

# **Operators Manual** OT II Switch



**Begin Spec E** 7/83 Printed in U.S.A.

# **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

death.

This symbol is used throughout the text to warn of possible injury or



This symbol is used to warn of pos-

The 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 closed and locked. Make sure only authorized personnel have the cabinet and operational 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.



# Supplement 962-1011

Date: 4-84 Insert with -Title: OT II Operator's Manual Number: See below

# Supplementary Instructions for Spec F 400 and 600 OT II Transfer Switches

Use this supplement in addition to the information given in Operator's Manual 962-0107, 962-0109, 962-0110, and 962-0112. The Spec F 400 and 600 ampere transfer switches are very similar to the Spec E 400 and 600 ampere automatic transfer switches shown in the operator's manual with a few exceptions. The cabinet dimensions, terminal lug capacities, and procedure to make it a bottom load connect transfer switch make up most of the differences.

# **INSTALLATION SECTION**



High voltages can cause serious personal injury or death. Make sure no power is connected to the transfer switch for the following procedures.

# **APPROXIMATE CABINET DIMENSIONS**

Transfer Switch Rating			Depth	
	Height	Width	With Door Closed	With Door Open
400 and 600	63.0 in. (1600 mm)	30.0 in. (762 mm)	21.7 in. (550 mm)	45.5in. (1157 mm)

WIRING

# **TERMINAL LUG CAPACITIES**

Transfer Switch Rating	Number of Conductors per Pole and Size		
nating	Copper	Aluminum	
400	(1) 00-600 MCM and (1) #6-250 MCM		
600	(2) 250-350 MCM	(2) 350-500 MCM	

OT Spec F 400 and 600 ampere transfer switches are shipped from the factory with the load terminal lugs located at the top of the transfer switch. These terminals may be moved for bottom load connections. Use this procedure and refer to the illustration provided.

- 1. Move transfer switch to the neutral position (contacts connected neither to the NORMAL nor to the EMER-GENCY side).
- 2. Disconnect the plugs J1, J2, and J3 from the front of the transfer switch.
- 3. Remove the switch cover by taking out the four ET screws.
- 4. Remove the load cover by taking out the two ET screws and flat washers.
- 5. Three-pole transfer switches only: Remove the lug barrier by taking out the two ET screws and flat washers.
- 6. Remove the 1/4-20 screws, spring washers, and lock washers from the jumper strap at center of the transfer switch.
- 7. Remove the three 3/8-16 screws and spring washers from the back side of the transfer switch which secures the load strap to the standoff insulator.
- 8. Turn off the three standoff insulators (same direction as nut counterclockwise if you were facing rear of transfer switch). Also remove the flat washers and ET washers that were under the standoff insulators.
- 9. Mount the standoff insulators, flat washers, and ET washers on the bottom of the transfer switch (studs provided on bottom as for top of switch).
- 10. Mount the load strap with its terminal lugs toward the bottom. Secure to the standoff insulators with the 3/8-16 screws and spring washers.
- 11. Secure the load strap to the jumper strap with the 1/4-20 screws, spring washers, flat washers, and lock washers (make sure electrical joint compound is applied to mating surfaces before assembly). Be sure to include one terminal ring on each jumper strap, and reconnect the wire leads to the terminal rings.
- 12. Tighten all the screws holding the load straps. Torques are shown in the illustration.
- 13. *Three-pole transfer switches only:* Install the lug barrier with the two 10-32 ET screws and flat washers to protect the center lug terminal. Observe torques shown.
- 14. Re-install the load cover with the two 10-32 ET screws and flat washers. Observe torques shown.
- 15. Re-install the switch cover with the four 10-32 ET screws observing proper torques.



SC-1452

NOTE: MATING SURFACES OF LOAD STRAP AND JUMPER STRAP MUST HAVE COATING OF ELECTRICAL JOINT COMPOUND

TRANSFER SWITCH LOAD TERMINALS (SIDE VIEW), 400 AND 600 AMPERES

# Contents

#### PAGE TITLE SAFETY PRECAUTIONS ......Inside Cover

#### WARNING

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

# **OPERATORS MANUAL**

This operator's manual provides information necessary for operation of the Onan OT transfer switch. The manual includes installation, description, and operation chapters. A troubleshooting guide is also included. Operators should become familiar with this manual, especially the operation procedures which apply to their 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



FIGURE 1. TRANSFER SWITCH FUNCTION (TYPICAL)

power source. The transfer and retransfer of the load are two basic functions of a transfer switch. Nonautomatic transfer switches require operator involvement to operate. Operation of a non-automatic/ remote transfer switch is initiated either by an external signal from a remote source or by an operator at the transfer switch with a keyed switch (if equipped).

### MODEL IDENTIFICATION

Identify your model by referring to the Model and Specification number as shown on the nameplate. Electrical characteristics are shown on the lower portion of the nameplate. It is located inside the cabinet door on the control box cover.

If it is necessary to contact a dealer or the factory regarding the transfer switch, always give the complete Model, Spec, and Serial number as listed on the nameplate. Also give the number(s) of any options that may be listed on a label below the nameplate. This information is necessary to properly identify your unit among the many types manufactured. A typical model number with explanation is given below.



- 1. Basic model series. OT indicates OT II transfer switch series.
- 2. Number of switched conductor poles B-indicates 3-pole.
- 3. Basic control group. A-Nonautomatic/remote.
- 4. Enclosure type. A-indicates general purpose NEMA 1.
- 5. Ampere rating.
- 6. Voltage code and frequency.
- 4X or 54X (50 Hz) = 277/480, 3-phase, 4-wire.
- 7. Agency Certification. U-Underwriters' Laboratories, Inc.
- 8. Control option group number.
- 9. Meter option group number.
- 10. Specification letter: advances with production modification.

# Installation

# LOCATION

Locating the transfer switch in the existing electrical circuit varies with application and type of entrance switch. There must be a switch and fuses in the commercial power line before the transfer switch.

Choose a vibration-free mounting surface. Avoid hot, moist, or dusty locations.

# MOUNTING

#### Wall Mount, 40-100 Ampere

- 1. Install two mounting bolts in the wall for the bottom cabinet mounting keyholes.
- 2. With the shipping box standing so the cabinet is upright, carefully remove the top and sides of the box.
- 3. Raise cabinet and mount on the two mounting bolts in the wall.

**WARNING** Lifting and mounting cabinet could cause serious personal injury. Have sufficient manpower available to assist.

- 4. Tighten two bottom mounting bolts.
- 5. Install two top mounting bolts and tighten.

### Floor Mount, 150-1000 Ampere

- 1. With the shipping box standing so the cabinet is upright, carefully remove the top and sides of the box.
- 2. Connect a hoist or similar lift to the two lifting eyebolts on the cabinet top.

WARNING Lifting and mounting cabinet could cause serious personal injury. Have sufficient help available to assist.

3. Carefully raise the cabinet and move it to its installation location. Mounting bolts are usually placed in concrete when floor is poured. Bolts should protrude about one inch (25 mm) from floor. Secure the cabinet to the floor.

#### WIRING

Wiring must be performed by qualified personnel only. Run control circuit wiring in separate conduit from the AC wiring, otherwise induced currents could cause operational problems witin the OT. When facing the front of the cabinet, knockouts can be made through the top, bottom, or right side of the cabinet. **CAUTION** Use extreme care to keep drill chips and filings out of the relays, contacts, and other parts of the automatic transfer switch when mounting or connecting conduit. Also, screwdrivers should be used carefully to prevent damage to the resistors, coils, and contacts.

Remove AC power from any lines to which the OT will connect, and the disconnect starting battery of any generator set which will connect to the OT.

**WARNING** Failure to remove AC power or to disconnect any generator set starting battery before wiring begins presents a shock hazard and might cause serious personal injury or death.

#### **Transfer Switch**

Connect wires of sufficient size to carry rated current from the line, load, and generator set 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. Figure 2 shows transfer switch connections.

For transfer switches with an AC ammeter, the load wires must pass through a transformer three times for 40-ampere OT, twice (two primary turns) for a 70- and 100-ampere OT, once (one primary turn) for any 150-through 1000-ampere OT. See Figure 3.

Neutral bar with lugs is standard on switches supplied with cabinet. See Table 1 for wire sizes.

OT 150- to 1000-ampere transfer switches are factory assembled with the load terminal lugs at the top. The load terminal lugs may be moved for a bottom connection using this procedure:

#### TABLE 1. TERMINAL LUG CAPACITY

#### For Copper or Aluminum Conductors

Switch Amp Rating	Number of Conductors	Size Range of Conductors
40	1	#0 AWG to #14 AWG
70	1	#0 AWG to #14 AWG
100	1	#0 AWG to #14 AWG
150	1	#6 AWG to 350 MCM
260	1	#4 AWG to 500 MCM
400	1	350 MCM to 1000 MCM
600	2	#2 AWG to 600 MCM
800	4	#4 AWG to 600 MCM
1000	4	#4 AWG to 600 MCM







ES-1094

#### FIGURE 3. CURRENT TRANSFORMER WIRING



FIGURE 4. TRANSFER SWITCH LOAD TERMINALS (SIDE VIEW) 150-1000 AMPERE

- A. Remove switch covers, and load cover on front connect units. See Figure 4. On units in the 600 and 1000 ampere range, the end assemblies on each end of the actuator rod must be removed to facilitate removal of the switch cover.
- B. Remove nuts and lockwashers from jumper strap at center of switch (leave bolts in place). See Figure 4.
- C. Remove screw, lockwasher and flatwasher securing the standoff insulator to the mount-ing base.
- D. Reverse position of load strap and replace hardware removed in Step B. Be sure electrical joint compound is applied before assembly.
- E. Secure standoff insulator at bottom of switch with hardware removed in Step C.
- F. Torque screws and nuts to values shown in Figure 4.
- G. Replace load cover and switch covers.
- H. Replace end assemblies on actuator rod and torque screws to value shown (600 and 1000 ampere units only).

#### **Control Circuit Connections**

Control circuit connections are divided into two categories, those for remote control circuit connections for the OT and those for the transfer switch auxiliary contacts connections. For the nonautomatic OT transfer switches with no remote control circuit connections (control group 91 OTs), proceed to connections for auxiliary contacts.

**Remote Control Circuit Connections:** Follow the appropriate OT control connections below.

- Group 92 OT (120-volt input signal) Connect a 120-volt, remote control source to terminals TB1-1 and TB1-2 which is energized when you want the OT to operate.
- 2. Group 93 OT (C relay input signal) Connect a relay contact input signal to terminals TB1-1 and TB1-2 so that the relay contact closure initiates transfer switch operation.
- 3. Group 94 OT (120-volt input signal from Onan ERS control) The elevator remote selector control or similar control sends 120-volt signals to the OT for transfer.

TB7-6 COM
-----------

Α.

- B. TB7-4 120-volt lead which will cause transfer switch to open from closed NORMAL side to open neutral position.
- C. TB7-5 120-volt lead which will cause transfer switch to close from neutral position to EMER-GENCY side (signal from TB7-4 must remain in order for signal to TB7-5 to close switch to EMERGENCY.

D. TB7-7 120-volt source lead from Lamp Test Switch of ERS control.

E. TB7-9 C o n n e c t t o G E N lamp in ERS (indicates transfer switch closed to EMERGENCY source) - terminal provides 120 VAC when switch closed to emergency source.

**Auxiliary Contacts (if used):** Auxiliary contacts are located on the normal and emergency sides of the transfer switch for external alarm or control circuitry. The contacts have ratings of 10 amperes at 480 VAC.

Connections are divided into two categories, those for OTs with control groups 91 through 93 and those for OTs with control group 94 (used with ERS control or similar control). Use the appropriate instructions following.

 Groups 91 through 93 OTs — Connections for auxiliary contacts can be made on terminal block TB1 terminals 3 through 8. Listed below are open and closed positions of auxiliary contacts with transfer switch in neutral position. Moving the transfer switch to normal or emergency only affects the corresponding auxiliary contacts.

NORMA	L	EMERG	ENCY
AUXILIA	RY	AUXILIA	ARY
CONTA	СТ	CONTA	СТ
TB1-3	NC	TB1-6	NO
TB1-4	NO	TB1-7	NC
TB1-5	COM	TB1-8	COM

2. Group 94 OTs (for use with ERS or similar controls) — Connections can be made on terminal block TB7 terminals 1 through 3 and terminals 10 through 12. Listed below are open and closed positions of auxiliary contacts with transfer switch in neutral position. Moving the transfer switch to normal or emergency only affects the corresponding contacts.

NORMAL AUXILIARY CONTACT		EMERGENCY AUXILIARY CONTACT		
TB7-1	NO	TB7-10	COM	
TB7-2	NC	TB7-11	NC	
TB7-3	COM	TB7-12	NO	

#### **CLEANING OF CABINET**

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

### **CHECKOUT PROCEDURES**

After the generator set and automatic transfer switch are properly installed, check the various automatic transfer switch functions.

#### **Programmed Transition (if equipped)**

- 1. Locate the programmed transition time delay on the left inside wall of the cabinet (Figure 5). It normally has factory settings for a few seconds. If the setting is satisfactory, proceed to next check. Otherwise, proceed to Step 2.
- 2. The programmed transition has a time range of 0.5 to 5 seconds, 1.5 to 15 seconds, or 5 to 50 seconds (three timers are available). Turn the knob clockwise to increase delay, counterclockwise to decrease time delay. Increments are marked on the knob.



SC-1394-1

#### FIGURE 5. PROGRAMMED TRANSITION TIME DELAY

#### **Check Switch Positions**

**Transfer Switch:** If the transfer switch main contacts are not closed to the normal power source side, manually close the transfer switch to the normal side.

**Transfer Switch Disconnect Switch:** Move the disconnect switch to the up position for automatic operation. Close cabinet door when finished.

#### **Connect AC Line**

Connect AC line power to the automatic transfer switch. The lamp on the cabinet front should light.

# Description

### CABINET

The standard Onan OT cabinet meets requirements of the National Electrical Manufacturers Association (NEMA) for a "Type 1" cabinet. This type is designated as a general purpose, indoor cabinet. Exterior items on a typical OT cabinet are shown in Figure 6.

#### Indicator Lamps

Except for the OTs designed for use with the Onan ERS (Elevator Remote Selector) control, the nonautomatic/remote OT models have four indicator lamps on their cabinet. For the normal power source, one lamp lights to indicate normal power is available, and another lights to indicate load is connected to the normal power source. For the emergency source, one lamp lights to indicate this power source is available, and another lights to indicate load is connected to the emergency power source. For OT models designed for use with Onan ERS controls, the cabinet has two indicator lamps. These show whether load is connected to the normal power source or to the emergency power source.

#### Normal/Remote-Off/Emergency Switch

This switch is included on all non-automatic OTs except those for use with Onan elevator remote selector (ERS) controls. It has three positions and is spring-loaded to return to the REMOTE-OFF center off position. A key must be used to change switch positions. See the OPERATION section for use of the switch.



SC-1409

FIGURE 6. NON AUTOMATIC TRANSFER SWITCH

#### **Push to Load Shed Switch - Optional**

This momentary pushbutton switch is used to disconnect the load from the emergency power source (not used on OTs for use with Onan ERS or elevator remote selector controls). It will not shed from the normal power source.

# **TRANSFER SWITCH**

The transfer switch opens and closes the contacts that transfer the load between normal and emergency power. The transfer switch is mechanicallyinterlocked to prevent simultaneous closing to both power sources. The main parts of the transfer switch discussed here are the contact assemblies, linear actuator, motor disconnect switch, and auxiliary contacts.

#### **Contact Assemblies**

Series OT transfer switches are two or three-pole. The contact assemblies make and break the current flow. When closed to either normal or emergency power source, the contacts are mechanically held. A mechanical interlock prevents them from closing to both power sources at the same time.

#### **Linear Actuator**

The linear actuator is a linear induction motor that actuates the contact assemblies. It moves the contact assemblies between the normal power source and emergency power source as required. The linear actuator operation is initiated with automatic transfer switches. Manual operation of the transfer switch is possible. Refer to manual operation in the OPERA-TION section.

#### **Motor Disconnect Switch**

The Motor Disconnect switch opens and closes the linear actuator circuit. It is located on the transfer switch panel. It is placed in the down position for manual operation and the up position for automatic operation.

#### **Auxiliary Contacts**

Auxiliary contacts are provided on the normal and emergency side of the transfer switch. They are actuated by operation of the transfer switch during transfer and retransfer. The auxiliary contacts have current ratings of 10 amperes at 480 VAC.

#### **Programmed Transition - Optional**

Programmed transition is an optional feature of Onan series OT transfer switches. Programmed transition is the capability of the transfer switch to assume a mid-transition position, for an adjustable interval of time, when the load is neither connected to the normal power source nor to the emergency power source. This feature allows residual voltages in motor loads to decay to an acceptable level before transition is completed. The length of time that the transfer switch is in the mid-position can be adjusted from 0.5 to 5 seconds, 1.5 to 15 seconds, or 5 to 50 seconds depending on the timer option. The proper adjustment is a function of the motor and its connected load.

# Operation

This section covers operation of the non-automatic/ remote transfer switch and manual operation of the transfer switch. The non-automatic/remote transfer switches require initiation by the operator to transfer load, or if connected for remote operation, it requires a remote signal from a separate source for transfer switch operation.

The non-automatic/remote transfer switches for use with elevator remote selector (ERS) controls do not have switches for initiation by an operator. (You can easily identify this model because there is no selector switch on the cabinet front.) However, you can perform manual transfer switch operation. See "Manual Operation."

Manual transfer switch operation means the operator physically moves the transfer switch handles to transfer load (this procedure is the same for any of the above transfer switches).

# NORMAL/REMOTE-OFF/EMERGENCY 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.

#### Transfer

Transfer, switching the load from the normal power source to the emergency power source, is accomplished by turning the key selector switch to EMER-GENCY. Allow the key to return to the center REMOTE-OFF position. Voltage must be present at the emergency power source (EMERGENCY SOURCE AVAILABLE lamp must be lit). The EMER-GENCY SOURCE CONNECTED indicating lamp will light after transfer.

#### 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 the hold in the PUSH TO LOAD SHED pushbutton switch.
- 3. Release the key selector switch, allowing it to return to the center REMOTE-OFF position.
- 4. Release the PUSH TO LOAD SHED switch.

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 REMOTE-OFF position. Voltage must be present at the normal power source (NORMAL SOURCE AVAILABLE lamp must be lit). The NORMAL SOURCE CONNECTED indicating lamp will light after retransfer.

# MANUAL OPERATION

The transfer switch has operator handles for manually transferring of the load. Use the following procedure:

**WARNING** Some terminals within the transfer switch cabinet and door present a shock hazard which might cause serious personal injury or death if touched. For this reason, stay clear of exposed terminals while performing manual operation of the transfer switch.

- 1. Open the cabinet door of the automatic transfer switch.
- 2. Move the Motor Disconnect switch to the down or manual operation position.
- 3. **Transfer** from the normal to the emergency power source.
  - A. Pull the upper manual operator handle down.
  - B. Push the lower manual operator handle down.

**Retransfer -** from the emergency to the normal power source.

- A. Pull the lower manual operator handle up.
- B. Push the upper manual operator handle up.
- 4. Before moving the Motor Disconnect switch to the up or automatic position, remember the transfer switch will transfer load to the active power source (if both power sources are available, transfer will occur to normal source if voltage is satisfactory).

**WARNING** Automatic transfer switch operation results in rapid movement of the manual operator handles and presents a hazard of serious personal injury. Keep hands clear of handles when switching back to automatic operation.

- 5. Move the Motor Disconnect switch to the up or automatic position.
- 6. Close the cabinet door.

# NO TRANSFER OF LOAD TO THE EMERGENCY POWER SOURCE\*

- 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 or automatic position.

**WARNING** High voltages within cabinet and rear side of cabinet door present a shock hazard which might cause serious personal injury or death. Use care when opening cabinet door.

- 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, call your Onan service representative.

# NO TRANSFER OF LOAD TO THE NORMAL POWER SOURCE\*

- 1. Normal source voltage absent? Check the voltage source of the normal power source.
- 2. Motor disconnect switch open? Motor disconnect switch (S1) located on auxiliary contact cover should be in up or automatic position.

**WARNING** High voltages within cabinet and rear side of cabinet door present a shock hazard which might cause serious personal injury or death. Use care when opening cabinet door.

- 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, call your Onan service representative.

\*After OT receives remote signal to operate, or if keyed selector switch is used to initiate operation (where applicable).

# **Parts and Service Information**

Because of the individuality of each automatic transfer switch, contact the dealer or distributor 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. Also note if the cabinet contains a modi-

fication label inside which lists any added options. If it does, give the information listed on the label to your dealer too. The wiring diagrams furnished with your Series OT transfer switch should be kept with your instruction manual. 승규가 잘 못 해야 한 것이 있는 것이 있는 것이 가지 않는 것이 없다.

х х

Onan

Onan Corporation 1400 73rd Avenue N.E. Minneapolis, Minnesota 55432

Telephone: (612) 574-5000 Telex: 275477 Cable ONAN \*