

Onan

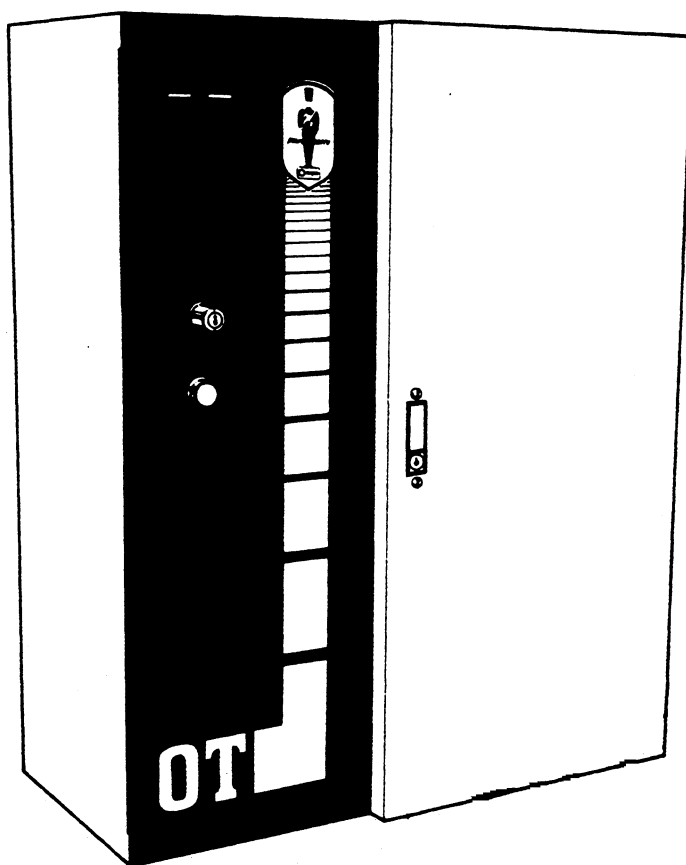
Operators

Manual

SERIES
OT
Switch

Nonautomatic Transfer Switch

Remote Transfer Switch



Important Safety Precautions

Read and observe these safety precautions when using or working on electric generators, engines and related equipment. Also read and follow the literature provided with the equipment.

Proper operation and maintenance are critical to performance and safety. Electricity, fuel, exhaust, moving parts and batteries present hazards that can cause severe personal injury or death.

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

Fire, explosion, and personal injury can result from improper practices.

- Used engine oil, and benzene and lead, found in some gasoline, have been identified by government agencies as causing cancer or reproductive toxicity. When checking, draining or adding fuel or oil, do not ingest, breathe the fumes, or contact gasoline or used oil.
- Do not fill tanks with engine running. Do not smoke around the area. Wipe up oil or fuel spills. Do not leave rags in engine compartment or on equipment. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip fuel supply with a positive fuel shutoff.
- Do not store or transport equipment with fuel in tank.
- Keep an ABC-rated fire extinguisher available near equipment and adjacent areas for use on all types of fires except alcohol.
- Unless provided with equipment or noted otherwise in installation manual, fuel lines must be copper or steel, secured, free of leaks and separated or shielded from electrical wiring.
- Use approved, non-conductive flexible fuel hose for fuel connections. Do not use copper tubing as a flexible connection. It will work-harden and break.

EXHAUST GAS IS DEADLY

- Engine exhaust contains carbon monoxide (CO), an odorless, invisible, poisonous gas. Learn the symptoms of CO poisoning.
- Never sleep in a vessel, vehicle, or room with a genset or engine running unless the area is equipped with an operating CO detector with an audible alarm.
- Each time the engine or genset is started, or at least every day, thoroughly inspect the exhaust system. Shut down the unit and repair leaks immediately.

- Warning: Engine exhaust is known to the State of California to cause cancer, birth defects and other reproductive harm.

Make sure exhaust is properly ventilated.

- Vessel bilge must have an operating power exhaust.
- Vehicle exhaust system must extend beyond vehicle perimeter and not near windows, doors or vents.
- Do not use engine or genset cooling air to heat an area.
- Do not operate engine/genset in enclosed area without ample fresh air ventilation.
- Expel exhaust away from enclosed, sheltered, or occupied areas.
- Make sure exhaust system components are securely fastened and not warped.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any guards or covers with the equipment running.
- Keep hands, clothing, hair, and jewelry away from moving parts.
- Before performing any maintenance, disconnect battery (negative [–] cable first) to prevent accidental starting.
- Make sure fasteners and joints are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- If adjustments must be made while equipment is running, use extreme caution around hot manifolds and moving parts, etc. Wear safety glasses and protective clothing.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- Always disconnect battery negative (–) lead first and reconnect it last. Make sure you connect battery correctly. A direct short across battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is explosive.
- Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the area thoroughly.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can be ignited by equipment operation or cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. **Do not operate diesel equipment where a flammable vapor environment can be created by fuel spill, leak, etc., unless equipped with an automatic safety device to block the air intake and stop the engine.**

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not service control panel or engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel.
- Do not connect the generator set to the public utility or to any other electrical power system. Electrocution can occur at a remote site where line or equipment repairs are being made. An approved transfer switch must be used if more than one power source is connected.
- Disconnect starting battery (negative [–] cable first) before removing protective shields or touching electrical equipment. Use insulative mats placed on dry wood platforms. Do not wear jewelry, damp clothing or allow skin surface to be damp when handling electrical equipment.
- Use insulated tools. Do not tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- With transfer switches, keep cabinet closed and locked. Only authorized personnel should have cabinet or operational keys. Due to serious shock hazard from high voltages within cabinet, all service and adjustments must be performed by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

1. Move genset operation switch or Stop/Auto/Handcrank switch (whichever applies) to Stop.
2. Disconnect genset batteries (negative [–] lead first).
3. Remove AC power to automatic transfer switch. If instructions require otherwise, use extreme caution due to shock hazard.

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training are required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Induced voltage remains even after equipment is disconnected from the power source. Plan maintenance with authorized personnel so equipment can be de-energized and safely grounded.

GENERAL SAFETY PRECAUTIONS

- Do not work on equipment when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.
- Never step on equipment (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions from leaking fuel, leaking exhaust fumes, etc.
- Keep equipment and area clean. Oil, grease, dirt, or stowed gear can cause fire or damage equipment by restricting airflow.
- Equipment owners and operators are solely responsible for operating equipment safely. Contact your authorized Onan/Cummins dealer or distributor for more information.

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

SAFETY PRECAUTIONS

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

WARNING Onan uses this symbol throughout the text to warn of possible injury or death.

CAUTION This symbol is used to warn of possible equipment damage.

The Series OT transfer switch has components with high voltages which present serious shock hazards. For this reason, read the following suggestions:

Keep the transfer switch cabinet(s) closed and locked. Make sure authorized personnel only have the

cabinet keys.

Always move the operation selector switch on the generator set to STOP, disconnect the starting batteries of the generator set, and remove AC line power to the transfer switch before performing maintenance or adjustments (unless specified otherwise in the instructions—then only using extreme caution due to danger of shock hazard).

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

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

Do not work on this equipment when mentally or physically fatigued.

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GENERAL INFORMATION

INTRODUCTION

This Operator's Manual provides the information necessary for the successful operation of Onan's Series OT nonautomatic or remote transfer switch. The manual includes installation, description, operation, and adjustment chapters. A troubleshooting guide and service information are also included. Operators should become familiar with this manual and especially the operation procedures that apply to their Series OT transfer switch.

TRANSFER SWITCH APPLICATION

Transfer switches are an essential part of a building's standby or emergency power system. The normal power source (commonly the utility line) is backed up by an emergency power source (often an electric generating set). A transfer switch supplies the electrical load with power from one of these two power sources. The load being served is connected to the common of the transfer switch as in Figure 1. Under normal conditions the load is supplied with power from the normal source as illustrated. Should the normal power source be interrupted, the load is transferred to the emergency power source. When normal power returns, the load is retransferred to the normal power source. The transfer and retransfer of the load are two basic functions of a transfer switch. Non-automatic transfer switches require operator involvement to operate. Operation of a nonautomatic transfer switch is initiated manually by the operator with a keyed switch. Onan remote transfer switches are electrically-operated transfer switches with respond to internal or external signals.

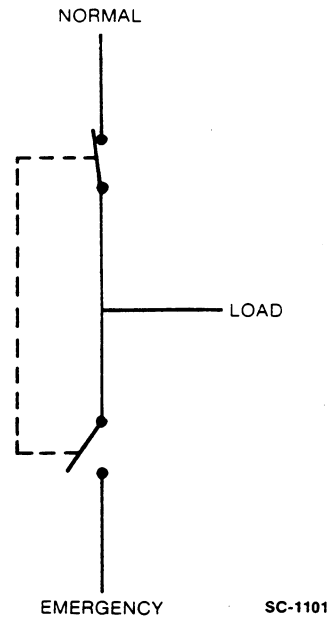


FIGURE 1. TRANSFER SWITCH

INSTALLATION

MOUNTING

Have an experienced electrician install the OT transfer switch according to the local codes and regulations. Locating the transfer switch in the existing electrical circuit varies with application.

Whether the OT is a wall-mounting model or a floor-mounting model, mount it on a vibration-free surface. The installation area should be protected from excessive heat, dust, and moisture.

WIRING

Transfer Switch

Connect wires of sufficient size to carry rated current from the line, load, and emergency power source directly to the transfer switch terminals which are marked A, B, and C (A and B on single-phase switches). Table 1 gives the type and maximum wire size the transfer switch will accept.

The phase rotations of the normal and emergency sources must agree. Check and correct, if necessary.

Neutral Bar (if used)

Connect the neutral wires to the neutral bar. Table 1 lists the wire sizes and types the neutral bar accepts.

Auxiliary Contacts

Auxiliary contacts are located on the normal and emergency sides of the transfer switch for external alarm or control circuitry. To gain access to the auxiliary contacts, remove the cover which houses the motor disconnect switch S1 (cover held in place by four screws). See Figure 2. The contacts have ratings of 25 amperes at 125, 250, or 480 VAC; 1 horsepower at 125 VAC; 2 horsepower at 250 VAC or 480 VAC; and a pilot duty rating of 750 VA at 277 VAC maximum.

Remote Control

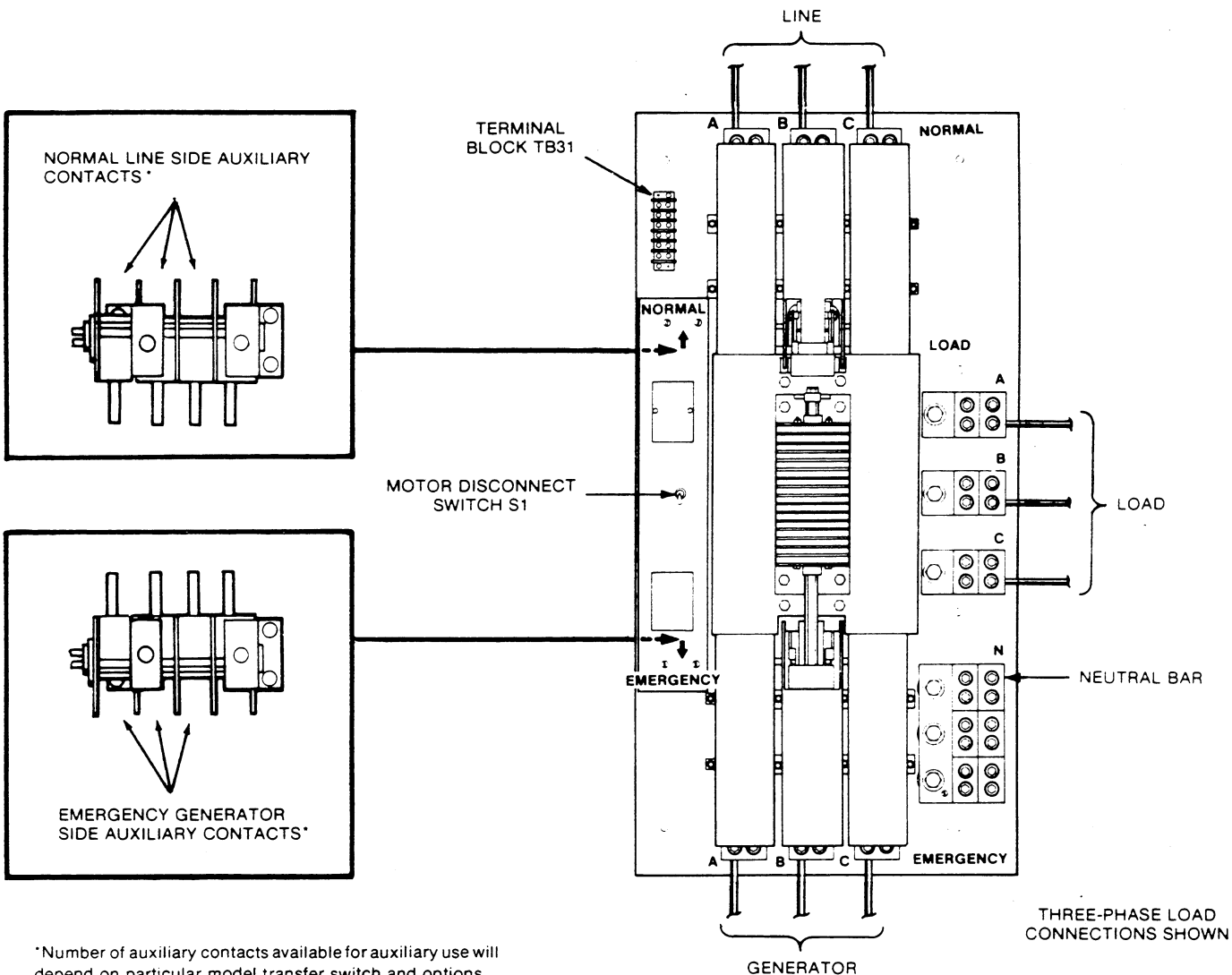
These connections apply to either the remote

transfer switch without load shed feature or to the remote transfer switch with load shed feature (remote OT with load shed has no selector switch on meter-lamp panel). These connections do not apply to non-automatic transfer switches.

Remote Control With Load Shed. The connection points for remote control are TB7-4, TB7-5, and TB7-6. These terminals connect to two 120-volt interposing relays, K1 and K2. Connect a ground to TB7-6 as the two relays have a common ground. Relay K1 which opens the transfer switch from the normal side to a neutral position connects to TB7-5. Relay K2 which closes the transfer switch from the neutral position to the emergency side connects to TB7-4.

Note the connections are made from the emergency power source. Also, both relays must have power in order for the transfer switch to close to the emergency side.

Remote Control Without Load Shed. Connection points for remote control are TB7-6 and TB7-12. A contact closure across these connection points causes the transfer switch to change position. Control voltage is taken from the emergency power source (line-to-line).



*Number of auxiliary contacts available for auxiliary use will depend on particular model transfer switch and options.

FIGURE 2. TRANSFER SWITCH WIRE CONNECTIONS

TABLE 1. SERIES OT TRANSFER SWITCH WIRE CAPACITIES

TRANSFER SWITCH (AMPERES)	TERMINAL LUGS Number of Conductors and Size Per Pole	
	Switch Pole*	Neutral Bar*
100	ONE No. 6 - 250 MCM	ONE No. 6 - 250 MCM
150 & 225	ONE No. 6 - 350 MCM	ONE No. 6 - 350 MCM
280	ONE No. 4 - 500 MCM	ONE No. 4 - 500 MCM
400	ONE 350 MCM - 1000 MCM	ONE 350 MCM - 1000 MCM
600	TWO No. 2 - 600 MCM	TWO No. 2 - 600 MCM
800 & 1000	FOUR No. 2 - 600 MCM	FOUR No. 2 - 600 MCM

* Connectors compatible with copper and aluminum.

DESCRIPTION

An Onan Series OT transfer switch has four main parts: the transfer switch itself, the control portion, the meter-lamp panel, and the enclosure. This description is presented in this same theme and covers both the nonautomatic and the remote transfer switches.

TRANSFER SWITCH

The transfer switch (a common model is illustrated in Figure 2) connects the load either to the normal or to the emergency power source as called for by the control. Mechanical interlocks prevent the transfer switch from closing to both power sources simultaneously. (Switched neutral transfer switches have additional mechanical interlocks. See Manual Operation in the OPERATION section). The principal parts of the transfer switch are the linear actuator, the motor disconnect switch, and the manual operators.

Linear Actuator

The linear actuator is a linear induction motor that provides the force to move the transfer switch contacts. A downward force transfers the load to emergency power and an upward force retransfers the load to normal power.

Transfer switches with a switched neutral pole have a second, separate linear actuator to move the neutral

contacts. The neutral pole contacts are make-before-break. Switched neutral transfer switches have additional mechanical interlocks which set a specific switching sequence. See Manual Operation in the OPERATION section.

Motor Disconnect Switch

The motor disconnect switch opens one side of the power supply to the linear actuator allowing safe manual operation. The motor disconnect switch is closed in the UP position and operation is electrical. The motor disconnect switch is open in the DOWN position, which disables the linear actuator.

Manual Operators

One pair of manual operator handles for each linear actuator allow the operator to transfer or retransfer the load manually. See Manual Operation in the OPERATION section.

CONTROL

Nonautomatic Transfer Switch Control

The nonautomatic transfer switch is equipped with indicating lamps, a keyed selector switch, and a load shed button. These items are mounted on the left-hand panel on the front of the cabinet. See Figure 3.

Key Selector Switch. The key selector switch is used by the operator to select the position of the transfer switch. It has three positions: NORMAL, OFF, and EMERGENCY. The key selector switch is spring-loaded to return to the OFF position. The key must be used to change switch positions. See Nonautomatic Transfer Switch in the OPERATION section.

Load Shed Button. The load shed button is a momentary switch that is used to disconnect the load from the emergency power source. It will not shed load from the normal power source.

Remote Transfer Switch Control

Onan remote transfer switches are controlled by a remote control, usually an automatic control of another transfer switch (or, separate control might be simply a single-pole, single-throw switch which changes the transfer switch position each time it is closed).

An Onan remote transfer switch with the load shed feature has no control items by itself. However, remote transfer switches without load shed have a keyed selector switch. A description of that follows.

Key Selector Switch. The key selector switch is located on the left-hand panel of the transfer switch enclosure as shown in Figure 3 (however, remote transfer switch does not have load shed button). The operator must use a key to change the keyed selector switch positions, which are REMOTE, NORMAL, and EMERGENCY.

Remote: In the remote position, control of the transfer switch is done remotely by a separate control.

Normal: When the key selector switch is moved to NORMAL, the action the transfer switch takes depends on whether the transfer switch is in the normal or emergency position.

If the transfer switch is in the normal position (green NORMAL lamp lit), then the transfer switch will stay mechanically held to the normal source even if normal power is interrupted.

If the transfer switch is in the emergency position (red EMERGENCY lamp lit) when the key selector switch is moved to NORMAL, the transfer switch will remain mechanically held to the emergency source until normal power returns. When normal power returns, the transfer switch will automatically retransfer the load to normal power.

Emergency: When the key selector switch is moved to this position, the transfer switch will move to the emergency source whenever emergency voltage is present.

METER-LAMP PANEL

The meter-lamp panel supports two indicating lamps. On Onan provided enclosures, the meter-lamp panel is the left-hand front panel of the enclosure so that the indicating lamps can be seen without opening the doors.

A green indicating lamp marked NORMAL lights when the load is connected to the normal power source. A red indicating lamp marked EMERGENCY lights when the load is connected to the emergency power source.

ENCLOSURE

There are a variety of enclosures that contain Onan Series OT transfer switches. Application factors such as environmental conditions, continuous current rating of the transfer switch, the number of poles of the transfer switch, and others determine the specific enclosure required.

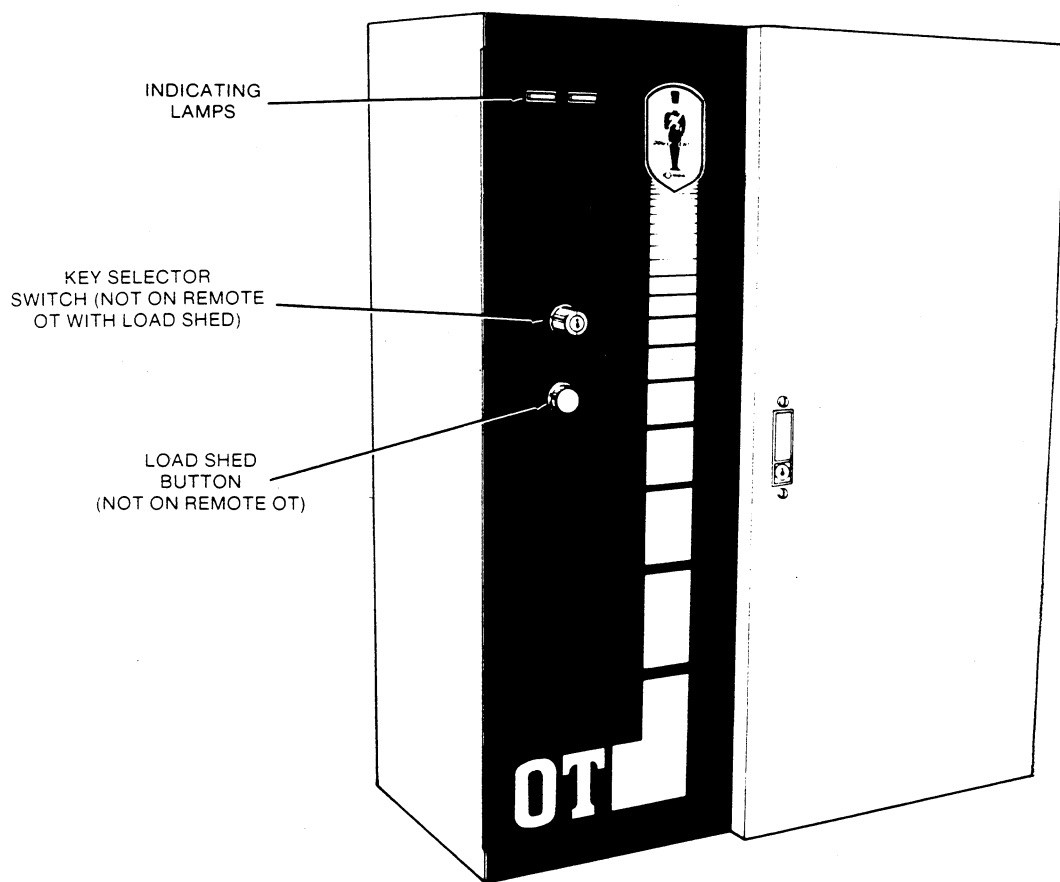


FIGURE 3. TRANSFER SWITCH

OPERATION

This section covers operation of a nonautomatic transfer switch, remote transfer switch, and manual operation of the transfer switch. The nonautomatic transfer switches require initiation by the operator to transfer load. A remote transfer switch receives a remote signal from a separate source for transfer switch operation, although the remote transfer switches without load shed can also have initiation of operation at the transfer switch itself. Manual transfer switch operation means the operator physically moves the transfer switch operator handles to transfer load (this procedure is the same for any of the above transfer switches).

NONAUTOMATIC TRANSFER SWITCH

Operation of a nonautomatic transfer switch is manually initiated by the operator using the key selector switch. The key selector switch provides electrical control of the transfer switch. The position of the transfer switch, with either the normal or the emergency power source supplying the load, can be selected by the operator. Three operations are possible: transfer, load shed and retransfer.

Transfer

Transfer, switching the load from the normal power source to the emergency power source, is accomplished by turning the key selector switch to EMERGENCY. Allow the key to return to the center OFF position. Voltage must be present at the emergency power source. The EMERGENCY indicating lamp will light.

Load Shed

When the emergency power source is supplying the load, the operator can disconnect the load using the following procedure. The load cannot be shed from the normal power source.

To Shed Load From Emergency Power Source:

1. Turn and hold the key selector switch in the EMERGENCY position.
2. Push and hold the load shed button.
3. Release the key selector switch, allowing it to return to the center OFF position.
4. Release the load shed button.

The load can be restored to the emergency power source by turning the key selector switch to EMERGENCY.

Retransfer

Retransfer, switching the load from the emergency power source to the normal power source is done by turning the key selector switch to NORMAL. Allow the key to return to the center OFF position. Voltage must be present at the normal power source. The NORMAL indicating lamp will light.

REMOTE TRANSFER SWITCH

Transfer, inhibit transfer, and remote transfer control are the operations possible using the key selector switch (remote transfer switch with load shed does not have this switch).

Transfer: When the normal source voltage is absent, the operator can transfer the load from normal to emergency by moving the key selector switch to EMERGENCY, if emergency source voltage is present.

Inhibit Transfer: With the transfer switch in the normal position, moving the key selector switch to NORMAL inhibits a transfer operation (normal to emergency). The transfer switch remains mechanically-held to the normal power source.

Remote Transfer Control: Placing the key selector switch to REMOTE allows a separate control to initiate transfer switch operation.

MANUAL OPERATION

An operator can manually transfer or retransfer a Series OT transfer switch using direct manpower. The transfer switch is equipped with manual operator handles for this purpose. Operators must follow the procedure that matches the description of their transfer switch.

WARNING

Use extreme care when operating the transfer switch manually. High voltage on transfer switch terminals presents a serious personal injury hazard.

WARNING

Be sure to move the motor disconnect switch down, to the manual operation position, before beginning manual operation. Otherwise, the transfer switch linear motor can operate causing rapid movement of the operator handles and present a hazard of serious, personal injury.

Single Actuator Transfer Switches

100-1000 Amperes, Except 225-280 Amperes Without Programmed Transition.

1. Move the motor disconnect switch to the DOWN, manual operation position.
2. Transfer or retransfer, following these steps:
Transfer, from normal power to the emergency power source:
 - a. Pull the upper manual operator handle down.
 - b. Push the lower manual operator handle down.

Retransfer, from emergency power to the normal power source:

- c. Pull the lower manual operator handle up.
 - d. Push the upper manual operator handle up.
3. Return the motor disconnect switch to the UP, electrical operation position.

225-280 Amperes, Without Programmed Transition.

1. Move the motor disconnect switch to the DOWN, manual operation position.
2. Pull either manual operator handle in the desired direction; down for emergency, up for normal.
3. Return the motor disconnect switch to the UP, electrical operation position.

Two Actuator Transfer Switches (Switched Neutral)

Manual operation of a transfer switch with two linear actuators, those having a switched neutral pole, is different than a single actuator transfer switch. The procedure that follows will overcome the mechanical interlock which prevents disconnecting the neutral pole while the power poles are connected to either power source. The mechanical interlock also prevents the power poles from closing to either power source before the neutral pole is closed to that source.

Transfer, Manual. The procedure for manual transfer, from the normal power source to the emergency power source is:

1. Move the motor disconnect switch to the DOWN, manual operation position. See Figure 4.

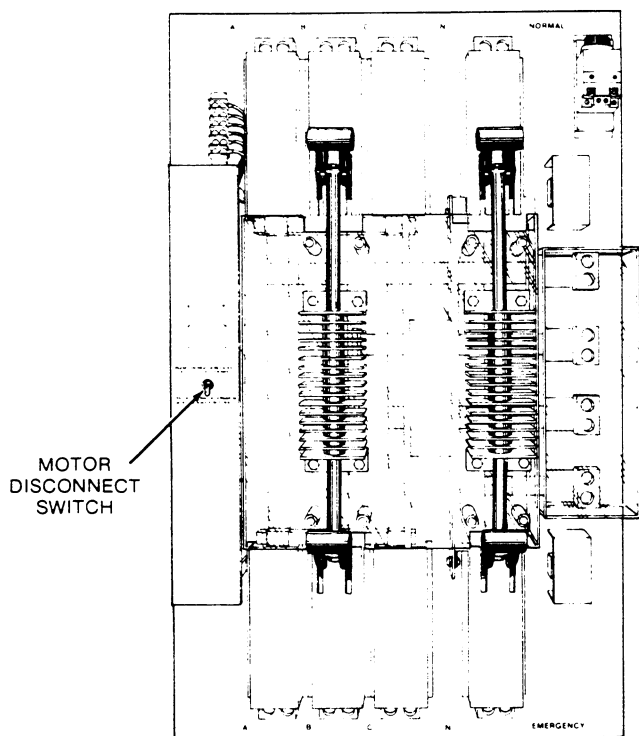


FIGURE 4.

2. Pull the top power handle down, as shown in Figure 5, disconnecting the power poles from the normal power source.
3. Pull the top neutral pole handle all the way down, as shown in Figure 6, connecting the load neutral to the emergency neutral and disconnecting it from the normal power source.
4. Push the lower power pole handle down, as in Figure 7, connecting the load to the emergency power source. This completes the manual transfer switching sequence.

PULL POWER
POLES
HANDLE
DOWN

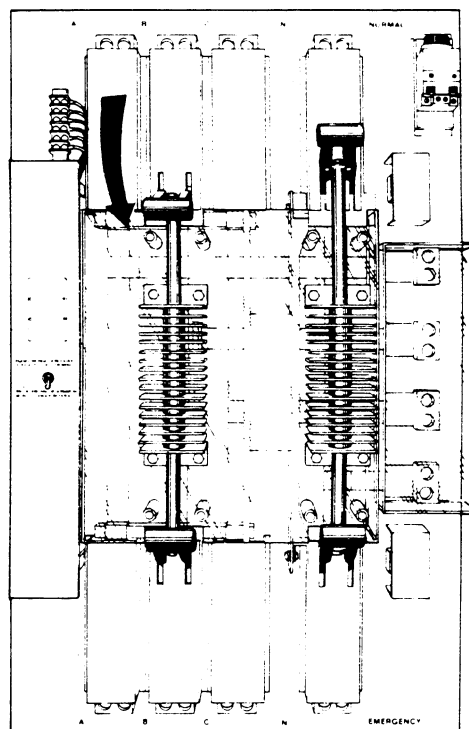


FIGURE 5.

PULL
NEUTRAL
POLE
HANDLE
DOWN

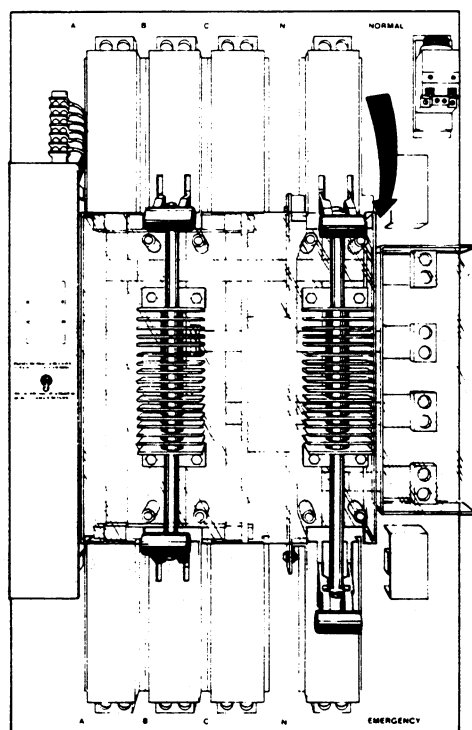


FIGURE 6.

Retransfer, Manual. The procedure for manual retransfer, from the emergency power source to the normal power source, is:

With the motor disconnect switch in the DOWN, manual position:

1. Pull the lower power pole handle up, as illustrated in Figure 8, disconnecting the load from the emergency power source.
2. Pull the lower neutral pole handle all the way up, as shown in Figure 9, connecting the load neutral to the neutral of the normal power source and disconnecting it from the emergency power source.

3. Push the upper power pole handle up, as in Figure 10, connecting the load to the normal power source. This completes the manual retransfer switching sequence.
4. Return to electric operation by moving the motor disconnect switch to the UP position.

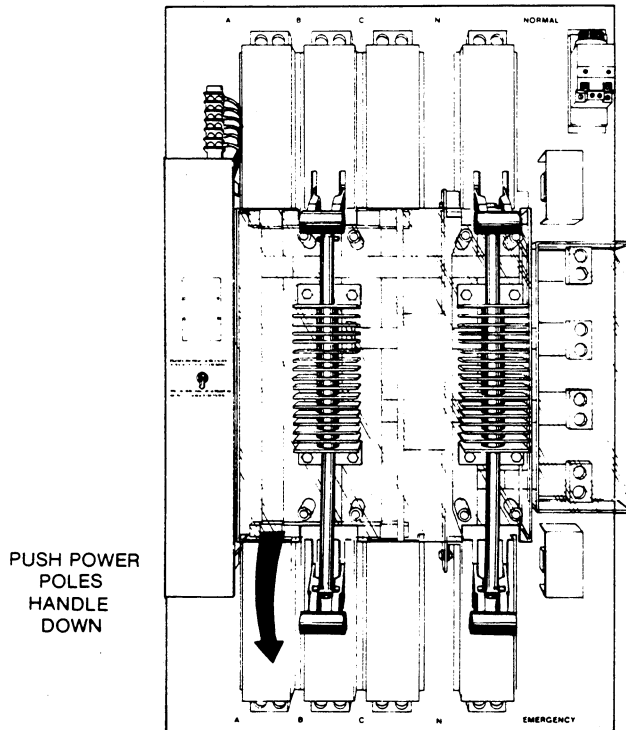


FIGURE 7.

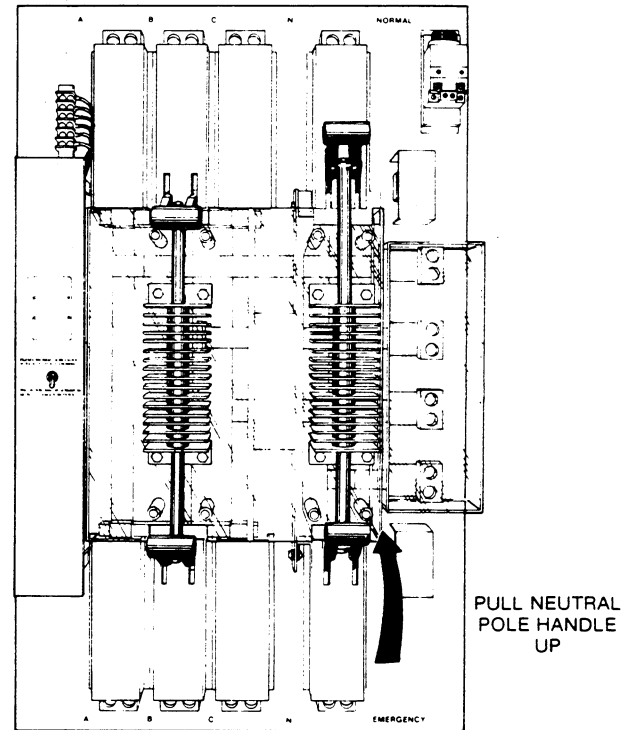


FIGURE 9.

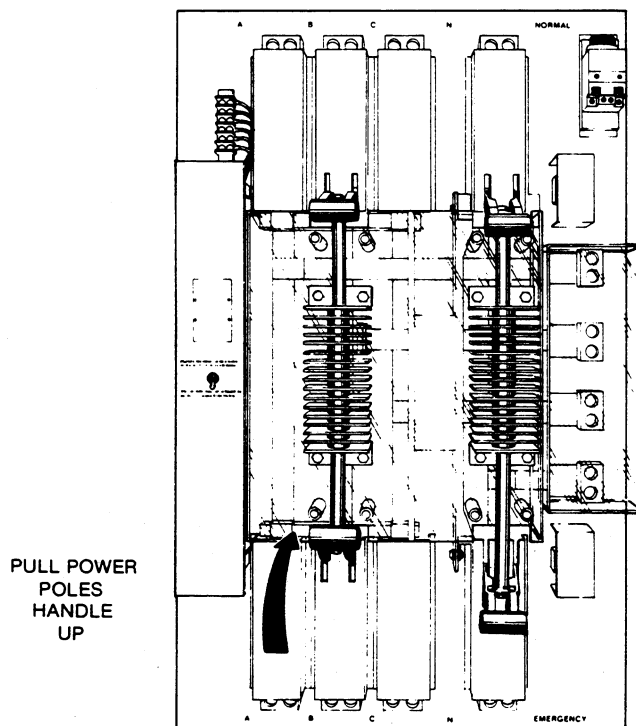


FIGURE 8.

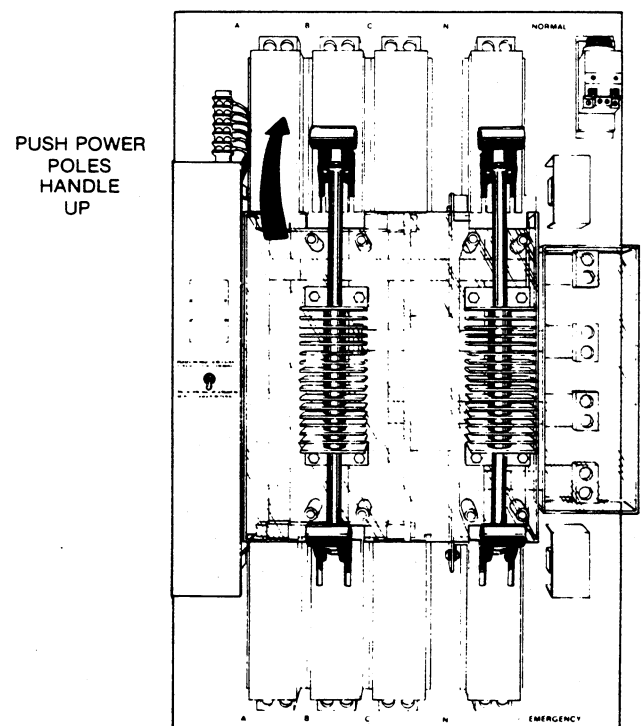


FIGURE 10.

ADJUSTMENTS

PROGRAMMED TRANSITION

To change the setting of the time delay relay for programmed transition, use the following procedure.

1. Open cabinet of Series OT transfer switch.
2. Move the engine operation selector switch to STOP and disconnect the generator set starting battery.
3. Remove AC line power to the transfer switch.

WARNING

Be sure to move the operation selector switch to STOP, disconnect starting battery, and remove AC line power before attempting adjustments.

4. Locate the time delay relay (shown following) in the rear of the cabinet on the transfer switch base assembly.
5. Turn the knob clockwise to increase delay (increments marked on knob), counterclockwise to decrease time delay.
6. Restore AC line power to the transfer switch.
7. Move the engine operation selector switch to RMT.
8. Reconnect the generator set starting battery.
9. Close the OT transfer switch cabinet.



FIGURE 11. PROGRAMMED TRANSITION TIME DELAY RELAY

TROUBLESHOOTING

Transfer switch fails to move to EMERGENCY source after receiving remote signal for remote OT or if using keyed selector switch (where applicable).

1. Emergency source voltage absent? Check the voltage of the alternate power source.
2. Motor disconnect switch open? Motor disconnect switch (S1) located on auxiliary contact cover should be in UP position.
3. If equipped with programmed transition, has the programmed transition time delay relay timed out?
4. Can the switch be transferred manually? Refer to manual operation in the OPERATION chapter. If the transfer switch will not operate manually, refer to the transfer switch section of the OT Master Service Manual.

Transfer switch fails to move to NORMAL source after receiving remote signal for remote OT or if using keyed selector switch (where applicable).

1. Normal source voltage absent? Check the voltage of the normal power source.
2. Motor disconnect switch open? Motor disconnect switch (S1) located on auxiliary contact cover should be in the UP position.
3. If equipped with programmed transition, has the programmed transition time delay relay timed out?
4. Can the switch be transferred manually? Refer to manual operation in the OPERATION chapter. If the transfer switch will not operate manually, refer to the transfer switch section of the OT Master Service Manual.

PARTS AND SERVICE INFORMATION

This Series OT transfer switch is custom engineered and specially constructed. Because of the individuality of each transfer switch, contact the dealer from whom you purchased this equipment for service and parts. Remember to give the complete model and serial number when requesting service or parts information. The wiring diagrams furnished with your Series OT transfer switch may be kept with your instruction manual in the "pocket" inside the cabinet.

Any shipments made are complete. Shipments are properly packed and in good order when delivered to the transportation company. Any claim for loss or damage in transit should be filed promptly against the transportation company making the delivery.

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