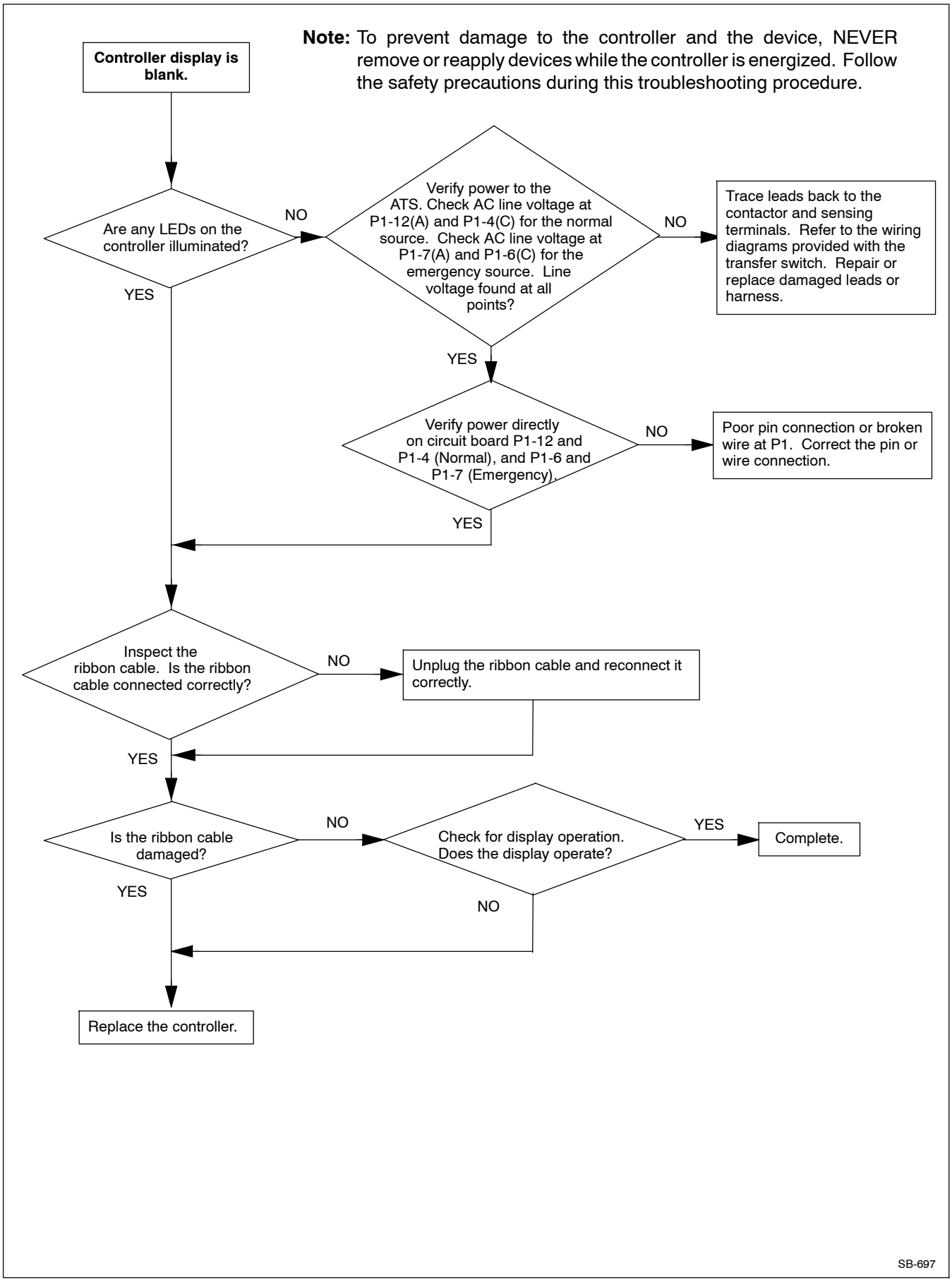


Figure 4-21 Blank Display Troubleshooting, MPAC 1200 Controller

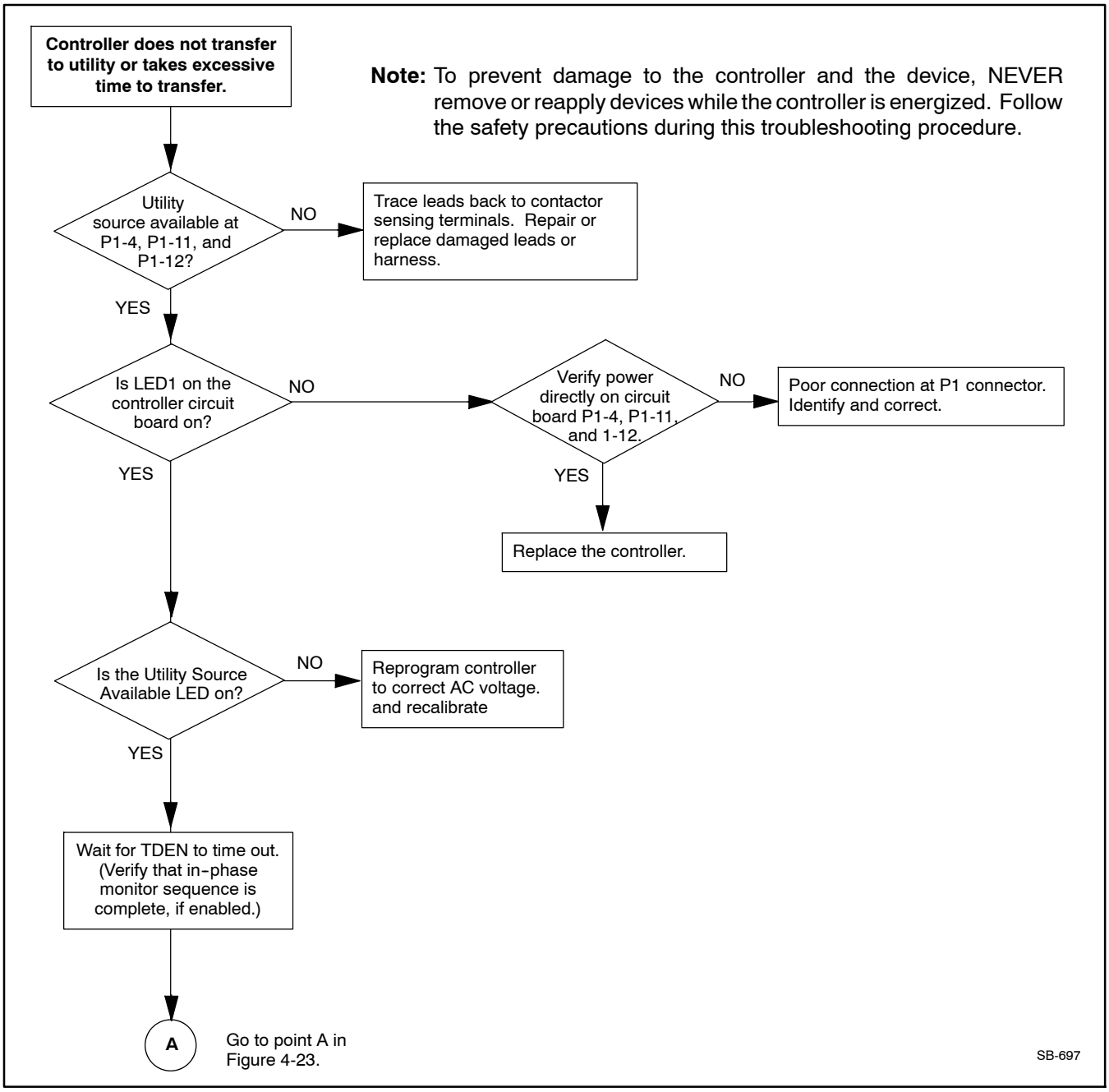


Figure 4-22 Transfer Troubleshooting, Models KSS/KSP, Part 1

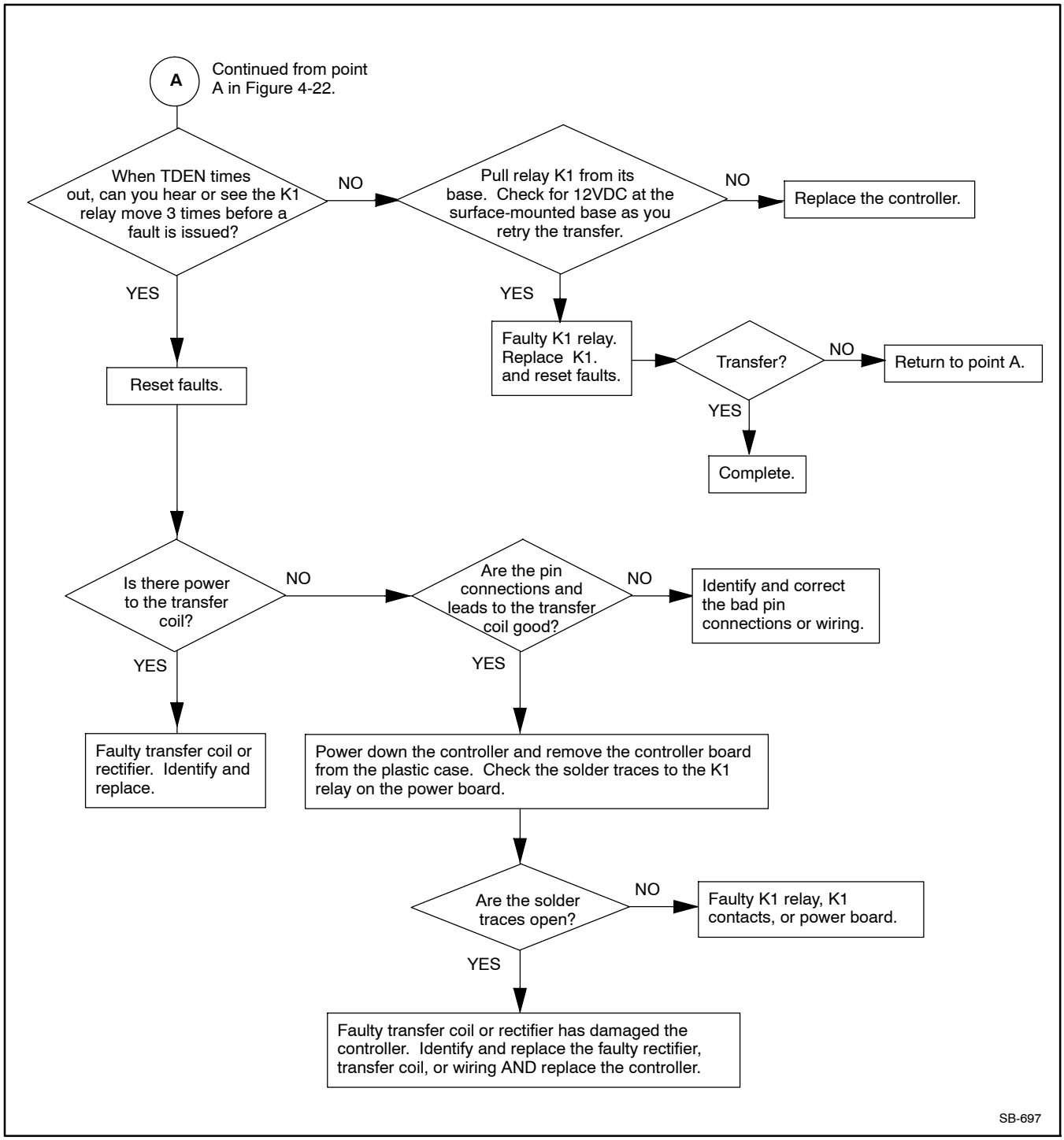


Figure 4-23 Transfer Troubleshooting, Models KSS/KSP, Part 2

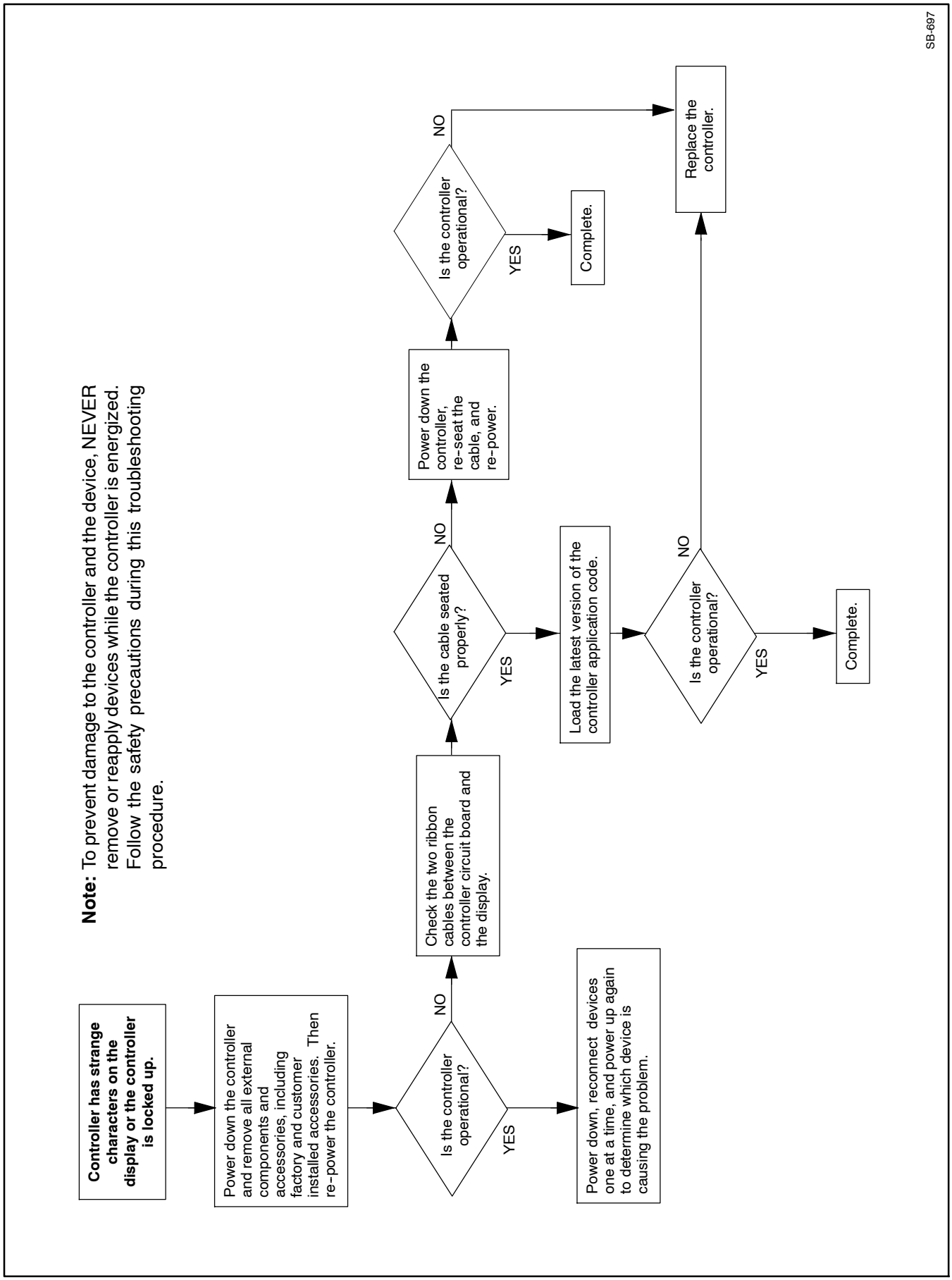


Figure 4-24 Troubleshooting Display Errors or Controller Lockup, MPAC 1200

4.14.2 MPAC 1500 Controller for Models KGS/KGP

Use the troubleshooting flowcharts in Figure 4-26 through Figure 4-30 to diagnose and correct the following problems on the controller.

- Incorrect voltage sensing
- Blank display
- Slow or no transfer to utility
- Strange characters on display or controller lockup

Refer to the operation/installation manual and wiring diagrams provided with the transfer switch during the procedure. See Figure 4-25 for an illustration of the controller connections referred to in the flowcharts.

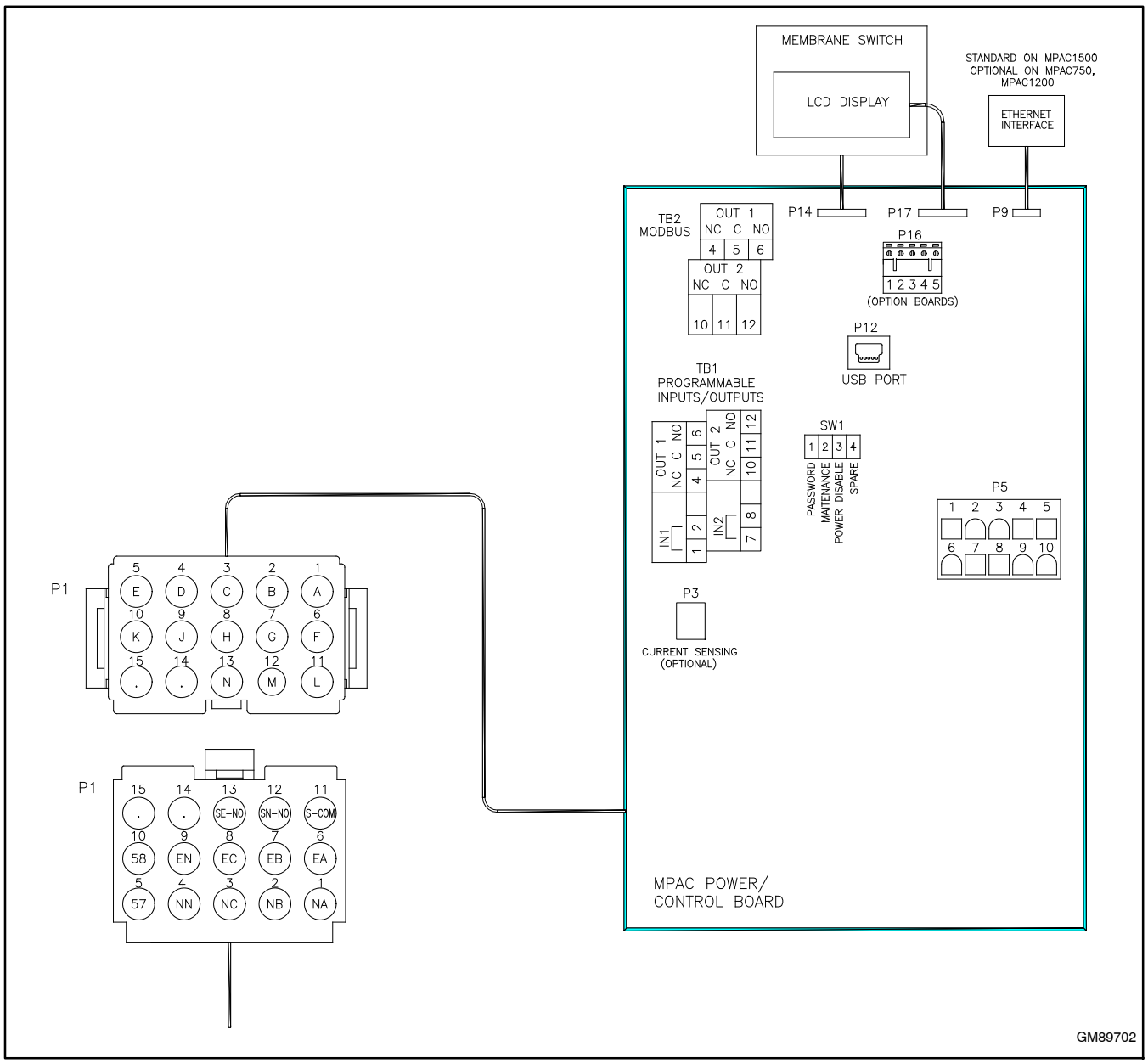


Figure 4-25 MPAC Controller Circuit Board P1 Connector, Models KGS/KGP

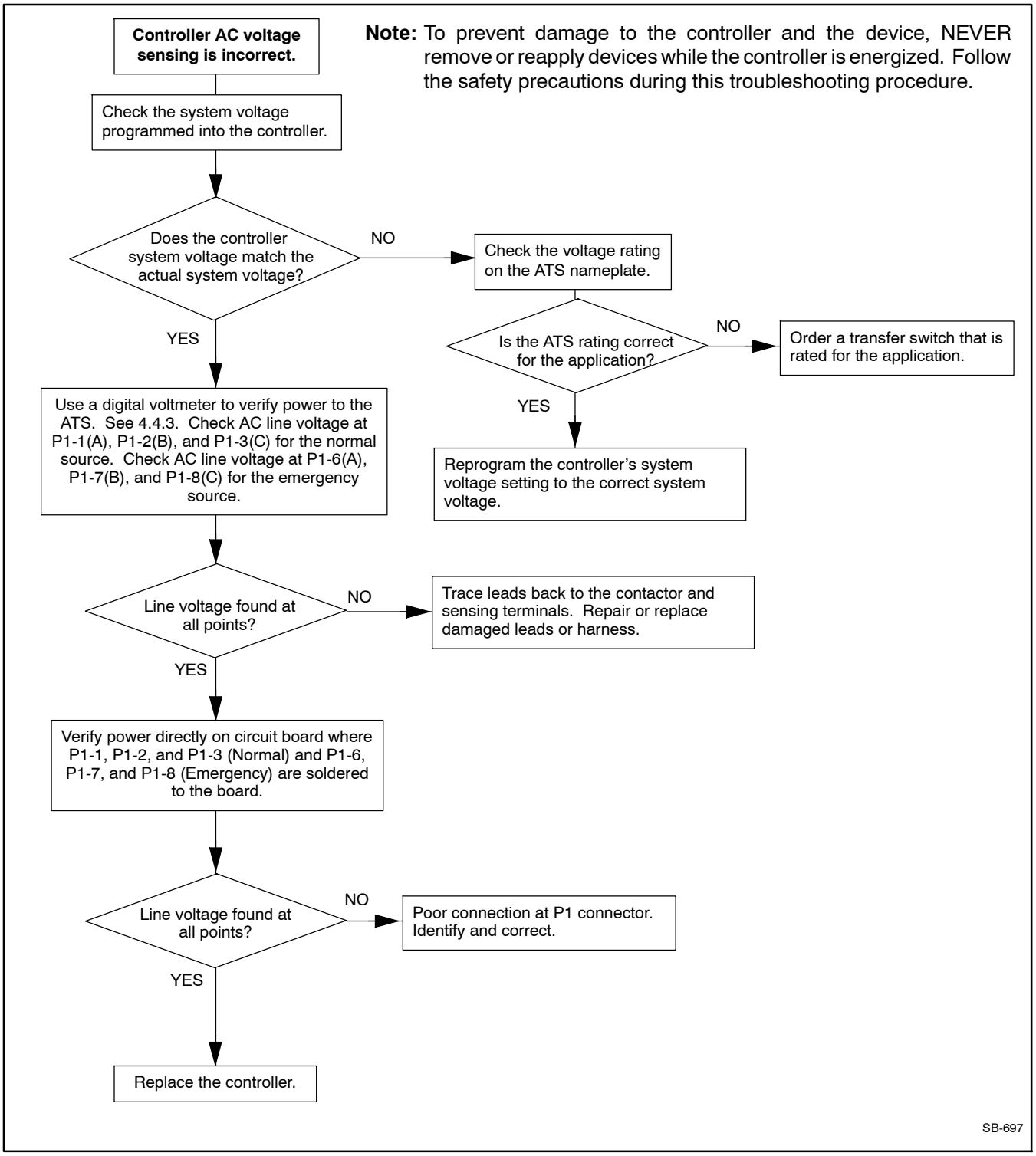


Figure 4-26 Voltage Sensing Troubleshooting, Models KGS/KGP

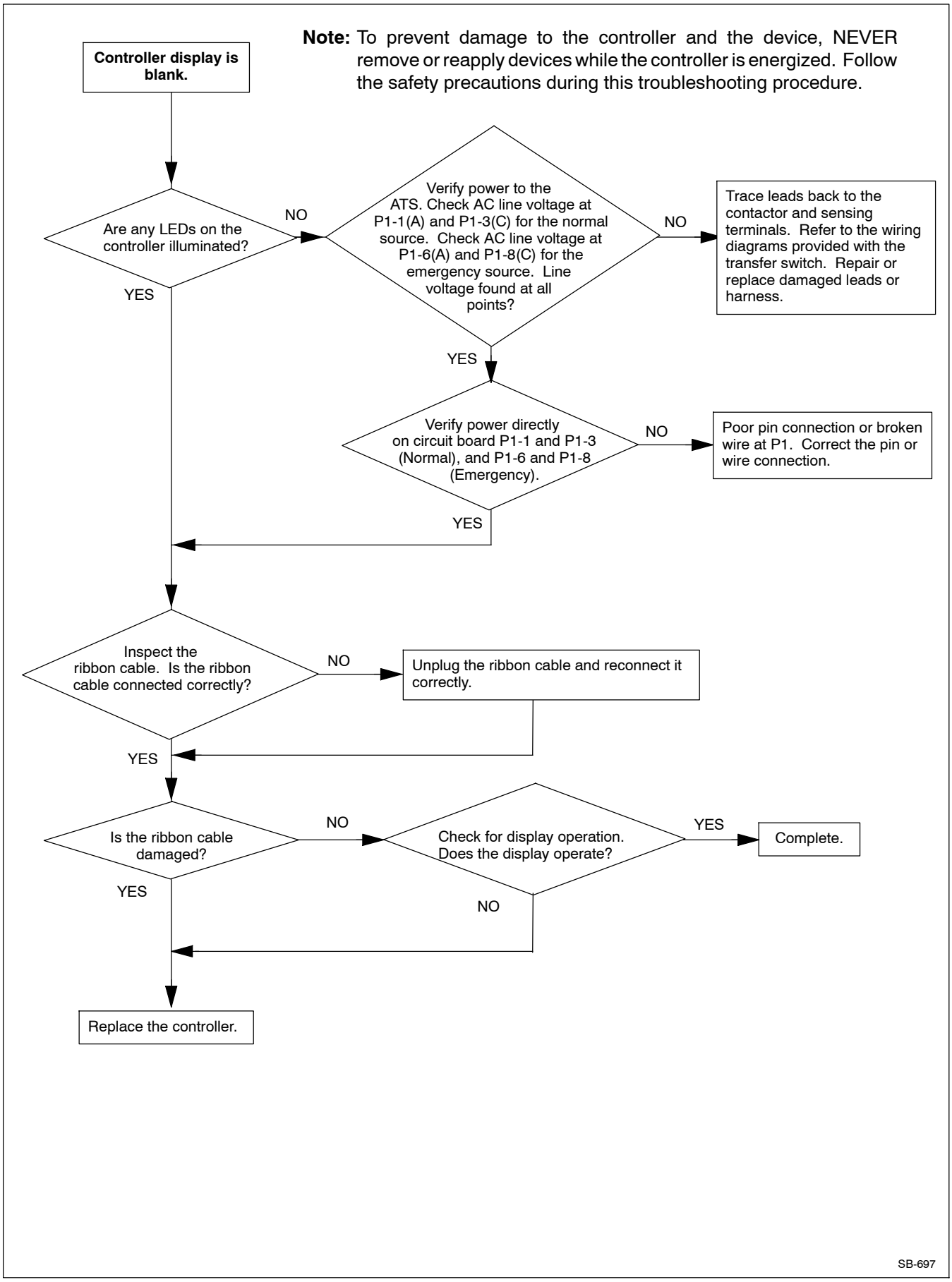


Figure 4-27 Blank Display Troubleshooting, Models KGS/KGP

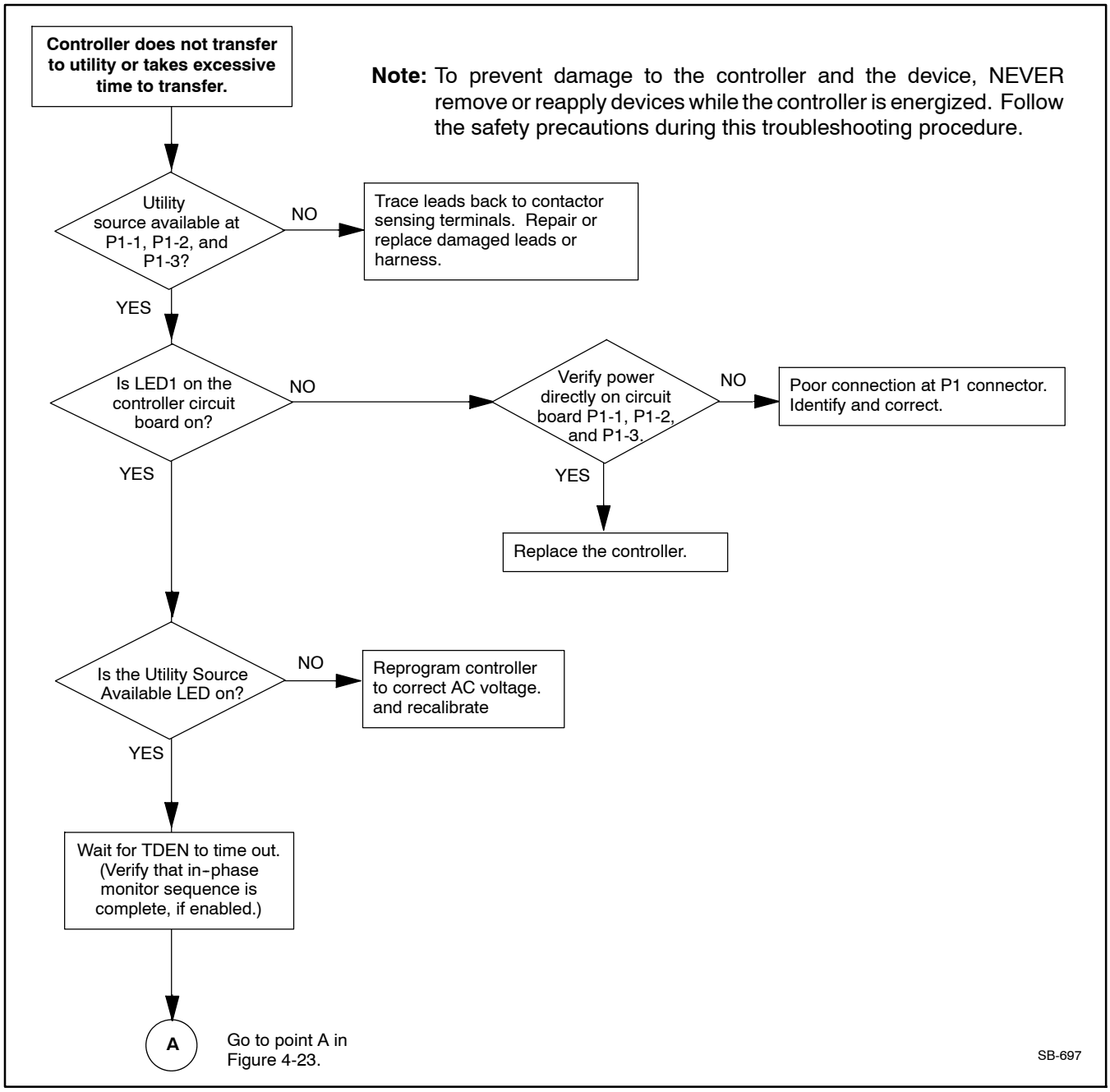


Figure 4-28 Transfer Troubleshooting, Models KGS/KGP, Part 1

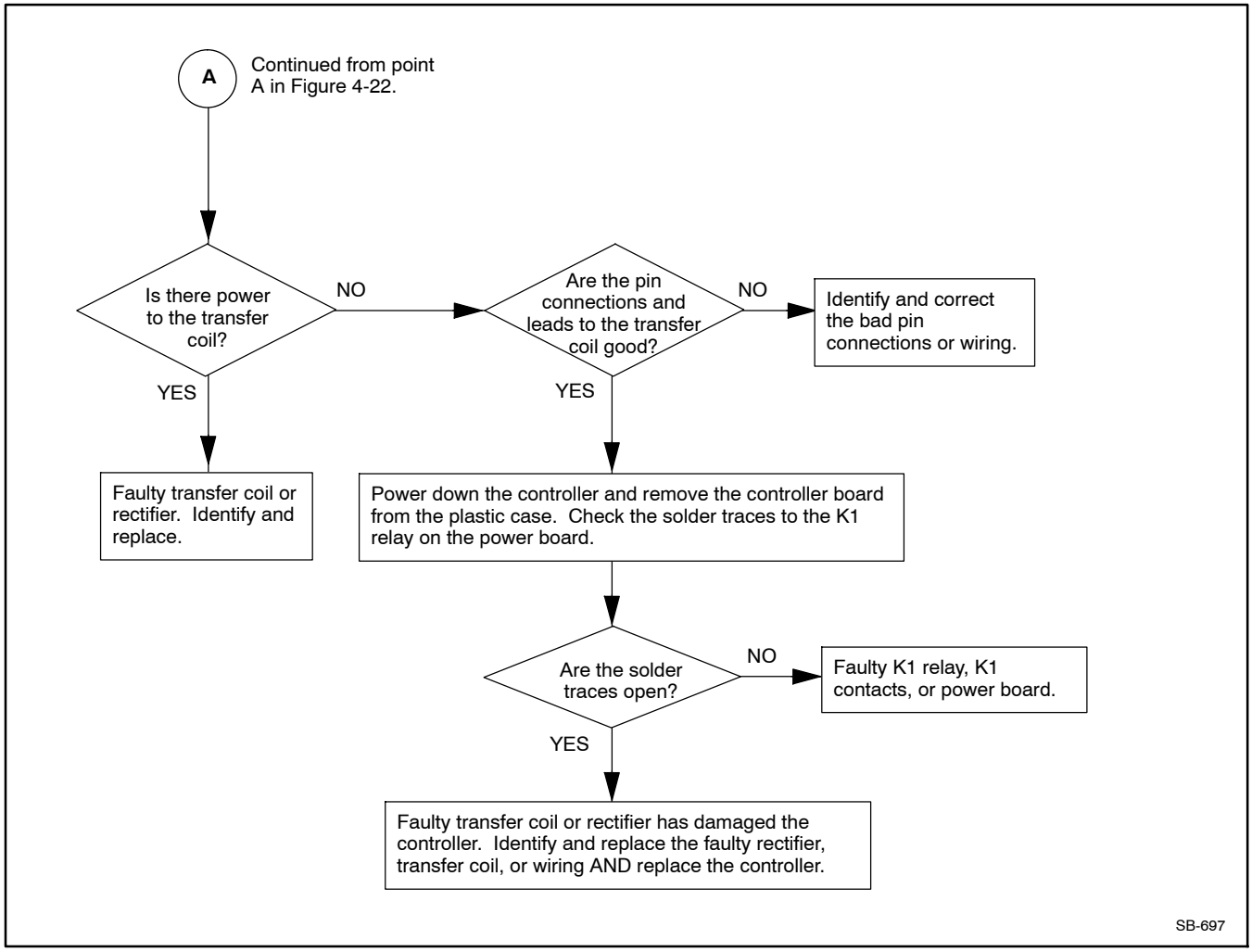


Figure 4-29 Transfer Troubleshooting, Models KGS/KGP, Part 2

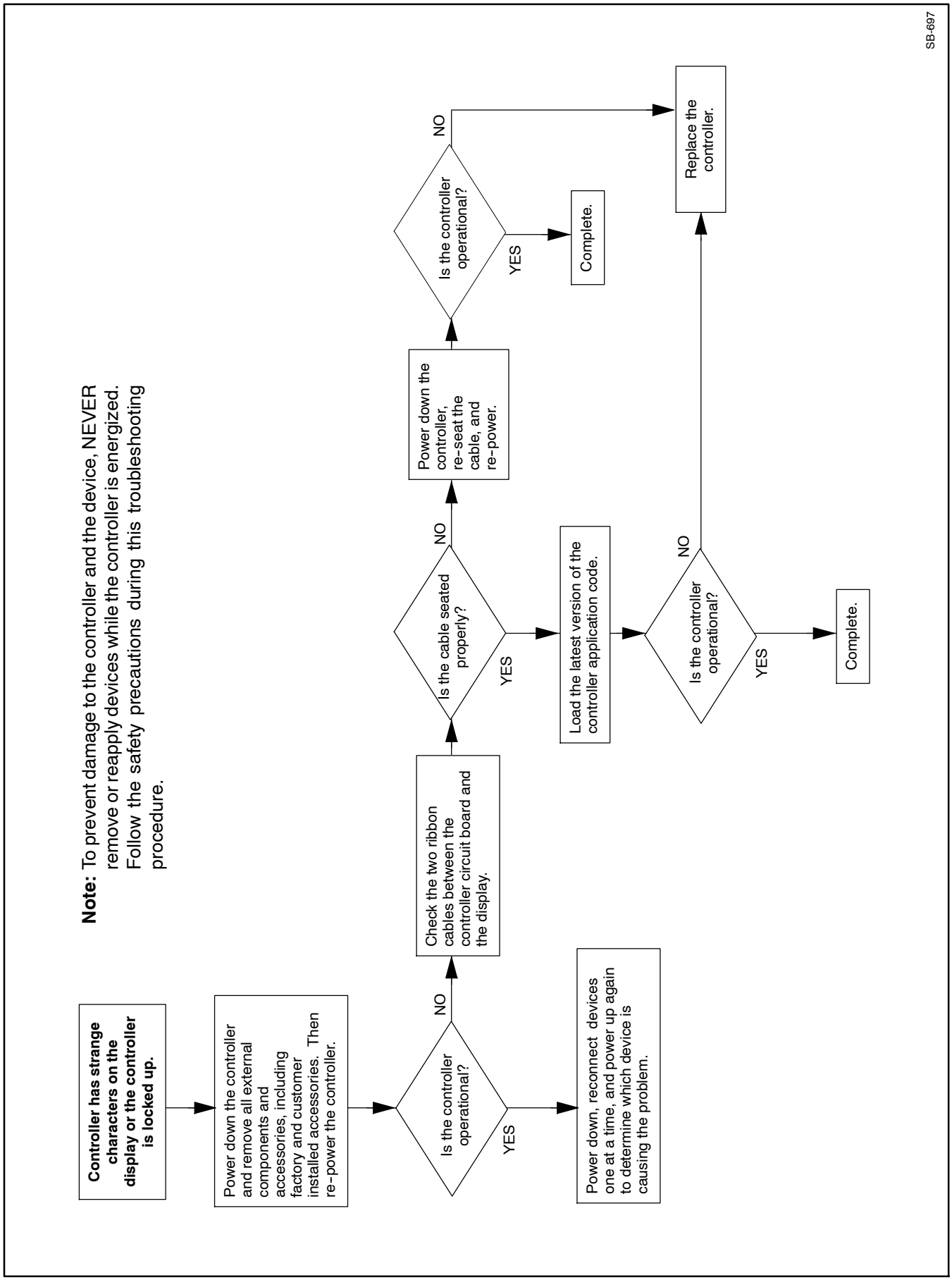


Figure 4-30 Troubleshooting Display Errors or Controller Lockup, Models KGS/KGP

5.1 Initial Checks

When troubleshooting the transfer switch mechanism, always check for simple causes first: broken or loose wires, corroded contacts, exposure to dirt or foreign material, etc.

Check the time delays, source settings, and other system parameters as described in Sections 4 and 6 before concluding that there is a mechanical problem with the transfer switch. Many transfer problems can be traced to inappropriate controller settings.

Verify that the voltage on the nameplate matches the actual nominal source voltage. Use the procedure in Section 4.4.3 to measure the source voltage. Observe safety precautions when taking voltage measurements. Verify that the measured voltage matches the transfer switch rated voltage.

5.2 Contacts

Use the millivolt drop test in Section 2.3.3 to identify damaged contacts. If the contacts are damaged or have high resistance, replace the power panel assembly. See the table of contents for service procedures for your transfer switch.

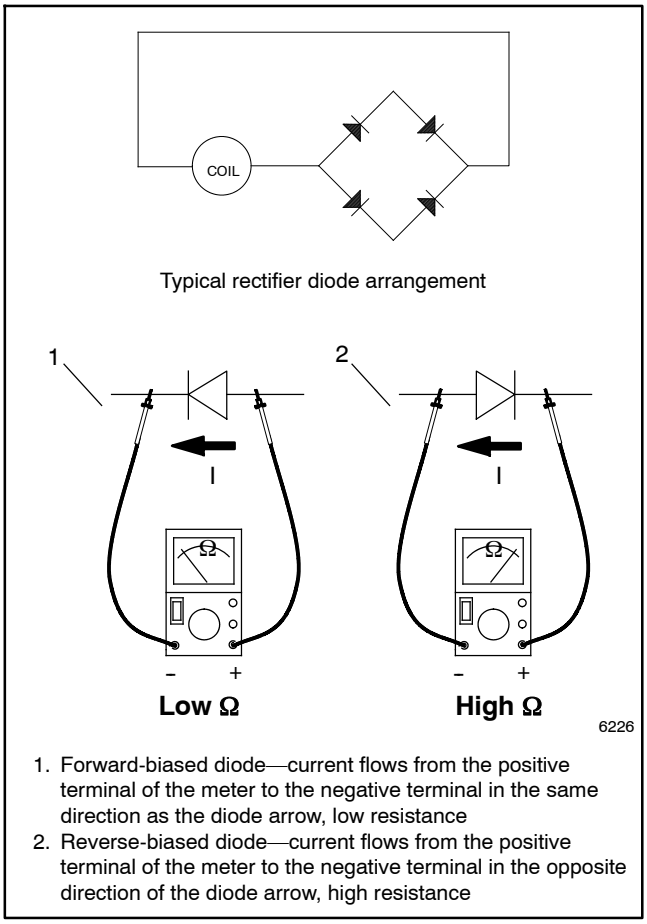
5.3 Rectifier Test

Use an ohmmeter or a diode checker to test the rectifiers when necessary. See Section 7.6 for instructions to test rectifiers on Model KSS switches.

Note: The rectifiers on model KSP programmed-transition switches are built into the solenoid coils and are not accessible for testing.

Disconnect all leads to the bridge rectifier and test each rectifier (diode) in the bridge individually using an ohmmeter (R x 1 scale) or diode checker. See Figure 5-1 and Figure 5-2. The diodes should exhibit a reverse resistance of at least 100 times the forward resistance. If the reverse resistance is low, replace the damaged rectifier assembly.

Figure 5-1 Checking Rectifier Diode Operation



1. Forward-biased diode—current flows from the positive terminal of the meter to the negative terminal in the same direction as the diode arrow, low resistance
2. Reverse-biased diode—current flows from the positive terminal of the meter to the negative terminal in the opposite direction of the diode arrow, high resistance

Figure 5-2 Testing Diodes

5.4 Solenoid Tests

5.4.1 Solenoid Coil Resistance

Use an ohmmeter to measure the coil resistance. Most damaged coils will result in an open circuit (very high resistance) or a shorted coil (near zero resistance).

Note: Because coils for model KSP programmed-transition switches have integral rectifiers, the coil resistance on those units cannot be easily measured. Check coil operation according to the diagrams in Section 5.4.2. If the coil does not operate correctly, replace it.

See Section 7.6 for instructions to test coils on Model KSS switches. Replace the coil if an open circuit or a short circuit is found.

5.4.2 Solenoid Operation

This section contains descriptions and diagrams of the solenoid coil operation. For complete diagrams, refer to the schematic diagrams provided with the transfer switch.

The ATS controller monitors the connected source and detects source failure, either a complete loss of the source or a source parameter that is outside the acceptable range. The controller starts the engine start time delay. If power is restored before the time delay ends, the controller resets the time delay and continues to monitor the source. If the source failure persists and the time delay ends, the controller closes the engine start contacts to signal the Source E generator set to start.

When Source E (or the standby source) becomes available, the controller starts the preferred-to-standby time delay (if not set to zero). When the time delay ends, relay K2 (ER) in the controller closes, applying power to the solenoid coil and initiating transfer.

When Source N (or the preferred source) is restored, the controller starts the standby-to-preferred time delay. When the time delay ends, the controller's K1 (NR) relay closes, applying power to the solenoid coil and initiating transfer back to Source N (or the preferred source).

Note: The K1 (NR) and K2 (ER) relays are energized for only 250 milliseconds to initiate transfer.

On 40–225 amp model KSS standard-transition switches, control contacts SCN and SCE control the amount of time that power is applied to the solenoid coil. The contacts open before the operating mechanism reaches Top Dead Center (TDC). Inertia carries the mechanism through TDC, and a spring in the solenoid assembly moves the mechanism into the Source E (or standby) position.

Model KSP programmed-transition models stop in the OFF position for a programmed length of time during transfer. The transfer-to-OFF sequence is controlled by the NR1 and ER1 relays on the programmed-transition interface board (PTIB).

The controller K1 and K2 relays and the PTIB relays are replaceable.

Note: Always check all wiring and connections before replacing parts.

The solenoid power circuits vary for different ATS models. The following sections describe and illustrate the transfer sequence for the different models.

Figure 5-3 explains the notation used in the solenoid operation diagrams in the following coil operation diagrams.

ATS1:	Trip switch, Normal *	NR, ER:	Controller relays. Energized for 250 milliseconds to initiate transfer.
AX:	Coil clearing switch, Normal *	NR1, ER1:	Programmed-transition interface board relays. *
BTS1:	Trip switch, Emergency *	SCN, SCE:	Coil control contacts (microswitches)
BX:	Coil clearing switch, Emergency *	SC:	Select coil *
CC:	Closing coil *	S1:	Bridge rectifier *
EA, EC:	Emergency source	TC:	Trip coil *
LS:	Line select switch *		
NA, NC:	Normal source		

Power through the coil circuit.

= closed contacts

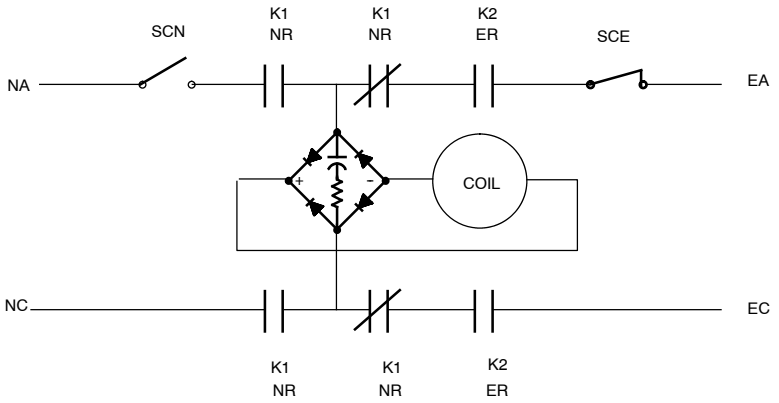
= open contacts

* Used on programmed-transition switch diagrams

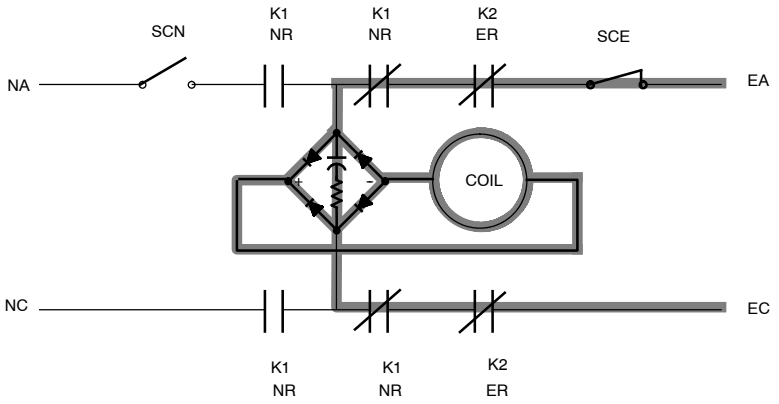
Figure 5-3 Legend for Solenoid Operation Diagrams

5.4.3 Solenoid Operation Diagrams, 40–225 Amp Model KSS Standard Transition Switches

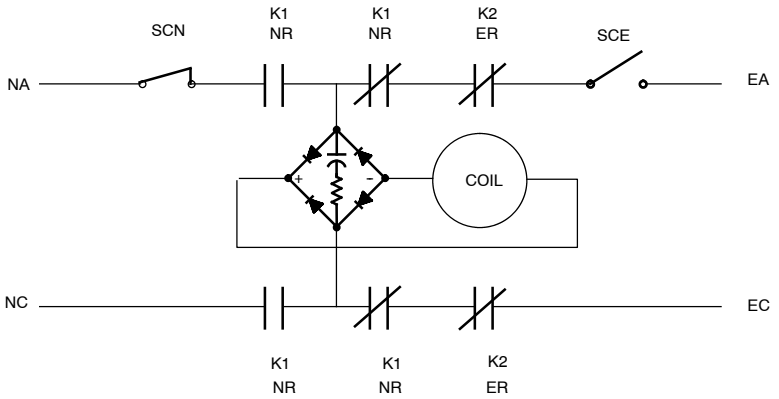
Source N position, Source N available. The solenoid coil is not energized.



Source N position, Source N lost. The coil is energized if Source E is available. The transfer switch is ready to transfer to Source E.



Source E position, Source E available. The solenoid coil is not energized.



Source E position, Source N available. The controller is calling for transfer to Source N. The coil is energized and the transfer switch will transfer to Source N.

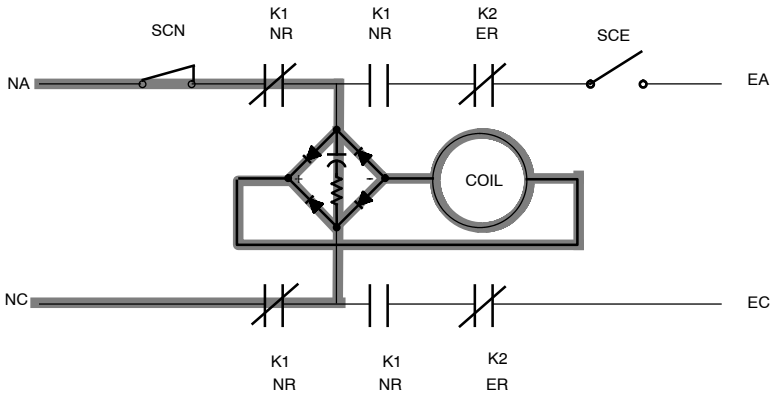
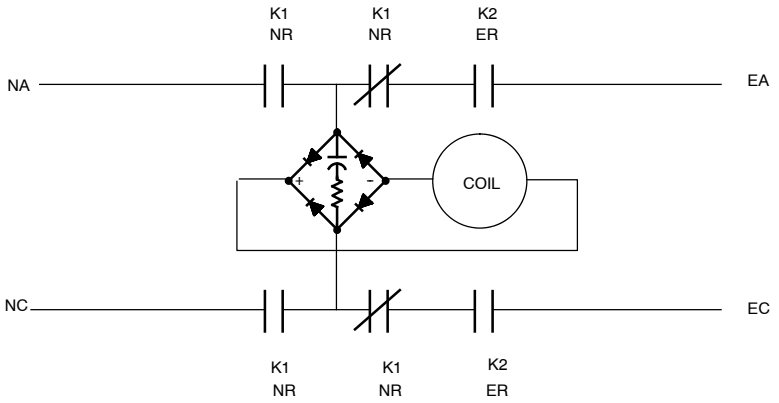


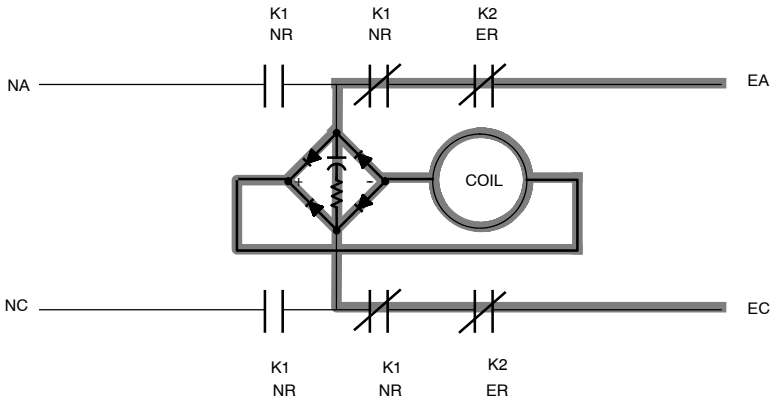
Figure 5-4 40–225 Amp Model KSS Standard-Transition Switches, Solenoid Operation

5.4.4 Solenoid Operation Diagrams, 400–600 Amp Model KSS Standard Transition Switches

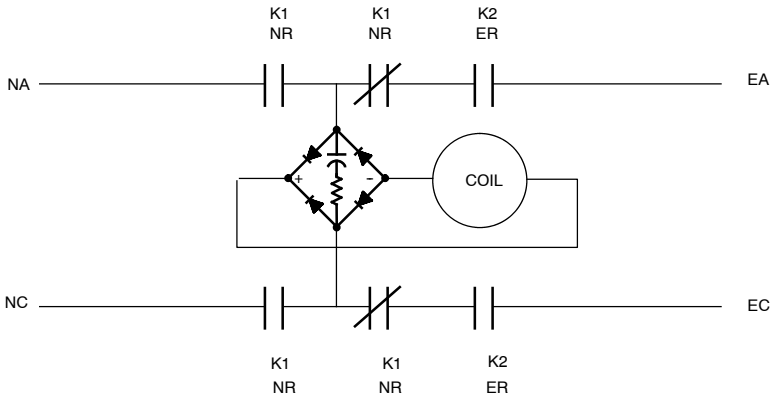
Source N position, Source N available. The solenoid coil is not energized.



Source N position, Source N lost. The coil is energized if Source E is available. The transfer switch is ready to transfer to Source E.



Source E position, Source E available. The solenoid coil is not energized.



Source E position, Source N available. The controller is calling for transfer to Source N. The coil is energized and the transfer switch will transfer to Source N.

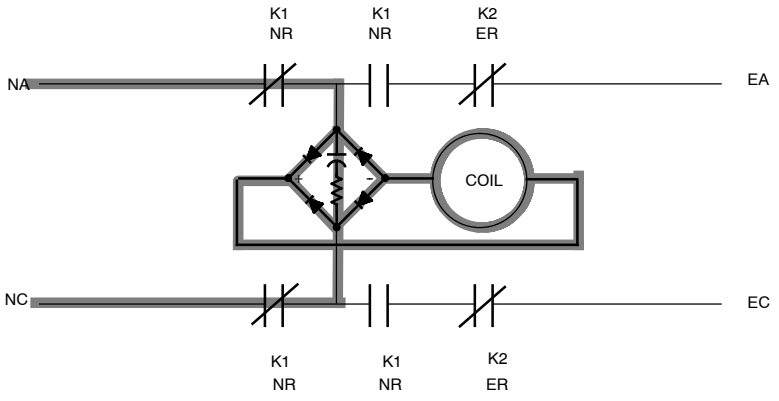


Figure 5-5 400–600 Amp Model KSS Standard-Transition Switches, Solenoid Operation

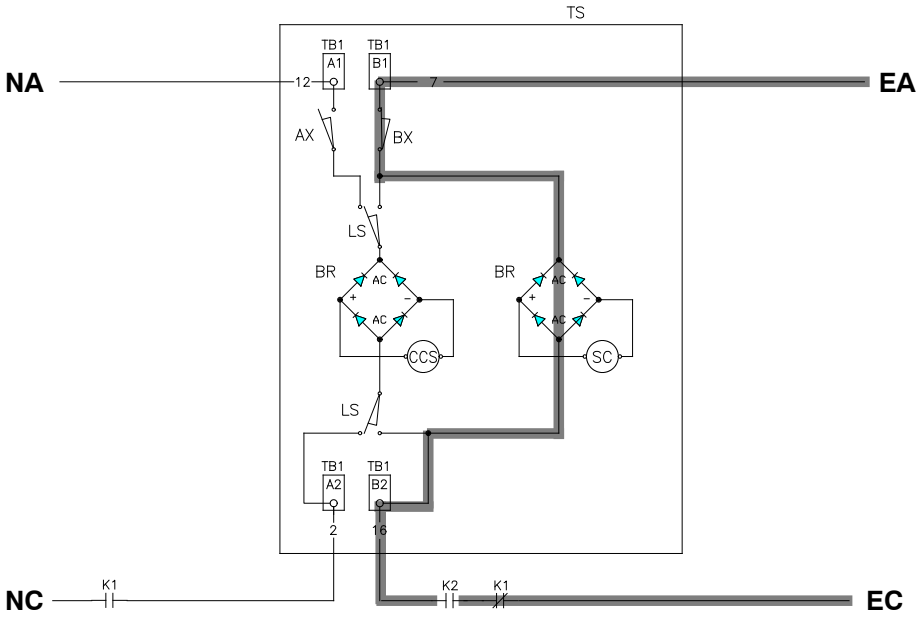
5.4.5 Solenoid Operation Diagrams, 800–1000 Amp Model KSS Standard Transition Switches

Transfer from Normal to Emergency

Contactor in Source N position; power is lost on N.

Power is available on E.

BX is closed.



K2 is pulsed (closed) for 250 ms. Select coil SC is energized.

Line select switch LS is energized and moves to supply closing coil solenoid CCS with current.

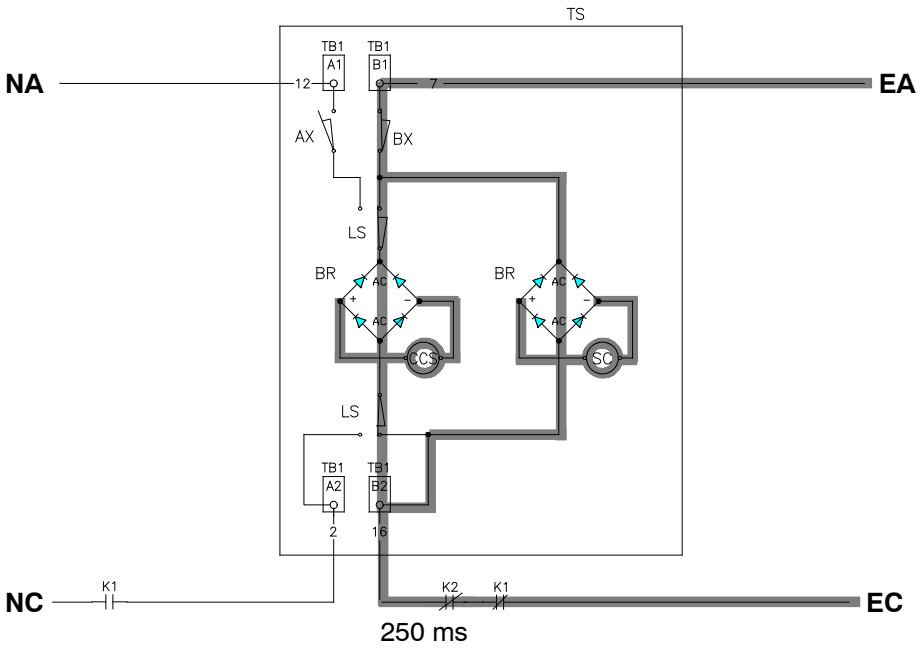


Figure 5-6 800–1000 Amp Model KSS Standard-Transition Switches, Transfer from Normal to Emergency, Steps 1 and 2

Coil clearing switch BX opens when contactor is in Emergency position.

LS returns to deenergized state.

Coil clearing switch AX closes.

Contactor remains in Emergency position.

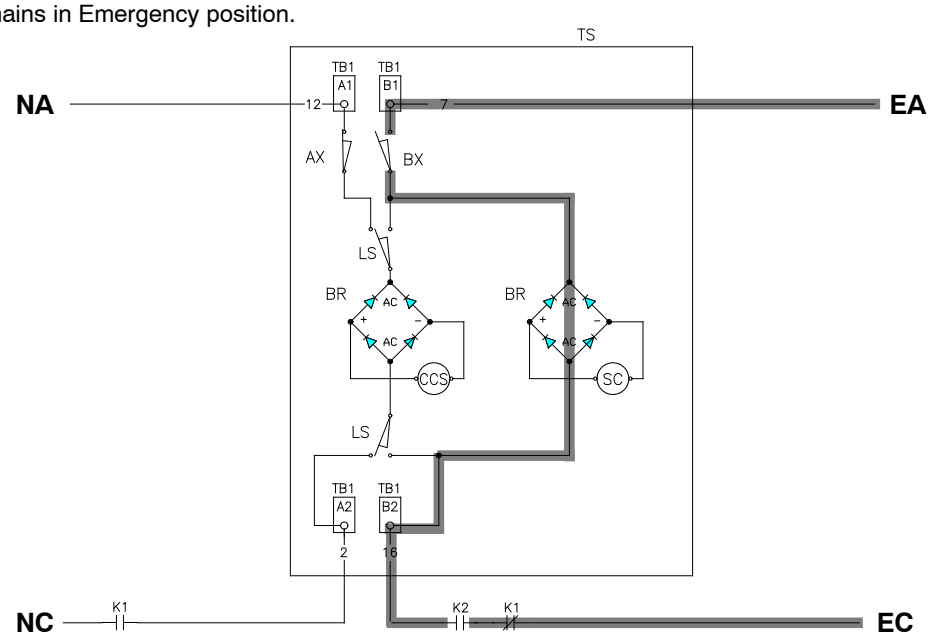


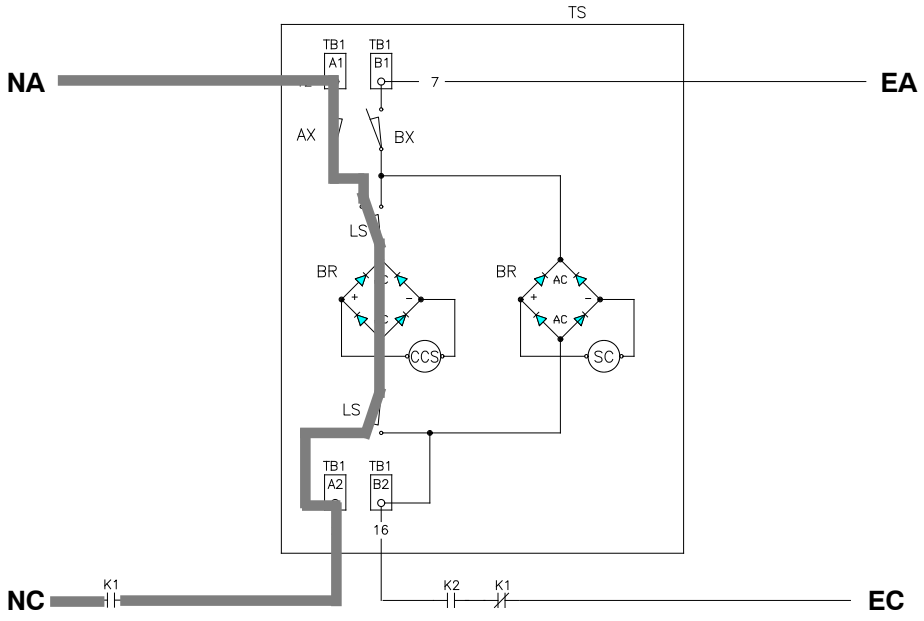
Figure 5-7 800–1000 Amp Model KSS Standard-Transition Switches, Transfer from Normal to Emergency, Step 3

Transfer from Emergency to Normal

Contactor is in Emergency position.

Power is available on N.

AX is closed.



K1 is pulsed for 250 ms.

CCS is supplied current from the Normal source.

Contactor moves to the Normal position.

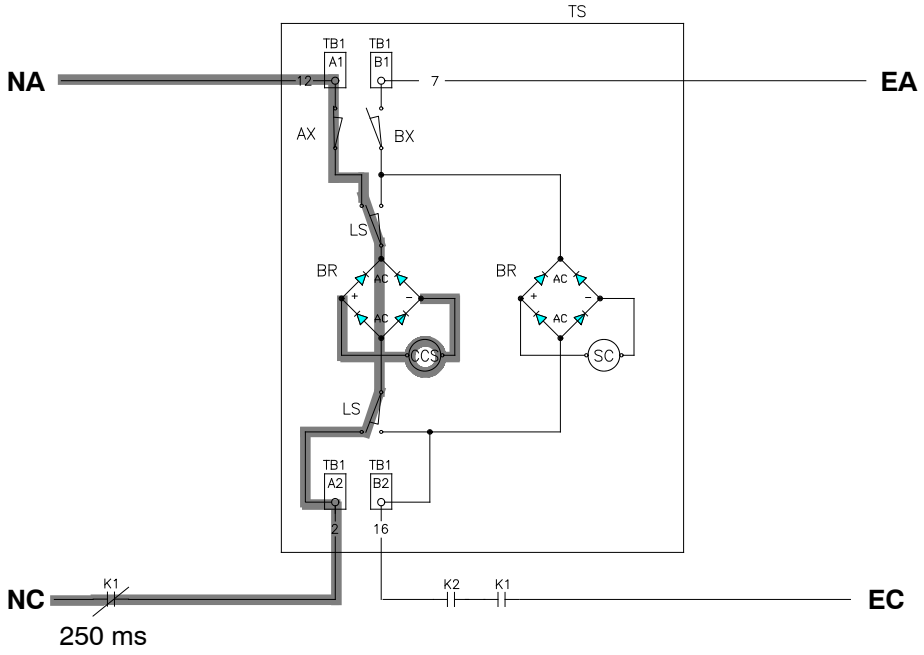


Figure 5-8 800–1000 Amp Model KSS Standard-Transition Switches, Transfer from Emergency to Normal, Steps 1 and 2

AX Opens when contactor is in the normal position.

Emergency coil clearing switch BX closes.

Contactor remains in Normal position.

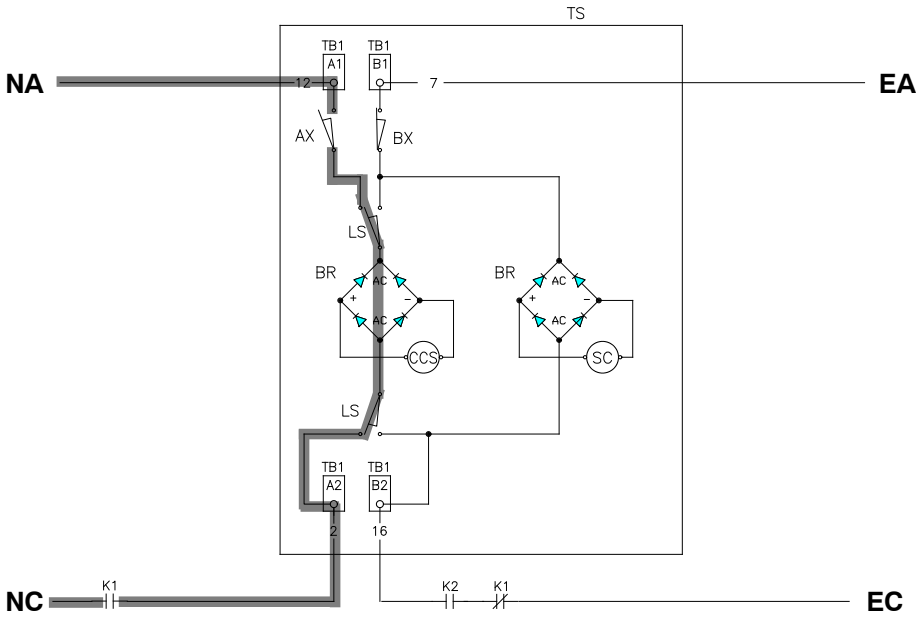


Figure 5-9 800–1000 Amp Model KSS Standard-Transition Switches, Transfer from Emergency to Normal, Step 3

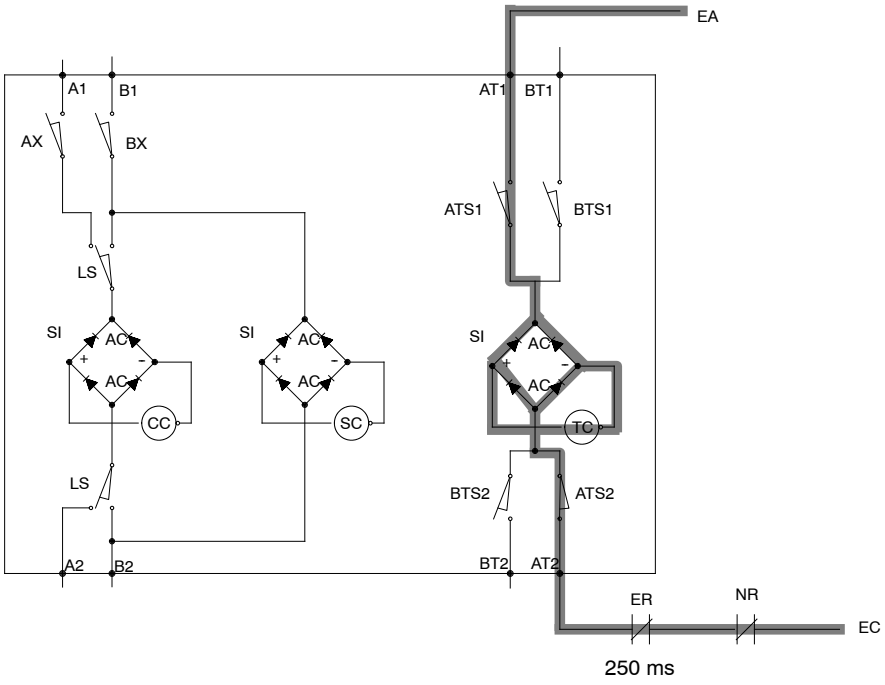
5.4.6 Solenoid Operation Diagrams, Model KSP Programmed-Transition Models

Normal to OFF

Source N position
Source N is lost
Emergency available

ER is pulsed for 250 ms to energize trip coil TC.

ATS1 AND ATS2:
Closed in Normal
Open in OFF



OFF to Emergency

ER1 is pulsed for 250 ms to energize select coil SC. SC picks up LS, which energizes closing coil CC

BX:
Closed in OFF
Open in Emergency

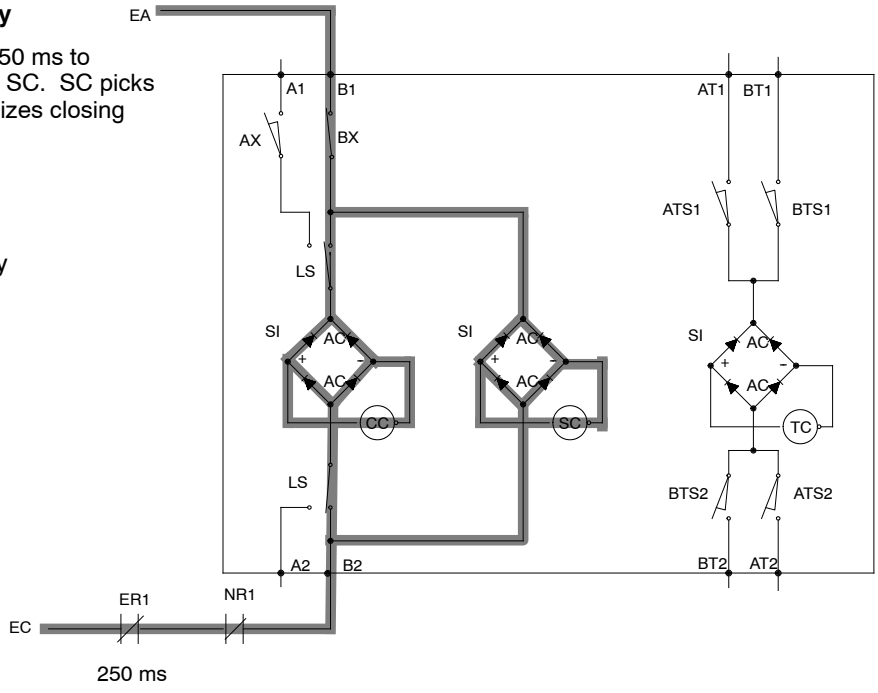
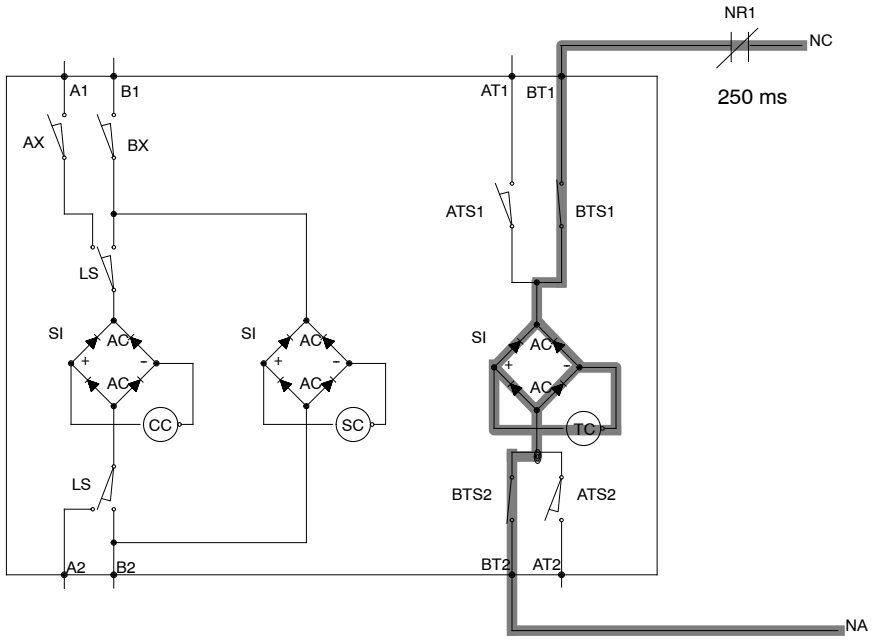


Figure 5-10 Model KSP Programmed-Transition Switches, Transfer from Normal to Emergency

Emergency to OFF

NR1 is pulsed for 250 ms to energize trip coil TC.

BTS1 and BTS2: Closed in Emergency Open in OFF



OFF to Normal

NR is pulsed for 250 ms to energize closing coil CC.

AX is closed in OFF.

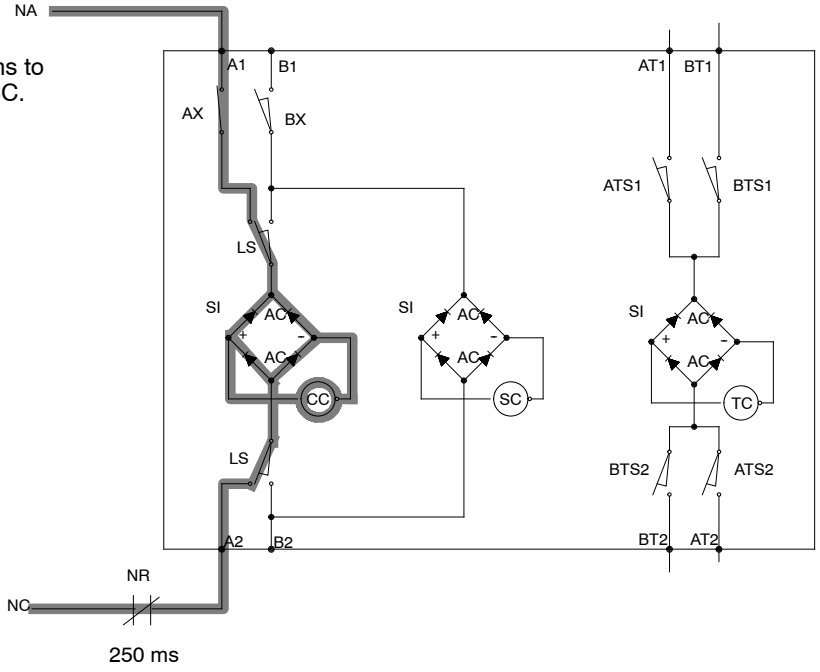
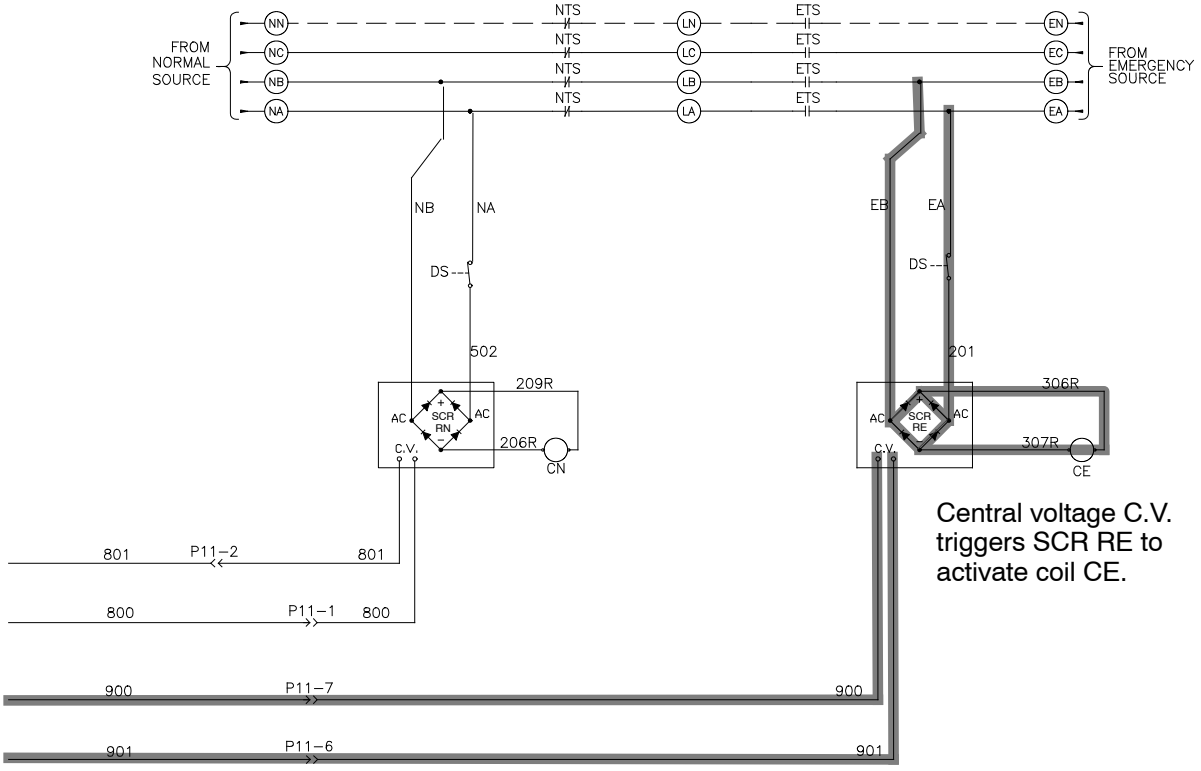


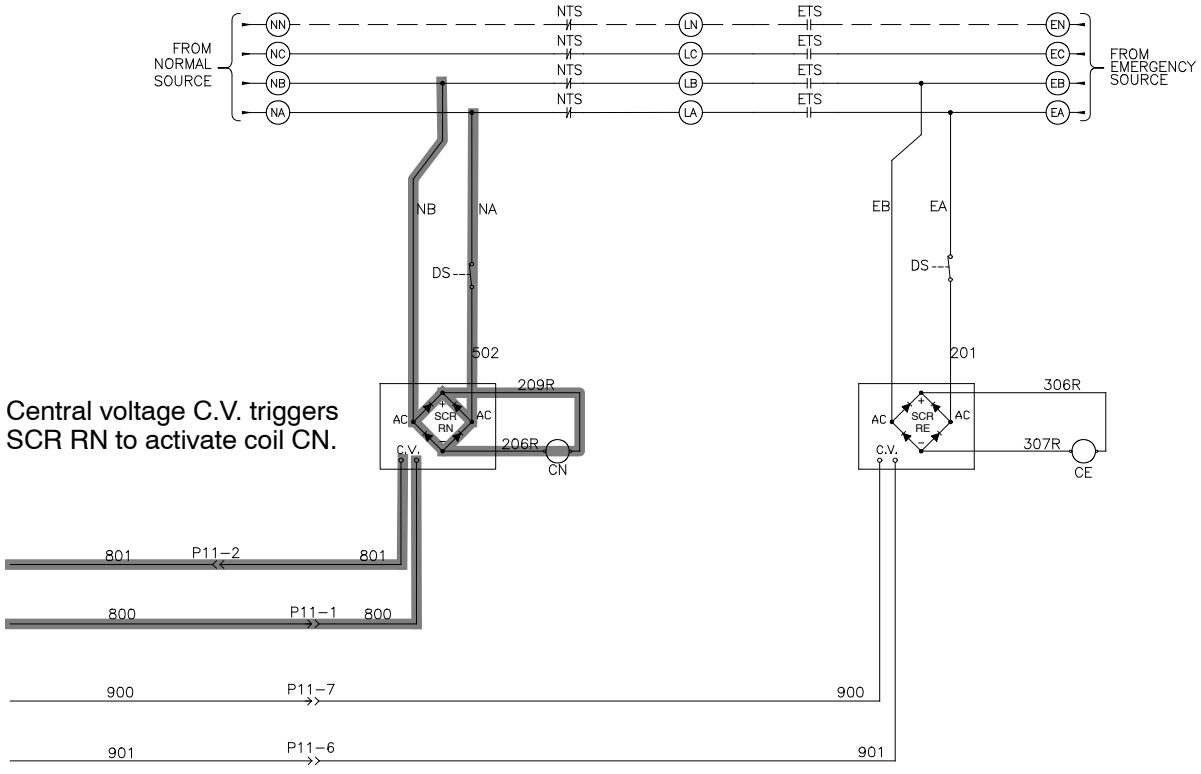
Figure 5-11 Model KSP Programmed-Transition Switches, Transfer from Emergency to Normal

5.4.7 Solenoid Operation Diagrams, Model KGS Open Transition Bypass/Isolation Switches

Normal to Emergency



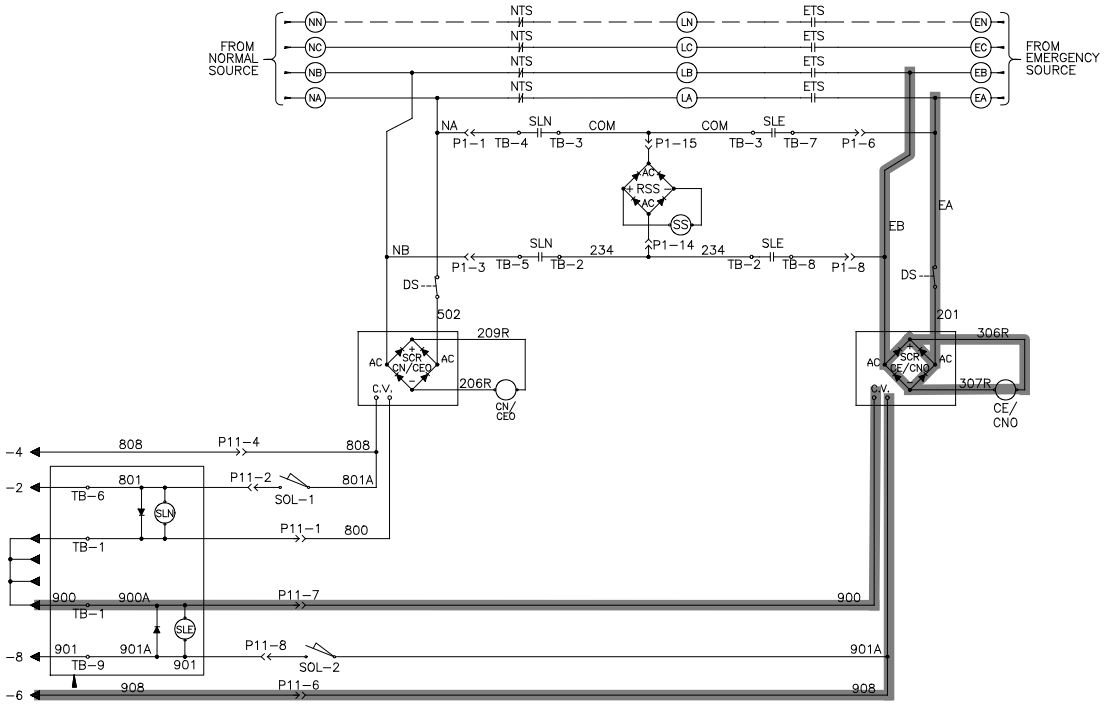
Emergency to Normal



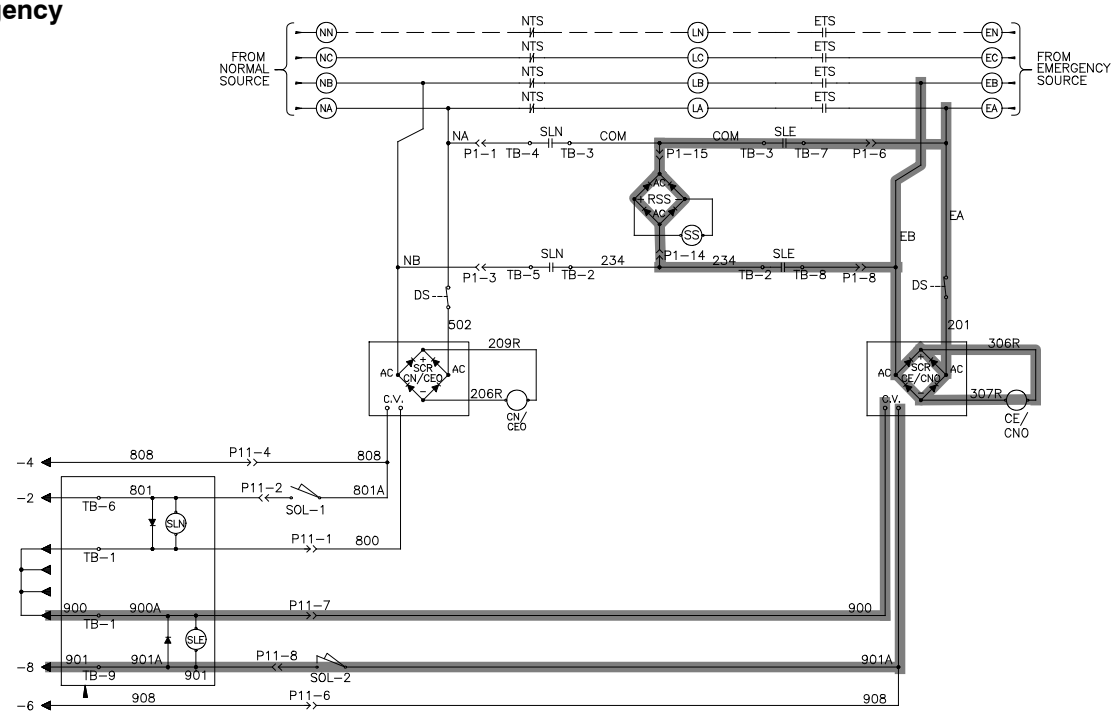
GM46246

5.4.8 Solenoid Operation Diagrams, 150–400 Amp Model KGP Programmed-Transition Bypass/Isolation Switches

Normal to Off



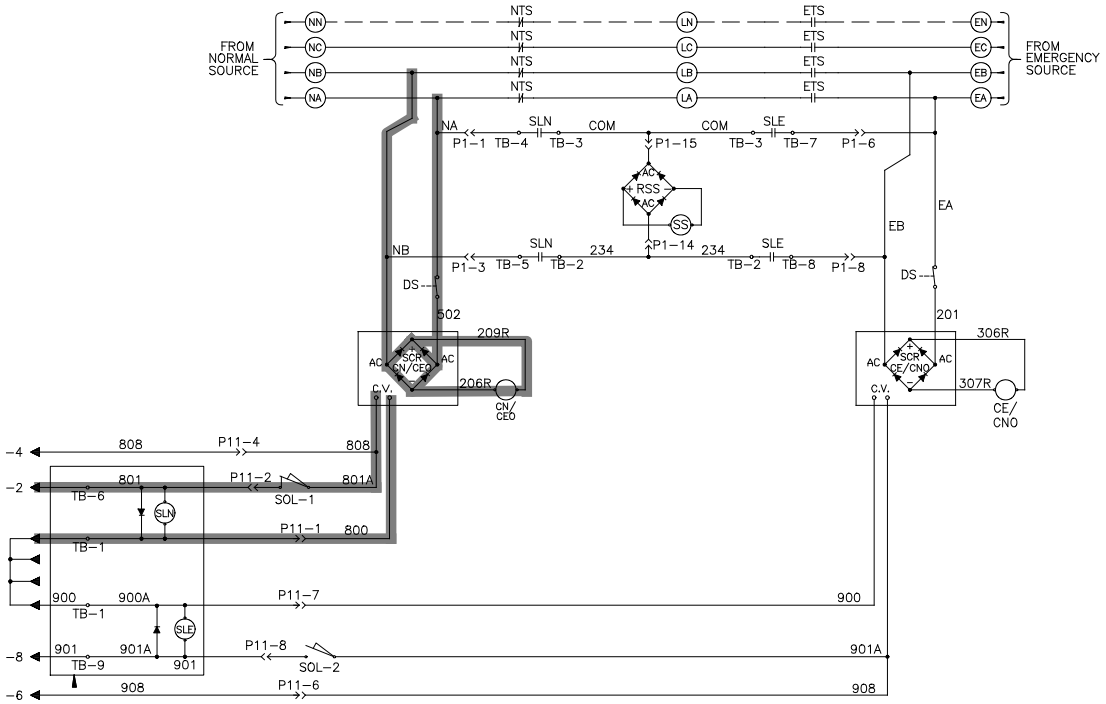
Off to Emergency



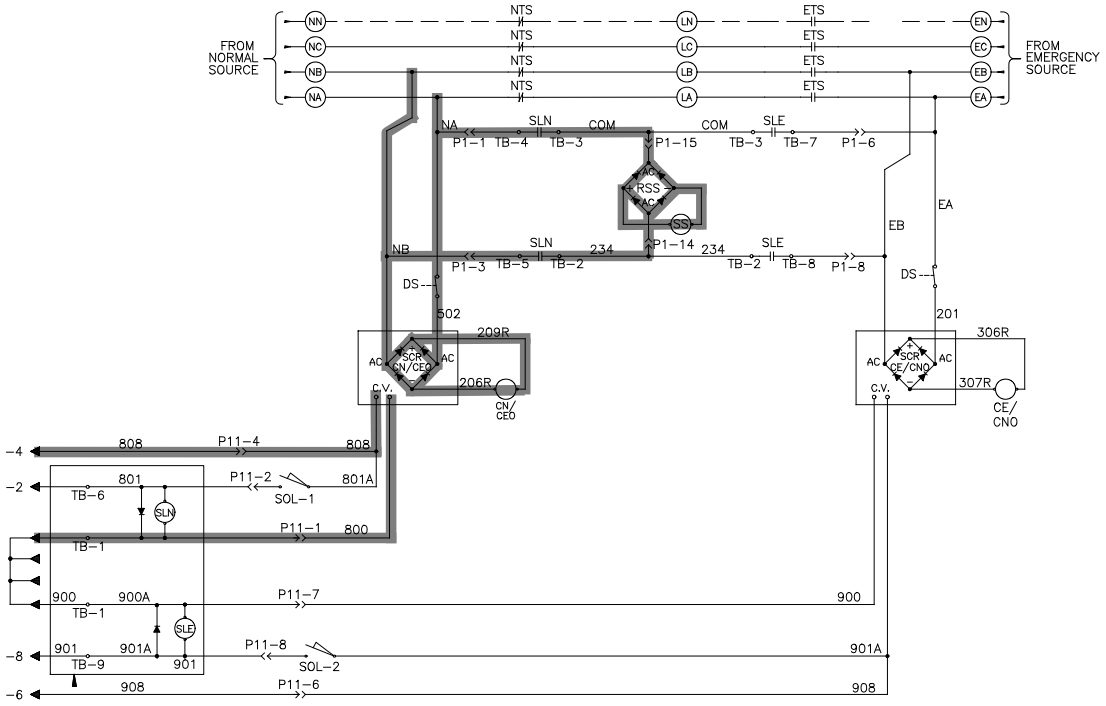
GM46248

Solenoid Operation Diagrams, 150–400 Amp Model KGP Programmed-Transition Bypass/Isolation Switches, continued

Emergency to Off



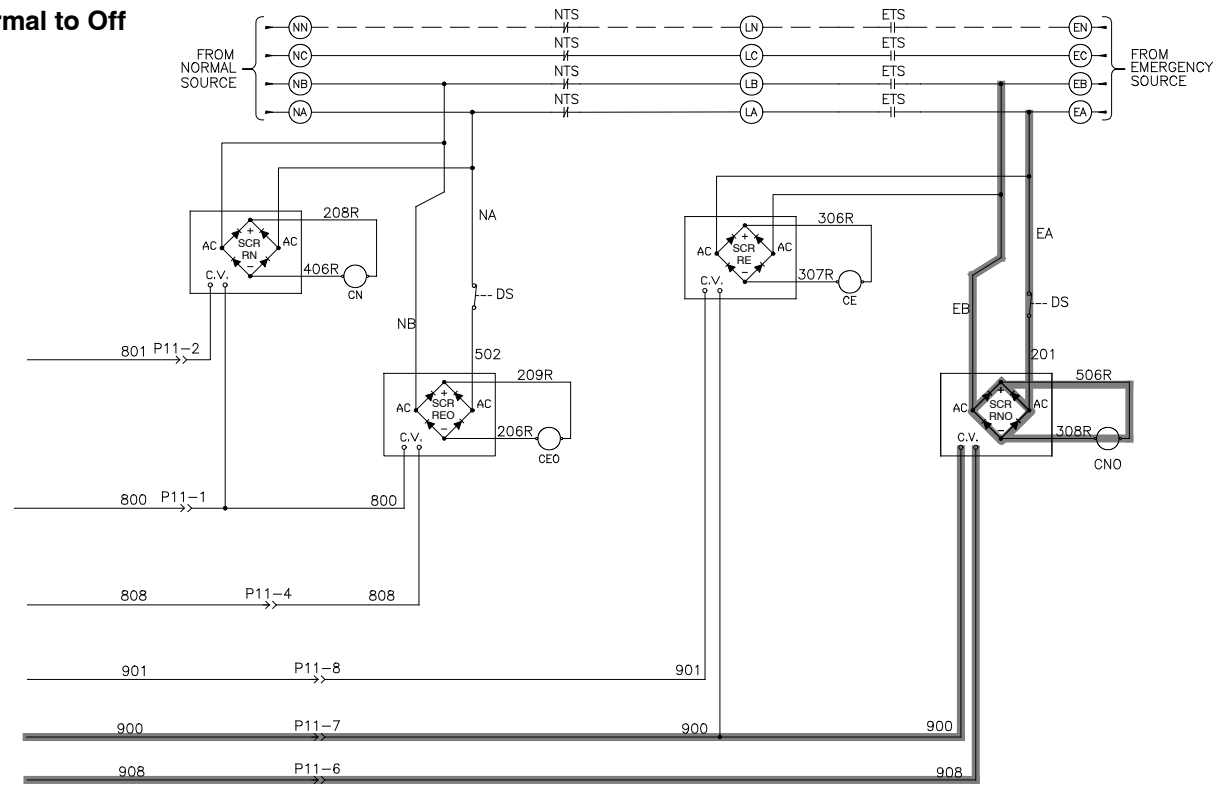
Off to Normal



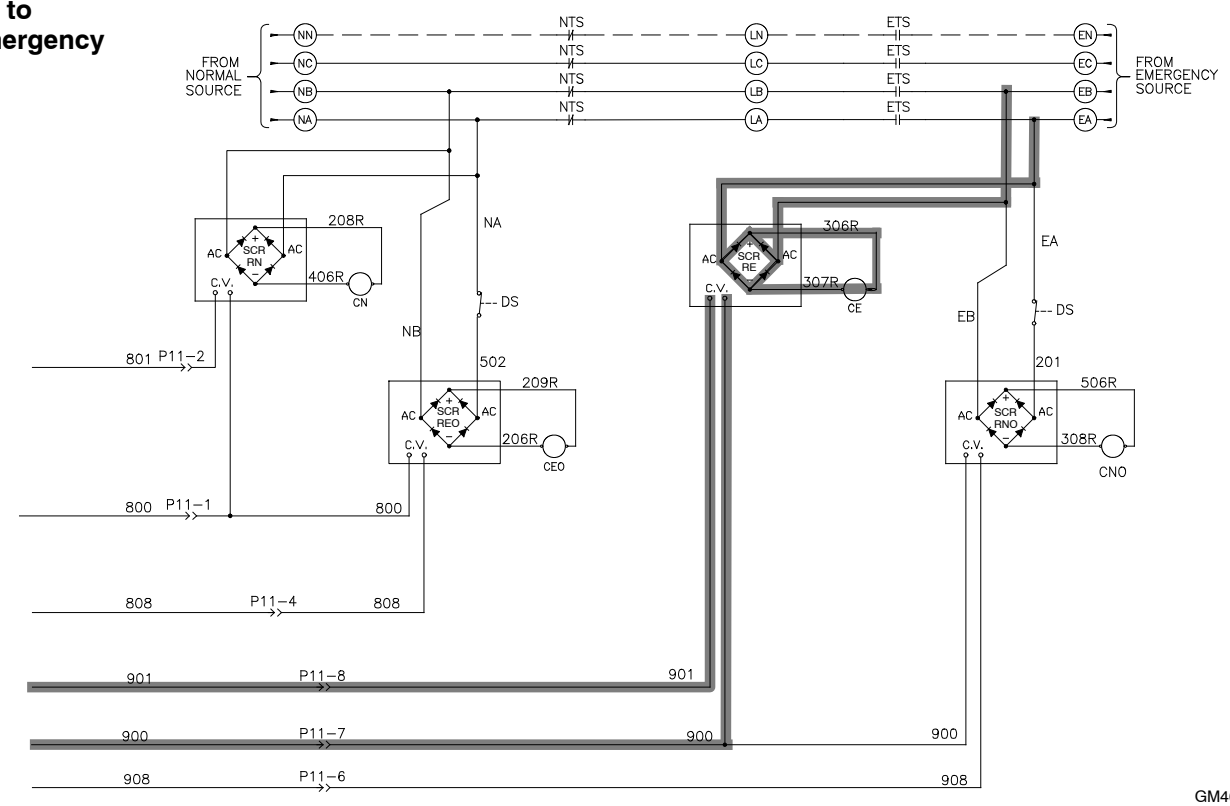
GM46248

5.4.9 Solenoid Operation Diagrams, 600–3000 Amp Model KGP Programmed-Transition Bypass/Isolation Switches

Normal to Off



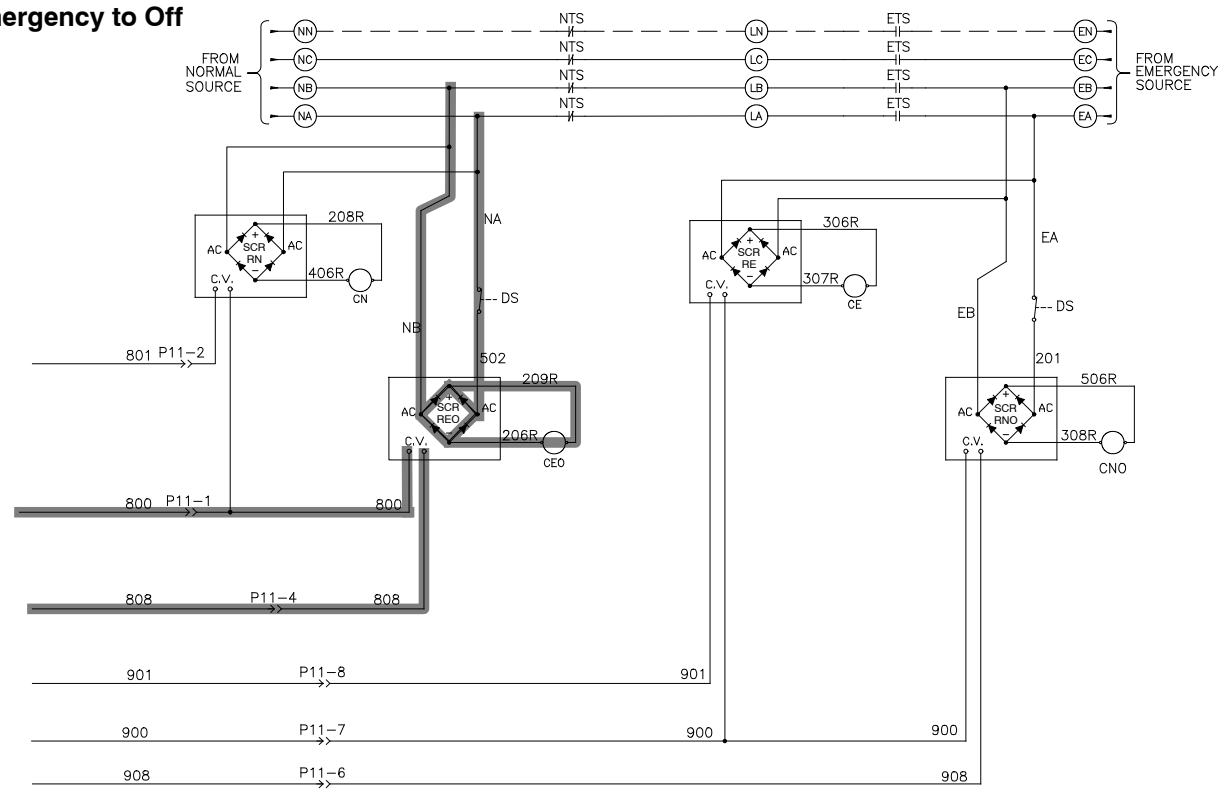
Off to Emergency



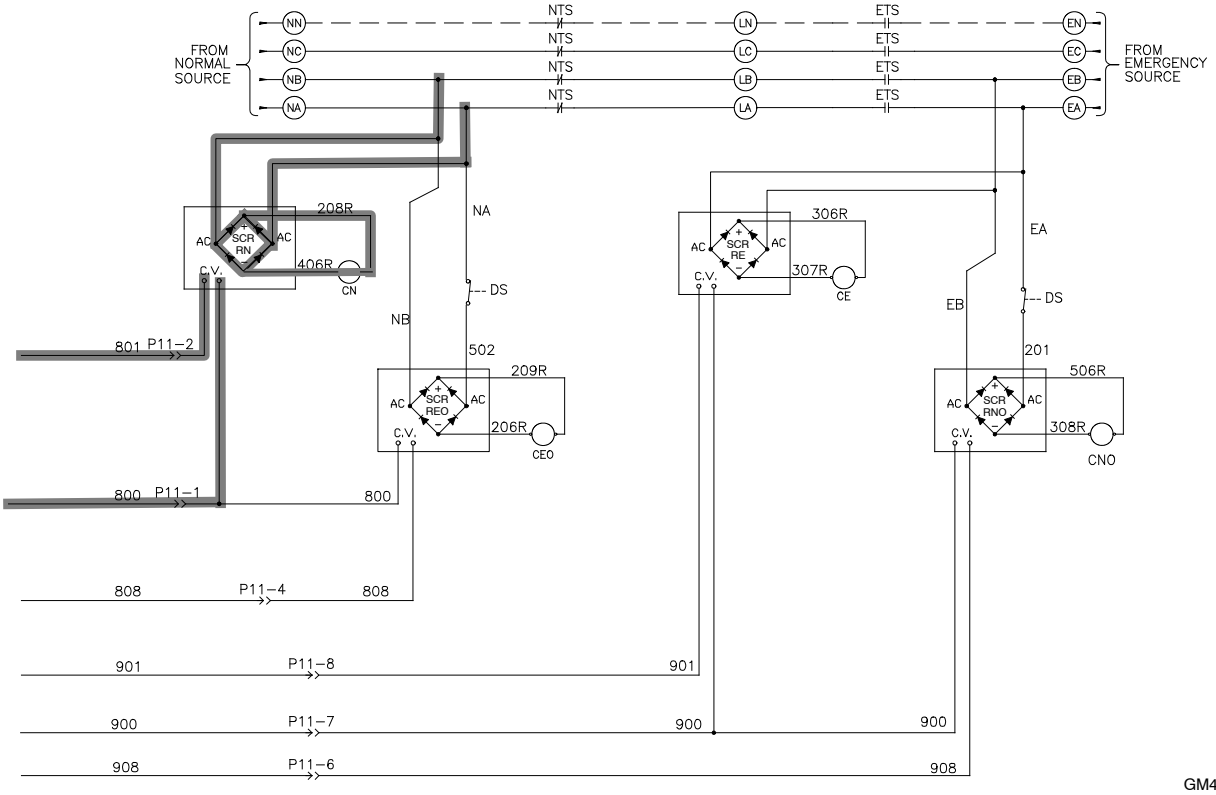
GM46249

Solenoid Operation Diagrams, 600–3000 Amp Model KGP Programmed-Transition Bypass/Isolation Switches, Continued

Emergency to Off



Off to Normal



GM46249

Notes

6.1 User Interface Panel

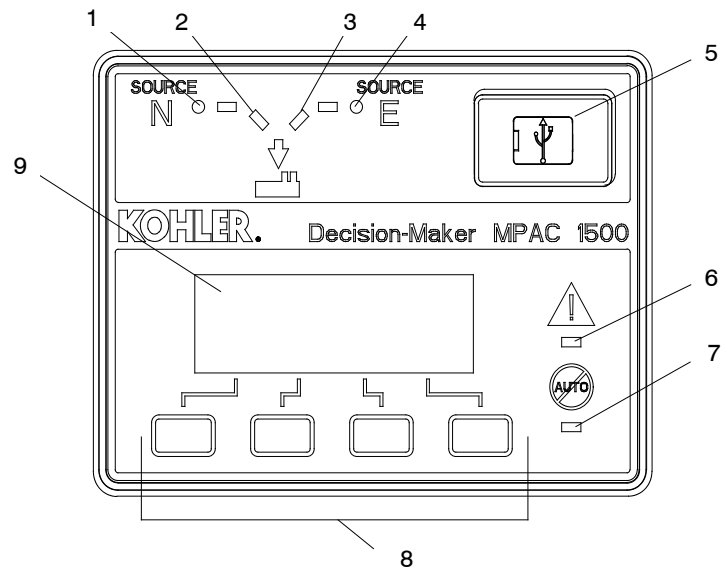
The user interface panel is located on the transfer switch door. Figure 6-1 and Figure 6-2 show the user interface panels for the Decision-Maker® MPAC 1200/1500 and MPAC 750 controllers.

6.1.1 Display

The Decision-Maker® MPAC 750 controller has no display. The four-line display on the Decision-Maker® MPAC 1200 and MPAC 1500 controllers indicates transfer switch status and setup, including the following:

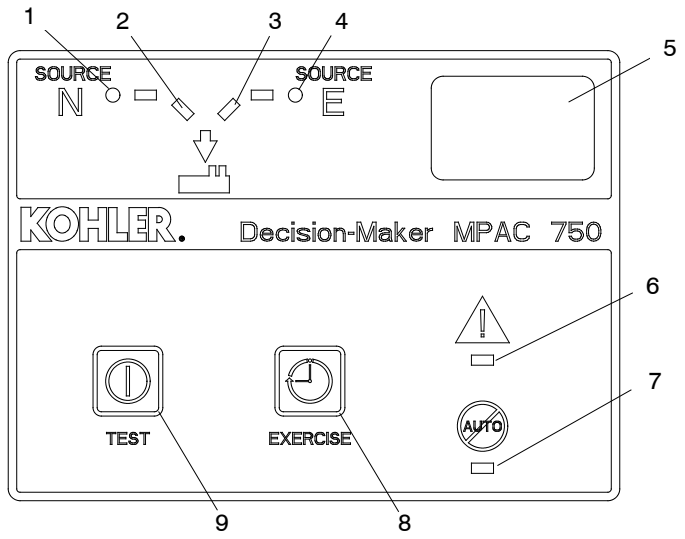
- System status
- Faults and warnings
- Active time delays
- Source voltages
- Source frequency (Hz)
- Current (amps)
- Source setup information
- Time and date
- Time and date of next scheduled exercise

The display also identifies the pushbutton functions, which can change from screen-to-screen.



1. Source N Available LED
2. Source N Position LED
3. Source E Position LED
4. Source E Available LED
5. USB port for SiteTech™ connection
6. System Alert LED
7. Not in Auto LED
8. Pushbuttons (4)
9. Display

Figure 6-1 User Interface Panel, MPAC 1200/1500 Controller



1. Source N Available LED
2. Source N Position LED
3. Source E Position LED
4. Source E Available LED
5. USB port location
6. System Alert LED
7. Not in Auto LED
8. Exercise button
9. Test button

Figure 6-2 User Interface, MPAC 750 Controller

6.1.2 LED Indicators

LEDs on the user interface indicate contactor position, source availability, faults, and other conditions. Figure 6-3 describes the functions of the LED indicators. See Section 4.9 for more information about warnings and faults.

LED Indicator	Condition
Source N Available, Green	Source N is available.
Source E Available, Red	Source E is available.
Position A, Green	Contactor is in Normal position.
Position B, Red	Contactor is in Emergency position.
System Alert, Red	Fault. Identify and correct the cause of the fault condition, then reset faults at the controller. See Section 4.9.
	Input active: Low Battery Voltage or Remote Common Alarm.
Not in Auto, Red	ATS is not set for automatic operation or a load shed (forced transfer to OFF) sequence is active.
	Flashes for manual transfer waiting.
	Input active: Inhibit Transfer or Forced Transfer to OFF.

Figure 6-3 User Interface LED Indicators

6.1.3 Pushbuttons

The MPAC 750 controller has Test and Exercise pushbuttons. See the controller operation manual for instructions.

The MPAC 1200 and MPAC 1500 controller user interface panels have four pushbuttons below the display. Pushbutton functions are shown above each button in the last line of the display and can change from screen-to-screen.

The pushbutton functions are defined in Figure 6-5. See the controller operation manual for instructions to use the pushbuttons to navigate the controller menus and change settings.

6.1.4 Lamp Test

The lamp test can be preformed on MPAC 1200 and MPAC 1500 controllers. To test the LEDs on the controller's user interface, go to the Main screen. Press the down arrow button once, then press the Lamp Test button and verify that all 6 LEDs on the user interface illuminate. See Figure 6-4.

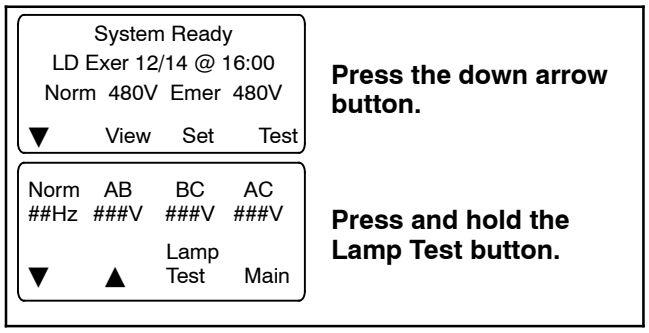
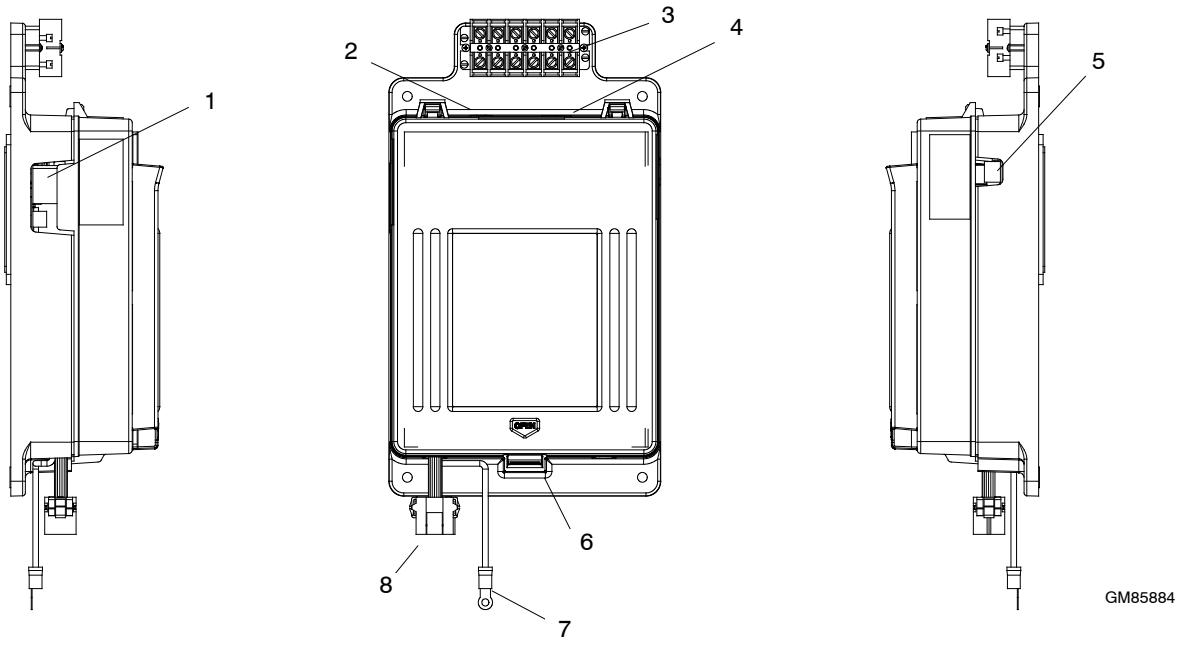


Figure 6-4 Lamp Test

▼	Down arrow (closed). Step down to the next screen or scroll through a list.
▲	Up arrow (closed). Step back to the previous screen.
▶	Right arrow (closed). Move to the next submenu.
△	Up arrow (open). Increases the selected numerical value.
▽	Down arrow (open). Decreases the selected numerical value.
▷	Right arrow (open). Steps to the next digit in a selected numerical value.
Back	Steps back to the previous screen or submenu.
End Delay	Ends the current time delay.
End Test	Ends an active test sequence. See Section 1.2.3.
OK	Enters the displayed numerical value (password or setting).
Main	Returns to the main screen.
Next	Steps to the next parameter in an item with multiple settings (for example, in Exerciser Setup).
Reset	Reset the fault condition shown on the display, or reset an accessory module after connection.
Save	Saves settings shown on the display.
Set	From the main screen, moves to the first setup screen.
Start	From the Test screen, starts the test sequence.
Test	From the main screen, moves to the test sequence screens.
View	From the main screen, moves to the first view screen.

Figure 6-5 MPAC 1200/1500 Pushbutton Functions

6.2 Controller Connections



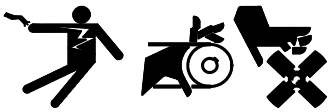
1. Standard input/output connection
2. RS-485 connection TB2
3. Connection for optional current sensing kit
4. Optional I/O module connection P16
5. Access openings to optional RJ-45 connector
6. Latch
7. Ground wire
8. Contactor harness connection

Figure 6-6 Controller

6.3 Controller Power

6.3.1 Controller Disconnect Switch

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(Decision-Maker® 3+ and 550 Generator Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

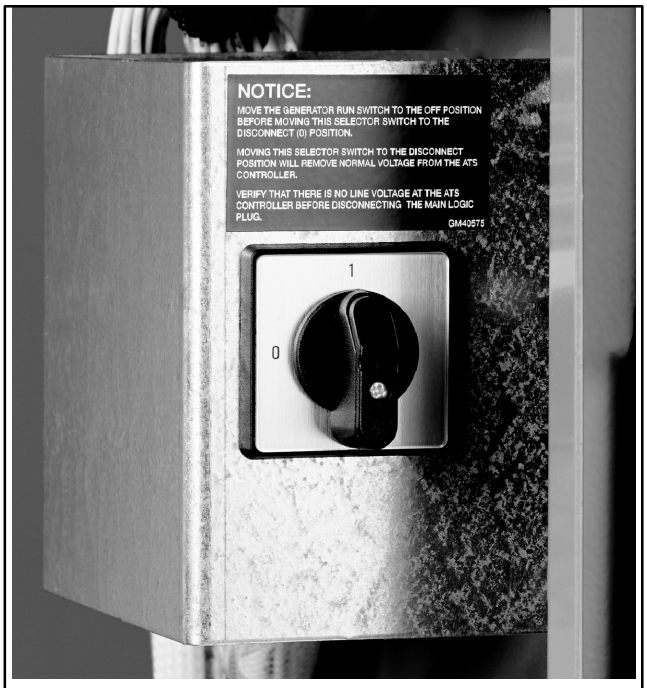
The controller disconnect switch allows disconnection of the power to the controller during maintenance and service. See Figure 6-7.

Note: Disable the generator set before using the controller disconnect switch to disconnect power to the ATS controls.

Disconnecting power to the controls will cause the ATS to send an engine start signal to the generator set. Prevent the generator set from starting by pressing the OFF button on the generator set controller and disconnecting the battery charger and battery. Refer to the generator set operation manual for specific instructions.

The switch has two positions, auto (I) and disconnect (0). Move the controller disconnect switch to the 0 position to disconnect power to the ATS controller. After maintenance or service, move the switch to the I position to reconnect power. Follow the instructions in the generator set documentation to re-enable the generator set.

The controller disconnect switch is not available for service entrance models, which are equipped with a control circuit isolation switch as standard equipment.



I = Connect

0 = Disconnect

Figure 6-7 Controller Disconnect Switch

6.3.2 Controller Power Supply

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

The controller circuitry converts AC line voltage to DC voltage. Line voltage or DC voltage from an external battery connected through an External Battery Supply Module (EBSM) will cause LED1 on the controller's power board to light. See Figure 6-8 for the LED location.

- If the Normal or Emergency source is available but the controller display is dark, check LED1 on the controller power board. LED1 lights when voltage is available for the controller. See Figure 6-8.
- Verify that the transfer switch wiring harness is connected to the controller. See Figure 6-9.
- If the transfer switch is equipped with a controller disconnect switch. verify that the switch is in the Connect position. See Section 6.3.1.
- If the transfer switch is equipped with an External Battery Supply Module (EBSM), disconnect the I/O module assembly at connector P16 on the controller to remove the external battery supply. Then check LED1 with the Normal or Emergency source available.
- If LED1 does not light when the Normal or Emergency source is available, check for line voltage to the controller using the following procedure.

Check for Line Voltage to the Controller

1. Disconnect power to the transfer switch by opening circuit breakers or switches.
2. Disconnect the transfer switch wiring harness from the controller at the 24-pin connector. See Figure 6-9.
3. Reapply power to the transfer switch.
4. Check for voltage across the wiring harness pins. Observe all Safety Precautions when checking the voltage.

Models KSS and KSP:

a. If Source N is available, check for line voltage across pins 4 and 12 of the transfer switch wiring harness connector.

b. If Source E is powering the transfer switch, check for line voltage across pins 6 and 7 of the connector.

Models KGS and KGP:

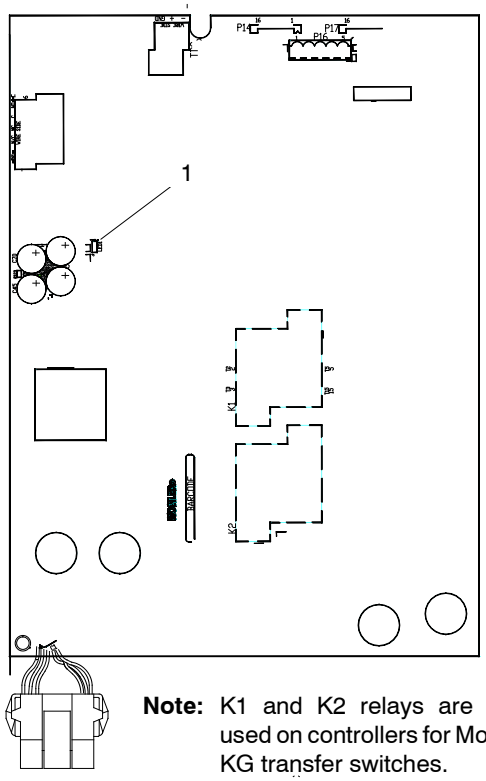
c. If Source N is available, check for line voltage across pins 1 and 3 of the transfer switch wiring harness connector P1.

d. If Source E is powering the transfer switch, check for line voltage across pins 6 and 8 of connector P1.

If there is no power to the pins checked in step 4, check the wiring harness continuity. Replace the harness if necessary.

If there is power to the pins checked in step 4 but LED1 on the power board does not light when power is connected, replace the controller.

Note: Model KGS/KGP transfer switches use a different controller than other models with MPAC 1500 controls. Refer to Parts Catalog TP-6433 for the correct part numbers.



Note: K1 and K2 relays are not used on controllers for Model KG transfer switches.

GM86131

1. LED1 Power indicator

Figure 6-8 LED1 Location on MPAC Controller Circuit Board

1. Transfer switch harness connection to controls, controller connector P1

Figure 6-9 Transfer Switch Harness Connection to Control Board, Typical

6.4 System Test, MPAC 1200 and 1500 Controllers

Use the system test feature to:

- Start and run the generator set, or
- Simulate a preferred source failure, resulting in a transfer to the standby source.

On MPAC 1200 and 1500 controllers, a password is required to activate the system test, ensuring that only authorized personnel can start a test. Pressing the Test pushbutton signals the controller to initiate the system test sequence.

An Auto-Loaded test executes for a set length of time and then ends automatically. Press the End Test pushbutton to end a Loaded or Unloaded test. Time delays will execute as programmed after the end test button is pressed. Pressing the End Delay button will end the currently displayed time delay.

To check the source voltage and frequency while a test is running, press the Main button. Press the Test button to return to the test sequence screens.

During a system test, if the emergency source becomes unavailable based on its preset operating parameters, the fail to acquire standby signal is indicated immediately, and the test is terminated. If the contactor is in the standby position, it transfers immediately to the preferred position.

6.4.1 Unloaded System Test

When an unloaded test is initiated, the controller immediately signals the generator to start, without waiting for time delay engine start to timeout. The contactor does not change position during an unloaded test, but if the normal source should fail, the contactor will transfer to the emergency source. The unloaded test feature will be available only with the Util-Genset and Genset-Genset modes of operation.

6.4.2 Loaded System Test

A loaded test actually simulates a preferred source failure, except that the engine start time delay is bypassed. The generator set is signaled to start immediately upon test activation. Load control signals are issued prior to transfer with their associated time delays. Since the loaded test transfer will be between two live sources, the in-phase monitor will be activated if it is enabled. If the preferred source is lost during a loaded test with the contactor in the standby position, the test will continue to be active, even on restoration of preferred. If the standby source is lost and the preferred source is available, the test will be terminated, and the transfer switch will immediately transfer to the preferred source position, bypassing all time delays except the off-position requirements in a programmed-transition system.

When a loaded test is terminated normally, the retransfer sequence will be as though the preferred source has been restored after a failure. All time delays will be executed and an in-phase transfer will occur if enabled. The loaded test feature will be available with the Util-Genset, Util-Util and Genset-Genset modes of operation.

6.4.3 Auto-Loaded System Test

The auto-loaded test feature is a timed loaded test. The auto-loaded time delay determines how long after the transfer to standby to terminate the test and transfer back to the preferred source. The time is defaulted to 30 minutes and can be adjusted from 1 minute to 60 minutes.

6.4.4 Test Procedure

Use the following procedure to run a test to check the transfer switch operation. Watch the LEDs on the controller's user interface as the time delays run and Source E becomes available when the generator set starts. For a loaded test, watch the position LEDs to verify that the ATS transfers the load.

The test sequence simulates a loss of the normal source, starts the generator set, and transfers the load to the emergency source (loaded test), executing all time delays that are set up to operate during a loss of the normal source. When the test is ended in step 8 of the procedure, the transfer switch transfers the load back to the normal source and removes the engine start signal, executing all programmed time delays.

Refer to Section 1 for the test sequence of operation without and with load.

Note: If the standby source fails during a test, the ATS will immediately attempt to transfer to the preferred source.

Check the preferred source selection. The test procedure assumes that Source N is the preferred source.

If the transfer switch is equipped with a supervised transfer switch, verify that it is set to the Auto position.

Note: Close and lock the enclosure door before starting the test procedure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Automatic Operation Test Procedure

1. Check the controller LED indicators to verify that the Position N and Source N Available indicators are lit.

2. Verify that the generator set master switch is in the AUTO position.

3. Refer to Figure 6-10. From the main screen, press the Test button. Enter the test password when prompted and press OK.

4. Press the down arrow button to display Type of Test Loaded.

5. Press the Start button.

6. Verify that the generator set starts and the Source E Available LED lights.

7. Verify that the switch transfers the load to Source E.

   a. Open-Transition Models: After the preferred-to-standby time delay, verify that the Position N LED goes out and the Position E LED lights, indicating that the switch has transferred the load to Source E.

   b. Programmed-Transition Models: After the preferred-to-off time delay, verify that the Position N LED goes out. After the off-to-standby time delay, check that the Position E LED lights, indicating that the switch has transferred the load to Source E.

8. Press the End Test button.

9. Verify that the switch transfers the load back to Source N.

   a. Open-Transition Models: After the standby-to-preferred time delay, verify that the Position E LED goes out and the Position N LED lights, indicating that the switch has transferred the load to Source N.

   b. Programmed-Transition Models: After the standby-to-off time delay, verify that the Position E LED goes out. After the off-to-preferred time delay, check that the Position N LED lights, indicating that the switch has transferred the load to Source N.

   Note: The generator set may have an engine cooldown time delay that causes the generator set engine to run after the transfer switch engine start signal is removed.

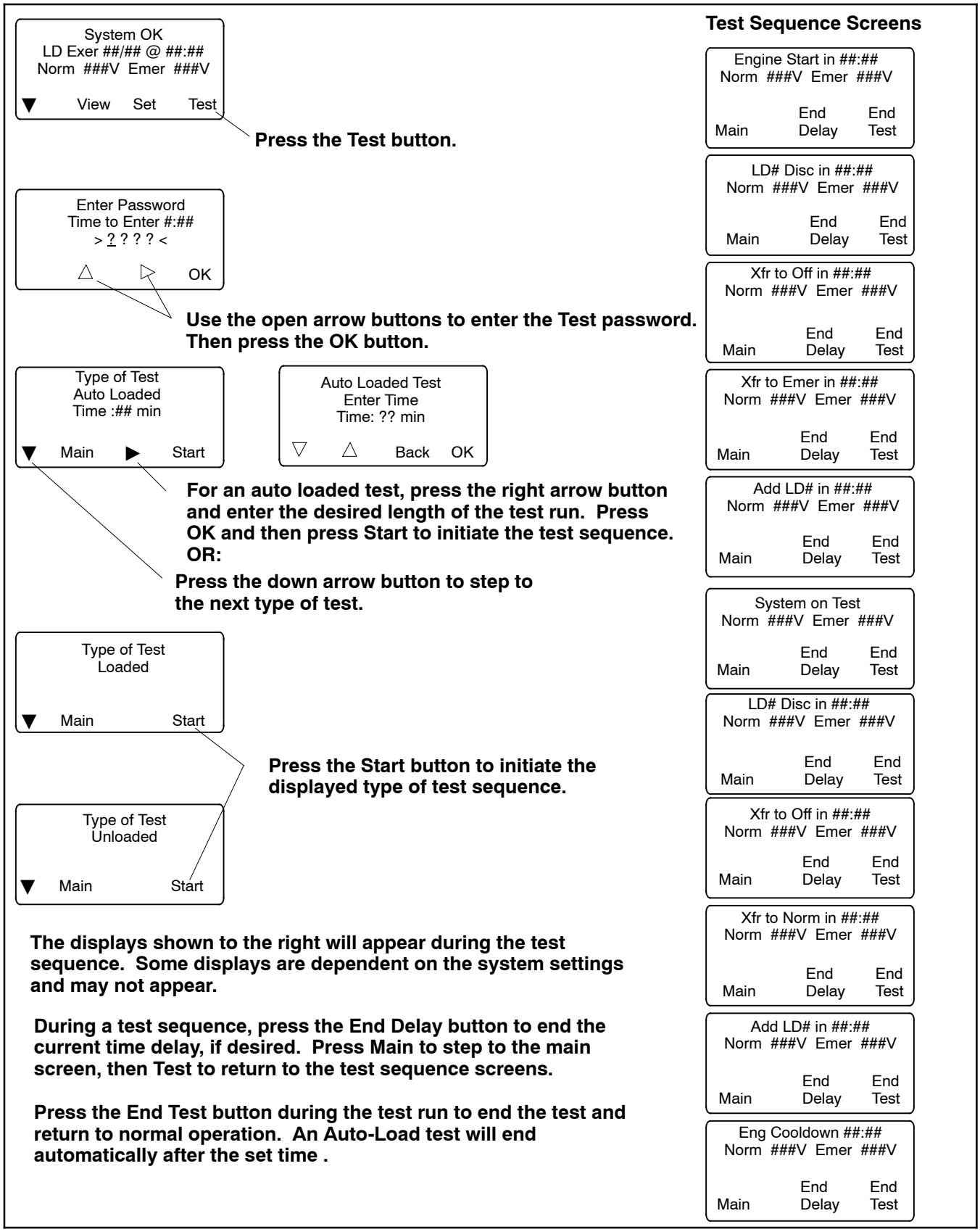


Figure 6-10 Test Sequence Screens, MPAC 1200/1500 controllers

6.5 Test, MPAC 750 Controller

Use the Test button to:

- Start and run the generator set (unloaded test).
- Simulate a Source N failure, resulting in a transfer to Source E (loaded test).

If the emergency source is lost during a system test, the test is terminated. If the contactor is in the standby position, it transfers immediately to the preferred position.

Refer to Section 1 for the test sequence of operation without and with load.

6.5.1 Unloaded System Test

Press and hold the Test button for 3–5 seconds to start an unloaded test. The generator set will start without waiting for the engine start time delay. The load is not transferred to the generator set. The generator runs until the test is ended.

During an unloaded test, the Source E available LED flashes, 1 second on and 1 second off.

Note: End the test as described below. The test will not end automatically unless the source is lost.

Press and hold the Test pushbutton for about 2 seconds to end the test. Time delays will execute as programmed when the test is ended. The Source E available LED lights during the time delays. The generator set shuts down.

If the normal source fails during the test, the contactor transfers to the emergency source. The ATS then monitors the sources and operates automatically when the normal source returns.

6.5.2 Loaded System Test

A loaded test simulates a failure of source N. Press and hold the Test button for 6 seconds or longer to start a loaded test. The generator set will start without waiting for the engine start time delay. The ATS then transfers the load to the generator set.

Since the loaded test transfer will be between two live sources, the in-phase monitor feature will be activated if it is enabled.

During a loaded test, the Source E available and Source E position LEDs flash, 1 second on and 1 second off.

Note: End the test as described below. The test will not end automatically unless the source is lost.

Press and hold the Test pushbutton for about 2 seconds to end the test. The retransfer sequence operates as though Source N has been restored after a failure. The load is transferred back to source N. All time delays are executed and an in-phase transfer will occur if enabled. The Source E LEDs light during the time delays. The generator set shuts down.

If Source E is lost during the test and Source N is available, the transfer switch will immediately transfer to the Source N position, bypassing all time delays. If source N is lost during a loaded test with the contactor in the standby position, the test will continue to run.

6.5.3 Automatic Operation Test, MPAC 750 Controller

Check the transfer switch's automatic control system immediately after the voltage check. Review the operation instructions in the controller operation manual before proceeding.

Note: Close and lock the enclosure door before starting the test procedure.

Follow the procedure below to start a loaded test. Verify that the ATS starts the generator set and transfers the load to the emergency source, executing all time delays that are set up to operate during a loss of the normal source. End the test and verify that the transfer switch transfers the load back to the normal source and removes the engine start signal, executing all appropriate programmed time delays. Refer to Section 1.2.3 for a more detailed description of the test sequence of operation.

Note: If the standby source fails during a loaded test, the ATS will immediately attempt to transfer to the preferred source.

Automatic Operation Test Procedure

1. Check the controller LED indicators to verify that the Source N Position and Source N Available indicators are lit.
2. Verify that the generator set master switch is in the AUTO position.
3. Press and hold the Test button for 6 seconds or longer to start a loaded test.
4. Verify that the generator set starts and the Source E Available LED lights.
5. Verify that the switch transfers the load to Source E. Observe the controller LEDs and display as the

time delays execute and the load is transferred.

After the preferred-to-standby transfer time delay, verify that the Source N Position LED turns off and the Source E Position LED lights, indicating that the switch has transferred the load to Source E.

6. Press and hold the Test pushbutton for about 2 seconds to end the test.

7. Verify that the switch transfers the load back to Source N. After the standby-to-preferred time delay, verify that the Source E Position LED goes out and the Source N Position LED lights, indicating that the switch has transferred the load to Source N.

8. After the engine cooldown time delay expires, the engine start signal is removed. Verify that the generator set stops.

Note: The generator set may have an engine cooldown time delay that causes the generator set engine to run after the transfer switch engine start signal is removed.

6.6 Exercise

Schedule exercise runs through the Set Exercise screen or use the exercise button on the MPAC 750 controller. See the transfer switch Operation and Installation Manual for instructions. To run the generator set at a time other than a scheduled exercise sequence, use the Test function. See Section 6.4 for instructions.

When a scheduled exercise is running, the screens shown in Figure 6-11 appear on the MPAC 1200 or 1500 display. Press Main to return to the main screen, if desired. Press the End button to end the exercise sequence before the scheduled stop time, if necessary.

Refer to Section 1 for the exercise sequence of operation without and with load.

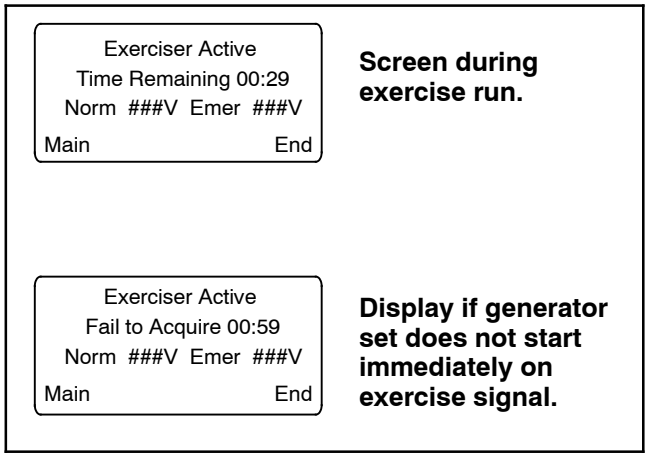


Figure 6-11 Exercise Sequence Screens, MPAC 1200/1500 Controllers

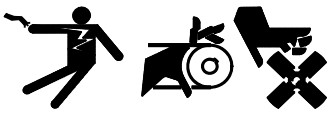
6.7 Engine Start

The engine start contacts close when the Normal source is lost and when the ATS controller starts a test or exercise sequence. The engine start contacts are labeled with a decal. Check the Operation/Installation Manual or the dimension drawing for the contact location, if necessary.

Use the following procedure to check for continuity across the engine start contacts when the Normal source is disconnected and during a test sequence. Allow time for the engine start and engine cooldown time delays during the test. Refer to the sequence of operation in Sections 1 and 6.4 for the applicable time delays.

Be sure to read and follow the safety precautions when performing the test procedure.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Engine Start Test Procedure

Start with the transfer switch in the Source N position.

1. Connect an ohmmeter or test lamp across the engine start contacts at one of the following locations:

   a. Models KSS/KSP: Pins 8 and 9 of connector P1. See Figure 6-12.

   b. Models KGS/KGP: Pins 5 and 10 of connector P1. See Figure 6-13.

   c. The engine start contacts on the transfer switch contactor or field-connection terminal block. See the decal on the transfer switch or the transfer switch Operation and Installation Manual for the engine start contact location.

   d. The generator set engine start leads. See the generator set documentation for engine start lead identification and location.

2. Disconnect Normal power from the transfer switch and verify that the engine start contacts close.

3. Reconnect Normal power to the transfer switch and verify that the engine start contacts open after applicable time delays.

4. If the engine start contacts do not operate as indicated in steps 2 and 3 when power is disconnected and reconnected, replace the ATS controller. See Section 6.13.

5. Press the Test button to initiate a test sequence and verify that the engine start contacts close.

6. Press the End button to end the test. Verify that the engine start contacts open after the engine cooldown time delay (which may be set to zero).

7. If the ATS engine start contacts do not close during the Test Procedure, replace the ATS controller. See Section 6.13.

If the generator set engine does not start, check the engine start connections to the generator set. Verify that the generator set master switch is in the AUTO position. Troubleshoot the generator set if the engine start connections are good but the engine does not start.

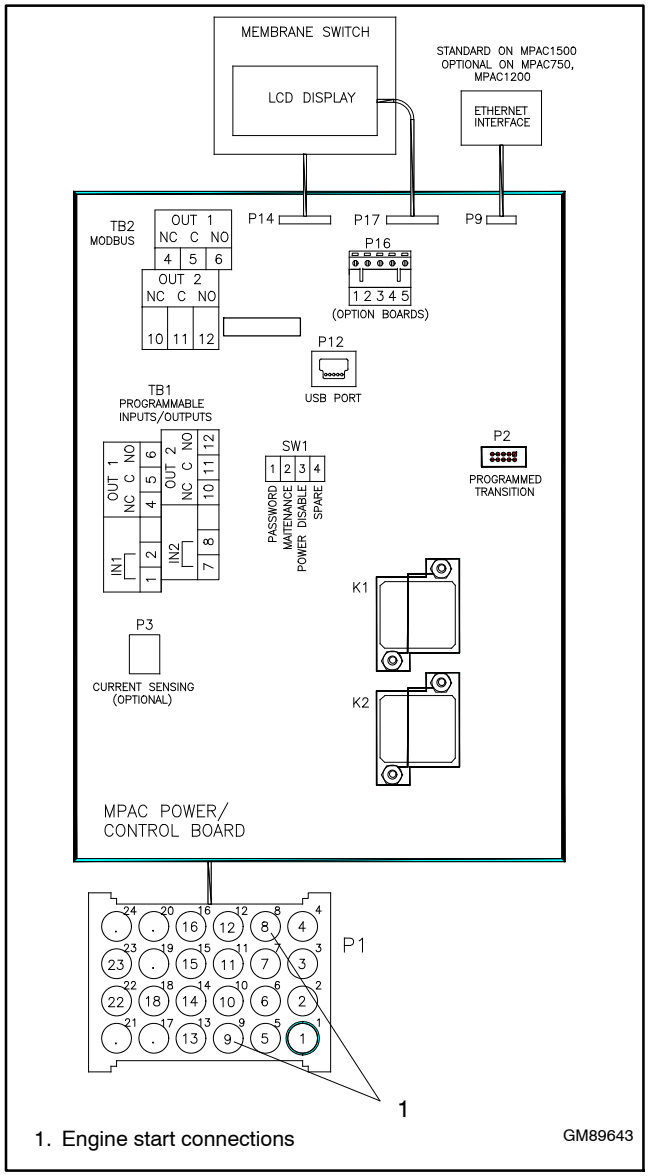


Figure 6-12 Connector P1 Engine Start Connections, Models KSS/KSP

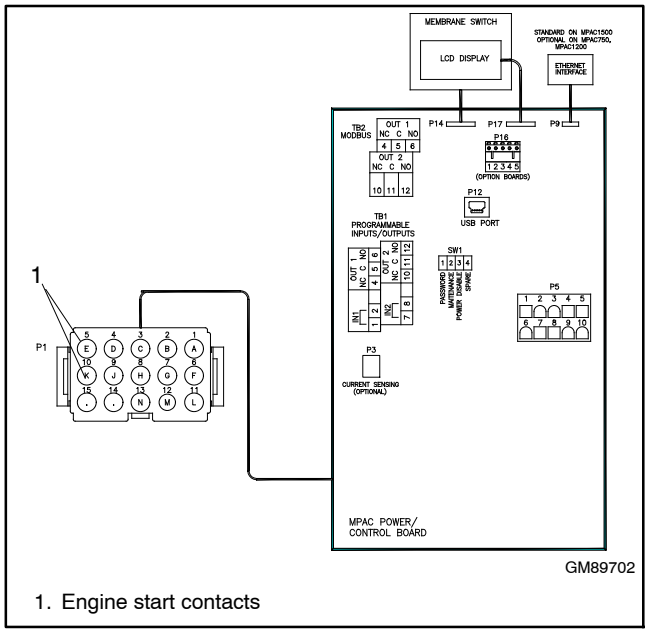


Figure 6-13 Connector P1 Engine Start Connections, Models KGS/KGP

6.8 Controller DIP Switches

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Two DIP switches on the controller's circuit board are assigned functions. Switch 3 is for factory use only. Switch 4 is not used. The DIP switches are located on the controller's circuit board on the inside of the enclosure door. Figure 6-14 shows the locations of the switches on the controller circuit board.

SW1-1, Password Disable. Closing the password disable DIP switch SW1-1 disables the setup password and resets it to the factory defaults. When the switch is closed, system setup and programming is allowed without the need to enter a password.

Note: Disable the setup password only during service unless the transfer switch is installed in a secure location.

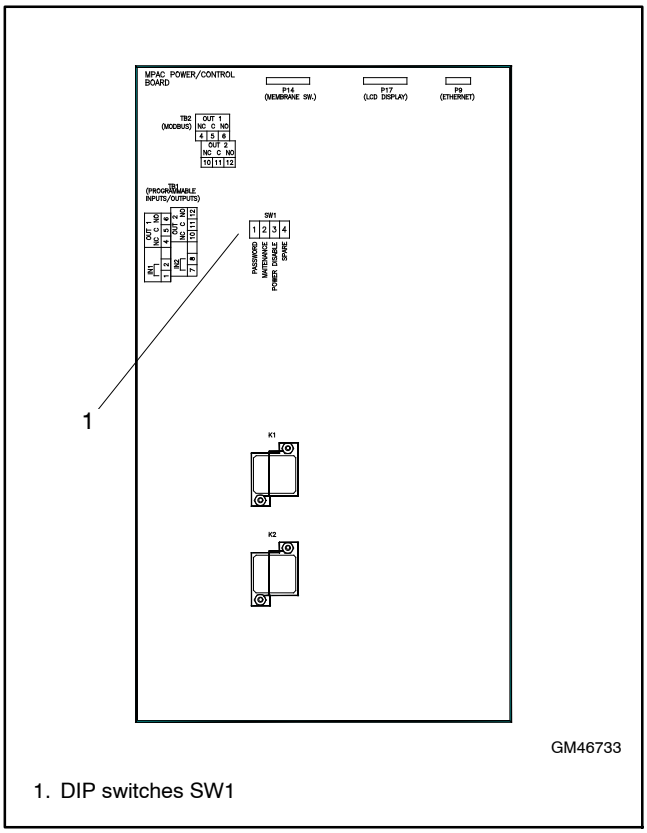
Closing and then reopening DIP switch SW1-1 resets the password to the default value, 0000.

The test password is not affected by this DIP switch. Use the Reset Data screen to disable the test password.

SW1-2, Maintenance. The maintenance DIP switch inhibits transfer. Use it to prevent transfers while servicing the ATS. When this switch is in the closed position, sensing, timing, engine start and contactor functions are disabled. A preferred source failure will be ignored. The Not in Auto LED flashes red and the message Maintenance Mode is indicated on the LCD screen. In addition, a programmable digital output is turned on and an entry in the event log indicates that the maintenance mode has been activated. System monitoring and setup are allowed while in maintenance mode.

Switch SW1-2 should be closed only during maintenance or service. It must be open during normal operation.

Close and lock the enclosure door before energizing the transfer switch.



1. DIP switches SW1

Figure 6-14 DIP Switch Location (cover removed)

6.9 Calibration

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

The transfer switch controls are calibrated at the factory and should not require recalibration in the field. If recalibration is necessary, follow the instructions in this section.

The current sensing accessory is required in order for the transfer switch to measure and display the current values. Use a clamp-on current sensing meter to measure the current and enter the measured values through the Setup Screen–Calibration shown below or through the calibration screens in SiteTech.

A personal computer and Kohler SiteTech software are required for calibration of the MPAC 750 controller. SiteTech can be used to calibrate the MPAC 1200 and 1500 controllers, if desired. See Figure 6-16 for a sample SiteTech calibration screen.

Calibration

1. Measure the source voltages as instructed in Section 4.4.3. Be sure to review and follow the safety precautions when measuring the source voltages. Record the measured values.

2. Use the Setup Screen–Calibration or SiteTech software to enter the measured values. See Figure 6-15.

Entering new calibration using SiteTech

1. Connect the computer to the MPAC controller and start the SiteTech program.

2. Click on Parameters in the dark blue navigation panel. Scroll down to find MPAC Source 1 Calibration or MPAC Source 2 Calibration as applicable for the source being calibrated. Click on the down arrow to open the calibration menu.

3. Enter the measured voltage into the corresponding line under MPAC Source 1 Calibration or MPAC Source 2 Calibration.

4. Click on Apply Changes near the top of the screen to save the new calibration settings.

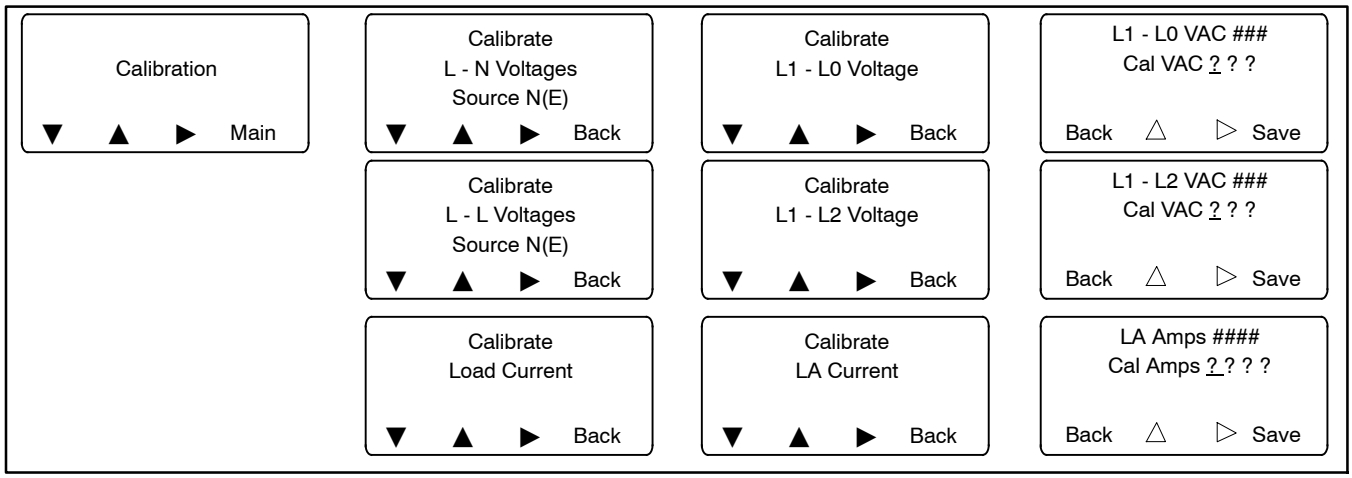
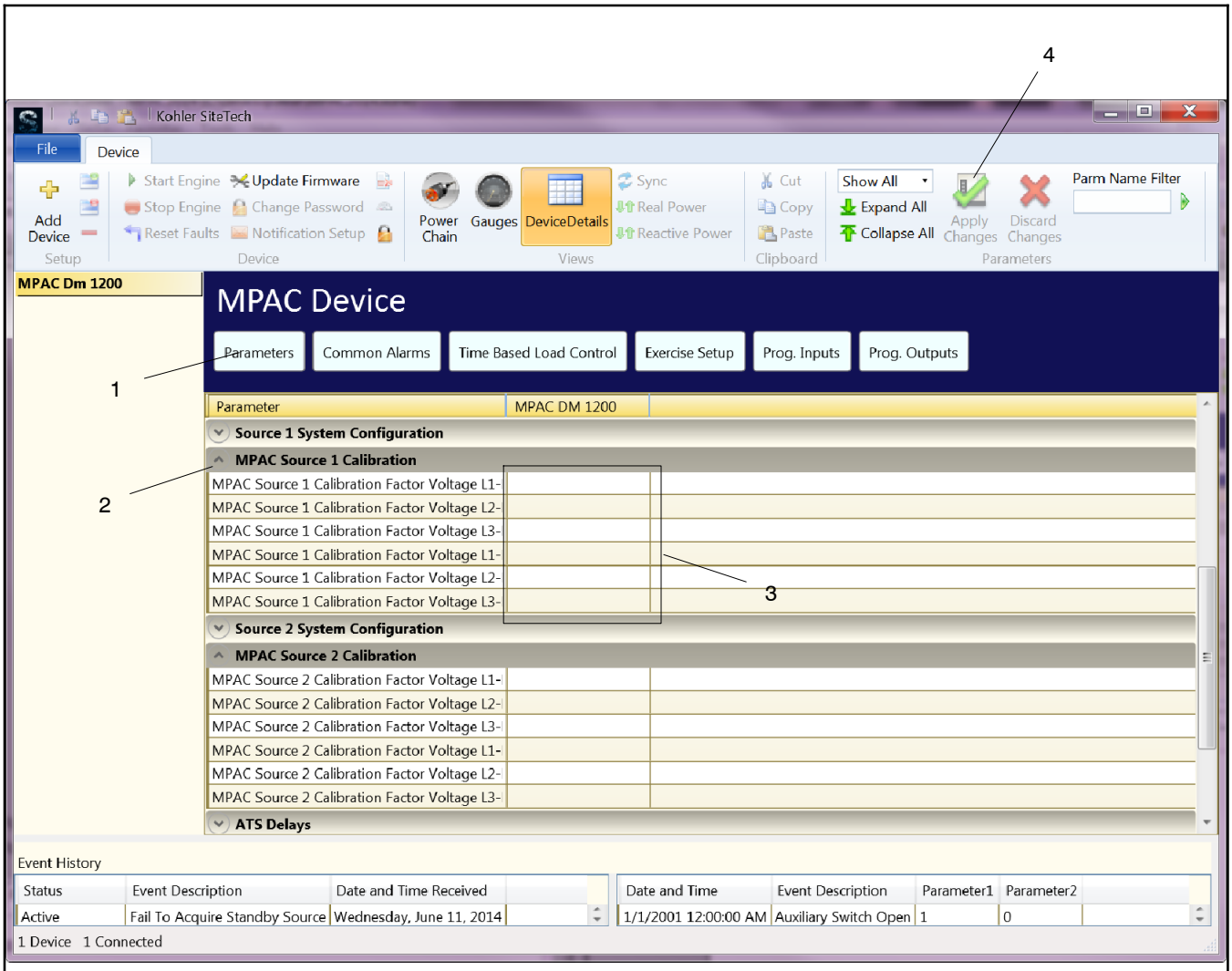


Figure 6-15 Calibration Screens, MPAC 1200/1500 Controls



1. Click on Parameters.
2. MPAC Source 1 Calibration (go to MPAC Source 2 Calibration if applicable). Click on arrow to open the menu.
3. Enter new values.
4. Click Apply Changes to save new settings.

Figure 6-16 Calibration Using SiteTech

6.10 Position Microswitch Test

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

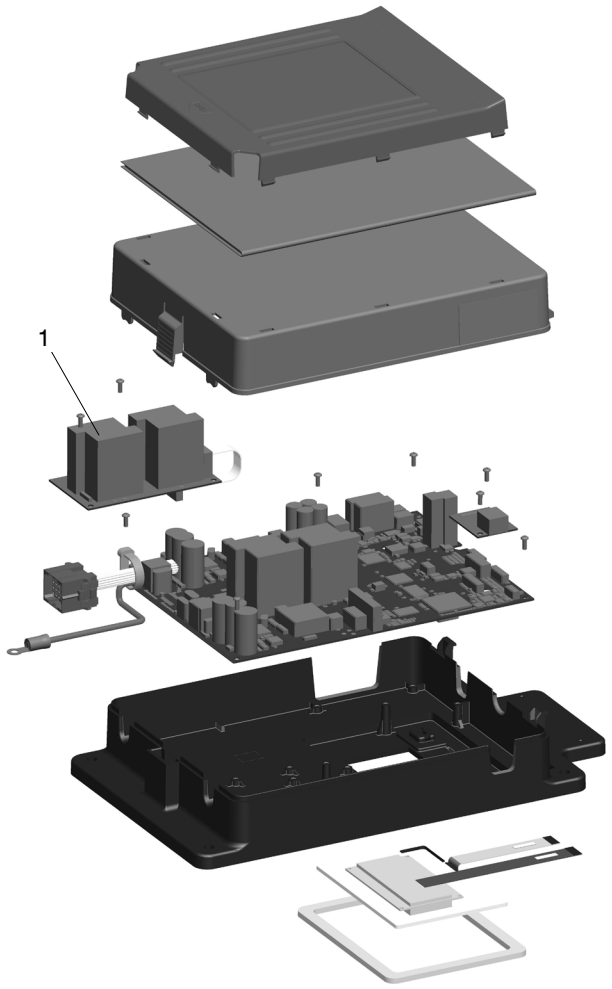
(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

Test Procedure

Disconnect power to the transfer switch and use an ohmmeter or test lamp to check the operation of the position microswitches. Manually operate the switch and check for continuity across pins 10 and 13 of the connector P1 for Source E and pins 10 and 14 for Source N.

6.11 Programmed-Transition Interface Board

Programmed-transition transfer switch models KSP and KGP are equipped with the programmed-transition interface board (PTIB). See Figure 6-17. The PTIB contains two replaceable 10-amp relays. Refer to the operation sequence diagrams in Section 5.4.2 and to the schematic diagram provided with the transfer switch to troubleshoot the relays.



1. Programmed-Transition Interface Board (PTIB)

GM85884

Note: The controller's main circuit board and user interface are not replaceable.

Figure 6-17 Programmed-Transition Interface Board

6.12 Controller Application Program

The manufacturer occasionally releases new versions of the controller application code. The new code can be downloaded from TechTools and loaded onto the controller using Kohler SiteTech software.

Program Loader software is *not* used for loading code onto the Decision-Maker® MPAC controllers.

To download the latest version of the controller application code:

1. On your computer, go to Kohler TechTools.
2. Click on Software and then ATS Controllers.
3. Click on the ATS controller and then click on the link to download the latest software version. The file name will be of the form MpacDmAppV###.zip, where V### indicates the version number.

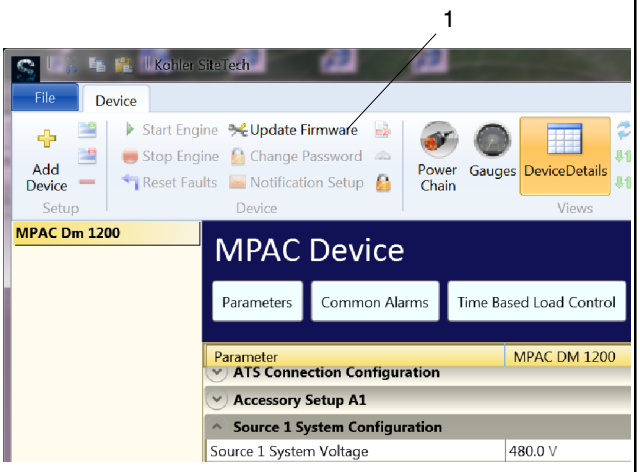
   Note: All three Decision-Maker® MPAC controllers use the same application code file.
4. Save the file onto your laptop computer.
5. Connect the computer to the ATS controller using a USB cable. See Figure 3-1 and Section 3 if necessary. Start Kohler SiteTech software.
6. Select UpdateFirmware near the top of the screen. See Figure 6-18.
7. In the Update Firmware dialog box, click on Browse and navigate to the location of the firmware file on your computer. Click on the firmware zip file and click Open.

   Note: Select the entire zip file. Do not attempt to load individual files contained within the zip file.
8. Click on the Update Firmware button in the dialog box to start loading the new firmware onto the controller.
9. SiteTech will indicate that the firmware was successfully updated. Close the program and disconnect the computer from the controller.

See the SiteTech Operation Manual, TP-6701, for more information, if necessary.

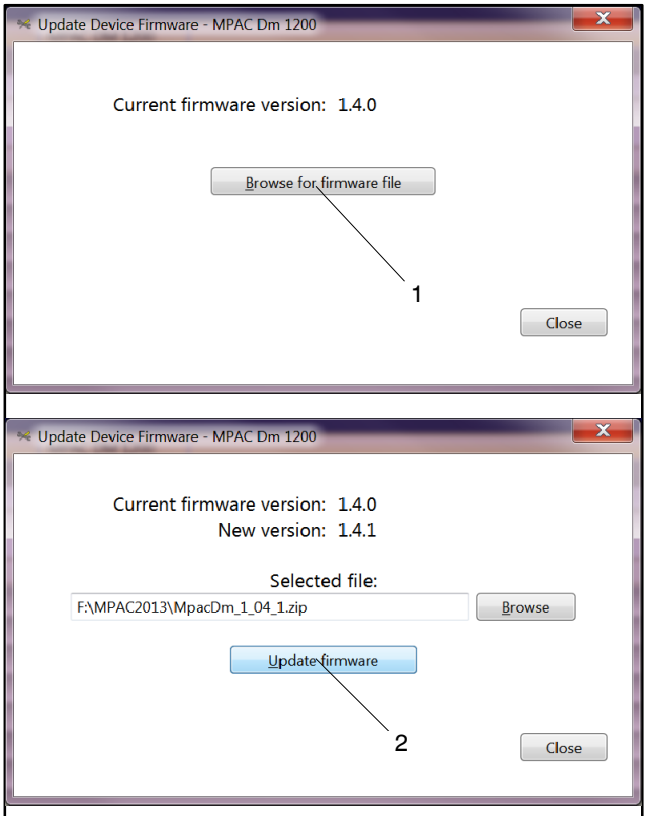
Loading new code does not change the system settings. After loading a new version of code, check the system settings, input/output assignments, time delays, and other parameters to verify that they are correct for the application.

After loading new code, run a loaded test to verify that the system operates correctly. See Section 6.4, System Test.



1. Update Firmware

Figure 6-18 SiteTech Update Firmware Command



1. Click and find the firmware file stored on your computer.
2. Click to start loading the new firmware onto the controller.

Figure 6-19 Firmware Update Dialog Boxes

6.13 Controller Replacement

Always check for open switches or circuit breakers, loose connections, or faulty wiring before replacing any parts. Replace the controller only if the troubleshooting and test procedures in this manual indicate conclusively that the controller is damaged or inoperative.

Relays on the controller circuit board can be replaced if necessary.

The user interface and the controller circuit board cannot be replaced separately. If necessary, replace the entire controller and plastic housing assembly. Save the old controller's plastic cover, which includes the transfer switch nameplate, for use with the new controller.

6.13.1 Controller Configuration (Settings)

New controllers are shipped with the factory default settings for the system settings, including voltage, frequency, number of phases, phase rotation, and other user-adjustable settings. After installation, the system parameters must be set for the application.

If the old controller is operable, it may be possible to save the controller settings to a file before removing the controller from the transfer switch. The settings file contains the system parameter settings, including system setup, source setup, time delays, input and output assignments, and communications settings. The configuration file can be loaded onto the new controller using SiteTech.

Note: Operation problems can be caused by incorrect controller settings. Do not load the old configuration file onto the new controller unless you are certain that all the settings in the file are correct.

If the configuration settings file is not available, use the controller user interface or a computer with Kohler SiteTech software to check and adjust the system settings for the application. Refer to the Transfer Switch Operation and Installation Manual for instructions.

6.13.2 Circuit Board and Electronic Component Handling

Improper removal, installation, transportation, storage, or service can damage sensitive electronic components. Observe the following guidelines to prevent damage when working with circuit boards or electronic components.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Circuit Board and Electronic Component Handling

- Keep circuit boards or electronic components inside the antistatic, cushioned factory packaging until installation.
- Store circuit boards or electronic components in a clean environment away from moisture, vibration, static electricity, corrosive chemicals, and solvents.
- Disconnect all power sources before removing or installing circuit boards or electronic components.
- Wear an approved, grounded, antistatic wrist strap when handling circuit boards or electronic components.
- Carefully hold the circuit board by its edges and not by any of its components or electrical contacts.
- Do not drop the circuit board or electronic components.
- Do not bend the circuit board, electronic components, or electronic component leads.
- Do not strike the circuit board or electronic components using or against a hard object.
- Clean dusty or dirty circuit boards with a vacuum cleaner or soft, dry brush.
- Never attempt circuit board repairs, adjustments, or modifications other than replacing plug-in service parts or performing manufacturer-approved installation or service procedures.

6.13.3 Replacement Procedure

Before removing the old controller, refer to Section 6.13.1. It may be possible to download the system settings from the controller to a file that can later be loaded onto the new controller for more efficient system setup.

Disconnect power to the transfer switch before starting to disconnect the controller. Observe the following safety precautions to avoid injury or equipment damage.

Note: Model KGS/KGP transfer switches use a different controller part number than other models with MPAC 1500 controls. Refer to Parts Catalog TP-6433 for the correct part numbers.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

Controller Replacement Procedure

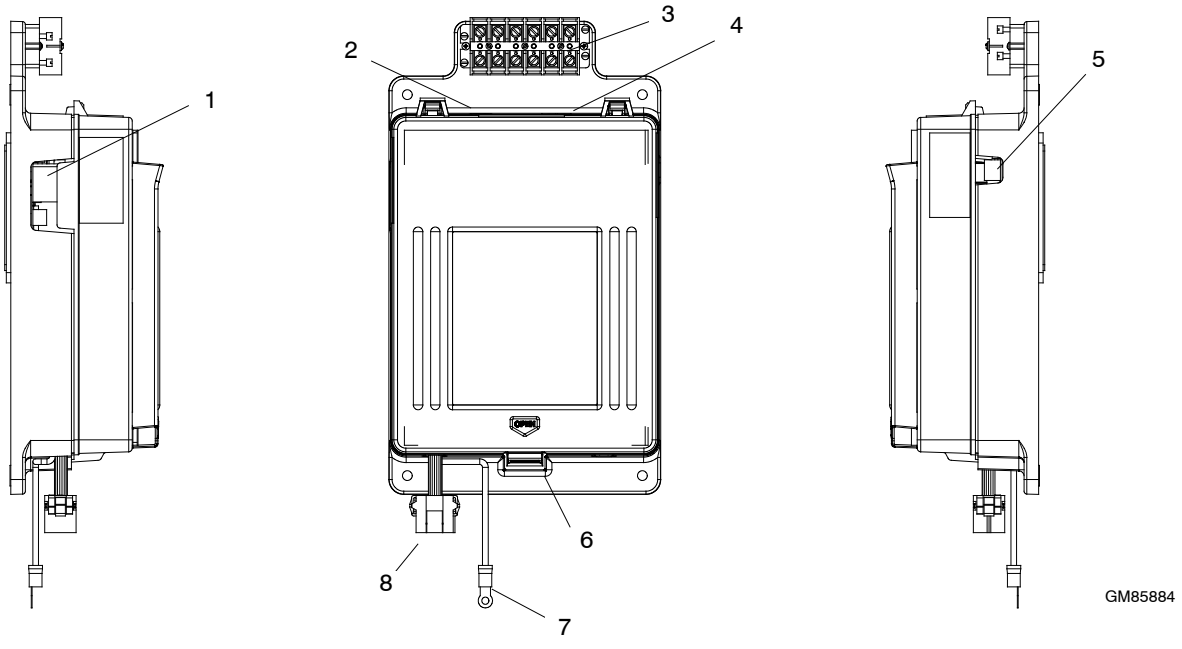
1. Move the generator set master switch to the OFF position.
2. Disconnect the generator set engine starting battery, negative (–) lead first.
3. Disconnect power to the transfer switch by opening switches or circuit breakers to the switch.

Remove the old controller.

4. Open the transfer switch enclosure.
5. Check the voltage at the source lugs to verify that the power is off.
6. Disconnect the transfer switch harness at the P1 connector at the bottom of the controller. See Figure 6-6.
7. Disconnect the programmed-transition board, if equipped, from the controller at connector P2.
8. Disconnect the controller ground wire at the ring terminal on the enclosure door.
9. Disconnect the accessory module assembly at connector P16 at the top of the controller, if connected.
10. Remove the plastic cover from the old controller and save it to install on the new controller assembly.

    Note: The cover includes the transfer switch nameplate, which must remain with the transfer switch.

    To remove the cover, depress the latch at the bottom of the cover. Swing the cover open on its hinges and lift it off.
11. Label and then disconnect any input and output leads connected to terminal strip TB1 on the controller. See Figure 6-6.
12. Label and then disconnect the RS-485 communication cable from terminal strip TB2 on the controller (if connected). See Figure 6-6.
13. Disconnect any other communications connections to the ethernet port or the USB port. See Figure 6-6 for connector identification.
14. Disconnect the current sensing accessory at connector P3, if equipped.



1. Standard input/output connection
2. RS-485 connection TB2
3. Connection for optional current sensing kit
4. Optional I/O module connection P16
5. Access openings to optional RJ-45 connector
6. Latch
7. Ground wire
8. Contactor harness connection

Figure 6-20 Controller Assembly

15. Support the controller assembly and remove four nuts at the corners.

16. Carefully remove the entire controller assembly, including the user interface panel, which is part of the assembly.

Install and connect the new controller

17. Replace the entire assembly with a new controller. Secure the four nuts at the corners and tighten them to no more than 6.8 Nm (5 ft. lbs. or 60 in lbs.) torque.

18. Connect the controller ground wire to the terminal on the enclosure door. See Figure 6-6.

19. Connect the programmed-transition board, if equipped, to the controller at connector P2. See Figure 6-6.

20. Connect the I/O leads to terminal strip TB1, using the labels attached in step 11 to connect the leads to the appropriate terminals. See Figure 6-6.

21. Connect RS-485 communication cable, if used, to terminal strip TB2, using the labels attached in step 12 to connect the leads to the appropriate terminals. See Figure 6-6.

22. Connect the accessory module assembly (if equipped) at connector P16.

23. Reconnect any other items that were disconnected from the controller. See Figure 6-6 for connector identification.

24. Connect the transfer switch harness to the connector on bottom of the controller.

25. Check the controller's DIP switch settings and adjust them if necessary. See Section 6.8, Controller DIP Switches.

26. Close and lock the transfer switch enclosure door.

27. Reconnect power to the transfer switch by closing circuit breakers or switches.

Note: Power to the controller is required in order to check and adjust the controller settings. If all the power sources are generator sets, reconnect the normal source generator set engine starting battery and move the generator set master switch to the AUTO position.

Set up the new controller.

28. If the settings file for the transfer switch was downloaded from the old controller, use SiteTech to load it onto the new controller.

29. If the settings file cannot be loaded using SiteTech, use the controller's user interface or a computer and Kohler SiteTech software to check and adjust the system settings for the application. Check the system voltage, frequency, number of phases, phase rotation, time delays, and other user-adjustable settings. Refer to the Transfer Switch Operation and Installation Manual for setup instructions.

    A computer and Kohler SiteTech software are required to check and change settings on the MPAC 750 controller. See Section 3 and the SiteTech Software Operation Manual for instructions.

Note: Contactor and ATS serial numbers can only be entered through Modbus using Monitor III or a customer-supplied Modbus driver and the distributor-level password.

30. Reconnect the generator set engine starting battery, negative (–) lead last.

31. Move the generator set master switch to the AUTO position or press the AUTO button on the generator controller.

Test the operation.

32. From the main screen, press the down arrow button and then press the LAMP TEST button to verify that all LEDs light.

33. Run a loaded test to check the system operation. See Section 6.4, System Test.

Notes

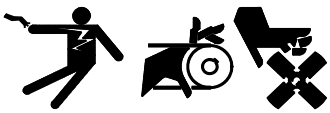
Section 7 Component Replacement, 40-600 Amp KSS and KGS/KGP

7.1 Introduction

This section contains instructions for component replacement on 40–600 Amp Model KSS and Model KG transfer switches. See Section 9 for 800–1000 Amp Model KSS component replacement procedures. See Section 8 for Model KSP programmed-transition switches. See Section 10 for 800–3000 Amp Model KGS/KGP.

Observe the following safety precautions when performing any service procedures on the transfer switch.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Making line or auxiliary connections. Hazardous voltage can cause severe injury or death. To prevent electrical shock deenergize the normal power source before making any line or auxiliary connections.

7.2 Microswitch Replacement

Required tools and equipment:
Basic electrician's hand tools
Microswitch
Required protective equipment:
Rubber insulating gloves class 0
Safety glasses
Electrical hazard safety shoes

7.2.1 40–260 Amp

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Microswitch Replacement Procedure

1. Prevent all connected generator sets from starting.

   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.

   b. Disconnect the power to the battery charger, if equipped.

   c. Disconnect the generator set engine starting battery(ies), negative (-) lead first.

      Note: On systems with multiple transfer switches connected to a single generator set, disconnect all power sources to the generator set before proceeding.

2. Disconnect power to the transfer switch.
3. Open the transfer switch enclosure.
4. Verify zero volts across each phase.
5. Note the location of the fast-on connectors to the microswitch terminals. See Figure 7-1.

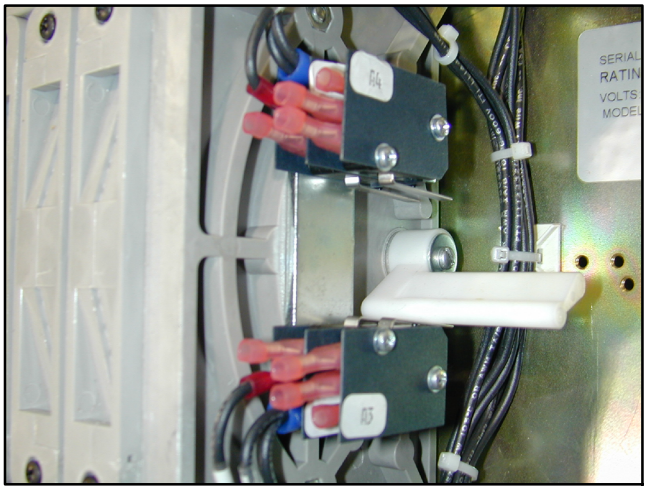


Figure 7-1 Microswitches

6. Disconnect the fast-on connectors.
7. Remove the holding screws.
8. Remove the suspect microswitch.

   Note: For SN/SE assemblies that have four microswitches, you must remove the end plate to access the microswitches. See Figure 7-2.

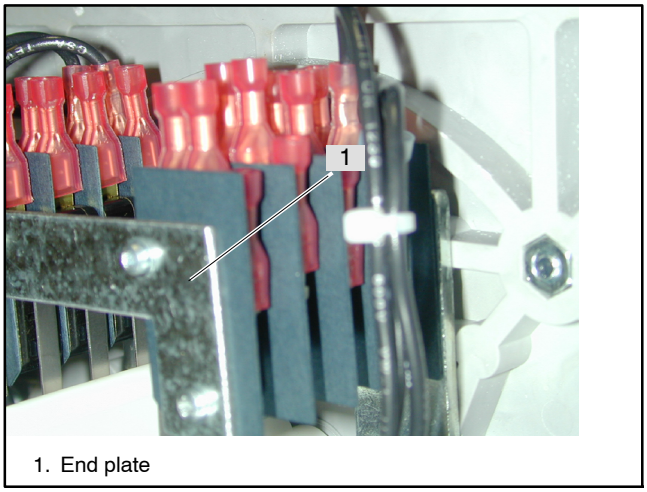
9. Install the new microswitch.

   Note: For SN/SE assemblies that have four microswitches, you must install an end plate for stability. See Figure 7-2.

10. Install the holding screws.
11. Tighten the holding screws to 0.3 Nm (3 in. lb.).
12. Connect the fast-on connections to the microswitch terminals. See Figure 7-1.

    Note: The terminals used were noted in step 5.

13. Close the ATS enclosure.
14. Connect power to the ATS.
15. Enable the generator set.
    a. Check that the generator set master switch is in the OFF position.
    b. Reconnect the generator set engine starting battery, negative (–) lead last.
    c. Reconnect power to the battery charger, if equipped.



1. End plate

Figure 7-2 End Plate (required for assemblies with four microswitches)

16. Move the generator set master switch to the AUTO position or press the AUTO button on the generator set controller.
17. Test the transfer switch operation by performing the Automatic Operation Test described in Section 6.4.4.

    Note: Do not leave the transfer switch in the Test mode.

7.2.2 400–600 Amp

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Microswitch Replacement Procedure

1. Prevent all connected generator sets from starting.

   a. Place the generator set master switch in the OFF position or press the OFF button on the generator controller.

   b. Disconnect the power to the battery charger, if equipped.

   c. Disconnect the generator set engine starting battery(ies), negative (-) lead first.

      Note: On systems with multiple transfer switches connected to a single generator set, disconnect all power sources to the generator set before proceeding.

2. Disconnect power to the transfer switch.

3. Open the transfer switch enclosure.

4. Verify zero volts across each phase.

   Note: A3/A4 microswitches can still be energized with customer power. The microswitches may be used for primary alarm circuits or primary controlling devices. Verify that all power is disconnected before proceeding.

5. Note the location of the fast-on connectors to the microswitch terminals. See Figure 7-3.

6. Disconnect the fast-on connectors. See Figure 7-4.

7. Remove the microswitch holding screws. See Figure 7-5.

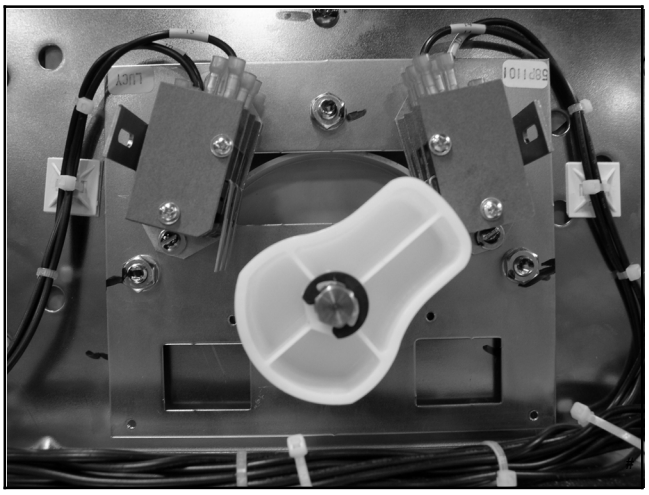


Figure 7-3 Microswitches

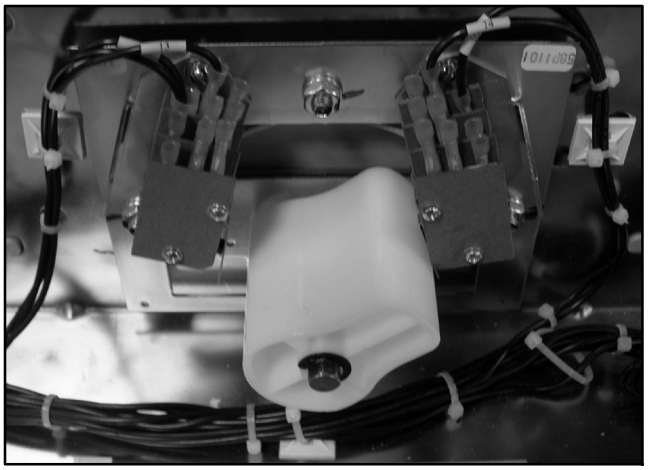


Figure 7-4 Microswitch Fast-On Connectors

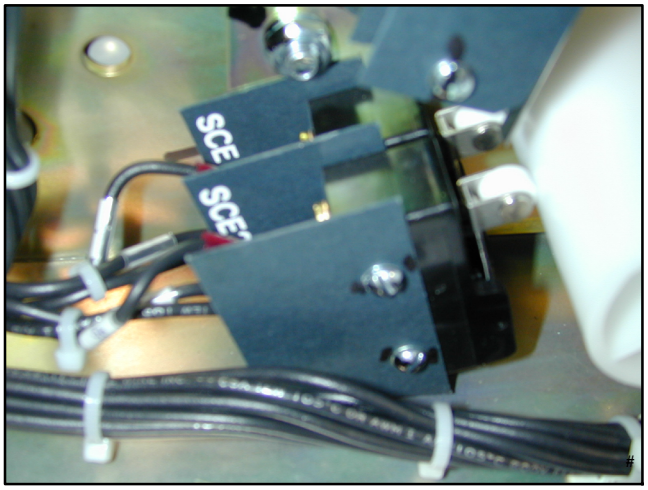


Figure 7-5 Microswitch Holding Screws

8. Remove the suspect microswitch.
9. Install the new microswitch.
10. Install the holding screws.
11. Tighten the holding screws to 0.3 Nm (3 in. lb.).
12. Connect the fast-on connections to the microswitch terminals as noted in step 5.
13. Close the transfer switch enclosure.
14. Connect power to the ATS.
15. Enable the generator set startup.
    a. Check that the generator set master switch is in the OFF position.
    b. Reconnect the generator set engine starting battery, negative (–) lead last.
    c. Reconnect power to the battery charger, if equipped.
16. Test the transfer switch operation by performing the Automatic Operation Test described in Section 6.4.4.

    Note: Do not leave the transfer switch in the Test mode.

7.3 Power Panel Replacement

Required tools and equipment:
Basic electrician's hand tools
Multimeter digital or analog
Wiring harness
Tie wraps
Required protective equipment:
Rubber insulating gloves class 0
Safety glasses
Electrical hazard safety shoes

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Power Panel Replacement Procedure

1. Prevent all connected generator sets from starting.
   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.
   b. Disconnect the battery charger, if equipped.
   c. Disconnect the generator set engine starting batter(ies), negative (-) lead first.
2. Disconnect primary and emergency power to the transfer switch.
3. Open the transfer switch enclosure.
4. Check for zero volts on the normal and emergency power lugs.
5. Remove the tie wraps securing the harness.
6. Disconnect the power panel harness from the controller harness.

   Note: The replacement power panel is shipped with a factory-wired power panel harness.
7. Disconnect the engine start leads from the ATS engine start terminals.
8. Disconnect the emergency power supply cables from the switch.

   Note: Mark each cable as to its position as it is removed from the switch. Example: E1, E2 and E3 for the emergency side of the switch.
9. Disconnect the normal power supply cables from the switch, marking the cables as they are removed.
10. Disconnect the load cables from the switch, marking the cables as they are removed.
11. Remove the four nuts securing the power panel.
12. Remove the power panel.
13. Install the new power panel onto the studs in the back of the enclosure. See Figure 7-6.

14. Fasten the power panel with flat washers, lock washers and nuts.

15. Torque the nuts to 7.3 Nm (65 in. lb.).

16. Connect the power panel harness to the controller harness at the inline connector.

17. Connect the load cables to the T terminals.

18. Tighten the connecting bolts to 16.3 Nm (12 ft. lb.).

19. Connect the normal cables to the N terminals.

Figure 7-6 Installing the Power Panel

20. Tighten the connecting bolts to 16.3 Nm (12 ft. lb.).

21. Connect the emergency supply cables to the E terminals.

22. Tighten the connecting bolts to 16.3 Nm (12 ft. lb.).

23. Install tie wraps as needed to secure the harness.

24. Connect the generator set engine start leads.

25. Close the transfer switch enclosure.

26. Connect power to the ATS.

27. Enable the generator set.

    a. Check that the generator set master switch is in the OFF position.

    b. Reconnect the generator set engine starting battery, negative (–) lead last.

    c. Reconnect power to the battery charger, if equipped.

28. Move the generator set master switch to the AUTO position or press the AUTO button on the generator set controller.

29. Test the transfer switch operation by performing the Automatic Operation Test described in Section 6.4.4.

    Note: Do not leave the transfer switch in the Test mode.

7.4 Arc Chute Replacement

Required tools and equipment:
Basic electrician's hand tools
Arc chute
Required protective equipment:
Rubber insulating gloves class 0
Safety glasses
Electrical hazard safety shoes

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

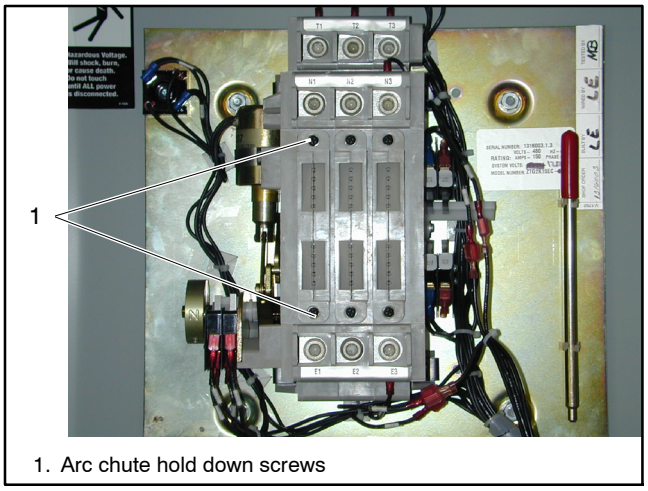
Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Arc Chute Replacement Procedure

1. Prevent all connected generator sets from starting.
   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.
   b. Disconnect the battery charger, if equipped.
   c. Disconnect the generator set engine starting batter(ies), negative (-) lead first.
2. Disconnect power to the transfer switch.
3. Open the transfer switch enclosure.
4. Verify zero volts across each phase.
5. Remove the arc chute hold down screws. See Figure 7-7.
6. Remove the arc chute.
7. Inspect the movable contact for damage. See Figure 7-8. If damage is found, order a replacement power panel and continue to Step 8.
8. Install the new arc chute.
9. Install the holding screws and washers.
10. Torque screws to 2.8 Nm (25 in. lb.).
11. Manually operate the switch several times to ensure that it does not stick. See Figure 7-9.



1. Arc chute hold down screws

Figure 7-7 Arc Chute Screws

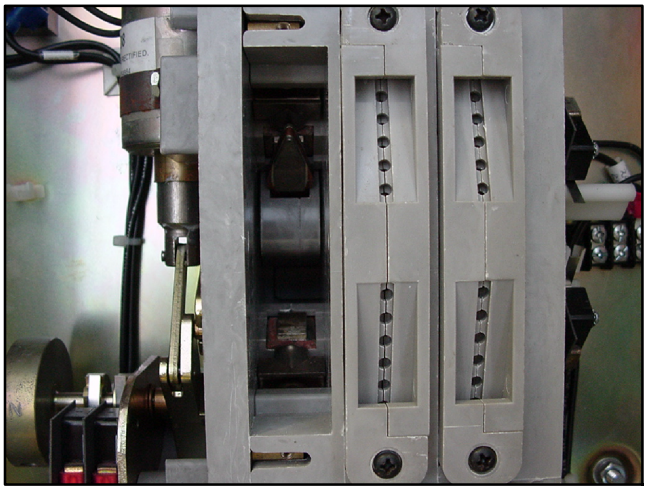


Figure 7-8 Movable Contacts (arc chute removed)

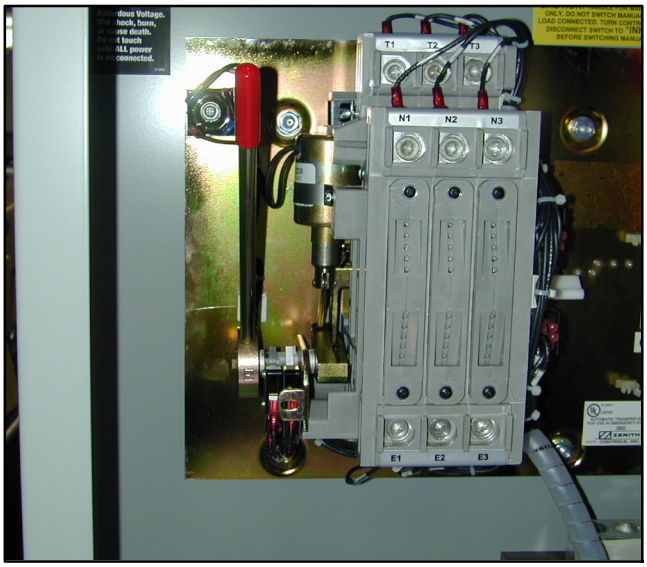


Figure 7-9 Manual Operation Handle Inserted

12. Close the transfer switch enclosure.
13. Reconnect power to the ATS.
14. Enable the generator set.
    a. Check that the generator set master switch is in the OFF position.
    b. Reconnect the generator set engine starting batter(ies), negative (–) lead last.
    c. Reconnect the battery charger, if equipped.
15. Move the generator set master switch to the AUTO position or press the AUTO button on the generator set controller.
16. Test the transfer switch operation by performing the Automatic Operation Test Procedure described in Section 6.4.4.

    Note: Do not leave the transfer switch in the Test mode.

7.5 Limit Switch Assembly Replacement

Required tools and equipment:
Basic electrician's hand tools
Multimeter digital or analog
Limit switch
Required protective equipment:
Rubber insulating gloves class 0
Safety glasses
Electrical hazard safety shoes

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Set Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Procedure

1. Prevent all connected generator sets from starting.
   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.
   b. Disconnect the battery charger, if equipped.
   c. Disconnect the generator set engine starting batter(ies), negative (-) lead first.
2. Disconnect power to the transfer switch.
3. Open the transfer switch enclosure.
4. Verify zero volts across each phase.
5. Note the location of the fast-on connections to the SCN/SCE microswitch terminals.
6. Disconnect the fast-on connectors. See Figure 7-10.

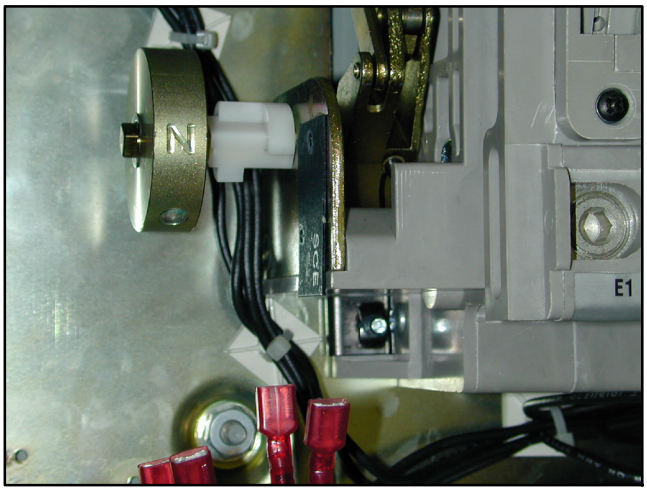


Figure 7-10 Microswitch Fast-On Connectors

7. Remove the holding screws. Note the microswitch labels on the insulators. See Figure 7-11.
8. Remove the microswitch assembly.
9. Remove the suspect microswitch. See Figure 7-12.

10. Install the new microswitch into the assembly.

    Note: Replace SCN/SCE insulators in the correct order. Normally, the SCE is closest to the base.

11. Reinstall the microswitch assembly. See Figure 7-13.

    a. Install the holding screws.

    b. Tighten the holding screws.

    c. Connect the fast-on connections to the microswitch terminals as noted in step 5.

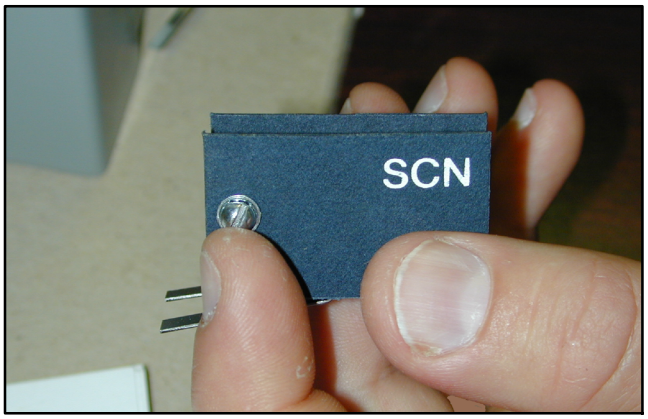


Figure 7-11 Microswitch Insulator with Label

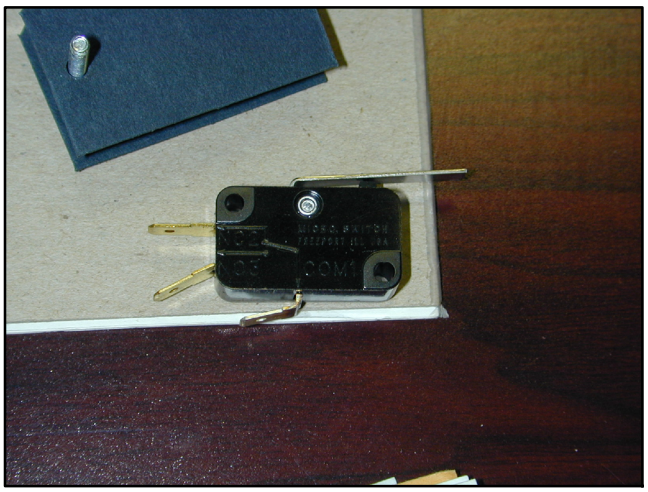


Figure 7-12 Microswitch

12. Clean the inside of the ATS.

13. Close and lock the enclosure.

14. Connect power to the ATS.

15. Enable the generator set startup.

    a. Check that the generator set master switch is in the OFF position.

    b. Reconnect the generator set engine starting batter(ies), negative (–) lead last.

    c. Reconnect the battery charger, if equipped.

16. Move the generator set master switch to the AUTO position or press the AUTO button on the generator set controller.

17. Test the transfer switch operation by performing the Automatic Operation Test Procedure described in Section 6.4.4.

    Note: Do not leave the transfer switch in the Test mode.

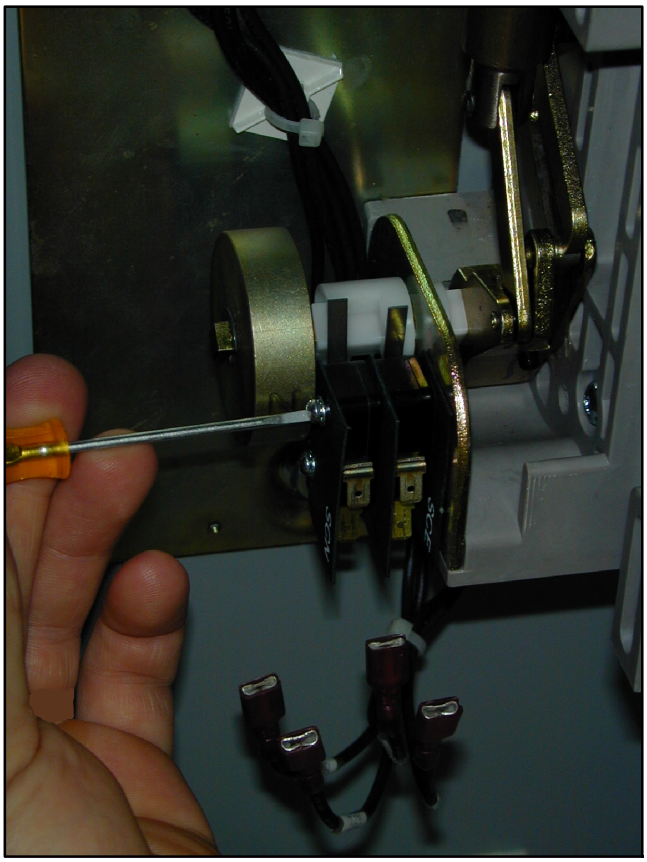


Figure 7-13 Microswitch Installation

7.6 Solenoid and Rectifier Replacement

7.6.1 Solenoid and Rectifier Replacement, 40–225 Amp Models

Required tools and equipment:
Basic electricians hand tools
Multimeter digital or analog
Solenoid
Tie wraps
Required protective equipment:
Rubber insulating gloves class 0
Safety glasses
Electrical hazard safety shoes

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Kohler Decision-Maker® 3+ and 550 Generator Set Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Kohler RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Procedure

1. Prevent all connected generator sets from starting.
   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.
   b. Disconnect the battery charger, if equipped.
   c. Disconnect the generator set engine starting batter(ies), negative (–) lead first.
2. Disconnect main power.
3. Open the ATS enclosure.
4. Verify zero volts across each phase.
5. Remove DC fast-on connections from the rectifier terminals. See Figure 7-14.

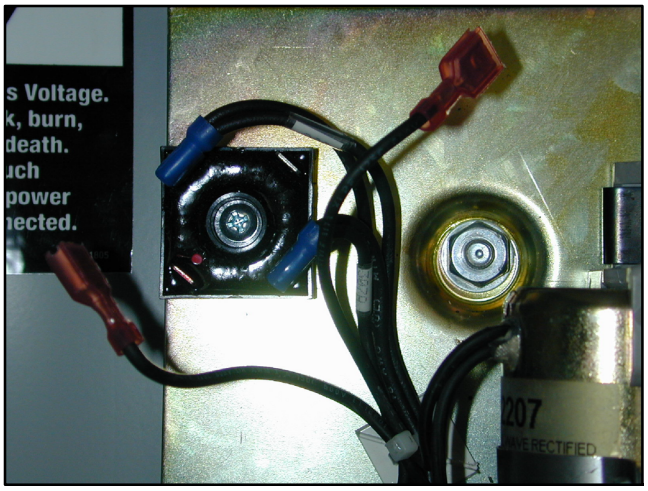


Figure 7-14 Rectifier Connections (DC solenoid leads shown disconnected)

6. Check the coil resistance. See Figure 7-15.

   Note: If the resistance reading is infinite or shorted, replace the coil.

Figure 7-15 Checking Coil Resistance

Rectifier Check and Replacement

7. Remove the AC fast-on connections from the AC terminals of the rectifier.

8. Check the diode operation of the rectifier. See Figure 7-16 and Section 5.3 for rectifier test instructions. If the rectifier is good, go to step 11. If the rectifier is bad, continue on.

9. Remove the faulty rectifier.

10. Install the new rectifier so that the red dot is in the upper right corner.

11. Connect the AC fast-on connections to the AC terminals.

    Note: The AC terminals are in the upper left and lower right hand corners.

Figure 7-16 Checking Diode Operation of Rectifier

Solenoid Replacement

⚠ WARNING

Spring-loaded parts.
Can cause severe personal injury or property damage.

Wear protective goggles when servicing spring-loaded parts. Hold parts securely during disassembly.

Disassembling the solenoid. Spring-loaded parts can cause severe personal injury or property damage. The spring in the solenoid assembly exerts substantial force on the coil. Hold the coil assembly securely when removing the screws.

12. Remove tie wraps, as necessary.

    Note: Do not cut the insulation on the wiring.

13. Remove the front bolt of the coil securing the strap. See Figure 7-17.

14. Loosen the rear bolt of the coil securing the strap.

15. Remove the coil.

    Note: The plunger assembly is spring-loaded. See Figure 7-18.

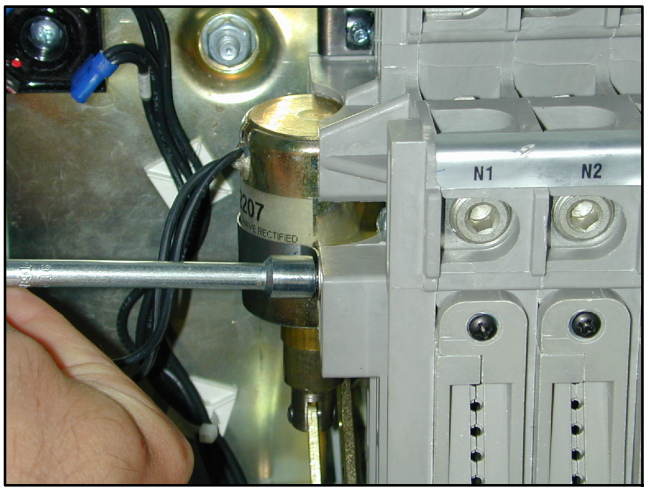


Figure 7-17 Coil Securing Strap

Figure 7-18 Spring and Plunger Assembly

16. Lubricate the spring and plunger assembly.

17. Insert the spring into the new coil.

    Note: Insert and seat the spring into the spring holder of the coil. The spring should be centered in the hole. See Figure 7-19.

Figure 7-19 Spring Holder in Coil

18. Install the plunger into the new coil.

    Note: The spring will slide into the plunger. See Figure 7-18.

19. Install the new coil into the coil slot.

20. Install the coil holding strap.

21. Tighten the bolts for the coil holding strap. See Figure 7-17.

22. Connect the DC fast-on connections to the DC terminals of the rectifier.

    Note: The DC terminals are in the lower left and upper right hand corners.

23. Install any required tie wraps.

24. Close the enclosure.

25. Reconnect power to the ATS.

26. Enable the generator set startup.

    a. Check that the generator set master switch is in the OFF position or press the OFF button on the generator set controller.

    b. Reconnect the generator set engine starting batter(ies), negative (-) lead last.

    c. Reconnect the battery charger, if equipped.

27. Move the generator set master switch to the AUTO position or press the AUTO button on the generator set controller.

28. Test the transfer switch operation by performing the Automatic Operation Test Procedure described in Section 6.4.4.

    Note: Do not leave the transfer switch in the Test mode.

7.6.2 Solenoid and Rectifier Replacement, 400-600 Amp Models

Required tools and equipment:
Basic electricians hand tools
Multimeter digital or analog
Solenoid
Tie wraps
Required protective equipment:
Rubber insulating gloves class 0
Safety glasses
Electrical hazard safety shoes

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Kohler Decision-Maker® 3+ and 550 Generator Set Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Kohler RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Set Controllers)

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Procedure

1. Prevent all connected generator sets from starting.
   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.
   b. Disconnect the battery charger, if equipped.
   c. Disconnect the generator set engine starting batter(ies), negative (–) lead first.
2. Disconnect main power and open the transfer switch enclosure.
3. Verify zero volts across each phase.
4. Remove the DC fast-on connections from the rectifier terminals. See Figure 7-20.

   Note: A red dot identifies one DC terminal. The other DC terminal is at the opposite corner of the rectifier.
5. Check the coil resistance.

   Note: If reading is infinite or shorted, replace coil.

Figure 7-20 Rectifier Fast-On Connectors (contactor shown on the bench)

Rectifier Check and Replacement

6. Remove the AC fast-on connections from the AC terminals of the rectifier.
7. Check the diode operation of the rectifier. See Figure 7-21 and Section 5.3 for rectifier test instructions. If the rectifier is bad, replace it. If the rectifier is good, proceed to step 9.
8. Replace the rectifier. Orient the new rectifier so that the red dot is in the upper right corner when the contactor is mounted in the enclosure.
9. Connect AC fast-on connections to AC terminals.

Figure 7-21 Checking Rectifier Diode Operation

Solenoid Replacement

⚠ WARNING

Spring-loaded parts.
Can cause severe personal injury or property damage.

Wear protective goggles when servicing spring-loaded parts. Hold parts securely during disassembly.

Disassembling the solenoid. Spring-loaded parts can cause severe personal injury or property damage. The spring in the solenoid assembly exerts substantial force on the coil. Hold the coil assembly securely when removing the screws.

10. Note the rectifier connections and disconnect the AC leads. See Figure 7-22.

11. Remove tie wraps as necessary.

    Note: Be careful to avoid cutting the insulation on the leads.

12. Place the switch in the Normal position.

13. Mark the location of the solenoid assembly mounting bracket.

14. Hold the solenoid coil firmly and remove the four screws and washers. See Figure 7-22.

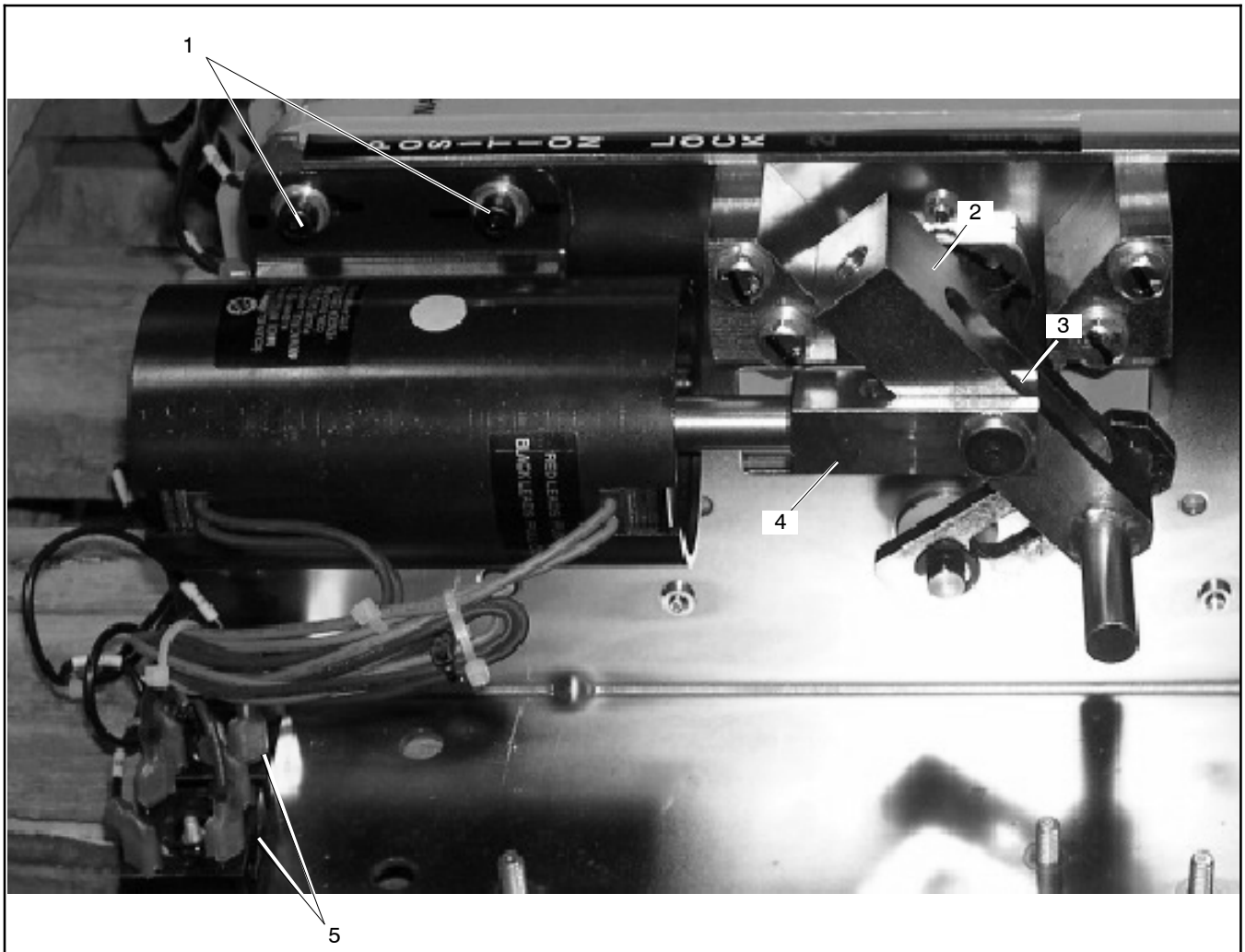
15. Pull the solenoid assembly with the attached linkage away from the contactor.

    Note: The sealed solenoid coil assembly contains the coil and the plunger. Do not attempt to remove the plunger from the coil assembly.

16. Remove the clip that secures the plunger to the linkage and remove the linkage from the coil assembly.

17. Use the clip to attach the linkage to the new coil assembly.

18. Place the new solenoid assembly into position, aligning the linkage pins with the mechanism slots. See Figure 7-22.



1. Mounting screws with washers (4 ea.)
2. Linkage
3. Clip location (not visible this view)
4. Plunger
5. Rectifier connections

Figure 7-22 Solenoid Assembly (shown on the bench)

19. Insert four mounting screws with washers and align the mounting bracket with marks made in step 13.

20. Tighten all four bolts to 10.8 Nm (96 in. lb).

21. Connect the DC fast-on connections to the DC terminals of the rectifier. See Figure 7-23.

    Note: A red dot identifies one DC terminal. The other DC terminal is at the opposite corner.

22. Install any required tie wraps. See Figure 7-23.

23. Close the ATS enclosure.

24. Reconnect power to the ATS.

25. Enable the generator set startup.

    a. Check that the generator set master switch is in the OFF position or press the OFF button on the generator set controller.

    b. Reconnect the generator set engine starting batter(ies), negative (-) lead last.

    c. Reconnect the battery charger, if equipped.

26. Move the generator set master switch to the AUTO position or press the AUTO button on the generator set controller.

27. Test the transfer switch operation by performing the Automatic Operation Test Procedure described in Section 6.4.4.

    Note: Do not leave transfer switch in Test mode.

Figure 7-23 Rectifier Connections and Tie Wraps

Notes

8.1 Introduction

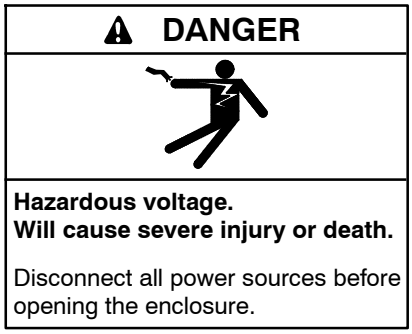
This section contains instructions for component replacement on the following models:

- 800-1000 Amp Model KSS transfer switches
- All Model KSP programmed-transition transfer switches.

Illustrations in this section show the transfer switch removed from the enclosure and placed on a bench. Remove the transfer switch from the enclosure if necessary to access components.

Read and follow all safety precautions before servicing the transfer switch.

8.2 Disconnect Power



Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Kohler Decision-Maker® 3+ and 550 Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Kohler RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

Before performing any of the following service procedures, disable all connected generator sets and disconnect power to the ATS as described below.

Procedure

1. Prevent all connected generator sets from starting.
   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.
   b. Disconnect the battery charger, if equipped.
   c. Disconnect the generator set engine starting batter(ies), negative (-) lead first.
2. Disconnect power to the transfer switch.
3. Open the transfer switch enclosure.
4. Use a voltmeter to verify zero volts across each phase.

8.3 Component Replacement, 100–400 Amp Model KSP

8.3.1 Disassembly, 100–400 Amps

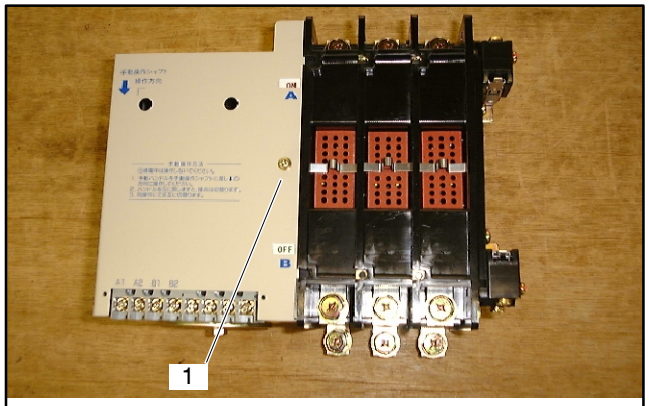
Disassemble the mechanical unit and the current-carrying unit.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

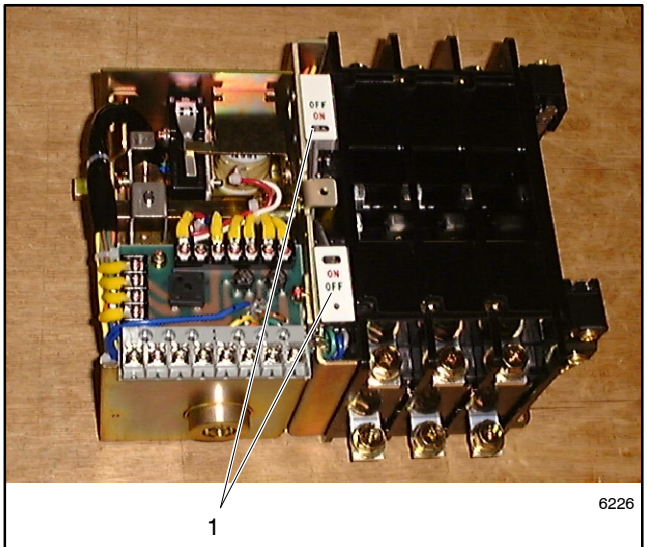
1. Disconnect power and open the transfer switch enclosure as described in Section 8.2.
2. Loosen the M4 bolt and remove the cover from the mechanical unit. See Figure 8-1.



1. M4 bolt

Figure 8-1 Removing Cover

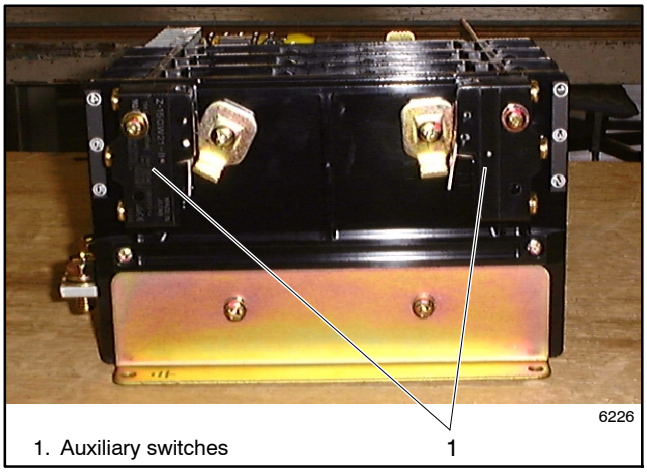
3. Remove the ON/OFF indicators. Save the indicators for installation during reassembly. See Figure 8-2.



1. ON/OFF indicators

Figure 8-2 ON/OFF Indicators

4. Remove the auxiliary switches. See Figure 8-3.

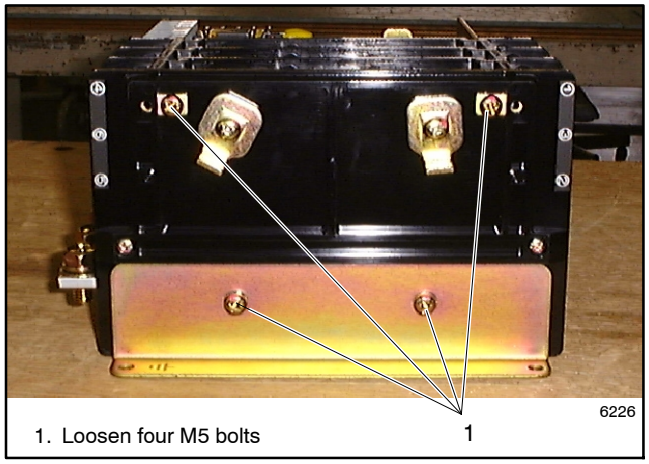


1. Auxiliary switches

Figure 8-3 Auxiliary Switches

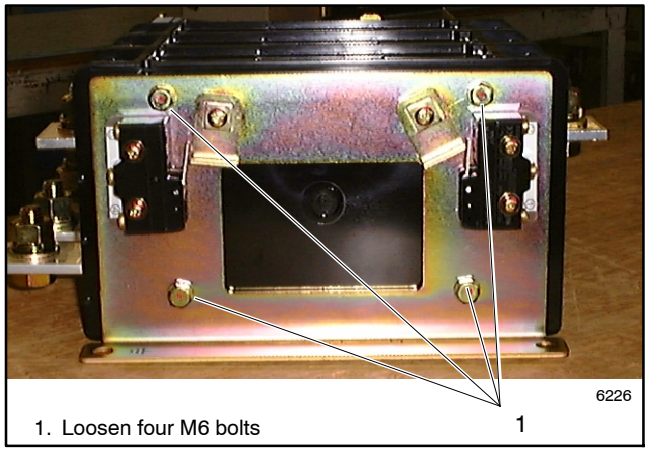
5. Loosen four bolts and separate the mechanical unit from the current-carrying unit. See Figure 8-4, Figure 8-5, and Figure 8-6.

   Note: The current-carrying unit on 400-amp models is made up of sections that will separate when disassembled.



1. Loosen four M5 bolts

Figure 8-4 Separating Units, 100 and 200 Amp



1. Loosen four M6 bolts

Figure 8-5 Separating Units, 400 Amp

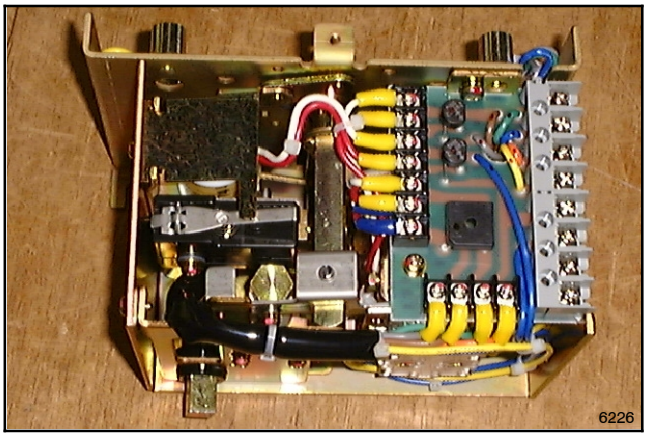


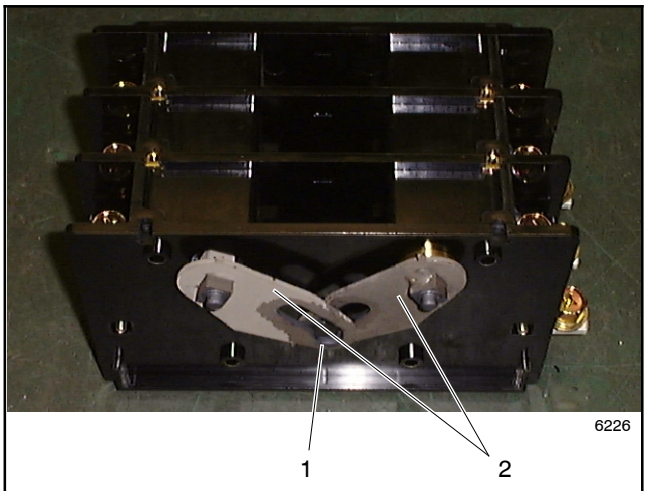
Figure 8-6 Mechanical Unit

8.3.2 Reassembly, 100–400 Amps

Reassemble the mechanical unit and the current-carrying unit.

1. Assemble the current-carrying unit and the mechanical unit. Make sure that the shaft from the mechanical unit goes through both main shaft levers. See Figure 8-7.

   On 400-amp units, the current-carrying unit is made up of separate sections. Make sure that the sections are flush across the front when reassembling.

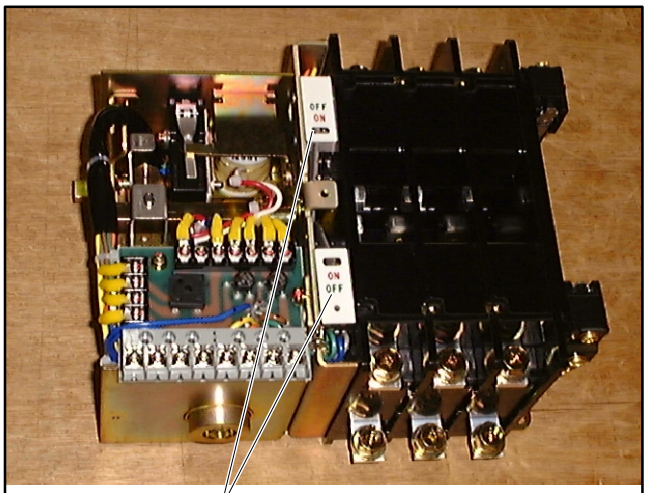


1. Openings for shaft from coil
2. Main shaft levers

Figure 8-7 Current-Carrying Unit

2. Replace the ON/OFF indicators and the cover.

Note: The ON/OFF indicators are not identical. Install them as shown in Figure 8-8.

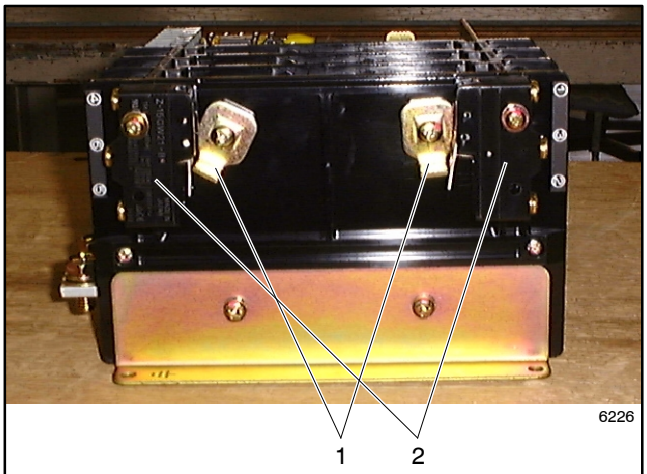


1. ON/OFF indicators

Figure 8-8 Assembled Units

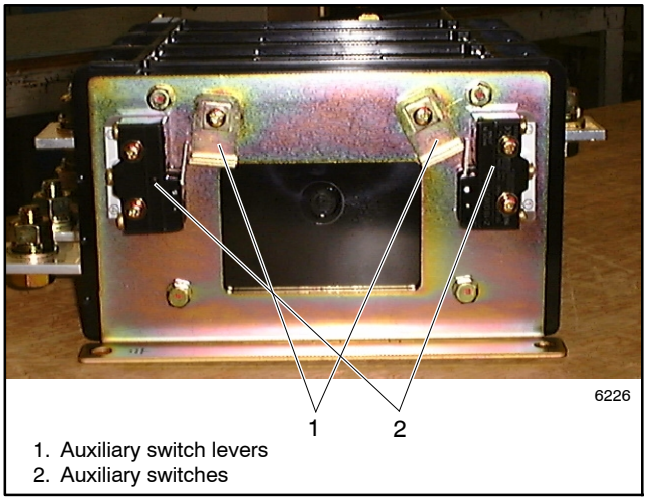
3. Reinstall the auxiliary switch levers, if removed, aligning the square indentation with the end of the square shaft. See Figure 8-9 and Figure 8-10.

4. Reinstall the auxiliary switches, if removed. The 100 and 200 amp models use one bolt and one alignment pin per switch. See Figure 8-9. Larger models use two bolts per switch. See Figure 8-10.



1. Auxiliary switch levers
2. Auxiliary switches

Figure 8-9 100 and 200 Amp Models



1. Auxiliary switch levers
2. Auxiliary switches

Figure 8-10 400 Amp Models

8.3.3 Printed Circuit Board Replacement, 100–400 Amps

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

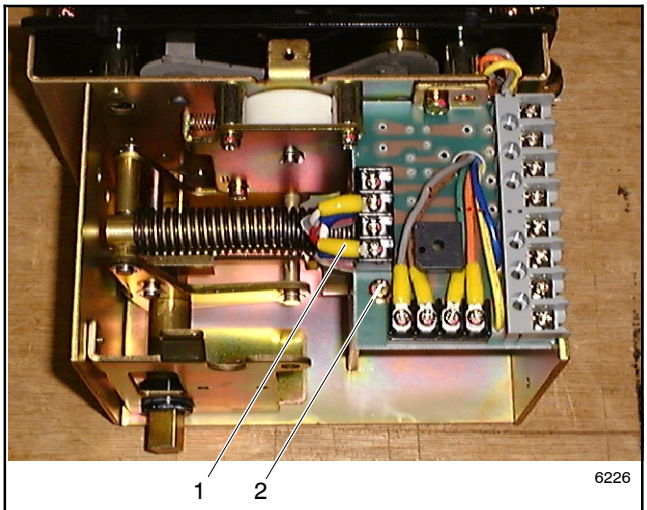
NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Separate the current-carrying unit from the mechanical unit. See Section 8.3.1.

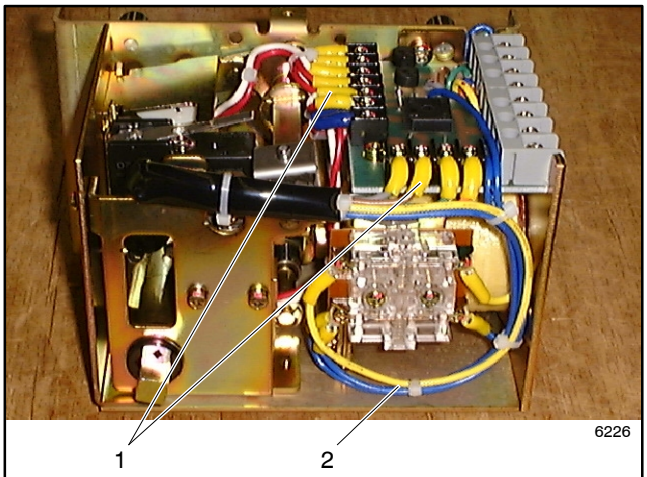
1. Note the connections (for reconnection later) and disconnect the printed circuit board leads. See Figure 8-11 or Figure 8-12.
2. Disconnect the control switch leads at three terminals. See Figure 8-12.

   Note: Hold the terminals while loosening the screws to avoid damage.
3. Note the connections (for reconnection later) and disconnect the control switch leads at eight locations. See Figure 8-13.
4. Remove the bolt and replace the printed circuit board. See Figure 8-11.
5. Reconnect all leads as noted during step 1.



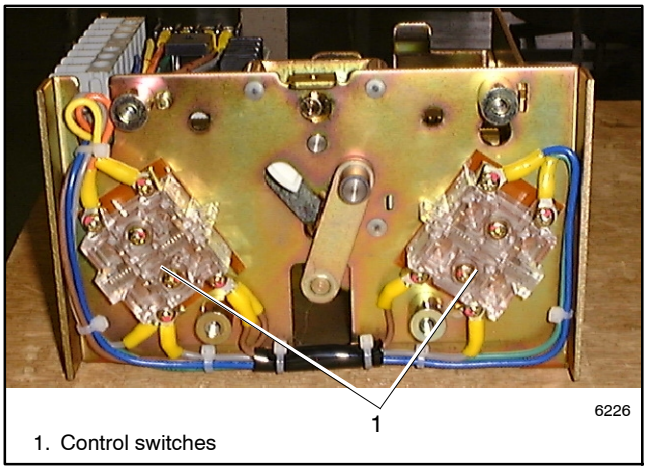
1. Coil leads
2. Bolt

Figure 8-11 Circuit Board Connections



1. Printed circuit board leads
2. Switch leads

Figure 8-12 Control Switch Wiring



1. Control switches

Figure 8-13 Control Switches

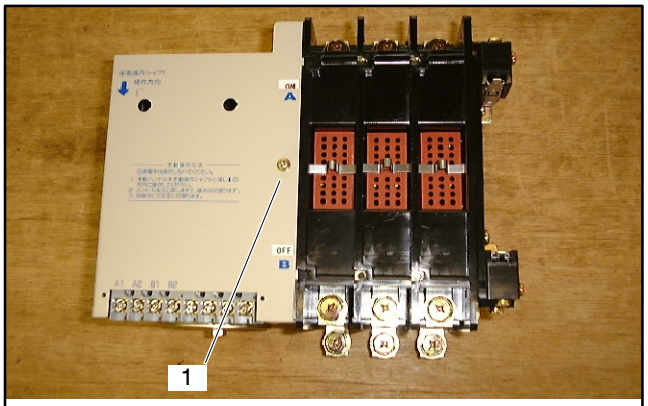
8.3.4 Closing Coil Replacement, 100–400 Amps

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

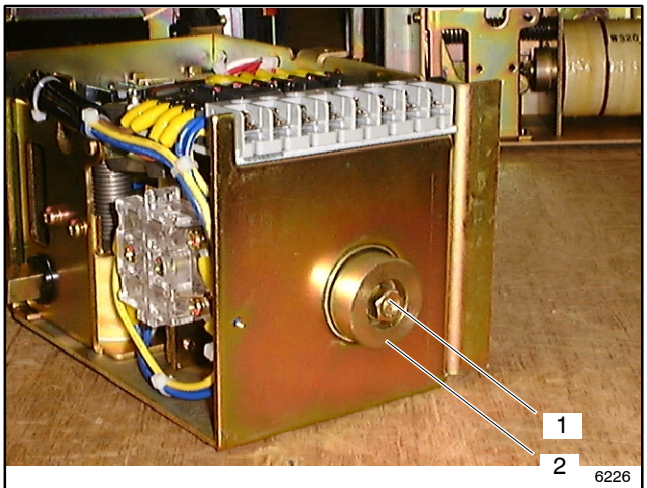
1. Disconnect power and open the transfer switch enclosure as described in Section 8.2.
2. Loosen the M4 bolt and remove the cover from the mechanical unit. See Figure 8-1.
3. Push the trip button.
4. See Figure 8-15. Remove the M6 nut and washer. Turn the movable steel shaft counterclockwise to remove it.
5. Remove the printed circuit board. See Figure 8-16 and Section 8.3.3.



6226

1. M4 bolt

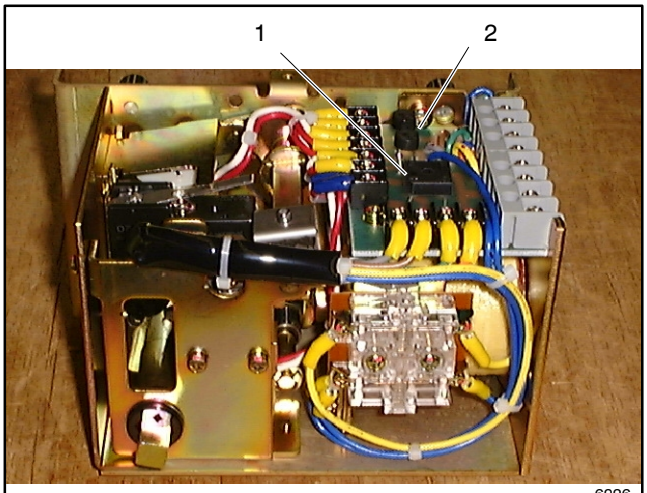
Figure 8-14 Removing Cover



6226

1. M6 nut and washer
2. Movable steel shaft

Figure 8-15 Movable Steel Shaft, 100–400 Amp Models



6226

1. Printed circuit board
2. M6 bolt location

Figure 8-16 Printed Circuit Board and M6 Bolt (for closing coil)

6. Loosen the M6 bolt and remove the frame with the coil. See Figure 8-16 and Figure 8-17.

7. Loosen the M12 nut and replace the closing coil. See Figure 8-17.

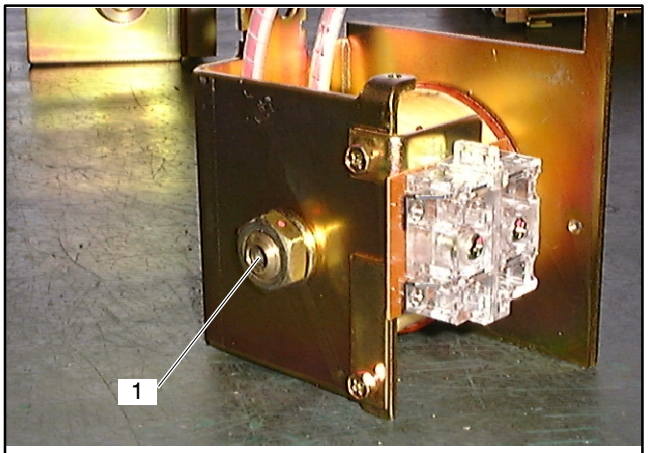


Figure 8-17 Closing Coil with Frame, 100–400 Amp Models

8. Reinstall movable steel shaft. To adjust the shaft:

   a. Turn the large round shaft in (clockwise) until mechanism just latches when operated with the manual handle. If turned too far, it won't latch.

   b. Back the shaft out (counterclockwise) one full rotation from the limit of the switching range.

   c. Install the washer and nut. Hold the shaft to prevent it from turning while tightening the nut.

8.3.5 Select Coil Replacement, 100–400 Amps

1. Note connections and disconnect select coil leads. See Figure 8-18. Cut the cable tie, if necessary.

2. Remove two M4 bolts shown in Figure 8-19 and remove the select coil assembly.

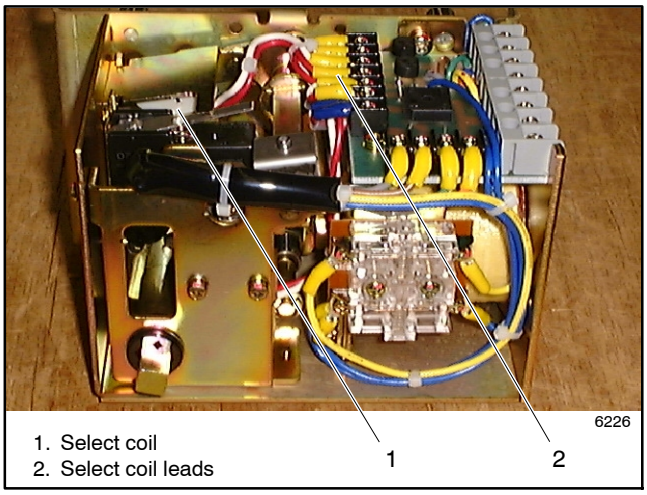


Figure 8-18 Select Coil Connections

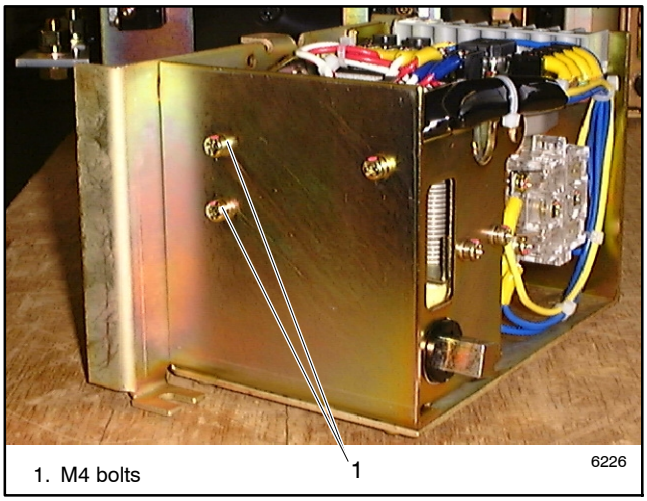
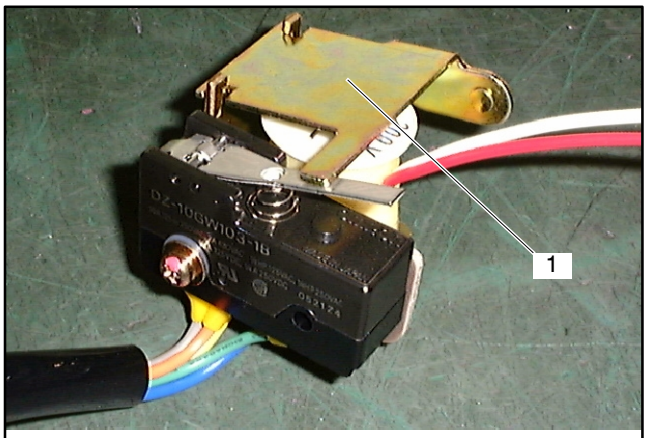


Figure 8-19 Select Coil Assembly Bolts

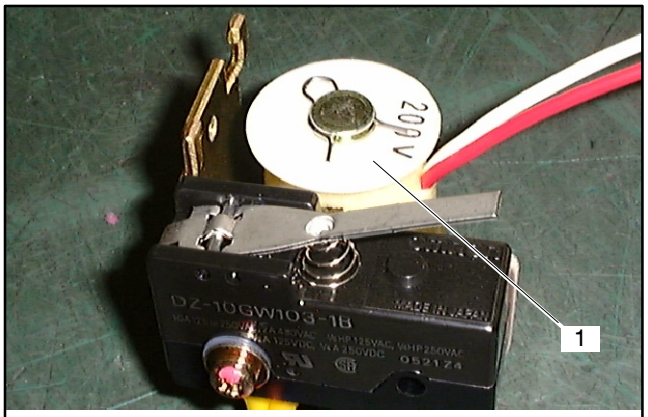
3. Remove the upper plate from the select coil assembly. See Figure 8-20.

4. Replace the select coil. See Figure 8-21.



1. Upper plate 6226

Figure 8-20 Select Coil Assembly



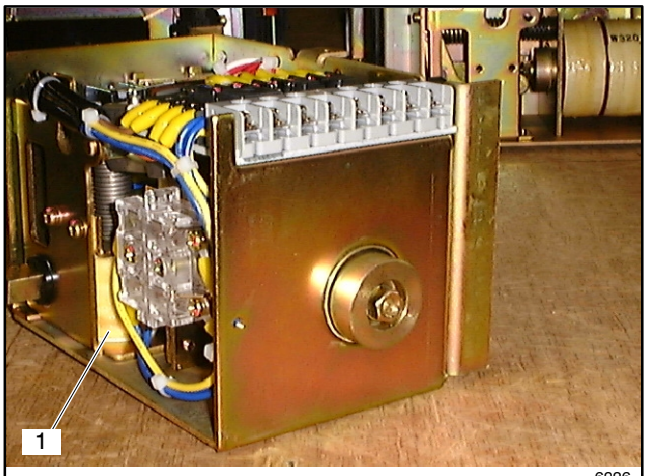
1. Select coil 6226

Figure 8-21 Select Coil

8.3.6 Trip Coil Replacement, 100-400 Amps

Note: Remove the select coil first for easier access to the trip coil. See Section 8.3.5.

1. Locate the trip coil. See Figure 8-22.

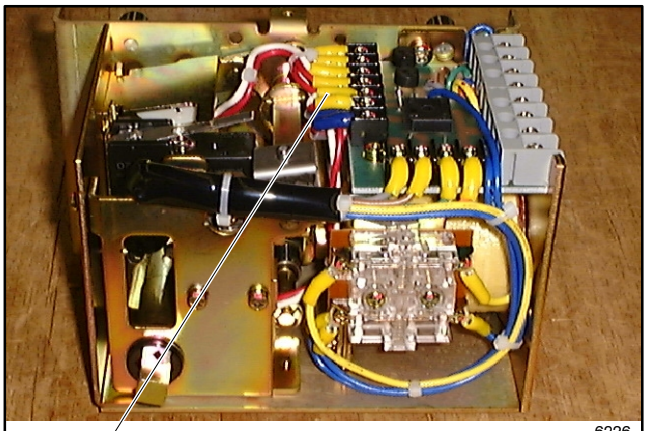


6226

1. Trip coil

Figure 8-22 Trip Coil Location

2. Note the connections and disconnect the trip coil leads from the printed circuit board. See Figure 8-23.

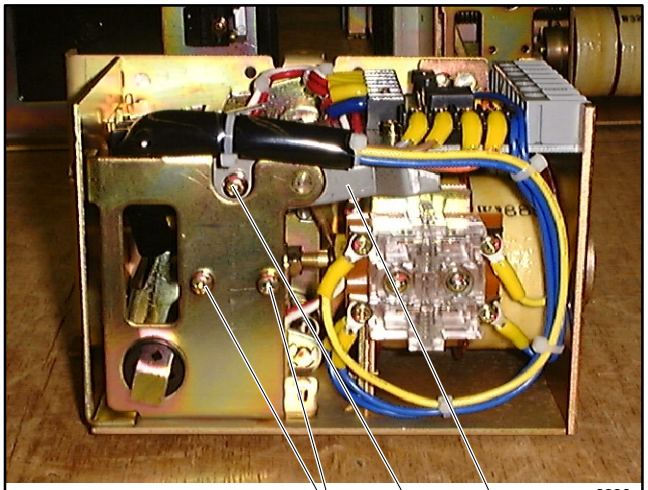


6226

1. Trip coil connections

Figure 8-23 Trip Coil Connections

3. Remove two M4 bolts that secure the trip coil. See Figure 8-24.



1. Trip coil M4 bolts (2)
2. Trip shaft M4 bolt (and ring, not visible in this view)
3. Trip lever

Figure 8-24 Trip Coil and Trip Shaft Bolts

⚠ WARNING

Spring-loaded parts.
Can cause severe personal injury or property damage.

Wear protective goggles when servicing spring-loaded parts. Hold parts securely during disassembly.

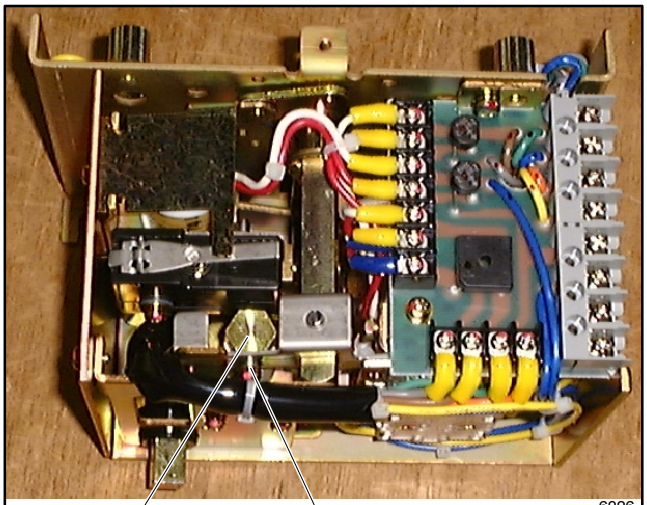
4. The trip shaft is spring-loaded. Hold the shaft securely while removing the trip shaft bolt. See Figure 8-25. Remove the M4 bolt with ring, trip shaft, spring, and L-shaped bracket. See Figure 8-26. Keep the parts for reassembly later.

5. Loosen three bolts shown in Figure 8-27, remove the side plate, and replace the trip coil. See Figure 8-27.

6. Reassemble in reverse order:

   Align the bosses on the coil with the holes in the L-shaped bracket.

   Be sure to reinstall the ring on the trip shaft bolt and align the parts so that the ring fits into the hole on the trip lever.



1. Trip shaft
2. M4 bolt

Figure 8-25 Trip Shaft Location

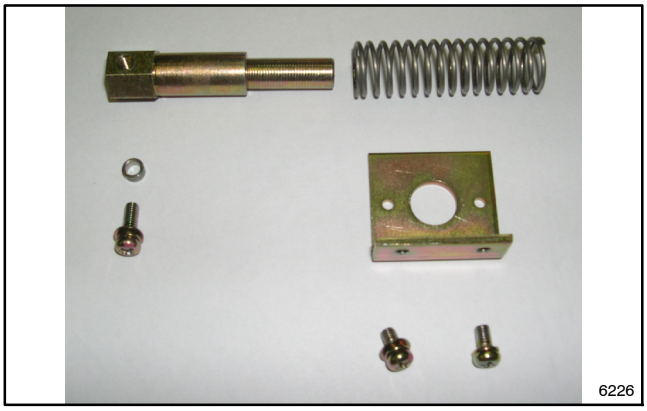
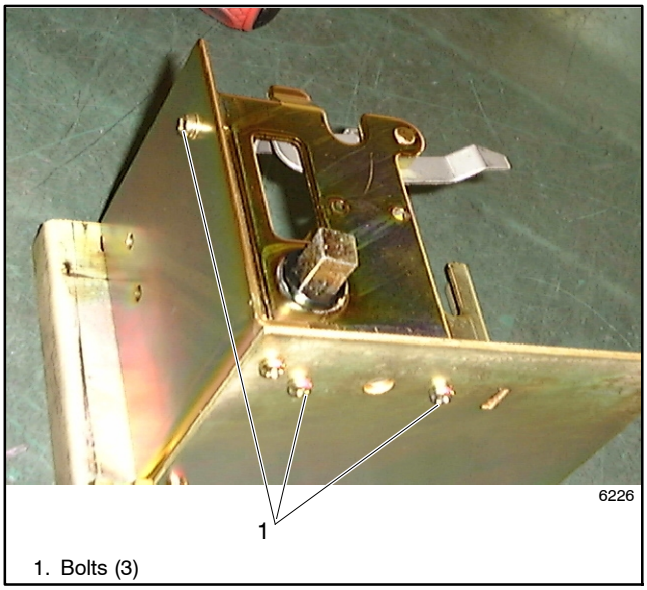


Figure 8-26 Trip Shaft Parts



1. Bolts (3)

Figure 8-27 Side Plate Bolts

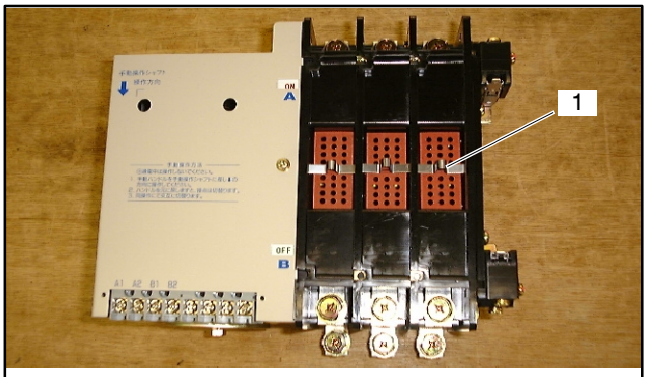
8.3.7 Arc Chute Replacement, 100–400 Amps

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

1. Disconnect power as described in Section 8.2.
2. Remove the retainer clips shown in Figure 8-28.
3. Replace the required arc chute.
4. Reinstall the retainer clips.



6226

1. Arc chute retainer clips

Figure 8-28 Arc Chutes

8.4 Component Replacement, 600 Amp Model KSP

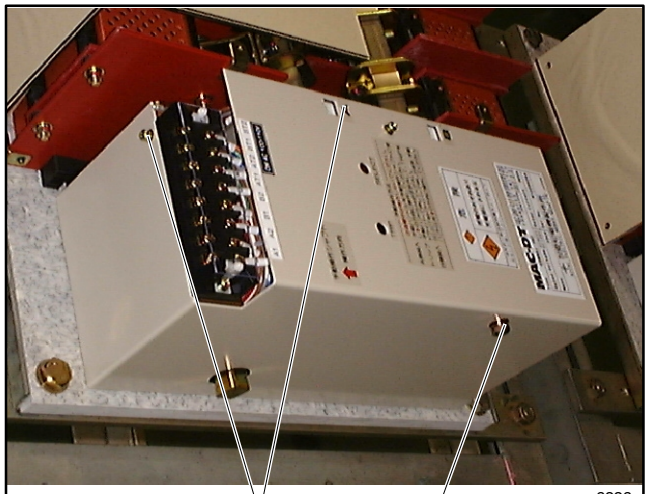
8.4.1 Closing Coil Replacement, 600 Amp Model KSP

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

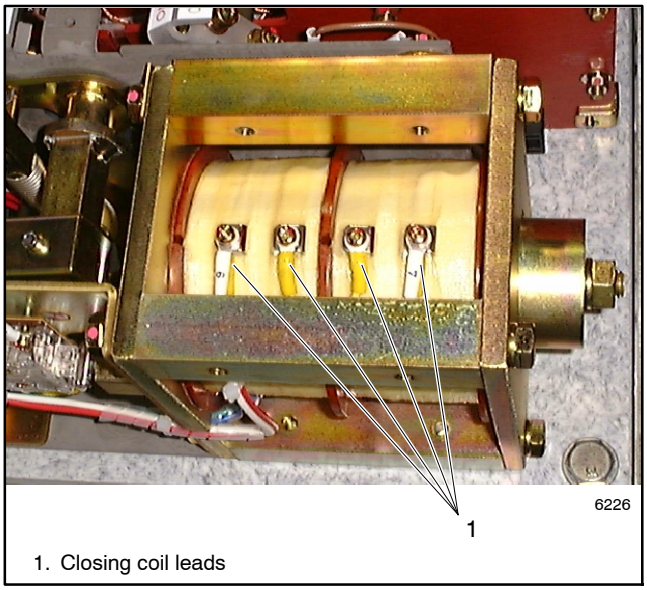
Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 8.2.
2. Remove the M4 bolts and the M6 bolt. Remove the cover from the mechanical unit. See Figure 8-29.
3. Note the connections shown in Figure 8-30 and disconnect the closing coil leads at four locations.



1. M4 bolts
2. M6 bolt

Figure 8-29 Removing the Cover



1. Closing coil leads

Figure 8-30 Closing Coil Connections

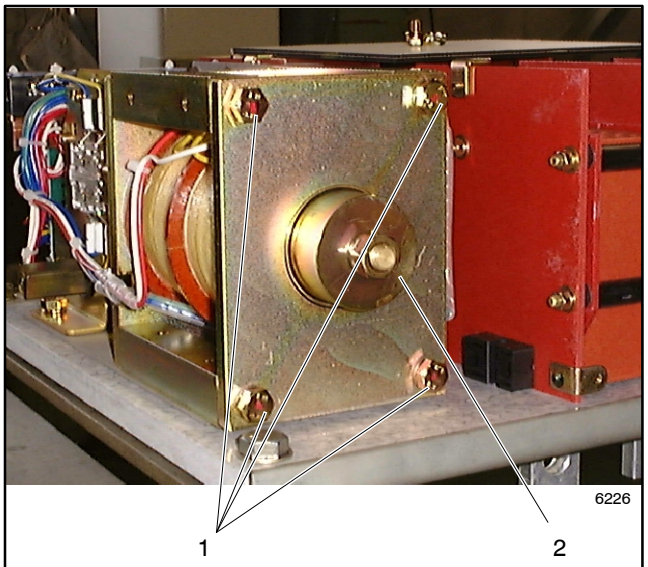
⚠ WARNING

Spring-loaded parts.
Can cause severe personal injury or property damage.

Wear protective goggles when servicing spring-loaded parts. Hold parts securely during disassembly.

Disassembling the solenoid. Spring-loaded parts can cause severe personal injury or property damage. The spring in the solenoid assembly exerts substantial force on the coil. Hold the coil assembly securely when removing the screws.

4. The closing coil is spring-loaded. Hold the closing coil securely and remove four M8 bolts. Remove the closing coil. See Figure 8-31.



1. M8 bolts
2. Nut, movable steel shaft

Figure 8-31 Closing Coil Bolts and Nut

5. Replace the closing coil.
   a. Reuse the spring from the original coil.
   b. Align the boss on the coil into the recess in the frame.
   c. Replace the four M8 bolts. See Figure 8-31.
   d. Reconnect four leads shown in Figure 8-30.
6. Adjust the movable steel shaft as described in the following procedure.

8.4.2 Shaft Adjustment, 600 Amp Model KSP

Note: It is not necessary to remove the movable steel shaft when replacing the closing coil.

1. Turn the large round shaft in (clockwise) until the mechanism just latches when operated with the manual handle. If turned too far, it won't latch.
2. Turn the shaft back 1.5 rotations from the limit of the switching range.
3. Hold the shaft and tighten the nut.
4. Replace the cover on the mechanical unit.

8.4.3 Trip Coil Replacement, 600 Amp Models

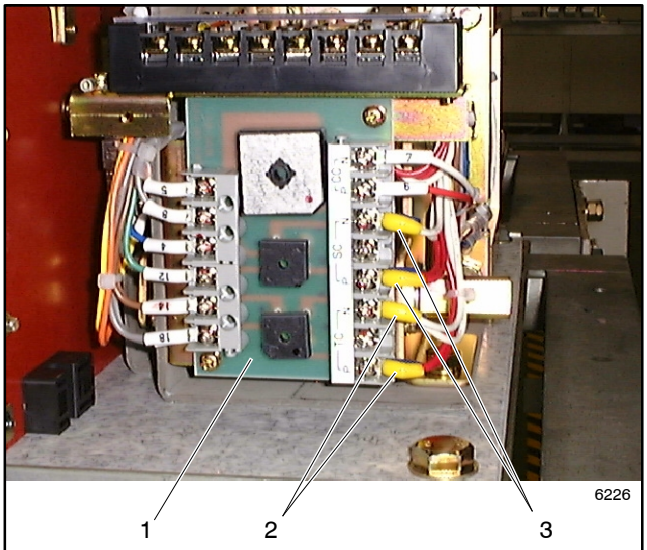
⚠ WARNING

Spring-loaded parts.
Can cause severe personal injury or property damage.

Wear protective goggles when servicing spring-loaded parts. Hold parts securely during disassembly.

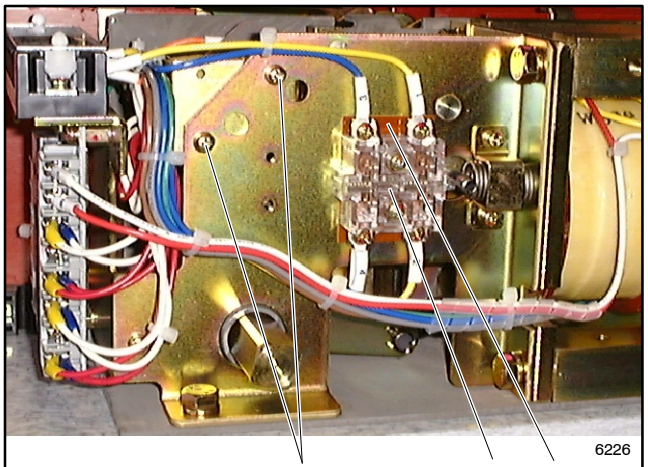
Disassembling the solenoid. Spring-loaded parts can cause severe personal injury or property damage. The spring in the solenoid assembly exerts substantial force on the coil. Hold the coil assembly securely when removing the screws.

1. Note the connections and disconnect the trip coil leads from the printed circuit board and the control switch. See Figure 8-32 and Figure 8-33.



1. Printed circuit board
2. Trip coil (TC) leads
3. Select coil (SC) leads

Figure 8-32 Circuit Board Connections

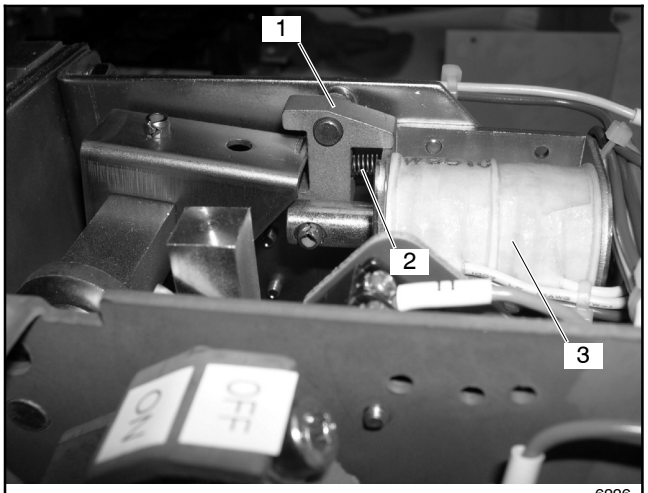


1. Trip coil M4 bolts
2. Control switch
3. Insulator

Figure 8-33 Trip Coil Replacement, 600 Amp Models

2. Remove two M4 bolts and replace the trip coil. Retain the small spring for the trip coil lever. See Figure 8-33 and Figure 8-34.

3. Connect the trip coil leads to the printed circuit board and control switch as noted during disassembly. Tighten control switch connections to 0.14 Nm (1 in. lb.), maximum.



1. Trip lever
2. Spring
3. Trip coil

Figure 8-34 Trip Coil

8.4.4 Select Coil Replacement, 600 Amp Models

⚠ WARNING

Spring-loaded parts.
Can cause severe personal injury or property damage.

Wear protective goggles when servicing spring-loaded parts. Hold parts securely during disassembly.

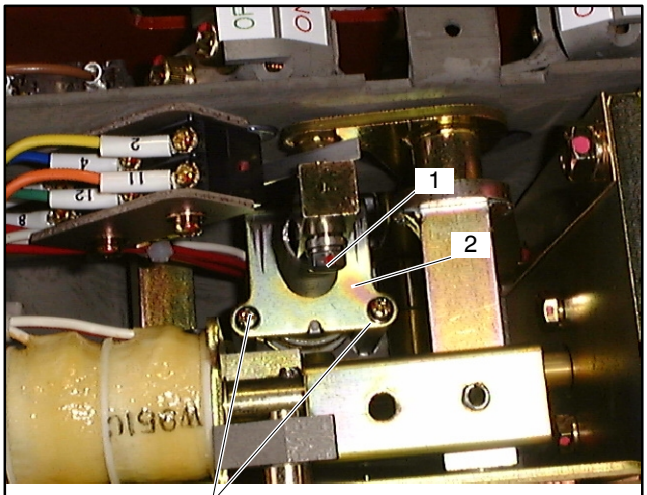
Disassembling the solenoid. Spring-loaded parts can cause severe personal injury or property damage. The spring in the solenoid assembly exerts substantial force on the coil. Hold the coil assembly securely when removing the screws.

1. Note the connections and disconnect the select coil leads from the printed circuit board and the control switch. See Figure 8-32 and Figure 8-33.

2. Loosen the M5 bolt and remove the select coil movable steel shaft and the spring. See Figure 8-35 and Figure 8-36.

3. Loosen the M4 bolts and replace the select coil. See Figure 8-35.

4. Connect the select coil leads to the control switch and circuit board.



1. Steel shaft (and spring, see Figure 8-36)
2. Select coil
3. Select coil M4 bolts

Figure 8-35 Select Coil Replacement, 600 Amp Models

1. Spring

Figure 8-36 Spring Location

8.4.5 Printed Circuit Board Replacement, 600 Amp Models

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Note: The individual rectifiers are not replaceable. Replace the entire printed circuit board in the case of rectifier failure.

1. Note the connections and disconnect all leads to the circuit board. See Figure 8-32.
2. Loosen the M4 bolts to replace the printed circuit board.
3. Reconnect all leads.

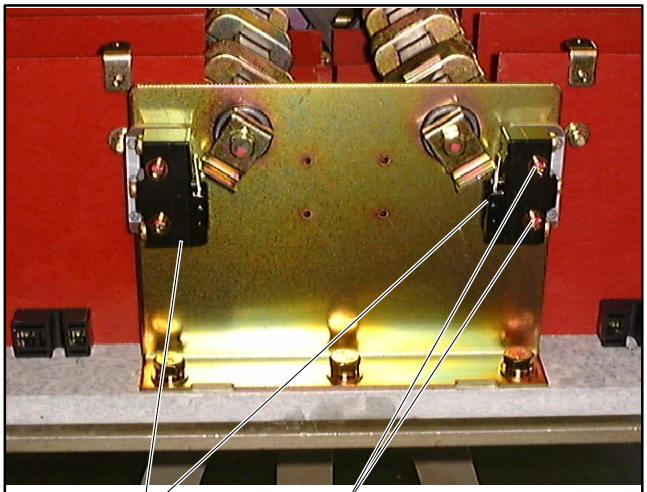
8.4.6 Auxiliary Switch Replacement

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 8.2.
2. Loosen the M4 bolts and replace the auxiliary switches. See Figure 8-37.
3. Tighten the mounting screws to 0.14 Nm (1 in. lb.), maximum.

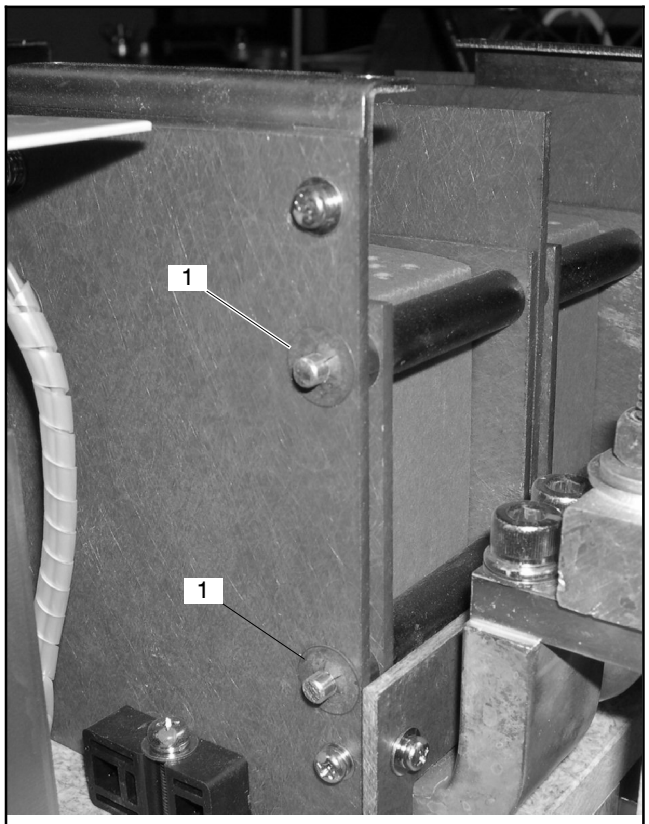


1. Auxiliary switches
2. M4 bolts

Figure 8-37 Auxiliary Switches, 600 Amp Models

8.4.7 Arc Chute Replacement, 600 Amp Models

Note: Some units use retainers (part number 295010) instead of M6 nuts. See Figure 8-38. Obtain new retainers before disassembly.



1. Retainer

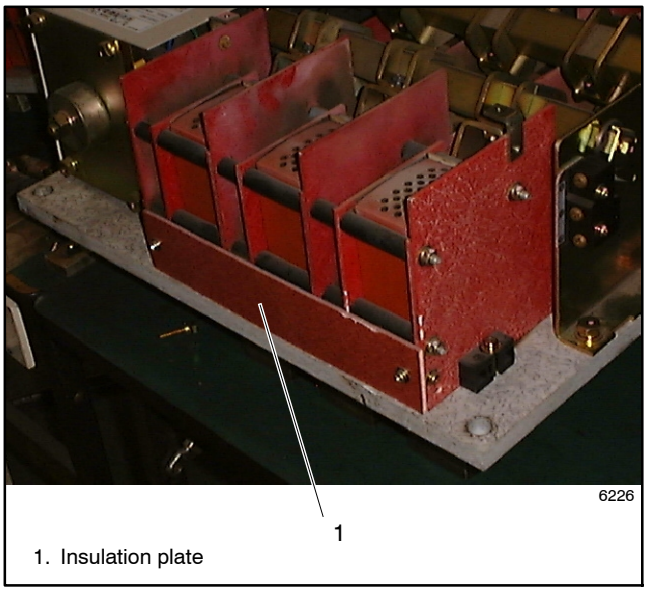
Figure 8-38 Retainer

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 8.2.
2. Remove the insulation plate. See Figure 8-39.



1. Insulation plate

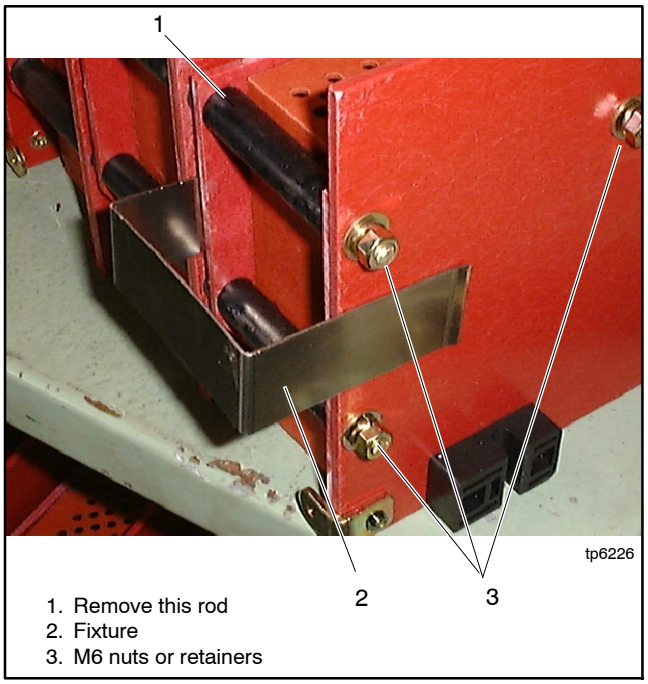
Figure 8-39 600 Amp Contactor

3. Attach a clamp or fixture similar to the one shown in Figure 8-40.

   Note: The transfer switch will come apart if the parts are not clamped as shown before the nuts or retainers are removed.

4. Loosen the M6 nuts or remove the retainers. See Figure 8-40.

5. Remove the upper rod shown in Figure 8-40.



1. Remove this rod
2. Fixture
3. M6 nuts or retainers

Figure 8-40 Fixture or Clamp, 600 Amp Models

6. Replace the arc chutes.

7. Replace the rod.

8. Reinstall and tighten the M6 nuts or install new retainers and then remove the clamp.

9. Reinstall the insulation plate.

8.4.8 Contact Replacement

Source A Side

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 8.2.

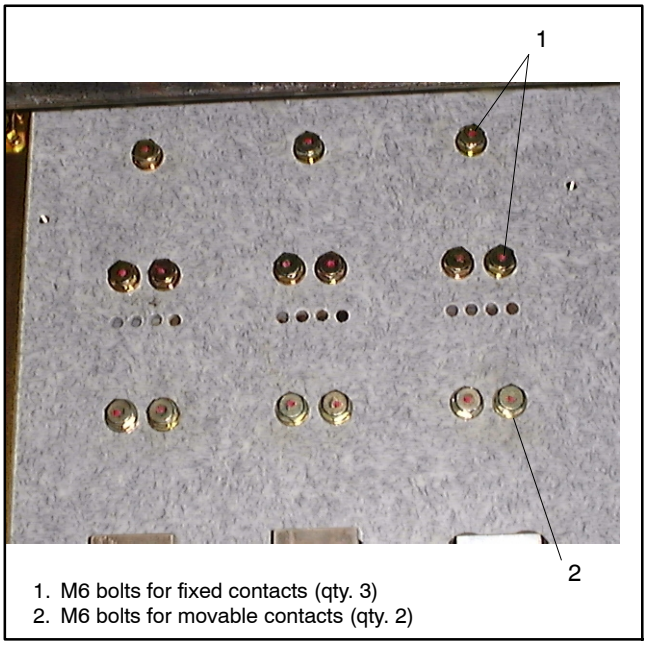
2. Loosen three (3) M6 bolts for the fixed contacts and two (2) M6 bolts for the movable contacts as shown in Figure 9-14.

3. Remove the M6 capscrews and all M4 bolts as shown in Figure 9-15.

4. Install the new contacts.

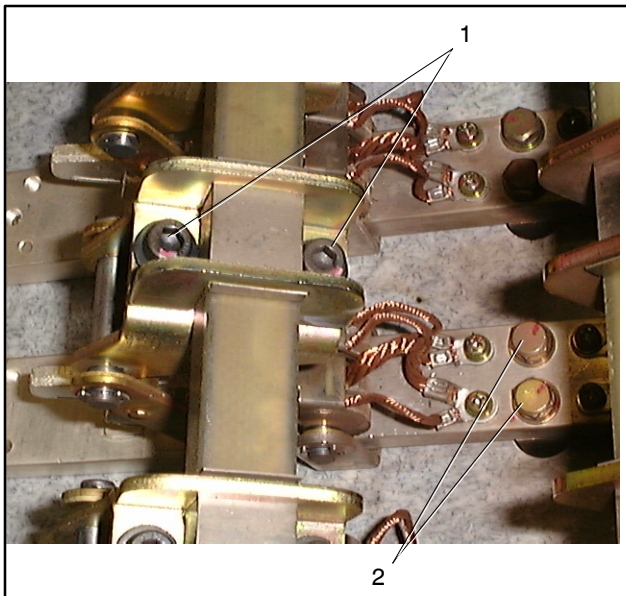
5. After replacing the movable contact, check the contact pressure with the contact wipe gauge at the closed position as shown in Figure 9-16. You should NOT be able to insert the gauge.

6. If the gauge can be inserted, add a 0.5 mm (0.02 in.) spacer as shown in Figure 9-17.



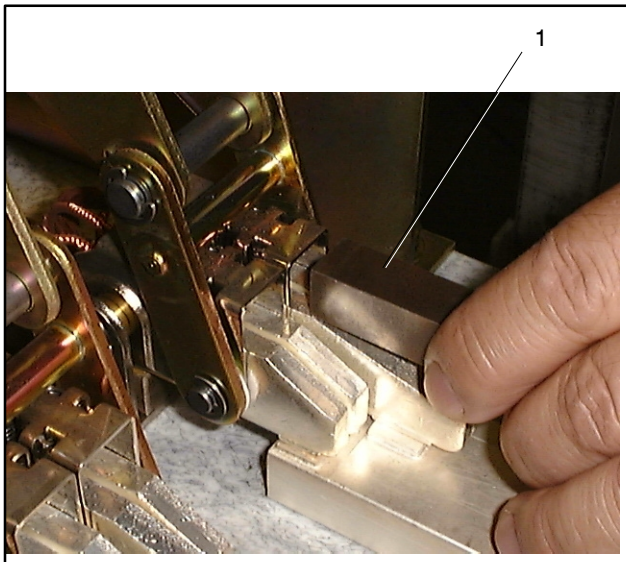
1. M6 bolts for fixed contacts (qty. 3)
2. M6 bolts for movable contacts (qty. 2)

Figure 8-41 Loosen Bolts (back)



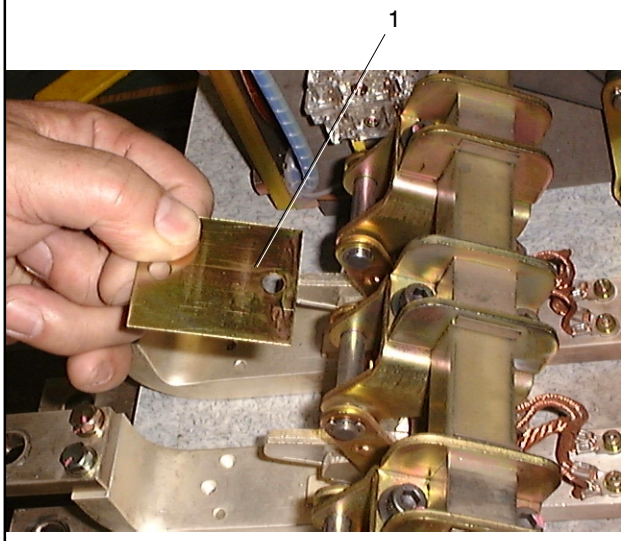
1. Remove the M6 capscrews (2).
2. Remove all M4 bolts.

Figure 8-42 Remove Contact Screws



1. Contact wipe gauge

Figure 8-43 Check New Contact



1. Spacer. 0.5 mm (0.02 in.) thick

Figure 8-44 Add Spacer if Needed

Source B Side

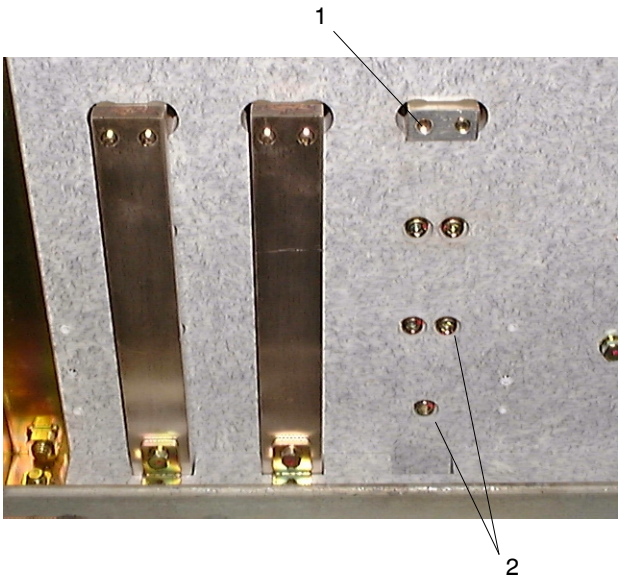
DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

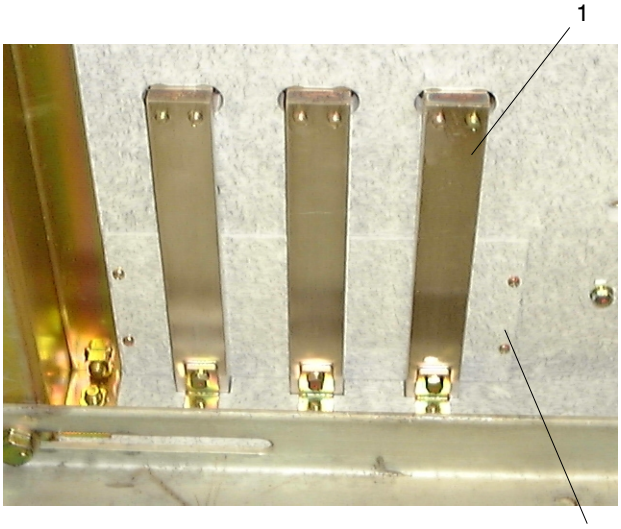
1. Disconnect power and open the transfer switch enclosure as described in Section 8.2.
2. Loosen the M6 capscrews (qty. 2) to replace the movable contacts. See Figure 8-45.
3. Remove the load-side terminal. See Figure 8-46.
4. Remove the insulation plate. See Figure 8-46.
5. To replace the fixed contacts, loosen the M6 capscrews (qty. 3). See Figure 8-45.

Refer to the replacement method of Source A side for the adjustment of contact pressure on the movable contacts.



1. M6 capscrews for movable contacts, qty. 2
2. M6 capscrews for fixed contacts, qty. 3

Figure 8-45 Loosen Screws



1. Load-side terminal
2. Insulation plate

Figure 8-46 Source B Side

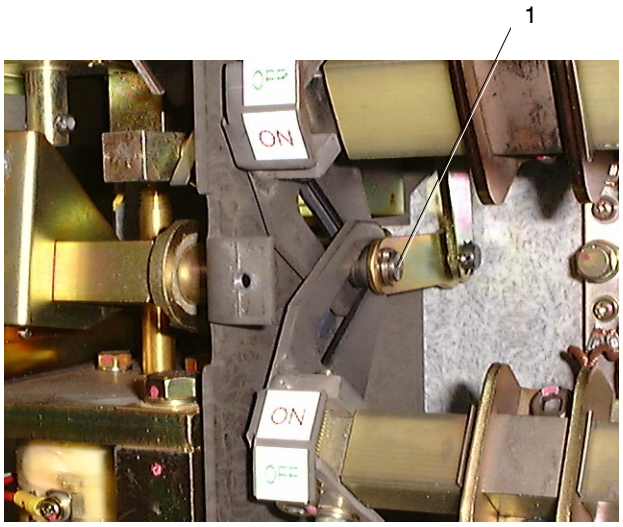
8.4.9 Replacement of the Mechanical Unit

DANGER

Hazardous voltage.
Will cause severe injury or death.

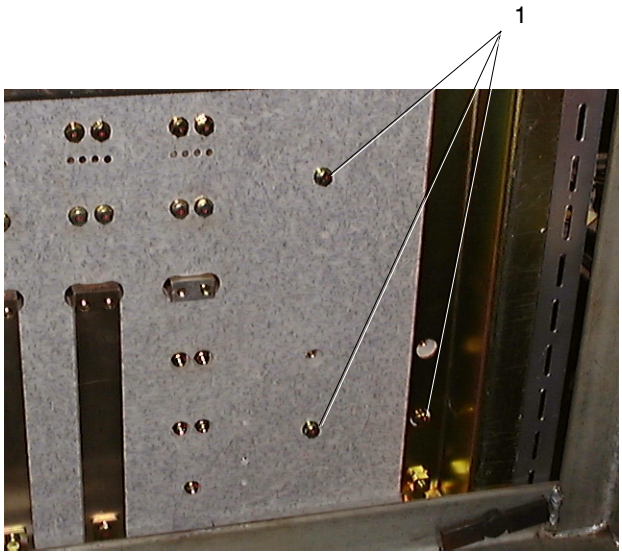
Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 8.2.
2. Remove the split pin and pull out the switch pin.
3. Remove the M6 bolts (qty. 3).
4. Remove the M8 bolt to replace the mechanical unit.



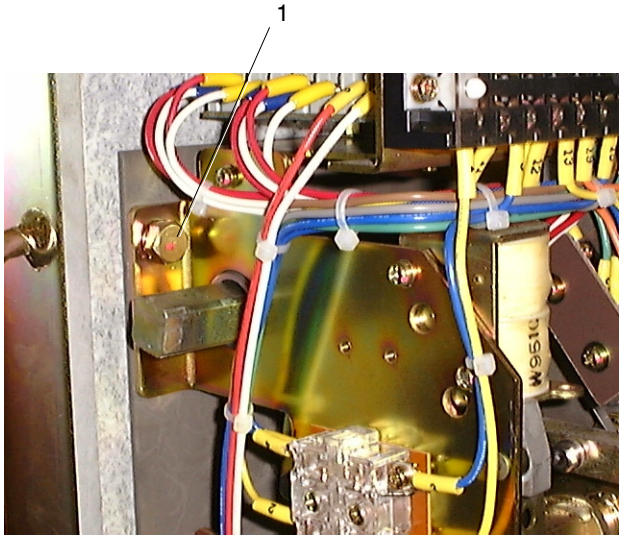
1. Remove split pin and pull out switch pin.

Figure 8-47 Remove pins



1. M6 bolts (qty. 3)

Figure 8-48 Remove M6 Bolts



1. M8 bolt

Figure 8-49 Remove M8 Bolt

Notes

9.1 Introduction

This section contains instructions for component replacement on 800–1000 amp Model KSS standard-transition transfer switches. See Section 7 for component replacement procedures for 40–600 amp Model KSS. See Section 8 for programmed-transition switches.

Observe the safety precautions in the following sections when performing any service procedures on the transfer switch.

9.2 Disconnect Power

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Decision-Maker® 3+ and 550 Generator Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Generator Controllers)

Before performing any of the following service procedures, disable all connected generator sets and disconnect power to the ATS as described below.

Procedure

1. Prevent all connected generator sets from starting.
   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.
   b. Disconnect the battery charger, if equipped.
   c. Disconnect the generator set engine starting batter(ies), negative (-) lead first.
2. Disconnect power to the transfer switch.
3. Open the transfer switch enclosure.
4. Use a voltmeter to verify zero volts across each phase.

9.3 Remove the Cover

Remove the cover from the mechanical unit to gain access to the circuit board and solenoid coil.

1. Remove the two screws securing the cover. See Figure 9-1.
2. Remove the cover from the mechanical unit. See Figure 9-2.

1. M6 screw
2. M4 screw

Figure 9-1 Mechanical Unit Cover

Figure 9-2 Mechanical Unit with Cover Removed

9.4 Rectifier Circuit Board Replacement

⚠ DANGER

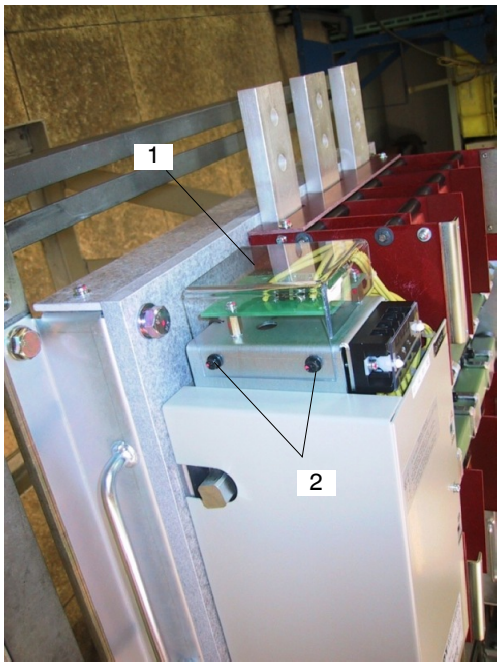
Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

1. Disconnect power as described in Section 9.2.
2. Remove the circuit board cover. See Figure 9-3.
3. The leads are soldered to the circuit board. Note the connections and disconnect the leads at the contactor and coil.
4. Remove the M4 screws securing the circuit board. See Figure 9-4.
5. Install the new circuit board and secure it with the M4 screws.
6. Connect the new circuit board leads to the contactor and coil.
7. Replace the covers for the circuit board and the mechanical unit.



1. Circuit board cover
2. M4 Screws

Figure 9-3 Rectifier Circuit Board Cover

1. M4 screws
2. Rectifier leads

Figure 9-4 Rectifier Circuit Board

9.5 Closing Coil Replacement

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ WARNING

Spring-loaded parts.
Can cause severe personal injury or property damage.

Wear protective goggles when servicing spring-loaded parts. Hold parts securely during disassembly.

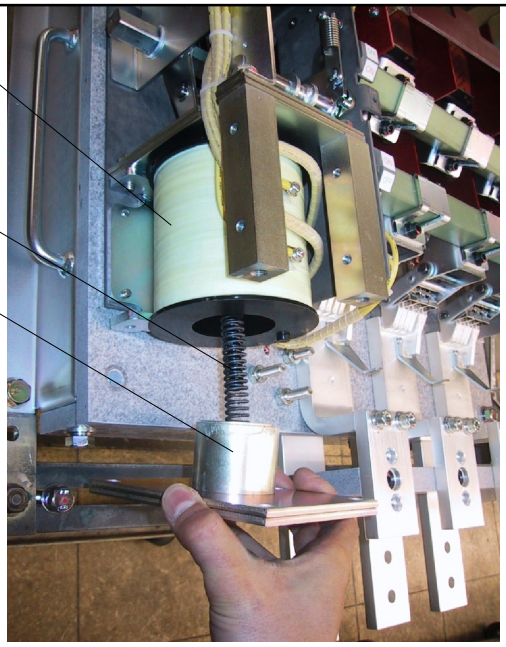
Disassembling the solenoid. Spring-loaded parts can cause severe personal injury or property damage. The spring in the solenoid assembly exerts substantial force on the coil. Hold the coil assembly securely when removing the screws.

1. Disconnect power and open the transfer switch enclosure as described in Section 9.2.
2. Remove the cover from the mechanical unit as described in Section 9.3.
3. Hold the bottom plate securely and remove the four M8 bolts that secure the bottom plate to the coil assembly. See Figure 9-5.
4. Remove the plate. See Figure 9-6.
5. Remove the two M4 bolts shown in Figure 9-7 (240 volt models) or Figure 9-8 (480 volt models). Figure 9-9 shows the unit after the coil has been removed.

1. M8 bolts (qty. 4)

Note: The coil is spring-loaded. Hold the plate securely while removing the bolts.

Figure 9-5 Closing Coil Bottom Plate

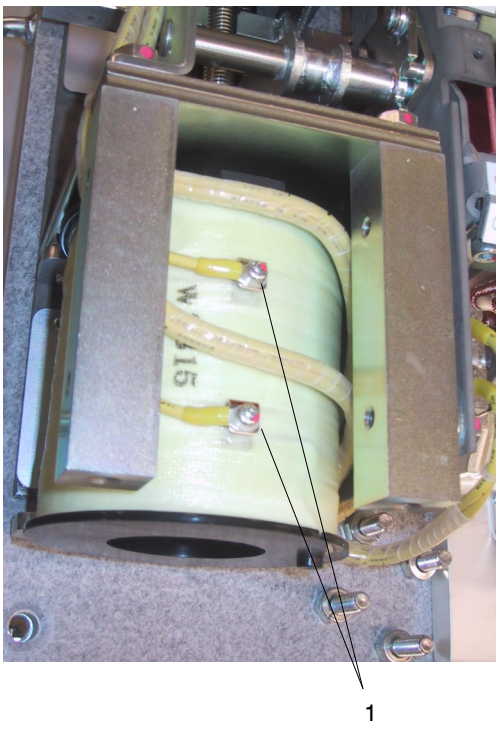


1. Closing coil
2. Spring
3. Steel Core

Figure 9-6 Remove the Bottom Plate

1. Remove two M4 bolts

Figure 9-7 240 Volt Coil



1. M4 bolts, qty. 2

Figure 9-8 480 Volt Coil

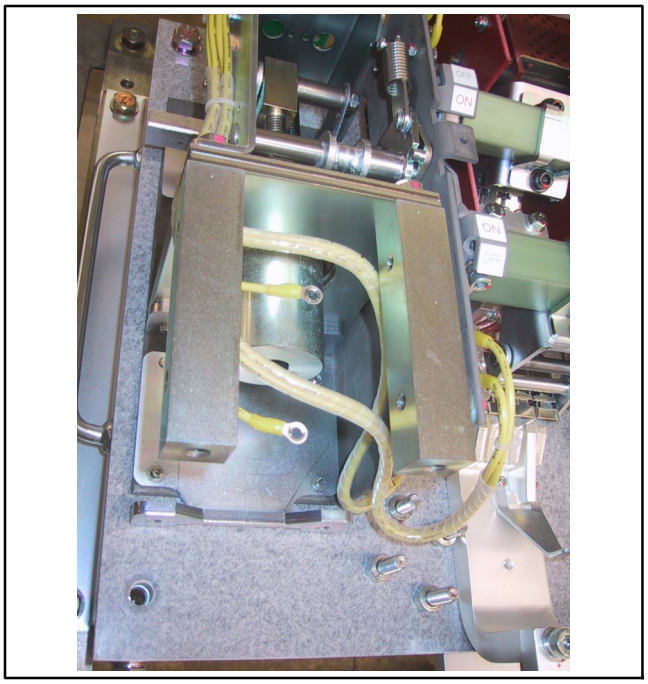


Figure 9-9 Coil Removed

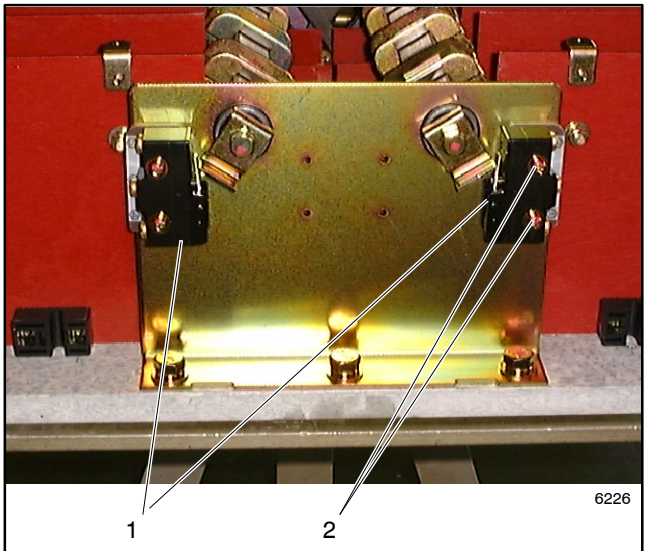
9.6 Auxiliary Switch Replacement

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 9.2.
2. Loosen the M4 bolts and replace the auxiliary switches.
3. Tighten the mounting screws to 0.14 Nm (1 in. lb.), maximum. See Figure 9-10.

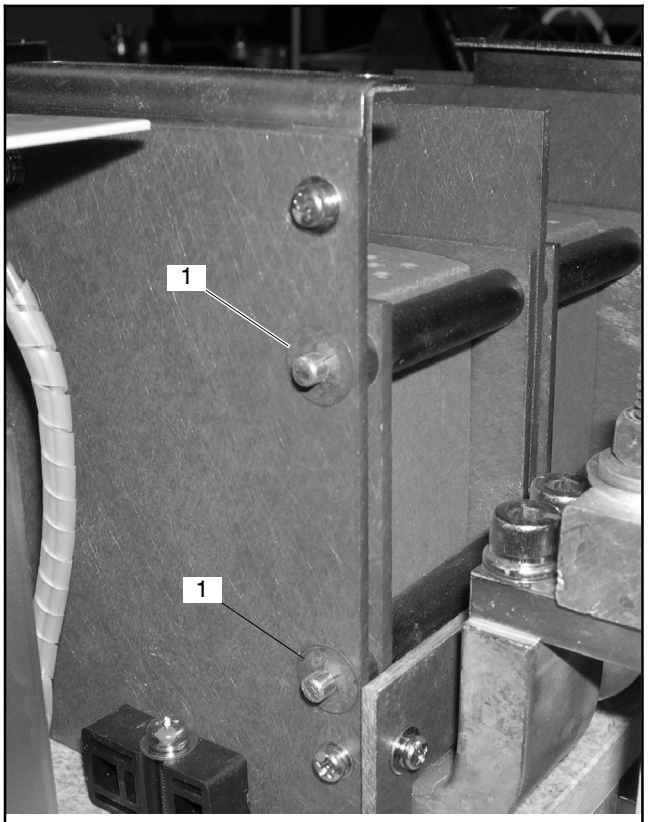


1. Auxiliary switches
2. M4 bolts

Figure 9-10 Auxiliary Switches

9.7 Arc Chute Replacement

Note: Some units use retainers (part number 295010) instead of M6 nuts. See Figure 9-11. Obtain new retainers before disassembly.



1. Retainer

Figure 9-11 Retainer

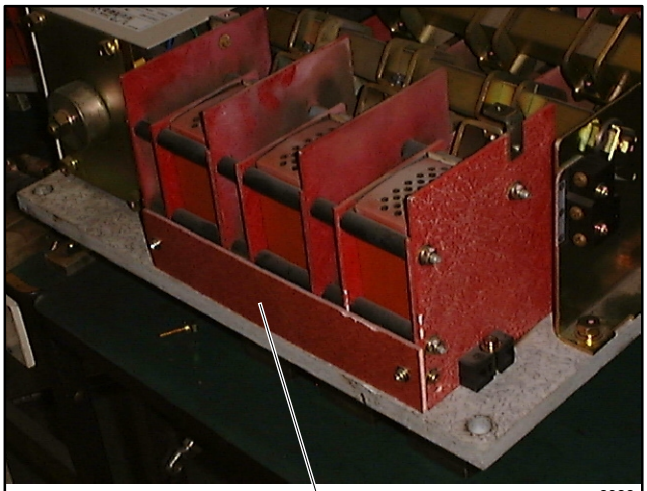
Arc Chute Replacement Procedure

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 9.2.
2. Remove the insulation plate. See Figure 9-12.



1. Insulation plate

Figure 9-12 Contactor

3. Attach a clamp or fixture similar to the one shown in Figure 9-13.

   Note: The transfer switch will come apart if the parts are not clamped as shown before the nuts or retainers are removed.

4. Loosen the M6 nuts or remove the retainers. See Figure 9-13.

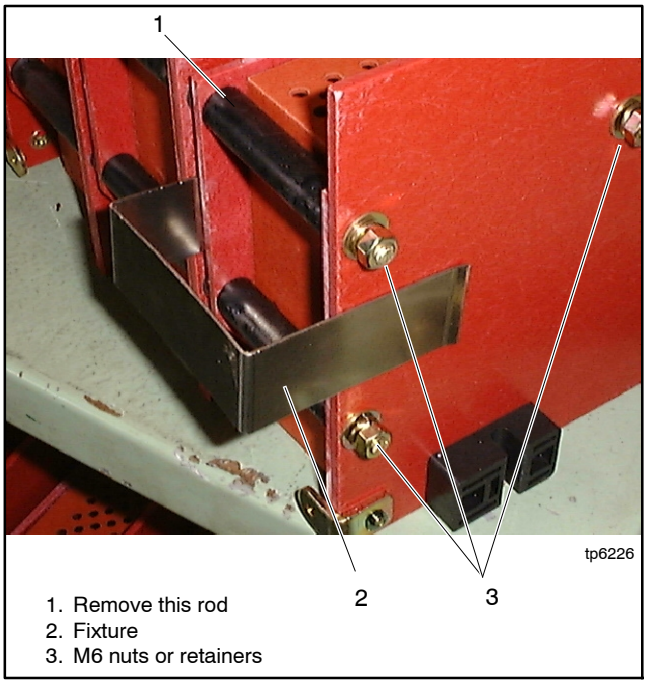
5. Remove the upper rod shown in Figure 9-13.

6. Replace the arc chutes.

7. Replace the rod.

8. Reinstall and tighten the M6 nuts or install new retainers and then remove the clamp.

9. Reinstall the insulation plate.



1. Remove this rod
2. Fixture
3. M6 nuts or retainers

Figure 9-13 Fixture or Clamp

9.8 Contact Replacement

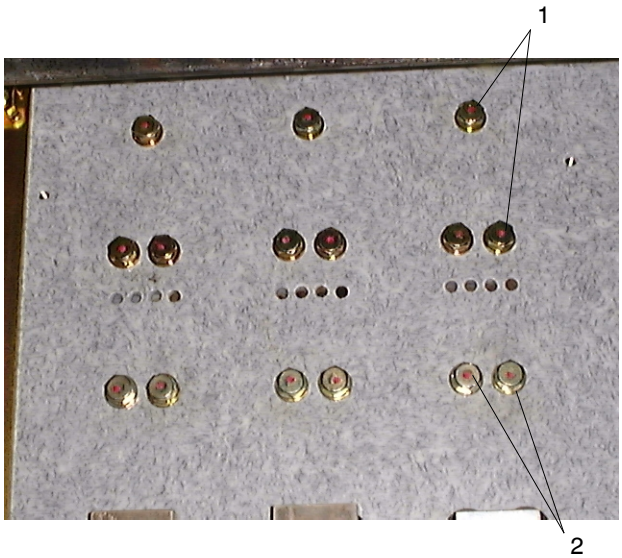
9.8.1 Source A Side

DANGER

Hazardous voltage.
Will cause severe injury or death.

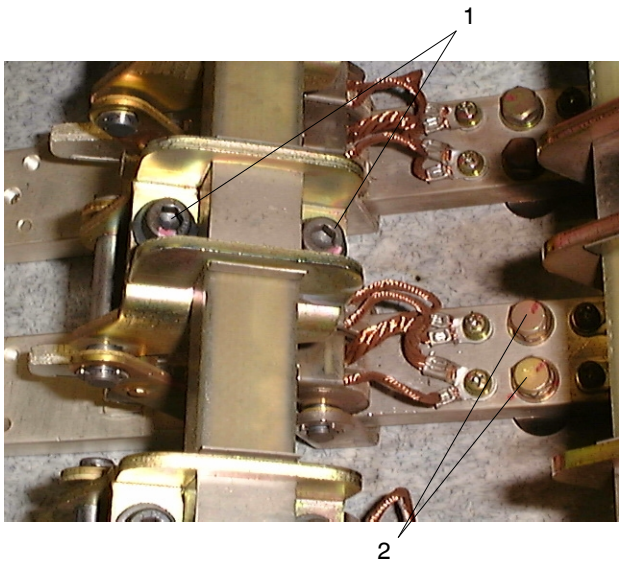
Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 9.2.
2. Loosen three (3) M6 bolts for the fixed contacts and two (2) M6 bolts for the movable contacts as shown in Figure 9-14.
3. Remove the M6 cap screws and all M4 bolts as shown in Figure 9-15.
4. Install the new contacts.
5. After replacing the movable contact, check the contact pressure with the contact wipe gauge at the closed position as shown in Figure 9-16. You should NOT be able to insert the gauge.
6. If the gauge can be inserted, add a 0.5 mm (0.02 in.) spacer as shown in Figure 9-17.



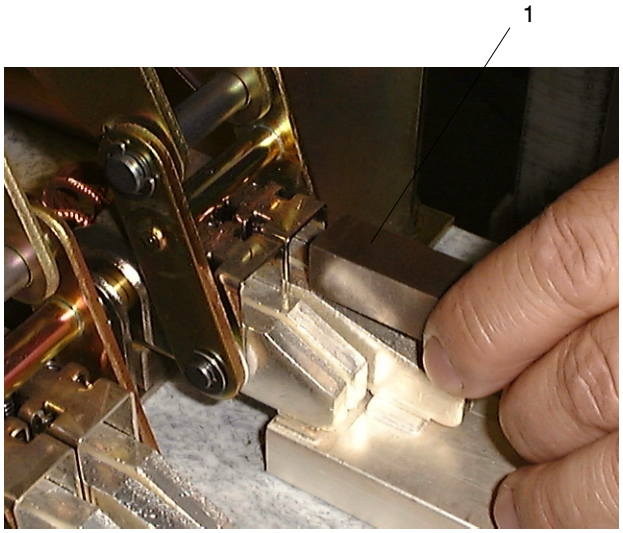
1. M6 bolts for fixed contacts (qty. 3)
2. M6 bolts for movable contacts (qty. 2)

Figure 9-14 Loosen Bolts (back)



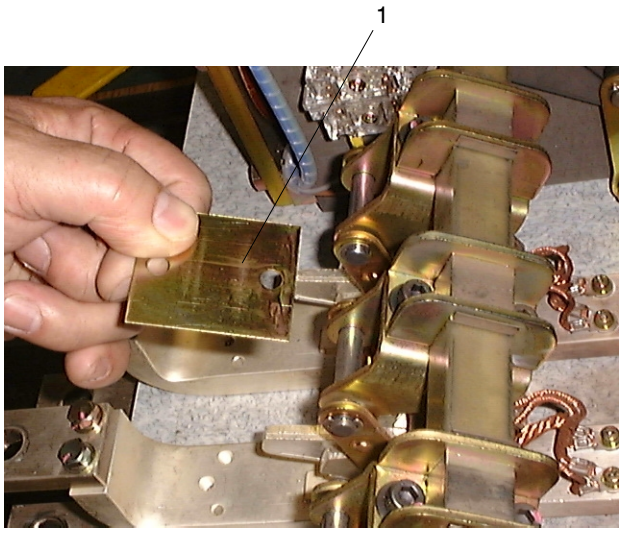
1. Remove the M6 cap screws (2).
2. Remove all M4 bolts.

Figure 9-15 Remove Contact Screws



1. Contact wipe gauge

Figure 9-16 Check New Contact



1. Spacer. 0.5 mm (0.02 in.) thick

Figure 9-17 Add Spacer if Needed

9.8.2 Source B Side

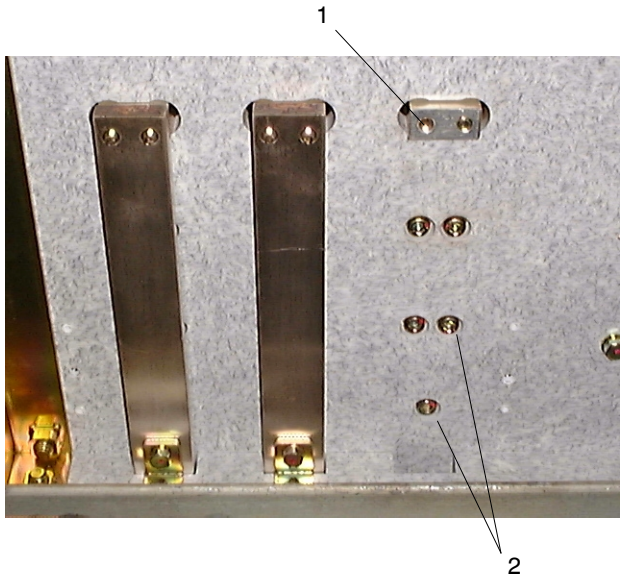
DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

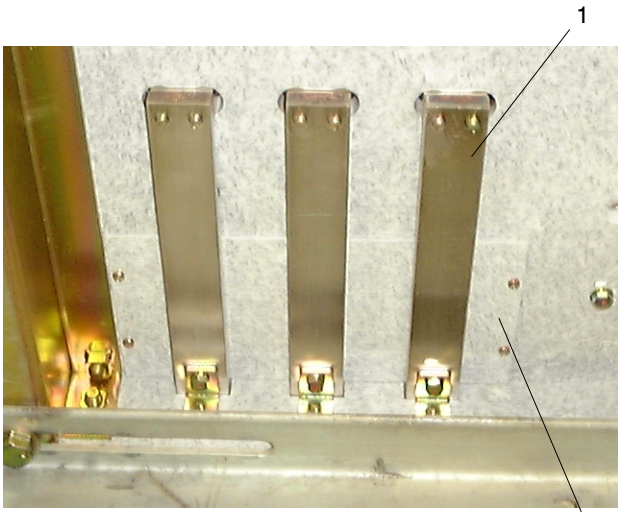
1. Disconnect power and open the transfer switch enclosure as described in Section 9.2.
2. Loosen the M6 cap screws (qty. 2) to replace the movable contacts. See Figure 9-18.
3. Remove the load-side terminal. See Figure 9-19.
4. Remove the insulation plate. See Figure 9-19.
5. To replace the fixed contacts, loosen the M6 cap screws (qty. 3). See Figure 9-18.
6. Install the new contacts.

Refer to the procedure in Section 9.8.1, Source A Side, for the adjustment of contact pressure on the movable contacts.



1. M6 cap screws for movable contacts, qty. 2
2. M6 cap screws for fixed contacts, qty. 3

Figure 9-18 Contact Screws



1. Load-side terminal
2. Insulation plate

Figure 9-19 Load Side Terminal and Insulation Plate

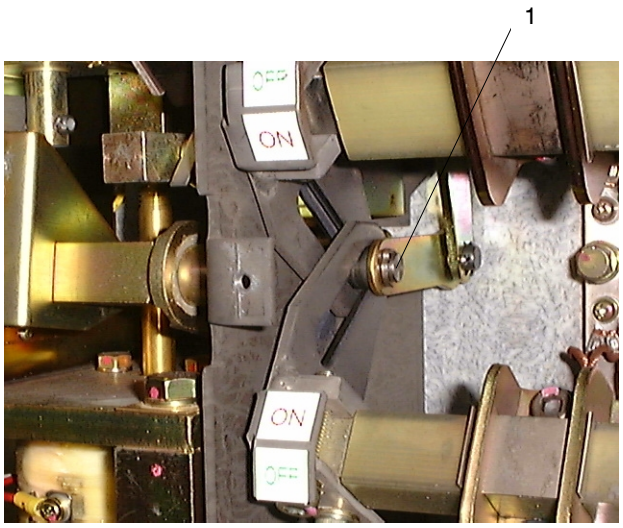
9.8.3 Replacement of the Mechanical Unit

DANGER

Hazardous voltage.
Will cause severe injury or death.

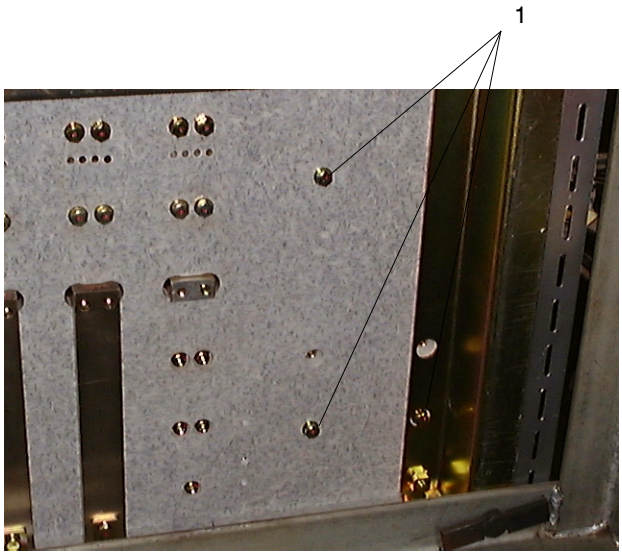
Disconnect all power sources before opening the enclosure.

1. Disconnect power and open the transfer switch enclosure as described in Section 9.2.
2. Remove the split pin and pull out the switch pin. See Figure 9-20.
3. Remove the M6 bolts (qty. 3). See Figure 9-21.
4. Remove the M8 bolt to replace the mechanical unit. See Figure 9-22.



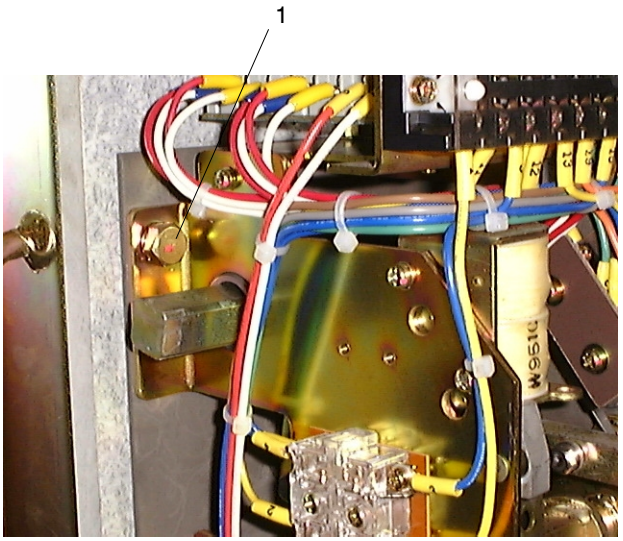
1. Remove split pin and pull out switch pin.

Figure 9-20 Remove pins



1. M6 bolts (qty. 3)

Figure 9-21 Remove M6 Bolts

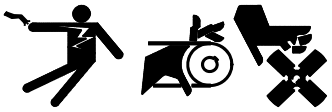


1. M8 bolt

Figure 9-22 Remove M8 Bolt

9.9 Reconnect Power and Test

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

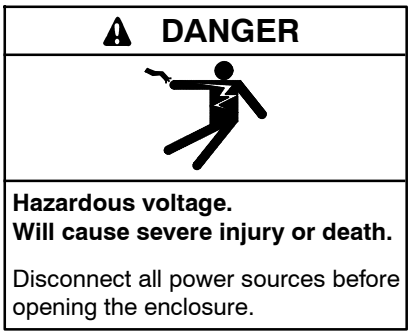
After service, reconnect power and test operation as described below.

1. Close and secure the transfer switch enclosure door.
2. Reconnect power to the transfer switch by closing circuit breakers or switches.
3. Reconnect the generator set engine starting battery, negative lead last.
4. Move the generator set master switch to AUTO or press the AUTO button on the generator set controller.
5. Test the system operation by running a test as described in Section 6.4 or 6.5.

10.1 Introduction

This section contains component removal and replacement procedures for 800–3000 Amp Model KGS/KGP bypass/isolation switches. This section contains information available at the time of publication.

10.2 Disconnect Power



Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Kohler Decision-Maker® 3+ and 550 Controllers)

Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Turn off the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (–) leads first. Reconnect negative (–) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

(Kohler RDC, DC, RDC2, DC2, Decision-Maker® 3000, 3500 and 6000 Controllers)

Before performing any of the following service procedures, disable all connected generator sets and disconnect power to the ATS as described below.

Procedure

1. Prevent all connected generator sets from starting.
   a. Place the generator set master switch in the OFF position or press the OFF button on the generator set controller.
   b. Disconnect the battery charger, if equipped.
   c. Disconnect the generator set engine starting batter(ies), negative (–) lead first.
2. Disconnect power to the transfer switch.
3. Open the transfer switch enclosure.
4. Use a voltmeter to verify zero volts across each phase.

10.3 Contact Assembly Removal and Replacement

10.3.1 800–1200 Amp Models

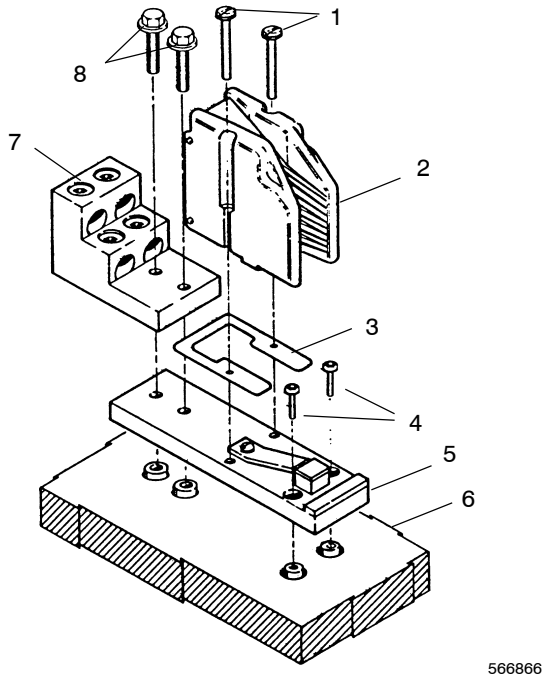
⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Disconnect power as described in Section 10.2.

Refer to Figure 10-1 and Figure 10-2 for the following procedure.

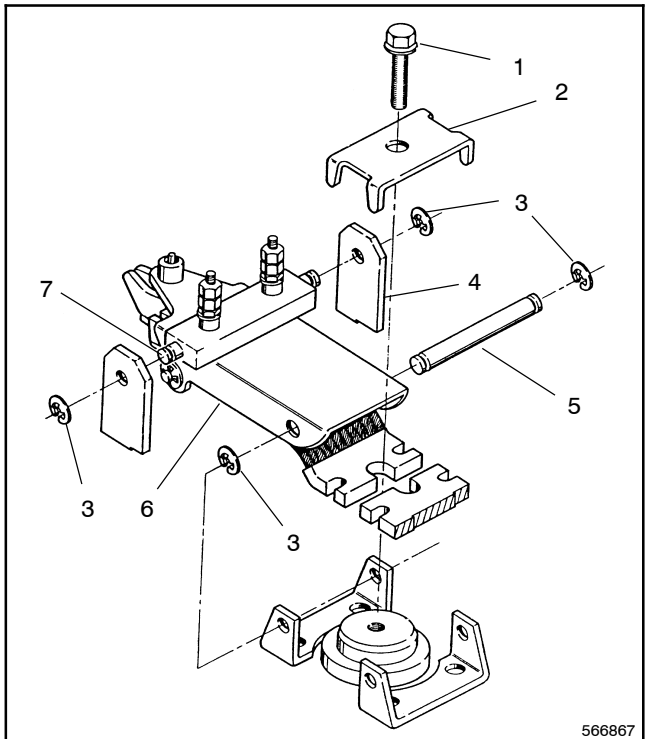


1. Arc chute retaining screws
2. Arc chute
3. Arc chute pad
4. Machine screws
5. Stationary contact assembly
6. Transfer switch panel
7. Lug terminal
8. Hex head cap screw

Figure 10-1 Stationary Contact, 800–1200 Amp

Removing Contact Assemblies, 800–1200 Amp Models

1. Remove the machine screws and flat washers that secure the blue plastic switch cover.
2. Remove the cover.
3. Manually place the movable contact assembly in the open position.
4. Remove the screws that secure the arc chute.
5. Remove the arc chute and arc chute pad.
6. Remove the two retaining rings and slide the actuator arms from the contact posts.
7. Remove one of the retaining rings from the pivot pin.



1. Bus stub bolt
2. Clamp bracket
3. Retaining ring
4. Actuator arms
5. Pivot pin
6. Movable contact assembly
7. Contact posts

Figure 10-2 Movable Contact, 800–1200 Amp

8. Slide out the pivot pin.

9. Remove the bus stud bolt, compression washer, and clamp bracket.

10. Remove the movable contact assembly.

11. If replacing the stationary contact, proceed to step 12. If not replacing the stationary contact, proceed to the replacement procedure.

12. Remove the hex head cap screws and the compression washers (2) that secure the lug terminal.

13. Remove the machine screws (2) that secure the other end of the stationary contact to the transfer switch panel.

14. Remove the stationary contact.

Replacing Contact Assemblies, 800–1200 Amp Models

Refer to Figure 10-1, Figure 10-2, Figure 10-4, Figure 10-3, and Figure 10-5 for the following procedure:

1. If replacing the stationary contact, position the new stationary contact on the transfer switch panel.

2. Secure the new stationary contact and the lug assembly using hex head cap screws, compression washers, and machine screws (2).

3. Torque the cap screws to 31.2 Nm (23 ft. lb.) and the machine screws to 13.6 Nm (10 ft. lb.).

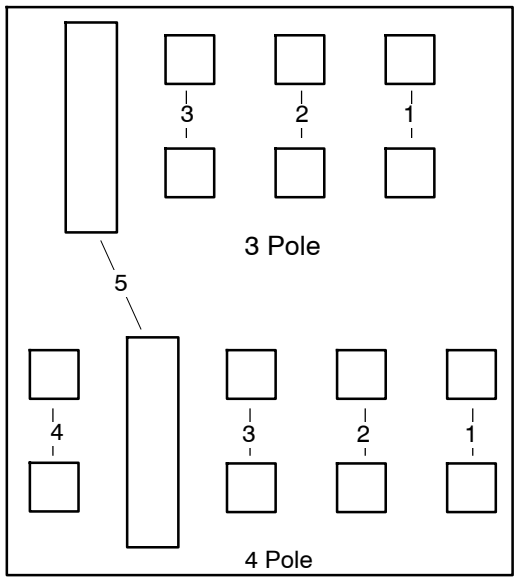
4. Using the new hardware supplied with the contact assemblies kit secure the new movable contact assembly with the bus stud bolt, compression washer, and clamp bracket.

5. Torque the bus stud bolt to 31.2 Nm (23 ft. lb.)

6. Install the pivot pin and secure with the retaining ring.

7. Connect the actuator arms to the contact posts and secure with the two retaining rings. See Figure 10-2.

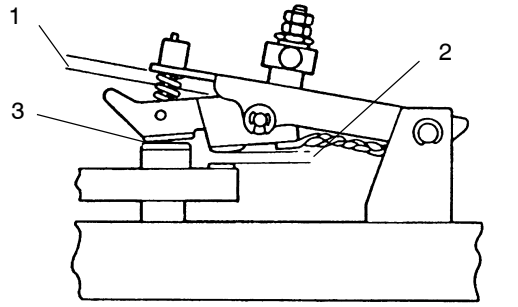
8. Adjust the contacts (steps 9, 10, 12, and 13) in the sequence shown in Figure 10-3. For 3-pole switch all contacts should close at approximately the same time. For 4 pole switches poles A, B, and C should close at approximately at the same time. The neutral pole should close approximately 12.7 mm (1/2 in.) before the other three poles.



1. C Pole
2. B Pole
3. A Pole
4. Neutral pole
5. Operator

Figure 10-3 Contact Adjustment Order

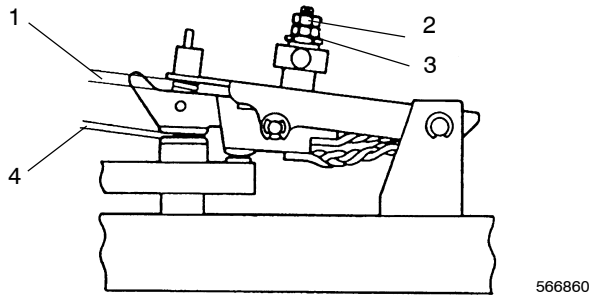
9. Manually close the contacts until the arcing contacts touch. See Figure 10-4. The main contacts should have a 1.59 mm (1/16 in.) minimum gap. If they do not, reject the contact assembly. Measure and record the prespring gap.



1. Prespring gap
2. Main contact gap
3. Arcing contact

Figure 10-4 Contact Adjustment Part 1

10. Close the contacts fully. See Figure 10-5.



1. Spring gap
2. Locknuts
3. Adjustment screw
4. Arcing contacts 0.003 gap

Figure 10-5 Contact Adjustment Part 2

11. Rock the arcing contact from toe to heel and verify that there is a 0.0762 mm (0.003 in.) minimum gap at the arcing contacts. The feeler gauge must enter 1.59 mm (1/16 in.) past the edge of the silver.

12. Adjust the spring gap dimension to 3.175 mm (1/8 in.) maximum to 1.59 mm (1/16 in.) minimum deflection on the mains less than the prespring gap, measured in step 9, bias to 1.59 mm (1/16 in.)

13. Turn the adjustment screw by hand to set the spring gap dimension.

14. Lock the setting by tightening the locknuts.

15. Check both sides of the main contacts to ensure they are level. Recheck the arc contact to make sure that it has not changed.

16. Secure the arc chute and arc chute pad with the two machine screws.

17. Check the operation of the transfer switch by manually opening and closing the switch assemblies.

18. Reinstall and secure the blue plastic cover.

19. Close and secure the transfer switch enclosure door.

20. Reconnect power to the transfer switch by closing circuit breakers or switches.

21. Reconnect the generator set engine starting battery, negative lead last.

22. Move the generator set master switch to AUTO or press the AUTO button on the generator set controller.

23. Test the system operation by running a test as described in Section 6.4.

10.3.2 1600–2000 Amp Models

Removing Contact Assembly, 1600–2000 Amp Models

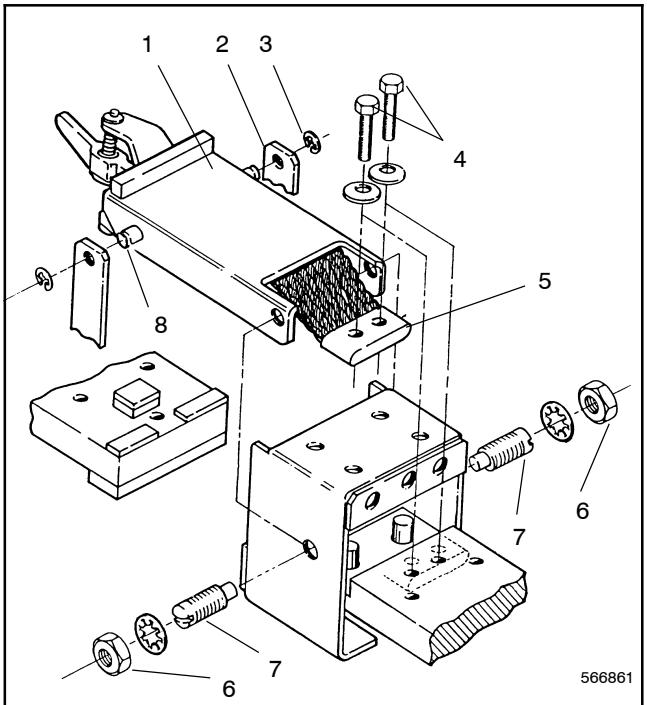
⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Disconnect power as described in Section 10.2.

Refer to Figure 10-1 and Figure 10-6 for the following procedure:



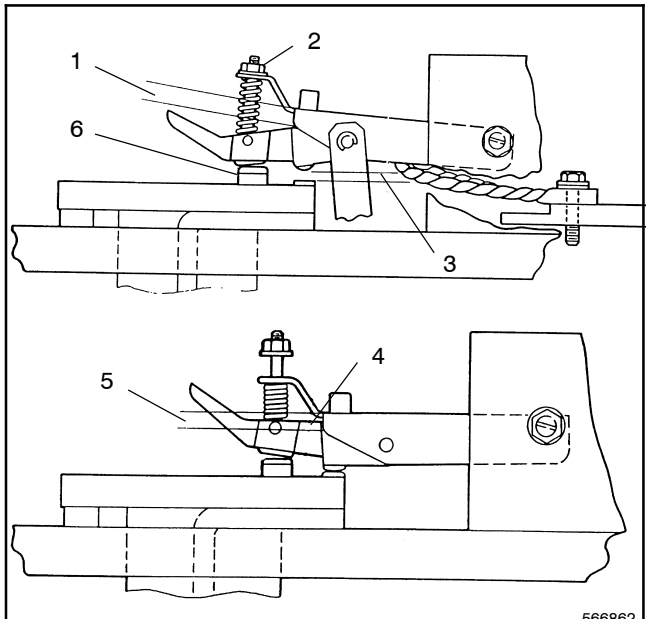
1. Contact assembly
2. Actuator arms
3. Retaining rings
4. Bolts
5. Braid lug
6. Locknuts
7. Pivot studs
8. Contact posts

Figure 10-6 Movable Contact, 1600–2000 Amp

1. Remove the machine screws and flat washers that secure the blue plastic switch cover.
2. Remove the cover.
3. Remove the screws that secure the arc chute.
4. Remove the arc chute and arc chute pad.
5. Manually place the movable contact assembly that will be removed in the open position.
6. Remove the two retaining rings and slide the actuator arms from the contact posts. See Figure 10-6.
7. Remove the bolts and compression washers (2) from the braid lug.
8. Loosen the locknuts and remove the pivot studs.
9. Remove the contact assembly.

Replacing Contact Assembly 1600-2000 Amp Models

Refer to Figure 10-6 and Figure 10-7 for the following procedure:



1. Prespring gap
2. Arc finger adjustment nut
3. Main contacts
4. Arc finger
5. Spring gap
6. Arcing contacts

Figure 10-7 Contact Adjustment

1. Secure the new movable contact assembly with the pivot studs, locknuts, and lock washers.
2. Torque the locknuts to 13.6 Nm (10 ft. lb.).
3. Secure the braid lug with the braid lug bolts and compression washers.
4. Torque the bolts to 31.2 Nm (23 ft. lb.).
5. Connect the actuator arms to the contact posts and secure with the two retaining rings.
6. Manually close the contacts slowly until the arcing contacts touch. The main contacts should have 6.35 mm (1/4 in.) minimum gap. If not, adjust the arc finger adjustment nut as required. If the contacts cannot be brought within specifications, reject the contact assembly.
7. Measure and record the gap at the prespring gap.
8. Close the contacts fully.
9. Rock the arcing contact from toe to heel and verify that there is a 0.0762 mm (0.003 in.) minimum gap at the arcing contacts. The feeler gauge must enter 1.59 mm (1/16 in.) past the edge of the silver.
10. The spring gap dimension must be 1.59 mm (1/16 in.) less than prespring gap measured in step 7. If the contacts are not within specs, reject the contact assembly.
11. Check that the contact pressure of each of the three outside main contacts is between 1.7-2 kg (3.75-4.5 lb.).
12. Check that the contact pressure of the arc finger is between 4-6.4 kg (9-14 lb.).
13. Check that both main and arc contact fingers are not bottomed out when closed.
14. Secure the arc chute and arc chute pad with the two machine screws.
15. Check the operation of the transfer switch by manually opening and closing the switch assemblies.
16. Reinstall and secure the blue plastic cover.
17. Close and secure the transfer switch enclosure door.
18. Reconnect power to the transfer switch by closing circuit breakers or switches.
19. Reconnect the generator set engine starting battery, negative lead last.
20. Move the generator set master switch to AUTO or press the AUTO button on the generator set controller.
21. Test the system operation by running a test as described in Section 6.4.

10.3.3 3000 Amp Model

Removing Contact Assembly, 3000 Amp Model

⚠ DANGER

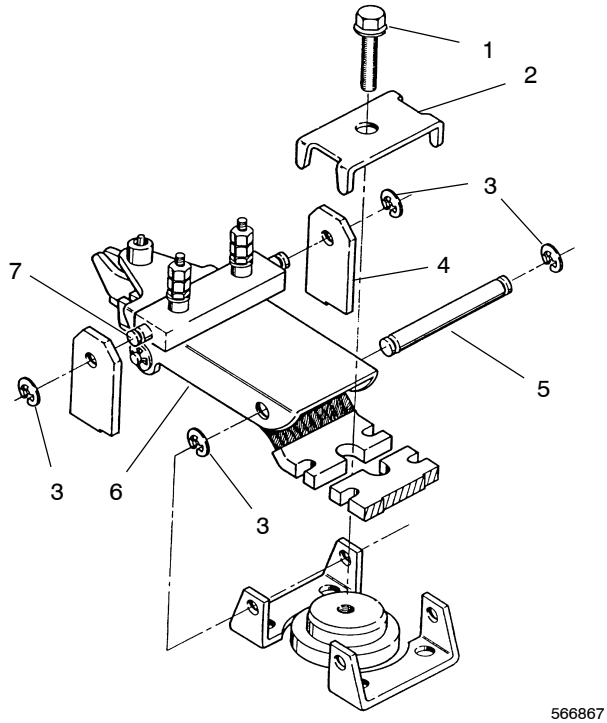
Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Disconnect power as described in Section 10.2.

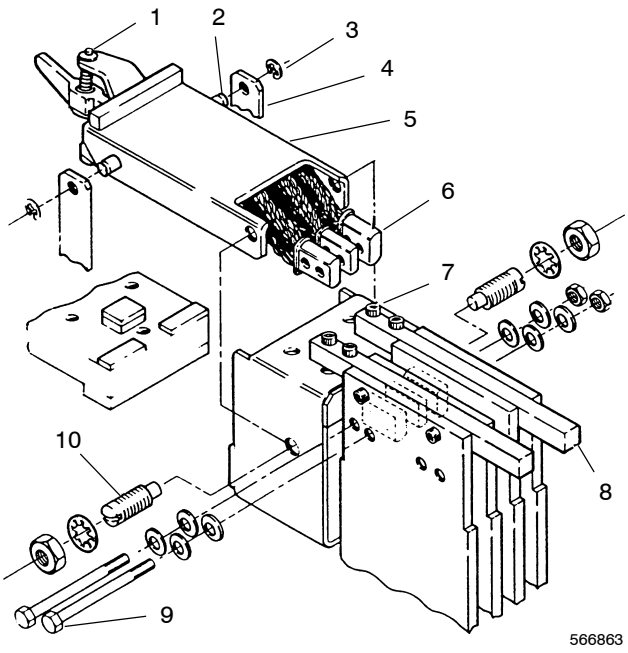
Note: Replace the B-phase contact assembly only by first removing two bolts from the adjacent C-phase contact assembly. Refer to step 7b. for this replacement procedure.

Refer to Figure 10-8 and Figure 10-9 during the following procedure.



1. Bus stub bolt
2. Clamp bracket
3. Retaining ring
4. Actuator arms
5. Pivot pin
6. Movable contact assembly
7. Contact posts

Figure 10-8 Stationary Contact



1. Arc finger adjustment nuts
2. Contact post
3. Retaining rings
4. Actuator arms
5. Contact assembly
6. Braid lug
7. Socket head cap screws
8. Anchor bars
9. Braid lug bolts
10. Pivot studs

Figure 10-9 Movable Contact A or C Phase, 3000 Amp

1. Remove the machine screws and flat washers that secure the blue plastic switch cover.
2. Remove the cover.
3. Remove the screws that secure the arc chute.
4. Remove the arc chute and arc chute pad.
5. Manually place the movable contact assembly that will be removed in the open position.
6. Remove the two retaining rings and slide the actuator arms from the contact posts.
7. Remove the twelve 1/4-20 socket head cap screws from the load bus assembly and lift out the anchor bars. The longer cap screws are used on the sides.
   a. To remove an A-phase, C-phase, or neutral contact assembly: Remove the bolts, nuts, and compression washers that secure the braid lugs to the bus bars. To remove a B-phase contact assembly follow the procedure described in step 7b.

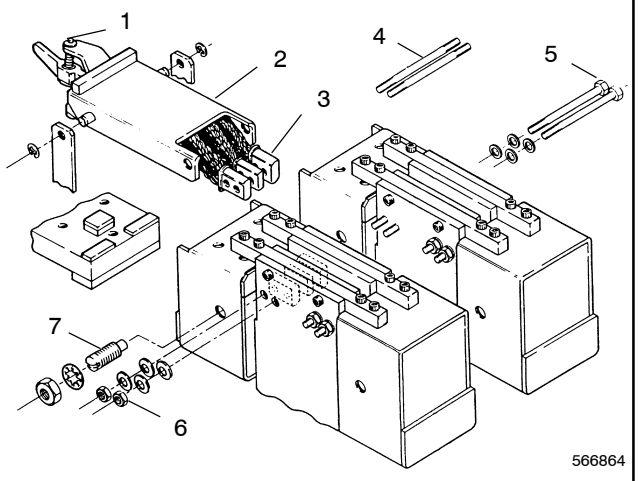
b. To remove a B-phase contact assembly:

- Remove the nuts and compression washers from the ends of the braid lug studs.
- Remove the nut and washers from the lower bolt on the C-phase braid lug.
- Remove the bolt.
- Slide the lower B-phase threaded stud into the hole where the C-phase bolt had been.
- Repeat this procedure with the upper C-phase bolt and corresponding upper B-phase stud. Keep the threaded studs in the C-phase assembly to hold the C-phase braid lugs in position.

8. Loosen the locknuts and remove the pivot studs.
9. Remove the contact assembly.

Replacing Contact Assembly, 3000 Amp Model

Refer to Figure 10-7, Figure 10-9, and Figure 10-10 for the following procedure.



1. Arc finger, adjustment nut
2. Contact assembly
3. Braid lug
4. B-Phase braid lug studs
5. C-Phase braid lug bolts
6. Braid lug nuts and washers
7. Pivot stud

Figure 10-10 Movable Contact B Phase, 3000 Amp

1. Secure the new movable contact assembly with the pivot studs, locknuts, and lock washers. Torque the locknuts to 13.6 Nm (10 ft. lb.).
2. To replace an A-phase, C-phase, or neutral contact assembly secure the braid lugs to the bus bars with the bolts, nuts and compression washers. Torque the nuts to 19 Nm (14 ft. lb.). To replace a B-phase contact assembly, follow the procedure described in step 3b.

OR

3. To replace a B-phase contact assembly:
   a. Use a bent wire to align the bus bar holes with the braid lug holes.
   b. Use the braid lug bolts that were removed from the C-phase assembly to push the B-phase braid lug studs back into position in the B-phase assembly. Tap the bolts lightly with a hammer, if necessary.
   c. Secure the B-phase studs and C-phase bolts with compression washers and nuts. Torque the nuts to 19 Nm (14 ft. lb.).
4. Install the anchor bars on the load bus assembly with twelve 1/4-20 socket head cap screws. The longer cap screws are used on the sides. Torque the cap screws to 10.2 Nm (90 in. lb.).
5. Connect the actuator arms to the contact posts and secure with two retaining rings.
6. Close the contacts slowly until the arcing contacts touch. The main contacts should have a 6.35 mm (1/4 in.) minimum gap. If they do not, adjust the arc finger adjustment nut as required. If the contacts cannot be brought within specifications, reject the contact assembly.
7. Measure and record the prespring gap.
8. Close the contacts fully.
9. Rock the arcing contact from toe to heel and verify that there is an 0.0762 mm (0.003 in.) minimum gap at the arcing contact. A feeler gauge must enter 1.59 mm (1/16 in.) past the edge of the silver.
10. The spring gap dimension must be 1.59 mm (1/16 in.) less than the prespring gap dimension measured in step 7. If the contacts are not within specifications, reject the contact assembly.
11. Check that the contact pressure of each of the three outside main contacts is between 1.7–2 kg (3.75–4.5 lb.). Check that the contact pressure of the arc finger, is between 4–6.4 kg (9–14 lb.).
12. Check that both main and arc contact fingers are not bottomed out when closed.

13. Secure the arc chute and arc chute pad with two machine screws.

14. Check the operation of the transfer switch by manually opening and closing the switch assemblies.

15. Reinstall and secure the blue plastic cover.

16. Close and secure the transfer switch enclosure door.

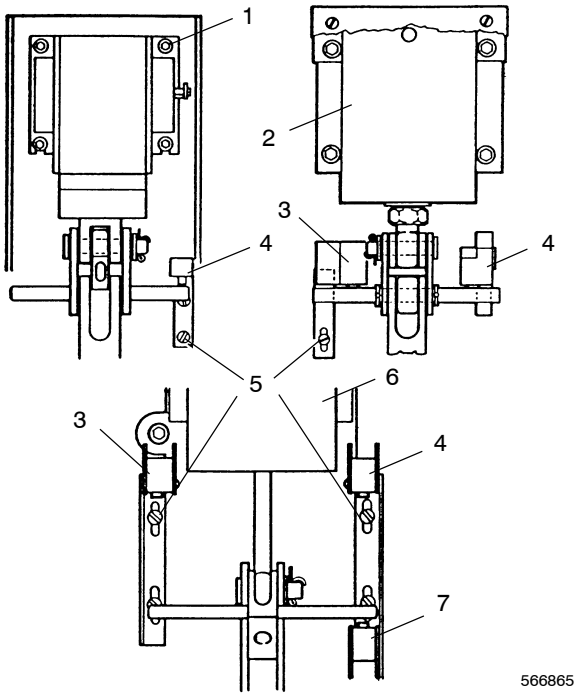
17. Reconnect power to the transfer switch by closing circuit breakers or switches.

18. Reconnect the generator set engine starting battery, negative lead last.

19. Move the generator set master switch to AUTO or press the AUTO button on the generator set controller.

20. Test the system operation by running a test as described in Section 6.4.

10.4 Auxiliary Switch Removal and Replacement



1. 1200 amp 2-position switches
2. 1600–3000 amp 2-position switches
3. SE switches
4. SN switches
5. Mounting screws
6. 1200–3000 amp 3-position switches
7. SNO switches

Figure 10-11 Auxiliary Switches

Removing and Replacing Auxiliary Switch Assembly

DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Disconnect power as described in Section 10.2.

1. Remove the four machine screws, if applicable, and lift off the metal solenoid cover.
2. Remove the two mounting screws that secure the bracket-mounted switch assembly to the panel.
3. Before disconnecting the control wiring leads from the auxiliary switch, observe and note the switch terminal markings, NO, NC, and C, and which wire connects to each.
4. Disconnect the wires and connect them to the corresponding terminals of the replacement switch assembly.
5. Install the new auxiliary switch assembly with the two mounting screws.
6. Manually operate the transfer switch to make sure that the new auxiliary switch trips. Listen for an audible click when the switch trips.
7. Check the following on the new auxiliary switch:
   a. SN/SNO and SE/SEO pairs are adjusted to have the same over travel.
   b. The auxiliary switch trips 1.59 mm (1/16 in.) before it reaches its fully seated position.
   c. After the auxiliary switch trips, there must be over travel to ensure good switch operation.
   d. Do not force the auxiliary switch into the fully operated position.
   e. The auxiliary switches that operate as the main contacts are closing should trip just as the contact mechanism reaches the over-center point.

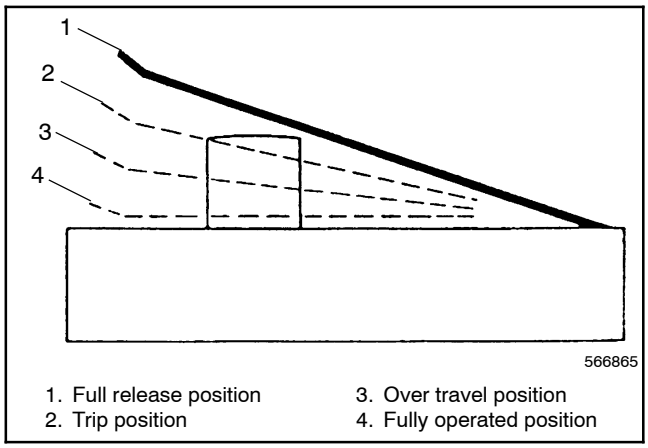


Figure 10-12 Auxiliary Adjustment

10.5 Reconnect Power and Test

After service, reconnect power and test operation as described below.

1. Close and secure the transfer switch enclosure door.
2. Reconnect power to the transfer switch by closing circuit breakers or switches.
3. Reconnect the generator set engine starting battery, negative lead last.
4. Move the generator set master switch to AUTO or press the AUTO button on the generator set controller.
5. Test the system operation by running a test as described in Section 6.4.

Notes

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	advanced digital control; analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
Ah	amp-hour
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
APDC	Air Pollution Control District
API	American Petroleum Institute
approx.	approximate, approximately
AQMD	Air Quality Management District
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CAN	controller area network
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
cogen.	cogeneration
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cUL	Canadian Underwriter's Laboratories
CUL	Canadian Underwriter's Laboratories
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dB(A)	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
DFMEA	Design Failure Mode and Effects Analysis
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
ECM	electronic control module, engine control module
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
fglass.	fiberglass
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lb.	foot pounds (torque)
ft./min.	feet per minute
ftp	file transfer protocol
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temp., high engine temp.
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lb.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard

k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)
KBus	Kohler communication protocol
kg	kilogram
kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
kWth	kilowatt-thermal
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
m^3/hr.	cubic meters per hour
m^3/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCCB	molded-case circuit breaker
MCM	one thousand circular mils
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
ms	millisecond
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MTU	Motoren-und Turbinen-Union
MW	megawatt
mW	milliwatt
µF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips® head Crimptite® (screw)
PHH	Phillips® hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
psig	pounds per square inch gauge
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart, quarts
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
Res/Coml	Residential/Commercial
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTU	remote terminal unit
RTV	room temperature vulcanization
RW	read/write
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number
SNMP	simple network management protocol
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec	specification
specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
THD	total harmonic distortion
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

Appendix B Screen Summaries

For reference, this section lists the items displayed during normal operation, and the information and settings shown in the View screens and Setup menus on Decision-Maker® MPAC 1200 and 1500 controllers.

Operation Screens

Main Screen

- System Status
- Next Exercise Time and Date
- Normal Source Voltage
- Emergency Source Voltage *
- Frequency
- Lamp Test
- Current, Amps
- Time/Date
- Daylight Saving Time Info
- Preferred Source
- Source-Source Type
- Commit/No Commit to Transfer
- Standard/Programmed/Closed Transition †
- Phase Rotation (3-phase only)
- In-Phase Monitoring Enabled/Disabled

Test Sequence Screens

- Enter Password
- Type of Test
  - Loaded/Unloaded/Auto Load/Sync Check
  - Auto Load Test Run Time
- Test Sequence Status Screens
  - Active Time Delay with Time Remaining
  - Source Voltages
  - End Delay Button
  - End Test Button
  - Phase Angle (sync check only)

Exerciser Sequence (during exercise run)

- Exerciser Active
- Source Voltages
- Time Remaining (in exercise run)
- End Exercise Button

View Screens

Main Screen

- System Status
- Next Exercise Time and Date
- Normal and Emergency Voltage

View Event History

- Event Description
- Date and Time of event

View Maintenance Records

- Total Min Not Preferred
- Reset Min Not Preferred
- Total Min in Standby
- Reset Min in Standby
- Total Min Operation
- Reset Min Operation
- Total Transfers
- Reset Transfers
- Total Fail Transfer
- Reset Fail Transfer
- Total Loss Pref Tran
- Reset Lodd Pref Tran
- Transfer Time N>E
- Transfer Time E>N
- System Start Date
- Last Maint Date
- Last Loss Duration
- Last Loss Date/Time
- Dual Source Connect Time *
- S1 to Open Time *
- S1 to Close time *
- S2 to Open Time *
- S2 to Close Time *

* Decision-Maker MPAC 1500 controller only

† Closed-transition and seervice entrance models are not covered in this manual.

View Exerciser Setup

- Exercise Event Number
- Enabled/Disabled
- Exercise Run Time
- Start Date
- Start Time
- Weekly/Biweekly
- Loaded/Unloaded

View System Setup

- Standard/Programmed/Closed Transition †
- Source Type: Util/Gen, Gen/Gen*, Util/Util* or Util/Gen/Gen*
- Service Entrance: Yes/No *†
- In-Phase Monitor Enabled/Disabled
- Commit/No Commit to Transfer
- # I/O Modules Installed
- Rated Current
- 3 Src Engine Start Mode Mode1/Mode2 *
- Remote Test Loading Loaded/Unloaded
- Peak Shave Delay Enabled/Disabled

View Source Setup

- ABC/BAC Rotation (3-phase only)
- System Voltage, Normal/Emergency
- Frequency (Hz), Source N and E
- Normal Under Voltage PU% and DO%
  - Normal Over Voltage PU% and DO%
  - Debounce Time, Seconds
- Normal Under Frequency PU% and DO%
  - Debounce Time
- Normal Voltage Unbalance Enable/Disable
  - Normal Voltage Unbalance PU% and DO%
- Emergency Under Voltage PU% and DO%
  - Emergency Over Voltage PU% and DO%
  - Debounce Time
- Emergency Under Frequency PU% and DO%
  - Emergency Over Frequency PU% and DO%
  - Debounce Time
- Emergency Voltage Unbalance Enable/Disable
  - Emergency Voltage Unbalance PU% and DO%
- In-Phase Monitor
  - Enabled/Disabled
  - Angle, degrees
- In-Phase Transfer Fail
  - Enabled/Disabled
  - Time Delay min:sec

View Source Setup, Continued

- Synchronization (for closed-transition)
  - Voltage Differential
  - Frequency Differential
  - Angle differential
- Fail toSync
  - Enabled/Disabled
  - Time Delay min:sec

View Time Delays, Source S1 and Source S2

- Engine Start (gen set only)
- Engine Cooldown
- Xfr Preferred>Standby (Standby>Preferred)
- Xfr Off > Standby (Off >Preferred) (programmed-transition only)
- Fail to Acquire Preferred *
- Fail to Acquire Standby
- Load Control
  - Mode: None/Time/Current *
  - Loads to Control (1-9)
- Time-Based Control
  - Load Disconnect N>E (E>N) Time Delay min:sec
  - Load Add E>N (N>E) Time Delay min:sec
- Current-Based Control *
  - Load Disc N>E (E>N) time delay min:sec
  - Load control Source1 (Source2) Enabled/Disabled
  - Load Add Source1 (Source2) Time Delay min:sec
  - Load Add Source1 (Source2) Priority
  - Load Remove Source1 (Source2) Time Delay min:sec
  - Load RemoveSource1 (Source2) Priority
  - Amps Level Remove Source1 (Source2)
  - Amps Level Add Source1 (Source2)

View Inputs/Outputs

- Main Board I/O
  - Input Function Descriptions (2)
  - Output Function Descriptions (2)
- Auxiliary Inputs/ Outputs (optional modules)
  - Module Type and Address
  - Module Status
  - Input Function Descriptions
  - Output Function Descriptions

View Common Alarms

- Alarm Group (1 and 2)
- Alarm Description
- Audible (Yes or No)
- Common (Yes or No)

* Decision-Maker MPAC 1500 controller only

† Closed-transition and seervice entrance models are not covered in this manual.

View Communications Setup

- Modbus Server TCP Enabled/Disabled
- Modbus Server Port 0 Enable/Disabled
- Modbus Address Port 0
- Baud Rate Port 0 9600/19200/57600
- Modbus TCP Unit ID
- IP Address
- Subnet Mask
- MAC Address

View Control Parameters

- Application Version (factory-set)
- ATS Serial Number (factory-set)
- Controller Serial Number (factory-set)
- Contactor Serial Number (factory-set)
- Site Designation (optional; use SiteTech to set)
- Load Description (optional; use SiteTech to set)
- Branch Description (optional; use SiteTech to set)
- Location (optional; use SiteTech to set)

Setup Menus

Set Time/Date

- Set Time
- Set Date
- Set Automatic Daylight Saving Time

Set Exerciser

For each exerciser event:

- Enable/Disable
- Loaded/Unloaded
- Interval
- Repeat Rate
- Duration
- Start Date
- Start time

Set Prime Power Run *

- Enable/Disable
- Duration at Source1 DD:HH:MM
- Duration at Source2 DD:HH:MM
- Sequence Start/Stop

Set S1 Time Delays (Set S2 Time Delays)

- Engine Start
  - External Battery? Y or N
  - Time Delay min:sec
- Engine Cooldown Time Delay min:sec
- Xfr Preferred>Standby (Standby>Preferred)
- Xfr Off > Standby (Off >Preferred) (programmed–transition only)
- Fail to Acquire Standby (Preferred *)
  - Enable/Disable
  - Time Delay min:sec
- Load Control
  - Mode: None/Time/Current
  - Loads to Control (1–9)
- Time-Based Control (for each connected load)
  - Load Disconnect N>E (E>N) Time Delay min:sec
  - Load Add E>N (N>E) Time Delay min:sec
- Current-Based Control *
  - Load Disc N>E (E>N) time delay min:sec
  - For each connected load:
    - Load Add Source1 (Source2) Time Delay min:sec
    - Load Add Source1 (Source2) Priority
    - Load Remove Source1 (Source2) Time Delay min:sec
    - Load RemoveSource1 (Source2) Priority
    - Load Control Enable/Diable
  - Set Hi current Level, Load Remove Source1 (Source2)
  - Set Lo Current Level, Load Add Source1 (Source2)

Set Source

- Phase Rotation ABC/BAC/Disabled
- Set In-Phase Monitor
  - Enable/Disable
  - Angle
  - In-Phase Transfer Fail Time Delay
    - Enable/Disable
    - Time Delay min:sec
- Set Synchronization (closed-transition models †)
  - Voltage Differential
  - Frequency Differential
  - Angle Differential
  - Fail to Sync
    - Enable/Disable
    - Time Delay min:sec
- Set Preferred Source Normal/Emergency (alarm module required)
- Set Normal (Emergency) Source:
  - Number of Phases
  - Voltage
  - Frequency
  - Under Voltage Pickup
  - Under Voltage Dropout
  - Over Voltage Pickup
  - Over Voltage dropout
  - Voltage Debounce Time
  - Voltage Unbalance Enable/Disable (3-phase only)
  - Voltage Unbalance Pickup (3-phase only)
  - Voltage Unbalance Dropout (3-phase only)
  - Under Frequency Pickup
  - Under Frequency Dropout
  - Over Frequency Pickup
  - Over Frequency Dropout
  - Frequency Debounce time

Set Input/Output

- Set Main Board I/O
  - Set Input Functions
  - Set Output Functions
- Set Auxiliary I/O (Modules)
  - Set Input Functions
  - Set Output Functions

Set Common Alarms

- Alarm Group 1 or 2
- Modify Alarm
  - Common (Yes/No)
  - Audible (Yes/No)
- Remove All Alarms Yes/No

* Decision-Maker MPAC 1500 controller only

† Closed-transition and seervice entrance models are not covered in this manual.

Set System

- Source Type: Utility/Generator, Generator/Generator*, Utility/Utility*, Utility/Generator/Generator (3-source system)*
- Transition Type: Standard/Programmed/Closed †
  - Prog Transition Override Automatic/Manual (closed-transition only) †
- Service Entrance No/ICCB/MCCB †
- Rated Current, Amps
- 3 Source Engine Start Mode *
  - Mode1/Mode2
  - Preferred Source Toggle Enable/Disable
- Transfer Commit Commit/No Commit
- Remote Test Loading Loaded/Unloaded
- Peak Shave TD Bypass Enable/Disable

Set Communications

- Modbus Server TCP Enable/Disable
- Modbus Server Port 0 Enable/Disable
- Modbus Address Port 0
- Baud Rate Port 0 9600/19200/57600
- Modbus TCP Unit ID
- IP Address
- Subnet Mask
- Default Gateway
- DHCP Status

Set Passwords

- Setup Password
- Test Password

Calibration

- Line-Neutral Voltages, Source N and E
- Line-Line Voltages, Source N and E
- Load Current, LA, LB, and LC

Reset Data

- Reset Maintenance Records, Yes or No
- Reset Event History, Yes or No
- Reset Default Parameters, Yes or No
- Reset Exercise Setup, Yes or No
- Reset Test Password, Yes or No
- Disable Test Password, Yes or No

* Decision-Maker MPAC 1500 controller only

† Closed-transition and seervice entrance models are not covered in this manual.

Appendix C Noise and Wiring Practices

Electrical noise is an unwanted electrical signal that can cause errors in measurement, loss of control, malfunctions in microprocessor-based control systems, errors in data transfer between systems over communication links, or reductions in system performance.

Good system design and wiring practices can minimize noise levels and the effects of noise.

Noise, because of its random nature, is typically characterized by frequency distribution. Many noise sources are broad-spectrum, that is, they produce many frequencies distributed over a wide range. Broad-spectrum noise is particularly troublesome because it cannot be removed easily by filtering, and because it can affect a variety of systems in unpredictable ways. One common source of broad-spectrum noise is a switch, which can produce voltage and current changes when an electrical circuit is connected and disconnected.

Coupling is the transfer of signals between separate circuits. Signals from one circuit become noise in another. The amount of coupling is cumulative and is a function of the proximity of the circuits, their orientation, exposed area, and length of run. Minimize coupling by the following:

- Isolating circuits from each other by using separate raceways or conduit
- Separating circuits from each other by locating them as far apart as possible
- Enclosing circuits with a grounded metallic shield such as an enclosure, metallic conduit, or cable shield
- Running conductors perpendicular, rather than parallel, to each other
- Running wires loosely and randomly rather than bundling them tightly together
- Twisting a circuit's wires together in pairs

In an industrial environment, there are typically five types of circuits with different noise emission and rejection capabilities. The five types of circuits are as follows:

- **High-Power Distribution.** Circuits to high-power loads such as large electric motors and heaters can emit transient high levels of broad-spectrum noise. Loads on high-power distribution circuits are nearly immune to noise.
- **General Purpose Power Distribution.** Circuits to medium-power loads such as lighting, offices, light-duty equipment, and small motors such as fans and pumps can emit transient, medium levels of broad-spectrum noise. Some electronic equipment, such as computers, emits constant levels of broad-spectrum noise in addition to transient broad-spectrum noise. Loads on general-purpose circuits, except for sensitive electronic equipment, are nearly immune to noise.
- **Control.** Control circuits include DC circuits and 120 VAC maximum AC circuits that operate at a low power level (less than 1 W). Typical circuits include circuits to switches, actuators, and dry-contact relays, including the generator engine-start circuit. Control circuits emit transient low levels of broad-spectrum noise and are fairly immune to noise.
- **Analog.** Analog circuits are low-voltage DC circuits that convey measurement information as relatively small changes in current or voltage. Typical circuits include those connected to the controller's analog inputs. Analog circuits create the lowest noise levels and are the most sensitive to noise.
- **Communication and Signaling.** Communication and signaling circuits are low-voltage circuits that convey information. Typical circuits include RS-232 and RS-485 serial communication lines, telephone lines, and computer network lines. These circuits create noise with frequencies related to the communication signaling rate. These circuits have some level of built-in noise immunity. Typical systems will detect or correct errors caused by noise below certain levels, but with a corresponding reduction in the data transfer rate.

When planning an installation, separate all of these types of circuits as much as possible to minimize the hazards of insulation failure, accidental miswiring, and noise coupling. For best results, install control circuits, analog circuits, and communication and signaling circuits separately. Combining circuit types is unavoidable in the controller's enclosure and some other areas.

Note: It is very important to isolate high- and medium-power circuits in raceways or conduit separate from the other types of circuits.

Appendix D Common Hardware Application Guidelines

Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

Bolt/Screw Length: When bolt/screw length is not given, use Figure 1 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of 1/2 the bolt/screw diameter beyond the nut is the preferred method.

Washers and Nuts: Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spiralock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

See Appendix E, General Torque Specifications, and other torque specifications in the service literature.

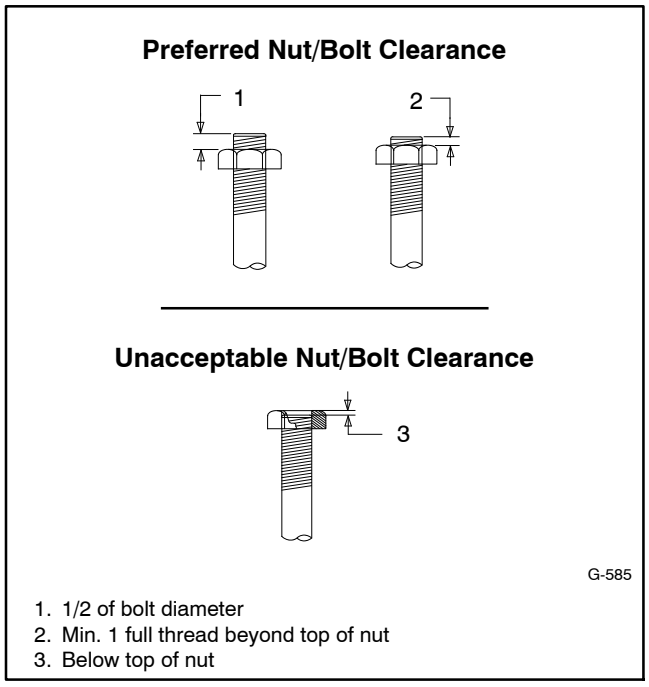


Figure 1 Acceptable Bolt Lengths

Steps for common hardware application:

1. Determine entry hole type: round or slotted.
2. Determine exit hole type: fixed female thread (weld nut), round, or slotted.

   For round and slotted exit holes, determine if hardware is greater than 1/2 inch in diameter, or 1/2 inch in diameter or less. Hardware that is *greater than 1/2 inch* in diameter takes a standard nut and SAE washer. Hardware *1/2 inch or less* in diameter can take a properly torqued whiz nut or spiralock nut. See Figure 2.
3. Follow these SAE washer rules after determining exit hole type:
   a. Always use a washer between hardware and a slot.
   b. Always use a washer under a nut (see 2 above for exception).
   c. Use a washer under a bolt when the female thread is fixed (weld nut).
4. Refer to Figure 2, which depicts the preceding hardware configuration possibilities.

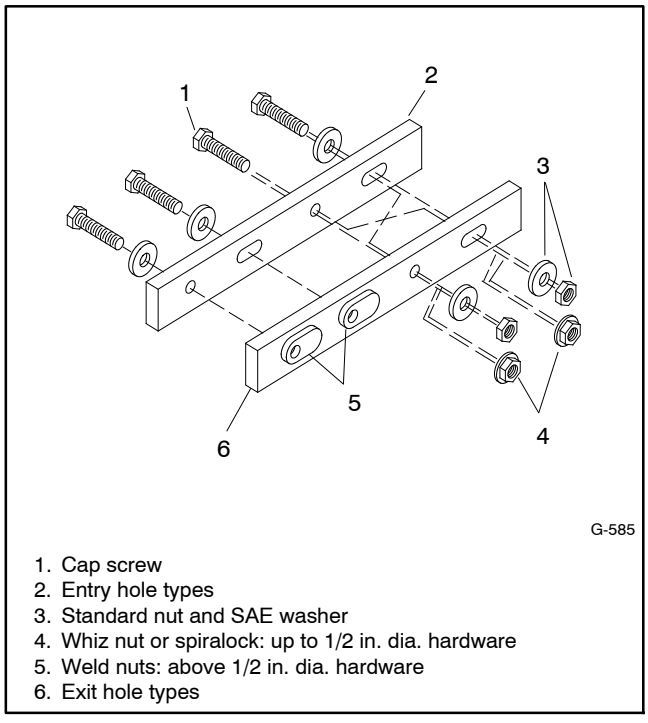


Figure 2 Acceptable Hardware Combinations

Appendix E General Torque Specifications

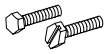
American Standard Fasteners Torque Specifications								
Size	Torque Measurement	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 2 or 5
		Grade 2		Grade 5		Grade 8		
8-32	Nm (in. lb.)	1.8	(16)	2.3	(20)	—		See Note 3
10-24	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
10-32	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
1/4-20	Nm (in. lb.)	6.8	(60)	10.8	(96)	14.9	(132)	
1/4-28	Nm (in. lb.)	8.1	(72)	12.2	(108)	16.3	(144)	
5/16-18	Nm (in. lb.)	13.6	(120)	21.7	(192)	29.8	(264)	
5/16-24	Nm (in. lb.)	14.9	(132)	23.1	(204)	32.5	(288)	
3/8-16	Nm (ft. lb.)	24.0	(18)	38.0	(28)	53.0	(39)	
3/8-24	Nm (ft. lb.)	27.0	(20)	42.0	(31)	60.0	(44)	
7/16-14	Nm (ft. lb.)	39.0	(29)	60.0	(44)	85.0	(63)	
7/16-20	Nm (ft. lb.)	43.0	(32)	68.0	(50)	95.0	(70)	
1/2-13	Nm (ft. lb.)	60.0	(44)	92.0	(68)	130.0	(96)	
1/2-20	Nm (ft. lb.)	66.0	(49)	103.0	(76)	146.0	(108)	
9/16-12	Nm (ft. lb.)	81.0	(60)	133.0	(98)	187.0	(138)	
9/16-18	Nm (ft. lb.)	91.0	(67)	148.0	(109)	209.0	(154)	
5/8-11	Nm (ft. lb.)	113.0	(83)	183.0	(135)	259.0	(191)	
5/8-18	Nm (ft. lb.)	128.0	(94)	208.0	(153)	293.0	(216)	
3/4-10	Nm (ft. lb.)	199.0	(147)	325.0	(240)	458.0	(338)	
3/4-16	Nm (ft. lb.)	222.0	(164)	363.0	(268)	513.0	(378)	
1-8	Nm (ft. lb.)	259.0	(191)	721.0	(532)	1109.0	(818)	
1-12	Nm (ft. lb.)	283.0	(209)	789.0	(582)	1214.0	(895)	

Metric Fasteners Torque Specifications, Measured in Nm (ft. lb.)								
Size (mm)	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 5.8 or 8.8
	Grade 5.8		Grade 8.8		Grade 10.9		
M6 x 1.00	6.2	(4.6)	9.5	(7)	13.6	(10)	See Note 3
M8 x 1.25	15.0	(11)	23.0	(17)	33.0	(24)	
M8 x 1.00	16.0	(11)	24.0	(18)	34.0	(25)	
M10 x 1.50	30.0	(22)	45.0	(34)	65.0	(48)	
M10 x 1.25	31.0	(23)	47.0	(35)	68.0	(50)	
M12 x 1.75	53.0	(39)	80.0	(59)	115.0	(85)	
M12 x 1.50	56.0	(41)	85.0	(63)	122.0	(90)	
M14 x 2.00	83.0	(61)	126.0	(93)	180.0	(133)	
M14 x 1.50	87.0	(64)	133.0	(98)	190.0	(140)	
M16 x 2.00	127.0	(94)	194.0	(143)	278.0	(205)	
M16 x 1.50	132.0	(97)	201.0	(148)	287.0	(212)	
M18 x 2.50	179.0	(132)	273.0	(201)	390.0	(288)	
M18 x 1.50	189.0	(140)	289.0	(213)	413.0	(305)	

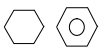
Notes:

1. The torque values above are general guidelines. Always use the torque values specified in the service manuals and/or assembly drawings when they differ from the above torque values.
2. The torque values above are based on new plated threads. Increase torque values by 15% if non-plated threads are used.
3. Hardware threaded into aluminum must have either two diameters of thread engagement or a 30% or more reduction in the torque to prevent stripped threads.
4. Torque values are calculated as equivalent stress loading on American hardware with an approximate preload of 90% of the yield strength and a friction coefficient of 0.125.

Appendix F Common Hardware Identification

Screw/Bolts/Studs	
Head Styles	
Hex Head or Machine Head	
Hex Head or Machine Head with Washer	
Flat Head (FHM)	
Round Head (RHM)	
Pan Head	
Hex Socket Head Cap or Allen™ Head Cap	
Hex Socket Head or Allen™ Head Shoulder Bolt	
Sheet Metal Screw	
Stud	
Drive Styles	
Hex	
Hex and Slotted	
Phillips®	
Slotted	
Hex Socket	

Nuts	
Nut Styles	
Hex Head	
Lock or Elastic	
Square	
Cap or Acorn	
Wing	
Washers	
Washer Styles	
Plain	
Split Lock or Spring	
Spring or Wave	
External Tooth Lock	
Internal Tooth Lock	
Internal-External Tooth Lock	

Hardness Grades	
American Standard	
Grade 2	
Grade 5	
Grade 8	
Grade 8/9 (Hex Socket Head)	
Metric	
Number stamped on hardware; 5.8 shown	

Allen™ head screw is a trademark of Holo-Krome Co.

Phillips® screw is a registered trademark of Phillips Screw Company.

Sample Dimensions

American Standard (Screws, Bolts, Studs, and Nuts)

1/4-20 x 1

- 1 — Length In Inches (Screws and Bolts)
- 20 — Threads Per Inch
- 1/4 — Major Thread Diameter In Fractional Inches Or Screw Number Size

Metric (Screws, Bolts, Studs, and Nuts)

M8-1.25 x 20

- 20 — Length In Millimeters (Screws and Bolts)
- 1.25 — Distance Between Threads In Millimeters
- M8 — Major Thread Diameter In Millimeters

Plain Washers

9/32 x 5/8 x 1/16

- 1/16 — Thickness
- 5/8 — External Dimension
- 9/32 — Internal Dimension

Lock Washers

5/8

- 5/8 — Internal Dimension

Appendix G Common Hardware List

The Common Hardware List lists part numbers and dimensions for common hardware items.

American Standard

Part No.	Dimensions
Hex Head Bolts (Grade 5)	
X-465-17	1/4-20 x .38
X-465-6	1/4-20 x .50
X-465-2	1/4-20 x .62
X-465-16	1/4-20 x .75
X-465-18	1/4-20 x .88
X-465-7	1/4-20 x 1.00
X-465-8	1/4-20 x 1.25
X-465-9	1/4-20 x 1.50
X-465-10	1/4-20 x 1.75
X-465-11	1/4-20 x 2.00
X-465-12	1/4-20 x 2.25
X-465-14	1/4-20 x 2.75
X-465-21	1/4-20 x 5.00
X-465-25	1/4-28 x .38
X-465-20	1/4-28 x 1.00
X-125-33	5/16-18 x .50
X-125-23	5/16-18 x .62
X-125-3	5/16-18 x .75
X-125-31	5/16-18 x .88
X-125-5	5/16-18 x 1.00
X-125-24	5/16-18 x 1.25
X-125-34	5/16-18 x 1.50
X-125-25	5/16-18 x 1.75
X-125-26	5/16-18 x 2.00
230578	5/16-18 x 2.25
X-125-29	5/16-18 x 2.50
X-125-27	5/16-18 x 2.75
X-125-28	5/16-18 x 3.00
X-125-22	5/16-18 x 4.50
X-125-32	5/16-18 x 5.00
X-125-35	5/16-18 x 5.50
X-125-36	5/16-18 x 6.00
X-125-40	5/16-18 x 6.50
X-125-43	5/16-24 x 1.75
X-125-44	5/16-24 x 2.50
X-125-30	5/16-24 x .75
X-125-39	5/16-24 x 2.00
X-125-38	5/16-24 x 2.75
X-6238-2	3/8-16 x .62
X-6238-10	3/8-16 x .75
X-6238-3	3/8-16 x .88
X-6238-11	3/8-16 x 1.00
X-6238-4	3/8-16 x 1.25
X-6238-5	3/8-16 x 1.50
X-6238-1	3/8-16 x 1.75
X-6238-6	3/8-16 x 2.00
X-6238-17	3/8-16 x 2.25
X-6238-7	3/8-16 x 2.50
X-6238-8	3/8-16 x 2.75
X-6238-9	3/8-16 x 3.00
X-6238-19	3/8-16 x 3.25
X-6238-12	3/8-16 x 3.50
X-6238-20	3/8-16 x 3.75
X-6238-13	3/8-16 x 4.50
X-6238-18	3/8-16 x 5.50
X-6238-25	3/8-16 x 6.50

Part No.	Dimensions
Hex Head Bolts, cont.	
X-6238-14	3/8-24 x .75
X-6238-16	3/8-24 x 1.25
X-6238-21	3/8-24 x 4.00
X-6238-22	3/8-24 x 4.50
X-6024-5	7/16-14 x .75
X-6024-2	7/16-14 x 1.00
X-6024-8	7/16-14 x 1.25
X-6024-3	7/16-14 x 1.50
X-6024-4	7/16-14 x 2.00
X-6024-11	7/16-14 x 2.75
X-6024-12	7/16-14 x 6.50
X-129-15	1/2-13 x .75
X-129-17	1/2-13 x 1.00
X-129-18	1/2-13 x 1.25
X-129-19	1/2-13 x 1.50
X-129-20	1/2-13 x 1.75
X-129-21	1/2-13 x 2.00
X-129-22	1/2-13 x 2.25
X-129-23	1/2-13 x 2.50
X-129-24	1/2-13 x 2.75
X-129-25	1/2-13 x 3.00
X-129-27	1/2-13 x 3.50
X-129-29	1/2-13 x 4.00
X-129-30	1/2-13 x 4.50
X-463-9	1/2-13 x 5.50
X-129-44	1/2-13 x 6.00
X-129-51	1/2-20 x .75
X-129-45	1/2-20 x 1.25
X-129-52	1/2-20 x 1.50
X-6021-3	5/8-11 x 1.00
X-6021-4	5/8-11 x 1.25
X-6021-2	5/8-11 x 1.50
X-6021-1	5/8-11 x 1.75
273049	5/8-11 x 2.00
X-6021-5	5/8-11 x 2.25
X-6021-6	5/8-11 x 2.50
X-6021-7	5/8-11 x 2.75
X-6021-12	5/8-11 x 3.75
X-6021-11	5/8-11 x 4.50
X-6021-10	5/8-11 x 6.00
X-6021-9	5/8-18 x 2.50
X-6239-1	3/4-10 x 1.00
X-6239-8	3/4-10 x 1.25
X-6239-2	3/4-10 x 1.50
X-6239-3	3/4-10 x 2.00
X-6239-4	3/4-10 x 2.50
X-6239-5	3/4-10 x 3.00
X-6239-6	3/4-10 x 3.50
X-792-1	1-8 x 2.25
X-792-5	1-8 x 3.00
X-792-8	1-8 x 5.00

Part No.	Dimensions	Type
Hex Nuts		
X-6009-1	1-8	Standard
X-6210-3	6-32	Whiz
X-6210-4	8-32	Whiz
X-6210-5	10-24	Whiz
X-6210-1	10-32	Whiz
X-6210-2	1/4-20	Spiralock
X-6210-6	1/4-28	Spiralock
X-6210-7	5/16-18	Spiralock
X-6210-8	5/16-24	Spiralock
X-6210-9	3/8-16	Spiralock
X-6210-10	3/8-24	Spiralock
X-6210-11	7/16-14	Spiralock
X-6210-12	1/2-13	Spiralock
X-6210-15	7/16-20	Spiralock
X-6210-14	1/2-20	Spiralock
X-85-3	5/8-11	Standard
X-88-12	3/4-10	Standard
X-89-2	1/2-20	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
X-25-46	.125	.250	.022	#4
X-25-9	.156	.375	.049	#6
X-25-48	.188	.438	.049	#8
X-25-36	.219	.500	.049	#10
X-25-40	.281	.625	.065	1/4
X-25-85	.344	.687	.065	5/16
X-25-37	.406	.812	.065	3/8
X-25-34	.469	.922	.065	7/16
X-25-26	.531	1.062	.095	1/2
X-25-15	.656	1.312	.095	5/8
X-25-29	.812	1.469	.134	3/4
X-25-127	1.062	2.000	.134	1

Metric

Hex head bolts are hardness grade 8.8 unless noted.

Part No.	Dimensions
Hex Head Bolts (Partial Thread)	
M931-05055-60	M5-0.80 x 55
M931-06040-60	M6-1.00 x 40
M931-06055-60	M6-1.00 x 55
M931-06060-60	M6-1.00 x 60
M931-06060-SS	M6-1.00 x 60
M931-06070-60	M6-1.00 x 70
M931-06070-SS	M6-1.00 x 70
M931-06075-60	M6-1.00 x 75
M931-06090-60	M6-1.00 x 90
M931-06145-60	M6-1.00 x 145
M931-06150-60	M6-1.00 x 150
M931-08035-60	M8-1.25 x 35
M931-08040-60	M8-1.25 x 40
M931-08045-60	M8-1.25 x 45
M931-08050-60	M8-1.25 x 50
M931-08055-60	M8-1.25 x 55
M931-08055-82	M8-1.25 x 55*
M931-08060-60	M8-1.25 x 60
M931-08070-60	M8-1.25 x 70
M931-08070-82	M8-1.25 x 70*
M931-08075-60	M8-1.25 x 75
M931-08080-60	M8-1.25 x 80
M931-08090-60	M8-1.25 x 90
M931-08095-60	M8-1.25 x 95
M931-08100-60	M8-1.25 x 100
M931-08110-60	M8-1.25 x 110
M931-08120-60	M8-1.25 x 120
M931-08130-60	M8-1.25 x 130
M931-08140-60	M8-1.25 x 140
M931-08150-60	M8-1.25 x 150
M931-08200-60	M8-1.25 x 200
M931-10040-82	M10-1.25 x 40*
M931-10040-60	M10-1.50 x 40
M931-10045-60	M10-1.50 x 45
M931-10050-60	M10-1.50 x 50
M931-10050-82	M10-1.25 x 50*
M931-10055-60	M10-1.50 x 55
M931-10060-60	M10-1.50 x 60
M931-10065-60	M10-1.50 x 65
M931-10070-60	M10-1.50 x 70
M931-10080-60	M10-1.50 x 80
M931-10080-82	M10-1.25 x 80*
M931-10090-60	M10-1.50 x 90
M931-10090-82	M10-1.50 x 90*
M931-10100-60	M10-1.50 x 100
M931-10110-60	M10-1.50 x 110
M931-10120-60	M10-1.50 x 120
M931-10130-60	M10-1.50 x 130
M931-10140-60	M10-1.50 x 140
M931-10180-60	M10-1.50 x 180
M931-10235-60	M10-1.50 x 235
M931-10260-60	M10-1.50 x 260
M960-10330-60	M10-1.25 x 330
M931-12045-60	M12-1.75 x 45
M960-12050-60	M12-1.25 x 50
M960-12050-82	M12-1.25 x 50*
M931-12050-60	M12-1.75 x 50
M931-12050-82	M12-1.75 x 50*
M931-12055-60	M12-1.75 x 55
M931-12060-60	M12-1.75 x 60
M931-12060-82	M12-1.75 x 60*
M931-12065-60	M12-1.75 x 65
M931-12075-60	M12-1.75 x 75
M931-12080-60	M12-1.75 x 80
M931-12090-60	M12-1.75 x 90
M931-12100-60	M12-1.75 x 100
M931-12110-60	M12-1.75 x 110

Part No.	Dimensions
Hex Head Bolts (Partial Thread), continued	
M960-16090-60	M16-1.50 x 90
M931-16090-60	M16-2.00 x 90
M931-16100-60	M16-2.00 x 100
M931-16100-82	M16-2.00 x 100*
M931-16120-60	M16-2.00 x 120
M931-16150-60	M16-2.00 x 150
M931-20065-60	M20-2.50 x 65
M931-20090-60	M20-2.50 x 90
M931-20100-60	M20-2.50 x 100
M931-20120-60	M20-2.50 x 120
M931-20140-60	M20-2.50 x 140
M931-20160-60	M20-2.50 x 160
M931-22090-60	M22-2.50 x 90
M931-22120-60	M22-2.50 x 120
M931-22160-60	M22-2.50 x 160
M931-24090-60	M24-3.00 x 90
M931-24120-60	M24-3.00 x 120
M931-24160-60	M24-3.00 x 160
M931-24200-60	M24-3.00 x 200
Hex Head Bolts (Full Thread)	
M933-04006-60	M4-0.70 x 6
M933-05030-60	M5-0.80 x 30
M933-05035-60	M5-0.80 x 35
M933-05050-60	M5-0.80 x 50
M933-06010-60	M6-1.00 x 10
M933-06012-60	M6-1.00 x 12
M933-06014-60	M6-1.00 x 14
M933-06016-60	M6-1.00 x 16
M933-06020-60	M6-1.00 x 20
M933-06025-60	M6-1.00 x 25
M933-06030-60	M6-1.00 x 30
M933-06040-60	M6-1.00 x 40
M933-06050-60	M6-1.00 x 50
M933-07025-60	M7-1.00 x 25
M933-08010-60	M8-1.25 x 10
M933-08012-60	M8-1.25 x 12
M933-08016-60	M8-1.25 x 16
M933-08020-60	M8-1.25 x 20
M933-08025-60	M8-1.25 x 25
M933-08030-60	M8-1.25 x 30
M933-08030-82	M8-1.25 x 30*
M933-10012-60	M10-1.50 x 12
M961-10020-60	M10-1.25 x 20
M933-10020-60	M10-1.50 x 20
M933-10025-60	M10-1.50 x 25
M961-10025-60	M10-1.25 x 25
M933-10025-82	M10-1.50 x 25*
M961-10030-60	M10-1.25 x 30
M933-10030-60	M10-1.50 x 30
M933-10030-82	M10-1.50 x 30*
M961-10035-60	M10-1.25 x 35
M933-10035-60	M10-1.50 x 35
M933-10035-82	M10-1.50 x 35*
M961-10040-60	M10-1.25 x 40

Part No.	Dimensions
Hex Head Bolts (Full Thread), continued	
M933-12016-60	M12-1.75 x 16
M933-12020-60	M12-1.75 x 20
M961-12020-60F	M12-1.50 x 20
M933-12025-60	M12-1.75 x 25
M933-12025-82	M12-1.75 x 25*
M961-12030-60	M12-1.25 x 30
M933-12030-82	M12-1.75 x 30*
M961-12030-82F	M12-1.50 x 30*
M933-12030-60	M12-1.75 x 30
M933-12035-60	M12-1.75 x 35
M961-12040-82	M12-1.25 x 40*
M933-12040-60	M12-1.75 x 40
M933-12040-82	M12-1.75 x 40*
M961-14025-60	M14-1.50 x 25
M933-14025-60	M14-2.00 x 25
M961-14050-82	M14-1.50 x 50*
M961-16025-60	M16-1.50 x 25
M933-16025-60	M16-2.00 x 25
M961-16030-82	M16-1.50 x 30*
M933-16030-82	M16-2.00 x 30*
M933-16035-60	M16-2.00 x 35
M961-16040-60	M16-1.50 x 40
M933-16040-60	M16-2.00 x 40
M961-16045-82	M16-1.50 x 45*
M933-16045-82	M16-2.00 x 45*
M933-16050-60	M16-2.00 x 50
M933-16050-82	M16-2.00 x 50*
M933-16060-60	M16-2.00 x 60
M933-16070-60	M16-2.00 x 70
M933-18035-60	M18-2.50 x 35
M933-18050-60	M18-2.50 x 50
M933-18060-60	M18-2.50 x 60
M933-20050-60	M20-2.50 x 50
M933-20055-60	M20-2.50 x 55
M933-24060-60	M24-3.00 x 60
M933-24065-60	M24-3.00 x 65
M933-24070-60	M24-3.00 x 70
Pan Head Machine Screws	
M7985A-03010-20	M3-0.50 x 10
M7985A-03012-20	M3-0.50 x 12
M7985A-04010-20	M4-0.70 x 10
M7985A-04016-20	M4-0.70 x 16
M7985A-04020-20	M4-0.70 x 20
M7985A-04050-20	M4-0.70 x 50
M7985A-04100-20	M4-0.70 x 100
M7985A-05010-20	M5-0.80 x 10
M7985A-05012-20	M5-0.80 x 12
M7985A-05016-20	M5-0.80 x 16
M7985A-05020-20	M5-0.80 x 20
M7985A-05025-20	M5-0.80 x 25
M7985A-05030-20	M5-0.80 x 30
M7985A-05080-20	M5-0.80 x 80
M7985A-05100-20	M5-0.80 x 100
M7985A-06100-20	M6-1.00 x 100
Flat Head Machine Screws	
M965A-04012-SS	M4-0.70 x 12
M965A-05012-SS	M5-0.80 x 12
M965A-05016-20	M5-0.80 x 16
M965A-06012-20	M6-1.00 x 12

* This metric hex bolt's hardness is grade 10.9.

Metric, continued

Part No.	Dimensions	Type
Hex Nuts		
M934-03-50	M3-0.50	Standard
M934-04-50	M4-0.70	Standard
M934-04-B	M4-0.70	Brass
M934-05-50	M5-0.80	Standard
M934-06-60	M6-1.00	Standard
M934-06-64	M6-1.00	Std. (green)
M6923-06-80	M6-1.00	Spiralock
M982-06-80	M6-1.00	Elastic Stop
M934-08-60	M8-1.25	Standard
M6923-08-80	M8-1.25	Spiralock
M982-08-80	M8-1.25	Elastic Stop
M934-10-60	M10-1.50	Standard
M934-10-60F	M10-1.25	Standard
M6923-10-80	M10-1.50	Spiralock
M6923-10-62	M10-1.50	Spiralock†
M982-10-80	M10-1.50	Elastic Stop
M934-12-60	M12-1.75	Standard
M934-12-60F	M12-1.25	Standard
M6923-12-80	M12-1.75	Spiralock
M982-12-80	M12-1.75	Elastic Stop
M982-14-60	M14-2.00	Elastic Stop
M6923-16-80	M16-2.00	Spiralock
M982-16-80	M16-2.00	Elastic Stop
M934-18-80	M18-2.5	Standard
M982-18-60	M18-2.50	Elastic Stop
M934-20-80	M20-2.50	Standard
M982-20-80	M20-2.50	Elastic Stop
M934-22-60	M22-2.50	Standard
M934-24-80	M24-3.00	Standard
M982-24-60	M24-3.00	Elastic Stop
M934-30-80	M30-3.50	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
M125A-03-80	3.2	7.0	0.5	M3
M125A-04-80	4.3	9.0	0.8	M4
M125A-05-80	5.3	10.0	1.0	M5
M125A-06-80	6.4	12.0	1.6	M6
M125A-08-80	8.4	16.0	1.6	M8
M125A-10-80	10.5	20.0	2.0	M10
M125A-12-80	13.0	24.0	2.5	M12
M125A-14-80	15.0	28.0	2.5	M14
M125A-16-80	17.0	30.0	3.0	M16
M125A-18-80	19.0	34.0	3.0	M18
M125A-20-80	21.0	37.0	3.0	M20
M125A-24-80	25.0	44.0	4.0	M24

† This metric hex nut's hardness is grade 8.

KOHLER®
Power Systems

KOHLER CO. Kohler, Wisconsin 53044
Phone 920-457-4441, Fax 920-459-1646
For the nearest sales/service outlet in the
US and Canada, phone 1-800-544-2444
KOHLERPower.com

Kohler Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65) 6264-6422, Fax (65) 6264-6455

TP-6921 10/14